

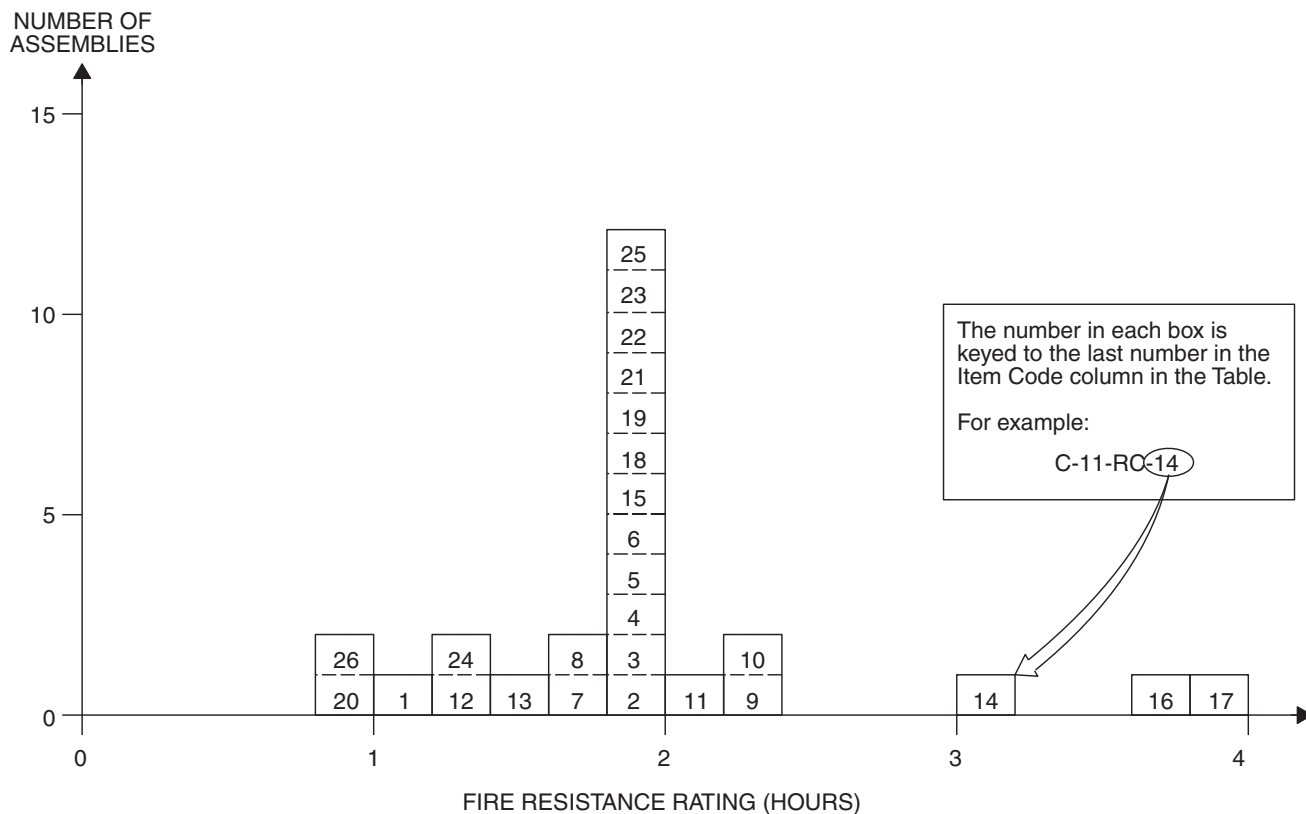
SECTION II—COLUMNS

TABLE 2.1.1—REINFORCED CONCRETE COLUMNS  
MINIMUM DIMENSION 0" TO LESS THAN 6"

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-6-RC-1	6"	6" x 6" square columns; gravel aggregate concrete (4030 psi); Reinforcement: vertical, four 7/8" rebars; horizontal, 5/16" ties at 6" pitch; Cover: 1".	34.7 tons	62 min.			7	1, 2	1
C-6-RC-2	6"	6" x 6" square columns; gravel aggregate concrete (4200 psi); Reinforcement: vertical, four 1/2" rebars; horizontal, 5/16" ties at 6" pitch; Cover: 1".	21 tons	69 min.			7	1, 2	1

Notes:  
1. Collapse.  
2. British Test.

FIGURE 2.1.2—REINFORCED CONCRETE COLUMNS  
MINIMUM DIMENSION 10" TO LESS THAN 12"



**TABLE 2.1.2—REINFORCED CONCRETE COLUMNS  
MINIMUM DIMENSION 10" TO LESS THAN 12"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-10-RC-1	10"	10" square columns; aggregate concrete (4260 psi); Reinforcement: vertical, four 1 <sup>1</sup> / <sub>4</sub> " rebars; horizontal, 3 <sup>3</sup> / <sub>8</sub> " ties at 6" pitch; Cover: 1 <sup>1</sup> / <sub>4</sub> ".	92.2 tons	1 hr. 2 min.			7	1	1
C-10-RC-2	10"	10" square columns; aggregate concrete (2325 psi); Reinforcement: vertical, four 1 <sup>1</sup> / <sub>2</sub> " rebars; horizontal, 5 <sup>1</sup> / <sub>16</sub> " ties at 6" pitch; Cover: 1".	46.7 tons	1 hr. 52 min.			7	1	1 <sup>3</sup> / <sub>4</sub>
C-10-RC-3	10"	10" square columns; aggregate concrete (5370 psi); Reinforcement: vertical, four 1 <sup>1</sup> / <sub>2</sub> " rebars; horizontal, 5 <sup>1</sup> / <sub>16</sub> " ties at 6" pitch; Cover: 1".	46.5 tons	2 hrs.			7	2, 3, 11	2
C-10-RC-4	10"	10" square columns; aggregate concrete (5206 psi); Reinforcement: vertical, four 1 <sup>1</sup> / <sub>2</sub> " rebars; horizontal, 5 <sup>1</sup> / <sub>16</sub> " ties at 6" pitch; Cover: 1".	46.5 tons	2 hrs.			7	2, 7	2
C-10-RC-5	10"	10" square columns; aggregate concrete (5674 psi); Reinforcement: vertical, four 1 <sup>1</sup> / <sub>2</sub> " rebars; horizontal, 5 <sup>1</sup> / <sub>16</sub> " ties at 6" pitch; Cover: 1".	46.7 tons	2 hrs.			7	1	2
C-10-RC-6	10"	10" square columns; aggregate concrete (5150 psi); Reinforcement: vertical, four 1 <sup>1</sup> / <sub>2</sub> " rebars; horizontal, 5 <sup>1</sup> / <sub>16</sub> " ties at 6" pitch; Cover: 1".	66 tons	1 hr. 43 min.			7	1	1 <sup>3</sup> / <sub>4</sub>
C-10-RC-7	10"	10" square columns; aggregate concrete (5580 psi); Reinforcement: vertical, four 1 <sup>1</sup> / <sub>2</sub> " rebars; horizontal, 5 <sup>1</sup> / <sub>16</sub> " ties at 6" pitch; Cover: 1 <sup>1</sup> / <sub>8</sub> ".	62.5 tons	1 hr. 38 min.			7	1	1 <sup>1</sup> / <sub>2</sub>
C-10-RC-8	10"	10" square columns; aggregate concrete (4080 psi); Reinforcement: vertical, four 1 <sup>1</sup> / <sub>8</sub> " rebars; horizontal, 5 <sup>1</sup> / <sub>16</sub> " ties at 6" pitch; Cover: 1 <sup>1</sup> / <sub>8</sub> ".	72.8 tons	1 hr. 48 min.			7	1	1 <sup>3</sup> / <sub>4</sub>
C-10-RC-9	10"	10" square columns; aggregate concrete (2510 psi); Reinforcement: vertical, four 1 <sup>1</sup> / <sub>2</sub> " rebars; horizontal, 5 <sup>1</sup> / <sub>16</sub> " ties at 6" pitch; Cover: 1".	51 tons	2 hrs. 16 min.			7	1	2 <sup>1</sup> / <sub>4</sub>
C-10-RC-10	10"	10" square columns; aggregate concrete (2170 psi); Reinforcement: vertical, four 1 <sup>1</sup> / <sub>2</sub> " rebars; horizontal, 5 <sup>1</sup> / <sub>16</sub> " ties at 6" pitch; Cover: 1".	45 tons	2 hrs. 14 min.			7	12	2 <sup>1</sup> / <sub>4</sub>
C-10-RC-11	10"	10" square columns; gravel aggregate concrete (4015 psi); Reinforcement: vertical, four 1 <sup>1</sup> / <sub>2</sub> " rebars; horizontal, 5 <sup>1</sup> / <sub>16</sub> " ties at 6" pitch; Cover: 1 <sup>1</sup> / <sub>8</sub> ".	46.5 tons	2 hrs. 6 min.			7	1	2

(Continued)

