Table of Contents

2022-19 Main Ballot Items

Ballot Closes on October 3, 2021 at 11:59 pm eastern time

Portal Display Order	Ballot Item Number	Attachment	Vote Completed
1	19-CR-001 #5, 6, 7		
2	19-CR-002 #8		
3	19-CR-003 #31		
4	19-CR-004 #32		
5	19-CR-005 #33		
6	19-CR-006 #58		
7	19-CR-007 #109		
8	19-CR-008 #159		
9	19-CR-009 #182		
10	19-DE-PC03-ety		
11	19-DE-PC09 #9		
12	19-DE-PC10 #10		
13	19-DE-PC11 #11		
14	19-DE-PC35 #35		
15	19-FS-001		
16	19-FS-002 #183		
17	19-FS-003 #204		
18	19-GR 069 #69		
19	19-GR-036 #36		
20	19-GR-074 #74		
21	19-GR-107 #107		
22	19-GR-126 #126		
23	19-GR-132 #132		
24	19-GR-133 #133		
25	19-GR-200 #200		
26	19-GR-202 #202		
27	19-GR-205 #205		
28	19-GR-217 #217		
29	19-PR-001 #30	19-PR-001 NAMC Paper & Addendum	
30	19-RC-003 PC37		
31	19-RC-004 PC01		
32	19-RC-005 PC46 & PC47		
33	19-RC-006 PC48		
34	19-RC-007 PC50-55		
35	19-RC-008 PC62		
36	19-RC-009 PC76 & 77		
37	19-RC-010 PC178		
38	19-RC-011 PC79		
39	19-RC-014 PC80		
40	19-SL-001 #13		
41	19-SL-002 #82 83 84 88 89 122 123 124		
42	19-SL-003 #87		
43	19-SL-004 #90		

Portal Display Order	Ballot Item Number	Attachment	Vote Completed
44	19-SL-005 #93		
45	19-SL-007 #105		
46	19-SL-008 #110		
47	19-SL-010 #142		
48	19-SL-011 #147		
49	19-SL-012 #118 140		
50	19-SL-013 #120		
51	19-SL-016 #193		
52	19-SL-017 #194		
53	19-SM-PC#18-19		
54	19-VG-038		
55	19-VG-043		
56	19-VG-061		
57	19-VG-064-195		
58	19-VG-068		
59	19-VG-072		
60	19-VG-092		
61	19-VG-099		
62	19-VG-100		
63	19-VG-113-215		
64	19-VG-117		
65	19-VG-150		
66	19-VG-151		
67	19-VG-161		
68	19-VG-162		
69	19-VG-164		
70	19-VG-172		
71	19-VG-177		
72	19-VG-192		
73	19-VG-204		
74	19-VG-208		
75	19-VG-209		
76	19-VG-210-212		
77	19-VG-214		
78	19-VG-216		

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-CR- 001	
Technical Contact/Email: Jonathon R. Merk / jon@forrestassociate.com	
Public Comment Number: 2022 Comments # 5, 6, & 7	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment #5:

It is common to use preblended masonry mortar in many regions. I suggest that 2.1 A be modified to include ASTM C1714.

Response/Rationale:

Three public comments request the addition of ASTM C1714 (Standard Specification for Preblended Dry Mortar Mix for Unit Masonry) to the Code and Specification. This ballot item seeks to make those additions in the requested locations.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

TMS 402 Code Section 1.4:

ASTM C1693-11 (2017) — Standard Specification for Autoclaved Aerated Concrete (AAC)

ASTM C1714/C1714M – 19a – Standard Specification for Preblended Dry Mortar Mix for Unit Masonry

ASTM C1877-19 — Standard Specification for Adhered Concrete Masonry Units

Code Commentary: N/A

TMS 602 Specification Article 1.3:

ASTM C1693-11 (2017) Standard Specification for Autoclaved Aerated Concrete (AAC).

ASTM C1714/C1714M – 19a – Standard Specification for Preblended Dry Mortar Mix for Unit Masonry

ASTM C1788-14 (2019) Standard Specification for Non-Metallic Plaster Bases (Lath) Used with Portland Cement Based Plaster in Vertical Wall Applications

TMS 602 Specification Article 2.1 A:

2.1 A. Provide mortar of the type and color specified, and conforming with ASTM C270 or ASTM C1714.

Specification Commentary: N/A

Subcommittee Vote:				
6 *Affirmative*	1 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	6 *Did not vote*

Subcommittee Comments: The AWC response reads as follows:

"In the past, others have said this was unnecessary because C1714 produces mortars whose materials and design requirements are governed by Specification C270. It's just a different method of production / delivery.

If users are reluctant to specify mortar this way, or are unaware of it or confused by C1714 not being listed, ok to add it but we should also then add commentary to Spec Article 2.1 A: "Mortars specified via C1714/C1714M have materials and design requirements governed by C270, but are preblended dry in a factory instead of produced from individual raw materials delivered to the jobsite."

Also, standard should be referenced as C1714 / C1714M in Code 1.4 and Spec A.1.3"

CR Chair response: CR will discuss the suggested commentary language as well as the Main Cmte. ballot item result at our next subcommittee meeting. With respect to the standard reference, if this ballot item is approved by Main Cmte. in ballot 19, CR would seek to correct that editorially.

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-CR- 002	
Technical Contact/Email: Jonathon R. Merk / jon@forrestassociate.com	
Public Comment Number: 2022 Comment # 8	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☐ ***Committee agrees with Public Comment, change is proposed***

☒ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment #8:

The term "mortar" is used throughout the document, but there is no definition for mortar in 2.2. I suggest adding a definition for mortar to 2.2 which includes reference to ASTM C270 Standard Specification for Mortar for Unit Masonry, and ASTM C1714 Standard Specification for Preblended Dry Mortar Mix for Unit Masonry.

Response/Rationale:

CR agrees that TMS 402 / 602 should contain a definition for mortar similar to the existing definition for grout. However, CR disagrees with including the requested ASTM references as existing definitions within TMS 402 / 602 generally do not include such references.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

TMS 402 Code Section 2.2:

Modulus of rigidity — Ratio of shear stress to corresponding shear strain for shear stress below the proportional limit of the material.

Mortar – (1) A plastic mixture of cementitious materials, fine aggregates, and water, with or without admixtures, that is used to construct unit masonry assemblies. (2) The hardened equivalent of such mixtures.

Nominal strength — The strength of a member or cross section calculated in accordance with the requirements and assumptions of the strength design methods of these provisions before application of strength-reduction factors.

Code Commentary: N/A

TMS 602 Specification Article 1.2:

Minimum/maximum (not less than . . . not more than) — Minimum or maximum values given in this Specification are absolute. Do not construe that tolerances allow lowering a minimum or increasing a maximum.

Mortar – (1) A plastic mixture of cementitious materials, fine aggregates, and water, with or without admixtures, that is used to construct unit masonry assemblies. (2) The hardened equivalent of such mixtures.

Otherwise required — Specified differently in requirements supplemental to this Specification.

Specification Commentary: N/A

Subcommittee Vote:				
6 *Affirmative*	1 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	6 *Did not vote*

Subcommittee Comments: The AWC response reads as follows:

"Agree with adding a definition, but it could be simplified by removing reference to "plastic" and "hardened" as follows, which is how it is listed in ASTM C1180, Standard Terminology of Mortar and Grout for Unit Masonry:

Mortar "(1) A ~~plastic~~ mixture of cementitious materials, fine aggregates, and water, with or without admixtures, that is used to construct unit masonry assemblies. ~~(2) The hardened equivalent of such mixtures.~~""

CR Chair response: The proposed definition for mortar follows the same convention used in the existing definition for grout in TMS 402 Section 2.2 and TMS 602 Article 1.2.

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-CR- 003	
Technical Contact/Email: Jonathon R. Merk / jon@forrestassociate.com	
Public Comment Number: 2022 Comment # 31	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment #31:

Regarding TMS 602, Article 1.8.C.3.b.2. Language setting the minimum acceptable mixing temperature set to 70 degrees F, while requiring the minimum placement temperature be maintained above 70 degrees F does not make sense. Is the mason to apply heat on the way to the wall to raise the grout temperature above what is minimally required at the mixer? Either raise the minimum mixing temperature, or lower the minimum placement temperature, to account for a reasonable temperature drop between the mixer and the wall.

Response/Rationale:

CR's efforts to obtain the original research supporting the existing temperature requirements came up empty while we addressed the premise of this comment during the committee portion of the cycle and in two ballots during the TAC portion, both of which declined to make changes due to a lack of supporting data. However, CR was recently able to obtain ACI's Guide to Cold Weather Concreting 306R – 16 (which was also adopted by PCA in their Design and Control of Concrete Mixtures EB001). While it is not part of this ballot, ACI 306R – 16 Table 5.1 has been attached as a reference to support the requested change.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code: N/A

Code Commentary: N/A

TMS 602 Specification Article 1.8 C.3.b.2:

2) Heat grout aggregates and mixing water to product grout temperature between 70°F (21.1°C) and 120°F (48.9°C) at the time of mixing. Maintain grout temperature above ~~70°F (21.1°C)~~ 55°F (12.8°C) at the time of grout placement.

Specification Commentary: N/A

Subcommittee Vote:					
5 *Affirmative*	1 *Affirmative w/ comment*	0 *Negative*	1 *Abstain*	6 *Did not vote*	

Subcommittee Comments:

The ballot portal recorded one AWC response, but the comment was not received.

The abstention reads as follows:

"I'm abstaining because I researched this topic and couldn't locate the history of the current requirements. The proposed change seems reasonable, but lessens the temperature requirement, which is intended to afford some level of protection and cushion in cold weather conditions.

Without knowing the history or having any new data to support the change, I don't know if the proposed requirement is still too restrictive or not restrictive enough. The concrete temperature requirements from ACI 306-R are only a proxy for grout because concrete is placed into formwork (which has less mass than masonry units), whereas grout is placed into cells of masonry units and will be more affected by the temperature of the masonry construction."

Table 5.1—Recommended concrete temperatures

		Section size, minimum dimension			
		< 12 in. (300 mm)	12 to 36 in. (300 to 900 mm)	36 to 72 in. (900 to 1800 mm)	> 72 in. (1800 mm)
Line	**Air temperature**	**Minimum concrete temperature as placed and maintained**			
1	—	55°F (13°C)	50°F (10°C)	45°F (7°C)	40°F (5°C)
		Minimum concrete temperature as mixed for indicated air temperature*			
2	Above 30°F (−1°C)	60°F (16°C)	55°F (13°C)	50°F (10°C)	45°F (7°C)
3	0 to 30°F (−18 to −1°C)	65°F (18°C)	60°F (16°C)	55°F (13°C)	50°F (10°C)
4	Below 0°F (−18°C)	70°F (21°C)	65°F (18°C)	60°F (16°C)	55°F (13°C)
5	—	**Maximum allowable gradual temperature drop in first 24 hours after end of protection**			
		50°F (28°C)	40° (22°C)	30°F (17°C)	20°F (11°C)

*For colder weather, a greater margin in temperature is provided between concrete as mixed and required minimum temperature of fresh concrete in place.

Note 1: For Line 1, maximum placement temperature is minimum temperature in the table plus 20°F (11°C).

Note 2: For Lines 2-4, maximum temperature is minimum temperature in the table plus 15°F (9°C).

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-CR- 004	
Technical Contact/Email: Jonathon R. Merk / jon@forrestassociate.com	
Public Comment Number: 2022 Comment # 32	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☐ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☒ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment#32:

When completing a low-lift wall, it would be helpful for the mason and / or inspector to have some wiggle room with respect to the cleanout requirement of TMS 602 3.2 F. For instance, if a mason wants to build 7'-4" above the last 5'-4" build, to top out the wall in one final step, and wishes to do so without cleanouts, or a grout demonstration panel, the inspector should still be able to adequately inspect the cells down to the last grout lift and then allow the mason to grout the 7'-4" height in two lifts. Please add language allowing conditions similar to the one described above.

Response/Rationale:

While we appreciate what the commenter is attempting to accomplish here, CR disagrees with the requested change. If we're being brutally honest, some masons are lucky to go 2'-8" in height and keep the grout space clean enough to satisfy Code requirements for grout placement while other masons are capable of extending well beyond the current limitation of 5'-4". The only legitimate way to determine that is through a demonstration panel. This could easily be accomplished with an enlarged sample panel reflecting the project conditions. Asking a mason to take this additional step in return for being allowed to deviate from Code does not constitute an onerous burden. Therefore, CR proposes no changes in response to this comment.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code: N/A

Code Commentary: N/A

Specification: N/A

Specification Commentary: N/A

Subcommittee Vote:				
7 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	6 *Did not vote*

Subcommittee Comments: N/A

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-CR- 005	
Technical Contact/Email: Jonathon R. Merk / jon@forrestassociate.com	
Public Comment Number: 2022 Comment # 33	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☐ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☒ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment #33:

TMS 602, Table 4, Inspection Task 1.f, requires the special inspection of the sample panel construction for Levels 2 and 3, and lists Article 1.6 D for the inspection criteria. What is the purpose of these sample panels? So the mason and the inspector can practice the special inspection process before building and inspecting the actual walls? That does not seem beneficial since whatever might be established structurally by the completed sample panel would still have to be special inspected during the actual wall construction. Considerable code work has been done to require special inspections so that the actual construction agrees structurally with the approved construction documents, so why require it on a little piece of wall beforehand? If the structural engineer feels that a part of the construction warrants sampling for some structural reason, then he / she can always specify that outside of TMS 602, but sample panels should not be automatically required for every Level 2 or 3 masonry project. Please remove Inspection Task 1.f and let Article 1.6 D speak to aesthetic issues only, which most of the related commentary does anyway.

Response/Rationale:

Sample panels exist to help confirm the units match the design criteria, for the mason to demonstrate they are capable of installing the product within Code / project specification tolerances, and for the mason to demonstrate any difficult / unusual conditions the design team is concerned about, all of which establish a baseline for the quality of the masonry that extends well beyond aesthetics. Having a small sample panel rejected for a misunderstanding / etc. would have little impact on a project. Waiting to verify these items on "finished work" would yield terrible consequences. Therefore, CR proposes no changes in response to this comment.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code: N/A

Code Commentary: N/A

Specification: N/A

Specification Commentary: N/A

Subcommittee Vote:				
7 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	6 *Did not vote*

Subcommittee Comments: N/A

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-CR- 006	
Technical Contact/Email: Jonathon R. Merk / jon@forrestassociate.com	
Public Comment Number: 2022 Comment # 58	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment #58:

Item 4 in Article 2.4 G is listed as "Ties." It would be clearer to list this as "Wire ties" as is done for Item 4 in Article 2.4 I.

Response/Rationale:

CR concurs and proposes the following change.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code: N/A

Code Commentary: N/A

TMS 602 Specification Article 2.4 G.4:

4. Wire Ties ASTM A1064 / A1064M

Specification Commentary: N/A

Subcommittee Vote:				
7 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	6 *Did not vote*

Subcommittee Comments: N/A

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-CR- 007	
Technical Contact/Email: Jonathon R. Merk / jon@forrestassociate.com	
Public Comment Number: 2022 Comment # 109	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment #109:

Article 3.5 E.b is clear that grout should be reconsolidated after initial water loss and settlement has occurred, but does not give any indication limiting how long after initial water loss and settlement. Previous codes used the term "before plasticity is lost". I would suggest some upper limitation, such as "loss of plasticity" since the attempt to reconsolidate grout that has lost plasticity does more damage than good.

Response/Rationale:

CR concurs and offers the proposed revision in response to this comment.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code: N/A

Code Commentary: N/A

TMS 602 Specification Article 3.5 E.b:

b. Consolidate pours exceeding 12 in. (305 mm) in height by mechanical vibration, and reconsolidate by mechanical vibration after initial water loss and settlement has occurred, but prior to loss of plasticity.

Specification Commentary: N/A

Subcommittee Vote:				
7 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	6 *Did not vote*

Subcommittee Comments: N/A

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-CR- 008	
Technical Contact/Email: Jonathon R. Merk / jon@forrestassociate.com	
Public Comment Number: 2022 Comment # 159	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment #159:

The commentary has explanations for Dimension (nominal), drainage space and Inspection, but does not have the titles like the Spec column does. Please add titles to these three definitions in the Commentary. This would make TMS 602 definitions consistent with TMS 402 definitions.

Response/Rationale:

CR concurs and proposes the following changes in response to this comment. CR is also attempting to remove two commentary headings inadvertently left in place following approval of a FS ballot intending to remove headings from the definitions. For clarity's sake, page and line numbers are listed in parenthesis but are not part of this ballot item.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code: N/A

Code Commentary: N/A

Specification: N/A

Specification Commentary:

(pg. 311, line 55) ~~**C.**~~ *Bond beam* – This reinforced member is usually …….

(pg. 312, line 75) *Dimension, nominal –* The permitted tolerances for units ……..

(pg. 312, line 85) *Drainage space –* The drainage space may contain ……..

(pg. 313, line 60) *Inspection –* The Inspection Agency is required …….

(pg. 314, line 80) ~~**AT.**~~ *Running bond* – TMS 402 requires horizontal …….

Subcommittee Vote:				
7 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	6 *Did not vote*

Subcommittee Comments: N/A

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-CR- 009	
Technical Contact/Email: Jonathon R. Merk / jon@forrestassociate.com	
Public Comment Number: 2022 Comment # 182	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☐ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☒ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment #182:

The term "grout pour" is not understood by the design community and is too often confused with the pouring of grout into the wall which we call placement. The term should be deleted from the code and spec and described in another way. In many places in TMS 602, the phrase "maximum height of masonry prior to grouting" or "maximum height of the masonry to be grouted" can be used instead of grout pour to denote the maximum height the masonry may be built. This will eliminate the need to explain in great detail the difference between a lift and a pour.

Response/Rationale:

TMS 602 Article 1.2 contains a definition for grout pour that makes clear what the committee is trying to convey with that term. If a designer is unclear / confused on the term, it is incumbent upon them to look that up within our document. Additionally, the term "grout pour" appears in many locations throughout the document and is much shorter than the suggested seven or eight word phrase. Therefore, CR does not propose any changes in response to this comment.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code: N/A

Code Commentary: N/A

Specification: N/A

Specification Commentary: N/A

Subcommittee Vote:				
7 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	6 *Did not vote*

Subcommittee Comments: N/A

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Design Subcommittee	**Ballot #: 19**
Item #: 19-DE-PC03	
Technical Contact/Email:	Dr. Richard Bennett (rmbennett@utk.edu) and Dr. Mark McGinley (m.mcginley@louisville.edu)
Public Comment Number:	2022 Comment # 3
Public Comment Response Based on TMS 402/602 Draft Dated	**6/4/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment: In Figure CC-9.1-1, ey should be ety on the x-axis.

Response/Rationale: The Committee agrees with the comment and the change is made.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code: NONE

Code Commentary:

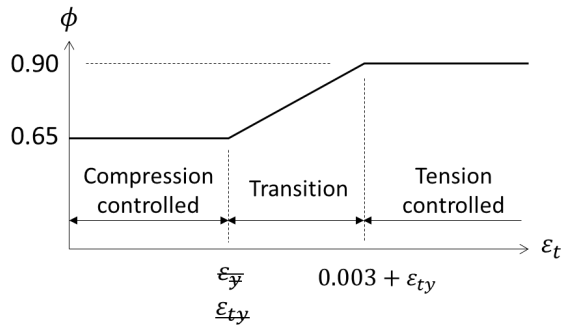


Figure CC-9.1-1 Variation of ϕ with net tensile strain in extreme tension reinforcement, ε_t

Specification: NONE

Specification Commentary: NONE

Subcommittee Vote:									
10	*Affirmative*	0	*Affirmative w/ comment*	0	*Negative*	0	*Abstain*	10	*Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-DE-PC09	
Technical Contact/Email:	Dr. Richard Bennett (rmbennett@utk.edu) and Dr. Mark McGinley (m.mcginley@louisville.edu)
Public Comment Number:	2022 Comment # 09
Public Comment Response Based on TMS 402/602 Draft Dated	**6/4/2021**

This ballot item proposes the following response to the Public Comment:

☐ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☒ ***Public Comment only requires a response, no change to document***

Public Comment: The radius of gyration as used in equations 8-13, 8-14, 8-16, 8-18, 8-19, 9-11, 9-12, 9-14, 9-15, and 9-16 in the 2016 version of TMS 402 is not well defined. The understood definition from other sources is that of the square root of the moment of inertia divided by the area. This leads to questions about which moment of inertia and which area, especially for partially grouted walls, and members undergoing cracking. Section 4.3.3 identifies it as the average net cross-sectional area, but this brings questions about how to incorporate 5.1.2 for the effective width per bar with this concept, as well as whether or not cracked moments of inertia should be used. I think it's worth mentioning the Table GN-8 from page 548 of the 7th edition reinforced masonry engineering handbook identifies both a net radius of gyration and an average radius of gyration, not a combined average net radius of gyration. I believe the primary question here is: is the radius of gyration intended as a stress calculation parameter or a stiffness calculation parameter?

Response/Rationale:

Thank you for your public comment. Several questions/issues were raised, and they are answered in the following.

1. With regard to the primary question, the radius of gyration is considered as a stiffness calculation parameter. We believe this is clear from the second sentence of the commentary of Section 4.3.3: "Because stiffness is based on the average net cross-sectional area of the member considered, this same area should be used in the calculation of radius of gyration."
2. With regard to partially grouted walls, the net area should be used, and not the gross area. There is the net area based on the minimum cross-sectional area, which is used for stress calculations per Section 4.3.1.1. For stiffness calculations, the average net-cross-sectional area is used per Section 4.3.2.
3. With regard to incorporating the effective width of the bar, the difference is small enough that the committee leaves that to engineering judgement. For example, for an 8 inch CMU wall, the average radius of gyration for a grout spacing of 48 inches (the maximum effective compression width) is 2.66 inches (NCMA TEK 14-1B). The radius of gyration for a grout spacing of 120 inches, or 2.5 times as large, is 2.76, or less than a 4% difference.
4. Since the radius of gyration is used to calculate axial capacity, the effect of wall cracking is small. For example, for tests performed by Hatzinkolas with #3, #6, and #9 bars at 16 inch, the ratio of the experimental capacity to the predicted capacity using uncracked properties was 1.15. For tests performed by Yokel with #5 bars at 40 inch, the ratio of the experimental capacity to the predicted

capacity using uncracked properties was 1.97. Cracked properties are appropriate, and used, for primarily flexural loading.

5. The TMS 402/602 committee has no control over the nomenclature that is used in publications such as the Reinforced Masonry Engineering Handbook. However, we note that the difference between the net radius of gyration and the average radius of gyration is generally less than 10%. The effect on the axial capacity would typically be less than that.

For voter convenience, the pertinent sections of TMS 402 are given below. These are not a part of the response, and no changes are being proposed.

Code:

4.3.2 *Stiffness*
Calculation of stiffness based on uncracked section is permissible. Use of the average net cross-sectional area of the member considered in stiffness calculations is permitted.

4.3.3 *Radius of gyration*
Radius of gyration shall be calculated using the average net cross-sectional area of the member considered.

Code Commentary:

4.3.2 *Stiffness*
Stiffness is a function of the extent of cracking. Because unreinforced masonry is designed assuming it is uncracked, Code equations for design of unreinforced masonry are based on the member's uncracked moment of inertia and ignoring the effects of reinforcement, if present. For reinforced masonry, more accurate estimates may result if stiffness approximations are based on the cracked section.

The section properties of masonry members may vary from point to point. For example, in a single-wythe concrete masonry wall made of hollow ungrouted units, the cross-sectional area varies through the unit height. Also, the distribution of material varies along the length of the wall or unit. For stiffness calculations, an average value of the appropriate section property (cross-sectional area or moment of inertia) is considered adequate for design. The average net cross-sectional area of the member would in turn be based on average net cross-sectional area values of the masonry units and the mortar joints composing the member.

4.3.3 *Radius of gyration*
The radius of gyration is the square root of the ratio of bending moment of inertia to cross-sectional area. Because stiffness is based on the average net cross-sectional area of the member considered, this same area should be used in the calculation of radius of gyration. To simplify the calculation of radius of gyration, tabulated section properties for walls consisting of hollow units with a variety of grout configurations are available in NCMA TEK 14-1B (2007) and BIA TN 3B (1993).

Subcommittee Vote:				
10 *Affirmative*	1 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	9 *Did not vote*

Subcommittee Comments:
Editorial changes made based on comment

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-DE-PC10	
Technical Contact/Email:	Dr. Richard Bennett (rmbennett@utk.edu) and Dr. Mark McGinley (m.mcginley@louisville.edu)
Public Comment Number:	2022 Comment # 10
Public Comment Response Based on TMS 402/602 Draft Dated	**6/4/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment: The symbol used for the direct shear strength used in Section 11.1.8.4 and Equation 11-2, appears to be the wrong symbol. This symbol is defined on page 11 line 6 as the calculated shear stress, not the shear strength.

Response/Rationale: The Committee agrees with the comment. The symbol in Equation 11-2 is changed.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code:

2.1 — Notation

f_{vd} = direct shear strength

11.1.8.4 *Masonry direct shear strength* — The direct shear strength, ~~f_v~~ f_{vd} , across an interface of AAC material shall be determined by Equation 11-2, and shall be taken as 50 psi (345 kPa) across an interface between grout and AAC material.

$$\text{~~}f_v\text{~~ } f_{vd} = 0.15 f'_{AAC} \qquad \text{(Equation 11-2)}$$

Code Commentary: NONE

Specification: NONE

Specification Commentary: NONE

Subcommittee Vote:				
10 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	10 *Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-DE-PC11	
Technical Contact/Email:	Dr. Richard Bennett (rmbennett@utk.edu) and Dr. Mark McGinley (m.mcginley@louisville.edu)
Public Comment Number:	2022 Comment # 11
Public Comment Response Based on TMS 402/602 Draft Dated	**6/4/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment: The symbol used in equation 11-30, Vcr, does not appear on the list of defined symbols on page C-13. Consider adding it.

Response/Rationale: The Committee agrees with the comment. Vcr is added to the list of defined symbols.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code:

2.1 — Notation

V_{cr} = flexural cracking strength

11.3.6.5 *Flexural cracking strength* — The flexural cracking strength shall be calculated in accordance with Equation 11-30, where f_{rAAC} is given by Section 11.1.8.3:

$$V_{cr} = \frac{S_n}{h}\left(f_{rAAC} + \frac{P}{A_n}\right) \qquad \text{(Equation 11-30)}$$

Code Commentary: NONE

Specification: NONE

Specification Commentary: NONE

Subcommittee Vote:									
10	*Affirmative*	0	*Affirmative w/ comment*	0	*Negative*	0	*Abstain*	10	*Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-DE-PC35	
Technical Contact/Email:	Dr. Richard Bennett (rmbennett@utk.edu) and Dr. Mark McGinley (m.mcginley@louisville.edu)
Public Comment Number:	2022 Comment # 35
Public Comment Response Based on TMS 402/602 Draft Dated	**6/4/2021**

This ballot item proposes the following response to the Public Comment:

☐ ***Committee agrees with Public Comment, change is proposed***

☒ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

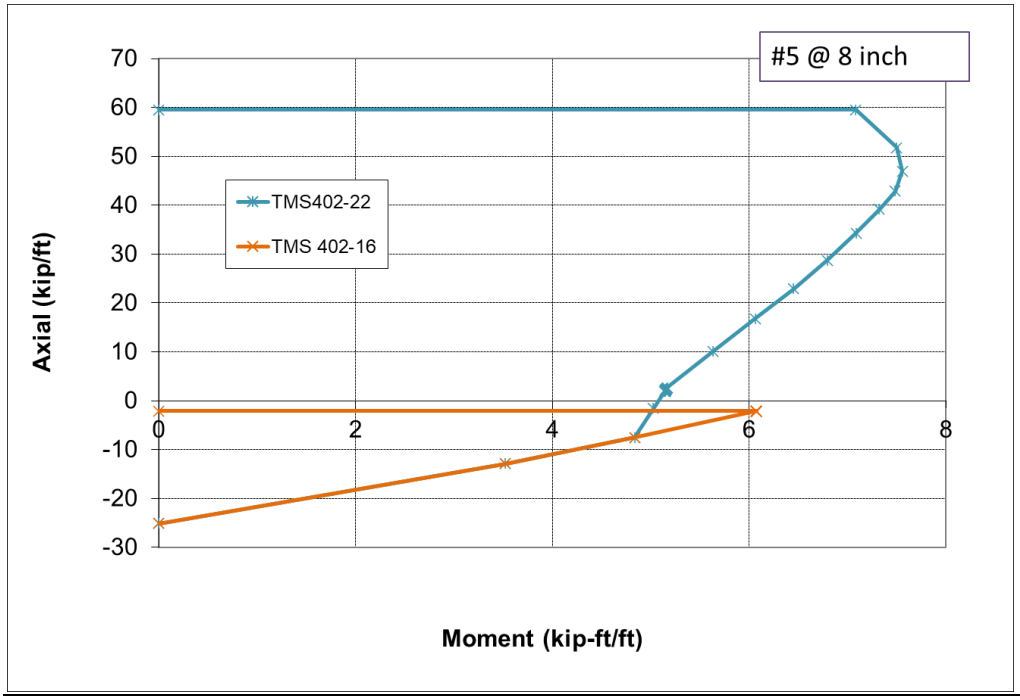
☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment: While doing some out-of-plane CMU wall runs, I found at least one case where the equation listed in Table CC-9.1-1 for calculating the Pu limit results in a negative value (8" CMU, f'm = 2,000 psi, #8@8" o/c Grade 60 vertical reinforcement cell centered). I interpreted this to mean that the wall is compression controlled for all values of Pu. If that is correct, and to avoid potential user confusion, I recommend that "≥ 0" be added at the end of all Pu limit equations of Table CC-9.1-1 for which the above condition applies.

Response/Rationale: The Committee agrees with the intent of the comment, and obtaining a negative value for P_u from the equations in Table CC-9.1-1 could be confusing. A slightly alternate solution is being proposed with commentary being added.

As background, let's take an 8 inch CMU wall with #5@8 inch. Using the equations in Table CC-9.1-1, P_u would be -7.725 kip/ft for the section to be tension controlled. If we somehow had a permanent tension force of greater than 7.725 kip/ft on the wall (please don't ask how), then the wall would be tension controlled. The wall becomes compression controlled at about 2.2 kip/ft, which is the little kink in the diagram below. Between -7.725 kip/ft and 2.2 kip/ft, we are in the transition region. If one was doing the design and calculations by hand, it would be appropriate to neglect the transition region and just use phi=0.65. If one were using a spreadsheet or computer program, they could consider the transition region and get just a smidge more capacity. But to the primary point of the comment, we do believe it could be confusing to users if they come up with a negative value, and commentary would be added.



PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code: NONE

Code Commentary:

9.1.4.4 *Combinations of flexure and axial load in reinforced masonry —*
Table CC-9.1-1 gives limiting values of the factored axial load, P_u, such that sections are tension-controlled. As long as P_u is less than these values, the strength-reduction factor will be 0.90. If the value of P_u in Table CC-9.1-1 is negative, this means that a tension force is needed for the section to be tension-controlled. The section would be compression-controlled or in the transition region for all compressive axial loads. The value of A_s for fully grouted shear walls is the total area of vertical reinforcement along the wall. The limits for fully grouted shear walls can also be used for partially grouted shear walls if the width b is adjusted to account for the amount of grouting. For partially grouted walls subjected to out-of-plane loads, b_w is the width of the compression section minus the sum of the length of ungrouted cells, and t_{fs} is the specified face-shell thickness for hollow masonry units. The equations are based on a yield strain of 0.002.

Specification: NONE

Specification Commentary: NONE

Subcommittee Vote:				
10 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	10 *Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-FS-001	
Technical Contact/Email: Jamie Farny, jfarny@cement.org, 773-343-3616	
Public Comment Number: 2022 Comment # **70, 71, 75, 81, 85, 101, 102, 119, 121, 141, 206**	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment:

PC 70: P. 27. On line 8, 20, and 24, there should not be a space between steel and the comma. On line 8 this causes the comma to go the next line.
This is picky, but Phil says the best way to document this.

PC 71: P. 34, line 1. The symbol should just be Chi, and not X.
On page 273 line 7 X is used instead of Chi in 0.80Xf'm and should be changed to Chi.

PC 75: p. 89, line 71. There are two periods at the end of the sentence.
"... that have a 6-in. (152 mm) length per core or cell.."

PC 81: P. 119, lines 60, 68. Delete the second comma after exception in line 60.
Delete the comma and t at the end of the paragraph in line 68.

PC 85: P. 124, line 59. Insert a hyphen between "force" and "resisting" in the following.
The 2.0 load factor for special reinforced masonry shear walls that are part of the seismic-force resisting system designed by allowable stress design procedures is applied only to in-plane shear forces.

PC 101: P. 241, line 61. The word "code" should be in uppercase in "this Code."

PC 102: P. 245, line 28. Subsection (f) should end with a period and not a dash.

PC 119: P. 119, line 62. There is a double comma after the word "exception"

PC 121 [DUPLICATES SECOND PART OF PC 81]: P. 119, line 69. In the commentary at the end of the sentence, there is an added ", t" that does not belong.

PC 141 [FIRST PART DUPLICATES SECOND PART OF PC 81 AND PC 121]: P. 119, lines 62, 68. At line 62,", t"□ should be replaced with a period. At line 82, the phrase "can be achieved"□ should be deleted.

PC 206: P. 45, line 20. "tiess" spelling.

