DEPARTMENT OF LABOR AND INDUSTRY

CODE CHANGE PROPOSAL FORM

(Must be submitted electronically)

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Date: 4-19-18

Model Code: **2018 International Residential Code (IRC)**

Code or Rule Section: **MR 1309.0404 Section R404.1**

Firm/Association affiliation, if any: Oswell Engineering/BAM

Code or rule section to be changed: **2018 IRC, Section R404.1 (Concrete and Masonry Cantilevered Foundation Walls)**

Intended for Technical Advisory Group; **Residential Building Code TAG**

General Information	**Yes**	**No**
A. Is the proposed change unique to the State of Minnesota?	☒	☐
B. Is the proposed change required due to climatic conditions of Minnesota?	☐	☒
C. Will the proposed change encourage more uniform enforcement?	☒	☐
D. Will the proposed change remedy a problem?	☐	☒
E. Does the proposal delete a current Minnesota Rule, chapter amendment?	☐	☒
F. Would this proposed change be appropriate through the ICC code development process?	☐	☒

Proposed Language

1. The proposed code change is meant to:

☐ change language contained the model code book? If so, list section(s).

☒ change language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).
MN 1309.404 section R404 Tables R404.1.1(5) (6) and (7)

☐ delete language contained in the model code book? If so, list section(s).

☐ delete language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

☐ add new language that is not found in the model code book or in Minnesota Rule.

2. Is this proposed code change required by Minnesota Statute? If so, please provide the citation.
   No

3. Provide *specific* language you would like to see changed. Indicate proposed new words with underlining and words proposed to be deleted. Include the entire code (sub) section or rule subpart that contains your proposed changes.

   Remove Tables R404.1.1 (5), (6), and (7) from the MN rules and replace them with the following paragraph added/rewrite of the R404.1 exception:

   Exception 1: Cantilevered concrete and masonry foundation walls that do not have permanent lateral support at the top shall be constructed as follows when the unbalanced grade height supported by the foundation wall measured from the top of the slab on grade is no more than 30".

   1. The foundation wall shall be at least 8" thick.
   2. Final grade shall be at least 6" below the top of the foundation wall. The backfill soil shall be of soil group I, II, or III per Table R405.1.
   3. The maximum frame wall height atop the foundation wall shall be 7'.
   4. The foundation wall shall be supported in tight contact by a concrete slab-on-grade at least 3.5" in thickness.
   5. The concrete strip footing supporting the foundation wall shall be at least 20" wide by 8" thick centered on the foundation wall but not less than the size noted in Table R403. The footing elevation may be lowered below the slab-on-grade as required for frost protection.
   6. The minimum load-bearing pressure of the soil below the footing shall be 1500 pounds per square foot.
   7. The foundation wall and strip footing shall be connected together with #4 grade 40 minimum by 36" minimum long rebar dowels centered in the foundation wall at a maximum of 24" on center with at least 5" embedment into the strip footing. For masonry walls the cores containing dowels shall be grouted solid full height. Alternative dowel bar sizes and spacings having an equivalent cross-sectional area of reinforcement per lineal foot of wall shall be permitted provided the spacing of the dowels does not exceed 72" on center.
   8. Anchor bolts shall be installed in accordance with section R403.1.6.
   9. Horizontal reinforcing for concrete walls shall be installed in accordance with Table R404.1.2(1).
   10. Mortar shall be type M or S and masonry shall be laid in running bond.
   11. Grout and concrete shall have a 28 day compressive strength of at least 3000 psi.

   Exception 2: Cantilevered concrete and masonry foundation walls that do not have permanent lateral support at the top shall be constructed as follows when the unbalanced grade height supported by the foundation wall measured from the top of the slab on grade more than 30" but no more than 48". Cantilevered foundation walls supporting more than 48" of unbalanced grade shall be designed in accordance with accepted engineering practice.