**TABLE 2.1.2—REINFORCED CONCRETE COLUMNS  
MINIMUM DIMENSION 10" TO LESS THAN 12"—continued**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-11-RC-12	11"	11" square columns; gravel aggregate concrete (4150 psi); Reinforcement: vertical, four 1 <sup>1</sup> / <sub>4</sub> " rebars; horizontal, 3 <sup>3</sup> / <sub>8</sub> " ties at 7 <sup>1</sup> / <sub>2</sub> " pitch; Cover: 1 <sup>1</sup> / <sub>2</sub> ".	61 tons	1 hr. 23 min.			7	1	1 <sup>1</sup> / <sub>4</sub>
C-11-RC-13	11"	11" square columns; gravel aggregate concrete (4380 psi); Reinforcement: vertical, four 1 <sup>1</sup> / <sub>4</sub> " rebars; horizontal, 3 <sup>3</sup> / <sub>8</sub> " ties at 7 <sup>1</sup> / <sub>2</sub> " pitch; Cover: 1 <sup>1</sup> / <sub>2</sub> ".	61 tons	1 hr. 26 min.			7	1	1 <sup>1</sup> / <sub>4</sub>
C-11-RC-14	11"	11" square columns; gravel aggregate concrete (4140 psi); Reinforcement: vertical, four 1 <sup>1</sup> / <sub>4</sub> " rebars; horizontal, 3 <sup>3</sup> / <sub>8</sub> " ties at 7 <sup>1</sup> / <sub>2</sub> " pitch; steel mesh around reinforcement; Cover: 1 <sup>1</sup> / <sub>2</sub> ".	61 tons	3 hrs. 9 min.			7	1	3
C-11-RC-15	11"	11" square columns; slag aggregate concrete (3690 psi); Reinforcement: vertical, four 1 <sup>1</sup> / <sub>4</sub> " rebars; horizontal, 3 <sup>3</sup> / <sub>8</sub> " ties at 7 <sup>1</sup> / <sub>2</sub> " pitch; Cover: 1 <sup>1</sup> / <sub>2</sub> ".	91 tons	2 hrs.			7	2, 3, 4, 5	2
C-11-RC-16	11"	11" square columns; limestone aggregate concrete (5230 psi); Reinforcement: vertical, four 1 <sup>1</sup> / <sub>4</sub> " rebars; horizontal, 3 <sup>3</sup> / <sub>8</sub> " ties at 7 <sup>1</sup> / <sub>2</sub> " pitch; Cover: 1 <sup>1</sup> / <sub>2</sub> ".	91.5 tons	3 hrs. 41 min.			7	1	3 <sup>1</sup> / <sub>2</sub>
C-11-RC-17	11"	11" square columns; limestone aggregate concrete (5530 psi); Reinforcement: vertical, four 1 <sup>1</sup> / <sub>4</sub> " rebars; horizontal, 3 <sup>3</sup> / <sub>8</sub> " ties at 7 <sup>1</sup> / <sub>2</sub> " pitch; Cover: 1 <sup>1</sup> / <sub>2</sub> ".	91.5 tons	3 hrs. 47 min.			7	1	3 <sup>1</sup> / <sub>2</sub>
C-11-RC-18	11"	11" square columns; limestone aggregate concrete (5280 psi); Reinforcement: vertical, four 1 <sup>1</sup> / <sub>4</sub> " rebars; horizontal, 3 <sup>3</sup> / <sub>8</sub> " ties at 7 <sup>1</sup> / <sub>2</sub> " pitch; Cover: 1 <sup>1</sup> / <sub>2</sub> ".	91.5 tons	2 hrs.			7	2, 3, 4, 6	2
C-11-RC-19	11"	11" square columns; limestone aggregate concrete (4180 psi); Reinforcement: vertical, four 5 <sup>5</sup> / <sub>8</sub> " rebars; horizontal, 3 <sup>3</sup> / <sub>8</sub> " ties at 7" pitch; Cover: 1 <sup>1</sup> / <sub>2</sub> ".	71.4 tons	2 hrs.			7	2, 7	2
C-11-RC-20	11"	11" square columns; gravel concrete (4530 psi); Reinforcement: vertical, four 5 <sup>5</sup> / <sub>8</sub> " rebars; horizontal, 3 <sup>3</sup> / <sub>8</sub> " ties at 7" pitch; Cover: 1 <sup>1</sup> / <sub>2</sub> " with 1 <sup>1</sup> / <sub>2</sub> " plaster.	58.8 tons	2 hrs.			7	2, 3, 9	1 <sup>1</sup> / <sub>4</sub>
C-11-RC-21	11"	11" square columns; gravel concrete (3520 psi); Reinforcement: vertical, four 5 <sup>5</sup> / <sub>8</sub> " rebars; horizontal, 3 <sup>3</sup> / <sub>8</sub> " ties at 7" pitch; Cover: 1 <sup>1</sup> / <sub>2</sub> ".	Variable	1 hr. 24 min.			7	1, 8	2

(Continued)

**TABLE 2.1.2—REINFORCED CONCRETE COLUMNS  
MINIMUM DIMENSION 10" TO LESS THAN 12"—continued**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-11-RC-22	11"	11" square columns; aggregate concrete (3710 psi); Reinforcement: vertical, four 5/8" rebars; horizontal, 3/8" ties at 7" pitch; Cover: 1 1/2".	58.8 tons	2 hrs.			7	2, 3, 10	2
C-11-RC-23	11"	11" square columns; aggregate concrete (3190 psi); Reinforcement: vertical, four 5/8" rebars; horizontal, 3/8" ties at 7" pitch; Cover: 1 1/2".	58.8 tons	2 hrs.			7	2, 3, 10	2
C-11-RC-24	11"	11" square columns; aggregate concrete (4860 psi); Reinforcement: vertical, four 5/8" rebars; horizontal, 3/8" ties at 7" pitch; Cover: 1 1/2".	86.1 tons	1 hr. 20 min.			7	1	1 1/3
C-11-RC-25	11"	11" square columns; aggregate concrete (4850 psi); Reinforcement: vertical, four 5/8" rebars; horizontal, 3/8" ties at 7" pitch; Cover: 1 1/2".	58.8 tons	1 hr. 59 min.			7	1	1 3/4
C-11-RC-26	11"	11" square columns; aggregate concrete (3834 psi); Reinforcement: vertical, four 5/8" rebars; horizontal, 5/16" ties at 4 1/2" pitch; Cover: 1 1/2".	71.4 tons	53 min.			7	1	3/4

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

**Notes:**

1. Failure mode - collapse.
2. Passed 2 hour fire exposure.
3. Passed hose stream test.
4. Reloaded effectively after 48 hours but collapsed at load in excess of original test load.
5. Failing load was 150 tons.
6. Failing load was 112 tons.
7. Failed during hose stream test.
8. Range of load 58.8 tons (initial) to 92 tons (92 minutes) to 60 tons (80 minutes).
9. Collapsed at 44 tons in reload after 96 hours.
10. Withstood reload after 72 hours.
11. Collapsed on reload after 48 hours.

**TABLE 2.1.3—REINFORCED CONCRETE COLUMNS  
MINIMUM DIMENSION 12" TO LESS THAN 14"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-12-RC-1	12"	12" square columns; gravel aggregate concrete (2647 psi); Reinforcement: vertical, four 5/8" rebars; horizontal, 5/16" ties at 4 1/2" pitch; Cover: 2".	78.2 tons	38 min.		1	7	1	1/2
C-12-RC-2	12"	Reinforced columns with 1 1/2" concrete outside of reinforced steel; Gross diameter or side of column: 12"; Group I, Column A.	—	6 hrs.		1		2, 3	6
C-12-RC-3	12"	Description as per C-12-RC-2; Group I, Column B.	—	4 hrs.		1		2, 3	4
C-12-RC-4	12"	Description as per C-12-RC-2; Group II, Column A.	—	4 hrs.		1		2, 3	4
C-12-RC-5	12"	Description as per C-12-RC-2; Group II, Column B.	—	2 hrs. 30 min.		1		2, 3	2 1/2
C-12-RC-6	12"	Description as per C-12-RC-2; Group III, Column A.	—	3 hrs.		1		2, 3	3
C-12-RC-7	12"	Description as per C-12-RC-2; Group III, Column B.	—	2 hrs.		1		2, 3	2
C-12-RC-8	12"	Description as per C-12-RC-2; Group IV, Column A.	—	2 hrs.		1		2, 3	2
C-12-RC-9	12"	Description as per C-12-RC-2; Group IV, Column B.	—	1 hr. 30 min.		1		2, 3	1 1/2

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 pound per square yard = 5.3 N/m<sup>2</sup>.

**Notes:**

1. Failure mode - unspecified structural.
2. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.  
 Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.<sup>2</sup>, placed not more than 1 inch from the surface of the concrete.  
 Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.<sup>2</sup>, placed not more than 1 inch from the surface of the concrete.  
 Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.
3. Groupings of aggregates and ties are the same as for structural steel columns protected solidly with concrete, the ties to be placed over the vertical reinforcing bars and the mesh where required, to be placed within 1 inch from the surface of the column.  
 Column A: working loads are assumed as carried by the area of the column inside of the lines circumscribing the reinforcing steel.  
 Column B: working loads are assumed as carried by the gross area of the column.

**TABLE 2.1.4—REINFORCED CONCRETE COLUMNS  
MINIMUM DIMENSION 14" TO LESS THAN 16"**

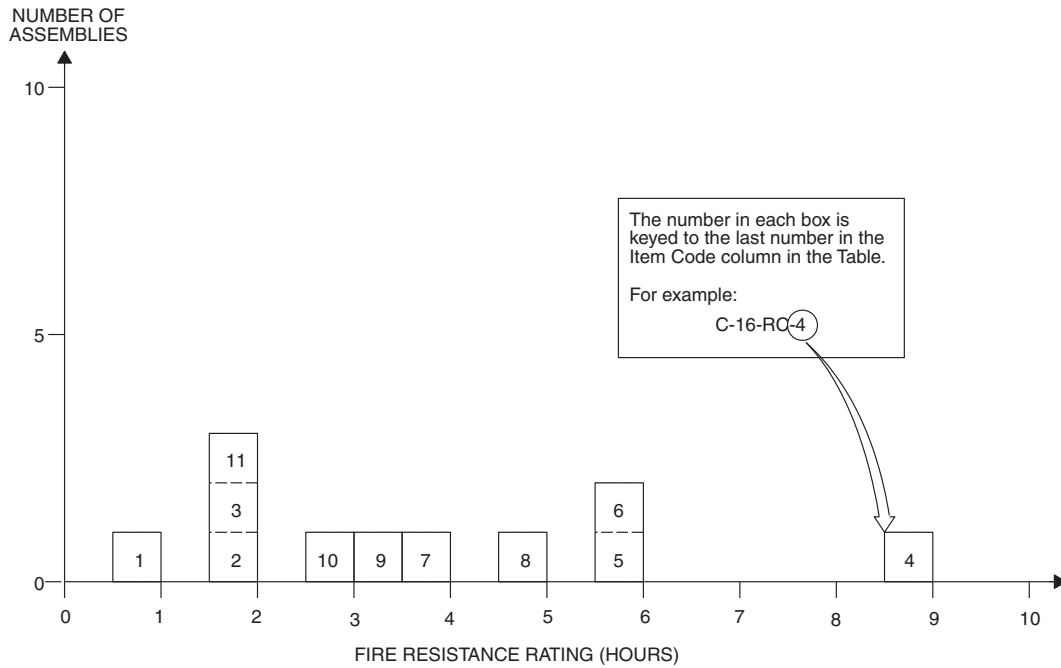
ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-14-RC-1	14"	14" square columns; gravel aggregate concrete (4295 psi); Reinforcement: vertical four 3/4" rebars; horizontal: 1/4" ties at 9" pitch; Cover: 1 1/2".	86 tons	1 hr. 22 min.			7	1	1 1/4
C-14-RC-2	14"	Reinforced concrete columns with 1 1/2" concrete outside reinforcing steel; Gross diameter or side of column: 12"; Group I, Column A.	—	7 hrs.		1		2, 3	7
C-14-RC-3	14"	Description as per C-14-RC-2; Group II, Column B.	—	5 hrs.		1		2, 3	5
C-14-RC-4	14"	Description as per C-14-RC-2; Group III, Column A.	—	5 hrs.		1		2, 3	5
C-14-RC-5	14"	Description as per C-14-RC-2; Group IV, Column B.	—	3 hrs. 30 min.		1		2, 3	3 1/2
C-14-RC-6	14"	Description as per C-14-RC-2; Group III, Column A.	—	4 hrs.		1		2, 3	4
C-14-RC-7	14"	Description as per C-14-RC-2; Group III, Column B.	—	2 hrs. 30 min.		1		2, 3	2 1/2
C-14-RC-8	14"	Description as per C-14-RC-2; Group IV, Column A.	—	2 hrs. 30 min.		1		2, 3	2 1/2
C-14-RC-9	14"	Description as per C-14-RC-2; Group IV, Column B.	—	1 hr. 30 min.		1		2, 3	1 1/2

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 pound per square yard = 5.3 N/m<sup>2</sup>.

**Notes:**

1. Failure mode - main rebars buckled between links at various points.
2. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.  
 Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.<sup>2</sup>, placed not more than 1 inch from the surface of the concrete.  
 Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.<sup>2</sup>, placed not more than 1 inch from the surface of the concrete.  
 Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.
3. Groupings of aggregates and ties are the same as for structural steel columns protected solidly with concrete, the ties to be placed over the vertical reinforcing bars and the mesh where required, to be placed within 1 inch from the surface of the column.  
 Column A: working loads are assumed as carried by the area of the column inside of the lines circumscribing the reinforcing steel.  
 Column B: working loads are assumed as carried by the gross area of the column.