Response/Rationale:

All of these items are considered editorial. As such, they are grouped together in one ballot item, but should be considered individually. If a negative vote is cast for any one of them, please identify the item, page, and line number.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code:

PC 70: B_{as} = allowable axial tensile load on an anchor bolt when governed by the tensile strength of the steel-, lb (N)
B_{vns} = nominal shear strength of an anchor bolt when governed by the shear strength of the steel-, lb (N)
B_{vs} = allowable shear load on an anchor bolt when governed by the shear strength of the steel-, lb (N)

PC 71 first part: should be p. 34 line 19 ~~Y~~χ = factor used to account for direction of compressive stress in a masonry member relative to the direction used for the determination of f'_m
PC 71 second part **D.4.3** *Lintels* The masonry stress over the equivalent compression stress block of Section 9.3.2(g) shall be 0.80~~Y~~$\chi f'_m$, where:

PC 102: (f) *Sheathing* — Sheathing is required over frame backing receiving an adhered veneer ~~assembly~~ assembly.

PC 206: *Veneer, anchored* — Masonry veneer secured to and supported laterally by the backing through veneer ~~tiess~~ties and supported vertically by the foundation or other structural members.

Code Commentary:

PC75: Code Commentary 6.1.3.2.5…cell or core for two-celled units), with a footnote to address nominal 12-in. (305 mm) long clay units that have a 6-in. (152 mm) length per core or cell.~~-~~ Table 6.1.3.2.5.1 applies…

PC 81 and PC 121: **7.3.1** *Nonparticipating elements* — With regards to the exception,~~-~~ non-isolated, nonparticipating elements can influence a structure's strength and stiffness, and as a result the distribution of lateral loads and building irregularities. The influence of any non-isolated nonparticipating elements can inadvertently have on the performance of a structural system should be considered in design in accordance with Section 4.1.6 of this code, and other applicable provisions such as the modelling criteria of ASCE/SEI 7. Where partial height nonparticipating elements are constructed tight to building columns, this should include the consideration of short column effects.~~-t~~

PC 85: **7.3.2.5.1.1** The 2.0 load factor for special reinforced masonry shear walls that are part of the seismic-force-resisting system designed by allowable stress design procedures is applied only to in-plane shear forces.

PC 101: … require such a property as well as other design values found in other parts of this ~~c~~Code.

PC 119: **7.3.1** *Nonparticipating elements* — With regards to the exception,~~-~~ non-isolated, nonparticipating elements can…

PC 141: For lateral force resisting systems constructed of other materials, a nonparticipating element can achieve a ductility compatible with the ductility of the lateral force resisting system ~~can be achieved~~ by detailing the nonparticipating element in accordance with the requirements for a masonry shear wall with an R value not less than that of the lateral force resisting system.

Specification:

No change.

Specification Commentary:

No change.

Subcommittee Vote:				
5 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	0 *Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-FS-002	
Technical Contact/Email: Jamie Farny, jfarny@cement.org, 773-343-3616	
Public Comment Number: 2022 Comment # **183**	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

- ☐ ***Committee agrees with Public Comment, change is proposed***
- ☒ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***
- ☐ ***Committee disagrees with Public Comment and no changes are proposed***
- ☐ ***Committee unable to fully develop a response to Public Comment***
- ☐ ***Public Comment only requires a response, no change to document***

Public Comment:

PC 183: P. 40, line 32/33

The term Licensed Design Professional is defined in Chapter 2 and used 4 times in the document. The term Architect/Engineer is not defined and is used 61 times in the document. The term Licensed Design Professional appears to be favored in the IBC, at least in part because it is more inclusive. I recommend using picking one and using it consistently. I recommend using Licensed Design Professional because there are cases where non-Architect/Engineers may use the code, particularly the prescriptive design chapters. For example, landscape architects will use the anchored veneer provisions for masonry site walls and certified interior designers may use the adhered veneer provisions for interior adhered veneer.

Response/Rationale:

This is a little more complex than the public comment indicates. There is room for both LDP and A/E, keeping some parts less specific by using A/E, which is more inclusive. You do not necessarily need to be licensed to do some work in some locations, so "licensed" may not apply. Making two changes in the Code as described below resolves the issue with definitions and is the fewest number of changes to clean up the language.

"Designer" occurs only once in the Code, so we can modify that statement (13.2.3.1.1) to remove "designer" so that it only appears in Commentary. This means that we do not need to define "designer" in the Code because it's now only used in Commentary.

We can modify the statement in 13.3.2.2 (b) to change "Architect/Engineer" to "Licensed Design Professional", which is defined in the Code, and meets the intent that this is handled by the designer.

LDP is mostly used in the Code Commentary, as signified by the term "designer." A/E is used primarily in the Specification, more or less equally in the Spec itself and the Spec Commentary.

The Code (402) uses LDP only 3 times, in the definition of it and commentary to it. The definition states that "designer" is used in the commentary to mean LDP. "Designer" appears 41 times in 402: only once in the Code (13.2.3.1.1) and 40 times in the Code Commentary. "Designer" appears 5 times in 602: once in the Preface and 4 times in the Spec Commentary.

The Specification (602) uses Architect/Engineer 57 times and does define it: 34 times in Spec and the rest in Spec Commentary or Checklists.

The Code (402) uses Architect/Engineer only 4 times: only once in the Code (13.3.2.2(b)) and 3 times in Code Commentary.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code:

13.2.3.1.1 *Deemed to comply strength and stiffness* — The ~~designer shall be permitted to utilize the~~ strength and stiffness values of Table 13.2.3.1.1 shall be permitted to be utilized for veneer ties that meet the requirements of Table 13.2.2.4.

13.3.2.2 *Unit limitations* — Units for prescriptively-designed adhered veneer shall comply with the following:
(a) The average thickness of adhered masonry veneer units shall not exceed 2.625 in. (67 mm).
(b) The bonded surface area of each adhered masonry veneer unit shall not exceed 720 $in.^2$ (0.465 m^2). Units having a bonded surface area greater than 360 $in.^2$ (0.232 m^2) shall have an installation procedure approved by the ~~Architect/Engineer~~ Licensed Design Professional.

Code Commentary:

No change.

Specification:

No change.

Specification Commentary:

No change.

Subcommittee Vote:				
4 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	1 *Did not vote*

Subcommittee Comments: In some states or jurisdictions, “registered design professional” is used rather than “licensed design professional” and this is already covered by including a reference to RDP in the definition for LDP.

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-FS-003	
Technical Contact/Email: Jamie Farny, jfarny@cement.org, 773-343-3616	
Public Comment Number: 2022 Comment # **204 partial**	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☐ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☒ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment:

PC 204: P. 45, line 6 (FS to address the first part of the comment; VG to address second part)
Use of the terms "attach" and "connect" are not harmonized throughout this code, and to some extend, neither is "anchor". Also examine the non-harmonized use of the term "tied". These terms appear at multiple locations throughout the code without consistency.

Response/Rationale:

There are 116 occurrences of "connect" and derivations and only 19 of "attach" and derivations. The committee has reviewed the occurrences of "attach" and "connect" and believes that the terms are used reasonably consistently. (Note that we previously did a similar evaluation for "comply/conform" and these were determined to be synonyms that can be used interchangeably without causing confusion for users of the document.)

To help justify the difference between "connect" and "attach," consider the definition for "Connector" on p. 37, line 30 — A mechanical device for securing two or more pieces, parts, or members together, including anchors and ties.

Connecting two things together is therefore slightly different from attaching one thing to another, such as attaching veneer to a backup.

As such, no change is made to the way attach and connect and their derivations are used.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code:

No change.

Code Commentary:

No change.

Specification:

No change.

Specification Commentary:

No change.

Subcommittee Vote:				
5 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	0 *Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-GR-069	
Technical Contact/Email: Charles Clark / cclark@bia.org	
Public Comment Number: 2022 Comment # 69 & 196	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/4/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment:

Comment #69: Commentary 1.2.1 There are two very similar sentences in the commentary. I think the second one should be deleted. Graphic depictions of movement joints may provide greater clarity than notes. Graphic depictions of joints may provide greater clarity compared to notes.

Comment #196: "Graphic depictions" statement is made twice...one must be deleted.

Response/Rationale:

The committee agrees with both comments and recommends deleting the second sentence.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code: NONE

Code Commentary:

1.2.1

(h) Control joints, expansion joints, and other movement joints are the primary means of accommodating dimensional changes and differential movement. Joint placement can influence structural design and performance in many ways, including, but not limited to, shear wall length, flange behavior at corners and/or intersecting walls, and potential interference with lintel bearing. Therefore, it is recommended that the drawings accurately reflect design assumptions so that the masonry and movement joints can be constructed and placed as intended. Graphic depictions of movement joints may provide greater clarity than notes. ~~Graphic depictions of joints may provide greater clarity compared to notes.~~

Specification: NONE

Specification Commentary: NONE

Subcommittee Vote:				
8 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	1 *Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-GR-036	
Technical Contact/Email: Charles Clark / cclark@bia.org	
Public Comment Number: 2022 Comment # 36	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/4/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment: Note 1 to Table 4.2.2 states "As an alternative for prestressing steel, the modulus of elasticity, Eps, shall be permitted to be taken as 29,000,000 psi (200,000 MPa) for wires and bars and 27,560,000 psi (190,000 MPA) for strands." The commentary states "Prestressing steel - The modulus of elasticity of prestressing steel is often taken equal to 28,000 ksi (193,000 MPa) for design, but can vary and should be verified with the manufacturer." The conflict between the code and commentary should be resolved. It also seems that expressing the modulus to four significant figures is too precise.

Response/Rationale:

The committee agrees with the comment, and changes are made to the table.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code: Modify footnote 1 of Table 4.2.2. For voter convenience, the portion of Table 4.2.2 referenced by footnote 1 is shown but no other modifications are proposed.

Table 4.2.2: Modulus of Elasticity and Modulus of Rigidity

Material	Modulus of Elasticity	Modulus of Rigidity
Prestressing Steel[1]	E_{ps} shall be determined by tests or provided by manufacturer	---

[1]As an alternative for prestressing steel, the modulus of elasticity, E_{ps}, shall be permitted to be taken as 29,000,000 psi (200,000 MPa) for wires and bars and ~~27,560,000 psi (190,000 MPA)~~ 28,000,000 psi (193,000 MPa) for strands.

Code Commentary: No modifications proposed. For voter convenience, the portion of commentary referencing prestressing steel in Section 4.2.2 is shown.

4.2.2 *Modulus of elasticity and modulus of rigidity* — This table provides design values for the modulus of elasticity and the modulus of rigidity which are commonly used in the design of masonry. Other modulii may exist.

Prestressing steel — The modulus of elasticity of prestressing steel is often taken equal to 28,000 ksi (193,000 MPa) for design, but can vary and should be verified with the manufacturer.

Specification: NONE

Specification Commentary: NONE

Subcommittee Vote:				
8 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	1 *Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-GR-074	
Technical Contact/Email: Charles Clark / cclark@bia.org	
Public Comment Number: 2022 Comment # 74	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/4/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment: Delete the heading in the commentary of 4.7.1 Embedded conduits, pipes, and sleeves.

Response/Rationale:

The committee agrees with the comment and recommends deleting the heading.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code: NONE

Code Commentary:

4.7 — Embedded conduits, pipes, and sleeves

~~4.7.1~~ ~~*Embedded conduits, pipes, and sleeves*~~

Specification: NONE

Specification Commentary: NONE

Subcommittee Vote:				
8 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	1 *Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-GR-107	
Technical Contact/Email: Charles Clark / cclark@bia.org	
Public Comment Number: 2022 Comment #107	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/4/2021**

This ballot item proposes the following response to the Public Comment:

☐ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☒ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment: I have never seen 'loads used for the design of masonry structures' indicated on project drawings or project specifications. It may be relevant to the information provided for permit approval, but listing as a construction project document requirement does not seem appropriate. Suggest deleting this requirement.

Response:
The committee respectfully disagrees with the comment. Indicating the loads used for design as information on the drawings is common practice. The requirement to indicate the loads used in design on the drawings is typical in other material standards such as ACI 318.

Subcommittee Vote:				
8 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	1 *Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-GR-126	
Technical Contact/Email: Charles Clark / cclark@bia.org	
Public Comment Number: 2022 Comment # 126	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/4/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment: Need an additional definition: "Dimension, actual – the measured dimension."

Response/Rationale:

The committee agrees with this comment, and a new definition is to be added.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code:

2.2 — Definitions

Dimension, actual – the measured dimension of a unit, joint, or member.

Code Commentary:

2.2 — Definitions

Dimension, actual — Actual dimensions are the measurements of the masonry unit as manufactured. The actual dimensions will usually be within the permitted tolerances of the specified dimensions.

Specification: NONE

Specification Commentary: NONE

Subcommittee Vote:									
6	*Affirmative*	2	*Affirmative w/ comment*	0	*Negative*	0	*Abstain*	1	*Did not vote*

Subcommittee Comments:

Comments addressed editorially in submission to Main.

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-GR-132	
Technical Contact/Email: Charles Clark / cclark@bia.org	
Public Comment Number: 2022 Comment # 132	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/4/2021**

This ballot item proposes the following response to the Public Comment:

☐ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☒ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment: This definition does not define the masonry modulus of elasticity. It is defined in Table 4.2.2.

Response/Rationale:

The definition of "modulus of elasticity" in the Section 2.2 is generic and intended to be so in order to apply to all of the different types of masonry permitted by the standard as well as companion materials such as steel reinforcement and prestressing steel. Even under Section 4.2 – Material Properties, only the term "modulus of elasticity" is used, not "masonry modulus of elasticity". Table 4.2.2 also includes modulus of elasticity values for reinforcing steel and prestressing steel. As such, it is proposed that the definition remains as-is.

Subcommittee Vote:				
8 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	1 *Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-GR-133	
Technical Contact/Email: Charles Clark / cclark@bia.org	
Public Comment Number: 2022 Comment # 133	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/4/2021**

This ballot item proposes the following response to the Public Comment:

- ☐ ***Committee agrees with Public Comment, change is proposed***
- ☒ ***Committee agrees comment has merit, but proposed changes are not completely consistent with Public Comment***
- ☐ ***Committee disagrees with Public Comment and no changes are proposed***
- ☐ ***Committee unable to fully develop a response to Public Comment***
- ☐ ***Public Comment only requires a response, no change to document***

Public Comment: Delete "required by the contract documents" after "work". The contract documents are the drawings and specifications. The reason they are called contract documents is that they are the contract for the contractor in the usual legal definition.

Response/Rationale:

The committee agrees with this comment. As phrased, it would imply that the project drawings were not part of the contract documents. Also, the term “drawings” was used in the definition of project drawings, so the term was substituted. The following is proposed to address these issues.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code: 2.2 – Definitions

Project drawings — The ~~drawings~~ graphical representations that, along with the project specifications, complete the descriptive information for constructing the work. ~~required by the contract documents.~~

Code Commentary: NONE

Specification: NONE

Specification Commentary: NONE

Subcommittee Vote:				
8 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	1 *Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-GR-200	
Technical Contact/Email: Charles Clark / cclark@bia.org	
Public Comment Number: 2022 Comment # 200	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/4/2021**

This ballot item proposes the following response to the Public Comment:

☐ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit, but proposed changes are not completely consistent with Public Comment***

☒ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment: "...joint and opening locations assumed in the design..." Use of the term "assumed" is not appropriate. The design must be concluded...nothing about the design should be assumed. All that is needed to construct the structure in accordance with the design should be suitably communicated by the architect and/or engineer within the contract documents.

Response/Rationale:

The committee disagrees with this comment because the corresponding code language states "The contract documents shall be consistent with design assumptions," therefore, it seems appropriate to use the term "assumed" in the commentary, and no changes are made.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code: NONE

Code Commentary: NONE

Specification: NONE

Specification Commentary: NONE

Subcommittee Vote:									
8	*Affirmative*	0	*Affirmative w/ comment*	0	*Negative*	0	*Abstain*	1	*Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-GR-202	
Technical Contact/Email: Charles Clark / cclark@bia.org	
Public Comment Number: 2022 Comment # 202	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/4/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit, but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment: The term "cement backer unit" is used multiple times in this code, and is neither defined nor described.

Response/Rationale:

The committee agrees with this comment, and changes are made to propose a definition for cement backer unit. Type A units are intended for exterior applications, while Type B units are intended for interior applications.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code:

1.4 – Standards cited in this Code

ASTM C1325-21—Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units

2.2 – Definitions

Cement backer unit — a rigid panel made of portland cement, aggregate, and glass mesh complying with ASTM C1325, Type A or B as applicable.

Code Commentary:

2.2 – Definitions

Cement backer unit — material complying with ASTM C1325 Type A is intended for exterior applications and material complying with ASTM C1325 Type B is intended for interior applications.

Specification: NONE

Specification Commentary: NONE

Subcommittee Vote:				
7 *Affirmative*	1 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	1 *Did not vote*

Subcommittee Comments:

Comments addressed editorially.

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-GR-205	
Technical Contact/Email: Charles Clark / cclark@bia.org	
Public Comment Number: 2022 Comment # 205	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/4/2021**

This ballot item proposes the following response to the Public Comment:

☐ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit, but proposed changes are not completely consistent with Public Comment***

☒ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment:
Veneer, masonry…why not include in the definition the critical condition that the veneer is non-loadbearing.

Response/Rationale:
The committee disagrees with this comment and proposes no changes to the definition of masonry veneer for the following reasons:

1. According to the current draft, Section 13.1.2.4 allows masonry veneer to support a limited applied vertical load.
2. According to the current draft, the definition of a masonry veneer already addresses this by stating that the veneer "is not considered to add strength or stiffness of the wall system."
3. To some, use of the term "non-loadbearing" is confusing, since a veneer transfers load.

No changes to the Code, Code Commentary, Specification, or Specification Commentary are proposed.
The following information is given only for the voter's reference and convenience.

2.2 — Definitions

Veneer, masonry — A masonry wythe that provides the exterior finish of a wall system and transfers out-of-plane load directly to a backing, but is not considered to add strength or stiffness to the wall system.

13.1.2.4 *Limitation of applied vertical loads other than self-weight* — Superimposed allowable stress level vertical loads on the face of the veneer shall not exceed 20 pounds (89 N) vertical load applied in any 5 ft (1.52 m) by 5 ft (1.52 m) wall face area. Items attached to the veneer shall not project more than 12 in. (305 mm) from the face of the veneer.

Subcommittee Vote:				
8 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	1 *Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-GR-217	
Technical Contact/Email: Charles Clark / cclark@bia.org	
Public Comment Number: 2022 Comment # 217	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/4/2021**

This ballot item proposes the following response to the Public Comment:

- ☐ ***Committee agrees with Public Comment, change is proposed***
- ☒ ***Committee agrees comment has merit, but proposed changes are not completely consistent with Public Comment***
- ☐ ***Committee disagrees with Public Comment and no changes are proposed***
- ☐ ***Committee unable to fully develop a response to Public Comment***
- ☐ ***Public Comment only requires a response, no change to document***

Public Comment: Sub-Section (h) is very important and also seems to be one of the most vague and misunderstood sections of code. Sometimes architects take responsibility for all movement provisions, sometimes engineers do so for engineered masonry elements, sometimes neither one does or neither does it very well. At a minimum, it seems that the sub-section could be modified to say 'Provision, including vertical and/or horizontal movement joints and other detailing as necessary, for dimensional changes...'. It is my opinion that the movement joints should be located in the drawings, either in plan or elevation view, and they should be detailed for proper performance including dimensions and materials. Or, at a minimum add Commentary to clarify what 'Provision' may actually entail in the drawings.

Also, it would be good to add Commentary non-engineered veneer and non/engineered masonry movement provisions should be included in the architectural but may require input from the engineer in the case of horizontal joints below relief angles; and that joints in any engineered masonry (in my opinion, anything that's not veneer and has a prescriptive or engineered basis of design) should be developed and shown by the engineer. And that engineered veneers should have provisions developed and shown by the design engineer.

Response/Rationale:

The committee agrees with modifying the sub-section of the code. However, the committee disagrees with adding commentary regarding assigning responsibilities for movement joint design and placement because the code has not historically assigned such responsibilities. These responsibilities vary on a project-to-project basis.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code: NONE

(h) Provision, including vertical and/or horizontal movement joints and other detailing as necessary, for dimensional changes resulting from elastic deformation, creep, shrinkage, temperature, and moisture.

Code Commentary: NONE

Specification: NONE

Specification Commentary: NONE

Subcommittee Vote:				
8 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	1 *Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee

Proposed Change to Masonry Standard

Committee: Main Committee			**Ballot #:** 19
Item #: 19-PR-001			
Technical Contact/Email:	Arturo E. Schultz / arturo.schultz@utsa.edu		
Draft Document Dated:	8/27/2021		
Reballot of Main Committee Item No.:	**Response to TAC Comment No.:**	**Response to Public Comment No.:**	30

Reference *(Choose from Drop-Down Menu)*	**Section/Article**
TMS 402 Code Section	10.10.5, 10.10.5.1, 10.10.5.1.1, 10.10.5.1.2, 10.10.5.1.3, 10.10.5.2, 10.10.5.2.1, 10.10.5.2.2, 10.10.5.3
TMS 402 Commentary Section	10.10.5, 10.10.5.1, 10.10.5.1.1, 10.10.5.1.2, 10.10.5.1.3, 10.10.5.2, 10.10.5.3
TMS 402 Code Notation	2.1
TMS 402 Code Definitions	2.2

Rationale: *(Rationale is explanatory and not part of the proposed revision)*

In current practice, post-tensioning is used in walls with concentric placement of the tendons and relatively low magnitudes of pre-compression in the masonry. Anchorage stresses in the masonry seldom approaches the bearing stress limit, and cracking in the anchorage regions does not occur. With the introduction of horizontal prestressing in Chapter 10, the design of beams and lintels is possible. For these members, placement of the tendons may be eccentric for flexural efficiency, and the magnitude of the post-tensioning force may be larger than that for walls. Under certain conditions, large tensile stresses, known as bursting stresses, are generated in the anchorage zone along the width and depth of post-tensioned member. Thus, provisions are proposed here to safeguard from longitudinal cracks in the top and side faces of members can lead to loss of tendon anchorage and disintegration of the masonry in anchorage zones or concrete end blocks.

The provisions proposed here are adapted from ACI 318-19 and focus on the bursting force generated by the post-tensioning tendons, as well as the accompanying bursting stresses that are developed along the width and depth of the member in the anchorage zone. The provisions require the calculation of the bursting force, T_{burst}, and the corresponding the bursting stresses, f_{bv} and f_{bt}, along the depth and the width of the member section, respectively. To convert the T_{burst} into stresses, the length, l_{burst}, of the region which resists these stresses is defined as twice d_{burst}. If the bursting stresses exceed the tensile capacity of the masonry, transverse reinforcement must be provided to resist these stresses in their entirety. Equation 10-8 for T_{burst} is ACI 318-19R Equation R25.9.4.3.1a with the necessary changes in notation for consistency with the rest of this document. The depth of the bursting region, d_{burst}, is a simplification of ACI 318-19R Equation R25.9.4.3.1b. If transverse reinforcement is needed, it must meet the requirements for stirrups in Section 6.1.8.2.

A paper by Schultz and Biggs published in the 13th North American Masonry Conference, which provides design details for a post-tensioned concrete masonry beams, is included, along with an Addendum that applies the proposed anchorage stress calculations.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code:

10.10.5 *Bursting Stresses*

Post-tensioned members shall satisfy the requirements of either 10.10.5.1, 10.10.5.2 or 10.10.5.3

10.10.5.1 *Tendons Anchored by Mechanical Devices Bearing Directly on Masonry*

10.10.5.1.1 If transverse reinforcement is not provided in the masonry adjacent to the bearing surface, calculated bursting stresses, f_{bv} and f_{bt}, shall not exceed the product of the strength reduction factor, ϕ, and the modulus of rupture, f_r, where $\phi = 0.6$ and f_r is defined in Table 9.1.9.2.

The bursting stress, f_{bv}, along the depth of the member shall be calculated as the ratio of the bursting force, T_{burst}, to the net area of masonry in a plane defined by the width of the section, b, and the length of the zone affected by the bursting stresses, l_{burst}.

The bursting stress, f_{bt}, along the width of the member shall be calculated as the ratio of the bursting force, T_{burst}, to the net area of masonry in a plane defined by a depth equal to d_{burst} and the length of the zone affected by the bursting stresses, l_{burst}.

10.10.5.1.2 If transverse reinforcement is provided in the anchorage zone, the total cross-sectional area of the transverse reinforcement, ΣA_{tr}, shall not be less than is specified in Equation 10-7.

$$\Sigma A_{tr} = \frac{T_{burst}}{\phi f_{yt}} \qquad \text{(Equation 10-7)}$$

where $\phi = 0.8$. The total area of transverse reinforcement ΣA_{tr} shall cross the horizontal and vertical planes defined in 10.10.5.1.1, and shall comprise stirrups spaced uniformly along the length of the zone affected by the bursting stresses, l_{burst}. The stirrups shall meet the requirements in Section 6.1.8.2.

10.10.5.1.3 The bursting force T_{burst} shall be calculated using Equation 10-8.

$$T_{burst} = \tfrac{1}{4}\Sigma P_{ps}\left(1 - \frac{y_{anc}}{y}\right) \qquad \text{(Equation 10-8)}$$

Where ΣP_{ps} is the sum of the forces in the post-tensioned tendons at nominal moment. The centroidal distance, d_{burst}, of the bursting force, T_{burst}, to the bearing surface shall be taken equal to the distance, y_t, from the centroid of the post-tensioning force to the tensile face of the beam. The length of the zone affected by the bursting stresses, l_{burst}, shall be equal to twice d_{burst}, but not larger than the larger of the section dimensions b and y.

10.10.5.2 *Tendons Anchored in Concrete End Blocks*
For tendons that are a) embedded in concrete end blocks and anchored by bond, or b) anchored by mechanical devices bearing directly on concrete, the design of the concrete anchorage zone shall satisfy the requirements of 10.10.5.2.1 and 10.10.5.2.2.

10.10.5.2.1 The cross section dimensions of the end blocks shall match those of the beam, and the length of the end block shall be at least as large as the larger of the two cross section dimensions b and y.

10.10.5.2.2 The design of the concrete end blocks shall satisfy the requirements of Section 25.9 of ACI 318-19.

10.10.5.3 *Tendons Anchored by Devices Embedded in Masonry*
For tendons that are anchored by devices embedded in the masonry, the ability of the anchoring device to develop the tendon force P_{ps} shall be shown by test or calculation.

Code Commentary:

10.10.5 To date, most, if not all, post-tensioned masonry walls, beams and lintels have been designed and built using mechanical anchorage devices comprising steel plates bearing on masonry or concrete end blocks. The bearing stresses under the bearing plates are limited by 10.10.4 to values that do not require confinement reinforcement in the masonry or concrete directly adjacent to the bearing plates. However, the anchorage forces that are applied at the bearing surfaces are distributed to the masonry or concrete over localized regions, and in the process vertical stresses and transverse horizontal stresses, known as bursting (tensile) stresses, are generated in the masonry or concrete end blocks (*Figure CC-10.10-1*). Under certain conditions, the magnitude of the bursting stresses can produce longitudinal horizontal cracks in the top and side faces of members with large post-tensioning forces and/or eccentricity of tendon placement. These conditions are uncommon for walls, but may be present in beams and lintels, and the cracking induced by the bursting stresses can lead to loss of tendon anchorage and disintegration of the masonry or concrete end blocks. However, the magnitude of post-tensioning forces in masonry members is much lower than in post-tensioned concrete members, thus the need for reinforcement to resist bursting stresses is not necessary in most post-tensioned masonry applications. The provisions of 10.10.5.1 provide criteria to determine if transverse reinforcement is needed, and the amount and distribution of transverse reinforcement for cases in which it is needed.

10.10.5.1 These provisions were adapted from Section 25.9 of ACI 318-19 and they indicate that the bursting stresses increase with a) increasing post-tensioning force, b) increasing tendon eccentricity, and c) decreasing cross section dimensions. As a consequence of this mechanism, out-of-plane walls that are post-tensioned vertically have negligible bursting stress magnitudes because the tendons are typically centered in the wall (i.e. no eccentricity) and the length of the walls is large (which tends to reduce post-tensioning forces). However, for beams with eccentric post-tensioning force, the potential for high bursting stresses can be larger.

10.10.5.1.1 If calculated bursting stresses (*Figure CC-10.10-1*) do not exceed the tensile strength of the masonry transverse reinforcement is not needed.

10.10.5.1.2 Members for which bursting stresses exceed the tensile strength of masonry require transverse reinforcement. The amount of transverse reinforcement is defined neglecting the tensile strength of the masonry. The distribution of the transverse reinforcement must extend over the masonry areas in the planes defined in 10.10.5.1.1 (*Figure CC-10.10-2*).

10.10.5.1.3 Section 10.10.5.1.3 defines the magnitude and centroidal location of the bursting force, as well as the length of the zone which is affected by bursting stresses.

10.10.5.2 For members with concrete end blocks, the design of the concrete end blocks is referred to Section 25.9 of ACI 318-19.

10.10.5.3 For anchorage devices that are embedded in masonry testing or calculation is needed to demonstrate that the device can develop the expected force in the tendon at ultimate P_{ps}.

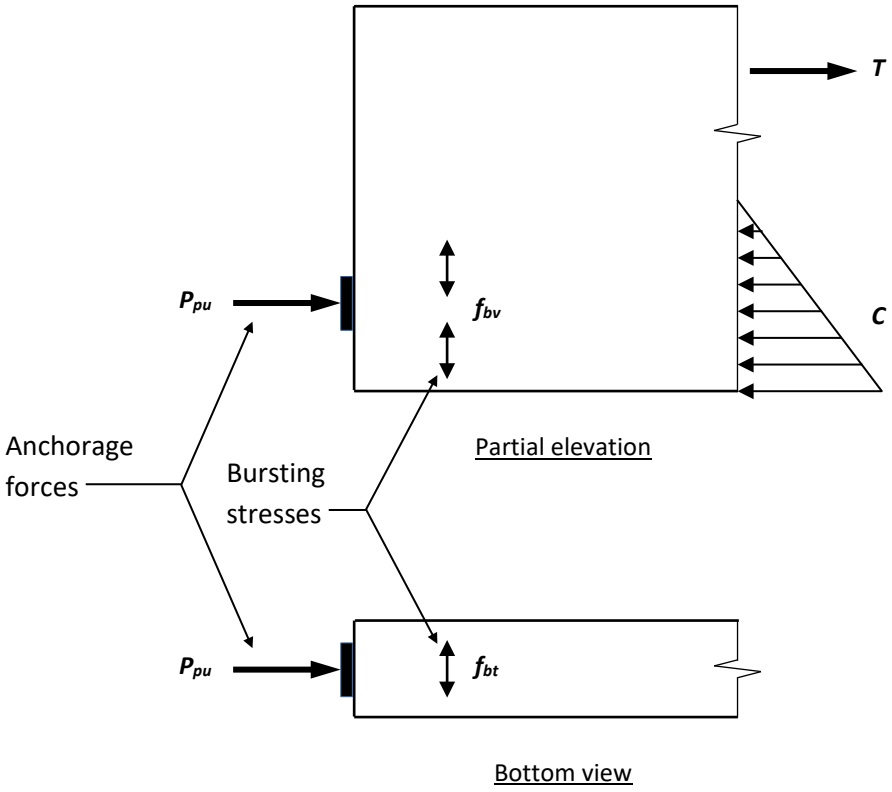


Fig. CC-10.10-1 Bursting (tensile) stresses in anchorage zone

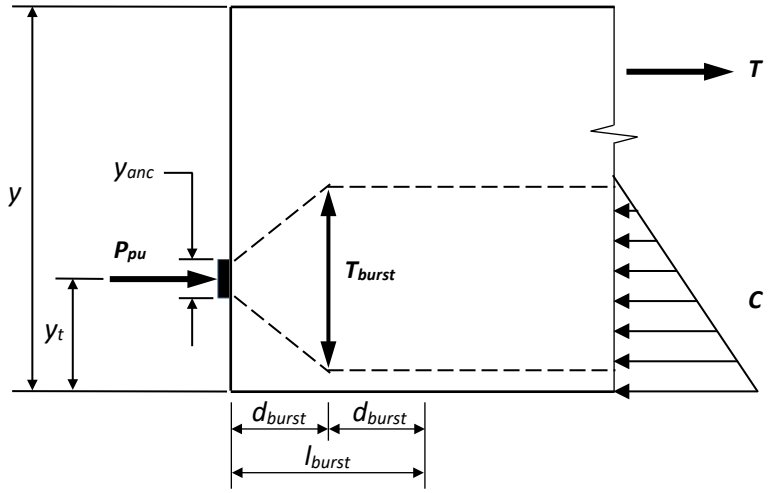


Fig. CC-10.10-2 Distribution of bursting stresses

Notation:

d_{burst} = distance from the centroid of the bursting force to the bearing surface in a post-tensioned member, in. (mm)

f_{bv} = bursting stress along the depth of a post-tensioned member, psi (MPa)

f_{bt} = bursting stress along the width of a post-tensioned member, psi (MPa)

l_{burst} = length of the zone affected by bursting stresses in a post-tensioned member, in. (mm)

T_{burst} = bursting force in a post-tensioned member, lb (N)

y = depth of section, in. (mm)

y_{anc} = dimension along the depth of the section of the anchorage device or group of closely spaced devices, in. (mm)

y_t = distance from centroid of post-tensioning force to tensile face of member, in. (mm)

ΣA_{tr} = total cross-sectional area of transverse reinforcement in the anchorage zone of a post-tensioned member, $in.^2$ (mm^2)

Definitions:

Bursting force – Force generated in the tendon anchorage zone of post-tensioned members.