   1. The foundation wall shall be at least 12" thick.
   2. Final grade shall be at least 6" below the top of the foundation wall. The backfill soil shall be of soil group I, II, or III per Table R405.1.
   3. The maximum frame wall height atop the foundation wall shall be 5'-6".
   4. The foundation wall shall be supported in tight contact by a concrete slab-on-grade at least 3.5" in thickness.
   5. The concrete strip footing supporting the foundation wall shall be at least 28" wide by 8" thick centered on the foundation wall but not less than the size noted in Table R403. The footing elevation may be lowered below the slab-on-grade as required for frost protection.
   6. The minimum load-bearing pressure of the soil below the footing shall be 1500 pounds per square foot.

7. The foundation wall and strip footing shall be connected together with #4 grade 40 minimum by 36" minimum long rebar dowels centered in the foundation wall at a maximum of 16" on center with at least 5" embedment into the strip footing. For masonry walls the cores containing dowels shall be grouted solid full height. Alternative dowel bar sizes and spacings having an equivalent cross-sectional area of reinforcement per lineal foot of wall shall be permitted provided the spacing of the dowels does not exceed 72" on center.
8. Anchor bolts shall be installed in accordance with section R403.1.6.
9. Horizontal reinforcing for concrete walls shall be installed in accordance with Table R404.1.2(1).
10. Mortar shall be type M or S and masonry shall be laid in running bond.
11. Grout and concrete shall have a 28 day compressive strength of at least 3000 psi.

4. Will this proposed code change impact other sections of a model code book or an amendment in Minnesota Rule? If so, please list the affected sections or rule parts.
   No

Need and Reason

1. Why is the proposed code change needed?
   The current cantilevered tables are confusing, not being used appropriately, and are based on questionable design (factor of safety of 1 for overturning, no use of wind, questionable dowel and side spanning use)
2. Why is the proposed code change a reasonable solution?
   It clarifies confusing language and replaces it with something that is already industry standard and suitable for all frost depth locations in the state.
3. What other considerations should the TAG consider?
   None

Cost/Benefit Analysis

1. Will the proposed code change increase or decrease costs? Please explain.
   Design will be required for higher wall cases that were uncommon but were included in the MN rules current tables.
2. If there is an increased cost, will this cost be offset by a safety or other benefit? Please explain.
   The new language actually is structurally adequate and simpler to install and inspection since it is more uniform
3. Are there any enforcement or compliance cost increases or decreases with the proposed code change? Please explain.
   No as it is already in effect in the current MN rules.
4. Will the cost of complying with the proposed code change in the first year after the rule takes effect exceed $25,000 for any one small business or small city? A small business is any business that has less than 50 full-time employees. A small city is any statutory or home rule charter city that has less than ten full-time employees. Please explain.
   Potentially, but it would only be in the design cost as the final construction would be about the same as it was before

Regulatory Analysis

1. What parties or segments of industry are affected by this proposed code change?
   Building officials, inspectors, builders, excavators, designers, and foundation contractors
2. What are the probable costs to the agency and to any other State agencies of implementing and enforcing of the proposed rule? Is there an anticipated effect on state revenues?
   None

3. Are there less costly intrusive methods for achieving the purpose of the proposed rule?
   No

4. Can you think of other means or methods to achieve the purpose of the proposed code change? If so, please explain what they are and why your proposed change is the preferred method or means to achieve the desired result.
   No

5. What are the probable costs of complying with the proposed rule, including the portion of the total costs that will be borne by identifiable categories of affected parties, such as separate classes of governmental units, businesses, or individuals?
   None

6. What are the probable costs or consequences of not adopting the proposed rule, including those costs or consequences borne by identifiable categories of affected parties, such as separate classes of government units, businesses, or individuals?
   Potential improper installation of cantilevered walls with associated distresses and failures

7. Are you aware of any federal regulation or federal requirement related to this proposed code change? If so, please list the federal regulation or requirement and your assessment of any differences between the proposed rule and the federal regulation or requirement.
   No

8. Please include an assessment of the cumulative effect of the rule with other federal and state regulations related to the specific purpose of the rule.
   None

***Note: Incomplete forms may be returned to the submitter with instruction to complete the form. Only completed forms can considered by the TAG.