**FIGURE 2.1.5—REINFORCED CONCRETE COLUMNS  
MINIMUM DIMENSION 16" TO LESS THAN 18"**



**TABLE 2.1.5—REINFORCED CONCRETE COLUMNS  
MINIMUM DIMENSION 16" TO LESS THAN 18"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-16-RC-1	16"	16" square columns; gravel aggregate concrete (4550 psi); Reinforcement: vertical, eight 1 <sup>3</sup> / <sub>8</sub> " rebars; horizontal, 5 <sup>5</sup> / <sub>16</sub> " ties at 6" pitch 1 <sup>3</sup> / <sub>8</sub> " below column surface and 5 <sup>5</sup> / <sub>16</sub> " ties at 6" pitch linking center rebars of each face forming a smaller square in column cross section.	237 tons	1 hr			7	1, 2, 3	1
C-16-RC-2	16"	16" square columns; gravel aggregate concrete (3360 psi); Reinforcement: vertical, eight 1 <sup>3</sup> / <sub>8</sub> " rebars; horizontal, 5 <sup>5</sup> / <sub>16</sub> " ties at 6" pitch; Cover: 1 <sup>3</sup> / <sub>8</sub> ".	210 tons	2 hrs.			7	2, 4, 5, 6	2
C-16-RC-3	16"	16" square columns; gravel aggregate concrete (3980 psi); Reinforcement: vertical, four 7 <sup>7</sup> / <sub>8</sub> " rebars; horizontal, 3 <sup>3</sup> / <sub>8</sub> " ties at 6" pitch; Cover: 1".	123.5 tons	2 hrs.			7	2, 4, 7	2
C-16-RC-4	16"	Reinforced concrete columns with 1 <sup>1</sup> / <sub>2</sub> " concrete outside reinforcing steel; Gross diameter or side of column: 16"; Group I, Column A.	—	9 hrs.		1		8, 9	9
C-16-RC-5	16"	Description as per C-16-RC-4; Group I, Column B.	—	6 hrs.		1		8, 9	6

(Continued)

**TABLE 2.1.5—REINFORCED CONCRETE COLUMNS  
MINIMUM DIMENSION 16" TO LESS THAN 18"—continued**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-16-RC-6	16"	Description as per C-16-RC-4; Group II, Column A.	—	6 hrs.		1		8, 9	6
C-16-RC-7	16"	Description as per C-16-RC-4; Group II, Column B.	—	4 hrs.		1		8, 9	4
C-16-RC-8	16"	Description as per C-16-RC-4; Group III, Column A.	—	5 hrs.		1		8, 9	5
C-16-RC-9	16"	Description as per C-16-RC-4; Group III, Column B.	—	3 hrs. 30 min.		1		8, 9	3½
C-16-RC-10	16"	Description as per C-16-RC-4; Group IV, Column A.	—	3 hrs.		1		8, 9	3
C-16-RC-11	16"	Description as per C-16-RC-4; Group IV, Column B.	—	2 hrs.		1		8, 9	2

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 pound per square yard = 5.3 N/m<sup>2</sup>.

**Notes:**

1. Column passed 1-hour fire test.
2. Column passed hose stream test.
3. No reload specified.
4. Column passed 2-hour fire test.
5. Column reloaded successfully after 24 hours.
6. Reinforcing details same as C-16-RC-1.
7. Column passed reload after 72 hours.
8. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.  
 Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.<sup>2</sup>, placed not more than 1 inch from the surface of the concrete.  
 Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.<sup>2</sup>, placed not more than 1 inch from the surface of the concrete.  
 Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.
9. Groupings of aggregates and ties are the same as for structural steel columns protected solidly with concrete, the ties to be placed over the vertical reinforcing bars and the mesh where required, to be placed within 1 inch from the surface of the column.  
 Column A: working loads are assumed as carried by the area of the column inside of the lines circumscribing the reinforcing steel.  
 Column B: working loads are assumed as carried by the gross area of the column.



**TABLE 2.1.6—REINFORCED CONCRETE COLUMNS  
MINIMUM DIMENSION 18" TO LESS THAN 20"**

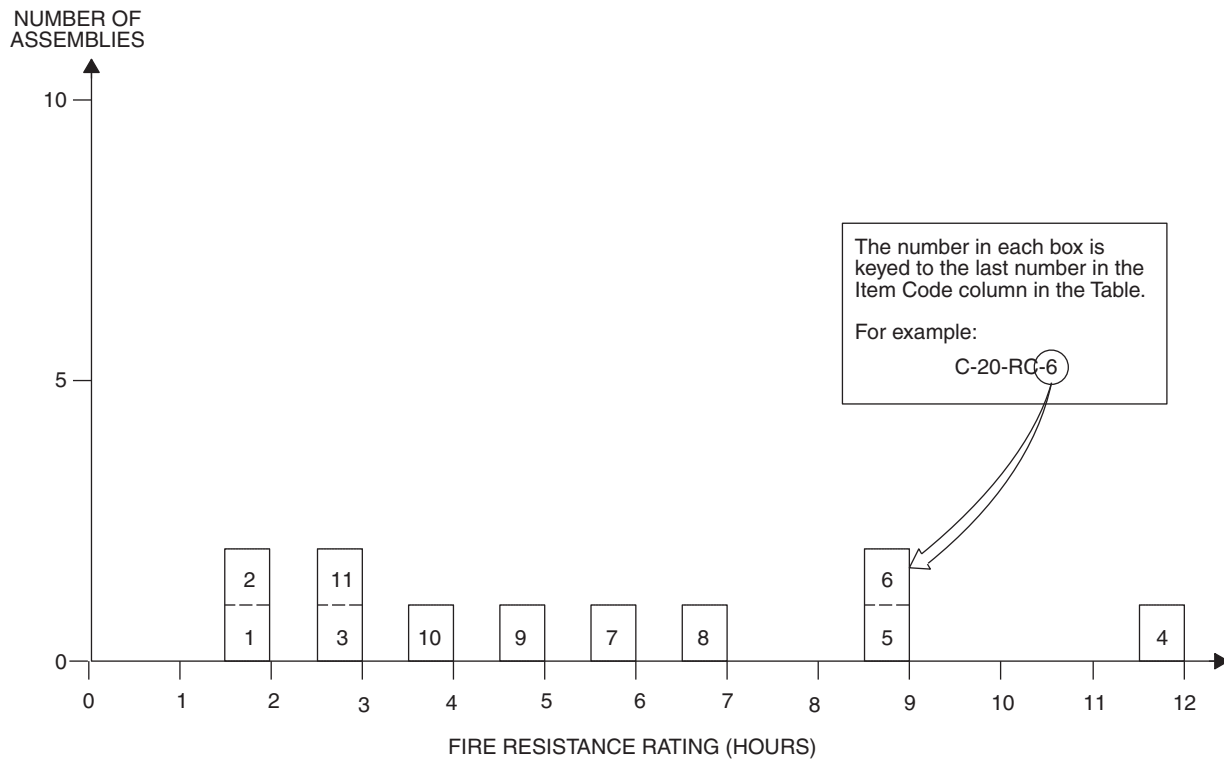
ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-18-RC-1	18"	Reinforced concrete columns with 1½" concrete outside reinforced steel; Gross diameter or side of column: 18"; Group I, Column A.	—	11 hrs.		1		1, 2	11
C-18-RC-2	18"	Description as per C-18-RC-1; Group I, Column B.	—	8 hrs.		1		1, 2	8
C-18-RC-3	18"	Description as per C-18-RC-1; Group II, Column A.	—	7 hrs.		1		1, 2	7
C-18-RC-4	18"	Description as per C-18-RC-1; Group II, Column B.	—	5 hrs.		1		1, 2	5
C-18-RC-5	18"	Description as per C-18-RC-1; Group III, Column A.	—	6 hrs.		1		1, 2	6
C-18-RC-6	18"	Description as per C-18-RC-1; Group III, Column B.	—	4 hrs.		1		1, 2	4
C-18-RC-7	18"	Description as per C-18-RC-1; Group IV, Column A.	—	3 hrs. 30 min.		1		1, 2	3½
C-18-RC-8	18"	Description as per C-18-RC-1; Group IV, Column B.	—	2 hrs. 30 min.		1		1, 2	2½

For SI: 1 inch = 25.4 mm, 1 pound per square yard = 5.3 N/m<sup>2</sup>.

**Notes:**

1. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.  
 Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.<sup>2</sup>, placed not more than 1 inch from the surface of the concrete.  
 Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.<sup>2</sup>, placed not more than 1 inch from the surface of the concrete.  
 Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint and, tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.
2. Groupings of aggregates and ties are the same as for structural steel columns protected solidly with concrete, the ties to be placed over the vertical reinforcing bars and the mesh where required, to be placed within 1 inch from the surface of the column.  
 Column A: working loads are assumed as carried by the area of the column inside of the lines circumscribing the reinforcing steel.  
 Column B: working loads are assumed as carried by the gross area of the column.

**FIGURE 2.1.7—REINFORCED CONCRETE COLUMNS  
MINIMUM DIMENSION 20" TO LESS THAN 22"**



**TABLE 2.1.7—REINFORCED CONCRETE COLUMNS  
MINIMUM DIMENSION 20" TO LESS THAN 22"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-20-RC-1	20"	20" square columns; gravel aggregate concrete (6690 psi); Reinforcement: vertical, four 1 <sup>3</sup> / <sub>4</sub> " rebars; horizontal, 3 <sup>3</sup> / <sub>8</sub> " wire at 6" pitch; Cover 1 <sup>3</sup> / <sub>4</sub> ".	367 tons	2 hrs.			7	1, 2, 3	2
C-20-RC-2	20"	20" square columns; gravel aggregate concrete (4330 psi); Reinforcement: vertical, four 1 <sup>3</sup> / <sub>4</sub> " rebars; horizontal, 3 <sup>3</sup> / <sub>8</sub> " ties at 6" pitch; Cover 1 <sup>3</sup> / <sub>4</sub> ".	327 tons	2 hrs.			7	1, 2, 4	2
C-20-RC-3	20 <sup>1</sup> / <sub>4</sub> "	20" square columns; gravel aggregate concrete (4230 psi); Reinforcement: vertical, four 1 <sup>1</sup> / <sub>8</sub> " rebars; horizontal, 3 <sup>3</sup> / <sub>8</sub> " wire at 5" pitch; Cover 1 <sup>1</sup> / <sub>8</sub> ".	199 tons	2 hrs. 56 min.			7	5	2 <sup>3</sup> / <sub>4</sub>
C-20-RC-4	20"	Reinforced concrete columns with 1 <sup>1</sup> / <sub>2</sub> " concrete outside of reinforcing steel; Gross diameter or side of column: 20"; Group I, Column A.	—	12 hrs.		1		6, 7	12
C-20-RC-5	20"	Description as per C-20-RC-4; Group I, Column B.	—	9 hrs.		1		6, 7	9
C-20-RC-6	20"	Description as per C-20-RC-4; Group II, Column A.	—	9 hrs.		1		6, 7	9

(Continued)

**TABLE 2.1.7—REINFORCED CONCRETE COLUMNS  
MINIMUM DIMENSION 20" TO LESS THAN 22"—continued**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-20-RC-7	20"	Description as per C-20-RC-4; Group II, Column B.	—	6 hrs		1		6, 7	6
C-20-RC-8	20"	Description as per C-20-RC-4; Group III, Column A.	—	7 hrs.		1		6, 7	7
C-20-RC-9	20"	Description as per C-20-RC-4; Group III, Column B.	—	5 hrs.		1		6, 7	5
C-20-RC-10	20"	Description as per C-20-RC-4; Group IV, Column A.	—	4 hrs.		1		6, 7	4
C-20-RC-11	20"	Description as per C-20-RC-4; Group IV, Column B.	—	3 hrs.		1		6, 7	3

For SI: 1 inch = 25.4 mm, 1 pound per square yard = 5.3 N/m<sup>2</sup>, 1 ton = 8.896 kN.