Bursting stress – Stresses generated along the depth and width of a post-tensioned member in response to the bursting force.

Subcommittee Vote:				
9 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	0 *Did not vote*

Subcommittee Comments: (none)

13th NAMC Paper (Schultz and Biggs)

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Manuscript title:	Proposed Design Provisions for Post-Tensioned Masonry Beams and Lintels
Author 1 name:	Arturo E. Schultz
Author 2 name:	David T. Biggs
Author 3 name:	
Abstract: (300-word limit)	The advent of prestressed masonry in the USA was focused primarily on vertically post-tensioned walls, and current design provisions are limited to walls loaded either out-of-plane or in-plane. However, post-tensioned masonry was initially proposed and studied outside of the USA as a reinforcing technique for beams and lintels. Recently, design provisions for horizontally prestressed masonry members have been proposed for inclusion in the masonry design standard in the USA (TMS 402). This paper reviews the proposed provisions, including the technical basis for the provisions. Supporting evidence from recent research on the design and performance of post-tensioned concrete block masonry beams is summarized. Highlights from the design of a post-tensioned masonry lintel are presented and compared with an equivalent design of a reinforced masonry lintel.
Keywords:	beams, codes, design, lintels, masonry, post-tensioning

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INTRODUCTION

Prestressing is a conceptually simple technique for increasing the ability of masonry to resist tensile stresses (Schultz and Scolforo 1991). By tensioning steel tendons (bars, strand or wires) against the masonry, the masonry is pre-compressed at desired locations and directions (Figure 1). Pre-compression is used to eliminate tensile stresses that masonry is ill-equipped to handle, and it also delays or suppresses the cracking of the masonry. Effective use of prestressing includes reduction of flexural tensile stresses to increase moment capacity, and increases section stiffness and shear strength by means of normal compression. In masonry, post-tensioning (i.e. tendons are tensioned after masonry has reached minimum strength) is much more common than pre-tensioning (i.e. tendons are tensioned between abutments before masonry is placed), even though both forms of prestressing are allowed in design practice in the USA (TMS 402-16). Thus, prestressing is a general term in masonry practice that includes both pre-tensioning and post-tensioning.

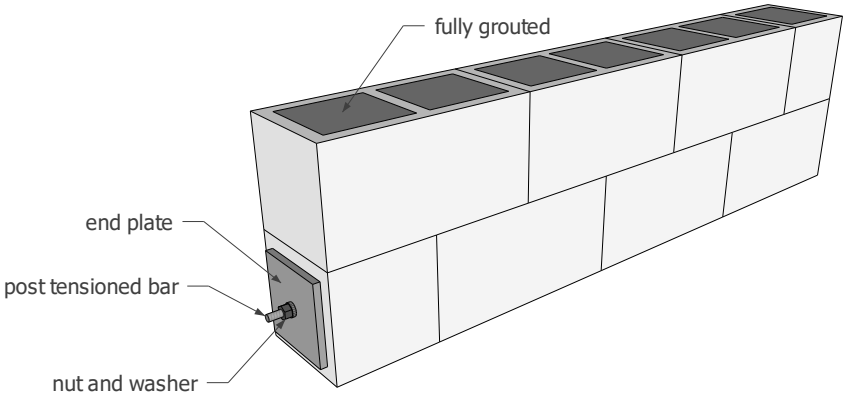


Figure 1. Post-tensioned masonry beam.

Prestressing offers advantages to masonry as compared to the use of steel reinforcement embedded in grout, including increased flexural capacity after the masonry cracks. However, prestressing offers other advantages such as suppression or delay of cracking, reduced deflections, and, in the event of cracking, the closing of such cracks upon reduction of loading. There are some disadvantages to prestressed masonry, including the additional cost of the prestressing hardware, the additional prestressing operation at the construction site, and the additional knowledge needed by architects and designers to use and specify this system. Careful selection of prestressing materials can minimize the cost, while dissemination of technology through educational campaigns can address the others. Actual costs will depend on the availability of prestressing materials and masonry contractors familiar with the system.

Design provisions for prestressed masonry structures were first introduced in the UK in British Standard 5628 in 1985. In the USA, prestressed masonry design provisions were first included in the Masonry Standards Joint Committee's (MSJC) *Design Provisions for Masonry Structures* in the 1999 edition, and they were sufficiently general to include horizontal prestressing. However, in the 2005 edition of the MSJC design standard, the provisions were restricted to vertical prestressing of walls and piers because horizontal prestressed structural masonry members were not used often. As prestressed masonry design practice has matured, the use of beams and lintels has become more attractive and design provisions for these members should be reintroduced. In response to this need, design criteria for horizontal prestressing in masonry beams and lintels are proposed here. The proposed criteria combine those formerly included in the 1999 edition of the MSJC standard, with new criteria in light of recent research on prestressed masonry beams

(García et al. 2017, 2019, Baqi et al. 1999). In this paper, a lintel is considered to be a type of beam that supports a masonry wall or parapet and is built integral with it.

PROPOSED PROVISIONS FOR HORIZONTAL PRESTRESSING

The principal changes that are proposed here to be incorporated into the prestressed masonry provisions of TMS 402 for horizontal prestressing of beams and lintels concern either the configuration of the members or the formulas for Strength Design (SD) analysis of the section. Regarding configuration, the members must be of uniform width and be either fully grouted (Figure 1) or solid (i.e. using solid brick and leaving grout pockets for the prestressing steel). Moreover, prestressing tendons have to be restrained laterally, meaning that there cannot be relative lateral movement of the tendons with respect to the adjacent masonry. However, laterally restrained tendons are a natural outcome of fully grouted or solid masonry construction.

For the analysis of the sections, the same formula for tendon strength at nominal moment capacity, f_{ps}, that is used for out-of-plane walls is proposed for post-tensioned beams and lintels. The stress in the tendon at ultimate is given by TMS 402-16 as follows

$$f_{ps} = f_{se} + \frac{0.03\left(\frac{E_{ps}d}{l_p}\right)\left(1-1.56\frac{A_{ps}f_{se}+P_u/\phi}{f'_m bd}\right)}{1+0.0468\left(\frac{E_{ps}A_{ps}}{f'_m bl_p}\right)} \tag{1}$$

where b is section width, d is effective depth, P_u is net section axial force not including the prestressing, f'_m is masonry compressive strength, f_{se} is effective prestress (after losses), l_p is tendon length (between end anchorages), A_{ps} is total prestressing steel area, E_{ps} is modulus of elasticity of prestressing steel, and ϕ, the strength reduction factor for axial loading and bending, is the same as that for SD, namely 0.8. To determine the flexural strength of the section, the distance from the compression face to the centroid of the tensile resultant, x_t, is specified as

$$x_t = \frac{f_{ps}A_{ps}d_{ps} + f_y A_s d + \left(P_u/\phi\right)\left(h/2\right)}{f_{ps}A_{ps} + f_y A_s + \left(P_u/\phi\right)} \tag{2}$$

where d_{ps} is the effective depth of the prestressing steel, A_s and f_y are total area and yield stress, respectively, of non-prestressed steel reinforcement, and h is section total depth. The compression block depth, a, is to be obtained using the proposed formula

$$a = \frac{f_{ps}A_{ps} + f_y A_s + P_u/\phi}{0.80 f'_m b} \tag{3}$$

The proposed flexural strength, M_n, of a prestressed beam or lintel, is given as

$$M_n = \left(f_{ps}A_{ps} + f_y A_s + P_u/\phi\right)\left(x_t - a/2\right) \tag{4}$$

For the common case of beams and lintels without bonded mild reinforcement ($A_s = 0$) or axial compression from external loading ($P_u = 0$), the centroidal depth from Equation (2) reduces to the depth of the prestressing steel (i.e. $x_t = d_{ps}$), the compression block depth from Equation (3) becomes $a = (f_{ps}A_{ps})/(0.80f'_m b)$ and the nominal flexural strength from Equation (4) is given by $M_n = f_{ps}A_{ps}(d_{ps} - a/2)$. Finally, in lieu of the strain distribution requirements used for SD of masonry in TMS 402-16 Chapter 10, maximum limits for the normalized compression block depth, a/d, are specified to achieve the same strain distributions. The proposed a/d limits are 0.36 for concrete masonry and 0.38 for clay masonry, with the difference arising from the different values specified for maximum usable strain for concrete and clay masonry.

Recent research by García et al. (2019) indicates that the performance of post-tensioned masonry beams under transverse loading offers a reliable beam and lintel construction system. The load-deflection responses shown in Figure 2 are for two nominally identical concrete masonry beams that were post-tensioned and loaded transversely with either monotonic loading or unidirectional cyclic loading. The responses demonstrate resistance characteristics that were observed in all tests of a series of 12 beams. The results indicate load-deflection performance up to maximum load capacity that is comparable to, or better than, that of reinforced masonry beams.

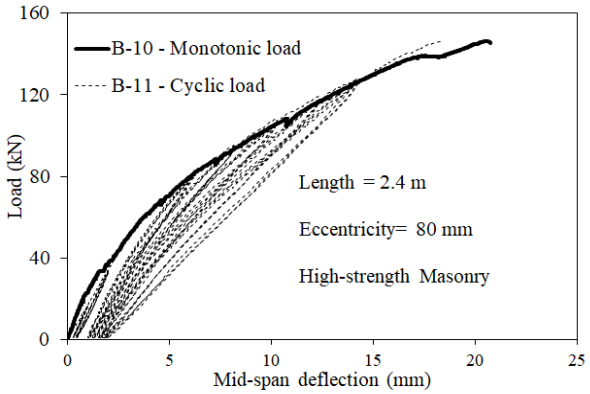
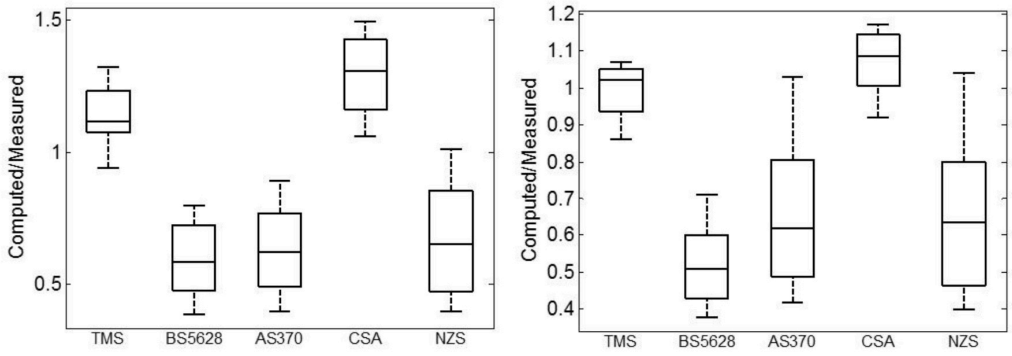


Figure 2. Load-deflection response of post-tensioned masonry beams (García et al. 2019) (1 kN = 0.2248 kips. 1 mm = 0.0394 in.).

García's study further noted that masonry strength was the most relevant parameter affecting the structural behavior of post-tensioned masonry beams, with changes in bar eccentricity and initial bar stress showing only slight influences on structural behavior. García et al. (2019) also demonstrated that the proposed provisions proposed for steel stress, f_{ps}, and nominal moment capacity, M_n, provided accurate and reliable estimates for the beams tested. These results are presented using box-and-whisker plots (Figure 3) for both f_{ps} and M_n. The plots illustrate the results in quartiles, with the bottom and top of the box representing the first and third quartiles, respectively; the line inside of the box denoting the second quartile (i.e. the median); and the ends of the lower and upper whiskers indicating the minimum and maximum values, respectively.

The performance of the proposed provisions shown in Figure 3 is superior to that of the British (BS5628 1985), Australian (AS370 2011), Canadian (CSA 2014) and New Zealand (NZS 2011) codes. Specifically, for the proposed provisions for f_{ps} and M_n, in relation to the other codes, the mean value is closest to unity, the variation over the second and third quartiles is smaller, and the difference between the minimum and maximum values is lower.

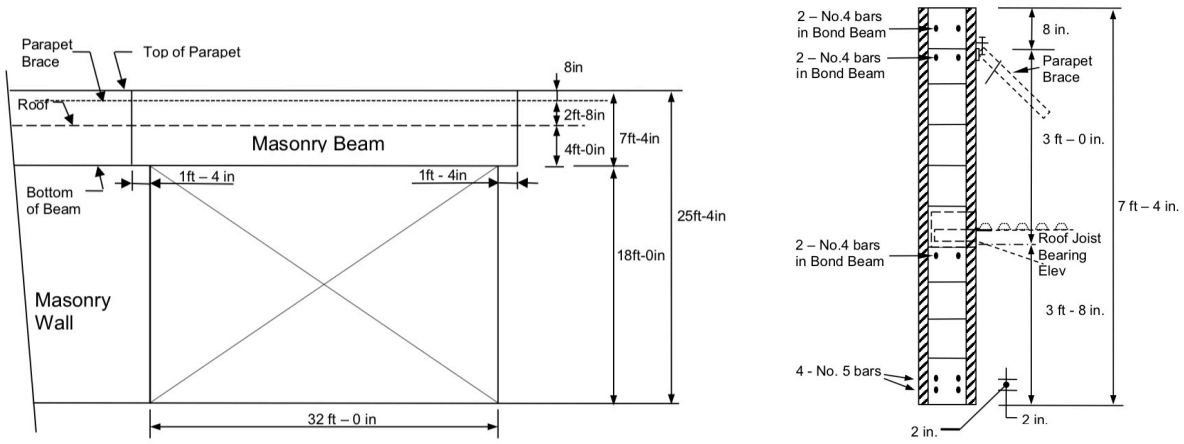


a) For steel stress at nominal capacity, f_{ps} b) For nominal moment capacity, M_n

Figure 3. Box-and-whisker plots for post-tensioned beam tests (García et al. 2019).

DESIGN OF A POST-TENSIONED LINTEL

For the purposes of illustrating the proposed design provisions, and comparing with a published design of a reinforced masonry member, the design of a reinforced masonry lintel beam included in TMS' *Masonry Designers' Guide 2016* (MDG-2016) is modified and presented here in a post-tensioned masonry member. The lintel design appears in MDG-2016 in both Allowable Stress Design (ASD) format (Example JHM Box-04 ASD in pp. 20-34 to 20-39), and in SD format (Example JHM BOX-04 SD in pp. 20-102 to 20-107). The lintel spans a 32-ft (9.75 m) wide garage door opening (Figure 4a) and bears on 16 in. (406 mm) of masonry on either side, for a center-to-center span of 33 ft-4 in. (10.16 m). The lintel comprises 11 courses of fully-grouted concrete masonry units with an 8-in. (203 mm) nominal thickness (Figure 4b) and supports clay brick veneer (not shown). The lintel supports roof joists and a 2 ft-8 in. (813 mm) tall parapet that is built integrally with the lintel. The parapet is supported laterally by means of braces that are attached at a 5-ft (1.52 m) spacing along the lintel.



a) Garage door opening b) Reinforced lintel section

Figure 4. Lintel for design example (1 ft = 0.3048m, 1 in. = 25.4mm).

The lintel was designed to resist dead (D) and roof live (L_r) loads, with the $D + L_r$ load combination controlling in the ASD version and the $1.2D + 1.6\ L_r$ combination controlling the SD version. Dead loads comprise 880 lb/ft (12.84 kN/m) for the lintel self-weight, and 480 lb/ft (7 kN/m) each for the brick veneer weight and the roof live load. The design forces determined in the MDG-2016 examples are M = 3,060 kip-in (345.7 kN-m) (ASD) and M_u = 4,000 kip-in (451.9 kN-m) (SD) at the midspan of the lintel, and V_u = 38.4 kips (170.8 kN) (SD) at the face of the support. Lastly, a deflection of 0.103 in. (2.6 mm) was calculated for the $D + L_r$ load combination.

The design of the reinforced masonry lintel in both the ASD and SD formats required 4-No. 5 reinforcing bars in the bottom course of the lintel for flexural capacity, as well as 2-No. 4 bars at roof level for the perimeter bond beam (i.e. 'ring' beam), and 2-No. 4 bars in each of the bond beams above and below the parapet brace attachment. Herein, only the reinforcement for flexural strength of the lintel (4-No. 5 bars in the bottom course) is redesigned as post-tensioned reinforcement. The grouted concrete masonry is assumed to have a 2,000-psi (13.79 MPa) compressive strength (f'_m), and the modulus of elasticity of the masonry is assumed to be $900f'_m$ = 1,800 ksi (12.41 GPa) as per TMS 402-16. Type S Portland cement-lime mortar is assumed as well as fine grout with a 2,000-pi (13.79 MPa) compressive strength (f'_g).

Prestressing Steel

There are many products available for post-tensioning masonry members, including wires, strand and bars. Typically, bars are preferred for post-tensioned masonry because of the relative ease with which they can be placed and spliced, and higher strength steel is seldom needed in masonry members. In this example, Grade B7 threaded bar meeting ASTM A193 requirements are selected because they offer intermediate strength and a variety of sizes. Minimum specified yield stress and strength are 105 ksi (724 MPa) and 125 ksi (862 MPa), respectively. Common sizes for use in post-tensioned masonry are listed in Table 1.

Table 1. Grade B7 Threaded Bars (ASTM A193)

Diameter (in.)	1/2	5/8	3/4	7/8	1	1-1/8	1-1/4	1-3/8	1-1/2
Area (in.^{2})	0.142	0.226	0.334	0.462	0.606	0.763	0.969	1.23	1.41

1 in. = 25.4 mm; 1 in.^{2} = 645 mm^2

Steel Stresses

The design of the lintel will be initiated by determining the maximum value of the post-tensioning steel that can be used for design. This stress is related to the maximum stress that can be imparted to the bar at jacking. As per TMS 402-16 Section 10.3.3, the maximum stress in the steel is the lesser of $0.7f_{pu}$ = 87.5 ksi (603.3 MPa) or $0.78f_{py}$ = 81.9 ksi (564.7 MPa), with the latter value controlling (i.e. $f_{ps,i}$ = 81.9 ksi (564.7 MPa) at jacking). The masonry will undergo dimensional changes leading to stress loss in the bars, which is estimated here using the 35% upper bound value for stress loss that is typically assumed in practice. Thus, the effective prestress in the bar after losses, f_{se}, is $(1 - 0.35)f_{ps,i} = 0.65(81.9) = 53.24$ ksi (367.1 MPa). The stress that is effective in resisting the maximum moment in the lintel, f_{ps}, is affected by the change in length of the masonry at the depth of the tendon due to flexural deformation at nominal moment capacity. This value can be calculated using Eq. 1, but it requires knowledge of the tendon area. An approximation for f_{ps} can be made using an estimate tendon area in Eq. 1. However, in this example, the stress is assumed to be equal to f_{se} = 53.24 ksi (367.1 MPa).

Estimate Tendon Size

For post-tensioned masonry, the flexural capacity of the member is defined at the strength level using an SD calculation (Eq. 4). Assuming that the post-tensioning bar is located at mid-depth of the first course of masonry units, then $d = d_{ps} = h - h_u/2 = 88$ in. $- (7.63$ in./2) $= 84.19$ in. (2,138 mm), and the internal moment arm ($d - a/2$) is assumed to be approximately equal to $0.95d$. The area of the tendon is approximated from Eq. 4 as follows

$$A_{ps} \geq \frac{M_u}{\phi f_{se}(0.95d)} \approx \frac{(4{,}000 \text{ in-kips})}{0.8(53.24 \text{ ksi})(0.95)(84.2 \text{ in.})} = 1.17 \text{ in}^2 \quad (754.8 \text{ mm}^2) \tag{5}$$

To meet this requirement, a 1.25-in.(31.8 mm) diameter bar is selected with $A_{ps} = 0.969$ in.^{2} (625.2 mm^2), which is slightly lower than the estimated requirement. However, the tendon stress, f_{ps}, at nominal moment capacity (M_n) must be calculated, and there is likely to be an increase in tendon stress (Δf_{ps}) due to flexural deformation at nominal moment capacity.

Re-evaluate Tendon Selection

To re-evaluate tendon size, the length between anchorages, l_p, is assumed to be equal to the total length of the lintel plus the length of the post-tensioning anchorages, which are assumed here to be equal to one-half of the length of a masonry unit. So that tendon length is $l_p = (33.33$ ft)(12 in./ft) + 2(16 in.) + ½(16 in.) = 440 in. (11.18 m). Also, $P_u = 0$ because there is no net axial load on lintel. The increment in tendon stress is calculated using Eq. 1 as follows

$$\Delta f_{ps} = \frac{0.03\dfrac{(29{,}000 \text{ ksi})(84.19 \text{ in.})}{(440 \text{ in.})}\left[1 - 1.56\dfrac{(0.969 \text{ in}^2)(53.24 \text{ ksi})}{(2 \text{ ksi})(7.63 \text{ in.})(84.19 \text{ in.})}\right]}{1 + 0.0468\dfrac{(29{,}000 \text{ ksi})(0.969 \text{ in}^2)}{(2 \text{ ksi})(7.63 \text{ in.})(440 \text{ in.})}} = 130.48 \text{ ksi} \quad (899.6 \text{ MPa}) \tag{6}$$

Thus, $f_{ps} = f_{se} + \Delta f_{ps} = 53.24 + 130.48$ ksi $= 183.72$ ksi (1,267 MPa). But, since this value exceeds the nominal yield stress ($f_{py} = 105$ ksi (723.9 MPa)), then $f_{ps} = f_{py} = 105$ ksi (723.9 MPa). The compression block depth, a, is computed using Eq. 2 as follows

$$a = \frac{A_{ps} f_{ps}}{0.8 f'_m b} = \frac{(0.969 \text{ in.}^2)(105 \text{ ksi})}{0.8(2 \text{ ksi})(7.63 \text{ in.})} = 8.33 \text{ in.} \quad (211.6 \text{ mm}) \tag{7}$$

and the moment capacity is obtained from Eq. 3

$$\phi M_n = 0.8(0.969 \text{ in.}^2)(105 \text{ ksi})\left[84.19 \text{ in.} - \tfrac{1}{2}(8.33 \text{ in.})\right] = 6{,}514 \text{ kip-in} \quad (735.9 \text{ kN-m}) \tag{8}$$

The moment capacity corresponding to a 1.25-in. (31.8 mm) bar exceeds the SD requirement of 4,000 kip-in (451.9 kN-m). Thus, the tendon size is recomputed assuming that $f_{ps} = f_{py} = 105$ ksi (723.9 MPa). For those conditions, A_{ps} is recomputed using Eq. 5 as $A_{ps} = 0.595$ in.^{2} (383.9 mm^2), and a 1-in. (25.4 mm) diameter bar is selected ($A_{ps} = 0.606$ in.^{2} (391.0 mm^2)). The increment in tendon stress at ultimate moment is recalculated such that $\Delta f_{ps} = 142.49$ ksi (982.4 MPa), and once again f_{ps} exceeds f_{py}, so $f_{ps} = f_{py} = 105$ ksi

(723.9 MPa). The compression block depth, a, and moment capacity ϕM_n are also recomputed using Eq. 7 and Eq. 8, respectively, and a = 5.21 in. (132.3 mm) and ϕM_n = 4,153 kip-in. (469.2 kN-m). Thus, the selection exceeds the requirement (M_u = 4,000 kip-in. (451.9 kN-m)) by a modest amount, and the 1-in. (25.4 mm) diameter Grade B7 bar is adequate for the lintel. In comparison with the reinforced lintel in the MDG-2016 example, only about one-half as much post-tensioned reinforcement (A_{ps} = 0.606 in.^{2} (391.0 mm^2)) is needed than non-prestressed reinforcement (A_s = 1.24 in.^{2} (645.2 mm^2)).

Sectional Ductility Check

To ensure sectional ductility, the ratio of compression block depth, a, to section depth, d, must not exceed the values proposed for prestressed masonry beams. This requirement was derived from the strain distributions specified for SD of reinforced masonry members. For concrete masonry, the proposed requirement is $a/d \leq 0.36$. For the sample prestressed lintel, a/d = 5.21 in./84.19 in. = 0.062, which is less than 0.36. Thus, the lintel meets the sectional ductility requirements.

Masonry Stresses at Jacking

In prestressed masonry design, prestressing steel is selected to meet the required flexural strength capacity using SD criteria. However, stress conditions at jacking and after losses are verified using ASD criteria to ensure serviceability. At jacking, the lintel is subjected to axial compression (f_a) from post-tensioning, and bending compression (f_b) because the tendon is placed eccentrically. The self-weight effect is likely to be present because the lintel will develop camber (negative curvature) under eccentric post-tensioning, and any transverse load on the beam is reacted at the supports. But, the moment from eccentric bending is negative (i.e. compression in bottom face) while the self-weight effect produces positive bending (i.e. compression in the top face). Thus, the self-weight load effect reduces the magnitude of jacking, and, typically, only the bending from eccentric post-tensioning is considered. These stresses must be evaluated in light of the ASD requirements for URM in TMS 402-16 Chapter 8.

At jacking, the allowable axial compression, F_a, and bending compression, F_b, can be increased by 20% because this condition is short lived: Tendon stress loss from creep begins immediately after jacking, and masonry compressive strength continues to increase beyond the value at jacking, f'_{mi}. This condition is used to obtain a requirement for the masonry compressive strength at the instant of jacking, f_{mi}.

Using ASD calculation methods, the axial stress at jacking, f_{ai}, is determined to be 74.1 psi (633.5 kPa), where the prestressing force at jacking, $P_{ps,i}$, is 49.63 kips (220.8 kN), the area of prestressing steel, A_{ps}, is 0.606 in.^{2} (391 mm^2), the tendon stress at jacking, $f_{ps,i}$, is 81.9 ksi (564.7 MPa), and the net area of masonry, A_n, is 670 in.^{2} (432,900 mm^2),where the total depth, h, is 88 in. (2,235 mm), the width, b, is 7.63 in. (193.8 mm), and the area of the tendon duct is estimated to be 1.5 in.^{2} (968 mm^2). Similarly, the bending stress at jacking, f_{bi}, is computed as 202.5 psi (1,396 kPa), where the net section modulus is taken as 9,848 in.^{3} (0.1614 m^3), and the eccentricity of the tendon is approximated as $e_{ps} \approx d/2 - h_{unit}$ = ½(88 in. – 7.63 in.) = 40.19 in. (1,021 mm).

In this example, as in the MDG example, all 11 masonry courses, including the top 4 courses which comprise the parapet, are assumed to participate in bending resistance because they are assumed to be fully grouted. Additionally, for a beam in positive bending, lateral support along the top of the compression region is most effective against lateral buckling (Yura, 2001). In this case, this support is provided by the parapet braces, and the allowable stress for axial compression, F_{ai}, is found to be $0.24f'_{mi}$, where the distance

between parapet braces, $s_{bracing}$ = 5 ft (1.52 m), is used to determine the slenderness ratio, l/r = 27.23. The allowable stress for bending compression, F_{bi}, is given by $0.33f'_{mi}$.

Substituting the compression stresses and allowable values into the TMS 402-16 linear interaction formula (TMS Eq. 8-11) with a 20% increase in allowable stress increase (TMS 402-16 Section 10.4.1.2), gives an expression for the minimum masonry compressive strength at jacking

$$\frac{f_{ai}}{1.2\left(0.24f'_{mi}\right)}+\frac{f_{bi}}{1.2\left(0.33f'_{mi}\right)}\le 1.0 \tag{9}$$

From this relation, the required value for the masonry compression strength at the time of jacking is obtained $f'_{mi} \ge$ (74.1 psi/0.24 + 202.5 psi/0.33)/1.2 = 764 psi ~ 800 psi (5.52 MPa).

Masonry Stresses after Losses

When all tendon stress losses have taken place and the lintel is under full service loads ($D + L_r$), the moment generated by loading is likely to exceed the moment from eccentric prestressing. The controlling compressive stress will be at the top of the section, and this condition is used to verify that the masonry compressive strength, f'_{mi}, is adequate. The stresses are combined using the linear interaction equation in TMS 402-16, but no increase is used for the allowable stresses.

Axial compression stress on the masonry after losses, f_a = 48.2 psi (332.3 kPa), is calculated using the prestress force after losses, $P_{ps,e}$ = 32.26 kips (143.5 kN), with the latter being obtained from the prestress after losses, $f_{ps,e}$ = 53.24 ksi (367.1 MPa), and the area of prestressing steel, A_{ps} = 0.606 in.^{2} (391 mm^2). The moment due to transverse loading is obtained for the $D + L_r$ load combination used to obtain the controlling bending compression stress, f_{bi} = 179.7 psi (1,239 kPa), at the top of the section where external loading induces compression and the prestressing induces tension. The net moment of 1,770 kip-in. (200 kN-m) is computed from the external service moment, M = 3066 kip-in. (346.4 kN-m), and the opposing prestressing moment calculated from $P_{ps,e}$ = 32.26 kips (143.5 kN) and e = 40.19 in. (1,201 mm). These compression stresses (f_a = 48.2 psi (332.3 kPa) and f_{bi} = 179.7 psi (1,239 kPa)) and the linear interaction formula are used to obtain a minimum value for f'_m, namely $f'_m \ge$ (48.2 psi/0.24) + (179.7 psi/0.33) = 740 psi (5.1 MPa). This required value is statisfied by the much larger specified masonry compressive strength of 2,000 psi (13.79 MPa).

Masonry Bearing Stresses at Anchorages

The largest bearing stress demand at the anchorages occurs at jacking when the masonry has not yet achieved its 28-day compressive strength (f'_m). This condition can be used to determine an additional requirement on the masonry compressive strength at jacking, f'_{mi}. As per TMS 402-16, the bearing stress at jacking, $f_{brg,i}$, must not exceed 50% of the masonry compressive strength at that time. Therefore, the additional code requirement for f'_{mi}, $f'_{mi} \ge 2f_{brg,i} = 2(P_{ps,i}/A_{brg}) \approx$ 2(49,630 lbs/56.7 in.^{2}) = 1,750 psi (12.07 MPa), where the bearing area is estimated as $A_{brg} \approx (7.63")^2 - (1.5$ in.$^2) = 56.7$ in.^{2} (36,580 mm^2). This requirement supersedes the previous minimum compressive stress at jacking f'_{mi} = 800 psi (5.52 MPa).

Shear Strength

Shear strength in the proposed provisions for prestressed beams follow general requirements for walls in Chapter 10, which refer to the SD provisions for unreinforced masonry in Chapter 9. The basis for this

proposed requirement is that properly designed prestressed beams will not be cracked in flexure at nominal moment strength conditions because the normal compression stress from prestressing will delay flexural cracking. Thus, nominal shear strength, V_n, depends upon the net uncracked area of masonry in shear, A_n, and the shear stress capacity of the masonry.

Design shear strength, ϕV_n, is the smallest of the values for various possible failure modes and is given by

$$\phi V_n = \text{smaller of} \left\{ \begin{array}{c} \phi k_1 A_{nv} \sqrt{f'_m} = 91{,}090 \text{ lbs} \\ \phi k_2 A_{nv} = 160{,}800 \text{ lbs} \\ \phi\left(k_3 A_{nv} + 0.45 N_u\right) = 59{,}850 \text{ lbs} \end{array} \right\} = 59{,}850 \text{ lbs} = 59.85 \text{ kips} \ \left(266.2 \text{ kN}\right) \qquad (10)$$

where $A_{nv} = A_n$ = 670 in.^{2} (432,300 mm^4), f'_m = 2,000 psi (13.79 MPa), ϕ = 0.8 for shear, and N_u is taken conservatively as the prestress force after losses $P_{ps,e}$ = 32.26 kips (143.5 kN). The constants k_1, k_2, and k_3, respectively, are given by TMS 402-16 as 3.8, 300 and 90 for US customary units (i.e., using in.^{2}, psi, and lbs), and 0.316, 2.07, 0.620 for SI units (i.e., using mm^2, MPa, and N). The design capacity, ϕV_n = 59.85 kips (266.2 kN), exceeds the factored shear force at the face of the support, V_u = 38.4 kips (170.8 kN). Additionally, the design shear strength of the prestressed lintel (w/o shear reinforcement) is 15% larger that that of the reinforced lintel in the MDG-2016 design example (w/o shear reinforcement) which was ϕV_n = 52.2 kips (232.2 kN). The shear strength in this case is controlled by the amount of prestressing force ($N_u = P_{ps,e}$), and, if needed, V_n could be augmented by increasing $P_{ps,e}$. Alternatively, shear strength could also be increased, if needed, by adding shear reinforcement, which could be done easily given the fully grouted nature of prestressed beams.

Deflection

Post-tensioned sections resist bending without cracking over the full range of service loads. This fact can be verified by computing the net tensile stress at the bottom of the section. Alternatively, the cracking moment, M_{cr}, including the precompression, can be compared to the full service load moment, M. The cracking moment, M_{cr}, is computed assuming that the section is linear, elastic, and that the precompression stress on the masonry is included, thus $M_{cr} = S_n(f_r + P_{ps,e}/A_n)$ = (9,848 in.^{3})[0.267 ksi + (32.26 kips/670 in.^{2})] = 3,359 in-kips (379.5 kN-m). Since the cracking moment exceeds the external moment under full service loads (M_{cr} = 3,359 in-kips (379.5 kN-m) > M = 3,066 in -kips (346.4 kN-m)), the lintel remains uncracked under service loads. Thus, the moment of inertia for deflections is calculated assuming an uncracked section, $I_n = bh^3/12$ = 433,300 in.^{4} (0.1804 m^4), and

$$\delta = \frac{5}{384}\frac{wL^4}{E_m I_n} = \frac{5}{384}\frac{\left(880 + 2\times 480 \text{ lb/ft}\right)\left(33.33 \text{ ft}\right)^4\left(12 \text{ in./ ft}\right)^3}{\left(1{,}800{,}000 \text{ psi}\right)\left(433{,}300 \text{ in.}^4\right)} = 0.066 \text{ in.} \ \left(1.7 \text{ mm}\right) \qquad (11)$$

which is far less than the TMS 402-16 code limit in Section 5.2.1.4.1 of $L/600$ = (33.33 ft)(12 in./ft)/600 = 0.67 in. (17 mm) for beams and lintels that provide support to masonry.