Subp. 6. **IRC Table R404.1.1(5).** Section R404 is amended by adding a new table as follows:

TABLE R404.1.1(5)

CANTILEVERED CONCRETE AND MASONRY FOUNDATION WALLS[e,f,g,h,k,l,m,n]

Max. Unbalanced Backfill Height (inches)[a,b,j]	Max. Frame Wall Height (feet)[i]	Fnd. Wall Thickness (inches)	Soil Class	Concrete Footing Width x Depth (inches)[c,g]	#4 Footing Dowel o.c. Spacing (inches)[d,k]	#4 Footing Hook o.c. Spacing (inches) [d,k]	#5 Footing Dowel o.c. Spacing (inches) [d,k]	#5 Footing Hook o.c. Spacing (inches) [d,k]
≤ 30	7'-0"	8	GW, GP, SW, SP	18 x 8	32	64	40	72
	7'-0"	8	GM, GC, SM, SM-SC, ML	18 x 8	24	54	32	72
	7'-0"	8	SC, ML-CL, I-CL	18 x 8	24	48	32	72
	7'-0"	10	GW, GP, SW, SP	18 x 8	56	72	64	72
	7'-0"	10	GM, GC, SM, SM-SC, ML	18 x 8	56	72	64	72
	7'-0"	10	SC, ML-CL, I-CL	18 x 8	56	72	64	72
	7'-0"	12	GW, GP, SW, SP	18 x 8	64	72	72	72
	7'-0"	12	GM, GC, SM, SM-SC, ML	18 x 8	64	72	72	72
	7'-0"	12	SC, ML-CL, I-CL	18 x 8	64	72	72	72
>30 to ≤ 48	5'-6"	8	GW, GP, SW, SP	24 x 8	16	32	16	48

5’-6”	10	GW, GP, SW, SP	24 x 8	16	40	24	64
5’-6”	10	GM, GC, SM, SM-SC, ML	26 x 8	16	32	16	48
5’-6”	12	GW, GP, SW, SP	24 x 8	24	48	32	72
5’-6”	12	GM, GC, SM, SM-SC, ML	26 x 8	16	32	24	56
5’-6”	12	SC, ML-CL, I-CL	28 x 8	16	32	16	48

a. Final grade shall be at least 6 inches below the top of the foundation wall.

b. A 3-1/2 inches minimum thick concrete slab-on-grade is to be poured tight against the bottom of the foundation wall.

c. The concrete strip footing supporting the foundation shall be centered on the foundation wall and sized in accordance with Table R404.1.1(5), but not less than the size noted in Table R403.1(1), Table R403.1(2), or Table R403.1(2). The footing elevation may be lowered below the slab-on-grade as required for frost protection.

d. Concrete Foundation wall and strip footing shall be connected together with Grade 60 minimum by 24 inches minimum long rebar dowel or hook centered in the foundation wall spaced in accordance with Table R404.1.1(5) with at least 5 inches embedment into the strip footing. Hooks are to have a 6 inches minimum long horizontal portion in the footing. For masonry walls the cores containing dowels or hooks shall be grouted solid full height. The dowel and hook vertical portion is to extend at least 14 inches above the top of the floor slab.

e. Anchor bolts shall be installed in accordance with section R403.1.6.

f. Mortar shall be Type M or S and masonry shall be laid in running bond.

g. Grout and concrete for walls shall have a minimum 28 day compressive strength of at least 3,000 psi.

h. Cantilevered foundation walls supporting more than 48 inches of unbalanced grade shall be designed in accordance with accepted engineering practice.

i. Maximum frame wall height from top of foundation wall.

j. Maximum unbalanced fill height from top of concrete slab to grade.

k. Concrete for footings shall have a minimum 28 day compressive strength of at least 5,000 psi per Table R402.2.

l. Horizontal reinforcing is required in the walls per R404.1.2(1).

m. The minimum allowable soil bearing capacity is to be at least 1500 psf.

n. The wind load is to be 115 mph exposure C or less.