**Notes:**

- Passed 2-hour fire test.
- Passed hose stream test.
- Failed during reload at 300 tons.
- Passed reload after 72 hours.
- Failure mode - collapse.
- Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.  
Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.<sup>2</sup>, placed not more than 1 inch from the surface of the concrete.  
Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.<sup>2</sup>, placed not more than 1 inch from the surface of the concrete.  
Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.
- Groupings of aggregates and ties are the same as for structural steel columns protected solidly with concrete, the ties to be placed over the vertical reinforcing bars and the mesh where required, to be placed within 1 inch from the surface of the column.  
Column A: working loads are assumed as carried by the area of the column inside of the lines circumscribing the reinforcing steel.  
Column B: working loads are assumed as carried by the gross area of the column.

**TABLE 2.1.8—HEXAGONAL REINFORCED CONCRETE COLUMNS  
MINIMUM DIMENSION 12" TO LESS THAN 14"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-12-HRC-1	12"	12" hexagonal columns; gravel aggregate concrete (4420 psi); Reinforcement: vertical, eight 1/2" rebars; horizontal, 5/16" helical winding at 1 1/2" pitch; Cover: 1/2".	88 tons	58 min.			7	1	3/4
C-12-HRC-2	12"	12" hexagonal columns; gravel aggregate concrete (3460 psi); Reinforcement: vertical, eight 1/2" rebars; horizontal, 5/16" helical winding at 1 1/2" pitch; Cover: 1/2".	78.7 tons	1 hr.			7	2	1

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

**Notes:**

- Failure mode - collapse.
- Test stopped at 1 hour.

RESOURCE A

**TABLE 2.1.9—HEXAGONAL REINFORCED CONCRETE COLUMNS  
MINIMUM DIMENSION 14" TO LESS THAN 16"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-14-HRC-1	14"	14" hexagonal columns; gravel aggregate concrete (4970 psi); Reinforcement: vertical, eight 1/2" rebars; horizontal, 5/16" helical winding on 2" pitch; Cover: 1/2".	90 tons	2 hrs.			7	1, 2, 3	2

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

**Notes:**

1. Withstood 2-hour fire test.
2. Withstood hose stream test.
3. Withstood reload after 48 hours.

**TABLE 2.1.10—HEXAGONAL REINFORCED CONCRETE COLUMNS  
DIAMETER — 16" TO LESS THAN 18"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-16-HRC-1	16"	16" hexagonal columns; gravel concrete (6320 psi); Reinforcement: vertical, eight 5/8" rebars; horizontal, 5/16" helical winding on 3/4" pitch; Cover: 1/2".	140 tons	1 hr. 55 min.			7	1	1 3/4
C-16-HRC-2	16"	16" hexagonal columns; gravel aggregate concrete (5580 psi); Reinforcement: vertical, eight 5/8" rebars; horizontal, 5/16" helical winding on 1 3/4" pitch; Cover: 1/2".	124 tons	2 hrs.			7	2	2

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

**Notes:**

1. Failure mode - collapse.
2. Failed on furnace removal.

**TABLE 2.1.11—HEXAGONAL REINFORCED CONCRETE COLUMNS  
DIAMETER — 20" TO LESS THAN 22"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-20-HRC-1	20"	20" hexagonal columns; gravel concrete (6080 psi); Reinforcement: vertical, 3/4" rebars; horizontal, 5/16" helical winding on 1 3/4" pitch; Cover: 1/2".	211 tons	2 hrs.			7	1	2
C-20-HRC-2	20"	20" hexagonal columns; gravel concrete (5080 psi); Reinforcement: vertical, 3/4" rebars; horizontal, 5/16" wire on 1 3/4" pitch; Cover: 1/2".	184 tons	2 hrs. 15 min.			7	2, 3, 4	2 1/4

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

**Notes:**

1. Column collapsed on furnace removal.
2. Passed 2 1/4-hour fire test.
3. Passed hose stream test.
4. Withstood reload after 48 hours.

TABLE 2.2—ROUND CAST IRON COLUMNS

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-7-CI-1	7" O.D.	Column: .6" minimum metal thickness; unprotected.	—	30 min.		1			1/2
C-7-CI-2	7" O.D.	Column: .6" minimum metal thickness concrete filled, outside unprotected.	—	45 min.		1			3/4
C-11-CI-3	11" O.D.	Column: .6" minimum metal thickness; Protection: 1 1/2" portland cement plaster on high ribbed metal lath, 1/2" broken air space.	—	3 hrs.		1			3
C-11-CI-4	11" O.D.	Column: .6" minimum metal thickness; Protection: 2" concrete other than siliceous aggregate.	—	2 hrs. 30 min.		1			2 1/2
C-12-CI-5	12.5" O.D.	Column: 7" O.D. .6" minimum metal thickness; Protection: 2" porous hollow tile, 3/4" mortar between tile and column, outside wire ties.	—	3 hrs.		1			3
C-7-CI-6	7.6" O.D.	Column: 7" I.D., 3/10" minimum metal thickness, concrete filled unprotected.	—	30 min.		1			1/2
C-8-CI-7	8.6" O.D.	Column: 8" I.D., 3/10" minimum metal thickness; concrete filled reinforced with four 3 1/2" x 3/8" angles, in fill; unprotected outside.	—	1 hr.		1			1

For SI: 1 inch = 25.4 mm.

FIGURE 2.3—STEEL COLUMNS—GYPSUM ENCASEMENTS

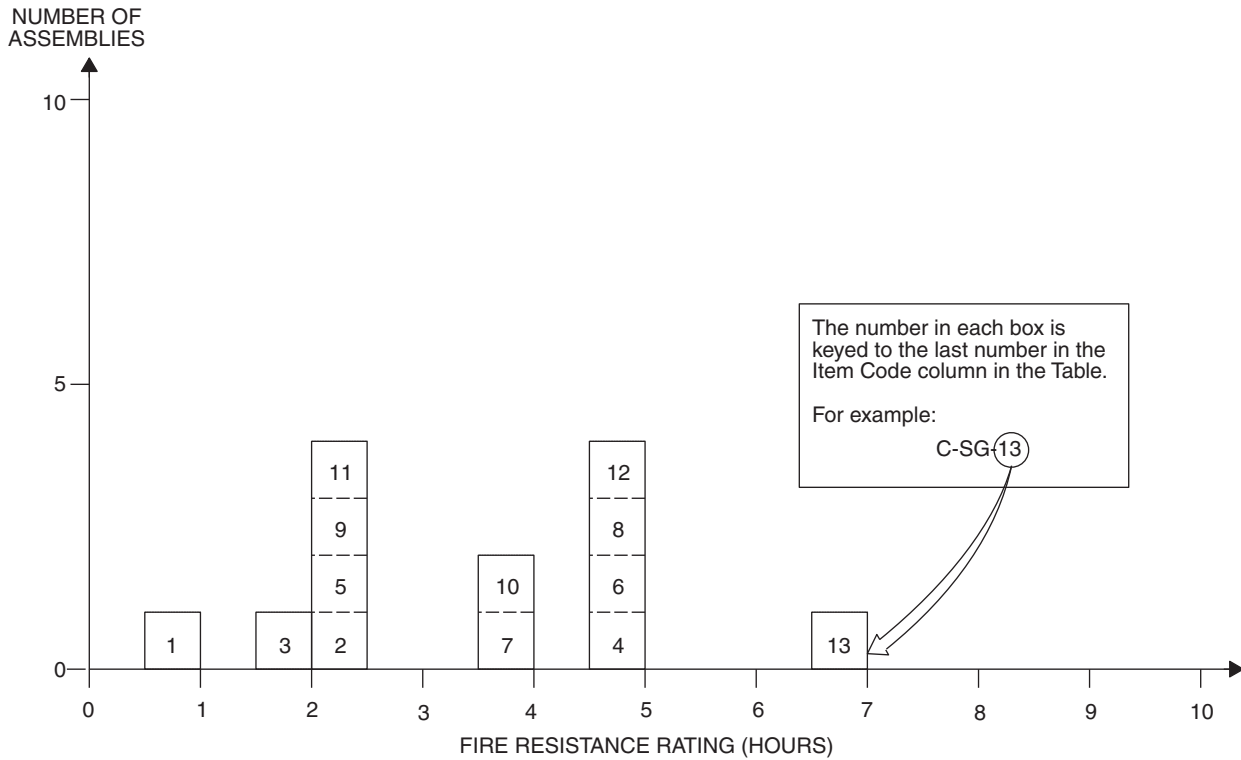


TABLE 2.3—STEEL COLUMNS—GYPSUM ENCASEMENTS

ITEM CODE	MINIMUM AREA OF SOLID MATERIAL	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-SG-1	—	Steel protected with $\frac{3}{4}$ " 1:3 sanded gypsum or 1" 1:2½ portland cement plaster on wire or lath; one layer.	—	1 hr.		1			1
C-SG-2	—	Same as C-SG-1; two layers.	—	2 hrs. 30 min.		1			2½
C-SG-3	130 in. <sup>2</sup>	2" solid blocks with wire mesh in horizontal joints; 1" mortar on flange; reentrant space filled with block and mortar.	—	2 hrs.		1			2
C-SG-4	150 in. <sup>2</sup>	Same as C-130-SG-3 with ½" sanded gypsum plaster.	—	5 hrs.		1			5
C-SG-5	130 in. <sup>2</sup>	2" solid blocks with wire mesh in horizontal joints; 1" mortar on flange; reentrant space filled with gypsum concrete.	—	2 hrs. 30 min.		1			2½
C-SG-6	150 in. <sup>2</sup>	Same as C-130-SG-5 with ½" sanded gypsum plaster.	—	5 hrs.		1			5
C-SG-7	300 in. <sup>2</sup>	4" solid blocks with wire mesh in horizontal joints; 1" mortar on flange; reentrant space filled with block and mortar.	—	4 hrs.		1			4
C-SG-8	300 in. <sup>2</sup>	Same as C-300-SG-7 with reentrant space filled with gypsum concrete.	—	5 hrs.		1			5

**TABLE 2.3—STEEL COLUMNS—GYPSUM ENCASEMENTS—continued**

ITEM CODE	MINIMUM AREA OF SOLID MATERIAL	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-SG-9	85 in. <sup>2</sup>	2" solid blocks with cramps at horizontal joints; mortar on flange only at horizontal joints; reentrant space not filled.	—	2 hrs. 30 min.		1			2½
C-SG-10	105 in. <sup>2</sup>	Same as C-85-SG-9 with ½" sanded gypsum plaster.	—	4 hrs.		1			4
C-SG-11	95 in. <sup>2</sup>	3" hollow blocks with cramps at horizontal joints; mortar on flange only at horizontal joints; reentrant space not filled.	—	2 hrs. 30 min.		1			2½
C-SG-12	120 in. <sup>2</sup>	Same as C-95-SG-11 with ½" sanded gypsum plaster.	—	5 hrs.		1			5
C-SG-13	130 in. <sup>2</sup>	2" neat fibered gypsum reentrant space filled poured solid and reinforced with 4" × 4" wire mesh ½" sanded gypsum plaster.	—	7 hrs.		1			7

For SI: 1 inch = 25.4 mm, 1 square inch = 645 mm<sup>2</sup>.