For the reinforced lintel in the MDG design example, the cracking moment is 2,610 kip-in. (294.9 kN-m), which is smaller than the full service moment of 3,066 kip-in. (346.4 kN-m). This relation, i.e. $M_{cr} < M$, is

appropriate for a reinforced section given that non-prestressed reinforcement is not effective until the masonry cracks in flexure. However, the prestressed lintel would remain uncracked in service (M_{cr} = 3,359 kip-in. (379.5 kN-m) > M = 3,066 kip-in. (346.4 kN-m)), and the consequences of the difference in cracking behavior are important for serviceability. First, the full service load deflection for the prestressed lintel is 0.066 in. (1.7 mm), which is only 2/3 of that for the reinforced lintel (Δ = 0.103 in. (2.6 mm)). Second, in the event of overloading beyond full service loads, the prestressed lintel would crack at a larger load than the reinforced lintel, which would further reduce deflections in the post-serviceability range.

Note that for the prestressed lintel, the cracking moment as the lintel approaches nominal moment capacity, $M_{cr,u}$, increases over that under service conditions (M_{cr}) because the prestress force increases with flexural deformation (P_{ps} vs. $P_{ps,e}$). At nominal flexural capacity, $P_{ps} = f_{ps}A_{ps}$ = (105 ksi)(0.606 in.^{2}) = 63.63 kips (283.0 kN) and $M_{cr,u} = S_n(f_r + P_{ps}/A_n)$ = (9,848 in.^{3})[0.267 ksi + (63.63 kips/670 in.^{2})] = 3,565 kip-in. (402.8 kN-m). Furthermore, for the prestressed lintel, $M_n/M_{cr,u}$ = 5,191 in-kips/3,565 in-kips = 1.46 > 1.3 as is required for reinforced beams in TMS 402-16 Section 9.3.4.2.2.2.

CONCLUDING REMARKS

A summary of proposed design provisions for prestressed masonry beams and lintels in the USA was presented. Results of recent research were referenced which verify the adequacy of these members, as well as the accuracy of TMS 402 design provisions. A lintel design example taken from MDG-2016 was presented that illustrates the application of the proposed provisions. Regarding the design example, the prestressed version of the lintel was determined to require less than 50% of the steel area needed for the reinforced lintel, and provided 15% more shear strength than the reinforced lintel. Calculations also indicated superior deflection and cracking serviceability for the prestressed lintel by virtue of the prestressed section remaining uncracked under full service loads.

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Addendum - Calculations

1) For the Design Example in the 13th NAMC paper we had the following data

$$b = 7.625"; \; h = 87.625"; \; h_{anc} = 7.625"; \; y_t = 0.5(7.625") = 3.813"$$

$$P_{ps} = \left(105 \text{ ksi}\right)\left(0.606 \text{ in.}^2\right) = 63.63 \text{ kips}$$

a) Assume that bursting reinforcement will not be used, and check the bursting stresses in the masonry.

$$P_{burst} = 0.25\left(63.63 \text{ kips}\right)\left(1 - \frac{7.625"}{87.625"}\right) = 14.52 \text{ kips}$$

$$e_{anc} = \left(87.625"/2\right) - 3.813" = 40"$$

$$d_{burst} = 0.5\left(87.625" - 2 \times 40"\right) = 3.813"$$

$$l_{burst} = 2\left(3.813"\right) = 7.625" \le \text{larger of} \left\{ \begin{array}{c} b = 7.625" \\ h = 87.625" \end{array} \right\} = 87.625"$$

$$f_{bv} = \frac{P_{burst}}{b \times l_{burst}} = \frac{14.52 \text{ kips}}{\left(7.625"\right)\left(7.625"\right)} = 0.250 \text{ ksi} = 250 \text{ psi}$$

$$f_{bt} = \frac{P_{burst}}{d_{burst} \times l_{burst}} = \frac{14.52 \text{ kips}}{\left(3.813"\right)\left(7.625"\right)} = 0.50 \text{ ksi} = 500 \text{ psi}$$

$f_r = 163$ psi for type M/S mortar, full grouting, and f_r normal to bed joints

$$\phi f_r = 0.6\left(163 \text{ psi}\right) = 97.8 \text{ psi} < f_{bv} = 250 \text{ psi} < f_{bt} = 500 \text{ psi}$$

Therefore, the design does not meet the proposed anchorage requirements.

b) Try using bursting reinforcement

$$\Sigma A_{tr} \ge \frac{P_{burst}}{\phi f_{yt}} = \frac{14.52 \text{ kips}}{0.8\left(60 \text{ ksi}\right)} = 0.30 \text{ in.}^2$$

For the vertical legs of the stirrups, two legs are provided by each stirrup, so the required cross-sectional area of the stirrups is

$$A_{st} = \frac{\Sigma A_{tr}}{2n} = \frac{0.30 \text{ in.}^2}{2n} = \frac{0.15 \text{ in.}^2}{n}$$

For the horizontal legs of the stirrups, only one leg is provided by each stirrup, so the required cross-sectional area of the stirrups is

$$A_{st} = \frac{\Sigma A_{tr}}{n} = \frac{0.30 \text{ in.}^2}{n}$$ This requirement controls.

The transverse reinforcement must be placed over a distance equal to l_{burst} = 7.625" from the bearing surface. This distance corresponds to one-half the length of a stretcher (or the

length of a corner unit). So there is only one cavity in which to place the stirrups. Thus, $n = 1$, and $A_{st} = 0.30$ in^2. Use #5 bars to bend the stirrups ($A_5 = 0.31$ in^2).

Use single closed stirrups, bent from #5 bars, at 3.81" from each end face of the beam.

c) Another option is to reduce tendon eccentricity (i.e. increase y_t). This can be done by placing the tendon in the second course from the bottom of the beam. This option reduces the internal moment arm of the beam by about 10%. For simplicity, the maximum tendon force, P_{ps}, is increased by 10% without redesigning the tendon or section.

$$b = 7.625"; \; h = 79.625"; \; h_{anc} = 7.625"; \; y_t = 8" + 0.5(7.625") = 11.813"$$

$$P_{ps} = 1.10\left(63.63 \text{ kips}\right) = 70.0 \text{ kips}$$

Assume that bursting reinforcement will not be used, and check masonry stresses.

$$P_{burst} = 0.25\left(70 \text{ kips}\right)\left(1 - \frac{7.625"}{79.625"}\right) = 15.82 \text{ kips}$$

$$e_{anc} = \left(79.625"/2\right) - 11.813" = 28"$$

$$d_{burst} = 0.5\left(79.625" - 2 \times 28"\right) = 11.813"$$

$$l_{burst} = 2\left(11.813"\right) = 23.625" \le \text{larger of} \left\{ \begin{array}{c} b = 7.625" \\ h = 79.625" \end{array} \right\} = 79.625"$$

$$f_{bv} = \frac{P_{burst}}{b \times l_{burst}} = \frac{15.82 \text{ kips}}{\left(7.625"\right)\left(23.625"\right)} = 0.088 \text{ ksi} = 88 \text{ psi}$$

$$f_{bt} = \frac{P_{burst}}{d_{burst} \times l_{burst}} = \frac{15.82 \text{ kips}}{\left(11.813"\right)\left(23.625"\right)} = 0.057 \text{ ksi} = 57 \text{ psi}$$

$$\phi f_r = 0.6\left(163 \text{ psi}\right) = 97.8 \text{ psi} > f_{bv} = 88 \text{ psi} > f_{bt} = 57 \text{ psi}$$

Therefore, the design meet the requirements and bursting reinforcement is not needed.

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-RC-003	
Technical Contact/Email: John M. Hochwalt / john.hochwalt@kpff.com	
Public Comment Number: 2022 Comment # 37	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment:

Public Comment 37 reads as follows:

> *This section (6.6.1(b)) states that joint reinforcing conforming to TMS 602 Article 2.4 D is within the scope of Chapter 6. It is unclear, however, whether stainless steel joint reinforcement is covered by this reference. While TMS 602 Article 2.4 D references ASTM A951 which in turn references ASTM 580 for stainless steel wire, the minimum yield strength requirements for wire in ASTM A951 (70 ksi) is incompatible with the yield strengths for ASTM 580 Grade 304 or 316 wire (30 to 45 ksi). This suggests that there may not be stainless steel joint reinforcement that is in conformance with ASTM A951 due to non-compliance with the minimum yield strength. Note that TMS 602 has a separate article that addresses stainless steel joint reinforcement (2.4 I) which only references ASTM A580; this is a wire specification, not a joint reinforcement specification.*
>
> *If the intent is to allow the use of stainless steel joint reinforcement for applications where conformance with Chapter 6 is required, several items need to be addressed.*
>
> *First, the specification of stainless steel joint reinforcement in TMS 602 needs to define a minimum yield strength of the wire. In addition it should be clarified that stainless steel joint reinforcement must be fabricated in accordance with ASTM A951, but using the lower strength ASTM A580 wire as permitted by TMS 602.*
>
> *Second, the provisions should be reviewed for the potential implications of the differing yield strengths of carbon steel and stainless steel joint reinforcement.*
> *(1) Are they equally as effective when used to meet the prescriptive requirements of Sections 7.3.2.2.1 and 7.4.3.1.1?*
> *(2) Are the minimum joint reinforcing areas for resisting shear of Sections 7.4.1.2.1 and 7.4.3.2.6 applicable regardless of wire type?*
> *(3) Is the allowable tensile stress of 30 ksi in Section 8.3.3.2 applicable to all wire types?*
> *(4) Can stainless steel joint reinforcement be used for conformance with Section 9.1.9.3.1?*

Response/Rationale:

This ballot is intended to address the first part of the comment, related to Chapter 6.

This ballot proposes to combine the requirements for stainless steel joint reinforcement in Article 2.4 I of TMS 602 with the provisions in Article 2.4 D for carbon steel joint reinforcement. Doing this clarifies that references to joint reinforcement in Chapter 6 are intended to apply to joint reinforcement manufactured from both carbon and stainless steel.

We have confirmed with manufacturers of joint reinforcement that the materials properties proposed for stainless steel joint reinforcement are consistent with materials that have been historically used and that are currently being used.

Given that the yield strength of stainless steel joint reinforcement is less than carbon steel joint reinforcement, the existing provisions in Chapter 6 for the development, splicing and anchorage of joint reinforcement can continue to be safely applied to joint reinforcement.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code:

None.

Code Commentary:

None.

Specification:

2.4 D. *Joint reinforcement* — Provide joint reinforcement that conforms to ASTM A951 with maximum wire size one-half the specified mortar joint thickness. Do not use joint reinforcement with stacked wires whose total thickness exceeds one-half the specified mortar joint thickness. Maximum spacing of cross wires in ladder-type joint reinforcement and of points of connection of cross wires to longitudinal wires of truss-type joint reinforcement shall be 16 in. (400 mm).

Exception: Joint reinforcement may be fabricated with AISI Type 304 or Type 316 stainless steel wire conforming to ASTM A580/A580M and having a minimum yield strength of 45 ksi (310 MPa) and a minimum ultimate tensile strength of 90 ksi (620 MPa).

2.4 I. *Stainless steel* — Stainless steel items shall be AISI Type 304 or Type 316, and shall conform to the following:

~~1. Joint reinforcement .....ASTM A580/A580M~~
2. Plate and bent-bar anchors .....ASTM A480/A480M and ASTM A666
3. Sheet-metal anchors and ties.....ASTM A480/A480M and ASTM A240/A240M
4. Wire ties .....ASTM A580/A580M

Specification Commentary:

2.4 D. *Joint reinforcement* — Code Section 9.1.9.3.2 limits the specified yield strength of joint reinforcement used to resist in-plane shear and flexural tension parallel to bed joints in strength design.

Where vertical reinforcement is present in a masonry wall, diagonal wires in the truss type joint reinforcement will conflict with placement of the vertical reinforcement. Mortar droppings on the

diagonal cross wires also make quality grouting more difficult. Consequently, truss-type joint reinforcement should not be specified when the masonry contains vertical reinforcement.

Some manufacturers fabricate joint reinforcement with cross wires spaced at less than 16 in. (400 mm) on center. Joint reinforcement with non-modular dimensioned cross wires can interfere with placement of vertical reinforcement.

Commonly available ASTM A580/A580M stainless steel wire does not conform to the minimum yield and tensile strengths required by ASTM A951. The exception allows the use of this wire and requires that it meet the minimum strength requirements for Type 304 or Type 316 cold-finished wire.

Subcommittee Vote:									
11	*Affirmative*	1	*Affirmative w/ comment*	0	*Negative*	0	*Abstain*	3	*Did not vote*

Subcommittee Comments:

The affirmative comment from Walcowicz expressed concern regarding product availability for stainless steel meeting the proposed yield strength minimum. This ballot was developed in consultation with reinforcement manufacturers for consistency with products historically and currently available.

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-RC-004	
Technical Contact/Email: Heather Sustersic, hsustersic@colbycoengineering.com	
Public Comment Number: 2022 Comment # 01	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment:

Congratulations to the Committee on adding in Appendix D. Adding in such reinforcement has been a goal for several cycles. Well done and thanks for the hard work. However, please consider revising the term "glass fiber reinforced polymer (GFRP) masonry" here and throughout the document. The modifiers make it seem that the masonry is a polymer. I would suggest that you use glass fiber reinforced polymer (GFRP) reinforced masonry. Similar changes may be needed to discuss this "reinforcement" such as GFRP reinforcement.

Response/Rationale:

The subcommittee agrees with the public comment and did a search through the document to find all instances where clarification is required. One instance within the Appendix D commentary was found and a change is proposed. The remaining instances found are located within the front matter (abstract, synopsis and keywords). No instances were found elsewhere in the code or specification. This ballot proposes to change "*glass fiber reinforced polymer (GFRP) masonry*" to "*glass fiber reinforced polymer (GFRP) <u>reinforced</u> masonry"* where applicable for consistency throughout the document.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown <u>underlined</u> and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Front Matter:

ABSTRACT *(page 2, line 63)*

… The Code Appendices address limit design and glass fiber reinforced polymer (GFRP) <u>reinforced</u> masonry. …

SYNOPSIS *(page 18, line 14)*

… The Code Appendices address limit design and glass fiber reinforced polymer (GFRP) <u>reinforced</u> masonry. …

Keywords *(page 18, line 20)*

… glass fiber reinforced polymper (GFRP)…

Code:

None.

Code Commentary:

D.4.4 *Nominal shear strength*

GFRP reinforced members typically have a smaller depth to the neutral axis than steel reinforced members

because of the lower of axial stiffness of the reinforcement. This results in a lower cross-section of the compression region and wider crack widths. Also, the contribution of dowel action of longitudinal GFRP reinforcement has not been determined. Because of this, the shear strength of the masonry is reduced. Equation D-6 is based on ACI 440.

Due to lack of research on the shear strength of GFRP reinforced masonry members with steel or GFRP shear reinforcement, all of the shear is required to be taken by the masonry.

Specification:

None.

Specification Commentary:

None.

Subcommittee Vote:				
12 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	3 *Did not vote*

Subcommittee Comments:

This ballot received one comment from corresponding member Fried suggesting reordering the placement of the word “reinforced” when this GFRP is spelled out. Because the predominant phrasing existing in Appendix D is consistent with the changes to the front matter proposed above and since most instances of the term use the acronym GFRP preceding “reinforced masonry” without fully spelling out the phrase, it is recommended to keep the consistent phrasing currently used throughout.

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-RC-005	
Technical Contact/Email: Heather Sustersic, hsustersic@colbycoengineering.com	
Public Comment Number: 2022 Comment # 46 and 47	
Public Comment Response Based on TMS 402/602 Draft Dated 6/1/2021	

This ballot item proposes the following response to the Public Comment:

☐ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☒ ***Public Comment only requires a response, no change to document***

Public Comment:

With the reorganization of Chapter 6, confirm that the following inserted commentary language is actually inserted in the right place: "Due to lack of experimental data on the development length of welded deformed wires in grout, the development length is determined without consideration of the beneficial effects of welded cross wires."

With the reorganization of Chapter 6, confirm that the following inserted commentary language is actually inserted in the right place: "Due to lack of experimental data on the splicing of welded deformed wires in grout, the splice length is determined without consideration of the beneficial effects of welded cross wires."

Response:

The subcommittee has reviewed the statement as it appears in commentary section 6.1.7.1.2.1 related to welded deformed wire *splices* in grout and the similarly worded statement in commentary section 6.1.6.3.1 related to welded deformed wire *development length* in grout. Both statements appear to be correctly placed with respect to the section headings for splices and development lengths of welded deformed wire reinforcement in grout. No change is proposed or required.

Subcommittee Vote:				
12 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	3 *Did not vote*

Subcommittee Comments:

None

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-RC-006	
Technical Contact/Email: Heather Sustersic, hsustersic@colbycoengineering.com	
Public Comment Number: 2022 Comment # 48	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment:

"6db, but" appears to have been inadvertently deleted from Table 6 for No.3 to No. 5 bar extensions for 135 Degree Hook requirements. Please review and re-insert, if appropriate.

Response/Rationale:

The subcommittee concurs with the public comment and a change to Specification Table 6 is proposed.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code:

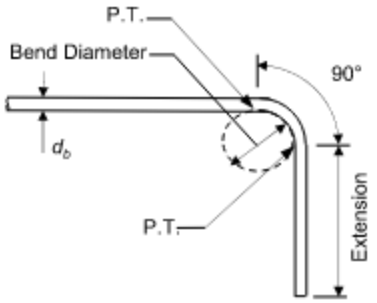
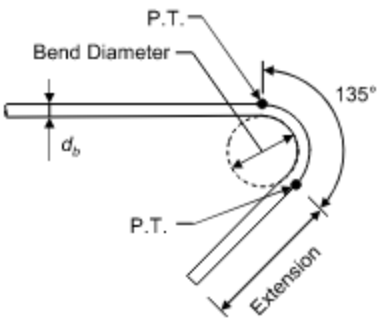
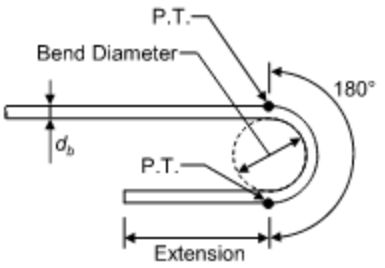
None

Code Commentary:

None

Specification:

Table 6: Standard Hooks Geometry and Minimum Inside Bend Diameters for Steel Reinforcing Bars and Deformed Wire

Standard Hook Type and Use	Steel Grade	Reinforcement Size	Min. Inside Bend Diameter	Extension	Standard Hook Figures
90 Degree Hook – Reinforcement	40 (M280)	No.3 - No. 7 (M#10 - #22)	$5d_b$	12 d_b	 P.T. = Point of Tangency
	50 or 60 (M350 or 420)	No. 3 - No. 8 (M#10 - #25)	6 d_b	12 d_b	
	50 or 60 (M350 or 420)	No. 9 - No. 11 (M#29 - #36)	8 d_b	12 d_b	
	75	D11 – D31 (MD 71 – MD 200)	6 d_b	12 d_b	
90 Degree Hook – Stirrups & Lateral Ties	40, 50, 60 (M280,350 or 420)	No.3 - No.5 (M#10 - #16)	$4d_b$	$6d_b$ but not less than 3 in. (76 mm)	
	40 (M280)	No.6 and No.7 (M#19 - #22)	5 d_b	6 d_b	
	50 or 60 (M350 or 420)	No.6 - No.8 (M#19 - #25)	6 d_b	6 d_b	
	75	D11 – D31 (MD 71 – MD 200)	4 d_b	$6d_b$ but not less than 3 in. (76 mm)	
135 Degree Hook – Stirrups & Lateral Ties	40, 50, 60 (M280, 350 or 420)	No.3 - No.5 (M#10 - #16)	4 d_b	$6d_b$ but not less than 3 in. (76 mm)	
	40 (M280)	No.6 and No.7 (M#19 - #22)	5 d_b	6 d_b	
	50 or 60 (M350 or 420)	No.6 - No.8 (M#19 - #25)	6 d_b	6 d_b	
	75	D11 – D31 (MD 71 – MD 200)	4 d_b	$6d_b$ but not less than 3 in. (76 mm)	
180 Degree Hook – Reinforcement	40 (M280)	No.3 - No.7 (M#10 - #22)	5 d_b	$4d_b$ but not less than 2-1/2 in. (64 mm)	
	50 or 60 (M350 or 420)	No.3 - No.8 (M#10 - #25)	6 d_b	$4d_b$ but not less than 2-1/2 in. (64 mm)	
	50 or 60 (M350 or 420)	No.9 - No.11 (M#29 -#36)	8 d_b	4 d_b	
	75	D11 – D31 (MD 71 – MD 200)	6 d_b	$4d_b$ but not less than 2 1/2 in. (64 mm)	
180 Degree Hook – Stirrups & Lateral Ties	40, 50, 60 (M280, 350 or 420)	No.3 - No.5 (M#10 - #16)	4 d_b	$4d_b$ but not less than 2-1/2 in. (64 mm)	
	40 (M280)	No.6 and No.7 (M#19 - #22)	5 d_b	4 d_b	
	50 or 60 (M350 or 420)	No.6 - No.8 (M#19 - #25)	6 d_b	4 d_b	
	75	D11 – D31 (MD 71 – MD 200)	4 d_b	$4d_b$ but not less than 2 1/2 in. (64 mm)	

Specification Commentary:

None

Subcommittee Vote:				
12 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	3 *Did not vote*

Subcommittee Comments:

None

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-RC-007	
Technical Contact/Email: Heather Sustersic, hsustersic@colbycoengineering.com	
Public Comment Number: 2022 Comment # 50, 51, 52, 53, 54 and 55	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment:

PC # 50: Reference to (Jawaheri Zadeh and Nanni, 2013) should be (Jawaheri Zadeh and Nanni (2013))

PC # 51: Reference to (D'Antino et al. 2018) should be (D'Antino et al. (2018))

PC # 52: Insert the qualifier "R" after ACI 440.1 in commentary section D.2.1, 2nd sentence of 2nd paragraph as follows: "...The value of kb for bent bars was determined using Equation 6.2.1 from ACI 440.1R and setting the bend radius..."

PC # 53: Insert the qualifier "R" after ACI 440.1 in commentary section D.3.3, last sentence, as follows: "The required development of dowels in concrete should be determined in accordance with ACI 440.1R."

PC # 54: Clarify reference to ACI in commentary section as follows, "Although for steel reinforcement the splice length is the same as the development length for masonry structures, a splice length of 1.3 multiplied by the development length is chosen to be consistent with ACI 440.1R."

PC # 55: Insert the qualifier "R" after the ACI 440 reference in commentary section D.4.4 as follows, "Because of this, the shear strength of the masonry is reduced. Equation D-6 is based on ACI 440.1R." Also, replace reference in section D.4.5.1 to (Bischoff et al., 2009) with (Bischoff et al. (2009)).

Response/Rationale:

The subcommittee concurs with the public comments for consistency in reference notation and the specific references ACI 440.1R in Appendix D.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code:

None

Code Commentary:

D.1.4 *Strength-reduction factors*
A comparative reliability analysis of steel and GFRP-reinforced concrete beams resulted in a strength-reduction factor, φ, of 0.70 for tension-controlled sections and a value of 0.75 for compression-controlled sections in order to give comparable reliability indices to steel-reinforced concrete beams, or a reliability index of approximately 3.5 (Jawaheri Zadeh and Nanni~~,~~ (2013)). …

D.2.1 *Design tensile strength and strain*
The tensile strength reported by the manufacturer, f_{fu}, is the mean tensile strength minus three times the standard deviation. The material properties provided by the manufacturers are considered as initial properties that do not include the effects of long-term exposure to the environment. Because long-term exposure to various environments may reduce the tensile strength of GFRP bars (D'Antino et al. (2018)), the material properties used in all design equations are reduced based on type and level of environmental exposure.

The tensile strength of GFRP bars at bends is reduced due to buckling of the fibers on the inside of the bend. The value of k_b for bent bars was determined using Equation 6.2.1 from ACI 440.1R and setting the bend radius to $3d_b$, based on the minimum bend diameter permitted by TMS 602 Article 2.7 B. …

D.3.3 *Development*
… The required development of dowels in concrete should be determined in accordance with ACI 440.1R.

D.3.4 *Splices*
Although for steel reinforcement the splice length is the same as the development length for masonry structures, a splice length of 1.3 multiplied by the development length is chosen to be consistent with ACI 440.1R.

D.4.4 *Nominal shear strength*
GFRP reinforced members typically have a smaller depth to the neutral axis than steel reinforced members because of the lower of axial stiffness of the reinforcement. This results in a lower cross-section of the compression region and wider crack widths. Also, the contribution of dowel action of longitudinal GFRP reinforcement has not been determined. Because of this, the shear strength of the masonry is reduced. Equation D-6 is based on ACI 440.1R.

D.4.5 *Deflections*
D.4.5.1 — *Effective moment of inertia*
The section-based expression to calculate the effective moment of inertia, Ieff, proposed by Bischoff (2005) is modified to include the factor γd. This factor accounts for the variation in stiffness along the length of the member. This approach provides reasonable estimates of deflection (Bischoff et al.~~,~~ (2009)). …

Specification:

None

Specification Commentary:

None

Subcommittee Vote:				
11 *Affirmative*	1 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	3 *Did not vote*

Subcommittee Comments:
The affirmative comment noted the absence of header label "D.3.4 Splices" that has been incorporated above.

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-RC-008	
Technical Contact/Email: Heather Sustersic, hsustersic@colbycoengineering.com	
Public Comment Number: 2022 Comment # 62	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment:

Much of paragraph 6.1.8.1.3 is duplicative and potentially conflicting with subparagraphs 6.1.8.1.3.1 and 6.1.8.1.3.2. Suggest revising this paragraph to read "Joint reinforcement used as shear reinforcement shall be anchored in accordance with either Section 6.1.8.1.3.1 or 6.1.8.1.3.2."

Response/Rationale:

The subcommittee agrees that paragraph 6.1.8.1.3 duplicates information provided in subsections 6.1.8.1.3.1 and 6.1.8.1.3.2. A change to section 6.1.8.1.3 is proposed that retains the object of joint reinforcement anchorage (around edge bars or deformed wire in the edge cell) and refers to subsections for more information.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code:

6.1.8.1.3 Joint reinforcement used as shear reinforcement shall be anchored around the edge reinforcing bar or deformed wire in the edge cell~~, either by placement of the vertical reinforcement between adjacent cross-wires or with a 90-degree bend in longitudinal wires bent around the edge cell and with at least 3-in. (76-mm) bend extensions in mortar or grout.~~ in accordance with either Section 6.1.8.1.3.1 or 6.1.8.1.3.2.

6.1.8.1.3.1 Where the joint reinforcement consists of two longitudinal wires, both of the wires shall be anchored either by one of the following:

(a) Placement of the vertical reinforcement between adjacent cross-wires, or

(b) A 90-degree bend in longitudinal wires bent around the edge cell and with at least 3-in. (76-mm) bend extensions in mortar or grout, or

(c) A 90-degree bend in longitudinal wires bent around the edge cell and with at least 4-in. (102-mm) overlap of the wires in mortar or grout.

6.1.8.1.3.2 Where the joint reinforcement consists of four longitudinal wires, all four of the wires shall be anchored by either:

(a) A 90-degree bend in the inner longitudinal wires bent around the edge cell and with at least 3-in. (76-mm) bend extensions in mortar or grout, and a 3/16 in.

(5 mm) U-stirrup lapped at least 8-in. (205-mm) with the outer wires, or

(b) A 90-degree bend in both the inner and outer longitudinal wires bent around the edge cell and with at least 4-in. (102-mm) overlap of the wires in mortar or grout.

Code Commentary:

None

Specification:

None

Specification Commentary:

None

Subcommittee Vote:				
12 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	3 *Did not vote*

Subcommittee Comments:

None

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-RC-009	
Technical Contact/Email: Heather Sustersic, hsustersic@colbycoengineering.com	
Public Comment Number: 2022 Comment # 76 and 77	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment:

PC # 76:
Equation 6-3 in line 64 should be Equation 6-1.
It seems strange to start with a sentence telling how Equation 6-1 was derived, then have sentences on 8 inch limit, where to find additional information, and epoxy coated wire, and then go back to the derivation of Equation 6-1. I would suggest grouping together the two discussions on the derivation of Equation 1.

PC # 77:
Line 69 refers the reader to commentary of Section 6.1.7.1.2.2.. (note the double period which needs to be corrected).
Line 81 also refers the reader to commentary of Section 6.1.7.1.2.2.
When the reader goes to 6.1.7.1.2.2 two pages later they read "Refer to commentary for Section 6.1.6.2.2."
So they go right back to the page they were on.
I would suggest directly referencing Section 6.1.6.2.2.

Response/Rationale:

The subcommittee agrees with the public comments and proposes grouping the derivation discussions together within commentary section 6.1.6.2. Additional minor edits to code and commentary sections 6.1.6.2 relate to the apparent extra spaces between words or numbers/section headings and improving usability of the commentary section as suggested by PC77.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code:

6.1.6.2 Reinforcement in mortar

6.1.6.2.1 *Deformed wire -reinforcement*

6.1.6.2.1.1 The development length of deformed wire embedded in mortar and subject to tension shall be determined by Equation 6-1, but shall not be less than 8 in. (203 mm).

l_d = 48 d_b (Equation 6-1)

Development length of epoxy-coated deformed wire embedded in mortar and subject to tension shall be taken as 150 percent of the length determined by Equation 6-1.

Code Commentary:

6.1.6.2 *Reinforcement in mortar*

6.1.6.2.1 *Deformed wire reinforcement*

6.1.6.2.1.1 Equation 6-~~3~~1 was derived from the historic development length expression using an allowable bond stress *u* of 160 psi (1103 kPa), which was based on testing of deformed bars in grout (Gallagher (1935); Richart (1949)). ~~The 8 in. (203 mm) limit is based on research on joint reinforcement, which is the only research available for reinforcement placed in mortar. The research on joint reinforcement is discussed in the commentary to Section 6.1.7.1.1.2.. Research (Treece and Jirsa (1989)) has shown that epoxy-coated reinforcing bars require longer development length than uncoated reinforcing bars. The Committee deemed it appropriate to apply this same increase to deformed wires embedded in mortar. The 50 percent increase in development length does not apply to the 8 in. (203 mm) minimum.~~ Equation 6-1 was derived as follows:

$l_d = F_s\ d_b / 4u = F_s\ d_b /4(160) = 0.0015\ F_s\ d_b$

(l_d = 0.22 $F_s\ d_b$ in SI units)

The term 0.0015$F_s d_b$ is equivalent to 45 d_b when F_s = 30,000 psi. The value was rounded up to 48 d_b to be consistent with other sections of the Code.

The 8 in. (203 mm) limit is based on research on joint reinforcement, which is the only research available for reinforcement placed in mortar. The research on joint reinforcement is discussed in Code Commentary Section 6.1.~~7.1.1~~6.2.2~~.~~. Research (Treece and Jirsa (1989)) has shown that epoxy-coated reinforcing bars require longer development length than uncoated reinforcing bars. The Committee deemed it appropriate to apply this same increase to deformed wires embedded in mortar. The 50 percent increase in development length does not apply to the 8 in. (203 mm) minimum.

6.1.6.2.1.2 The limitations in this section are based on the limitations of the research performed on joint reinforcement, as discussed in the commentary to Section 6.1.~~7.1.1~~6.2.2.

Specification:

None

Specification Commentary:

None

Subcommittee Vote:									
10	*Affirmative*	2	*Affirmative w/ comment*	0	*Negative*	0	*Abstain*	3	*Did not vote*

Subcommittee Comments:

The editorial affirmative comments from Hochwalt and Corcoran have been incorporated.

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-RC-010	
Technical Contact/Email: Heather Sustersic, hsustersic@colbycoengineering.com	
Public Comment Number: 2022 Comment # 178	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment:

Page 363, Line 3, Table 6
See also Page 101, Line 20, Section 6.1.8.1.2
Section 6.1.8.1.2 requires the tail of a standard hook to extend into the intersecting wall a minimum distance of twice the development length. The tail extension of a "standard hook", by definition in Table 6, is only 12 db. I recommend changing "Extension" to "Minimum Extension".

Response/Rationale:

The subcommittee agrees with the suggestion and proposes that the column heading “Extension” in Specification Table 6 be changed to “Minimum Extension.”