Subp. 6. **IRC Table R404.1.1(5).** Section R404 is amended by adding a new table as follows:

TABLE R404.1.1(5)

CANTILEVERED CONCRETE AND MASONRY FOUNDATION WALLS[e,f,g,h,k,l,m,n]

Max. Unbalanced Backfill Height (inches)[a,b,j]	Max. Frame Wall Height (feet)[i]	Fnd. Wall Thickness (inches)	Soil Class	Concrete Footing Width x Depth (inches)[c,g]	#4 Footing Dowel o.c. Spacing (inches)[d,k]	#4 Footing Hook o.c. Spacing (inches)[d,k]	#5 Footing Dowel o.c. Spacing (inches)[d,k]	#5 Footing Hook o.c. Spacing (inches)[d,k]	
≤ 30	7'-0"	8	GW, GP, SW, SP	18 x 8	32	64	40	72	#1
	7'-0"	8	GM, GC, SM, SM-SC, ML	18 x 8	24	54	32	72	
	7'-0"	8	SC, ML-CL, I-CL	18 x 8	24	48	32	72	
	7'-0"	10	GW, GP, SW, SP	18 x 8	56	72	64	72	
	7'-0"	10	GM, GC, SM, SM-SC, ML	18 x 8	56	72	64	72	#2
	7'-0"	10	SC, ML-CL, I-CL	18 x 8	56	72	64	72	
	7'-0"	12	GW, GP, SW, SP	18 x 8	64	72	72	72	
	7'-0"	12	GM, GC, SM, SM-SC, ML	18 x 8	64	72	72	72	
	7'-0"	12	SC, ML-CL, I-CL	18 x 8	64	72	72	72	#3
>30 to ≤ 48	5'-6"	8	GW, GP, SW, SP	24 x 8	16	32	16	48	#4

5'-6"	10	GW, GP, SW, SP	24 x 8	16	40	24	64	
5'-6"	10	GM, GC, SM, SM-SC, ML	26 x 8	16	32	16	48	#5
5'-6"	12	GW, GP, SW, SP	24 x 8	24	48	32	72	
5'-6"	12	GM, GC, SM, SM-SC, ML	26 x 8	16	32	24	56	
5'-6"	12	SC, ML-CL, I-CL	28 x 8	16	32	16	48	#6

a. Final grade shall be at least 6 inches below the top of the foundation wall.

b. A 3-1/2 inches minimum thick concrete slab-on-grade is to be poured tight against the bottom of the foundation wall.

c. The concrete strip footing supporting the foundation shall be centered on the foundation wall and sized in accordance with Table R404.1.1(5), but not less than the size noted in Table R403.1(1), Table R403.1(2), or Table R403.1(2). The footing elevation may be lowered below the slab-on-grade as required for frost protection.

d. Concrete Foundation wall and strip footing shall be connected together with Grade 60 minimum by 24 inches minimum long rebar dowel or hook centered in the foundation wall spaced in accordance with Table R404.1.1(5) with at least 5 inches embedment into the strip footing. Hooks are to have a 6 inches minimum long horizontal portion in the footing. For masonry walls the cores containing dowels or hooks shall be grouted solid full height. The dowel and hook vertical portion is to extend at least 14 inches above the top of the floor slab.

e. Anchor bolts shall be installed in accordance with section R403.1.6.

f. Mortar shall be Type M or S and masonry shall be laid in running bond.

g. Grout and concrete for walls shall have a minimum 28 day compressive strength of at least 3,000 psi.

h. Cantilevered foundation walls supporting more than 48 inches of unbalanced grade shall be designed in accordance with accepted engineering practice.

i. Maximum frame wall height from top of foundation wall.

j. Maximum unbalanced fill height from top of concrete slab to grade.

k. Concrete for footings shall have a minimum 28 day compressive strength of at least 5,000 psi per Table R402.2.

l. Horizontal reinforcing is required in the walls per R404.1.2(1).

m. The minimum allowable soil bearing capacity is to be at least 1500 psf.

n. The wind load is to be 115 mph exposure C or less.