**TABLE 2.4—TIMBER COLUMNS  
MINIMUM DIMENSION**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-11-TC-1	11"	With unprotected steel plate cap.	—	30 min.		1		1, 2	½
C-11-TC-2	11"	With unprotected cast iron cap and pintle.	—	45 min.		1		1, 2	¾
C-11-TC-3	11"	With concrete or protected steel or cast iron cap.	—	1 hr. 15 min.		1		1, 2	1¼
C-11-TC-4	11"	With ¾" gypsum wallboard over column and over cast iron or steel cap.	—	1 hr. 15 min.		1		1, 2	1¼
C-11-TC-5	11"	With 1" portland cement plaster on wire lath over column and over cast iron or steel cap; ¾" air space.	—	2 hrs.		1		1, 2	2

For SI: 1 inch = 25.4 mm, 1 square inch = 645 mm<sup>2</sup>.

**Notes:**

1. Minimum area: 120 square inches.
2. Type of wood: long leaf pine or Douglas fir.

**TABLE 2.5.1.1—STEEL COLUMNS—CONCRETE ENCASEMENTS  
MINIMUM DIMENSION LESS THAN 6"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-5-SC-1	5"	5" × 6" outer dimensions; 4" × 3" × 10 lbs. "H" beam; Protection: gravel concrete (4900 psi) 6" × 4" - 13 SWG mesh.	12 tons	1 hr. 29 min.			7	1	1¼

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

**Notes:**

1. Failure mode - collapse.

**TABLE 2.5.1.2—STEEL COLUMNS—CONCRETE ENCASEMENTS  
6" TO LESS THAN 8" THICK**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-7-SC-1	7"	7" × 8" column; 4" × 3" × 10 lbs. "H" beam; Protection: brick filled concrete (6220 psi); 6" × 4" mesh - 13 SWG; 1" below column surface.	12 tons	2 hrs. 46 min.			7	1	2 <sup>3</sup> / <sub>4</sub>
C-7-SC-2	7"	7" × 8" column; 4" × 3" × 10 lbs. "H" beam; Protection: gravel concrete (5140 psi); 6" × 4" 13 SWG mesh 1" below surface.	12 tons	3 hrs. 1 min.			7	1	3
C-7-SC-3	7"	7" × 8" column; 4" × 3" × 10 lbs. "H" beam; Protection: concrete (4540 psi); 6" × 4" - 13 SWG mesh; 1" below column surface.	12 tons	3 hrs. 9 min.			7	1	3
C-7-SC-4	7"	7" × 8" column; 4" × 3" × 10 lbs. "H" beam; Protection: gravel concrete (5520 psi); 4" × 4" mesh; 16 SWG.	12 tons	2 hrs. 50 min.			7	1	2 <sup>3</sup> / <sub>4</sub>

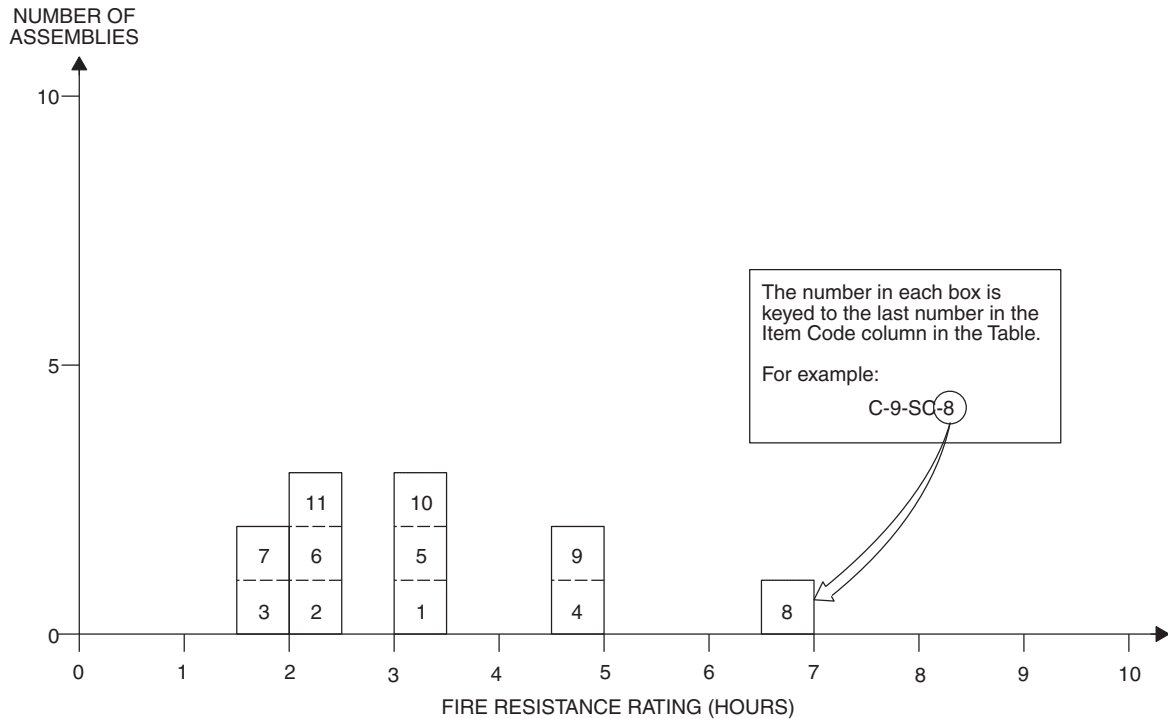
For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

**Notes:**

1. Failure mode - collapse.



**FIGURE 2.5.1.3—STEEL COLUMNS—CONCRETE ENCASEMENTS  
MINIMUM DIMENSION 8" TO LESS THAN 10"**



**TABLE 2.5.1.3—STEEL COLUMNS—CONCRETE ENCASEMENTS  
MINIMUM DIMENSION 8" TO LESS THAN 10"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-8-SC-1	8 1/2"	8 1/2" x 10" column; 6" x 4 1/2" x 20 lbs. "H" beam; Protection: gravel concrete (5140 psi); 6" x 4" - 13 SWG mesh.	39 tons	3 hrs. 8 min.			7	1	3
C-8-SC-2	8"	8" x 10" column; 8" x 6" x 35 lbs. "I" beam; Protection: gravel concrete (4240 psi); 6" x 4" - 13 SWG mesh; 1/2" cover.	90 tons	2 hrs. 1 min.			7	1	2
C-8-SC-3	8"	8" x 10" concrete encased column; 8" x 6" x 35 lbs. "H" beam; protection: aggregate concrete (3750 psi); 4" mesh - 16 SWG reinforcing 1/2" below column surface.	90 tons	1 hr. 58 min.			7	1	1 3/4
C-8-SC-4	8"	6" x 6" steel column; 2" outside protection; Group I.	—	5 hrs.		1		2	5
C-8-SC-5	8"	6" x 6" steel column; 2" outside protection; Group II.	—	3 hrs. 30 min.		1		2	3 1/2
C-8-SC-6	8"	6" x 6" steel column; 2" outside protection; Group III.	—	2 hrs. 30 min.		1		2	2 1/2
C-8-SC-7	8"	6" x 6" steel column; 2" outside protection; Group IV.	—	1 hr. 45 min.		1		2	1 3/4

(Continued)

**TABLE 2.5.1.3—STEEL COLUMNS—CONCRETE ENCASEMENTS  
MINIMUM DIMENSION 8" TO LESS THAN 10"—continued**

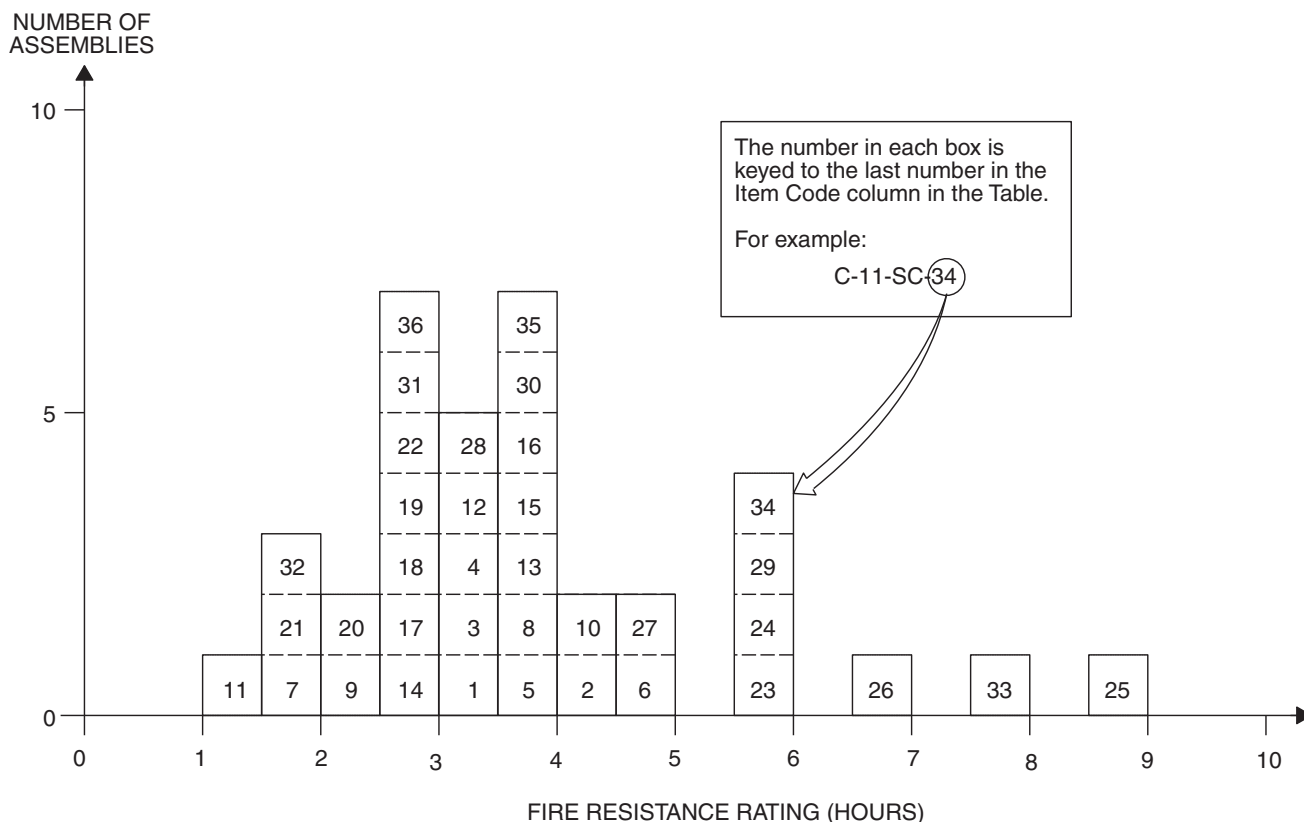
ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-9-SC-8	9"	6" × 6" steel column; 3" outside protection; Group I.	—	7 hrs.		1		2	7
C-9-SC-9	9"	6" × 6" steel column; 3" outside protection; Group II.	—	5 hrs.		1		2	5
C-9-SC-10	9"	6" × 6" steel column; 3" outside protection; Group III.	—	3 hrs. 30 min.		1		2	3½
C-9-SC-11	9"	6" × 6" steel column; 3" outside protection; Group IV.	—	2 hrs. 30 min.		1		2	2½

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 pound per square yard = 5.3 N/m<sup>2</sup>, 1 ton = 8.896 kN.