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code:

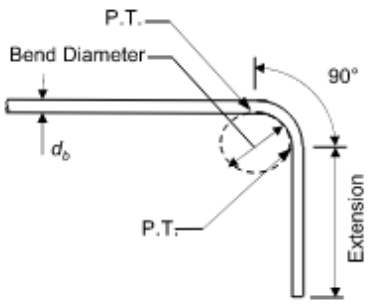
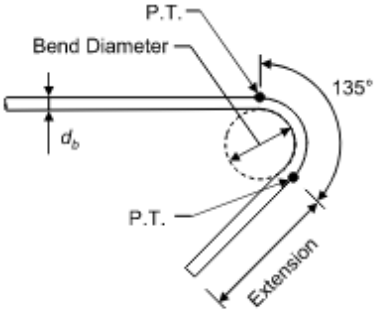
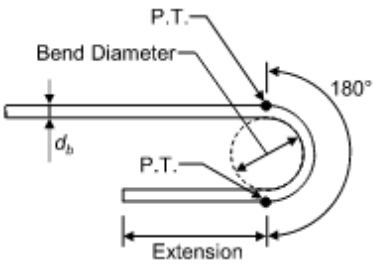
None

Code Commentary:

None

Specification:

Table 6: Standard Hooks Geometry and Minimum Inside Bend Diameters for Steel Reinforcing Bars and Deformed Wire

Standard Hook Type and Use	Steel Grade	Reinforcement Size	Min. Inside Bend Diameter	Minimum Extension	Standard Hook Figures
90 Degree Hook – Reinforcement	40 (M280)	No.3 - No. 7 (M#10 - #22)	$5d_b$	12 d_b	 P.T. = Point of Tangency
	50 or 60 (M350 or 420)	No. 3 - No. 8 (M#10 - #25)	6 d_b	12 d_b	
	50 or 60 (M350 or 420)	No. 9 - No. 11 (M#29 - #36)	8 d_b	12 d_b	
	75	D11 – D31 (MD 71 – MD 200)	6 d_b	12 d_b	
90 Degree Hook – Stirrups & Lateral Ties	40, 50, 60 (M280,350 or 420)	No.3 - No.5 (M#10 - #16)	$4d_b$	$6d_b$ but not less than 3 in. (76 mm)	
	40 (M280)	No.6 and No.7 (M#19 - #22)	5 d_b	6 d_b	
	50 or 60 (M350 or 420)	No.6 - No.8 (M#19 - #25)	6 d_b	6 d_b	
	75	D11 – D31 (MD 71 – MD 200)	4 d_b	$6d_b$ but not less than 3 in. (76 mm)	
135 Degree Hook – Stirrups & Lateral Ties	40, 50, 60 (M280, 350 or 420)	No.3 - No.5 (M#10 - #16)	4 d_b	not less than 3 in. (76 mm)	
	40 (M280)	No.6 and No.7 (M#19 - #22)	5 d_b	6 d_b	
	50 or 60 (M350 or 420)	No.6 - No.8 (M#19 - #25)	6 d_b	6 d_b	
	75	D11 – D31 (MD 71 – MD 200)	4 d_b	$6d_b$ but not less than 3 in. (76 mm)	
180 Degree Hook – Reinforcement	40 (M280)	No.3 - No.7 (M#10 - #22)	5 d_b	$4d_b$ but not less than 2-1/2 in. (64 mm)	
	50 or 60 (M350 or 420)	No.3 - No.8 (M#10 - #25)	6 d_b	$4d_b$ but not less than 2-1/2 in. (64 mm)	
	50 or 60 (M350 or 420)	No.9 - No.11 (M#29 -#36)	8 d_b	4 d_b	
	75	D11 – D31 (MD 71 – MD 200)	6 d_b	$4d_b$ but not less than 2 1/2 in. (64 mm)	
180 Degree Hook – Stirrups & Lateral Ties	40, 50, 60 (M280, 350 or 420)	No.3 - No.5 (M#10 - #16)	4 d_b	$4d_b$ but not less than 2-1/2 in. (64 mm)	
	40 (M280)	No.6 and No.7 (M#19 - #22)	5 d_b	4 d_b	
	50 or 60 (M350 or 420)	No.6 - No.8 (M#19 - #25)	6 d_b	4 d_b	
	75	D11 – D31 (MD 71 – MD 200)	4 d_b	$4d_b$ but not less than 2 1/2 in. (64 mm)	

Specification Commentary:

None

Subcommittee Vote:				
12 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	3 *Did not vote*

Subcommittee Comments:

None

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-RC-011	
Technical Contact/Email: Heather Sustersic, hsustersic@colbycoengineering.com	
Public Comment Number: 2022 Comment # 79	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment:

Delete "either" in the following. This was deleted in the ballot, but mistakenly not deleted in the working draft. Where the joint reinforcement consists of two longitudinal wires, both of the wires shall be anchoredeither by one of the following…

Response/Rationale:

The subcommittee agrees with the comment and proposes to strike the word “either” from the first sentence of section 6.1.8.1.3.1.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code:

6.1.8.1.3.1 Where the joint reinforcement consists of two longitudinal wires, both of the wires shall be anchored~~either~~ by one of the following:

(a) Placement of the vertical reinforcement between adjacent cross-wires, or

(b) A 90-degree bend in longitudinal wires bent around the edge cell and with at least 3-in. (76-mm) bend extensions in mortar or grout, or

(c) A 90-degree bend in longitudinal wires bent around the edge cell and with at least 4-in. (102-mm) overlap of the wires in mortar or grout.

Code Commentary:

None

Specification:

None

Specification Commentary:

None

Subcommittee Vote:									
11	*Affirmative*	1	*Affirmative w/ comment*	0	*Negative*	0	*Abstain*	3	*Did not vote*

Subcommittee Comments:

The affirmative comment questioned the need to ballot this change due to its editorial nature.

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-RC-014	
Technical Contact/Email: John M. Hochwalt / john.hochwalt@kpff.com	
Public Comment Number: 2022 Comment # 80	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☐ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☒ ***Public Comment only requires a response, no change to document***

Public Comment:

Public Comment 80 reads as follows:

Can prefabricated tees and corners be used to anchor joint reinforcement at wall intersections?

Response/Rationale:

The comment was made relative to Section 6.1.8.1.3.1, which addresses the anchorage requirements for two wire joint reinforcement used as shear reinforcement.

It is not appropriate at this time to use prefabricated tees or corners for the anchorage of shear reinforcement because there is not an industry standard way that these prefabricated accessories are fabricated; it is nearly impossible to establish minimum standards for fabrication that would ensure anchorage equivalent to the existing provisions. In addition, these prefabricated elements are not permitted in special reinforced masonry shear walls due to the requirement in Section 7.3.2.5 (e) that joint reinforcement used as shear reinforcement be in a single, unspliced piece.

The detailing of joint reinforcement used as shear reinforcement should be considered as a future business item for the next code cycle, as the current provisions only address anchorage at the ends of walls. Since 3/16" diameter wire is required for shear reinforcement by Section 7.4.1.2.1, among the issues that would need to be considered is the potential for (2) 3/16 longitudinal wires to cross at wall intersections.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code:

None.

Code Commentary:

None.

Specification:

None.

Specification Commentary:

None.

Subcommittee Vote:				
9 *Affirmative*	3 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	3 *Did not vote*

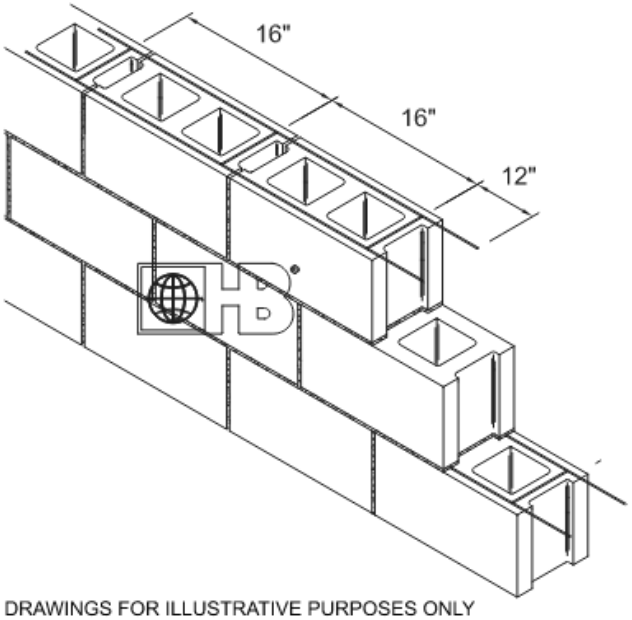
Subcommittee Comments:
The editorial affirmative comments to the rationale have been incorporated.

THE FOLLOWING PAGES ARE ATTACHED FOR VOTER INFORMATION
(NOT PART OF BALLOT)

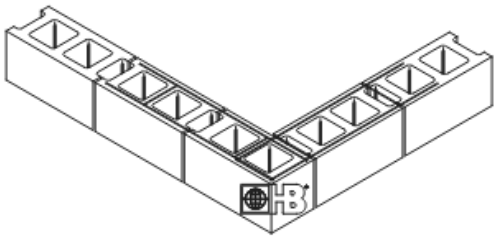
HOHMANN & BARNARD, INC.
a MiTek company

Lox♦All® Ladder Joint Reinforcement

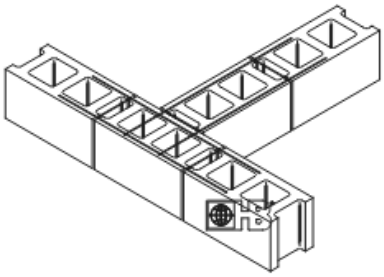
220 Ladder-Mesh



DRAWINGS FOR ILLUSTRATIVE PURPOSES ONLY



PREFABRICATED CORNER



PREFABRICATED TEE

MATERIAL CONFORMANCE
Hohmann & Barnard joint reinforcement products conform to:
ASTM A951/A951M (Standard Specification for Steel Wire for Masonry Joint Reinforcement)
ACI / ASCE 530 (Building Code Requirements for Masonry Structures)

Wire (Carbon Steel): Prefabricated from cold-drawn steel wire conforming to **ASTM A1064/A1064M**
Tensile Strength - 80,000 p.s.i. | Yield Point - 70,000 p.s.i. minimum
Zinc Coating:
Mill Galvanized coating: **ASTM A641/A641M** (0.1 oz/ft²)
Hot-Dip Galvanized after fabrication: **ASTM A153/A153M-B2** (1.5 oz/ft²)

Wire (Stainless Steel): **ASTM A580/ASTM 580M** - AISI Type 304 or Type 316

Wire Diameter:
9 gauge (.148" or W1.7) or 3/16"Ø (.187" or W2.8)
Side Rods and Cross Rods available in any combination of the above.
Cross welded 16" O.C.
First Cross Rods welded 12" in from each end to allow lap splices per code requirements.

H&B manufactures steel wire products from a minimum of 95% recycled material.

Finishes:
- ☐ Mill Galvanized Coating
- ☐ Hot-Dip Galvanized
- ☐ Stainless Steel - Type 304
- ☐ Stainless Steel - Type 316

Note: H&B recommends Stainless Steel for maximum protection against corrosion.

Wire Size (10' length standard, custom length available special order):
- ☐ (S) Standard Weight: 9 Gauge Side Rods x 9 Gauge Cross Rods
- ☐ (EH) Extra Heavy: 3/16" Side Rods x 9 Gauge Cross Rods
- ☐ (SHD) Super Heavy Duty: 3/16" Side Rods x 3/16" Cross Rods

Block Size:
- ☐ 4" ☐ 6" ☐ 8" ☐ 10"
- ☐ 12" ☐ 14" ☐ 16"

Note: For Corner or Tee, state width of block walls.

IMPORTANT: Since each construction project is unique, the appropriate selection and use of any product contained herein must be determined by competent architects, engineers and other appropriate professionals who are familiar with the specific requirements of the project in question.

HOHMANN & BARNARD, Inc.
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CORPORATE HEADQUARTERS
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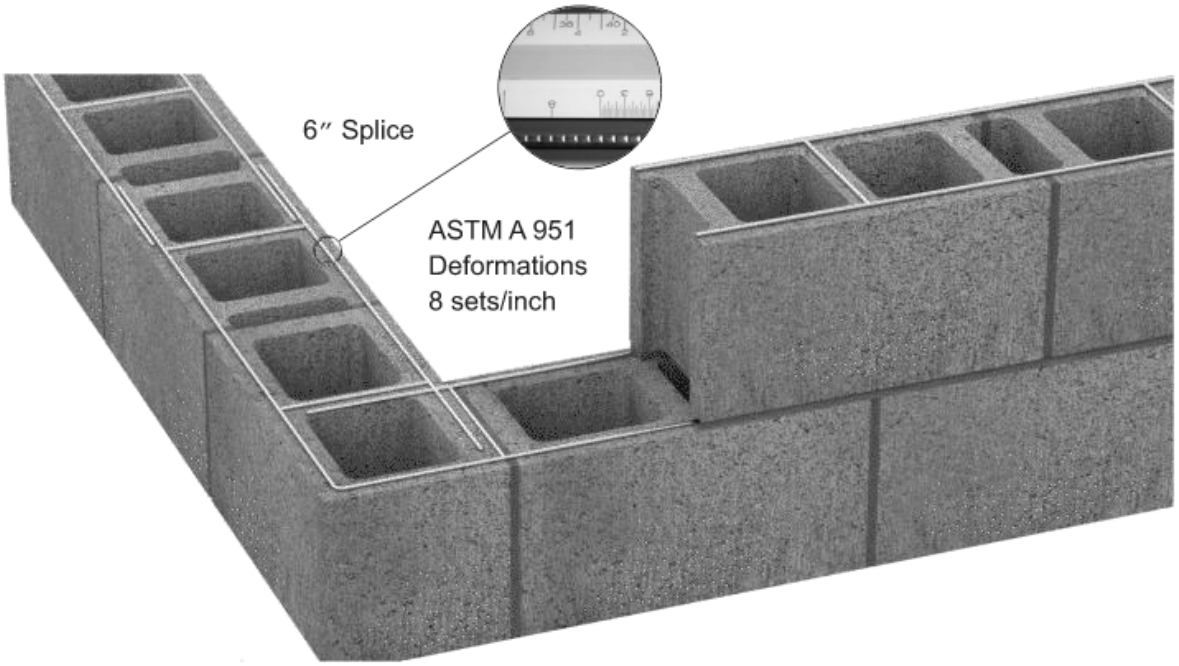
RESET FORM SAVE FORM
SAVE FORM LOCK & HIDE BUTTONS

PRODUCT SUBMITTAL

Ladder Corners (For Single Wythe Wall)



MATERIAL CONFORMANCE	SIZES / FINISHES
Wire (Carbon Steel): Prefabricated from cold-drawn steel wire conforming to **ASTM A1064/A1064M, ASTM A82/ A82M** Tensile Strength - 80,000 p.s.i. | Yield Point - 70,000 p.s.i. minimum **ASTM A951/A951M** (Standard Specification for Steel Wire for Masonry Joint Reinforcement) **ACI / ASCE 530** (Building Code Requirements for Masonry Structures) Mill Galvanized coating: **ASTM A641/A641M (0.1 oz/ft)** Hot-Dip Galvanized after fabrication: **ASTM A153/A153M-B2 (1.5 oz/ft)** Wire (Stainless Steel): **ASTM A580/ASTM 580M - AISI** Type 304 (Type 316 available on special orders) **Recycled Content:** Mill Galvanized & Fot Dipped, 82.8% Post-Consumer 17% Post Industrial / Pre Consumer **Stainless Steel** 97% Pre-Consumer V O C Content - 0%	**WIRE SIZE:** / **SIDE RODS:** / **CROSS RODS:** ☐ Standard — 9 Gauge (.148 in) — 9 Gauge ☐ Heavy Duty — 3/16 (.187 in) — 9 Gauge ☐ Extra Heavy Duty — 3/16 (.187 in) — 3/16 10′ length standard, custom length available special order) **CMU SIZE:** ☐ 4″ ☐ 6″ ☐ 8″ ☐ 10″ ☐ 12″ ☐ 14″ ☐ 16″ **FINISHES:** ☐ Mill Galvanized ☐ Hot Dip Galvanized ☐ Stainless Steel

Corporate Office: 400 Rountree Rd Charlotte, NC 28217
TEL: (800) 849-6722 FAX: (704) 525-3761
Mailing Address: P.O. Box 240988 Charlotte, NC 28224

WIRE-BOND
www.wirebond.com

Memphis Plant: 2365 Harbor Ave. Memphis, TN 38113
TEL: (800) 441-8359 FAX: (901) 775-9449
Mailing Address: P.O. Box 13124 Memphis, TN 38113

PRODUCT SUBMITTAL

Ladder Tee (For Single Wythe Wall)

MATERIAL CONFORMANCE	SIZES / FINISHES
Wire (Carbon Steel): Prefabricated from cold-drawn steel wire conforming to **ASTM A1064/A1064M, ASTM A82/ A82M** Tensile Strength - 80,000 p.s.i. | Yield Point - 70,000 p.s.i. minimum **ASTM A951/A951M** (Standard Specification for Steel Wire for Masonry Joint Reinforcement) **ACI / ASCE 530** (Building Code Requirements for Masonry Structures) Mill Galvanized coating: **ASTM A641/A641M (0.1 oz/ft)** Hot-Dip Galvanized after fabrication: **ASTM A153/A153M-B2 (1.5 oz/ft)** Wire (Stainless Steel): **ASTM A580/ASTM 580M - AISI** Type 304 (Type 316 available on special orders) **Recycled Content:** Mill Galvanized & Fot Dipped, 82.8% Post-Consumer 17% Post Industrial / Pre Consumer **Stainless Steel** 97% Pre-Consumer V O C Content - 0%	**WIRE SIZE:** / **SIDE RODS:** / **CROSS RODS:** ☐ Standard — 9 Gauge (.148 in) — 9 Gauge ☐ Heavy Duty — 3/16 (.187 in) — 9 Gauge ☐ Extra Heavy Duty — 3/16 (.187 in) — 3/16 10′ length standard, custom length available special order) **CMU SIZE:** ☐ 4″ ☐ 6″ ☐ 8″ ☐ 10″ ☐ 12″ ☐ 14″ ☐ 16″ **FINISHES:** ☐ Mill Galvanized ☐ Hot Dip Galvanized ☐ Stainless Steel

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2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-SL-001	
Technical Contact/Email: John M. Hochwalt / john.hochwalt@kpff.com	
Public Comment Number: 2022 Comment # 13	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment:

Public Comment 13 read as follows:

> Section 7.4.3.2.4 remains confusing. Are the first and second sentences separate topics, or are they intended to be related? Does the second sentence undo the first sentence? In other words, is the entire lateral force resisting system allowed to be provided by columns?

Response/Rationale:

The referenced code section addresses minimum requirements for the lateral force resisting system in SDC C+.

The code provision reads as follows:

> Along each line of lateral resistance at each story, at least 80 percent of the lateral stiffness shall be provided by seismic-force-resisting walls. Where seismic loads are determined based on a seismic response modification factor, R, not greater than 1.5, columns shall be permitted to be used to provide seismic load resistance.

The intent of the second sentence of the commentary is addressed by the last sentence of the commentary which states “The designer may opt to increase the percentage of lateral stiffness provided by columns if the structure is designed to perform elastically under seismic loads.”

We agree with the commenter that the code could be clearer, and are proposing to indicate that the second sentence is an exception to the first sentence.

The commenter also raises the question as to whether the entire lateral force resisting system is permitted to consist of columns. This would be permitted by the TMS 402 provisions if the lateral force resisting system is designed to remain essentially elastic, that is with R = 1.5. The Building Code may, however, have restrictions that limit the use of masonry columns as a lateral force resisting system. For example, the International Building Code references ASCE 7 for seismic design, and ASCE 7 only acknowledges a limited number of masonry seismic-force-resisting systems as being code compliant. The recognized systems do not include masonry columns. This

is a similar situation as exists for other masonry lateral force resisting systems that are recognized by TMS 402 but not by ASCE 7, such as some prestressed wall types and infill systems. It is proposed to provide commentary to remind the user that the governing building code may have additional restrictions that limit the use of masonry columns to resist lateral loads.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code:

7.4.3.2.4 *Lateral stiffness* — Along each line of lateral resistance at each story, at least 80 percent of the lateral stiffness shall be provided by seismic-force-resisting walls.
Exception: Where seismic loads are determined based on a seismic response modification factor, R, not greater than 1.5, columns shall be permitted to be used to provide seismic load resistance.

Code Commentary:

7.4.3.2.4 *Lateral stiffness* — In order to accurately distribute loads in a structure subjected to lateral loading, the lateral stiffness of all structural members should be considered. Although structures may be designed to use solid or perforated shear walls for lateral-load resistance, columns may also be incorporated for vertical capacity. The stipulation that seismic-force-resisting elements provide at least 80 percent of the lateral stiffness helps ensure that additional elements, such as columns, do not significantly contribute to the lateral stiffness.

A line of lateral resistance refers to the plan view of participating members within a vertical plane that provide resistance to seismic forces, including torsional effects. Potential lines of lateral resistance that do not include walls should be considered in determining whether compliance with this section has been achieved. One can evaluate whether potential lines of resistance are in fact lines of resistance for which compliance with this section is required by removing those lines of resistance from the analysis and assessing the change in forces in the remaining lines of resistance. Members offset a small amount from each other such that their displacements along the line of resistance are similar should be considered to comprise a single line of resistance. See Figure CC-7.4-1 for an illustration of lines of lateral resistance.

Based on typical design assumptions, the lateral stiffness of structural elements should be based on cracked section properties for reinforced masonry and uncracked section properties for unreinforced masonry.

The designer may opt to increase the percentage of lateral stiffness provided by columns if the structure is designed to perform elastically under seismic loads. The legally adopted building code may have additional restrictions on the use of masonry columns to resist seismic loads. For example, ASCE 7 does not currently recognize masonry columns as a seismic-force-resisting system.

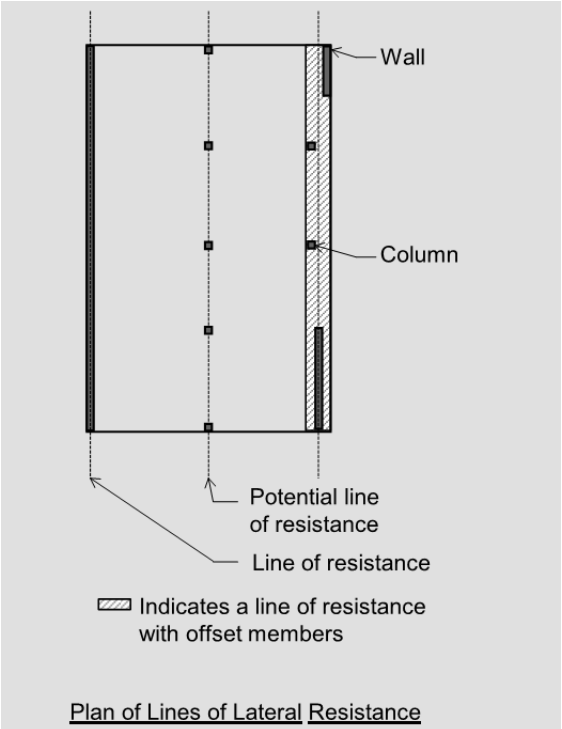


Figure CC-7.4-1 —Lines of lateral resistance

Specification:

None

Specification Commentary:

None

Subcommittee Vote:									
11	*Affirmative*	0	*Affirmative w/ comment*	0	*Negative*	0	*Abstain*	9	*Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-SL-002	
Technical Contact/Email: John M. Hochwalt / john.hochwalt@kpff.com	
Public Comment Number: 2022 Comments # 82, 83, 84, 88, 89, 122, 123, 124	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment:

All of these public comments were related to editorial corrections to the commentary for the minimum reinforcing requirements for special walls.

Three comments noted the same issue that the commentary to 7.3.2.5 (e) was mislabeled as 7.3.2.5 (d):

Public Comment 82 read as follows:

> The commentary labeled as (d) is really commentary on (e) in the code. Change (d) to (e) in the commentary.

Public Comment 88 read as follows:

> This commentary section should be labeled "(e)" not "(d)."

Public Comment 88 read as follows:

> In the commentary, the reference to section "(d)" should be '(e)".

Three comments noted the same issue with a missing word in the commentary to 7.3.2.5 (g):

Public Comment 83 read as follows:

> Insert "as" between "used" and "shear" in the following sentence.
>
> "Section 6.1.8.1 also addresses the anchorage of reinforcing bars and deformed wires used shear reinforcement in walls."

Public Comment 89 read as follows:

> The word "as" should be inserted between "used" and "shear."

Public Comment 123 read as follows:

> In the commentary, the line that ends with "used shear reinforcement in walls." should be "used as shear reinforcement in walls."

Two comments noted the same issue with an incorrect cross reference in the commentary to 7.3.2.5 (j):

Public Comment 84 read as follows:

> Change (f) to (h) in the following sentence.
> See commentary for item (f) for additional discussion of plastic hinge zones.

Public Comment 124 read as follows:

> In the commentary, the reference to section"(f)" should be "(h)"

Response/Rationale:

In addition to correcting the editorial items that were noted in the special reinforced wall commentary, this ballot proposes two other revisions in the interest of cleaning up the code and commentary for special walls:

- An editorial correction to the code provision for 7.3.2.5 (f) to replace a period with a colon.
- A correction to the commentary to acknowledge that 7.3.2.5 (e) should not be lumped in with the provisions that define “a minimum level of in-plane shear reinforcement.”

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code:

7.3.2.5 *Special reinforced masonry shear walls* — Design of special reinforced masonry shear walls shall comply with the requirements of Section 8.3, Section 9.3, or Appendix C. Reinforcement detailing shall also comply with the requirements of Section 7.3.2.2.1 and the following:

(a) In-plane flexural reinforcement shall be deformed reinforcing bars.

(b) The maximum spacing of vertical reinforcement shall be the smallest of one-third the length of the shear wall, one-third the height of the shear wall, and 48 in. (1219 mm) for masonry laid in running bond and 24 in. (610 mm) for masonry not laid in running bond.

(c) The maximum spacing of horizontal reinforcement shall not exceed 48 in. (1219 mm) for masonry laid in running bond and 24 in. (610 mm) for masonry not laid in running bond.

(d) The maximum spacing of horizontal reinforcement required to resist in-plane shear shall be the smaller of one-third the length of the shear wall and one-third the height of the shear wall. Horizontal reinforcement required to resist in-plane shear shall be uniformly distributed.

(e) Joint reinforcement and deformed wire placed in mortar required to resist in-plane shear shall be a single piece without splices for the length of the wall used for shear design, d_v.

(f) The vertical reinforcement ratio shall be at least one-third of the horizontal reinforcement ratio required to resist in-plane shear. The sum of the horizontal reinforcement ratio and vertical reinforcement ratio shall be at least 0.002. Reinforcement ratios shall be based on the gross cross-sectional area of the wall, using specified dimensions and shall be not less than the following~~.~~:

1. For masonry laid in running bond, the minimum reinforcement ratio in each direction shall be at least 0.0007.
2. For masonry not laid in running bond, the minimum vertical reinforcement ratio shall be at least 0.0007. The minimum horizontal reinforcement ratio shall be at least 0.0015.

Reinforcement used for compliance with these provisions shall be uniformly distributed.

(g) Joint reinforcement used as shear reinforcement shall be anchored in accordance with Section 6.1.8.1.3.1 (a) or (c) when two longitudinal wires are used and Section 6.1.8.1.3.2 when four longitudinal wires are used.

(h) Mechanical splices in flexural reinforcement in plastic hinge zones shall meet the requirements of Section 6.1.7.2.1 and develop the specified tensile strength of the spliced bar.

(i) Masonry not laid in running bond shall be fully grouted and shall be constructed of hollow open-end units or two wythes of solid units.

(j) Welded splices in reinforcement shall not be permitted in plastic hinge zones.

Code Commentary:

7.3.2.5 *Special reinforced masonry shear walls* — These shear walls are designed as reinforced masonry as noted in the referenced sections and are also required to meet restrictive reinforcement and material requirements. Accordingly, they are permitted to be used as part of the seismic-force-resisting system in any Seismic Design Category. Additionally, these walls have the most favorable seismic design parameters, including the highest response modification factor, R, of any of the masonry shear wall types.

(a) The reinforcing wire products – joint reinforcing, deformed wire and welded wire reinforcement – are cold worked and lack the ductility required for flexural reinforcement in special reinforced masonry shear walls.

Subsections (c)<u>, (d), and</u> ~~through~~ (f) stipulate a minimum level of in-plane shear reinforcement to improve ductility.

(~~d~~<u>e</u>) At this time, splicing of joint reinforcing and deformed wire placed in mortar is not permitted as research has not been done on the performance of lap splices of reinforcement placed in mortar under cyclic loads, and in mortar joints that may be cracked due to in-plane or out-of-planeloads. Where a wall is divided into two or more segments by movement joints, each segment will have its own length, d_v, and the joint reinforcing or deformed wires can be terminated in accordance with (g) on either side of the joint.

Joint reinforcing is also subject to the minimum reinforcement requirements based on Seismic Design Category, see Sections 7.4.1.2.1 and 7.4.3.2.6.

(f) The horizontal reinforcement ratio required to resist in-plane shear is determined by dividing the area of horizontal steel required to resist in-plane shear by the gross cross-sectional area of the wall in the vertical plane.

(g) Option (b) in Section 6.1.8.1.3.1 is excluded from use in special reinforced masonry shear walls due to lack of testing. Section 6.1.8.1 also addresses the anchorage of reinforcing bars and deformed wires used as shear reinforcement in walls.

(h) In a structure undergoing inelastic deformations during an earthquake, the tensile stresses in flexural reinforcement in plastic hinge zones may approach the tensile strength of the reinforcement. This requirement is intended to avoid a splice failure in such reinforcement.

In a perforated or coupled shear wall, plastic hinge zones may form at locations other than at the base of the wall, such as at the interfaces between horizontal and vertical wall segments. Mechanical splices in these regions are required to develop the specified tensile strength of the bar.

For the purpose of this section, the plastic hinge zone may be assumed to extend at least half of the member depth from the plane where yielding is expected to initiate.

(j) Welding can adversely affect the ductility of the reinforcement, and is thus prohibited in plastic hinge zones. See commentary for item (~~f~~h) for additional discussion of plastic hinge zones.

Specification:

None

Specification Commentary:

None

Subcommittee Vote:				
10 *Affirmative*	1 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	9 *Did not vote*

Subcommittee Comments:

Dillon commented as follows:

> I just thought of this as I was reading through this. It doesn't actually apply to the PC being addressed so I don't think we can technically address it this code cycle, but thought it'd be worth pointing out. The commentary for (j) notes that welding can adversely affect the ductility of the reinforcement, which is why it is prohibited for joint reinforcement splices in plastic hinge zone. Since joint reinforcement is regularly welded at each of the cross ties, this rationale would imply that joint reinforcement shouldn't be used at all within the plastic hinge zones.

The subcommittee chair agrees that the issue raised is outside the scope of the public comment.

The subcommittee chair would also note the following for future discussions of the issue raised:

1. Generally, shear reinforcement is not subject the same ductility demands as flexural reinforcing; both TMS and ACI allow less ductile reinforcement and detailing in shear reinforcement than in flexural reinforcement.
2. The welding process used to fabricate joint reinforcement (and welded wire fabric), resistance welding, does not raise the same concerns about loss of yield strength and ductility as the welding processes that would be used for field welded splices. This is addressed by the commentary to Section 26.6.4.1 in ACI 318-19:

Welding of wire to wire, and of wire or welded wire reinforcement to reinforcing bars or structural steel elements is not covered by AWS D1.4. If welding of this type is required on a project, the construction documents should specify requirements or performance criteria for this welding. If cold-drawn wires are to be welded, the welding procedures should address the potential loss of yield strength and ductility achieved by the cold-working process (during manufacture) when such wires are heated by welding. These potential concerns are not an issue for machine and resistance welding as used in the manufacture of welded plain and deformed wire reinforcement covered by ASTM A1064.

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-SL-003	
Technical Contact/Email: John M. Hochwalt / john.hochwalt@kpff.com	
Public Comment Number: 2022 Comment # 87	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment:

Public Comment 87 read as follows:

> The prescriptive reinforcement for non-participating elements in SDC C+ is permitted to be placed in either the horizontal or vertical direction. Should this prescriptive reinforcement be required to be placed in the direction of span? Providing horizontal reinforcement, for example, in a wall spanning vertically would seem to offer little improvement to the integrity of the wall.

Response/Rationale:

While the current provisions allow the minimum prescriptive reinforcement to be placed in either the horizontal or vertical direction, regardless of the direction of the wall span, this may not achieve the intent of in enhancing the wall integrity in areas of higher seismic risk. Maintaining the post-cracking integrity of the wall requires the presence of a minimum amount of reinforcing that crosses the potential failure plane.

For example, consider a wall spanning in the vertical direction, ungrouted and with joint reinforcing in the bed joints only. The potential failure plane in such a wall is the bed joint. Should the modulus of rupture in the bed joint be exceeded, the wall will crack across the bed joint. There will be no post-cracking ductility because there is no reinforcing crossing the crack. Mandating vertical reinforcing in this condition provides a minimum amount of post-cracking ductility.

Lastly, the ballot proposes the deletion of the sentence of commentary that reads “If reinforcement is required, it must be provided in the direction of the span.” While this is addressing required reinforcement, not the prescriptive reinforcement which was the subject of the public comment, the commentary no longer has a purpose if the prescriptive reinforcement is required to be placed in the direction of the span. There is no longer a reason for the user to think that the required reinforcement would be placed in any direction other than the direction of the span.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code:

7.4.3.1 *Design of nonparticipating elements* — Nonparticipating masonry elements shall comply with the requirements of Section 7.3.1 and Chapter 8, 9, 10, 11, 12, 15, or Appendix D. Nonparticipating masonry elements, except those constructed of AAC masonry, shall be reinforced in the direction of span ~~in either the horizontal or vertical direction~~ in accordance with Sections 7.4.3.1.1 and 7.4.3.1.2.