CASE #1

Nominal Wall Thickness =	8.0	in				Wall Type =	Masonry		
Wall Height (above TOF) =	3.33	ft				Soil Type =	Sand		
Footing Width =	1.50	ft				Allowable Bearing =	1500	psf	
Wall Reveal =	6	in				Active Soil Load =	30	psf/ft	
Unbalance Height =	2.50	ft				Soil Weight =	125	pcf	
Footing Thickness =	8	in				Wind Load =	17.3	psf	
Front Wall Offset =	0.42	ft	115 mph exposure C @ 15' (area 4 inward)						
Back Wall Offset =	0.42	ft							
Basement Clear Height =	10.00	ft							
Soil P =	94	plf	@ x =	0.83	ft	M =	78	lb-ft	
Wind P =	69	plf	@ x =	3.00	ft	M =	208	lb-ft	
				Total Mo at top of slab =			286	lb-ft	
Overturning Resistance:									
Wall Weight =	178	plf	@ y =	0.75	ft	M =	133	lb-ft	
Footing Weight =	150	plf	@ y =	0.75	ft	M =	113	lb-ft	
Soil Weight =	147	plf	@ y =	1.29	ft	M =	190	lb-ft	
DL from Above =	200	plf	@ y =	0.83	ft	M =	167	lb-ft	
						Total Mr =	603	lb-ft	
Bearing:						FS =	2.11	OK > 1.5	
e =	0.42	ft							
B/6 =	0.25	ft				**Footing Connection:**			
Bearing Pressure =	1378	psf				Mu =	5.5	k-in	
Ratio =	0.92		OK @ 4/3			Location =	C	(C or O)	
						d =	3.75	in	
Rear Footing Bending:						Ru =	0.036	ksi	
Mu =	0.59	k-in				Rebar Grade =	60	ksi	
S =	128	in3				F'c =	5	ksi	
fb =	5	psi				B1 =	0.8		
Fb =	318	psi	OK			m =	15.00		
Sr =	2	in3				rho =	0.0006		
Req'd Thickness =	1.0	in	OK			rho min =	0.0008		
						As =	0.04	in2/ft	
Wall Check:						Bar Size =	4	5	
Mu (18" above TOS) =	1.31	k-in				Bar Area =	0.20	0.31	in2
A =	36	in2				Minimum Ld =	10.2	12.7	in
S =	90	in3				Actual Ld =	5.0	5.0	in
fa =	8	psi				Dowel Spacing =	**32**	**40**	in
fb =	14	psi				Hook Spacing =	**65**	**101**	in
Fb =	500	psi	OK						
ft =	7	psi							
Ft =	25	psi	OK						