**Notes:**

1. Failure mode - collapse.
2. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.
- Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.<sup>2</sup>, placed not more than 1 inch from the surface of the concrete.
- Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.<sup>2</sup>, placed not more than 1 inch from the surface of the concrete.
- Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.

**FIGURE 2.5.1.4—STEEL COLUMNS—CONCRETE ENCASEMENTS  
MINIMUM DIMENSION 10" TO LESS THAN 12"**



**TABLE 2.5.1.4—STEEL COLUMNS—CONCRETE ENCASEMENTS  
MINIMUM DIMENSION 10" TO LESS THAN 12"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-10-SC-1	10"	10" x 12" concrete encased steel column; 8" x 6" x 35 lbs. "H" beam; Protection: gravel aggregate concrete (3640 psi); Mesh 6" x 4" 13 SWG, 1" below column surface.	90 tons	3 hrs. 7 min.			7	1,2	3
C-10-SC-2	10"	10" x 16" column; 8" x 6" x 35 lbs. "H" beam; Protection: clay brick concrete (3630 psi); 6" x 4" mesh; 13 SWG, 1" below column surface.	90 tons	4 hrs. 6 min.			7	2	4
C-10-SC-3	10"	10" x 12" column; 8" x 6" x 35 lbs. "H" beam; Protection: crushed stone and sand concrete (3930 psi); 6" x 4" - 13 SWG mesh; 1" below column surface.	90 tons	3 hrs. 17 min.			7	2	3 1/4
C-10-SC-4	10"	10" x 12" column; 8" x 6" x 35 lbs. "H" beam; Protection: crushed basalt and sand concrete (4350 psi); 6" x 4" - 13 SWG mesh; 1" below column surface.	90 tons	3 hrs. 22 min.			7	2	3 1/3

(Continued)

**TABLE 2.5.1.4—STEEL COLUMNS—CONCRETE ENCASEMENTS  
MINIMUM DIMENSION 10" TO LESS THAN 12"—continued**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-10-SC-5	10"	10" × 12" column; 8" × 6" × 35 lbs. "H" beam; Protection: gravel aggregate concrete (5570 psi); 6" × 4" mesh; 13 SWG.	90 tons	3 hrs. 39 min.			7	2	3½
C-10-SC-6	10"	10" × 16" column; 8" × 6" × 35 lbs. "I" beam; Protection: gravel concrete (4950 psi); mesh; 6" × 4" 13 SWG 1" below column surface.	90 tons	4 hrs. 32 min.			7	2	4½
C-10-SC-7	10"	10" × 12" concrete encased steel column; 8" × 6" × 35 lbs. "H" beam; Protection: aggregate concrete (1370 psi); 6" × 4" mesh; 13 SWG reinforcing 1" below column surface.	90 tons	2 hrs.			7	3, 4	2
C-10-SC-8	10"	10" × 12" concrete encased steel column; 8" × 6" × 35 lbs. "H" column; Protection: aggregate concrete (4000 psi); 13 SWG iron wire loosely around column at 6" pitch about 2" beneath column surface.	86 tons	3 hrs. 36 min.			7	2	3½
C-10-SC-9	10"	10" × 12" concrete encased steel column; 8" × 6" × 35 lbs. "H" beam; Protection: aggregate concrete (3290 psi); 2" cover minimum.	86 tons	2 hrs. 8 min.			7	2	2
C-10-SC-10	10"	10" × 14" concrete encased steel column; 8" × 6" × 35 lbs. "H" column; Protection: crushed brick filled concrete (5310 psi); 6" × 4" mesh; 13 SWG reinforcement 1" below column surface.	90 tons	4 hrs. 28 min.			7	2	4⅓
C-10-SC-11	10"	10" × 14" concrete encased column; 8" × 6" 35 lbs. "H" beam; Protection: aggregate concrete (342 psi); 6" × 4" mesh; 13 SWG reinforcement 1" below surface.	90 tons	1 hr. 2 min.			7	2	1
C-10-SC-12	10"	10" × 12" concrete encased steel column; 8" × 6" × 35 lbs. "H" beam; Protection: aggregate concrete (4480 psi); four 3/8" vertical bars at "H" beam edges with 3/16" spacers at beam surface at 3' pitch and 3/16" binders at 10" pitch; 2" concrete cover.	90 tons	3 hrs. 2 min.			7	2	3

(Continued)

**TABLE 2.5.1.4—STEEL COLUMNS—CONCRETE ENCASEMENTS  
MINIMUM DIMENSION 10" TO LESS THAN 12"—continued**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-10-SC-13	10"	10" × 12" concrete encased steel column; 8" × 6" × 35 lbs. "H" beam; Protection: aggregate concrete (5070 psi); 6" × 4" mesh; 13 SWG reinforcing at 6" beam sides wrapped and held by wire ties across (open) 8" beam face; reinforcements wrapped in 6" × 4" mesh; 13 SWG throughout; 1/2" cover to column surface.	90 tons	3 hrs. 59 min.			7	2	3 <sup>3</sup> / <sub>4</sub>
C-10-SC-14	10"	10" × 12" concrete encased steel column; 8" × 6" × 35 lbs. "H" beam; Protection: aggregate concrete (4410 psi); 6" × 4" mesh; 13 SWG reinforcement 1 1/4" below column surface; 1/2" limestone cement plaster with 3/8" gypsum plaster finish.	90 tons	2 hrs. 50 min.			7	2	2 <sup>3</sup> / <sub>4</sub>
C-10-SC-15	10"	10" × 12" concrete encased steel column; 8" × 6" × 35 lbs. "H" beam; Protection: crushed clay brick filled concrete (4260 psi); 6" × 4" mesh; 13 SWG reinforcing 1" below column surface.	90 tons	3 hrs. 54 min.			7	2	3 <sup>3</sup> / <sub>4</sub>
C-10-SC-16	10"	10" × 12" concrete encased steel column; 8" × 6" × 35 lbs. "H" beam; Protection: limestone aggregate concrete (4350 psi); 6" × 4" mesh; 13 SWG reinforcing 1" below column surface.	90 tons	3 hrs. 54 min.			7	2	3 <sup>3</sup> / <sub>4</sub>
C-10-SC-17	10"	10" × 12" concrete encased steel column; 8" × 6" × 35 lbs. "H" beam; Protection: limestone aggregate concrete (5300 psi); 6" × 4"; 13 SWG wire mesh 1" below column surface.	90 tons	3 hrs.			7	4, 5	3
C-10-SC-18	10"	10" × 12" concrete encased steel column; 8" × 6" × 35 lbs. "H" beam; Protection: limestone aggregate concrete (4800 psi) with 6" × 4"; 13 SWG mesh reinforcement 1" below surface.	90 tons	3 hrs.			7	4, 5	3
C-10-SC-19	10"	10" × 14" concrete encased steel column; 12" × 8" × 65 lbs. "H" beam; Protection: aggregate concrete (3900 psi); 4" mesh; 16 SWG reinforcing 1/2" below column surface.	118 tons	2 hrs. 42 min.			7	2	2
C-10-SC-20	10"	10" × 14" concrete encased steel column; 12" × 8" × 65 lbs. "H" beam; Protection: aggregate concrete (4930 psi); 4" mesh; 16 SWG reinforcing 1/2" below column surface.	177 tons	2 hrs. 8 min.			7	2	2

(Continued)

**TABLE 2.5.1.4—STEEL COLUMNS—CONCRETE ENCASEMENTS  
MINIMUM DIMENSION 10" TO LESS THAN 12"—continued**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-10-SC-21	10 <sup>3/8</sup> "	10 <sup>3/8</sup> " × 12 <sup>3/8</sup> " concrete encased steel column; 8" × 6" × 35 lbs. "H" beam; Protection: aggregate concrete (835 psi) with 6" × 4" mesh; 13 SWG reinforcing 1 <sup>3/16</sup> " below column surface; 3/16" gypsum plaster finish.	90 tons	2 hrs.			7	3, 4	2
C-11-SC-22	11"	11" × 13" concrete encased steel column; 8" × 6" × 35 lbs. "H" beam; Protection: "open texture" brick filled concrete (890 psi) with 6" × 4" mesh; 13 SWG reinforcing 1 <sup>1/2</sup> " below column surface; 3/8" lime cement plaster; 1/8" gypsum plaster finish.	90 tons	3 hrs.			7	6, 7	3
C-11-SC-23	11"	11" × 12" column; 4" × 3" × 10 lbs. "H" beam; gravel concrete (4550 psi); 6" × 4" - 13 SWG mesh reinforcing; 1" below column surface.	12 tons	6 hrs.			7	7, 8	6
C-11-SC-24	11"	11" × 12" column; 4" × 3" × 10 lbs. "H" beam; Protection: gravel aggregate concrete (3830 psi); with 4" × 4" mesh; 16 SWG, 1" below column surface.	16 tons	5 hrs. 32 min.			7	2	5 <sup>1/2</sup>
C-10-SC-25	10"	6" × 6" steel column with 4" outside protection; Group I.	—	9 hrs.			1	9	9
C-10-SC-26	10"	Description as per C-SC-25; Group II.	—	7 hrs.			1	9	7
C-10-SC-27	10"	Description as per C-10-SC-25; Group III.	—	5 hrs.			1	9	5
C-10-SC-28	10"	Description as per C-10-SC-25; Group IV.	—	3 hrs. 30 min.			1	9	3 <sup>1/2</sup>
C-10-SC-29	10"	8" × 8" steel column with 2" outside protection; Group I.	—	6 hrs.			1	9	6
C-10-SC-30	10"	Description as per C-10-SC-29; Group II.	—	4 hrs.			1	9	4
C-10-SC-31	10"	Description as per C-10-SC-29; Group III.	—	3 hrs.			1	9	3
C-10-SC-32	10"	Description as per C-10-SC-29; Group IV.	—	2 hrs.			1	9	2
C-11-SC-33	11"	8" × 8" steel column with 3" outside protection; Group I.	—	8 hrs.			1	9	8
C-11-SC-34	11"	Description as per C-10-SC-33; Group II.	—	6 hrs.			1	9	6
C-11-SC-35	11"	Description as per C-10-SC-33; Group III.	—	4 hrs.			1	9	4