7.4.3.1.1 *Horizontal reinforcement* — In walls spanning horizontally, h~~H~~orizontal reinforcement shall be provided within 16 in. (406 mm) of the top and bottom of nonparticipating masonry walls and shall consist of one of the following:

(a) Two longitudinal wires of W1.7 (MW11) joint reinforcement spaced not more than 16 in. (406 mm) on center. The space between these wires shall be the widest that the mortar joint will accommodate.

(b) Two D2 (MD13) deformed wires spaced not more than 16 in. (406 mm) on center for walls greater than 4 in. (102 mm) in width and at least one D2 (MD13) wire spaced not more than 16 in. (406 mm) on center for walls not exceeding 4 in. (102 mm) in width. Where two deformed wires are used, the space between these wires shall be the widest that the mortar joint will accommodate.

(c) One No. 4 (M #13) bar or one D20 (MD129) wire spaced not more than 48 in. (1219 mm) on center.

7.4.3.1.2 *Vertical reinforcement* — In walls spanning vertically, v~~V~~ertical reinforcement shall consist of at least one No. 4 (M #13) bar or one D20 (MD129) wire spaced not more than 120 in. (3048 mm). Vertical reinforcement shall be located within 16 in. (406 mm) of the ends of masonry walls.

Code Commentary:

7.4.3.1 *Design of nonparticipating elements* — Reinforcement requirements of Section 7.4.3.1 ~~are traditional for conventional concrete and clay masonry. They~~ are prescriptive in nature. The intent of this requirement is to provide structural integrity for nonparticipating masonry walls by ensuring that a minimum amount of reinforcing is present in the direction of the span should the seismic induced moment exceed the cracking strength of the masonry. AAC masonry walls differ from concrete masonry walls and clay masonry walls in that the thin-bed mortar strength and associated bond strength is typically greater than that of the AAC units. Also, the unit weight of AAC masonry is typically less than one-third of the unit weight of clay or concrete masonry, reducing seismic inertial forces. This reduced load, combined with a tensile bond strength that is higher than the strength of the AAC material itself, provides a minimum level of structural integrity. Therefore, prescriptive reinforcement is not required. All masonry walls, including non-participating AAC masonry walls, are required to be designed to resist out-of-plane forces. ~~If reinforcement is required, it must be provided in the direction of the span.~~ Permitted types of reinforcement are defined in Section 6.1.1. Commentary Section 6.1.3 provides additional information.

Specification:

None

Specification Commentary:

None

Subcommittee Vote:				
10 *Affirmative*	0 *Affirmative w/ comment*	1 *Negative*	0 *Abstain*	9 *Did not vote*

Subcommittee Comments:

The negative voter, Robinson, commented as follows:

> *The line indicated to be deleted "If reinforcement is required, it must be provided in the direction of the span." is not about the prescriptive reinforcement. This is about reinforcement required to resist out-of-plane loads. Therefore, it should not be deleted.*

From discussion with the negative voter, the subcommittee chair came understands that the concern was that proposed change was outside the scope of the public comment. The subcommittee chair has added a third paragraph to the rationale to explain how the proposed change relates to the public comment.

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-SL-004	
Technical Contact/Email: John M. Hochwalt / john.hochwalt@kpff.com	
Public Comment Number: 2022 Comments # 90	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment:

Public Comment 90 read as follows:

> Since "shear reinforcements" is now a defined term, it is suggested to replace the phrase "reinforcement required to resist in-plane shear" in six locations in this section with "shear reinforcement."

Response/Rationale:

In Section 2.2, Shear reinforcement is defined as:

> *Reinforcement, shear* — Reinforcement required for compliance with Section 8.3.5, Section 9.3.3.1.2, or Section 11.3.4.1.2.

As the public comment notes, the provisions for Special Reinforced Masonry Shear Walls in Section 7.3.2.5 use the terminology "reinforcement required to resist in-plane shear." The only provisions in TMS 402 that require the use of reinforcement to resist shear are those referenced in the definition of "shear reinforcement" in Section 2.2. It is proposed to simplify the wording in Section 7.3.2.5 by using the defined term of "shear reinforcement."

Note: There is a separate ballot, 19-SL-02, that corrects typographical errors in these provisions.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code:

7.3.2.5 *Special reinforced masonry shear walls* — Design of special reinforced masonry shear walls shall comply with the requirements of Section 8.3, Section 9.3, or Appendix C. Reinforcement detailing shall also comply with the requirements of Section 7.3.2.2.1 and the following:

(a) In-plane flexural reinforcement shall be deformed reinforcing bars.

(b) The maximum spacing of vertical reinforcement shall be the smallest of one-third the length of the shear wall, one-third the height of the shear wall, and 48 in. (1219 mm) for masonry laid in running bond and 24 in. (610 mm) for masonry not laid in running bond.

(c) The maximum spacing of horizontal reinforcement shall not exceed 48 in. (1219 mm) for masonry laid in running bond and 24 in. (610 mm) for masonry not laid in running bond.

(d) The maximum spacing of ~~horizontal~~ in-plane shear reinforcement ~~required to resist in-plane shear~~ shall be the smaller of one-third the length of the shear wall and one-third the height of the shear wall. ~~Horizontal~~ In-plane shear reinforcement ~~required to resist in-plane shear~~ shall be uniformly distributed.

(e) Joint reinforcement and deformed wire placed in mortar used as shear reinforcement~~required to resist in-plane shear~~ shall be a single piece without splices for the length of the wall used for shear design, d_v.

(f) The vertical reinforcement ratio shall be at least one-third of the ~~horizontal~~ in-plane shear reinforcement ratio ~~required to resist in-plane shear~~. The sum of the horizontal reinforcement ratio and vertical reinforcement ratio shall be at least 0.002. Reinforcement ratios shall be based on the gross cross-sectional area of the wall, using specified dimensions and shall be not less than the following.

1. For masonry laid in running bond, the minimum reinforcement ratio in each direction shall be at least 0.0007.
2. For masonry not laid in running bond, the minimum vertical reinforcement ratio shall be at least 0.0007. The minimum horizontal reinforcement ratio shall be at least 0.0015.

Reinforcement used for compliance with these provisions shall be uniformly distributed.

(g) Joint reinforcement used as shear reinforcement shall be anchored in accordance with Section 6.1.8.1.3.1 (a) or (c) when two longitudinal wires are used and Section 6.1.8.1.3.2 when four longitudinal wires are used.

(h) Mechanical splices in flexural reinforcement in plastic hinge zones shall meet the requirements of Section 6.1.7.2.1 and develop the specified tensile strength of the spliced bar.

(i) Masonry not laid in running bond shall be fully grouted and shall be constructed of hollow open-end units or two wythes of solid units.

(j) Welded splices in reinforcement shall not be permitted in plastic hinge zones.

Code Commentary:

7.3.2.5 *Special reinforced masonry shear walls* — These shear walls are designed as reinforced masonry as noted in the referenced sections and are also required to meet restrictive reinforcement and material requirements. Accordingly, they are permitted to be used as part of the seismic-force-resisting system in any Seismic Design Category. Additionally, these walls have the most favorable seismic design parameters, including the highest response modification factor, R, of any of the masonry shear wall types.

(a) The reinforcing wire products – joint reinforcing, deformed wire and welded wire reinforcement – are cold worked and lack the ductility required for flexural reinforcement in special reinforced masonry shear walls.

Subsections (c) through (f) stipulate a minimum level of in-plane shear reinforcement to improve ductility.

(d) At this time, splicing of joint reinforcing and deformed wire placed in mortar is not permitted as research has not been done on the performance of lap splices of reinforcement placed in mortar under cyclic loads, and in mortar joints that may be cracked due to in-plane or out-of-planeloads. Where a wall is divided into two or more segments by movement joints, each segment will have its own length, d_v, and the joint reinforcing or deformed wires can be terminated in accordance with (g) on either side of the joint.

Joint reinforcing is also subject to the minimum reinforcement requirements based on Seismic Design Category, see Sections 7.4.1.2.1 and 7.4.3.2.6.

(f) The ~~horizontal~~ in-plane shear reinforcement ratio ~~required to resist in-plane shear~~ is determined by dividing the area of horizontal steel required to resist in-plane shear by the gross cross-sectional area of the wall in the vertical plane.

(g) Option (b) in Section 6.1.8.1.3.1 is excluded from use in special reinforced masonry shear walls due to lack of testing. Section 6.1.8.1 also addresses the anchorage of reinforcing bars and deformed wires used shear reinforcement in walls.

(h) In a structure undergoing inelastic deformations during an earthquake, the tensile stresses in flexural reinforcement in plastic hinge zones may approach the tensile strength of the reinforcement. This requirement is intended to avoid a splice failure in such reinforcement.

In a perforated or coupled shear wall, plastic hinge zones may form at locations other than at the base of the wall, such as at the interfaces between horizontal and vertical wall segments. Mechanical splices in these regions are required to develop the specified tensile strength of the bar.

For the purpose of this section, the plastic hinge zone may be assumed to extend at least half of the member depth from the plane where yielding is expected to initiate.

(j) Welding can adversely affect the ductility of the reinforcement, and is thus prohibited in plastic hinge zones. See commentary for item (f) for additional discussion of plastic hinge zones.

Specification:

None

Specification Commentary:

None

Subcommittee Vote:				
11 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	9 *Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-SL-005	
Technical Contact/Email: John M. Hochwalt / john.hochwalt@kpff.com	
Public Comment Number: 2022 Comments # 93	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment:

Public Comment 93 read as follows:

> The first sentence of 7.3.2.5 (f) is redundant with provisions in 8.3.5.2.2 and 9.3.5.2. Can it be deleted?

Response/Rationale:

The provisions referenced by the comment reads follows:

> **8.3.5.2.2** For shear walls, reinforcement shall be provided perpendicular to the shear reinforcement and shall be at least equal to one-third A_v. The reinforcement shall be uniformly distributed and shall not exceed a spacing of 8 ft (2.44 m).
>
> **9.3.5.2** *Reinforcement* — Reinforcement shall be provided perpendicular to the shear reinforcement and shall be at least equal to one-third A_v. The reinforcement shall be uniformly distributed and shall not exceed a spacing of 8 ft (2.44 m).

The first sentence of 7.3.2.5 (f) is a little different than the provisions in Chapters 8 and 9 in that it references reinforcement ratios and not reinforcement areas. This was a change made in ballot 15-SL-022. The language prior to ballot 15-SL-022 was:

> The minimum cross-sectional area of vertical reinforcement shall be one-third of the required shear reinforcement.

The current language was passed in 15-SL-022 and reads as follows:

> The minimum vertical reinforcement ratio shall be one-third of the required horizontal reinforcement ratio.

The reason for the revisions made in 15-SL-022 was to have all of the provisions in 7.3.2.5 (f) expressed in terms of reinforcement ratios instead of reinforcement areas. Thus while the language of 7.3.2.5 (f) is different than the

language in Chapters 8 and 9, the intent is the same and the provision is redundant as noted by the public commenter. It is therefore proposed to delete that sentence.

With the removal of the first sentence of 7.3.2.5 (f), the associated commentary is no longer relevant and is replaced by commentary that guides the user to the appropriate provisions in Chapters 8 and 9..

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code:

7.3.2.5 *Special reinforced masonry shear walls* — Design of special reinforced masonry shear walls shall comply with the requirements of Section 8.3, Section 9.3, or Appendix C. Reinforcement detailing shall also comply with the requirements of Section 7.3.2.2.1 and the following:

. . .

(f) ~~The vertical reinforcement ratio shall be at least one-third of the horizontal reinforcement ratio required to resist in-plane shear.~~ The sum of the horizontal reinforcement ratio and vertical reinforcement ratio shall be at least 0.002. Reinforcement ratios shall be based on the gross cross-sectional area of the wall, using specified dimensions and shall be not less than the following.

1. For masonry laid in running bond, the minimum reinforcement ratio in each direction shall be at least 0.0007.
2. For masonry not laid in running bond, the minimum vertical reinforcement ratio shall be at least 0.0007. The minimum horizontal reinforcement ratio shall be at least 0.0015.

Reinforcement used for compliance with these provisions shall be uniformly distributed.

Code Commentary:

7.3.2.5 *Special reinforced masonry shear walls* — These shear walls are designed as reinforced masonry as noted in the referenced sections and are also required to meet restrictive reinforcement and material requirements. Accordingly, they are permitted to be used as part of the seismic-force-resisting system in any Seismic Design Category. Additionally, these walls have the most favorable seismic design parameters, including the highest response modification factor, R, of any of the masonry shear wall types.

. . .

(f) In previous editions of the Code, this section included a requirement for a minimum amount of vertical reinforcement based on the amount of horizontal reinforcement required to resist shear. This requirement for a minimum amount of vertical reinforcement was redundant with provisions applicable to all reinforced masonry shear wall designs in Chapters 8 and 9 and has been removed from this section. ~~The horizontal reinforcement ratio required to resist in-plane shear is determined by dividing the area of horizontal steel required to resist in-plane shear by the gross cross-sectional area of the wall in the vertical plane.~~

Specification:

None

Specification Commentary:

None

Subcommittee Vote:				
11 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	9 *Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-SL-007	
Technical Contact/Email: John M. Hochwalt / john.hochwalt@kpff.com	
Public Comment Number: 2022 Comments # 105	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment:

Public Comment 105 read as follows:

> The commentary to Section 7.4.4 starting with the second sentence should be moved and incorporated into Section 7.3.2.5.

Response/Rationale:

The committee agrees that the referenced commentary is specific to Special Reinforced Masonry Shear Walls, and is better located in section 7.3.2.5 with the provisions for that wall type than it is in Section 7.4.4 for Seismic Design Category D.

Part of this commentary addresses the requirement that the vertical reinforcement ratio shall be at least one-third of the horizontal reinforcement ratio required to resist in-plane shear. Ballot 19-SL-05 proposes that provision be deleted from 7.3.2.5 as it is redundant with provisions in Chapters 8 and 9. Should both ballots pass, this ballot proposes to simply delete the last sentence of the commentary to 7.4.4 and not relocate it to 7.3.2.5 as the provision it is discussing will no longer be present.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code:

Note: The ballot does not proposed changes to the code provisions. The following is provided to show the context of the proposed revisions to the commentary.

7.3.2.5 *Special reinforced masonry shear walls* — Design of special reinforced masonry shear walls shall comply with the requirements of Section 8.3, Section 9.3, or Appendix C. Reinforcement detailing shall also comply with the requirements of Section 7.3.2.2.1 and the following:

. . .

(f) The vertical reinforcement ratio shall be at least one-third of the horizontal reinforcement ratio required to resist in-plane shear. The sum of the horizontal reinforcement ratio and vertical reinforcement ratio shall be at least 0.002. Reinforcement ratios shall be based on the gross cross-sectional area of the wall, using specified dimensions and shall be not less than the following.

1. For masonry laid in running bond, the minimum reinforcement ratio in each direction shall be at least 0.0007.
2. For masonry not laid in running bond, the minimum vertical reinforcement ratio shall be at least 0.0007. The minimum horizontal reinforcement ratio shall be at least 0.0015.

Reinforcement used for compliance with these provisions shall be uniformly distributed.

. . .

7.4.4 *Seismic Design Category D requirements* — Masonry elements in structures assigned to Seismic Design Category D shall comply with the requirements of Section 7.4.3 and with the additional requirements of Sections 7.4.4.1 and 7.4.4.2.

Exception: Design of participating elements of AAC masonry shall comply with the requirements of Section 7.4.3.

. . .

Code Commentary:

Note: Ballot 19-SL-05 proposes to delete the first sentence of the code provisions in Section 7.3.2.5 (f). Should both this ballot and 19-SL-05 pass, the ballots will be reconciled by:

- **Relocating the second to last sentence of the commentary to 7.4.4 - "The minimum amount of wall reinforcement . . ." – to the commentary to 7.3.2.5 (f) as shown below**
- **Deleting the last sentence of the commentary to section 7.4.4 – ‘‘Because the minimum required reinforcement . . ." - and not relocating it.**

7.3.2.5 *Special reinforced masonry shear walls* — These shear walls are designed as reinforced masonry as noted in the referenced sections and are also required to meet restrictive reinforcement and material requirements. Accordingly, they are permitted to be used as part of the seismic-force-resisting system in any Seismic Design Category. Additionally, these walls have the most favorable seismic design parameters, including the highest response modification factor, R, of any of the masonry shear wall types.

. . .

(f) The horizontal reinforcement ratio required to resist in-plane shear is determined by dividing the area of horizontal steel required to resist in-plane shear by the gross cross-sectional area of the wall in the vertical plane. Because the minimum required reinforcement may be used to satisfy design requirements, at least 1/3 of the minimum amount is reserved for the lesser stressed direction in order to ensure an appropriate distribution of loads in both directions.

The minimum amount of wall reinforcement for special reinforced masonry shear walls has been a long-standing, standard empirical requirement in areas of high seismic loading. It is expressed as a percentage

of gross cross-sectional area of the wall. It is intended to improve the ductile behavior of the wall under earthquake loading and assist in crack control.

. . .

7.4.4 *Seismic Design Category D requirements* — Masonry shear walls for structures assigned to Seismic Design Category D are required to meet the requirements of special reinforced masonry shear walls or ordinary reinforced AAC masonry shear walls because of the increased risk and expected intensity of seismic activity. ~~The minimum amount of wall reinforcement for special reinforced masonry shear walls has been a long-standing, standard empirical requirement in areas of high seismic loading. It is expressed as a percentage of gross cross-sectional area of the wall. It is intended to improve the ductile behavior of the wall under earthquake loading and assist in crack control. Because the minimum required reinforcement may be used to satisfy design requirements, at least 1/3 of the minimum amount is reserved for the lesser stressed direction in order to ensure an appropriate distribution of loads in both directions.~~

Specification:

None

Specification Commentary:

None

Subcommittee Vote:									
10	*Affirmative*	1	*Affirmative w/ comment*	0	*Negative*	0	*Abstain*	9	*Did not vote*

Subcommittee Comments:

The affirmative with comment voter, Robinson, commented as follows:

> *I am unsure about the explanation for the reconciliation of 19-SL-05 with this ballot item. The added second paragraph in the commentary to section 7.3.2.5 starting with "The minimum amount of wall reinforcement..." should still be moved from section 7.4.4 and be placed in section 7.3.2.5, even if 19-SL-05 passes.*

This discussion about the potential reconciliation of this ballot with 19-SL-05 has been revised for clarity as suggested by the voter.

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-SL-008	
Technical Contact/Email: John M. Hochwalt / john.hochwalt@kpff.com	
Public Comment Number: 2022 Comments # 110	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment:

Public Comment 110 read as follows:

> I understand that not all the masonry cement limitations can be listed in Code Commentary 1.2.1 (j), but I think users would be helped if we added a few words to explain that fully grouted members have no limitations on mortar type per Section 7.4.4.2.2. I suggest revising "...and participating masonry elements (Section 7.4.4.2.2)" to "...and participating masonry members that are not fully grouted (Section 7.4.4.2.2)."

Note: The comment was submitted in reference to page 121, it appears that it was intended to be referenced to page 21.

Response/Rationale:

As noted by the commenter to revised commentary is intended to clarify that the seismic performance of fully grouted walls is insensitive to cement type. The Chapter 7 provision referenced by the commenter applies in Seismic Design Category D and reads as follows:

> **7.4.4.2.2** *Material requirements* — Fully grouted participating elements shall be designed and specified with Type S or Type M cement-lime mortar, masonry cement mortar, or mortar cement mortar. Partially grouted participating elements shall be designed and specified with Type S or Type M cement-lime mortar or mortar cement mortar.

The associated commentary notes:

> **7.4.4.2.2** *Material requirements* — Based on numerous tests by several researchers, (Brown and Melander (1999); Hamid et al (1979); Minaie et al (2009); Klingner et al (2010)) the behavior of fully grouted walls subjected to out-of-plane flexural and in-plane shear loads is dominated by grout and unaffected by mortar formulation. In tests by Minaie et al (2009) and Klingner et al (2010), fully grouted concrete masonry walls exhibited good in-plane response when subjected to seismic loads. For fully grouted participating elements in buildings assigned to Seismic Categories D or higher, no mortar material restrictions are necessary. Historical

provisions requiring use of Type S or M cement-lime or mortar cement mortar are retained for partially grouted participating elements in buildings assigned to Seismic Design Categories D or higher.

We agree that the proposed revision will be helpful to users of the code.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code:

Note: The ballot does not propose changes to the code provisions. The following is provided to show the context of the proposed revisions to the commentary.

1.2.1 Show or indicate all information required by TMS 402 on the project drawings or in the project specifications, including:

. . .

(j) Masonry members in which mortar cement mortar or non-air-entrained cement-lime mortar is required.

Code Commentary:

1.2.1 This Code lists some of the more important items of information that must be included in the project drawings or project specifications. This is not an all-inclusive list, and additional items may be required by the building official.

. . .

(j) Under certain conditions, masonry cement mortar is not permitted and either cement-lime mortar or mortar cement mortar must be used. Those conditions include, but are not limited to: masonry in which joint reinforcement is used to resist applied vertical and lateral loads (Sections 6.1.6.2.1.2 and 6.1.6.2.2.2) and participating masonry elements that are not fully grouted (Section 7.4.4.2.2). Refer to ASTM C270 for more information on mortar kinds and types.

Specification:

None

Specification Commentary:

None

Subcommittee Vote:				
11 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	9 *Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-SL-010	
Technical Contact/Email: John M. Hochwalt / john.hochwalt@kpff.com	
Public Comment Number: 2022 Comments # 142	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment:

In reference to the commentary for 7.3.2.5, Public Comment 142 read as follows:

> This should say "plain shear wall types" rather than "unreinforced shear wall types."

Response/Rationale:

The committee agrees. “Unreinforced” designates a design method, not a wall type.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code:

Note: The ballot does not propose changes to the code provisions. The following is provided to show the context of the proposed revisions to the commentary.

7.3.2 *Participating elements* — Masonry walls that are part of the seismic-force-resisting system shall be classified as participating elements and shall comply with the requirements of Section 7.3.2.1, 7.3.2.2, 7.3.2.3, 7.3.2.4, 7.3.2.5, 7.3.2.6, 7.3.2.7, 7.3.2.8, 7.3.2.9, 7.3.2.10, or 7.3.2.11.

Code Commentary:

7.3.2 *Participating elements* — A seismic-force-resisting system must be defined for every structure. Most masonry buildings use masonry shear walls to serve as the seismic-force-resisting system, although other systems are sometimes used (such as concrete or steel frames with masonry infill). Such shear walls must be designed by the engineered methods in Part 3.

Eleven shear wall types are defined in this section. Depending upon the masonry material and detailing method, inelastic response capacity and energy dissipation may vary for each wall type. Eight of these shear wall types are assigned system design parameters per ASCE/SEI 7, which include response modification factors, R, overstrength factors, Ω_0 and deflection amplification factors, C_d, based on their expected performance and ductility. Section 12.2.1 of ASCE/SEI 7 permits wall types not addressed by that standard provided that analytical and test data are submitted to authorities having jurisdiction. Certain shear wall types are permitted in each seismic design category, however ~~unreinforced~~ plain shear wall types are not permitted in regions of intermediate and high seismic risk. Requirements for each of the eleven shear wall types, as given in Section 7.3.2, are summarized in Table CC-7.3.2-1.

Specification:

None

Specification Commentary:

None

Subcommittee Vote:				
11 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	9 *Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-SL-011	
Technical Contact/Email: John M. Hochwalt / john.hochwalt@kpff.com	
Public Comment Number: 2022 Comments # 147	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment:

In reference to the commentary for 7.4.4.2.1, Public Comment 14 read as follows:

> Consider updating this commentary. Would it be clearer to refer to beneficial effects of column ties as "confinement"? Also, the last phrase "and better resistance to shear" is incorrect. Shear will be constant over the height of the column; when heavier ties are provided at the top and bottom of the column it is to provide enhanced confinement of potential hinge regions.
>
> Should enhanced confinement of potential hinge regions be made mandatory?

Response/Rationale:

This ballot addresses the first part of the comment only. The second part of the comment asking whether enhanced confinement of the hinge zones should be made mandatory will addressed on a separate ballot.

This commentary applies to participating columns in SDC D+.

A series of edits to the commentary are proposed in response to the comment to explain the role of column ties in improving ductility.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code:

Note: The ballot does not propose changes to the code provisions. The following is provided to show the context of the proposed revisions to the commentary.

7.4.4 *Seismic Design Category D requirements*

. . .

7.4.4.2 *Design of participating elements* — Masonry shear walls shall be designed to comply with the requirements of Section 7.3.2.5, 7.3.2.8, or 7.3.2.11.

7.4.4.2.1 *Minimum reinforcement for masonry columns* — Lateral ties in masonry columns shall be spaced not more than 8 in. (203 mm) on center and shall be at least 3/8 in. (9.5 mm) diameter. Lateral ties shall be embedded in grout.

Code Commentary:

7.4.4.2.1 *Minimum reinforcement for masonry columns* — Adequate lateral restraint is important for column longitudinal reinforcement ~~subjected to overturning~~ resisting compression forces due to earthquakes. Many column failures during earthquakes have been attributed to buckling of longitudinal reinforcement and inadequate ~~lateral tying~~confinement of concrete or masonry in compression. For this reason, closer spacing of lateral ties than might otherwise be required is prudent. An arbitrary minimum spacing has been established through experience. Columns not involved in the seismic-force-resisting system should also be more heavily tied at the tops and bottoms for more ductile performance in potential plastic hinge regions ~~and better resistance to shear~~.

Specification:

None

Specification Commentary:

None

Subcommittee Vote:				
11 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	9 *Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #:** 19
Item #: 19-SL-012	
Technical Contact/Email: Alan Robinson / arobinson@trseinc.com	
Public Comment Number: 2022 Comment # 118 and 140	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment:
Two comments were received on the commentary to section 7.2.4:

> Comment 118:
> Commentary to section 7.2.4 The word "exceeded" in the line "As such, the committee felt that requiring designers to check story drifts for those systems of low and moderate ductility was not exceeded." is not correct.
>
> Comment 140:
> Should the word "exceeded" be replaced by the word "necessary"?

Response/Rationale:
In the previous version of TMS 402, the word was “superfluous”. It was mistakenly changed due to a TAC comment (#201) to “not exceeded” in this code cycle. The intent of the commentary is to indicate that it is not necessary to check the story drifts for these systems, not that anything was or was not exceeded. This ballot item proposes to change the wording to match the intent of the commentary.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code: NONE

Code Commentary:

Ordinary plain, detailed plain, ordinary reinforced, intermediate reinforced, ordinary plain AAC, and detailed plain AAC masonry shear walls are inherently designed to have relatively low inelastic deformations under seismic loads. As such, the Committee felt that requiring designers to check story drifts for these systems of low and moderate ductility was not ~~exceeded~~warranted.

Specification: NONE

Specification Commentary: NONE

Subcommittee Vote:									
10	*Affirmative*	1	*Affirmative w/ comment*	0	*Negative*	0	*Abstain*	9	*Did not vote*

Subcommittee Comments:

Dillon commented that the part of the header that categorizes the subcommittee's response had not been correctly filled out. That has been corrected.

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #:** 19
Item #: 19-SL-013	
Technical Contact/Email: Alan Robinson / arobinson@trseinc.com	
Public Comment Number: 2022 Comment # 120	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

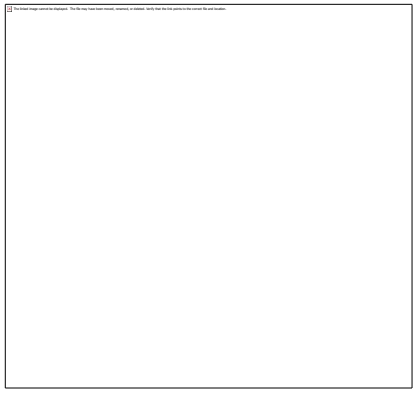
☐ ***Public Comment only requires a response, no change to document***

Public Comment:
Comment regarding Commentary Section 7.3.1

> The commentary language "The influence of any non-isolated nonparticipating elements can inadvertently have on performance of a structural system should be considered in design in accordance with Section 4.1.6 of this code, and other applicable provisions such as the modeling criteria of ASCE /SEI 7." is language that should be mandatory and placed in the code, not the commentary. The reference to ASCE 7 can be left in the commentary, but the first part should be placed in the code as "The influence of any non-isolated nonparticipating elements can inadvertently have on performance of a structural system shall be considered in design in accordance with Section 4.1.6 of this code."

Response/Rationale:

As indicated in the current commentary language, the influence of any non-isolated nonparticipating elements may alter the center of rigidity of the structure to such an extent that the loads to other participating elements may be increased. This could lead an under design of certain participating elements.



A shifting of the center of rigidity as shown from the addition of the non-isolated nonparticipating elements will increase the torsional load on the perpendicular walls and may also increase the load on some of the parallel walls. If the designer has determined the loads to the lateral load resisting system without including the non-isolated

nonparticipating elements, the designs of some of the walls may be inadequate and lead to premature failure. The designer might not think that the non-isolated nonparticipating elements are just a major addition to the system and a check of the entire system might not be needed. This proposal adds a requirement that the addition of the non-isolated nonparticipating elements be included in the modeling of the system per section 4.1.6 of the code.

For convenience section 4.1.6 reads as follows:

Code

4.1.6 *Lateral load distribution*

Lateral loads shall be distributed to the structural system in accordance with member stiffnesses and shall comply with the requirements of this section.

4.1.6.1 Flanges of intersecting walls designed in accordance with Section 5.1.1.1 shall be included in stiffness determination.

4.1.6.2 Distribution of load shall be consistent with the forces resisted by foundations.

4.1.6.3 Distribution of load shall include the effect of horizontal torsion of the structure due to eccentricity of wind or seismic loads.

Commentary

4.1.6 *Lateral load distribution*

The design assumptions for masonry buildings include the use of a lateral-force-resisting system. The distribution of lateral loads to the members of the lateral-force-resisting system is a function of the rigidities of the structural system and of the horizontal diaphragms. The method of connection at intersecting walls and between walls and floor and roof diaphragms determines if the wall participates in the lateral-force-resisting system. Lateral loads from wind and seismic forces are normally considered to act in the direction of the principal axes of the structure. Lateral loads may cause forces in walls both perpendicular and parallel to the direction of the load. Horizontal torsion can be developed due to eccentricity of the applied load with respect to the center of rigidity. The analysis of lateral load distribution should be in accordance with accepted engineering procedures.

Analysis should also rationally consider the effects of openings in shear walls. The interaction of coupled shear walls is complex and further information may be obtained from Kingsley et al (2014) and Ashour et al (2016). The designer should assess the effects of coupling. The governing behavior mode will depend on whether the configuration of vertical and horizontal oriented wall segments allows the segments to act as an uncoupled or coupled shear wall. Walls may be coupled by concrete slabs, and in this configuration, the coupling effect of the slabs can contribute increased axial forces and moments generated in walls (Kingsley et al (2014) and Ashour et al (2016)). Masonry beams can also couple masonry walls. If the walls are subject to significant lateral displacement, the coupling beams are more likely to fail in shear than meet the deformation demand. Calculation of the stiffness of shear walls should consider shearing and flexural deformations. A guide for solid shear walls (that is, with no openings) is given in Figure CC-4.1-1. For ungrouted hollow unit shear walls, the use of equivalent solid thickness of wall in calculating web stiffness is acceptable.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code:

7.3.1 *Nonparticipating elements* — Masonry elements that are not part of the seismic-force-resisting system shall be classified as nonparticipating elements and shall be isolated in their own plane from the seismic-force-resisting system. Isolation joints and connectors shall be designed to accommodate the design story drift.

Exception: Isolation is not required if a deformation compatibility analysis demonstrates that the non-participating element can accommodate the inelastic displacement, $C_d\delta_{ne}$, of the structure in a manner complying with the requirements of this code. Elements supporting gravity loads in addition their self-weight shall be evaluated for gravity load combinations of (1.2*D* + 1.0*L* + 0.2*S*) or 0.9*D*, whichever is critical, acting simultaneously with the inelastic displacement and shall have a ductility compatible with the ductility of the lateral force resisting system. The influence of any non-isolated nonparticipating elements on the lateral force resisting system shall be considered in design in accordance with Section 4.1.6 of this code.

Code Commentary:

7.3.1 *Nonparticipating elements* — With regards to the exception, non-isolated, nonparticipating elements can influence a structure's strength and stiffness, and as a result the distribution of lateral loads and building irregularities. ~~The influence of any n~~Non-isolated nonparticipating elements can inadvertently have significant effects on the performance of a structural system and are to be considered in accordance with the code. This should also be considered ~~in design~~ in accordance with ~~Section 4.1.6 of this code, and~~ other applicable provisions such as the modeling criteria of ASCE/SEI 7. Where partial height non-participating elements are constructed tight to building columns, this should include the consideration of short column effects.

The deformation compatibility analysis may consider the effect of cracking on element stiffness. Elements that are detailed to achieve ductile behavior may also develop plastic mechanisms. For example, elements detailed in accordance with the provisions for special reinforced masonry shear walls may be able to accommodate displacements through the development of plastic hinges. For such elements, Appendix C may be used to provide guidance on the determination of hinge rotation capacity. In addition to these provisions, other applicable provisions, such as the deformation limit and deformation compatibility provisions of ASCE/SEI 7 should be considered in design

Specification: NONE

Specification Commentary: NONE

Subcommittee Vote:				
9 *Affirmative*	2 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	9 *Did not vote*

Subcommittee Comments:

Dillon and Sommer commented that the part of the header that categorizes the subcommittee's response had not been correctly filled out. That has been corrected.