CASE #2

Nominal Wall Thickness =	10.0	in				Wall Type =	Masonry		
Wall Height (above TOF) =	3.33	ft				Soil Type =	SC		
Footing Width =	1.50	ft				Allowable Bearing =	1500	psf	
Wall Reveal =	6	in				Active Soil Load =	45	psf/ft	
Unbalance Height =	2.50	ft				Soil Weight =	125	pcf	
Footing Thickness =	8	in				Wind Load =	17.3	psf	
Front Wall Offset =	0.33	ft	115 mph exposure C @ 15' (area 4 inward)						
Back Wall Offset =	0.33	ft							
Basement Clear Height =	10.00	ft							
Soil P =	141	plf	@ x =	0.00	ft	M =	0	lb-ft	
Wind P =	69	plf	@ x =	3.00	ft	M =	208	lb-ft	
						Total Mo at top of slab =	208	lb-ft	
Overturning Resistance:									
Wall Weight =	222	plf	@ y =	0.75	ft	M =	167	lb-ft	
Footing Weight =	150	plf	@ y =	0.75	ft	M =	113	lb-ft	
Soil Weight =	118	plf	@ y =	1.33	ft	M =	157	lb-ft	
DL from Above =	200	plf	@ y =	0.92	ft	M =	183	lb-ft	
						Total Mr =	620	lb-ft	
Bearing:						FS =	2.98	OK > 1.5	
e =	0.30	ft							
B/6 =	0.25	ft				**Footing Connection:**			
Bearing Pressure =	1024	psf				Mu =	4.0	k-in	
Ratio =	0.68		OK @ 4/3			Location =	C	(C or O)	
						d =	4.75	in	
Rear Footing Bending:						Ru =	0.016	ksi	
Mu =	0.38	k-in				Rebar Grade =	60	ksi	
S =	128	in3				F'c =	5	ksi	
fb =	3	psi				B1 =	0.8		
Fb =	318	psi	OK			m =	15.00		
Sr =	1	in3				rho =	0.0003		
Req'd Thickness =	0.8	in	OK			rho min =	0.0004		
						As =	0.02	in2/ft	
Wall Check:						Bar Size =	4	5	
Mu (18" above TOS) =	1.34	k-in				Bar Area =	0.20	0.31	in2
A =	36	in2				Minimum Ld =	10.2	12.7	in
S =	125	in3				Actual Ld =	5.0	5.0	in
fa =	8	psi				Dowel Spacing =	**56**	**70**	in
fb =	11	psi				Hook Spacing =	**113**	**177**	in
Fb =	500	psi	OK						
ft =	2	psi							
Ft =	25	psi	OK						

CASE #3

Nominal Wall Thickness =	12.0	in				Wall Type =	Masonry		
Wall Height (above TOF) =	3.33	ft				Soil Type =	Clay		
Footing Width =	1.50	ft				Allowable Bearing =	1500	psf	
Wall Reveal =	6	in				Active Soil Load =	60	psf/ft	
Unbalance Height =	2.50	ft				Soil Weight =	125	pcf	
Footing Thickness =	8	in				Wind Load =	17.3	psf	
Front Wall Offset =	0.25	ft	115 mph exposure C @ 15' (area 4 inward)						
Back Wall Offset =	0.25	ft							
Basement Clear Height =	10.00	ft							
Soil P =	188	plf	@ x =	0.00	ft	M =	0	lb-ft	
Wind P =	69	plf	@ x =	3.00	ft	M =	208	lb-ft	
						Total Mo at top of slab =	208	lb-ft	
Overturning Resistance:									
Wall Weight =	266	plf	@ y =	0.75	ft	M =	200	lb-ft	
Footing Weight =	150	plf	@ y =	0.75	ft	M =	113	lb-ft	
Soil Weight =	88	plf	@ y =	1.38	ft	M =	122	lb-ft	
DL from Above =	200	plf	@ y =	1.00	ft	M =	200	lb-ft	
						Total Mr =	634	lb-ft	
Bearing:						FS =	3.05	OK > 1.5	
e =	0.29	ft							
B/6 =	0.25	ft				**Footing Connection:**			
Bearing Pressure =	1032	psf				Mu =	4.0	k-in	
Ratio =	0.69		OK @ 4/3			Location =	C	(C or O)	
						d =	5.75	in	
Rear Footing Bending:						Ru =	0.011	ksi	
Mu =	0.21	k-in				Rebar Grade =	60	ksi	
S =	128	in3				F'c =	5	ksi	
fb =	2	psi				B1 =	0.8		
Fb =	318	psi	OK			m =	15.00		
Sr =	1	in3				rho =	0.0002		
Req'd Thickness =	0.6	in	OK			rho min =	0.0002		
						As =	0.02	in2/ft	
Wall Check:						Bar Size =	4	5	
Mu (18" above TOS) =	1.37	k-in				Bar Area =	0.20	0.31	in2
A =	36	in2				Minimum Ld =	10.2	12.7	in
S =	160	in3				Actual Ld =	5.0	5.0	in
fa =	9	psi				Dowel Spacing =	**67**	**84**	in
fb =	9	psi				Hook Spacing =	**137**	**215**	in
Fb =	500	psi	OK						
ft =	0	psi							
Ft =	25	psi	OK						