(Continued)

**TABLE 2.5.1.4—STEEL COLUMNS—CONCRETE ENCASEMENTS  
MINIMUM DIMENSION 10" TO LESS THAN 12"—continued**

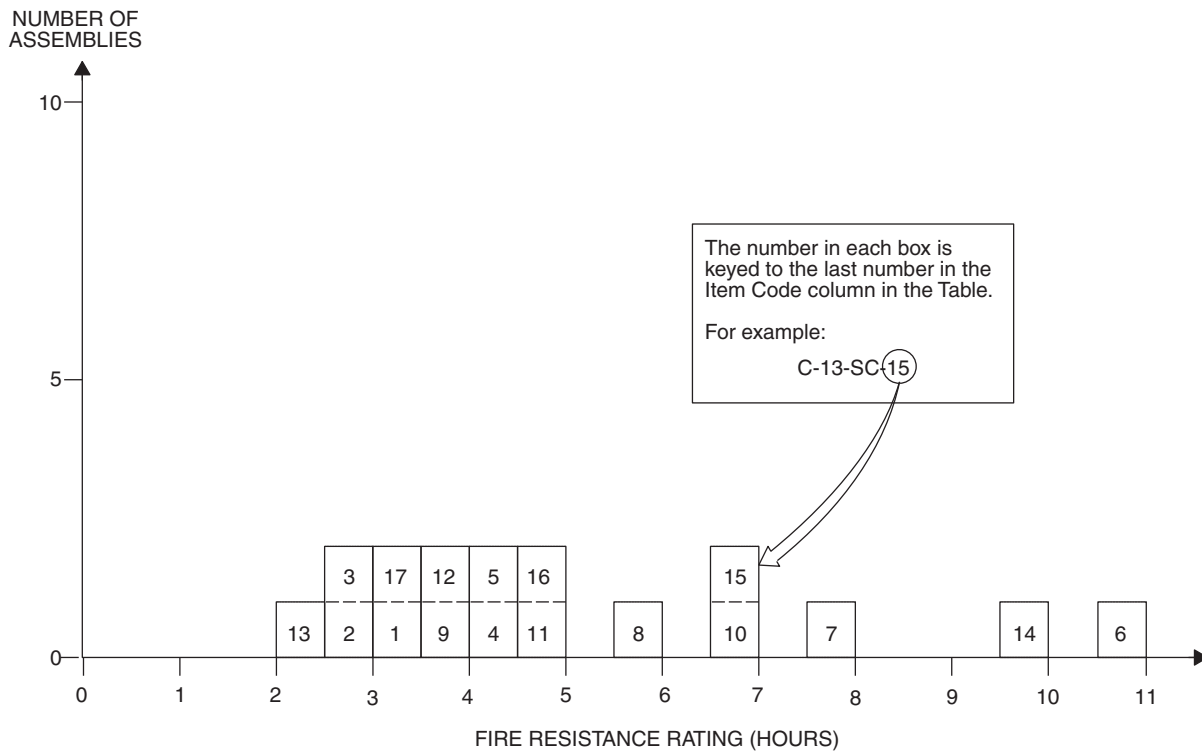
ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-11-SC-36	11"	Description as per C-10-SC-33; Group IV.	—	3 hrs.		1		9	3

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 pound per square yard = 5.3 N/m<sup>2</sup>, 1 ton = 8.896 kN.

**Notes:**

1. Tested under total restraint load to prevent expansion - minimum load 90 tons.
2. Failure mode - collapse.
3. Passed 2-hour fire test (Grade "C," British).
4. Passed hose stream test.
5. Column tested and passed 3-hour grade fire resistance (British).
6. Column passed 3-hour fire test.
7. Column collapsed during hose stream testing.
8. Column passed 6-hour fire test.
9. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.
- Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.<sup>2</sup>, placed not more than 1 inch from the surface of the concrete.
- Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.<sup>2</sup>, placed not more than 1 inch from the surface of the concrete.
- Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.

**FIGURE 2.5.1.5—STEEL COLUMNS—CONCRETE ENCASEMENTS  
MINIMUM DIMENSION 12" TO LESS THAN 14"**



**TABLE 2.5.1.5—STEEL COLUMNS—CONCRETE ENCASEMENTS  
MINIMUM DIMENSION 12" TO LESS THAN 14"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-12-SC-1	12"	12" x 14" concrete encased steel column; 8" x 6" x 35 lbs. "H" beam; Protection: aggregate concrete (4150 psi) with 4" mesh; 16 SWG reinforcing 1" below column surface.	120 tons	3 hrs. 24 min.			7	1	3 1/3
C-12-SC-2	12"	12" x 16" concrete encased column; 8" x 6" x 35 lbs. "H" beam; Protection: aggregate concrete (4300 psi) with 4" mesh; 16 SWG reinforcing 1" below column surface.	90 tons	2 hrs. 52 min.			7	1	2 3/4
C-12-SC-3	12"	12" x 16" concrete encased steel column; 12" x 8" x 65 lbs. "H" column; Protection: gravel aggregate concrete (3550 psi) with 4" mesh; 16 SWG reinforcement 1" below column surface.	177 tons	2 hrs. 31 min.			7	1	2 1/2
C-12-SC-4	12"	12" x 16" concrete encased column; 12" x 8" x 65 lbs. "H" beam; Protection: aggregate concrete (3450 psi) with 4" mesh; 16 SWG reinforcement 1" below column surface.	118 tons	4 hrs. 4 min.			7	1	4

(Continued)



**TABLE 2.5.1.5—STEEL COLUMNS—CONCRETE ENCASEMENTS  
MINIMUM DIMENSION 12" TO LESS THAN 14"—continued**

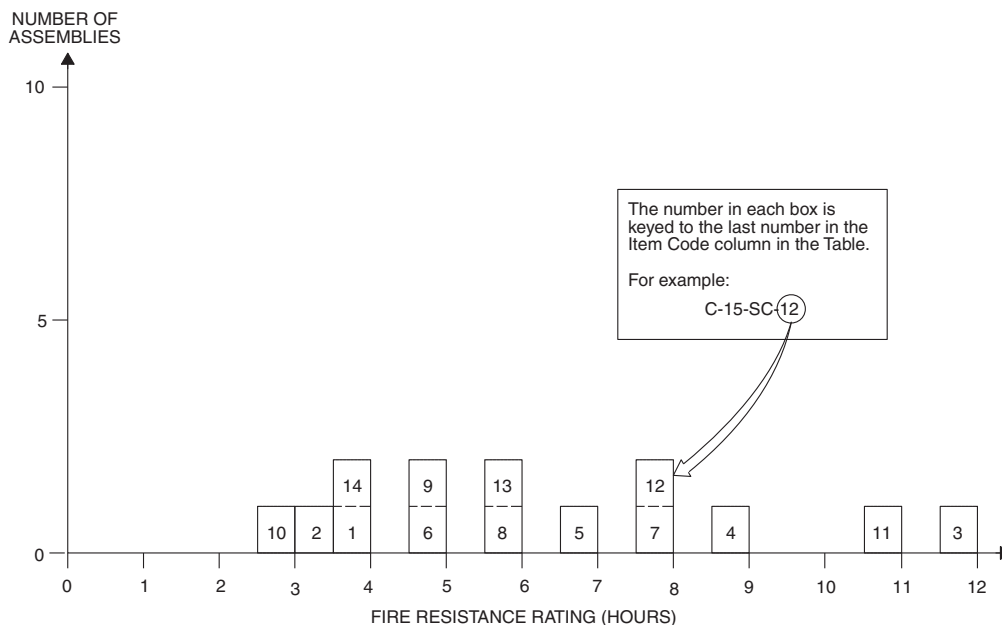
ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-12-SC-5	12 1/2"	12 1/2" x 14" column; 6" x 4 1/2" x 20 lbs. "H" beam; Protection: gravel aggregate concrete (3750 psi) with 4" x 4" mesh; 16 SWG reinforcing 1" below column surface.	52 tons	4 hrs. 29 min.			7	1	4 1/3
C-12-SC-6	12"	8" x 8" steel column; 2" outside protection; Group I.	—	11 hrs.			1	2	11
C-12-SC-7	12"	Description as per C-12-SC-6; Group II.	—	8 hrs.		1		2	8
C-12-SC-8	12"	Description as per C-12-SC-6; Group III.	—	6 hrs.		1		2	6
C-12-SC-9	12"	Description as per C-12-SC-6; Group IV.	—	4 hrs.		1		2	4
C-12-SC-10	12"	10" x 10" steel column; 2" outside protection; Group I.	—	7 hrs.		1		2	7
C-12-SC-11	12"	Description as per C-12-SC-10; Group II.	—	5 hrs.		1		2	5
C-12-SC-12	12"	Description as per C-12-SC-10; Group III.	—	4 hrs.		1		2	4
C-12-SC-13	12"	Description as per C-12-SC-10; Group IV.	—	2 hrs. 30 min.		1		2	2 1/2
C-13-SC-14	13"	10" x 10" steel column; 3" outside protection; Group I.	—	10 hrs.		1		2	10
C-13-SC-15	13"	Description as per C-12-SC-14; Group II.	—	7 hrs.		1		2	7
C-13-SC-16	13"	Description as per C-12-SC-14; Group III.	—	5 hrs.		1		2	5
C-13-SC-17	13"	Description as per C-12-SC-14; Group IV.	—	3 hrs. 30 min.		1		2	3 1/2

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 pound per square yard = 5.3 N/m<sup>2</sup>, 1 ton = 8.896 kN.

**Notes:**

1. Failure mode - collapse.
2. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.
- Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.<sup>2</sup>, placed not more than 1 inch from the surface of the concrete.
- Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.<sup>2</sup>, placed not more than 1 inch from the surface of the concrete.
- Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.

**FIGURE 2.5.1.6—STEEL COLUMNS—CONCRETE ENCASEMENTS  
MINIMUM DIMENSION 14" TO LESS THAN 16"**



**TABLE 2.5.1.6—STEEL COLUMNS—CONCRETE ENCASEMENTS  
MINIMUM DIMENSION 14" TO LESS THAN 16"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-14-SC-1	14"	24" × 16" concrete encased steel column; 8" × 6" × 35 lbs. "H" column; Protection: aggregate concrete (4240 psi); 4" mesh - 16 SWG reinforcing 1" below column surface.	90 tons	3 hrs. 40 min.			7	1	3
C-14-SC-2	14"	14" × 18" concrete encased steel column; 12" × 8" × 65 lbs. "H" beam; Protection: gravel aggregate concrete (4000 psi) with 4" - 16 SWG wire mesh reinforcement 1" below column surface.	177 tons	3 hrs. 20 min.			7	1	3
C-14-SC-3	14"	10" × 10" steel column; 4" outside protection; Group I.	—	12 hrs.		1		2	12
C-14-SC-4	14"	Description as per C-14-SC-3; Group II.	—	9 hrs.		1		2	9
C-14-SC-5	14"	Description as per C-14-SC-3; Group III.	—	7 hrs.		1		2	7
C-14-SC-6	14"	Description as per C-14-SC-3; Group IV.	—	5 hrs.		1		2	5
C-14-SC-7	14"	12" × 12" steel column; 2" outside protection; Group I.	—	8 hrs.		1		2	8
C-14-SC-8	14"	Description as per C-14-SC-7; Group II.	—	6 hrs.		1		2	6

(Continued)

**TABLE 2.5.1.6—STEEL COLUMNS—CONCRETE ENCASEMENTS  
MINIMUM DIMENSION 14" TO LESS THAN 16"—continued**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-14-SC-9	14"	Description as per C-14-SC-7; Group III.	—	5 hrs.		1		2	5
C-14-SC-10	14"	Description as per C-14-SC-7; Group IV	—	3 hrs.		1		2	3
C-15-SC-11	15"	12" × 12" steel column; 3" outside protection; Group I.	—	11 hrs.		1		2	11
C-15-SC-12	15"	Description as per C-15-SC-11; Group II.	—	8 hrs.		1		2	8
C-15-SC-13	15"	Description as per C-15-SC-11; Group III.	—	6 hrs.		1		2	6
C-15-SC-14	15"	Description as per C-15-SC-11; Group IV.	—	4 hrs.		1		2	4

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 pound per square yard = 5.3 N/m<sup>2</sup>, 1 ton = 8.896 kN.

**Notes:**

1. Collapse.
2. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.
- Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.<sup>2</sup>, placed not more than 1 inch from the surface of the concrete.
- Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.<sup>2</sup>, placed not more than 1 inch from the surface of the concrete.
- Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.

**TABLE 2.5.1.7—STEEL COLUMNS—CONCRETE ENCASEMENTS  
MINIMUM DIMENSION 16" TO LESS THAN 18"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-16-SC-13	16"	12" × 12" steel column; 4" outside protection; Group I.	—	14 hrs.		1		1	14
C-16-SC-2	16"	Description as per C-16-SC-1; Group II.	—	10 hrs.		1		1	10
C-16-SC-3	16"	Description as per C-16-SC-1; Group III.	—	8 hrs.		1		1	8
C-16-SC-4	16"	Description as per C-16-SC-1; Group IV.	—	5 hrs.		1		1	5

For SI: 1 inch = 25.4 mm.

**Notes:**

1. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.
- Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.<sup>2</sup>, placed not more than 1 inch from the surface of the concrete.
- Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.<sup>2</sup>, placed not more than 1 inch from the surface of the concrete.
- Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.

**TABLE 2.5.2.1—STEEL COLUMNS—BRICK AND BLOCK ENCASEMENTS  
MINIMUM DIMENSION 10" TO LESS THAN 12"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-10-SB-1	10 <sup>1/2</sup> "	10 <sup>1/2</sup> " × 13" brick encased steel columns; 8" × 6" × 35 lbs. "H" beam; Protection. Fill of broken brick and mortar; 2" brick on edge; joints broken in alternate courses; cement-sand grout; 13 SWG wire reinforcement in every third horizontal joint.	90 tons	3 hrs. 6 min.			7	1	3
C-10-SB-2	10 <sup>1/2</sup> "	10 <sup>1/2</sup> " × 13" brick encased steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: 2" brick; joints broken in alternate courses; cement-sand grout; 13 SWG iron wire reinforcement in alternate horizontal joints.	90 tons	2 hrs.			7	2, 3, 4	2
C-10-SB-3	10"	10" × 12" block encased columns; 8" × 6" × 35 lbs. "H" beam; Protection: 2" foamed slag concrete blocks; 13 SWG wire at each horizontal joint; mortar at each joint.	90 tons	2 hrs.			7	5	2
C-10-SB-4	10 <sup>1/2</sup> "	10 <sup>1/2</sup> " × 12" block encased steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: gravel aggregate concrete fill (unconsolidated) 2" thick hollow clay tiles with mortar at edges.	86 tons	56 min.			7	1	3/4
C-10-SB-5	10 <sup>1/2</sup> "	10 <sup>1/2</sup> " × 12" block encased steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: 2" hollow clay tiles with mortar at edges.	86 tons	22 min.			7	1	1/4

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

**Notes:**

1. Failure mode - collapse.
2. Passed 2-hour fire test (Grade "C" - British).
3. Passed hose stream test.
4. Passed reload test.
5. Passed 2-hour fire exposure but collapsed immediately following hose stream test.

**TABLE 2.5.2.2—STEEL COLUMNS—BRICK AND BLOCK ENCASEMENTS  
MINIMUM DIMENSION 12" TO LESS THAN 14"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-12-SB-1	12"	12" × 15" brick encased steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: 2 <sup>5/8</sup> " thick brick; joints broken in alternate courses; cement-sand grout; fill of broken brick and mortar.	90 tons	1 hr. 49 min.			7	1	1 <sup>3/4</sup>

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

**Notes:**

1. Failure mode – collapse.

**TABLE 2.5.2.3—STEEL COLUMNS—BRICK AND BLOCK ENCASEMENTS  
MINIMUM DIMENSION 14" TO LESS THAN 16"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-15-SB-1	15"	15" × 17" brick encased steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: 4½" thick brick; joints broken in alternate courses; cement-sand grout; fill of broken brick and mortar.	45 tons	6 hrs.			7	1	6
C-15-SB-2	15"	15" × 17" brick encased steel columns; 8" × 6" × 35 lbs. "H" beam; Protection. Fill of broken brick and mortar; 4½" brick; joints broken in alternate courses; cement-sand grout.	86 tons	6 hrs.			7	2, 3, 4	6
C-15-SB-3	15"	15" × 18" brick encased steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: 4½" brick work; joints alternating; cement-sand grout.	90 tons	4 hrs.			7	5, 6	4
C-15-SB-4	14"	14" × 16" block encased steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: 4" thick foam slag concrete blocks; 13 SWG wire reinforcement in each horizontal joint; mortar in joints.	90 tons	5 hrs. 52 min.			7	7	4¾

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

**Notes:**

1. Only a nominal load was applied to specimen.
2. Passed 6-hour fire test (Grade "A" - British).
3. Passed (6 minute) hose stream test.
4. Reload not specified.
5. Passed 4-hour fire exposure.
6. Failed by collapse between first and second minute of hose stream exposure.
7. Mode of failure-collapse.

**TABLE 2.5.3.1—STEEL COLUMNS—PLASTER ENCASEMENTS  
MINIMUM DIMENSION 6" TO LESS THAN 8"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-7-SP-1	7½"	7½" × 9½" plaster protected steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: 24 SWG wire metal lath; 1¼" lime plaster.	90 tons	57 min.			7	1	¾
C-7-SP-2	7⅞"	7⅞" × 10" plaster protected steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: ⅜" gypsum bal wire wound with 16 SWG wire helically wound at 4" pitch; ½" gypsum plaster.	90 tons	1 hr. 13 min.			7	1	1
C-7-SP-3	7¼"	7¼" × 9⅜" plaster protected steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: ⅜" gypsum board; wire helically wound 16 SWG at 4" pitch; ¼" gypsum plaster finish.	90 tons	1 hr. 14 min.			7	1	1

**Notes:**

1. Failure mode – collapse.

**TABLE 2.5.3.2—STEEL COLUMNS—PLASTER ENCASEMENTS  
MINIMUM DIMENSION 8" TO LESS THAN 10"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-8-SP-1	8"	8" × 10" plaster protected steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: 24 SWG wire lath; 1" gypsum plaster.	86 tons	1 hr. 23 min.			7	1	1 1/4
C-8-SP-2	8 1/2"	8 1/2" × 10 1/2" plaster protected steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: 24 SWG metal lath wrap; 1 1/4" gypsum plaster.	90 tons	1 hr. 36 min.			7	1	1 1/2
C-9-SP-3	9"	9" × 11" plaster protected steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: 24 SWG metal lath wrap; 1/8" M.S. ties at 12" pitch wire netting 1 1/2" × 22 SWG between first and second plaster coats; 1 1/2" gypsum plaster.	90 tons	1 hr. 33 min.			7	1	1 1/2
C-8-SP-4	8 3/4"	8 3/4" × 10 3/4" plaster protected steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: 3/4" gypsum board; wire wound spirally (#16 SWG) at 1 1/2" pitch; 1/2" gypsum plaster.	90 tons	2 hrs.			7	2, 3, 4	2

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

**Notes:**

1. Failure mode - collapse.
2. Passed 2 hour fire exposure test (Grade "C" - British).
3. Passed hose stream test.

**TABLE 2.5.4.1—STEEL COLUMNS—MISCELLANEOUS ENCASEMENTS  
MINIMUM DIMENSION 6" TO LESS THAN 8"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-7-SM-1	7 5/8"	7 5/8" × 9 1/2" (asbestos plaster) protected steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: 20 gage 1/2" metal lath; 9/16" asbestos plaster (minimum).	90 tons	1 hr. 52 min.			7	1	1 3/4

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

**Notes:**

1. Failure mode - collapse.

**TABLE 2.5.4.2—STEEL COLUMNS—MISCELLANEOUS ENCASEMENTS  
MINIMUM DIMENSION 8" TO LESS THAN 10"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-9-SM-1	9 5/8"	9 5/8" × 11 3/8" asbestos slab and cement plaster protected columns; 8" × 6" × 35 lbs. "H" beam; Protection: 1" asbestos slab; wire wound; 5/8" plaster.	90 tons	2 hrs.			7	1, 2	2

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

**Notes:**

1. Passed 2 hour fire exposure test.
2. Collapsed during hose stream test.

**TABLE 2.5.4.3—STEEL COLUMNS—MISCELLANEOUS ENCASEMENTS  
MINIMUM DIMENSION 10" TO LESS THAN 12"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-11-SM-1	11 1/2"	11 1/2" × 13 1/2" wood wool and plaster protected steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: wood-wool-cement paste as fill and to 2" cover over beam; 3/4" gypsum plaster finish.	90 tons	2 hrs.			7	1, 2, 3	2
C-10-SM-1	10"	10" × 12" asbestos protected steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: sprayed on asbestos paste to 2" cover over column.	90 tons	4 hrs.			7	2, 3, 4	4

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

**Notes:**

1. Passed 2 hour fire exposure (Grade "C" - British).
2. Passed hose stream test.
3. Passed reload test.
4. Passed 4 hour fire exposure test.

**TABLE 2.5.4.4—STEEL COLUMNS—MISCELLANEOUS ENCASEMENTS  
MINIMUM DIMENSION 12" TO LESS THAN 14"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-12-SM-1	12"	12" × 14 1/4" cement and asbestos protected columns; 8" × 6" × 35 lbs. "H" beam; Protection: fill of asbestos packing pieces 1" thick 1' 3" o.c.; cover of 2" molded asbestos inner layer; 1" molded asbestos outer layer; held in position by 16 SWG nichrome wire ties; wash of refractory cement on outer surface.	86 tons	4 hrs. 43 min.			7	1, 2, 3	4 <sup>2</sup> / <sub>3</sub>

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

**Notes:**

1. Passed 4 hour fire exposure (Grade "B" - British).
2. Passed hose stream test.
3. Passed reload test.