Sommer also identified a typographical error that has been corrected.

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-SL-016	
Technical Contact/Email: John M. Hochwalt / john.hochwalt@kpff.com	
Public Comment Number: 2022 Comments # 193	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment:

Public Comment 193 read as follows:

Correct the reference to Chapter 9 to 9.3.5.6.2.3 (a)

Response/Rationale:

The comment was made in reference to the commentary to Appendix C Section C3.1. The commenter is correct that the cross reference to Chapter 9 is incorrect.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code:

No changes to the Code are proposed. The following is provided for the voter's reference only.

C.3.1 The rotational deformation capacity of plastic hinges shall be taken as $0.5\ell_w\,\varepsilon_{mu}/c$. The value of c shall be calculated for the P_u corresponding to Load Combination 6 of Section 2.3.6 of ASCE/SEI 7.

Code Commentary:

C.3.1 The rotational deformation capacity is calculated assuming an ultimate curvature of ε_{mu}/c over a plastic hinge length of $0.5\ell_w$. The resulting expression is similar to that used in Section 9.3.5.6.2.3(a) to determine the need for special boundary elements. In the latter case, it is multiplied by wall height. The value of P_u includes earthquake effects, and may be calculated using a linearly elastic model.

Specification:

None

Specification Commentary:

None

Subcommittee Vote:				
11 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	9 *Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: 19-SL-017	
Technical Contact/Email: John M. Hochwalt / john.hochwalt@kpff.com	
Public Comment Number: 2022 Comments # 194	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☒ ***Committee agrees with Public Comment, change is proposed***

☐ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment:

Public Comment 194 read as follows:

> Are the angular deformation capacities of shear controlled elements intended to be the lesser of C3.1 and C3.2? As written, it could be interpreted that shear controlled elements need only comply with C3.2. This could be addressed by revising C3.2 to state that angular deformation capacity should be taken as not greater than 1/400 or 1/200, depending on detailing.

Response/Rationale:

C3.2 is not intended to allow angular deformations in excess of those permitted by C3.1. It is proposed to clarify the code accordingly.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code:

C.3.1 The rotational deformation capacity of plastic hinges shall be taken as $0.5\,\ell_w\,\varepsilon_{mu}/c$. The value of c shall be calculated for the P_u corresponding to Load Combination 6 of Section 2.3.6 of ASCE/SEI 7.

C.3.2 The angular deformation capacity of masonry components whose plastic hinge strengths are limited by shear as specified in C.1(d), shall be taken as not greater than 1 / 400. The angular deformation capacity shall be permitted to be taken as not greater than 1 / 200 for masonry components satisfying the following requirements:

(a) The areas of transverse and longitudinal reinforcement shall each not be less than 0.001 multiplied by the gross cross-sectional area of the component, using specified dimensions;

(b) Spacing of transverse and longitudinal reinforcement shall not exceed the smallest of 24 in. (610 mm), ℓ_w / 3 and h_w / 3~~.~~;

(c) Reinforcement ending at a free edge of masonry shall be anchored around perpendicular reinforcing bars with a standard hook.

Code Commentary:

No changes to the Commentary are proposed. The following is provided for the voter's reference only.

C.3.1 The rotational deformation capacity is calculated assuming an ultimate curvature of ε_{mu} / c over a plastic hinge length of 0.5 ℓ_w . The resulting expression is similar to that used in Section 9.3.5.6.3(a) to determine the need for special boundary elements. In the latter case, it is multiplied by wall height. The value of P_u includes earthquake effects, and may be calculated using a linearly elastic model.

C.3.2 In shear-dominated members (members whose hinge strength is assigned a value lower than their nominal flexural strength due to limitations in C.1(d)), the angular deformation capacity is limited to 1 / 400 or 1 / 200, depending on the percentage and maximum spacing of transverse and longitudinal reinforcement.

Specification:

None

Specification Commentary:

None

Subcommittee Vote:				
11 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	9 *Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Response to Public Comment

Committee: Main Committee	**Ballot #: 19**
Item #: **19-SM-PC 18, 19**	
Technical Contact/Email: David L. Pierson (davep@arwengineers.com)	
Public Comment Number: 2022 Comment #18, #19	
Public Comment Response Based on TMS 402/602 Draft Dated	**6/1/2021**

This ballot item proposes the following response to the Public Comment:

☐ ***Committee agrees with Public Comment, change is proposed***

☒ ***Committee agrees comment has merit but proposed changes are not completely consistent with Public Comment***

☐ ***Committee disagrees with Public Comment and no changes are proposed***

☐ ***Committee unable to fully develop a response to Public Comment***

☐ ***Public Comment only requires a response, no change to document***

Public Comment:

Number 18:
Add commentary for 5.2.1.1.1 as follows: Design engineers commonly use the clear span or the distance between the centers of the bearing as the span length. It is the design engineer's responsibility to determine the span length

Number 19:
Add commentary for 5.2.1.1.2 as follows: Design engineers commonly use the clear span or the distance between the centers of the bearing as the span length. It is the design engineer's responsibility to determine the span length

Response/Rationale:

These two Public Comments are very similar to four TAC comments (146, 147, 148 and 149). Those comments were considered over the past year during our response period for TAC comments. No changes were made to the code based on those comments. However, the committee agreed to continue working on better language regarding span length of beams.

The proposed language of the two comments would not be appropriate, since we should not say in the commentary that the engineer can decide what to use, while at the same time telling the engineer what to use in the code.

This committee has struggled to come to agreement on a definition of span length. There seems to be general agreement among the users of the code that this is not something engineers struggle to define. There is however some concern about building officials using code provisions to over-ride an engineer's decision as to what to use for span length.

We have tried many different approaches for this. This ballot attempts to not only respond to the public comments, but to honor the commitment made in our response to TAC comments, wherein we stated that we would continue to attempt to clarify this portion of the code.

The span length is needed by the engineer for determination of three basic things – Shear, Moment and Deflection. This provision would apply for all three.

The most basic argument against the current provisions is this. If a beam extends over a very wide support there is nothing to prevent a reviewer from requiring an engineer to use a very long span length even when it is obviously not rational to do that. The proposed language allows a much smaller length to be used if, for instance, the beam bears on a 2 ft. or 4 ft. wide pier. For instance, only 4" of bearing is required to support a reaction of 20 kips on normal 8" CMU (per sections 5.2.1.4, 9.1.8, and 8.1.5).

The proposed language almost exactly mirrors the language in the NDS that is used for determination of span lengths in wood beams. It has worked for wood for many years.

The new provision removes the need for all three of the subsections. Note that this does not address section 5.2.2 – Deep Beams, since the provisions for deep beams are different than for standard beams.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.) Do not use 'Track Changes'*

Code:

5.2.1 *General beam design*

5.2.1.1 *Span length* — ~~Span length shall be in accordance with the following:~~ For design of beams other than those designed as deep beams per section 5.2.2, span length shall be the distance from face-to-face of supports, plus ½ of the required bearing length at each end.

~~5.2.1.1.1 Span length of beams not built integrally with supports shall be taken as the clear span plus depth of beam, but need not exceed the distance between centers of supports.~~

~~5.2.1.1.2 For determination of moments in beams that are continuous over supports, span length shall be taken as the distance between centers of supports.~~

~~5.2.1.1.3 For determination of moments in beams that are built integrally with supports, the span length shall be determined based upon the principles of engineering mechanics, considering the actual end conditions, but shall be permitted to be taken as the distance between centers of support~~

Code Commentary:

No Changes

Specification:

No Changes

Specification Commentary:

No Changes

Subcommittee Vote:				
7 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	2 *Did not vote*

Subcommittee Comments:

This was a subcommittee meeting vote. There are a total of 9 subcommittee voting members.

2022 TMS 402/602 Committee
Proposed Change to Masonry Standard

Committee: Main Committee		**Ballot #:** 19
Item #: 19-VG-038		
Technical Contact/Email:	Brian E. Trimble, PE, btrimble@imiweb.org, (703) 300-0109	
Draft Document Dated:	**5/31/2021**	
Response to Public Comment No.: 38		
This ballot item proposes the following response to the TAC comment:		
☐	Committee agrees with public comment, change is proposed	
☐	Committee agrees comment has merit, but proposed changes are not completely consistent with public comment	
☒	Committee disagrees with public comment and no changes are proposed	
☐	Committee unable to fully develop a response to public comment	
☐	Public comment only requires a response, no change to document	

Public comment:
The components and claddings provisions of ASCE 7 have been evolving over the last few cycles. To my knowledge, the TMS 402/602 has not revisited the impact of these changing provisions on the prescriptive criteria listed in the veneer chapter (and possibly other locations where applicable), especially the prescriptive tie spacings for anchored veneer. There could also be criteria for adhered veneer that needs to be revaluated as well. Through this public comment I request the Committee to review the veneer chapter for compliance with the C&C provisions in ASCE 7-22. *[Page 222-249, Line 1]*

Response: The prescriptive design provisions for both anchored and adhered veneer are based on components and cladding wind pressure, and not on either wind speed or velocity pressure (q_h) as in previous editions of TMS 402. This is the most rational method as it relates the demand on a veneer tie or an anchored veneer fastener directly to the design wind pressure. Thus, any changes in components and cladding design pressures in ASCE 7 will not affect TMS 402.

Specifically, Table 13.2.1.1 (anchored veneer), and Table 13.3.2.5 and Table 13.3.2.6 (adhered veneer) are based on p_{veneer}, where p_{veneer} is defined in Section 2.1 as "strength level design wind pressure on veneer as determined from ASCE/SEI 7, Chapter 30, psf (kPa)." Chapter 30 of ASCE/SEI 7 is the components and cladding wind pressure.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.)*

Code: NONE

Code Commentary: NONE

Specification: NONE

Specification Commentary: NONE

Subcommittee Vote:				
14 *Affirmative*	1 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	0 *Did not vote*

Subcommittee Comments: A minor editorial change was made in response to the comment.

2022 TMS 402/602 Committee
Proposed Change to Masonry Standard

Committee: Main Committee	**Ballot #:** 19
Item #: 19-VG-043	
Technical Contact/Email:	Brian E. Trimble, PE, btrimble@imiweb.org, (703) 300-0109
Draft Document Dated:	**5/31/2021**
Response to Public Comment No.: 43	
This ballot item proposes the following response to the TAC comment:	
☐	Committee agrees with public comment, change is proposed
☐	Committee agrees comment has merit, but proposed changes are not completely consistent with public comment
☒	Committee disagrees with public comment and no changes are proposed
☐	Committee unable to fully develop a response to public comment
☐	Public comment only requires a response, no change to document

Public comment:
Please change the term ACHORED VENEER TO TIED VENEER. Reason: The committee changed the term for 'veneer anchors' to 'veneer ties' in the public comment draft. I was given two major explanations for this during the cycle when it was debated and voted upon -- 1.) that most users call veneer anchors, veneer ties, so it was a user-friendly change; and 2.) that by referring to them as anchors some inspectors or designers may try to apply the ASCE 7 criteria for anchors to these veneer connectors. Since the term has been changed to veneer ties in the public comment draft, we are left with ANCHORED VENEER which is no longer ANCHORED, but TIED. To be consistent, it should be called TIED veneer not ANCHORED veneer. If the concern for confusion by inspectors and designers over the use of the word "anchor" within the chapter was valid enough to contribute to the Committee feeling the need to change the term (as was explained to me during the cycle), then, by extension, calling it ANCHORED VENEER should raise similar concerns which would be alleviated by the use of TIED VENEER. I have listed the page and line number of the first use of the term within the Veneer chapter but it will need to be changed throughout the document if this comment is found persuasive. *[Page 222, Line 12]*

Response: The term “anchored veneer” is needed to differentiate it from “adhered veneer”. A masonry veneer is attached to its backing with a “veneer tie” in an anchored veneer wall. It is still appropriate to call it an anchored veneer wall even though a “tie” is used. A literal meaning is not necessary and could cause confusion since the term TIED veneer has never been used before while anchored veneer has been used since its introduction in 1995. This phrasing may not be much different than shoelaces that tie your shoes. They are not called laced shoes even though that is what they do. Similarly, railroad ties support the rails, but are still called railroad ties, not railroad supports. In masonry, joint reinforcement can be used to attach a veneer to its backing, but is not considered to be reinforced. It is important to call these walls “anchored veneer” even though the veneer is attached to the backing via wall ties.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.)*

Code: NONE
Code Commentary: NONE
Specification: NONE
Specification Commentary: NONE

Subcommittee Vote:				
14 *Affirmative*	1 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	0 *Did not vote*

Subcommittee Comments: A minor editorial change was made to the rationale based on the comment.

2022 TMS 402/602 Committee
Proposed Change to Masonry Standard

Committee: Main Committee		**Ballot #:** 19
Item #: 19-VG-061		
Technical Contact/Email:	Brian E. Trimble, PE, btrimble@imiweb.org, (703) 300-0109	
Draft Document Dated:	**5/31/2021**	
Response to Public Comment No.: 61		
This ballot item proposes the following response to the TAC comment:		
☒	Committee agrees with public comment, change is proposed	
☐	Committee agrees comment has merit, but proposed changes are not completely consistent with public comment	
☐	Committee disagrees with public comment and no changes are proposed	
☐	Committee unable to fully develop a response to public comment	
☐	Public comment only requires a response, no change to document	

Public comment:
In the last row of Table 13.2.2.3 the "other requirements" should be streamlined. The current language starts off with the phrase "When required" and ends with the sentence "Not applicable to joint reinforcement." First, there are also no fasteners associated with unit wire ties; they should be treated the same as joint reinforcement. Second, it is redundant to have both the "when required" statement and a listing of specific tie types which don't have fasteners. I suggest deleting "Not applicable for joint reinforcing" from the table. If further clarity is desired, commentary could be added to note that unit wire ties and joint reinforcement do not require fasteners. *[Page 234, Line 29]*

For voter's convenience here is that portion of Table 13.2.2.3 mentioned in the Public Comment:

Clay or Concrete Masonry	Adjustable, Unit Wire, or Joint Reinforcement	6 in. (152 mm)	Fastener: When required, minimum 3/16 in. (4.76 mm) screw(s) with 1.5 in. (38.1 mm) embedment . Not applicable for joint reinforcement.

Response: Changes are made consistent with public comment by providing requirements that apply to box and triangular unit ties.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.)*

Code:
Table 13.2.2.3: General prescriptive anchored veneer requirements *[remainder of Table is unchanged]*

Clay or Concrete Masonry	Adjustable, Unit Wire, or Joint Reinforcement	6 in. (152 mm)	Fastener: ~~When required,~~ Minimum ~~minimum~~ 3/16 in. (4.76 mm) screw(s) with 1.5 in. (38.1 mm) embedment. [1] ~~Not applicable for joint reinforcement.~~

[1] Unit wire ties and joint reinforcement do not require fasteners.
[renumber other footnote]

Code Commentary: NONE

Specification: NONE

Specification Commentary: NONE

Subcommittee Vote:				
15 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	0 *Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Proposed Change to Masonry Standard

Committee: Main Committee		**Ballot #:** 19
Item #: 19-VG-064-195		
Technical Contact/Email:	Brian E. Trimble, PE, btrimble@imiweb.org, (703) 300-0109	
Draft Document Dated:	**5/31/2021**	
Response to Public Comment No.: 64 and 195		
This ballot item proposes the following response to the TAC comment:		
☐	Committee agrees with public comment, change is proposed	
☒	Committee agrees comment has merit, but proposed changes are not completely consistent with public comment	
☐	Committee disagrees with public comment and no changes are proposed	
☐	Committee unable to fully develop a response to public comment	
☐	Public comment only requires a response, no change to document	

Public comment:

Comment 64 – I am suggesting several changes to Article 3.4 E.

1. Commentary number 2. is commentary on item 1 in the spec. Change the number from 2 to 1.
2. If the specifications require adjustable ties, I am not sure how the contractor would meet item 2. I would suggest "Install adjustable veneer ties such that the vertical offset between the two pieces does not exceed 1-1/4 in. (31.8 mm)."
3. There was confusion over how "Unless otherwise required" should be interpreted in item 4. Does "unless otherwise required" allow the spacing to be increased? However, a bigger issue is that the 16 inch x 16 inch spacing is not always sufficient. For wind pressures greater than 75 psf, this may not be sufficient spacing. The best solution is to just delete part 4. The Architect/Engineer specifies the spacing, that is put in the project documents, and we are done. We don't have defaults for other designs, such as reinforcement in beams or walls. Just delete part 4. *[Page 382, Line 3-20]*

Comment 195 – It appears there are no requirements for the minimum embedment of the ties into the veneer. Perhaps 1-1/2" minimum embedment should be required similar to the requirement for wall ties in 3.4 C.1. Requirements for the embedment of unit wire ties into masonry backing should be addressed. Perhaps 1-1/2" minimum embedment should be required similar to the requirement for wall ties in 3.4 C.1. *[Page 382, Line 2-37]*

*3.4 E.1.b and 3.4 E.8: Replace "anchors" with "ties."

Response: For PC 64, changes are made consistent with public comment. Note that the placement of veneer ties is already covered in 3.4 A.

> **3.4 A.** *Basic requirements* — Place reinforcement, ties, and anchors in accordance with the sizes, types, and locations indicated on the Project Drawings and as specified.

For PC 195, in the first sentence, those requirements are already found in Article 3.4 E 1. Requirements for embedment into the backing and the editorial change are shown below. It is also proposed to move Article 3.4 E up to before 3.4 D on anchor bolts so that wall ties and veneer ties follow each other in the Specification. Minor editorial changes were made based on the VG Subcommittee Ballot 2021-02.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.)*

Code: NONE

Code Commentary: NONE

Specification:

~~3.4 E.~~ 3.4 D. *Veneer ties*

1. Place corrugated sheet-metal anchors, sheet-metal unit wire and adjustable ties as follows:
   a. With solid units, embed veneer ties in mortar joint and extend into the ~~veneer~~ masonry wythe a minimum of 1½ in. (38.1 mm), with at least 5/8 in. (15.9 mm) mortar cover to the outside face of the veneer.
   b. With hollow units, embed ~~anchors~~ veneer ties in mortar or grout and extend into the ~~veneer~~ masonry wythe a minimum of 1 ½ in. (38.1 mm), with at least 5/8 in. (15.9 mm) mortar or grout cover to outside face.
2. ~~Do not use~~ Install adjustable veneer ties ~~when~~ such that the vertical offset between the two pieces ~~exceeds~~ does not exceed 1-1/4 in. (31.8 mm).
3. Embed longitudinal wires of joint reinforcement in the mortar joint with at least 5/8-in. (15.9-mm) mortar cover on each side.
~~4. Unless otherwise required, provide at least one veneer tie for each 1.78 ft^2 (0.165 m^2) of wall area with a spacing not to exceed 16 in. (406 mm) in either the vertical or horizontal direction.~~
~~5.~~ 4. Unless otherwise required, place veneer ties within 16 in. (406 mm) of supported edges, within 12 in. (305 mm) of unsupported edges, openings, and movement joints, and within 8 in. (203 mm) of the top of the veneer.
~~6.~~ 5. Place veneer ties within a tolerance of ± 1 in. (25.4 mm) of specified location.
~~7.~~ 6. Unless otherwise required, fasten veneer ties to the backing according to the following:
   a. Backing of wood: NDS.
   b. Backing of cold-formed metal: AISI S240.
   c. Backing of concrete: ACI 318.
~~8.~~ 7. Install veneer ~~anchors~~ ties perpendicular to a vertical line on the face of the backup from which they protrude and perpendicular to the face of the veneer. Comply with manufacturer's installation requirements, including placement tolerances.

Specification Commentary:

~~3.4 E.~~ 3.4 D. *Veneer ties* — Minimum embedment requirements have been established for each of the ~~anchor~~ tie types to ensure load resistance against push-through or pullout of the mortar joint.
~~2.~~ 1. Proper anchorage of veneer ties into veneers using hollow masonry units can be satisfied by mortaring veneer ties in bed joints or on the cross-webs of the units; by grouting the cells or cores adjacent to the veneer tie; or by following the veneer tie manufacturer's requirements for installing the veneer tie into the cell or core above or below the bed joint and filling the cell or core containing the veneer tie with mortar or grout.
~~4. The maximum tie spacing is intended to achieve compliance with TMS 402 requirements for Enhanced Prescriptive Design. The Contract Documents may allow increased tie spacings for projects that qualify for Basic Prescriptive Design or that have been designed using the engineered methods.~~
~~6.~~ 5. Veneer ties that are within tolerance will result in slight variations of the tributary area of the tie. This is considered to be acceptable.
~~7.~~ 6. Install the number of fasteners as required in the manufacturer's instructions.

Subcommittee Vote:					
14 *Affirmative*	2 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	0 *Did not vote*	

Subcommittee Comments:

Should "extend into the veneer" in 3.4.1.b also be change to "extend into the masonry wythe"? [yes]
Should 3.4.1.a have a requirement of "at least 5/8 in. (15.9 mm) mortar cover to the outside face" for both wythes, and not just the veneer? It depends on whether the requirement is for cover, or for providing a minimum strength of pushout of the tie under compressive loads. [no, the rqt is for weathering]

Proposed Specification Change 3.4 D.7 – It appears that we should refer to “veneer ties” here rather than veneer anchors to be consistent with other changes. [yes]
Proposed Specification Commentary Change 3.4 D. - It appears that we should refer to “veneer ties” here rather than veneer anchors to be consistent with other changes in this section. [yes]

2022 TMS 402/602 Committee
Proposed Change to Masonry Standard

Committee: Main Committee		**Ballot #:** 19
Item #: 19-VG-068		
Technical Contact/Email:	Brian E. Trimble, PE, btrimble@imiweb.org, (703) 300-0109	
Draft Document Dated:	**5/31/2021**	
Response to Public Comment No.: 68		
This ballot item proposes the following response to the TAC comment:		
☒	Committee agrees with public comment, change is proposed	
☐	Committee agrees comment has merit, but proposed changes are not completely consistent with public comment	
☐	Committee disagrees with public comment and no changes are proposed	
☐	Committee unable to fully develop a response to public comment	
☐	Public comment only requires a response, no change to document	

Public comment:
In this section both the code and commentary, light frame backing is referred to as just "frame backing." The word "light" should be inserted in both the code and commentary. *[Page 245, Line 27]*

Response: Changes are made consistent with public comment. *Based on an Aff w/ Comment on the VG Subcommittee Ballot 2021-02, two additional changes were made.*

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.)*

Code:

13.3.2.5 *General requirements* **—**
….
(f) *Sheathing* — Sheathing is required over light frame backing receiving an adhered veneer assembly-.
[delete hyphen at end of sentence and replace with period]

Code Commentary:

13.2.2.3 *General requirements* **—**
….
Veneers higher than 30 ft (9.1 m), or 38 ft (11.58 m) at a gable, are permitted with wood and cold-formed metal light frame backing provided a veneer tie other than corrugated sheet-metal is used, and detailing is provided to account for the differential movement. Support of veneer with a wood or cold-formed ~~steel~~ metal light frame backing typically…

13.3.2.5 *General requirements* **—**

….

(e) ….Table 13.3.2.5 assumes a conservative specific gravity value of 0.40 for the wood light frame backing and….

(f) Sheathing is required over light frame backing receiving an adhered veneer assembly in accordance with TMS 602 Article 3.3 C.1. Adhered veneer…

Specification: NONE

Specification Commentary: NONE

Subcommittee Vote:				
14 *Affirmative*	1 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	0 *Did not vote*

Subcommittee Comments:

There are several other places where we just use "frame backing" and it should be "light frame backing." Note also in 13.2.2.3 we use cold-formed metal and cold-formed steel. We should be consistent; this is the only place with steel so suggest changing to cold-formed metal light frame backing.

- Commentary 13.2.2.3: Veneers higher than 30 ft (9.1 m), or 38 ft (11.58 m) at a gable, are permitted with wood and cold-formed metal light frame backing provided a veneer tie other than corrugated sheet-metal is used, and detailing is provided to account for the differential movement. Support of veneer with a wood or cold-formed ~~steel~~ metal light frame backing typically…
- Commentary 13.3.2.5 (e): Table 13.3.2.5 assumes a conservative specific gravity value of 0.40 for the wood light frame backing.

2022 TMS 402/602 Committee
Proposed Change to Masonry Standard

Committee: Main Committee		**Ballot #:** 19
Item #: 19-VG-072		
Technical Contact/Email:	Brian E. Trimble, PE, btrimble@imiweb.org, (703) 300-0109	
Draft Document Dated:	**5/31/2021**	
Response to Public Comment No.: 72		
This ballot item proposes the following response to the TAC comment:		
☒	Committee agrees with public comment, change is proposed	
☐	Committee agrees comment has merit, but proposed changes are not completely consistent with public comment	
☐	Committee disagrees with public comment and no changes are proposed	
☐	Committee unable to fully develop a response to public comment	
☐	Public comment only requires a response, no change to document	

Public comment:
Should the reference to TMS 602 be to article 3.3 D.1 instead of 3.3 C.1.? *[Page 245, Line 79]*

Response: Changes are made consistent with public comment.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck through~~.)*

Code: NONE

Code Commentary:

13.3.2.5 *General requirements*

(f) Sheathing is required over frame backing receiving an adhered veneer assembly in accordance with TMS 602 Article ~~3.3 C.1.~~ 3.3.D.1. Adhered veneer….

Specification: NONE

Specification Commentary: NONE

Subcommittee Vote:									
15	*Affirmative*	0	*Affirmative w/ comment*	0	*Negative*	0	*Abstain*	0	*Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Proposed Change to Masonry Standard

Committee: Main Committee	**Ballot #:** 19
Item #: 19-VG-092	
Technical Contact/Email:	Brian E. Trimble, PE, btrimble@imiweb.org, (703) 300-0109
Draft Document Dated:	**5/31/2021**
Response to Public Comment No.: 092	
This ballot item proposes the following response to the TAC comment:	
☒	Committee agrees with public comment, change is proposed
☐	Committee agrees comment has merit, but proposed changes are not completely consistent with public comment
☐	Committee disagrees with public comment and no changes are proposed
☐	Committee unable to fully develop a response to public comment
☐	Public comment only requires a response, no change to document

Public comment:
Page 225, line 54, The commentary should reference the commentary of 4.5, not 4.6.
On page 227, line 63, the commentary should reference 4.6, not 4.5.

Response: Changes are made consistent with public comment.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.)*

Code: NONE

Code Commentary:
13.1.2.3 *Deflection of horizontally spanning support members* — See Commentary Section 4.5 ~~4.6~~ for further information.

Note to voters: Section 4.5 is:

4.5 — *Deflection of beams supporting unreinforced masonry*

13.2.1.3 *Veneer not laid in running bond* — The required area of joint reinforcement is equivalent to that in Section 4.6 ~~4.5~~ for a nominal 4-in. (102-mm) wythe.

Note to voters: Section 4.6 is:

4.6 — *Masonry not laid in running bond*

Specification: NONE

Specification Commentary: NONE

Subcommittee Vote:									
15	*Affirmative*	0	*Affirmative w/ comment*	0	*Negative*	0	*Abstain*	0	*Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Proposed Change to Masonry Standard

Committee: Main Committee		**Ballot #:** 19
Item #: 19-VG-099		
Technical Contact/Email:	Brian E. Trimble, PE, btrimble@imiweb.org, (703) 300-0109	
Draft Document Dated:	**5/31/2021**	
Response to Public Comment No.: 099		
This ballot item proposes the following response to the TAC comment:		
☒	Committee agrees with public comment, change is proposed	
☐	Committee agrees comment has merit, but proposed changes are not completely consistent with public comment	
☐	Committee disagrees with public comment and no changes are proposed	
☐	Committee unable to fully develop a response to public comment	
☐	Public comment only requires a response, no change to document	

Public comment:
Footnote 1 is not needed in Table 13.2.2.3. When the sheathing or ties meet the requirements of 13.2.2.3.3, the cavity width is measured from the back of the veneer to the face of the sheathing. This should be limited to 6 inches, and not increased by 5/8 inch, allowing 6-5/8 inch between the back face of the veneer and the sheathing. This footnote is a remnant of an older definition of cavity width. *[Page 234, Line 32]*

Response: Changes are made consistent with public comment.

[For voter convenience, the specified cavity width is defined in 13.2.2.3.3]

> **13.2.2.3.3** The specified cavity width shall be from the face of the backing to the inside face of the veneer. The specified cavity width shall be permitted to be from the face of the sheathing to the inside face of the veneer if:
>
> (a) the sheathing has a minimum allowable bearing stress of 100 psi (0.689 MPa), or
>
> (b) the veneer ties have prongs with a minimum allowable compressive strength of 200 lb (890N) that penetrate the sheathing and directly contacts the light frame backing.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.)*

Code:

[see next page]

Table 13.2.2.3 – General prescriptive anchored veneer requirements

Backing	Veneer Tie Type	Maximum Specified Cavity Width	Other requirements
Wood Light Frame	Corrugated Sheet-metal	1 in. (25.4 mm) [1]	Fastener: Minimum 2.5 in. (63.5 mm) x 0.131 in. (3.33 mm) ring-shank nail(s) with minimum 1 ⅜ in. (34.9 mm) penetration into backing, or, where sheathing is present, into the structural member behind the sheathing; or No. 10 screw(s) with ⅝ in. (15.9 mm) penetration into backing. Locate fastener within ½ in. (12.7 mm) of the 90-degree bend in the veneer tie. The limiting p_{veneer} values for prescriptive design method shall be 75 percent of those listed in Table 13.2.1.1. Corrugated ties shall not be used on veneers greater than 30 ft (9.14 mm), or 38 ft (11.58 m) at a gable, in height. Sheathing shall meet the requirements of Section 13.2.2.3.3.
	Sheet Metal	4 in. (101.6 mm) [1]	Fastener: Minimum No. 10 screw(s) with 1 ⅜ in. (34.9 mm) penetration into backing. Exterior veneer exceeding 30 ft (9.1 m), or 38 ft (11.58 m) at a gable, in height above the vertical support shall be designed and detailed to provide for differential movement.
	Adjustable	6 in. (152 mm) [1]	Fastener: Minimum No. 10 screw(s) with 1 ⅜ in. (34.9 mm) penetration into backing. Exterior veneer exceeding 30 ft (9.1 m), or 38 ft (11.58 m) at a gable, in height above the vertical support shall be designed and detailed to provide for differential movement.
Cold-formed Light Steel Frame	Adjustable	6 in. (152 mm) [1]	Fastener: Minimum corrosion resistant No. 10 screw(s) extending through the steel framing a minimum of three exposed threads. Steel framing shall be corrosion resistant and have a minimum base metal thickness of 0.043 in. (1.1 mm). Exterior veneer exceeding 30 ft (9.1 m), or 38 ft (11.58 m) at a gable, in height above the vertical support shall be designed and detailed to provide for differential movement.
Concrete	Adjustable	6 in. (152 mm)	Fastener: 3/16 in. (4.76 mm) screw(s) with 1.5 in. (38.1 mm) embedment.
Masonry	Adjustable, Unit Wire, or Joint Reinforcement	6 in. (152 mm)	Fastener: When required, 3/16 in. (4.76 mm) screw(s) with 1.5 in. (38.1 mm) embedment. Not applicable for joint reinforcement.
~~[1] The cavity width shall be permitted to be increased by the specified thickness of the sheathing up to 5/8 in. (15.9 mm) for sheathing or veneer ties meeting the requirements of Section 13.2.2.3.3.~~			

Code Commentary: NONE

Specification: NONE

Specification Commentary: NONE

Subcommittee Vote:				
14 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	0 *Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Proposed Change to Masonry Standard

Committee: Main Committee	**Ballot #:** 19
Item #: 19-VG-100	
Technical Contact/Email:	Brian E. Trimble, PE, btrimble@imiweb.org, (703) 300-0109
Draft Document Dated:	**5/31/2021**
Response to Public Comment No.: 100	
This ballot item proposes the following response to the TAC comment:	
☒	Committee agrees with public comment, change is proposed
☐	Committee agrees comment has merit, but proposed changes are not completely consistent with public comment
☐	Committee disagrees with public comment and no changes are proposed
☐	Committee unable to fully develop a response to public comment
☐	Public comment only requires a response, no change to document

Public comment:
Add a space between "modeling analysis" method and the beginning parentheses "(Section 13.2.3.3)."
I think the "or" should be "and": Engineered design options include the tributary area method (Section 13.2.3.2) or modeling analysis method (Section 13.2.3.3). *[Page 238, Line 72-73]*

Response: Changes are made consistent with public comment.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.)*

Code: NONE

Code Commentary:

13.2.3 *Engineered design of anchored masonry veneer* — Engineered design is used when the Architect/Engineer wants to exceed the limitations of Section 13.2.2 or when the veneer does not qualify to be designed under the prescriptive requirements. Engineered design options include the tributary area method (Section 13.2.3.2) ~~or~~ and the modeling analysis method (Section 13.2.3.3).