CASE #4

Nominal Wall Thickness =	8.0	in				Wall Type =	Masonry		
Wall Height (above TOF) =	4.83	ft				Soil Type =	Sand		
Footing Width =	2.00	ft				Allowable Bearing =	1500	psf	
Wall Reveal =	6	in				Active Soil Load =	30	psf/ft	
Unbalance Height =	4.00	ft				Soil Weight =	125	pcf	
Footing Thickness =	8	in				Wind Load =	17.3	psf	
Front Wall Offset =	0.67	ft	115 mph exposure C @ 15' (area 4 inward)						
Back Wall Offset =	0.67	ft							
Basement Clear Height =	10.00	ft							
Soil P =	240	plf	@ x =	1.33	ft	M =	320	lb-ft	
Wind P =	56	plf	@ x =	4.50	ft	M =	253	lb-ft	
						Total Mo at top of slab =	573	lb-ft	
Overturning Resistance:									
Wall Weight =	258	plf	@ y =	1.00	ft	M =	258	lb-ft	
Footing Weight =	200	plf	@ y =	1.00	ft	M =	200	lb-ft	
Soil Weight =	361	plf	@ y =	1.67	ft	M =	601	lb-ft	
DL from Above =	185	plf	@ y =	1.08	ft	M =	200	lb-ft	
						Total Mr =	1259	lb-ft	
Bearing:						FS =	2.20	OK > 1.5	
e =	0.57	ft							
B/6 =	0.33	ft				**Footing Connection:**			
Bearing Pressure =	1560	psf				Mu =	11.0	k-in	
Ratio =	1.04		OK @ 4/3			Location =	C	(C or O)	
						d =	3.75	in	
Rear Footing Bending:						Ru =	0.072	ksi	
Mu =	2.31	k-in				Rebar Grade =	60	ksi	
S =	128	in3				F'c =	5	ksi	
fb =	18	psi				B1 =	0.8		
Fb =	318	psi	OK			m =	15.00		
Sr =	7	in3				rho =	0.0012		
Req'd Thickness =	1.9	in	OK			rho min =	0.0016		
						As =	0.07	in2/ft	
Wall Check:						Bar Size =	4	5	
Mu (18" above TOS) =	2.96	k-in				Bar Area =	0.20	0.31	in2
A =	36	in2				Minimum Ld =	10.2	12.7	in
S =	90	in3				Actual Ld =	5.0	5.0	in
fa =	10	psi				Dowel Spacing =	**16**	**20**	in
fb =	33	psi				Hook Spacing =	**32**	**50**	in
Fb =	500	psi	OK						
ft =	23	psi							
Ft =	25	psi	OK						

CASE #5

Nominal Wall Thickness =	10.0	in				Wall Type =	Masonry		
Wall Height (above TOF) =	4.83	ft				Soil Type =	SC		
Footing Width =	2.17	ft				Allowable Bearing =	1500	psf	
Wall Reveal =	6	in				Active Soil Load =	45	psf/ft	
Unbalance Height =	4.00	ft				Soil Weight =	125	pcf	
Footing Thickness =	8	in				Wind Load =	17.3	psf	
Front Wall Offset =	0.67	ft	115 mph exposure C @ 15' (area 4 inward)						
Back Wall Offset =	0.67	ft							
Basement Clear Height =	10.00	ft							
Soil P =	360	plf	@ x =	1.33	ft	M =	480	lb-ft	
Wind P =	56	plf	@ x =	4.50	ft	M =	253	lb-ft	
				Total Mo at top of slab =			733	lb-ft	
Overturning Resistance:									
Wall Weight =	322	plf	@ y =	1.09	ft	M =	349	lb-ft	
Footing Weight =	217	plf	@ y =	1.09	ft	M =	235	lb-ft	
Soil Weight =	362	plf	@ y =	1.84	ft	M =	664	lb-ft	
DL from Above =	185	plf	@ y =	1.25	ft	M =	232	lb-ft	
						Total Mr =	1480	lb-ft	
Bearing:						FS =	2.02	OK > 1.5	
e =	0.68	ft							
B/6 =	0.36	ft				**Footing Connection:**			
Bearing Pressure =	1766	psf				Mu =	14.1	k-in	
Ratio =	1.18		OK @ 4/3			Location =	C	(C or O)	
						d =	4.75	in	
Rear Footing Bending:						Ru =	0.058	ksi	
Mu =	2.32	k-in				Rebar Grade =	60	ksi	
S =	128	in3				F'c =	5	ksi	
fb =	18	psi				B1 =	0.8		
Fb =	318	psi	OK			m =	15.00		
Sr =	7	in3				rho =	0.0010		
Req'd Thickness =	1.9	in	OK			rho min =	0.0013		
						As =	0.07	in2/ft	
Wall Check:						Bar Size =	4	5	
Mu (18" above TOS) =	3.43	k-in				Bar Area =	0.20	0.31	in2
A =	36	in2				Minimum Ld =	10.2	12.7	in
S =	125	in3				Actual Ld =	5.0	5.0	in
fa =	11	psi				Dowel Spacing =	**16**	**20**	in
fb =	27	psi				Hook Spacing =	**32**	**50**	in
Fb =	500	psi	OK						
ft =	17	psi							
Ft =	25	psi	OK						

CASE #6

Nominal Wall Thickness =	12.0	in				Wall Type =	Masonry		
Wall Height (above TOF) =	4.83	ft				Soil Type =	Clay		
Footing Width =	2.33	ft				Allowable Bearing =	1500	psf	
Wall Reveal =	6	in				Active Soil Load =	60	psf/ft	
Unbalance Height =	4.00	ft				Soil Weight =	125	pcf	
Footing Thickness =	8	in				Wind Load =	17.3	psf	
Front Wall Offset =	0.67	ft	115 mph exposure C @ 15' (area 4 inward)						
Back Wall Offset =	0.67	ft							
Basement Clear Height =	10.00	ft							
Soil P =	480	plf	@ x =	1.33	ft	M =	640	lb-ft	
Wind P =	56	plf	@ x =	4.50	ft	M =	253	lb-ft	
						Total Mo at top of slab =	893	lb-ft	
Overturning Resistance:									
Wall Weight =	386	plf	@ y =	1.17	ft	M =	450	lb-ft	
Footing Weight =	233	plf	@ y =	1.17	ft	M =	271	lb-ft	
Soil Weight =	360	plf	@ y =	2.00	ft	M =	719	lb-ft	
DL from Above =	185	plf	@ y =	1.42	ft	M =	262	lb-ft	
						Total Mr =	1702	lb-ft	
Bearing:						FS =	1.91	OK > 1.5	
e =	0.77	ft							
B/6 =	0.39	ft				**Footing Connection:**			
Bearing Pressure =	1950	psf				Mu =	17.1	k-in	
Ratio =	1.30		OK @ 4/3			Location =	C	(C or O)	
						d =	5.75	in	
Rear Footing Bending:						Ru =	0.048	ksi	
Mu =	2.30	k-in				Rebar Grade =	60	ksi	
S =	128	in3				F'c =	5	ksi	
fb =	18	psi				B1 =	0.8		
Fb =	318	psi	OK			m =	15.00		
Sr =	7	in3				rho =	0.0008		
Req'd Thickness =	1.9	in	OK			rho min =	0.0011		
						As =	0.07	in2/ft	
Wall Check:						Bar Size =	4	5	
Mu (18" above TOS) =	3.90	k-in				Bar Area =	0.20	0.31	in2
A =	36	in2				Minimum Ld =	10.2	12.7	in
S =	160	in3				Actual Ld =	5.0	5.0	in
fa =	12	psi				Dowel Spacing =	**16**	**20**	in
fb =	24	psi				Hook Spacing =	**32**	**50**	in
Fb =	500	psi	OK						
ft =	13	psi							
Ft =	25	psi	OK						