Specification: NONE

Specification Commentary: NONE

Subcommittee Vote:				
15 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	0 *Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Proposed Change to Masonry Standard

Committee: Main Committee		**Ballot #:** 19
Item #: 19-VG-113-215		
Technical Contact/Email:	Brian E. Trimble, PE, btrimble@imiweb.org, (703) 300-0109	
Draft Document Dated:	**5/31/2021**	
Response to Public Comment No.: 113 and 215		
This ballot item proposes the following response to the TAC comment:		
☒	Committee agrees with public comment, change is proposed	
☐	Committee agrees comment has merit, but proposed changes are not completely consistent with public comment	
☐	Committee disagrees with public comment and no changes are proposed	
☐	Committee unable to fully develop a response to public comment	
☐	Public comment only requires a response, no change to document	

Public comment:

Comment 113: Section 13.2.2.3.3 provides two means for transfer of load through sheathing: a sheathing that has a minimum allowable bearing stress of 100 psi or veneer ties with prongs. However, the point is that the compressive load on the veneer tie has to somehow be transferred through the sheathing to backing; there needs to be a continuous load path. The two means of transferring the load are either
1) through bearing/compression of the sheathing, or
2) through prongs.
Thus, it is proposed that criteria 1 be modified to require that the applied bearing stress on the sheathing is less than the allowable bearing stress. Sheathing with allowable bearing stresses of 100 psi or greater could be deemed to comply and a calculation is not necessary. If the allowable bearing stress is less than 100 psi, then the designer would have the option of calculating the applied bearing stress and if it is less than the allowable bearing stress, veneer ties with prongs are not needed and the compressive load can be transferred through bearing. Section 13.2.2.3.3 provides two means for transfer of load through sheathing: a sheathing that has a minimum allowable bearing stress of 100 psi or veneer ties with prongs. However, the point is that the compressive load on the veneer tie has to somehow be transferred through the sheathing to backing; there needs to be a continuous load path. The two means of transferring the load are either
1) through bearing/compression of the sheathing, or
2) through prongs.
Thus, it is proposed that criteria 1 be modified to require that the applied bearing stress on the sheathing is less than the allowable bearing stress. Sheathing with allowable bearing stresses of 100 psi or greater could be deemed to comply and a calculation is not necessary. If the allowable bearing stress is less than 100 psi, then the designer would have the option of calculating the applied bearing stress and if it is less than the allowable bearing stress, veneer ties with prongs are not needed and the compressive load can be transferred through bearing. *[Page 235, Line 15-22]*

Comment 215: Why use of (only) "prongs"...there are other means! *[Page 235, Line 20]*

Response: Changes are made consistent with the public comments. The last sentence of the existing commentary of Section 13.2.2.3.3 is moved to 13.2.2.3, as this is a more appropriate location.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.)*

Code:

13.2.2.3.3 The specified cavity width shall be from the face of the backing to the inside face of the veneer. The specified cavity width shall be permitted to be from the face of the sheathing to the inside face of the veneer if either of the following conditions is met:
(a) the bearing stress of the veneer tie on the sheathing from allowable stress level loads is less than the allowable bearing stress of the sheathing. ~~the sheathing has a minimum~~ Sheathing that has an allowable bearing stress of 100 psi (0.689 MPa) shall be deemed to comply. ~~, or~~
(b) the veneer ties penetrate the sheathing and directly contact the light frame backing ~~have prongs with~~ and have a minimum allowable compressive strength of 200 lb (890N) ~~that penetrate the sheathing and directly contacts the light frame backing~~.

Code Commentary:

13.2.2.3 *General requirements*
A ring-shank nail designated as Roof Sheathing Ring-Shank (RSRS-03) nail has a length of 2.5 in. (63.5 mm) and a diameter of 0.131 in. (3.33 mm) and is similar to an 8d nail. When more than one nail is required, a screw that provides greater withdrawal resistance should be used or two nails with some qualifications. If two nails or screws are used the designer should consider whether the fasteners can be placed side by side or if the backing plate is stiff enough in a vertical direction to equally load both fasteners. Prescriptive design requires the fastener to have sufficient penetration into the backing and does not consider the sheathing to contribute to pullout resistance.

13.2.2.3.3 Determining the specified width of the cavity will depend on the type of backing, whether sheathing is present and its properties or whether the veneer tie ~~contains prongs~~ penetrates the sheathing. For masonry or concrete backings, the cavity width is from the face of the backing to the inside face of the veneer. For light frame backing, that may or may not have sheathing, the requirements in this section define how the cavity should be measured when sheathing is present. The deemed to comply allowable bearing value of 100 psi (0.689 MPa) ~~This value~~ would be met by typical OSB and plywood sheathing, and some gypsum sheathings. If the allowable bearing stress of the sheathing is less than 100 psi (0.689 MPa) such as with some foam sheathings, either the veneer tie would need to ~~have prongs or another means of~~ transfer~~ring~~ the load through the sheathing to the backing or the bearing stress on the sheathing would need to be checked. ~~Penetration into sheathing alone cannot provide the pullout strength required to use the prescriptive requirements for anchored masonry veneer.~~

Specification: NONE

Specification Commentary: NONE

Subcommittee Vote:									
15	*Affirmative*	0	*Affirmative w/ comment*	0	*Negative*	0	*Abstain*	0	*Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Proposed Change to Masonry Standard

Committee: Main Committee		**Ballot #:** 19
Item #: 19-VG-117		
Technical Contact/Email:	Brian E. Trimble, PE, btrimble@imiweb.org, (703) 300-0109	
Draft Document Dated:	**5/31/2021**	
Response to Public Comment No.: 117		
This ballot item proposes the following response to the TAC comment:		
☐	Committee agrees with public comment, change is proposed	
☐	Committee agrees comment has merit, but proposed changes are not completely consistent with public comment	
☒	Committee disagrees with public comment and no changes are proposed	
☐	Committee unable to fully develop a response to public comment	
☐	Public comment only requires a response, no change to document	

Public comment:
Consider incorporating a reference to ASTM C1780 for the installation of adhered veneer as those provisions are more comprehensive that those proposed here. *[Page 369, Line 10-30]*

Response: This standard is already referenced in the commentary of Article 3.3 D. As there are no current installation requirements for clay brick veneer (which are currently under development in ASTM), a code requirement for this standard which only covers manufactured stone veneer is premature.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.)*

Code: NONE

Code Commentary: NONE

Specification: NONE

Specification Commentary: NONE

Subcommittee Vote:				
15 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	0 *Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Proposed Change to Masonry Standard

Committee: Main Committee		**Ballot #:** 19
Item #: 19-VG-150		
Technical Contact/Email:	Brian E. Trimble, PE, btrimble@imiweb.org, (703) 300-0109	
Draft Document Dated:	**5/31/2021**	
Response to Public Comment No.: 150		
This ballot item proposes the following response to the TAC comment:		
☐	Committee agrees with public comment, change is proposed	
☒	Committee agrees comment has merit, but proposed changes are not completely consistent with public comment	
☐	Committee disagrees with public comment and no changes are proposed	
☐	Committee unable to fully develop a response to public comment	
☐	Public comment only requires a response, no change to document	

Public comment:
This comment is from me, but was considered by the TMS Cast Stone Committee on their July 15, 2021 call. The use of the property f'm for cast stone should be reconsidered for the following reasons:
1) in the context of TMS 402/602, f'm is solely applicable to clay and concrete masonry;
2) the relationship between compressive strength and MOE applied here may be appropriate for a material such as concrete (f'c), but the compressive strength of a masonry unit and a masonry assembly are fundamentally different. Further, the compressive strength of concrete (f'c) is determined from a standard 2:1 cylinder whereas the compressive strength of cast stone is determined from a 1:1 cube making the use of this ACI 318 relationship speculative at best.
3) Cast stone systems are designed both as a material and as a system...depending on the application. For example, a large cast stone element may be set on shims and the joints sealed with caulking instead of mortar. It is understood that in the context of the 402/602 provisions the intent is to provide an option for the engineered design of cast stone veneers, but this nuance is likely going to be missed by the casual user.
Recommend replacing the MOE relationship in 402 Table 4.2.2 with a requirement that the MOE for cast stone be determined by testing only. *[Page 52, Line 25]*

Response: Changes are made consistent with public comment.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.)*

Code:

[see next page]

Table 4.2.2 Elastic Moduli

Material	Modulus of Elasticity	Modulus of Rigidity
Steel Reinforcement	E_s = 29,000,000 psi (200,000 MPa)	---
Prestressing Steel	E_{ps} shall be determined by tests or provided by manufacturer	---
Clay Masonry [2]	$E_m = 700\, f'_m$	$G = 0.4E_m$
Concrete Masonry [2]	$E_m = 900\, f'_m$	$G = 0.4E_m$
Cast Stone Masonry ~~[2]~~	~~$E_{MCS} = 57{,}000 \sqrt{f'_m}$~~ E_{MCS} shall be determined by tests or provided by manufacturer	--- ~~$G = 0.4\, E_{MCS}$~~
AAC Masonry	$E_{AAC} = 6500\,(f'_{AAC})0.6$	$G = 0.4E_{AAC}$
Grout	$E_g = 500\, f'_g$	---

[a] As an alternative for clay~~,~~ and concrete ~~and cast stone~~ masonry, the modulus of elasticity, E_m, shall be permitted to be taken equal to the chord modulus elasticity taken between 0.05 and 0.33 of the maximum compressive strength of each prism determined by test in accordance with the prism test method, Article 1.4 B.3 of TMS 602, and ASTM E111.

Code Commentary: NONE

Specification: NONE

Specification Commentary: NONE

Subcommittee Vote:				
15 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	0 *Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Proposed Change to Masonry Standard

Committee: Main Committee		**Ballot #:** 19
Item #: 19-VG-151		
Technical Contact/Email:	Brian E. Trimble, PE, btrimble@imiweb.org, (703) 300-0109	
Draft Document Dated:	**5/31/2021**	
Response to Public Comment No.: 151		
This ballot item proposes the following response to the TAC comment:		
☒	Committee agrees with public comment, change is proposed	
☐	Committee agrees comment has merit, but proposed changes are not completely consistent with public comment	
☐	Committee disagrees with public comment and no changes are proposed	
☐	Committee unable to fully develop a response to public comment	
☐	Public comment only requires a response, no change to document	

Public comment:
Table 13.2.2.4 - Veneer Tie Requirements - The requirements for the Tie Type - Unit Wire appear to have been written for a "Z" shaped wire tie, which is in fact referenced in the diagram in the commentary, same section. The requirements call specifically to "..... have ends bent to form an extension from the bend at least 2" long". For a Z-shaped tie this is fine, as the 2" extension will develop the necessary pullout strength, however, Z-shaped ties are nearly non-existent today. Further compounding the confusion, later in the table, under the Tie Type - Adjustable, the requirement for wire components of adjustable ties is for those ties to conform with the requirements under the Tie Type - Unit Wire. The wire components of the vast majority of adjustable veneer ties are either pintles or triangular ties, neither of which unambiguously conform to the language found within Unit Wire. If the intention is to provide a minimum of 2" of wire to be embedded in a mortar joint, please reword the Unit Wire requirements to state that instead of having commonly used ties conform to non-existent product requirements. *[Page 235, Line 27]*

For voter's convenience here are the unit type of wire ties mentioned in the Public Comment:

Response: Changes are made consistent with public comment by providing requirements that apply to box and triangular unit ties.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.)*

Code:

Table 13.2.2.4 *[remainder of Table is not changed]*

1) Minimum W1.7 (MW11) wire with ~~and have~~ ends bent to form an extension from the bend at least 2 in. (50.8 mm) long within the veneer for Z-ties.

2) Minimum W1.7 (MW11) wire with the total length of the wire within the veneer at least 2 in. (50.8 mm) long for box and triangular unit ties.

~~2)~~ 3) Drips are not permitted.

Code Commentary: NONE

Specification: NONE

Specification Commentary: NONE

Subcommittee Vote:				
15 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	0 *Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Proposed Change to Masonry Standard

Committee: Main Committee		**Ballot #:** 19
Item #: 19-VG-161		
Technical Contact/Email:	Brian E. Trimble, PE, btrimble@imiweb.org, (703) 300-0109	
Draft Document Dated:	**5/31/2021**	
Response to Public Comment No.: 161		
This ballot item proposes the following response to the TAC comment:		
☒	Committee agrees with public comment, change is proposed	
☐	Committee agrees comment has merit, but proposed changes are not completely consistent with public comment	
☐	Committee disagrees with public comment and no changes are proposed	
☐	Committee unable to fully develop a response to public comment	
☐	Public comment only requires a response, no change to document	

Public comment:
Vents in a rainscreen wall may not be at the "top of the wall" as stated, but may be at the top of a compartment (below a shelf angle or below a sill). Reword this section to better explain venting strategies. *[Page 231, Line 63-67]*

Response: Changes are made consistent with public comment.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.)*

Code: NONE

Code Commentary:

13.2.1.8 *Water Penetration Resistance*
….
In addition to a drainage space, flashing and weeps, incorporating air movement in a masonry wall to create a rainscreen is a good design strategy. Weeps that permit airflow into the cavity can be used to assist in removing moisture from a veneer wall. Improved performance can be achieved by adding vents at the top of cavity compartments or near the top of the wall to further aid in evaporation and drying (BIA TN 27 (1994)).

Specification: NONE

Specification Commentary: NONE

Subcommittee Vote:									
15	*Affirmative*	0	*Affirmative w/ comment*	0	*Negative*	0	*Abstain*	0	*Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Proposed Change to Masonry Standard

Committee: Main Committee	**Ballot #:** 19
Item #: 19-VG-162	
Technical Contact/Email:	Brian E. Trimble, PE, btrimble@imiweb.org, (703) 300-0109
Draft Document Dated:	**5/31/2021**
Response to Public Comment No.: 162	
This ballot item proposes the following response to the TAC comment:	
☒	Committee agrees with public comment, change is proposed
☐	Committee agrees comment has merit, but proposed changes are not completely consistent with public comment
☐	Committee disagrees with public comment and no changes are proposed
☐	Committee unable to fully develop a response to public comment
☐	Public comment only requires a response, no change to document

Public comment:
Table CC-13.1.1 and Section 13.3.2.1 are not consistent in regard to cast stone being used in an adhered veneer application. The table or the Section should be modified so that they are correct. In addition, should cast stone be allowed to use the Engineered Design method when used in an adhered veneer? *[Page 223-243, Line 1]*

Response: The table should be modified to allow cast stone to be used in adhered veneer applications as currently stated in Section 13.3.2.1. If cast stone can be used in prescriptive design, it should also be allowed with an engineered design.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.)*

Code: NONE

Code Commentary: *[additions are shown in bold X's]*

Table CC-13.1.1: Permitted Materials for each Design Method [1]

Masonry Material	Anchored Veneer		Adhered Veneer	
	Prescriptive	Engineered	Prescriptive	Engineered
Clay and Concrete	X	X	X	X
Dimension Stone		X	X	X
Cast Stone	X	X	**X**	**X**
Manufactured Stone			X	X

1 Specific requirements for each of these materials can be found in the respective design method sections.

Specification: NONE
Specification Commentary: NONE

Subcommittee Vote:				
14 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	0 *Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Proposed Change to Masonry Standard

Committee: Main Committee		**Ballot #:** 19
Item #: 19-VG-164		
Technical Contact/Email:	Brian E. Trimble, PE, btrimble@imiweb.org, (703) 300-0109	
Draft Document Dated:	**5/31/2021**	
Response to Public Comment No.: 164		
This ballot item proposes the following response to the TAC comment:		
☒	Committee agrees with public comment, change is proposed	
☐	Committee agrees comment has merit, but proposed changes are not completely consistent with public comment	
☐	Committee disagrees with public comment and no changes are proposed	
☐	Committee unable to fully develop a response to public comment	
☐	Public comment only requires a response, no change to document	

Public comment:
The title for Section 13.2.2.2 in the Code and the Commentary don't match. The Commentary title should read "Specified weight and thickness". *[Page 231, Line 88]*

Here are the sections referenced:

13.2.2.2 *Specified weight and thickness* — Prescriptively-designed anchored veneer shall have a specified weight of 50 psf (2.4 kPa) or less and a specified thickness of 5 in. (127 mm) or less.

13.2.2.2 *Installed weight* — The limitation on installed weight is to limit the force under seismic load, when seismic loading is a concern. Units that have an

Page 231

Response: Changes are made consistent with public comment.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.)*

Code: NONE

Code Commentary:

13.2.2.2 ~~*Installed weight*~~ *Specified weight and thickness* — The limitation on installed weight is to limit the force under seismic load, when seismic loading is a concern. Units that have an…

Specification: NONE

Specification Commentary: NONE

Subcommittee Vote:									
15	*Affirmative*	0	*Affirmative w/ comment*	0	*Negative*	0	*Abstain*	0	*Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Proposed Change to Masonry Standard

Committee: Main Committee		**Ballot #:** 19
Item #: 19-VG-172		
Technical Contact/Email:	Brian E. Trimble, PE, btrimble@imiweb.org, (703) 300-0109	
Draft Document Dated:	**5/31/2021**	
Response to Public Comment No.: 172		
This ballot item proposes the following response to the TAC comment:		
☒	Committee agrees with public comment, change is proposed	
☐	Committee agrees comment has merit, but proposed changes are not completely consistent with public comment	
☐	Committee disagrees with public comment and no changes are proposed	
☐	Committee unable to fully develop a response to public comment	
☐	Public comment only requires a response, no change to document	

Public comment:
The Commentary to Section 13.3.2.2 refers to density, but that is not a part of the code. The commentary should be revised to: "The unit limitations are imposed to reduce the..." *[Page 243, Line 59-65]*

Response: Changes are made consistent with public comment.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.)*

Code: NONE

Code Commentary:

13.3.2.2 *Unit limitations* – The ~~weight and density~~ unit limitations are imposed to reduce the...

Specification: NONE

Specification Commentary: NONE

Subcommittee Vote:									
15	*Affirmative*	0	*Affirmative w/ comment*	0	*Negative*	0	*Abstain*	0	*Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Proposed Change to Masonry Standard

Committee: Main Committee		**Ballot #:** 19
Item #: 19-VG-177		
Technical Contact/Email:	Brian E. Trimble, PE, btrimble@imiweb.org, (703) 300-0109	
Draft Document Dated:	**5/31/2021**	
Response to Public Comment No.: 177		
This ballot item proposes the following response to the TAC comment:		
☒	Committee agrees with public comment, change is proposed	
☐	Committee agrees comment has merit, but proposed changes are not completely consistent with public comment	
☐	Committee disagrees with public comment and no changes are proposed	
☐	Committee unable to fully develop a response to public comment	
☐	Public comment only requires a response, no change to document	

Public comment:
The commentary for Article 3.3 D 4.b really applies to the entire installation section. Move the existing language from 3.3 D 4.b to the end of the existing language of 3.3 D and reword to: "Proprietary systems or products may have requirements that are different than the generic prescriptive requirements shown here." *[Page 369, Line 72-74]*

Response: Make changes as recommended.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.)*

Code: NONE

Code Commentary: NONE

Specification: NONE

Specification Commentary:

3.3 D *Installing adhered veneer* — Article 3.3 D applies to adhered veneer in which the backing supports the weight of the units. Additional information on the installation of adhered veneer is in ASTM C1780 (2017), BIA (2014) and MVMA (2017).

Proprietary systems or products may have requirements that are different than the generic prescriptive requirements shown here.

~~3.3 D 4.b. Proprietary systems or products may have setting bed thickness that are different than the generic prescriptive requirements shown here.~~

Subcommittee Vote:				
15 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	0 *Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Proposed Change to Masonry Standard

Committee: Main Committee	**Ballot #:** 19
Item #: 19-VG-192	
Technical Contact/Email:	Brian E. Trimble, PE, btrimble@imiweb.org, (703) 300-0109
Draft Document Dated:	**5/31/2021**
Response to Public Comment No.: 192	
This ballot item proposes the following response to the TAC comment:	
☒	Committee agrees with public comment, change is proposed
☐	Committee agrees comment has merit, but proposed changes are not completely consistent with public comment
☐	Committee disagrees with public comment and no changes are proposed
☐	Committee unable to fully develop a response to public comment
☐	Public comment only requires a response, no change to document

Public comment:
The discussion of the work of Hochwalt et al should note that only simple span backing was investigated. Multi-span backing, backing with cantilevers, and backing interrupted with openings were not considered. *[Page 240, Line 75-78]*

Response: Make changes as recommended.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.)*

Code: NONE

Code Commentary:

13.2.3.2 *Tributary area method*

….

The design values were chosen based on extensive analyses of anchored veneer systems that considered various veneer tie stiffness values, various backing stiffness values, different heights, different mortar types, and solid and hollow veneer units for simple spans (Hochwalt et al (2019)). Multi-span backing, backing with cantilevers, and backing interrupted with openings were not considered.

Specification: NONE

Specification Commentary: NONE

Subcommittee Vote:				
15 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	0 *Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Proposed Change to Masonry Standard

Committee: Main Committee		**Ballot #:** 19
Item #: 19-VG-204		
Technical Contact/Email:	Brian E. Trimble, PE, btrimble@imiweb.org, (703) 300-0109	
Draft Document Dated:	**5/31/2021**	
Response to Public Comment No.: 204		
This ballot item proposes the following response to the TAC comment:		
☐	Committee agrees with public comment, change is proposed	
☒	Committee agrees comment has merit, but proposed changes are not completely consistent with public comment	
☐	Committee disagrees with public comment and no changes are proposed	
☐	Committee unable to fully develop a response to public comment	
☐	Public comment only requires a response, no change to document	

Public comment:
Use of the terms "attach" and "connect" are not harmonized throughout this code, and to some extent, neither is "anchor". Also examine the non-harmonized use of the term "tied". These terms appear at multiple locations throughout the code without consistency. *[Page 45, Line 6]*

Response: "Connect" is used 5 times in Chap. 13 – usage includes "connections", "connector" and "connected". "Attach" is used 14 times in Chap. 13 – usage includes "attached", "attaching" and "attachment"

Merriam-Webster definitions:
Attach – to make fast (as by tying or gluing)
Connect – to become joined

Typically, attach is used when discussing fasteners or elements fastened to a veneer. It appears that attach and connect are used consistently and appropriately so no further changes are recommended. The Form and Style Subcommittee looked at this already and came to the same conclusion on anchored and connected. Since 'tied' is used only once it should be changed to "connected".

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.)*

Code:
13.1.2.2.2 *Wood light frame backing* – Exterior veneer ~~tied~~ connected to wood light frame construction exceeding 30 ft (9.1 m), or 38 ft (11.58 m) at a gable, in height above the vertical support shall be designed and detailed to accommodate differential movement.

Code Commentary: NONE
Specification: NONE
Specification Commentary: NONE

Subcommittee Vote:				
14 *Affirmative*	1 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	0 *Did not vote*

Subcommittee Comments: A minor edit was made to the rationale to satisfy the comment.

2022 TMS 402/602 Committee
Proposed Change to Masonry Standard

Committee: Main Committee		**Ballot #:** 19
Item #: 19-VG-208		
Technical Contact/Email:	Brian E. Trimble, PE, btrimble@imiweb.org, (703) 300-0109	
Draft Document Dated:	**5/31/2021**	
Response to Public Comment No.: 208		
This ballot item proposes the following response to the TAC comment:		
☐	Committee agrees with public comment, change is proposed	
☐	Committee agrees comment has merit, but proposed changes are not completely consistent with public comment	
☒	Committee disagrees with public comment and no changes are proposed	
☐	Committee unable to fully develop a response to public comment	
☐	Public comment only requires a response, no change to document	

Public comment:
"Failures...contract documents"....This is not necessarily a true statement and should be deleted. Many investigations will reveal errors/omissions by the designer. *[Page 222, Line 78]*

[For voter's convenience here is the paragraph mentioned in the Public Comment]

> Failures of anchored and adhered veneer are often due to nonconformance with the contract documents. Therefore, TMS 602 Table 4 requires periodic inspection when the height of the veneer exceeds 60 ft (18.3 m) above grade plane. Consideration should be given to inspection for all veneers with the level of inspection varying by the job.

Response: Based on field experience, numerous presentations given, and papers written on the subject, failures are often caused due to nonconformance to the contract documents. The point of the sentence is to introduce the requirements for inspection, which is critical for veneers, especially those over 60 ft.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.)*

Code: NONE
Code Commentary: NONE
Specification: NONE
Specification Commentary: NONE

Subcommittee Vote:				
14 *Affirmative*	1 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	0 *Did not vote*

Subcommittee Comments:
I agree with the response that "often" is appropriate for nonconformance with the Contract Documents. From experience, I can also echo the comment many investigations will reveal errors and omissions by the designer. My experience is that nonconformance is a majority over design errors, so often is appropriate.

2022 TMS 402/602 Committee
Proposed Change to Masonry Standard

Committee: Main Committee		**Ballot #:** 19
Item #: 19-VG-209		
Technical Contact/Email:	Brian E. Trimble, PE, btrimble@imiweb.org, (703) 300-0109	
Draft Document Dated:	**5/31/2021**	
Response to Public Comment No.: 209		
This ballot item proposes the following response to the TAC comment:		
☐	Committee agrees with public comment, change is proposed	
☐	Committee agrees comment has merit, but proposed changes are not completely consistent with public comment	
☒	Committee disagrees with public comment and no changes are proposed	
☐	Committee unable to fully develop a response to public comment	
☐	Public comment only requires a response, no change to document	

Public comment:
This is far from being a comprehensive list and does not serve as a suitable introduction to the discussion under 13.1.2.2. *[Page 223, Line 75-80]*

[For voter's convenience here are the paragraphs that discuss deformations]

13.1.2.2 *Deformation and differential movement* — Deformations include out-of-plane deflection of the backing, vertical deflection of horizontally spanning support elements, and in-plane movement due to absolute and relative story drift. See Sections 13.2.1.5 and 13.3.1.2

There are many aspects of differential movement that need to be considered in the design of masonry veneer. One is the movement within the veneer itself due to irreversible moisture expansion, shrinkage, creep, and temperature movements. With anchored veneers, these movements are

Response: "Deformations include…" is not, in any way, limiting. It allows, and encourages, users to imagine other forces that might cause deformations.

The commentor is correct that the listing is far from being comprehensive, but "Deformations include…" admits that. Practically, it is impossible to list all the possible deformations. In situations such as this, "Deformations include…" is a common method of indicating or describing a broad range of situations/outcomes/findings, when an all-encompassing list is impossible (this case) or a broader list would be cumbersome (this case).

"There are many aspects of differential movement…One is the movement…" is also not limiting. It is less obvious than "Deformations include…" but is equally effective: There are many possibilities which the reader may imagine.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown <u>underlined</u> and deletions are shown ~~struck-through~~.)*

Code: NONE

Code Commentary: NONE

Specification: NONE

Specification Commentary: NONE

Subcommittee Vote:				
14 *Affirmative*	1 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	0 *Did not vote*

Subcommittee Comments:

May want to consider introducing the statement "but not limited to." Recommend changing, "Deformations include out-of-plane deflection of the backing, vertical deflection of horizontally spanning support elements, and in-plane movement due to absolute and relative story drift," to become, "Deformations include, but are not limited to, out-of-plane deflection of the backing, vertical deflection of horizontally spanning support elements, and in-plane movement due to absolute and relative story drift."

This will be taken up as new business.

2022 TMS 402/602 Committee
Proposed Change to Masonry Standard

Committee: Main Committee		**Ballot #:** 19
Item #: 19-VG-210-212		
Technical Contact/Email:	Brian E. Trimble, PE, btrimble@imiweb.org, (703) 300-0109	
Draft Document Dated:	**5/31/2021**	
Response to Public Comment No.: 210 and 212		
This ballot item proposes the following response to the TAC comment:		
☐	Committee agrees with public comment, change is proposed	
☒	Committee agrees comment has merit, but proposed changes are not completely consistent with public comment	
☐	Committee disagrees with public comment and no changes are proposed	
☐	Committee unable to fully develop a response to public comment	
☐	Public comment only requires a response, no change to document	

Public comments:

Comment 210 – "water penetration into the building"...What exactly is the extent of "into the building"...into the backing??...into interior space?? This statement must be consistent with the extent of water penetration permitted by the applicable building code. *[Page 226, Line 66]*

Comment 212 – "...entering into the building." What exactly is the extent of "into the building"...into the backing??...into interior space?? Such statements must be consistent with that permitted by the applicable building code. *[Page 230, Line 88]*

For voter's convenience here are the paragraphs referenced in the Public Comment and text from the 2021 IBC regarding weather protection as noted in the Public Comment:

design, detailing, and construction.

e) Water will penetrate the veneer, and the wall system should be designed, detailed, and constructed to prevent water penetration into the building.

f) Corrosion and fire resistance should be considered as

13.2.1.8 *Water Penetration Resistance* — Flashing and weep holes in exterior veneer wall systems shall be designed and detailed to resist penetration of water into the building interior. A minimum 1 in. (25.4 mm)

13.2.1.8 *Water Penetration Resistance* — Water penetration through the exterior veneer is expected. The wall system must be designed and constructed to prevent water from entering the building.

Page 230

1402.2 Weather protection. *Exterior walls* shall provide the building with a weather-resistant *exterior wall envelope*. The *exterior wall envelope* shall include flashing, as described in Section 1404.4. The *exterior wall envelope* shall be designed and constructed in such a manner as to prevent the accumulation of water within the wall assembly by providing a *water-resistive barrier* behind the exterior *veneer*, as described in Section 1403.2, and a means for draining water that enters the assembly to the exterior. Protection against condensation in the *exterior wall* assembly shall be provided in accordance with Section 1404.3.

Response: A designer has the prerogative to determine what level of design and detailing is required for a particular building. Therefore, having an all-encompassing statement is appropriate. We should frame the wording to resisting the movement of water beyond a point (which we can define rather precisely) rather than "into the building interior," which is difficult to define. "Beyond the drainage space" is recommended to define that plane.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.)*

Code:

13.2.1.8 *Water Penetration Resistance* — Flashing and weep holes in exterior veneer wall systems shall be designed and detailed to resist penetration of water ~~into the building interior~~ beyond the drainage space. A minimum 1 in. (25.4 mm) ….

Code Commentary:

13.2.1 *General requirements for anchored veneer*
….
e) Water will penetrate the veneer, and the wall system should be designed, detailed, and constructed to prevent water penetration ~~into the building~~ beyond the drainage space.

13.2.1.8 *Water Penetration Resistance* — Water penetration through the exterior veneer is expected. The wall system must be designed and constructed to prevent water from ~~entering the building~~ passing beyond the drainage space.

Specification: NONE

Specification Commentary: NONE

Subcommittee Vote:				
15 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	0 *Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Proposed Change to Masonry Standard

Committee: Main Committee		**Ballot #:** 19
Item #: 19-VG-214		
Technical Contact/Email:	Brian E. Trimble, PE, btrimble@imiweb.org, (703) 300-0109	
Draft Document Dated:	**5/31/2021**	
Response to Public Comment No.: 214		
This ballot item proposes the following response to the TAC comment:		
☐	Committee agrees with public comment, change is proposed	
☐	Committee agrees comment has merit, but proposed changes are not completely consistent with public comment	
☒	Committee disagrees with public comment and no changes are proposed	
☐	Committee unable to fully develop a response to public comment	
☐	Public comment only requires a response, no change to document	

Public comment:
13.2.1.8…For water penetration resistance…it is interesting that so many redundancies, such as air space and weep holes, etc., are required for water management for conventional (anchored) masonry veneer systems, but so little is required for adhered veneer with respect to water management! How is this possibly rationalized???? *[Page 230, Line 38-40]*

Response: Adhered veneers require more analysis since they can be designed as a barrier wall or a drainage wall. Adhered veneer could also be considered as "newer" wall systems as compared to anchored veneer walls and thus don't have as many prescriptive requirements. This committee will consider more prescriptive requirements for adhered veneer as more research is conducted and experience is gained on this wall system but the requirements, especially in regard to water penetration, are deemed as minimum levels appropriate for a building code at this time.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.)*

Code: NONE

Code Commentary: NONE

Specification: NONE

Specification Commentary: NONE

Subcommittee Vote:				
14 *Affirmative*	0 *Affirmative w/ comment*	0 *Negative*	0 *Abstain*	0 *Did not vote*

Subcommittee Comments:

2022 TMS 402/602 Committee
Proposed Change to Masonry Standard

Committee: Main Committee	**Ballot #:** 19
Item #: 19-VG-216	
Technical Contact/Email:	Brian E. Trimble, PE, btrimble@imiweb.org, (703) 300-0109
Draft Document Dated:	**5/31/2021**
Response to Public Comment No.: 216	
This ballot item proposes the following response to the TAC comment:	
☐	Committee agrees with public comment, change is proposed
☒	Committee agrees comment has merit, but proposed changes are not completely consistent with public comment
☐	Committee disagrees with public comment and no changes are proposed
☐	Committee unable to fully develop a response to public comment
☐	Public comment only requires a response, no change to document

Public comment:
The term "mechanical free play" should be defined. It is used repeatedly. *[Page 236, Line 69]*

Response: The term mechanical play is only used 3 times and most designers are familiar with the term. A parenthetical phrase is added to assist in a better understanding. Free play is not used anywhere in the code or specification.

PROPOSED CHANGES: *(Only the suggested change(s) being balloted are proposed for consideration. Supplementary text included for clarity, but not proposed for modification, is not part of this ballot item. Additions are shown underlined and deletions are shown ~~struck-through~~.)*

Code: NONE

Code Commentary:

13.2.2.4 *Veneer ties*
….
Veneer ties typically allow for movement in the plane of the wall, but resist movement perpendicular to the veneer. The mechanical play (clearance between adjustable parts) in adjustable veneer ties and the stiffness of the tie influence load transfer between the veneer and the backing.
…..

Specification: NONE

Specification Commentary: NONE

Subcommittee Vote:									
15	*Affirmative*	0	*Affirmative w/ comment*	0	*Negative*	0	*Abstain*	0	*Did not vote*

Subcommittee Comments: