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DFS.03.

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MICRO 2

WESTERN PA[illegible]TIONS
8300 SW HUNZIKER RD.
TIGARD, OR. 97223
(503) 620-1600

#10

FIREPROOF SUBMITTAL

JOB NAME: RIVER PARK PLAZA
WPI JOB #: 02-01-4501
SECTION: 07250 FIREPROOFING
SUBMITTAL DATE: 01/02/2001

City of Portland
APPROVED
JAN 17 2002
01-129413-DFS-03-CO
Permit Number

ATTACHMENTS:

1) SUBMITTAL NOTES (Page 2)
2) MONOKOTE MK-6/HY PRODUCT & TEST DATA (Pages 3 & 4)
3) COPY OF UL DESIGN D779 (Page 5 & 6)
4) COPY OF UL DESIGN X771 (Page 7 & 8)
5) COPY OF UL DESIGN X772 (Page 8)
6) D779 THICKNESS TABLES (Page 9 – 12)
7) X771 THICKNESS TABLES (Page 13)
8) X772 THICKNESS TABLES (Page 14)
9) SHOP DRAWINGS (Page 15 & 16)

APPROVAL

GENERAL CONTRACTOR

HOWARD S. WRIGHT CONSTRUCTION CO.
Submittal No. 08 | Spec Section 09100
Date Rec'd 1/3
To Arch. JAN 02 2002 Init. ND
LICENSE #

ARCHITECT

[X] NO EXCEPTION TAKEN [ ] EXCEPTIONS NOTED
[ ] REJECTED [ ] REVISE & RESUBMIT

Checking is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Any action shown is subject to the requirements of the plans and specifications. Deviations from the plans not clearly noted by the Contractor are not subject to this review. The Contractor is responsible for confirming all dimensions and coordinating all fabrications with actual field conditions and coordinating his work with all other related trades.

DATE 1/3/02 BY MM

Dennis [illegible] Thompson
ARCHITECTURE

01-129413-DFS-03

WESTERN PARTITIONS, INC.

River Park Plaza Fireproofing Submittal Notes

Construction Type I – FR

PRODUCTS:

- We are submitting to apply Monokote Type MK-6/HY.

UL DESIGN:

- UL D779 – used for protected Floors.
- UL X771 – used for Tube Steel Members.
- UL X772 – used for Wide Flange Columns.

NOTES:

- UBC – Section 601.4 (Structural Frame) "The structural frame shall be considered to be the columns and the girders, beams, trusses, and spandrels having direct connections to the columns and bracing members designed to carry gravity loads. The members of floor or roof panels that have no connection to the columns shall be considered secondary members and not part of the structural frame."
  - It is our intent to not fireproof bracing elements that are designed to carry only lateral loads, per Section 601.4.
- 3hr Occupancy Separation - We are submitting to spray-fireproof to achieve a 3hr rating at all primary and secondary members, as identified in the construction documents, to meet the 3hr occupancy separation requirements of this project.

If you should have any questions, please feel free to call me at (503) 620-1600

Sincerely,

Steve Lichtenberg
Estimator/Project Manager

City of Portland
APPROVED
JAN 17 2002
Permit Number

8300 SW HUNZIKER ROAD, TIGARD OR 97223 • PHONE: 503-620-1600 • FAX: 503-624-5781
CORPORATE OFFICE
CONTRACTOR LICENSES: OREGON: 60330 • WASHINGTON: WESTEPI172PB

1/2/02

P.2

DATA SUBMITTAL

Monokote® Fireproofing MK®-6/HY®

Product Data and Application Instructions

Product Information/ Description

Monokote® MK®-6/HY® is a single component, mill-mixed fireproofing plaster which requires only the addition of water on the job site to form a consistent, pumpable slurry. MK-6/HY is designed for use on structural steel columns, beams, joists, trusses and floor and roof decking.

Features/Benefits

Monokote cementitious fireproofing offers many significant advantages to the architect, owner, applicator and building occupant. These include:

- Proven in-place performance
- Low in-place cost
- Fast, efficient application
- UL tested and factory inspected
- Universal Building code compliance (ICBO, SBCCI, BOCA, NBCC)

Delivery and Storage

a. All material to be used for fireproofing shall be delivered in original unopened packages bearing the name of the manufacturer, the brand and proper Underwriters Laboratories Inc. labels for fire hazard and fire resistance classifications.

b. The material shall be kept dry until ready for use. Packages of material shall be kept off the ground, under cover and away from sweating walls and other damp surfaces. All bags that have been exposed to water before use shall be discarded Stock of material is to be rotated and used before its expiration date.

Performance Characteristics

Physical Properties	Values	Test Method
Dry Density, minimum average	240 kg/m³ (15 pcf)	ASTM E 605 UBC STD 7-6
Bond Strength	16.2 KPa (339 psf)	ASTM E 736
Compression, 10% Deformation	68.9 KPa (1,440 psf)	ASTM E 761
Air Erosion	0.000 g/m² (0.000 g/ft²)	ASTM E 859
High Velocity Air Erosion	No continued erosion after 4 hours	ASTM E 859 UMC STD 6-1
Corrosion	Does not contribute to corrosion	ASTM E 937
Bond Impact	No cracking, spalling or delamination	ASTM E 760
Deflection	No cracking, spalling or delamination	ASTM E 759
Resista... Mold Gr...	No growth after 60 days	ASTM G 21
Surface F... Characteris...	Flame Spread 0 Smoke Developed 0	ASTM E 84
Combustibilit...	Less than 5 MJ/m total, 20 kw/m² peak heat release	ASTM E 1354
Impact Penetration	3.3 cm³	Developed by City of San Francisco
Abrasion Resistance	8.3 cm³	Developed by City of San Francisco

Steel and Concrete Surfaces

a. Prior to the application of Monokote MK-6/HY, an inspection shall be made to determine that all steel surfaces are acceptable to receive fireproofing. The steel to be fireproofed shall be free of oil, grease, excess rolling compounds or lubricants, loose mill scale, excess rust, noncompatible primer, lock down agent or any other substance that will impair proper adhesion. Where necessary, the cleaning of steel surfaces to receive fireproofing shall be the responsibility of the general contractor.

b. The project architect shall determine if the painted/primed structural steel to receive fireproofing is to be tested in accordance with ASTM E 119, to provide the required fire resistance rating.

c. Many Fire Resistance Designs allow the use of painted metal floor or roof deck in place of galvanized decking. Painted decking must be UL listed in the specific fire resistance designs and must carry the UL classification marking. Consult your local Grace sales representative for details.

GRACE

d. Prior to application of Monokote MK-6/HY, a bonding agent, approved by the fireproofing manufacturer, shall be applied to all concrete substrates to receive MK-6/HY.
e. Fireproofing to the underside of roof deck assemblies shall be done only after roofing application is complete and roof traffic has ceased.
f. No fireproofing shall be applied prior to completion of concrete work on steel decking.

Mixing

a. Monokote Fireproofing shall be mixed by machine in a conventional, plaster-type mixer or a continuous mixer specifically modified for cementitious fireproofing. The mixer shall be kept clean and free of all previously mixed material. The mixer speed in a conventional mixer shall be adjusted to the lowest speed which gives adequate blending of the material and a mixer density of 640 - 720 kg/m³ (40 - 45 pcf) of material.
b. Using a suitable metering device and a conventional mixer, all water shall be first added to the mixer as the blades turn. Mixing shall continue until the mix is lump-free, with a creamy texture. All material is to be thoroughly wet. Target density of 688 ± 16 kg/m³ (43 ± 1 pcf) is most desirable. Overmixing Monokote will reduce pumping rate.

Application

a. Application of Monokote Fireproofing can be made in the following sequence:
   1. For thicknesses of approximately 13 mm (½ in.) or less, apply in one pass.
   2. For thicknesses of 16 mm (⅝ in.) or greater, apply subsequent passes after the first coat has set.
b. Spatterkote® SK-3 shall be applied to all flat plate cellular deck units and below all bottomless trench headers prior to application of MK-6/HY. Spatterkote shall be applied in accordance with the manufacturer's application instructions.
c. Spatterkote SK-3 shall be applied to roof decking where required prior to application of Monokote.
d. Monokote Fireproofing material shall not be used if it contains partially set, frozen or caked material.
e. Monokote shall have a minimum average dry, in-place density of 240 kg/m³ (15 lbs/ft³).
f. Monokote is formulated to be mixed with water at the job site.
g. Monokote Accelerator is to be used with Monokote MK-6/HY to enhance set characteristics and product yield. The Monokote Accelerator is injected into the Monokote MK-6/HY at the spray gun. Monokote Accelerator shall be mixed and used according to manufacturers recommendations.
h. Monokote is applied directly to the steel, at various rates of application which will be job dependent, using standard plastering type equipment or continuous mixer/pump units. A spray gun, with a properly sized orifice and spray shield and air pressure at the nozzle of approximately 38 kPa (20 psi), will provide the correct hangability, density and appearance. NOTE: If freshly sprayed Monokote does not adhere properly, it is probably due either to a too wet mix, poor thickness control, or an improperly cleaned substrate.

Temperature and Ventilation

a. An air and substrate temperature of 4.4°C (40°F) minimum shall be maintained for 24 hours prior to application, during application and for a minimum of 24 hours after application of Monokote.
b. Provisions shall be made for ventilation to properly dry the fireproofing after application. In enclosed areas lacking natural ventilation, air circulation and ventilation must be provided to achieve a minimum total air exchange rate of 4 times per hour until the material is substantially dry.

Field Tests

a. The architect will select an independent testing laboratory (for which the owner will pay) to sample and verify the thickness and density of the fireproofing in accordance with the provisions of ASTM E 605-93, "Standard Test Method for Thickness and Density of Sprayed Fire-Resistive Material Applied to Structural Members" or Uniform Building Code Standard No. 7-6 "Thickness and Density Determination for Spray Applied Fireproofing."
b. The architect will select an independent testing laboratory (for which the owner will pay) to randomly sample and verify the bond strength of the fireproofing in accordance with the provisions of ASTM E 736.
c. Results of the above tests will be made available to all parties at the completion of pre-designated areas which will have been determined at a pre-job conference.

Safety

a. Monokote is slippery when wet. The general contractor and applicator shall be responsible for posting appropriate cautionary SLIPPERY WHEN WET signs. Signs should be posted in all areas in contact with wet fireproofing material. Anti-slip surfaces should be used on all working surfaces.

For Material Safety Data Sheet information, please request as calling 800-778-2880.

W. R. Grace & Co. - Conn.
62 Whittemore Avenue
Cambridge, MA 02140-1692
Tel.: (800) 778-2880
Fax: (800) 772-2885

W. R. Grace & Co. - Conn.
Ajax Avenue
Slough, Berks SL1 4BH
United Kingdom
Tel.: 44-(0)-1753-692-929
Fax: 44-(0)-1753-637-616

W. R. Grace (Hong Kong) Limited
Devon House, 20th Floor
979 Kings Road
Quarrie Bay, Hong Kong
Tel.: 852-2-590-2828
Fax: 852-2-811-2661

Fire Resistance Ratings - ANSI/UL 263 (BXUV)—*Continued*

Design No. D779

Restrained Assembly Ratings — 1, 1-1/2, 2, 3 & 4 H
Unrestrained Assembly Ratings — 1, 1-1/2, 2, 3 & 4 H
Unrestrained Beam Ratings — 1, 1-1/2, 2, 3 & 4 H

1. Supports — W8 x 28 or W12 x 16 beam min size, or steel joist, 10K1 or 16K2 min size with a max tensile stress of 30,000 psi or 12K3 min size with a max tensile stress of 24,000 psi.
2. Normal Weight or Lightweight Concrete — Normal weight concrete, carbonate or siliceous aggregate, 145 pcf plus or minus 3 pcf unit weight, 3000 psi compressive strength, vibrated. Lightweight concrete, expanded shale, clay, or slate aggregate by rotary-kiln method 102-120 pcf unit weight, 3000 psi compressive strength, vibrated, 4 to 7 percent air. Min thickness as measured to crests of steel floor and form units, 2-1/2 in.
3. Welded Wire Fabric — 6 x 6 - W1.4 x W1.4.

3A. Fiber Reinforcement — As an alternate to Item 3, engineered synthetic fibers added to concrete mix to control shrinkage cracks in concrete. See Fiber Reinforcement (CBXQ) category in the Fire Resistance Directory for names of manufacturers and rates of application.

4. Steel Floor and Form Units — Composite 1-1/2, 2, or 3 in. deep galv units. Min gauge is 22 MSG.
   CONSOLIDATED SYSTEMS INC —24 in. wide Types CFD-2, 3, 24, 30, or 36 in. wide Type CFD-1.5. Units may be phos/ptd.
   DECK WEST INC —36 in. Type 2-DW, 3-DW, B-DW or BA-DW. Units may be welded or fastened together with No. 10 self-drilling, self-tapping screws 60 in. OC. The length of the screws shall be sufficient to fully penetrate adjacent floor units.
   EPIC METALS CORP —24 in. wide Types EC150, EC306, 36 in. wide Type EC266.
   H H ROBERTSON —24 in. wide, QL-3, 24 or 36 in. wide, 2 or 3 in. deep QL-99. Units may be welded or fastened together with No. 10 self-drilling, self-tapping screws 60 in. OC. The length of the screws shall be sufficient to fully penetrate adjacent floor units.
   UNITED STEEL DECK INC —24, 30 or 36 in. wide Type BL; 24 or 36 in. wide Types LF1.5, LF2, LF3; 24, 36 in. wide Types LF2, -3 may be welded or fastened together with min 1 in. long No. 10 self-drilling, self-tapping steel screws 36 in. OC. Types BL, LF2, -3, N-Lok may be phos/ptd.
   VERCO MFG CO —24, 30, or 36 in. wide Type B, BR; 24 or 36 in. wide Types W2, W3. Units may be phos/ptd.
   VULCRAFT, DIV OF
   NUCOR CORP —24, 30 or 36 in. wide Type 1.5VL1; 24 or 36 in. wide Types 2VL1, 3VL1. Units may be phos/ptd.
   WHEELING CORRUGATING CO, DIV OF
   WHEELING-PITTSBURGH STEEL CORP —30 in. wide Types SB150, -150N, -150NR, -150R; 24 in. wide Type SB200 or -300; 24 or 36 in. wide Types P20LF, SB-P21LF, -P31LF; 36 in. wide Types 1.5 SB, 1.5 SBR; 24 or 36 in wide Types 2.0 SB, 3.0 SB; Units may be phos/ptd. 24 or 36 in. wide Types 212 V-Grip, 312 V-Grip, 30 or 36 in. wide Types 1-1/2 V-Grip, 212 V-Grip, and 312 V-Grip may be phos/ptd.
5. Shear Connectors — (Optional) — Studs, 3/4 in. diam by 4-1/2 in. long, headed type or equivalent per AISC specification. Welded to top flange of the beam, or top chord of the joist, through the deck.
6. *Spray-Applied Fire Resistive Materials* — Applied by mixing with water and spraying to steel surfaces which must be clean and free of dirt, loose scale and oil. When steel deck is used, the area between the steel deck and the beams top flange shall be filled. Min avg and min ind density of 15/14 pcf respectively. Min avg and min ind density of 22/19 pcf respectively for Types Z-106, Z-106/G. Min avg and min ind density of 40/36 pcf respectively for Z-146. Application to steel roof deck requires the installation of expanded metal lath. See Item 7B. For method of density determination, refer to Design Information Section.

Restrained Assembly Rating Hr	Unrestrained Assembly Rating Hr	Unrestrained Beam Rating Hr	Spray Applied Fire Resistive Mil Thkns In. on Steel Deck Crests	Valley	Concrete Type
1	0	1	0	0	LW
1	1	1	5/16	5/16	NW or LW
1-1/2	1	1	5/16(a)	5/16(a)	NW or LW
1-1/2	1-1/2	1-1/2	5/16(a)	5/16(a)	NW or LW
2	1	1	3/8(b)	3/8	NW or LW
2	2	2	3/8(b)	3/8	NW or LW
3	2	2	1-7/16	13/16	NW
3	3	3	1-7/16	13/16	NW
4	3	3	2-1/2	1-1/2	NW
4	4	4	2-1/2	1-1/2	NW

(a) — Min thickness of 3/8 in. required when 1-1/2 in. deep fluted units are used.
(b) — Min thickness of 1/2 in. is required in crests of 1-1/2 in. deep fluted units for the 2 h Restrained Assembly Rating.

Restrained Assembly Rating Hr	Unrestrained Assembly Rating Hr	Unrestrained Beam Rating Hr	Spray Applied Fire Resistive Mil Thk In. on Beam W8x28	W12x16	10K1 Joist Spaced More Than 4 Ft OC	10K1 Joist Spaced 4 Ft or Less OC
1	0	1	7/16	5/8	1-1/8	15/16
1	1	1	7/16	5/8	1-1/8	15/16
1-1/2	1	1	7/16	5/8	1-5/16	1-5/16
1-1/2	1-1/2	1-1/2	3/4	1	1-5/8	1-7/16
2	1	1	7/16	5/8	1-7/16	1-7/16
2	2	2	1	1-3/8	2-3/16	1-15/16
3	1-1/2	1-1/2	3/4	1	2-3/16	1-15/16
3	3	3	1-5/16	1-3/4	3-1/4	2-13/16
4	2	2	1	1-3/8	—	—
4	4	4	1-5/8	2-3/16	—	—

Restrained & Unrestrained Assembly Rating Hr	Unrestrained Beam Rating Hr	Spray Applied Fire Resistive Mil Min Thkns In. For 12K3 or 16K2 Joist Spaced More Than 4 Ft OC	Spray Applied Fire Resistive Mil Min Thkns In. For 12K3 or 16K2 Joist Spaced 4 Ft or Less OC
1	1	15/16	15/16
1-1/2	1-1/2	1-1/4	1-3/16
2	2	1-9/16	1-1/2
3	3	2-1/4	2-1/16

The thicknesses of Spray-Applied Fire Resistive Materials shown in the table below are applicable when the thickness applied to the beams' lower flange edges is reduced to one-half.

Restrained Assembly Rating Hr	Unrestrained Assembly Rating Hr	Unrestrained Beam Rating Hr	Spray Applied Fire Resistive Mil Thkns In. on Beam W8x28	W12x16
1	0	1	7/16+	5/8
1	1	1	7/16+	5/8
1-1/2	1	1	7/16+	5/8
1-1/2	1-1/2	1-1/2	3/4	1
2	2	2	7/16+	5/8
2	2	1	1	1-3/8
3	1-1/2	1-1/2	3/4	1
3	3	3	1-7/16	1-15/16
4	2	2	1	1-3/8
4	4	4	1-15/16	2-5/8

ARABIAN VERMICULITE INDUSTRIES — Types MK-6/CBF, MK-6/ED, MK-6/HY, MK-6/HY Extended Set, MK-6s, Sonotex 1, Sonotex 6, Z-106, Z-106/G, Z-146 investigated for exterior use, Sonotex 35.
W R GRACE & CO - CONN
CONSTRUCTION PRODUCTS DIV — Types MK-6/HY, MK-6/HY Extended Set, MK-6s, RG, Monokote Acoustic 1, Monokote Acoustic 5, Z-106, Z-106/G, Z-146 investigated for exterior use, Monokote Acoustic 35.
GRACE KOREA INC — Types MK-6/CBF, MK-6/ED, MK-6/HY, MK-6/HY Extended Set, MK-6s, Monokote Acoustic 1, Monokote Acoustic 5, Z-106, Z-106/G, Z-146 investigated for exterior use, Monokote Acoustic 35.

7. Metal Lath — (Optional, not shown) — May be used to facilitate the spray application of spray-applied resistive material on steel bar joists. The diamond mesh, 3/8 in. expanded steel lath, 1.7 lb per sq yd min is secured to one side of each steel joist with No. 18 SWG galv steel wire at joist web and bottom chord members, spaced 15 in. O.C. max. When used, the metal lath is to be fully covered with spray-applied resistive material with no min thickness requirements for material applied onto the lath between chords and web members.

7A. Non-Metallic Fabric Mesh — (Optional, not shown) — As an alternate to the optional use of metal lath, glass fiber fabric mesh, weighing approximately 2.5 oz per sq yd or equivalent may be used to facilitate

Fire Resistance Ratings - ANSI/UL 263 (BXUV)–*Continued*

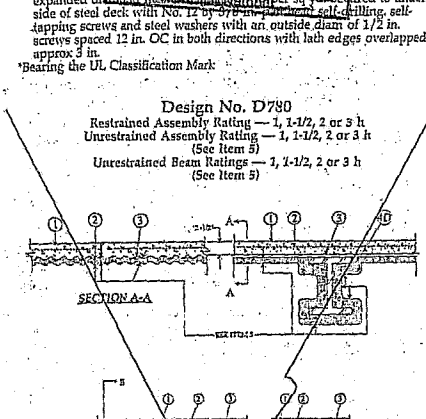
the spray application. The mesh is secured to one side of each web member. The method of attachment must be sufficient to hold the mesh and the spray applied resistive material in place during application until it has cured. An acceptable method to attach the mesh is by embedding the mesh in min 1/4 in. long beads of hot melted glue. The beads of glue shall be spaced a max of 12 in. O.C. along the top chord of the bar joist. Another method to secure the mesh is by 1-1/4 in. long by 1/2 in. wide hairpin clips from No. 18 SWG or heavier steel wire.

7B. Metal Lath — (Not Shown) —(Required with Z-146, Sonotex 35, and Monokote Acoustic 35, otherwise optional)—Metal lath shall be 3/8 in. expanded diamond mesh. Reinforcing channels per sq yd. Secured to underside of steel deck with No. 12 by 3/8 in. pan-head self-drilling, self-tapping screws and steel washers with an outside diam of 1/2 in. screws spaced 12 in. OC in both directions with lath edges overlapped approx 3 in.

*Bearing the UL Classification Mark

Design No. D780

Restrained Assembly Rating — 1, 1-1/2, 2 or 3 h
Unrestrained Assembly Rating — 1, 1-1/2, 2 or 3 h
(See Item 5)
Unrestrained Beam Ratings — 1, 1-1/2, 2 or 3 h
(See Item 5)



1. Normal Weight or Lightweight Aggregate Concrete — Normal weight carbonate or siliceous aggregate concrete, 150 plus over minus 3 pcf unit weight, 3500 psi compressive strength, vibrated. Lightweight concrete, expanded shale, clay, or slate aggregate by rotary-kiln method, 110 plus over minus 3 pcf unit weight, 3500 psi compressive strength, 4 to 7 percent entrapped air.
2. Welded Wire Fabric — 6 x 6 — W2.0 X W2.0
3. Steel Floor and Form Units — No. 28 MSG galv corrugated sheet steel minimum. The description and sizes of the corrugated sheet steel units and the max beam spacing are as follows:

Steel Deck Unit In.	Nom Pitch In.	Sheet Steel Gauge MSG	Max Beam Spacing
9/16	2-1/2	28	3 ft, 6 in. O.C.
15/16	3-3/4	26	5 ft, 0 in. O.C.
1-5/16	5	25	6 ft, 6 in. O.C.
1-5/16	5	24	7 ft, 0 in. O.C.
1-5/16	5	22	7 ft, 6 in. O.C.
1-5/16	5	20	8 ft, 0 in. O.C.

Units welded to each steel beam, 36 welds per 100 sq ft of form units with at least one weld at each side joint. Welding of deck side joint between beams for deck spans ranging between 3 ft, 6 in. and 6 ft, 6 in. O.C. shall be at least two welds of each side joint. Welding of side joints for spans greater than 6 ft, 6 in. O.C. shall be a minimum of three welds of each side joint.

Any Manufacturer Corrugated deck having cross-section similar to above description.

3A. Steel Floor and Form Units — As an alternate to Item 3, Composite 1-1/2, 2 or 3 in. deep galv fluted units. Min gauge is No. 22 MSG. Spacing of welds attaching units to supports shall be at each side of joint and not to exceed 12 in. OC between joints. Adjacent units button punched or welded together 36 in. OC at joints.

VULCRAFT, DIV OF
NUCOR CORP — 24, 30 and 36 in. wide Type 1.5VLI; 24 or 36 in. wide Types 2VLI, 3VLI. Types 1-SLVI, 2VLI, and 3VLI units may be phos/ptd.

4. Steel Joists — 10K1 or 16K2 min size with a max tensile stress of 30,000 psi or 12K3 min size with max tensile stress of 24,000 psi.

4A. As an alternate to Item 4, LH Series joists spanning no greater than 60 ft. For spans greater than 60 ft, deflection under the published total load shall not be greater than 1/277 of the joist span.

4B. Composite Joists — (Not shown) — As an alternate to Items 4 and 4A, steel joists designed for full composite action with the concrete slab. Min overall depth 13 in. Min area of joist members shall be 0.708 square in. for top and bottom chord angles and 0.442 square in. for web. Designed in accordance with SJI Specifications for K-Series joists as revised to November 18, 1989.

4C. Structural Steel Members* — (Not shown) — As an alternate to Items 4, 4A and 4B — (Not shown) — Composite joists with top chord embedded in concrete slab. Welded to end supports. Min area of joist members shall be 0.708 square in. for top and bottom chord angles and 0.442 square in. for web.

VESCOM STRUCTURAL SYSTEMS INC —Type V.

4D. Steel Beams — W8x28 min size. As an alternate to steel joists, Items 4, 4A, 4B and 4C.

4E. Horizontal Bridging — (Not shown) — Min 1-1/4 by 1-1/4 by 1/6 in. thick steel angles for use with noncomposite joists (Item 4). Number and spacing per Steel Joist Institute specifications. Welded to top and bottom chord of the joists. Min thickness of Spray-Applied Fire Resistive Materials on bridging angles is 1-1/2 in.

5. Spray-Applied Fire Resistive Materials* — Applied by mixing with water and spraying in no more than one coat to a final thickness as shown below to steel surfaces which must be free of dirt, loose scale and oil. Min avg and min density of 15/14 pcf, respectively. For method of density determination, see Design Information Section, Sprayed Materials.

Restrained Assembly Rating Hr	Unrestrained Assembly Rating Hr	Unrestrained Beam Rating Hr	Deck	Beam	Spray Applied Fire Resistive Mtl Thk In. 10K1 Joist Spaced		
					LH Joist	More Than 4 Ft OC	4 Ft or Less OC
1	1	1	3/8	7/16	1-1/8	1-1/8	15/16
1-1/2	1	1	1/2	7/16	1-3/16	1-3/16	1-3/16
1-1/2	1-1/2	1-1/2	1/2	9/16	1-3/2	1-3/8	1-7/16
2	1	1	1/2	7/16	1-7/16	1-7/16	1-7/16
2	2	1-1/2	5/8	1	1-1/2	1-3/16	1-15/16
3	1-1/2	1-1/2	1/2	1/4	1-1/2	3-1/4	2-13/16
3	3	3	7/8	1-5/16	3-1/4	3-1/4	2-13/16

Restrained & Unrestrained Assembly Rating Hr	Unrestrained Beam Rating Hr	Spray Applied Fire Resistive Mtl Min Thkns In. For 12K3 or 16K2 Joist Spaced	
		More Than 4 Ft OC	4 Ft or Less OC
1	1	15/16	15/16
1-1/2	1-1/2	1-1/4	1-3/16
2	2	1-9/16	1-1/2
3	3	2-1/4	2-1/8

ARABIAN VERMICULITE INDUSTRIES —Types MK-6/CBF, MK/6/ED, MK-6/HY, MK-6/HY Extended Set, MK-6s, Sonotex 1.

W R GRACE & CO - CONN
CONSTRUCTION PRODUCTS DIV —Types MK-6/HY, MK-6/HY Extended Set, MK-6s, Monokote Acoustic 1, RG.
GRACE KOREA INC —Types MK-6/CBF, MK-6/ED, MK-6/HY, MK-6/HY Extended Set, MK-6s, Monokote Acoustic 1.

5A. Spray-Applied Fire Resistive Materials* — Applied by mixing with water and spraying in more than one coat to a final thickness as shown below to steel surfaces which must be free of dirt, loose scale and oil. When steel deck is used, the area between the steel deck and the beams top flange shall be filled. Min avg and min ind density of 22/19 pcf, respectively. Min avg and min ind density of 40/36 pcf, respectively for Z-146. Application to steel roof deck requires the installation of expanded metal lath. See Item 6B. For method of density determination, see Design Information Section, sprayed materials.

Fire Resistance Ratings - ANSI/UL 263 (BXUV)–*Continued*

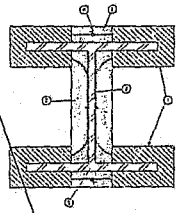
P.6

Fire Resistance Ratings - ANSI/UL 263 (BXUV)–*Continued*

b is the outer length of the tube (in.)
t is the wall thickness of the tube (in.)
*Bearing the UL Classification Mark

Design No. X769

Ratings — 1, 1-1/2, 2, 3 and 4 Hr.



1. Building Unit * — Pre-formed sections of Spray-Applied Fire Resistive Materials shaped to cover the flanges of W-shaped structural steel columns. The pre-formed sections are used along with a like thickness of Spray-Applied Fire Resistive Materials (Item 2) to form the completed column protection. See table below for appropriate thickness.

ating Hr	Min Thkns In.
	1-7/16
	1-1/8
	3/4
-1/2	5/8
	9/16

PARK DEROCHIE COATINGS LTD —*Type 2*

2. Spray-Applied Fire Resistive Materials * — See table under Item 1 for appropriate thicknesses. Spray-Applied Fire Resistive Materials thickness on web of column to be measured from lath surface. Spray-Applied Fire Resistive Materials on flange surfaces to be forced through lath of building units such that entire space between building unit edges is filled. Prepared by mixing with water according to instructions on each bag of mixture. Mixture is sprayed and/or trowel-applied over lath as shown. Minimum average density of 60 pcf with minimum individual density of 55 pcf. For method of density determination, see General Information Section, preceding these designs. Surface of material may be lightly finished with a trowel. As an option, the column and/or lath surfaces may be primed.

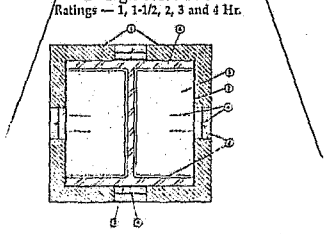
CAREOLINE CO —*Type 201*

3. Metal Lath — 3.4 lb/sq yd galvanized expanded steel. Secured to column with copper coated steel pins welded to column web along vertical centerline and spaced maximum 12 in. OC. Welded pins bent 90 degrees after installation of metal lath.
4. Wire Ties — Nominally No. 18 SWG galvanized steel wire used to tie the metal lath embedded in building units. Wire ties spaced maximum 10 in. OC along vertical centerline of column flange.
5. Steel Column — W10X49, minimum size.

*Bearing the UL Classification Mark

Design No. X770

Ratings — 1, 1-1/2, 2, 3 and 4 Hr.



1. Building Unit * — Pre-formed sections of Spray-Applied Fire Resistive Materials shaped to box W-shaped structural steel columns. The pre-formed sections are used along with a like thickness of Spray-Applied Fire Resistive Materials (Item 2) to form the completed column protection. See table below for appropriate thickness.

Rating Hr	Min Thkns In.
4	1-7/16
3	1-1/8
2	3/4
1-1/2	5/8
1	9/16

Fire Resistance Ratings - ANSI/UL 263 (BXUV)–*Continued*

PARK DEROCHIE COATINGS LTD —*Type 2*

2. Spray-Applied Fire Resistive Materials * — See table under Item 1 for appropriate thicknesses. Spray-Applied Fire Resistive Materials to be forced through lath of building units such that entire space between building unit edges is filled. Prepared by mixing with water according to instructions on each bag of mixture. Mixture is sprayed and/or trowel-applied over lath as shown. Min average density of 60 pcf with min individual density of 55 pcf. For method of density determination, see General Information Section, preceding these designs. Surface of material may be lightly finished with a trowel. As an option, the column and/or lath surfaces may be primed.

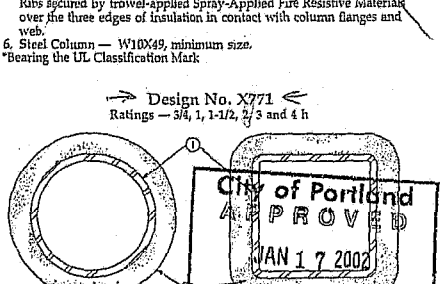
CARBOLINE CO —*Type 201*

3. Metal Lath — 3.4 lb/sq yd galvanized expanded steel. Secured to column with copper coated steel pins welded to column web along vertical centerline and spaced maximum 12 in. OC. Welded pins bent 90 degrees after installation of lath.
4. Wire Ties — Nominally No. 18 SWG galvanized steel wire used to tie the metal lath embedded in building unit. Wire ties spaced maximum 10 in. OC. along vertical centerline of column flange.
5. Ribs (Not Shown) — Nominally 2 in. thick cellular glass insulation cut to fit snugly between column flanges and spaced nominally 12 in. OC. Ribs secured by trowel-applied Spray-Applied Fire Resistive Materials over the three edges of insulation in contact with column flanges and web.
6. Steel Column — W10X49, minimum size.

*Bearing the UL Classification Mark

Design No. X771

Ratings — 3/4, 1, 1-1/2, 2, 3 and 4 h



1. *Steel Pipe or Tube Column* — Steel circular pipe or tube, outside diameter (OD) ranging from a minimum of 3 in. to a maximum of 32 in. and a minimum wall thickness of 3/16 in.
Steel square or rectangular tube with outside wall dimensions ranging from a minimum 3 in. to a maximum of 32 in. and a minimum wall thickness of 3/16 in.
The A/P ratio of the steel pipe or tube (see Item 2) shall range from 0.18 to 2.0.
2. Spray-Applied Fire Resistive Materials* — Applied by mixing with water and spraying in one or more coats to steel surfaces which must be clean and free of dirt, loose scale and oil. Min avg and ind density of 15/14 pcf respectively. Min avg and min ind density of 22/19 pcf respectively for: Types Z-106, Z-106/G. For method of density determination, see Design Information Section, preceding these designs.
The hourly rating of the structural membe. is dependent upon the ratio of A/P and the thickness of Spray-Applied Fire Resistive Materials, where A is the cross sectional area of the pipe or tube and) is the heated perimeter. The A/P ratio of a circular pipe is determined by:

$$A/P \text{ pipe} = \frac{t(d-t)}{d}$$

Where:
d = the outer diameter of the pipe (in.)
t = the wall thickness of the pipe (in.)

Fire Resistance Ratings - ANSI/UL 263 (BXUV)–*Continued*

The A/P ratio of a rectangular or square tube is determined by:

$$A/P\ tube = \frac{t(a+b-2t)}{a+b}$$

Where:
a = the outer width of the tube (in.)
b = the outer length of the tube (in.)
t = the wall thickness of the tube (in.)
The thickness of Spray-Applied Fire Resistive Materials for ratings of 3/4, 1, 1-1/2, 2, 3 and 4 h of a steel pipe or tube can be determined by the equation:

$$h = \frac{R-0.20}{4.43\ (A/P)}$$

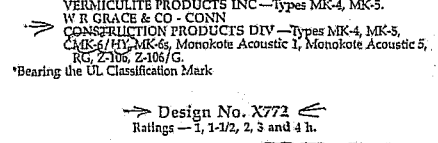
Where:
R = the hourly rating (hrs).
h = the thickness of Spray-Applied Fire Resistive Materials, minimum 1/4 in., maximum 3-7/8 in.

ARABIAN VERMICULITE INDUSTRIES —Types MK-6/CBF, MK-6/ED, MK-6/HY, MK-6s, Sonotex 1, Sonotex 5, Z-105, Z-105/G.
GRACE CANADA INC —Types MK-4, MK-5.
GRACE KOREA INC —Types MK-6/CBF, MK-6/ED, MK-6/HY, MK-6s, Monokote Acoustic 1, Monokote Acoustic 5, Z-106, Z-106/G.
PYROK INC —Type LD.
SOUTHWEST VERMICULITE CO —Types 4, 5, 5EF, 5GP, 5MD, 8EF, 8GP, 8MD, 9EF, 9GP, 9MD.
VERMICULITE PRODUCTS INC —Types MK-4, MK-5.
W R GRACE & CO - CONN
CONSTRUCTION PRODUCTS DIV —Types MK-4, MK-5, CMK-6/HY, MK-6s, Monokote Acoustic 1, Monokote Acoustic 5, RG, Z-106, Z-106/G.

*Bearing the UL Classification Mark

Design No. X772

Ratings — 1, 1-1/2, 2, 3 and 4 h.



1. Spray-Applied Fire Resistive Materials* — Applied by mixing with water and spraying in more than one coat to the thicknesses shown below, to steel surfaces which are clean and free of dirt, loose scale, and oil. Min avg and min ind density of 15/14 pcf respectively. Min avg and min ind density of 22/19 pcf respectively for Types Z-106, Z-106/G. For method of density determination, see Design Information Section, Sprayed Material.
The thickness of Spray-Applied Fire Resistive Materials to be applied to all surfaces of the column (Item 1) required for rating periods of 1 h, 1-1/2 h, 2 h, 3 h, 4 h may be determined by the equation:

$$h = \frac{R}{1.05\ (W/D) + 0.61}$$

Where:
h = Spray-Applied Fire Resistive Materials thickness in the range 0.25-3.875 in.
R = Fire resistance rating in hours (1 - 4 h)
D = Heated perimeter of steel column in inches
W = Weight of steel column in lbs per foot
W/D = 0.33 to 6.62
As an alternate to the equation, the minimum thickness of Spray-Applied Fire Resistive Materials required for various fire resistance ratings of contour sprayed or boxed columns may be determined from the table below:

Min Col Size	W/D	Min Thk In. 1 Hr	1-1/2 Hr	2 Hr	3 Hr	4 Hr
W6x9	0.33	1-1/8	1-1/2	2	2-1/2	3-13/16

Fire Resistance Ratings - ANSI/UL 263 (BXUV)–*Continued*

Min Col Size	W/D	Min Thk In. 1 Hr	1-1/2 Hr	2 Hr	3 Hr	4 Hr
W6x16	0.57	13/16	1-1/4	1-11/16	2-1/2	3-5/16
W8x28	0.67	3/4	1-3/16	1-3/8	2	2-11/16
W10x49	0.83	11/16	7/8	1-1/8	1-11/16	2-1/2
W14x228	2.49	5/16	1/2	9/16	7/8	1-1/4
W14x730	6.62	5/16	5/16	5/16	3/8	9/16

The thicknesses contained in the table below are applicable when the Spray-Applied Fire Resistive Materials applied to columns' flange tips are reduced to one-half that shown in the table below:

Min Col Size	W/D	Min Thk In. 1 Hr	1-1/2 Hr	2 Hr	3 Hr	4 Hr
W6x9	0.33	1-1/8	1-5/16	2-1/16	2-15/16	3-13/16
W6x16	0.57	7/8	1-5/16	1-3/4	2-9/16	3-3/8
W8x28	0.67	13/16	1-3/16	1-1/2	2-1/4	2-15/16
W10x49	0.83	3/4	1-1/16	1-3/8	2-1/16	2-3/4
W14x233	2.49	5/16	1/2	11/16	1-3/16	1-5/8
W14x730	6.62	5/16	5/16	5/16	9/16	3/4

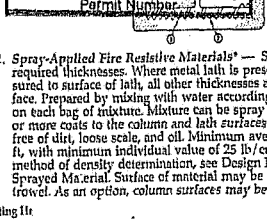
ARABIAN VERMICULITE INDUSTRIES —Types MK-6/CBF, MK-6/ED, MK-6/HY, MK-6/HY Extended Set, MK-6s, Sonotex 1, Sonotex 5, Z-106, Z-106/G.
GRACE CANADA INC—Types MK-4 or MK-5.
W R GRACE & CO - CONN
CONSTRUCTION PRODUCTS DIV —Types MK-4, MK-5, CMK-6/HY MK-6/HY Extended Set, MK-6s, RG, Monokote Acoustic 1, Monokote Acoustic 5, Z-106, Z-106/G.
GRACE KOREA INC—Types MK-6/CBF, MK-6/ED, MK-6/HY, MK-6/HY Extended Set, MK-6s, Monokote Acoustic 1, Monokote Acoustic 5, Z-106, Z-106/G.
PYROK INC —Type LD.
SOUTHWEST VERMICULITE CO —Types 4, 5, 5EF, 5GP, 5MD, 8EF, 8GP, 8MD, 9EF, 9GP, 9MD.
VERMICULITE PRODUCTS INC—Type MK-4 or MK-5.

2. Metal Lath — (Optional for contour application) — 3.4 lb/sq yd galvanized or painted expanded steel lath. Lath shall be lapped 1 in. and tied together with No. 18 SWG galvanized steel; wire spaced vertically 6 in. O.C.
3. Steel Column — Wide flange steel column, min sizes as shown in the tables below.

*Bearing the UL Classification Mark

Design No. X776

Ratings — 1-1/2, 2, 3 and 4 Hrs.



1. *Spray-Applied Fire Resistive Materials** — See table below for required thicknesses. Where metal lath is present, thicknesses are measured to surface of lath, all other thicknesses are measured to steel surface. Prepared by mixing with water according to instructions printed on each bag of mixture. Mixture can be spray or trowel applied in one or more coats to the column and lath surfaces which must be clean and free of dirt, loose scale, and oil. Minimum average density of 26 lb/cu ft, with minimum individual value of 25 lb/cu ft for the Type 239. For method of density determination, see Design Information Section, Sprayed Material. Surface of material may be lightly finished with a trowel. As an option, column surfaces may be primed.

Rating Hr	Min Thkns In.
1	1/2
1-1/2	7/8
2	1-1/16
3	1-1/2

Protected Floor/Ceiling - 2 1/2" Minimum Concrete, Fluted Decking

Products: Monokote® Type MK-5/HY, MK-5s, Z-106, Z-106/G, Z-106/HY, Z-146 and Retro-Guard® RG

Flange Protection: Full and Half Flange Thickness — **U. L. Design No.** D-779

Concrete Weight: NWC or LWC — **ICBO 4607 Table** 2A

FULL FLANGE TIP THICKNESS					Member		HALF-FLANGE TIP THICKNESS				
1 hr	1.5 hr	2 hr	3 hr	4 hr	Size x Wt.	W/D	1 hr	1.5 hr	2 hr	3 hr	4 hr
1/2	7/8	1 1/8	1 1/2	1 7/8	W4 x13	0.65	1/2	7/8	1 1/8	1 5/8	2 3/16
1/2	7/8	1 1/8	1 1/2	1 7/8	W5 x16	0.65	1/2	7/8	1 1/8	1 5/8	2 3/16
1/2	13/16	1 1/16	1 3/8	1 11/16	W5 x19	0.76	1/2	13/16	1 1/16	1 1/2	2
5/8	1 1/16	1 7/16	1 7/8	2 5/16	W6 x9	0.38	5/8	1 1/16	1 7/16	2 1/16	2 3/4
9/16	1	1 5/16	1 11/16	2 1/16	W6 x12	0.51	9/16	1	1 5/16	1 7/8	2 1/2
9/16	1	1 5/16	1 11/16	2 1/16	W6 x15	0.63	9/16	1	1 5/16	1 7/8	2 1/2
1/2	7/8	1 1/8	1 1/2	1 13/16	W6 x16	0.66	1/2	7/8	1 1/8	1 5/8	2 3/16
1/2	7/8	1 1/8	1 1/2	1 13/16	W6 x20	0.67	1/2	7/8	1 1/8	1 5/8	2 3/16
7/16	3/4	1	1 5/16	1 5/8	W6 x25	0.99	7/16	3/4	1	1 7/16	1 15/16
11/16	1 1/8	1 1/2	1 15/16	2 3/8	W8 x10	0.32	11/16	1 1/8	1 1/2	2 1/8	2 13/16
5/8	1	1 5/16	1 3/4	2 3/16	W8 x13	0.47	5/8	1	1 5/16	1 15/16	2 9/16
9/16	15/16	1 1/4	1 5/8	2	W8 x15	0.54	9/16	15/16	1 1/4	1 13/16	2 7/16
9/16	15/16	1 1/4	1 5/8	2	W8 x18	0.57	9/16	15/16	1 1/4	1 3/4	2 3/8
1/2	7/8	1 1/8	1 1/2	1 13/16	W8 x21	0.66	1/2	7/8	1 1/8	1 5/8	2 3/16
1/2	7/8	1 1/8	1 7/16	1 13/16	W8 x24	0.69	1/2	7/8	1 1/8	1 9/16	2 1/8
7/16	3/4	1	1 5/16	1 5/8	W8 x28	0.80	7/16	3/4	1	1 7/16	1 15/16
1/2	13/16	1 1/16	1 3/8	1 11/16	W8 x31	0.79	1/2	13/16	1 1/16	1 1/2	2
7/16	3/4	1	1 1/4	1 9/16	W8 x35	0.88	7/16	3/4	1	1 3/8	1 7/8
7/16	11/16	7/8	1 3/16	1 7/16	W8 x40	1.00	7/16	11/16	7/8	1 5/16	1 3/4
3/8	5/8	13/16	1 1/16	1 5/16	W8 x48	1.19	3/8	5/8	13/16	1 3/16	1 9/16
3/8	9/16	3/4	15/16	1 3/16	W8 x58	1.41	3/8	9/16	3/4	1 1/16	1 3/8
3/8	1/2	11/16	7/8	1 1/16	W8 x67	1.61	3/8	1/2	11/16	15/16	1 1/4
5/8	1 1/8	1 7/16	1 7/8	2 3/8	W10 x12	0.38	5/8	1 1/8	1 7/16	2 1/16	2 13/16
5/8	1	1 5/16	1 3/4	2 1/8	W10 x15	0.48	5/8	1	1 5/16	1 7/8	2 9/16
9/16	15/16	1 1/4	1 5/8	2	W10 x17	0.54	9/16	15/16	1 1/4	1 13/16	2 7/16
9/16	15/16	1 3/16	1 5/16	1 15/16	W10 x19	0.59	9/16	15/16	1 3/16	1 3/4	2 5/16
9/16	15/16	1 3/16	1 9/16	1 15/16	W10 x22	0.59	9/16	15/16	1 3/16	1 3/4	2 5/16
1/2	7/8	1 1/8	1 7/16	1 13/16	W10 x26	0.62	1/2	7/8	1 1/8	1 5/16	2 1/8
1/2	13/16	1 1/16	1 3/8	1 11/16	W10 x30	0.78	1/2	13/16	1 1/16	1 1/2	2
1/2	13/16	1 1/16	1 3/8	1 11/16	W10 x33	0.77	1/2	13/16	1 1/16	1 1/2	2
7/16	3/4	15/16	1 1/4	1 9/16	W10 x39	0.90	7/16	3/4	15/16	1 3/8	1 13/16
7/16	11/16	7/8	1 3/16	1 7/16	W10 x45	1.02	7/16	11/16	7/8	1 1/4	1 11/16
7/16	11/16	15/16	1 3/16	1 7/16	W10 x49	1.02	7/16	11/16	15/16	1 5/16	1 3/4
3/8	5/8	7/8	1 1/8	1 3/8	W10 x54	1.06	3/8	5/8	7/8	1 1/4	1 5/8
3/8	5/8	13/16	1 1/16	1 5/16	W10 x60	1.20	3/8	5/8	13/16	1 1/8	1 9/16
3/8	9/16	3/4	1	1 3/16	W10 x68	1.35	3/8	9/16	3/4	1 1/16	1 7/16
3/8	1/2	11/16	7/8	1 1/8	W10 x77	1.52	3/8	1/2	11/16	1	1 5/16
3/8	1/2	5/8	13/16	1	W10 x88	1.72	3/8	1/2	5/8	7/8	1 3/16
3/8	7/16	9/16	3/4	15/16	W10 x100	1.93	3/8	7/16	9/16	13/16	1 1/8
3/8	7/16	9/16	11/16	7/8	W10 x112	2.14	3/8	7/16	9/16	3/4	1 1/16
5/8	1 1/16	1 7/16	1 7/8	2 5/16	W12 x14	0.40	5/8	1 1/16	1 7/16	2 1/16	2 13/16
5/8	1	1 3/8	1 3/4	2 3/16	W12 x16	0.46	5/8	1	1 3/8	1 15/16	2 5/8
9/16	15/16	1 1/4	1 11/16	2 1/16	W12 x19	0.53	9/16	15/16	1 1/4	1 13/16	2 7/16
9/16	7/8	1 3/16	1 9/16	1 15/16	W12 x22	0.61	9/16	7/8	1 3/16	1 11/16	2 1/4
9/16	7/8	1 3/16	1 9/16	1 15/16	W12 x26	0.60	9/16	7/8	1 3/16	1 11/16	2 5/16
1/2	7/8	1 1/8	1 7/16	1 13/16	W12 x30	0.69	1/2	7/8	1 1/8	1 5/8	2 3/16
1/2	13/16	1 1/16	1 3/8	1 11/16	W12 x35	0.79	1/2	13/16	1 1/16	1 1/2	2
7/16	3/4	1	1 5/16	1 5/8	W12 x40	0.85	7/16	3/4	1	1 7/16	1 7/8
7/16	11/16	15/16	1 3/16	1 1/2	W12 x45	0.86	7/16	11/16	15/16	1 5/16	1 3/4
3/8	11/16	7/8	1 1/8	1 7/16	W12 x50	1.04	3/8	11/16	7/8	1 1/4	1 11/16
7/16	11/16	15/16	1 3/16	1 7/16	W12 x58	0.98	7/16	11/16	15/16	1 5/16	1 3/4

Protected Floor/Ceiling - 2 1/2" Minimum Concrete, Fluted Decking

Products: Monokote® Type (MK-5/HY) MK-6s, Z-105, Z-106/G Z-106/HY, Z-146 and Retro-Guard® RG

Flange Protection: (Full) and Half Flange Thickness — **U. L. Design No.** (D-779)

Concrete Weight: (NWC) or LWC — **ICBO 4507 Table** 24

FULL FLANGE TIP THICKNESS					Member		HALF-FLANGE TIP THICKNESS				
1 hr	1.5 hr	2 hr	3 hr	4 hr	Size xWt.	W/D	1 hr	1.5 hr	2 hr	3 hr	4 hr
3/8	11/16	7/8	1 1/8	1 7/16	W12 x54	1.04	3/8	11/16	7/8	1 1/4	1 11/16
3/8	11/16	7/8	1 1/8	1 7/16	W12 x58	1.04	3/8	11/16	7/8	1 1/4	1 11/16
3/8	5/8	7/8	1 1/8	1 3/8	W12 x58	1.08	3/8	5/8	7/8	1 1/4	1 5/8
3/8	5/8	7/8	1 1/8	1 3/8	W12 x65	1.08	3/8	5/8	7/8	1 1/4	1 5/8
3/8	5/8	13/16	1 1/16	1 5/16	W12 x72	1.20	3/8	5/8	13/16	1 1/8	1 9/16
3/8	9/16	3/4	1	1 3/16	W12 x79	1.32	3/8	9/16	3/4	1 1/16	1 7/16
3/8	9/16	11/16	15/16	1 1/8	W12 x87	1.44	3/8	9/16	11/16	1	1 3/8
3/8	1/2	11/16	7/8	1 1/16	W12 x96	1.57	3/8	1/2	11/16	15/16	1 1/4
3/8	1/2	5/8	13/16	1	W12 x106	1.73	3/8	1/2	5/8	7/8	1 3/16
3/8	7/16	9/16	3/4	15/16	W12 x120	1.94	3/8	7/16	9/16	13/16	1 1/8
3/8	7/16	9/16	11/16	7/8	W12 x136	2.17	3/8	7/16	9/16	3/4	1
3/8	3/8	1/2	5/8	13/16	W12 x152	2.40	3/8	3/8	1/2	11/16	15/16
3/8	3/8	7/16	5/8	3/4	W12 x170	2.66	3/8	3/8	7/16	5/8	7/8
3/8	3/8	7/16	9/16	11/16	W12 x190	2.89	3/8	3/8	7/16	5/8	13/16
3/8	3/8	3/8	1/2	5/8	W12 x210	3.21	3/8	3/8	3/8	9/16	3/4
3/8	3/8	3/8	1/2	9/16	W12 x230	3.47	3/8	3/8	3/8	1/2	11/16
3/8	3/8	3/8	7/16	9/16	W12 x252	3.76	3/8	3/8	3/8	1/2	5/8
3/8	3/8	3/8	7/16	1/2	W12 x279	4.10	3/8	3/8	3/8	7/16	5/8
3/8	3/8	3/8	3/8	1/2	W12 x305	4.41	3/8	3/8	3/8	7/16	9/16
3/8	3/8	3/8	3/8	7/16	W12 x336	4.76	3/8	3/8	3/8	3/8	9/16
9/16	15/16	1 1/4	1 11/16	2 1/16	W14 x22	0.58	9/16	15/16	1 1/4	1 13/16	2 7/16
9/16	7/8	1 3/16	1 9/16	1 15/16	W14 x26	0.61	9/16	7/8	1 3/16	1 11/16	2 1/4
1/2	7/8	1 3/16	1 1/2	1 7/8	W14 x30	0.68	1/2	7/8	1 3/16	1 11/16	2 1/4
1/2	13/16	1 1/8	1 7/16	1 3/4	W14 x34	0.71	1/2	13/16	1 1/8	1 9/16	2 1/8
1/2	13/16	1 1/16	1 3/8	1 11/16	W14 x38	0.79	1/2	13/16	1 1/16	1 1/2	2
7/16	3/4	1	1 5/16	1 5/8	W14 x43	0.85	7/16	3/4	1	1 7/16	1 7/8
7/16	11/16	15/16	1 1/4	1 1/2	W14 x48	0.94	7/16	11/16	15/16	1 5/16	1 13/16
7/16	11/16	7/8	1 3/16	1 7/16	W14 x53	1.03	7/16	11/16	7/8	1 1/4	1 11/16
3/8	11/16	7/8	1 1/8	1 3/8	W14 x61	1.07	3/8	11/16	7/8	1 1/4	1 5/8
3/8	5/8	13/16	1 1/16	1 5/16	W14 x68	1.19	3/8	5/8	13/16	1 1/8	1 9/16
3/8	9/16	3/4	1	1 1/4	W14 x74	1.28	3/8	9/16	3/4	1 1/8	1 1/2
3/8	9/16	3/4	15/16	1 3/16	W14 x82	1.41	3/8	9/16	3/4	1 1/16	1 3/8
3/8	9/16	3/4	1	1 1/4	W14 x90	1.27	3/8	9/16	3/4	1 1/8	1 1/2
3/8	9/16	3/4	15/16	1 3/16	W14 x99	1.39	3/8	9/16	3/4	1 1/16	1 3/8
3/8	1/2	11/16	7/8	1 1/8	W14 x109	1.52	3/8	1/2	11/16	1	1 5/16
3/8	1/2	5/8	13/16	1 1/16	W14 x120	1.67	3/8	1/2	5/8	15/16	1 1/4
3/8	7/16	5/8	13/16	15/16	W14 x132	1.83	3/8	7/16	5/8	7/8	1 1/8
3/8	7/16	9/16	3/4	15/16	W14 x145	1.94	3/8	7/16	9/16	13/16	1 1/8
3/8	7/16	9/16	11/16	7/8	W14 x159	2.11	3/8	7/16	9/16	3/4	1 1/16
3/8	3/8	1/2	11/16	13/16	W14 x176	2.32	3/8	3/8	1/2	11/16	1
3/8	3/8	1/2	5/8	3/4	W14 x193	2.49	3/8	3/8	1/2	5/8	13/16
3/8	3/8	7/16	9/16	11/16	W14 x211	2.74	3/8	3/8	7/16	5/8	13/16
3/8	3/8	7/16	9/16	11/16	W14 x233	3.00	3/8	3/8	7/16	5/8	13/16
3/8	3/8	3/8	1/2	5/8	W14 x257	3.27	3/8	3/8	3/8	9/16	3/4
3/8	3/8	3/8	1/2	9/16	W14 x283	3.57	3/8	3/8	3/8	1/2	11/16
3/8	3/8	3/8	7/16	9/16	W14 x311	3.88	3/8	3/8	3/8	1/2	5/8
3/8	3/8	3/8	7/16	1/2	W14 x342	4.21	3/8	3/8	3/8	7/16	9/16
3/8	3/8	3/8	3/8	1/2	W14 x370	4.51	3/8	3/8	3/8	7/16	9/16
3/8	3/8	3/8	3/8	7/16	W14 x398	4.80	3/8	3/8	3/8	3/8	9/16
3/8	3/8	3/8	3/8	7/16	W14 x426	5.05	3/8	3/8	3/8	3/8	1/2
3/8	3/8	3/8	3/8	7/16	W14 x455	5.39	3/8	3/8	3/8	3/8	1/2

Protected Floor/Ceiling - 2 1/2" Minimum Concrete, Fluted Decking

Products: Monokote® Type MK-5/HY, MK-5s, Z-106, Z-106/G
Z-106/HY, Z-146 and Retro-Guard® RG

Flange Protection: Full and Half Flange Thickness

Concrete Weight: NWC or LWC

U. L. Design No. D-779
ICBO 4507 Table 2A

FULL FLANGE TIP THICKNESS					Member		HALF-FLANGE TIP THICKNESS				
1 hr	1.5 hr	2 hr	3 hr	4 hr	Size x W/t	W/D	1 hr	1.5 hr	2 hr	3 hr	4 hr
3/8	3/8	3/8	3/8	3/8	W14 x500	5.82	3/8	3/8	3/8	3/8	7/16
3/8	3/8	3/8	3/8	3/8	W14 x550	6.30	3/8	3/8	3/8	3/8	7/16
3/8	3/8	3/8	3/8	3/8	W14 x605	6.80	3/8	3/8	3/8	3/8	3/8
3/8	3/8	3/8	3/8	3/8	W14 x665	7.34	3/8	3/8	3/8	3/8	3/8
3/8	3/8	3/8	3/8	3/8	W14 x730	7.80	3/8	3/8	3/8	3/8	3/8
9/16	15/16	1 1/4	1 5/8	2	W16 x26	0.55	9/16	15/16	1 1/4	1 3/4	2 3/8
1/2	7/8	1 1/8	1 1/2	1 7/8	W16 x31	0.65	1/2	7/8	1 1/8	1 5/8	2 3/16
1/2	7/8	1 1/8	1 7/16	1 13/16	W16 x36	0.69	1/2	7/8	1 1/8	1 9/16	2 1/16
1/2	13/16	1 1/16	1 3/8	1 11/16	W16 x40	0.76	1/2	13/16	1 1/16	1 1/2	2
7/16	3/4	1	1 5/16	1 5/8	W16 x45	0.85	7/16	3/4	1	1 7/16	1 7/8
7/16	11/16	15/16	1 1/4	1 1/2	W16 x50	0.94	7/16	11/16	15/16	1 5/16	1 13/16
3/8	11/16	7/8	1 1/8	1 3/8	W16 x57	1.02	3/8	11/16	7/8	1 1/4	1 5/8
3/8	11/16	7/8	1 1/8	1 3/8	W16 x67	1.07	3/8	11/16	7/8	1 1/4	1 5/8
3/8	5/8	13/16	1 1/16	1 1/4	W16 x77	1.22	3/8	5/8	13/16	1 1/8	1 1/2
3/8	9/16	3/4	15/16	1 3/16	W16 x89	1.40	3/8	9/16	3/4	1 1/16	1 3/8
3/8	1/2	11/16	7/8	1 1/16	W16 x100	1.56	3/8	1/2	11/16	15/16	1 5/16
1/2	7/8	1 1/8	1 1/2	1 13/16	W18 x35	0.66	1/2	7/8	1 1/8	1 5/8	2 3/16
1/2	13/16	1 1/16	1 3/8	1 11/16	W18 x40	0.75	1/2	13/16	1 1/16	1 1/2	2 1/16
7/16	3/4	1	1 5/16	1 9/16	W18 x46	0.86	7/16	3/4	1	1 7/16	1 7/8
7/16	3/4	1	1 1/4	1 5/16	W18 x50	0.87	7/16	3/4	1	1 3/8	1 7/8
7/16	11/16	15/16	1 3/16	1 1/2	W18 x55	0.95	7/16	11/16	15/16	1 5/16	1 3/4
7/16	11/16	7/8	1 3/16	1 7/16	W18 x60	1.03	7/16	11/16	7/8	1 1/4	1 11/16
3/8	5/8	7/8	1 1/8	1 3/8	W18 x65	1.11	3/8	5/8	7/8	1 3/16	1 5/8
3/8	5/8	13/16	1 1/16	1 5/16	W18 x71	1.21	3/8	5/8	13/16	1 1/8	1 1/2
3/8	5/8	7/8	1 1/8	1 3/8	W18 x76	1.11	3/8	5/8	7/8	1 3/16	1 5/8
3/8	5/8	13/16	1	1 1/4	W18 x86	1.24	3/8	5/8	13/16	1 1/8	1 1/2
3/8	9/16	3/4	15/16	1 3/16	W18 x97	1.39	3/8	9/16	3/4	1 1/16	1 3/8
3/8	1/2	11/16	7/8	1 1/8	W18 x106	1.52	3/8	1/2	11/16	1	1 5/16
3/8	1/2	5/8	13/16	1	W18 x119	1.68	3/8	1/2	5/8	15/16	1 1/4
1/2	13/16	1 1/16	1 7/16	1 3/4	W21 x44	0.75	1/2	13/16	1 1/16	1 9/16	2 1/16
7/16	3/4	1	1 5/16	1 5/8	W21 x50	0.83	7/16	3/4	1	1 7/16	1 15/16
7/16	11/16	15/16	1 1/4	1 1/2	W21 x57	0.93	7/16	11/16	15/16	1 3/8	1 13/16
7/16	11/16	15/16	1 1/4	1 1/2	W21 x62	0.94	7/16	11/16	15/16	1 5/16	1 13/16
7/16	11/16	7/8	1 3/16	1 7/16	W21 x68	1.03	7/16	11/16	7/8	1 1/4	1 11/16
3/8	5/8	7/8	1 1/8	1 3/8	W21 x73	1.10	3/8	5/8	7/8	1 3/16	1 5/8
3/8	5/8	13/16	1	1 1/4	W21 x83	1.24	3/8	5/8	13/16	1 1/8	1 1/2
3/8	9/16	3/4	15/16	1 3/16	W21 x93	1.38	3/8	9/16	3/4	1 1/16	1 3/8
3/8	9/16	3/4	1	1 1/4	W21 x101	1.29	3/8	9/16	3/4	1 1/8	1 7/16
3/8	9/16	3/4	15/16	1 3/16	W21 x111	1.41	3/8	9/16	3/4	1 1/16	1 3/8
3/8	1/2	11/16	7/8	1 1/8	W21 x122	1.54	3/8	1/2	11/16	1	1 5/16
3/8	1/2	5/8	7/8	1 1/16	W21 x132	1.66	3/8	1/2	5/8	1	1 1/4
3/8	7/16	5/8	13/16	15/16	W21 x147	1.83	3/8	7/16	5/8	1	1 1/16
7/16	3/4	1	1 5/16	1 5/8	W24 x55	0.82	7/16	3/4	1	1 7/16	1 15/16
7/16	3/4	15/16	1 1/4	1 1/2	W24 x62	0.92	7/16	3/4	15/16	1 3/8	1 13/16
7/16	11/16	15/16	1 1/4	1 1/2	W24 x68	0.98	7/16	11/16	15/16	1 5/16	1 13/16
7/16	11/16	7/8	1 3/16	1 7/16	W24 x76	1.02	7/16	11/16	7/8	1 1/4	1 11/16
3/8	5/8	13/16	1 1/16	1 3/8	W24 x84	1.10	3/8	5/8	13/16	1 1/8	1 5/8
3/8	5/8	13/16	1	1 1/4	W24 x94	1.26	3/8	5/8	13/16	1	1 1/2
3/8	5/8	13/16	1 1/16	1 1/4	W24 x104	1.22	3/8	5/8	13/16	1 1/8	1 1/2
3/8	9/16	3/4	15/16	1 3/16	W24 x117	1.36	3/8	9/16	3/4	1 1/16	1 7/16
3/8	1/2	11/16	7/8	1 1/8	W24 x131	1.52	3/8	1/2	11/16	1	1 5/16

Protected Floor/Ceiling - 2 1/2" Minimum Concrete, Fluted Decking

Products: Monokote® Type MK-6/HY, MK-6s, Z-106, Z-106/G
Z-106/HY, Z-146 and Retro-Guard® RG

Flange Protection: Full and Half Flange Thickness — **U. L. Design No.** D-779

Concrete Weight: NWC or LWC — **ICBO 4607 Table** 2A

FULL FLANGE TIP THICKNESS							*HALF-FLANGE TIP THICKNESS*				
1 hr	1.5 hr	2 hr	3 hr	4 hr	Member Size XWI.	W/D	1 hr	1.5 hr	2 hr	3 hr	4 hr
9/16	15/16	1 1/4	1 11/16	2 1/16	Other	0.52	9/16	15/16	1 1/4	1 13/16	2 7/16
9/16	15/16	1 1/4	1 11/16	2 1/16	Other	0.53	9/16	15/16	1 1/4	1 13/16	2 7/16
9/16	15/16	1 1/4	1 5/8	2	Other	0.54	9/16	15/16	1 1/4	1 13/16	2 7/16
9/16	15/16	1 1/4	1 5/8	2	Other	0.55	9/16	15/16	1 1/4	1 3/4	2 3/8
9/16	15/16	1 1/4	1 5/8	2	Other	0.56	9/16	15/16	1 1/4	1 3/4	2 3/8
9/16	15/16	1 1/4	1 5/8	2	Other	0.57	9/16	15/16	1 1/4	1 3/4	2 3/8
9/16	15/16	1 3/16	1 9/16	1 15/16	Other	0.58	9/16	15/16	1 3/16	1 3/4	2 5/16
9/16	15/16	1 3/16	1 9/16	1 15/16	Other	0.59	9/16	15/16	1 3/16	1 3/4	2 5/16
9/16	7/8	1 3/16	1 9/16	1 15/16	Other	0.60	9/16	7/8	1 3/16	1 11/16	2 5/16
9/16	7/8	1 3/16	1 9/16	1 15/16	Other	0.61	9/16	7/8	1 3/16	1 11/16	2 1/4
9/16	7/8	1 3/16	1 9/16	1 7/8	Other	0.62	9/16	7/8	1 3/16	1 11/16	2 1/4
1/2	7/8	1 3/16	1 1/2	1 7/8	Other	0.63	1/2	7/8	1 3/16	1 11/16	2 1/4
1/2	7/8	1 3/16	1 1/2	1 7/8	Other	0.64	1/2	7/8	1 3/16	1 5/8	2 3/16
1/2	7/8	1 1/8	1 1/2	1 7/8	Other	0.65	1/2	7/8	1 1/8	1 5/8	2 3/16
1/2	7/8	1 1/8	1 1/2	1 13/16	Other	0.66	1/2	7/8	1 1/8	1 5/8	2 3/16
1/2	7/8	1 1/8	1 1/2	1 13/16	Other	0.67	1/2	7/8	1 1/8	1 5/8	2 3/16
1/2	7/8	1 1/8	1 7/16	1 13/16	Other	0.68	1/2	7/8	1 1/8	1 5/8	2 1/8
1/2	7/8	1 1/8	1 7/16	1 13/16	Other	0.69	1/2	7/8	1 1/8	1 9/16	2 1/8
1/2	13/16	1 1/8	1 7/16	1 3/4	Other	0.70	1/2	13/16	1 1/8	1 9/16	2 1/8
1/2	13/16	1 1/8	1 7/16	1 3/4	Other	0.71	1/2	13/16	1 1/8	1 9/16	2 1/8
1/2	13/16	1 1/16	1 7/16	1 3/4	Other	0.72	1/2	13/16	1 1/16	1 9/16	2 1/16
1/2	13/16	1 1/16	1 7/16	1 3/4	Other	0.73	1/2	13/16	1 1/16	1 9/16	2 1/16
1/2	13/16	1 1/16	1 3/8	1 3/4	Other	0.74	1/2	13/16	1 1/16	1 9/16	2 1/16
1/2	13/16	1 1/16	1 3/8	1 11/16	Other	0.75	1/2	13/16	1 1/16	1 1/2	2 1/16
1/2	13/16	1 1/16	1 3/8	1 11/16	Other	0.76	1/2	13/16	1 1/16	1 1/2	2
1/2	13/16	1 1/16	1 3/8	1 11/16	Other	0.77	1/2	13/16	1 1/16	1 1/2	2
1/2	13/16	1 1/16	1 3/8	1 11/16	Other	0.78	1/2	13/16	1 1/16	1 1/2	2
1/2	13/16	1 1/16	1 3/8	1 11/16	Other	0.79	1/2	13/16	1 1/16	1 1/2	2
7/16	3/4	1	1 5/16	1 5/8	Other	0.80	7/16	3/4	1	1 7/16	1 15/16
7/16	3/4	1	1 5/16	1 5/8	Other	0.81	7/16	3/4	1	1 7/16	1 15/16
7/16	3/4	1	1 5/16	1 5/8	Other	0.82	7/16	3/4	1	1 7/16	1 15/16
7/16	3/4	1	1 5/16	1 5/8	Other	0.83	7/16	3/4	1	1 7/16	1 15/16
7/16	3/4	1	1 5/16	1 5/8	Other	0.84	7/16	3/4	1	1 7/16	1 15/16
7/16	3/4	1	1 5/16	1 5/8	Other	0.85	7/16	3/4	1	1 7/16	1 7/8
7/16	3/4	1	1 5/16	1 9/16	Other	0.86	7/16	3/4	1	1 7/16	1 7/8
7/16	3/4	1	1 1/4	1 9/16	Other	0.87	7/16	3/4	1	1 3/5	1 7/8
7/16	3/4	1	1 1/4	1 9/16	Other	0.88	7/16	3/4	1	1 3/8	1 7/8
7/16	3/4	1	1 1/4	1 9/16	Other	0.89	7/16	3/4	1	1 3/8	1 7/8
7/16	3/4	15/16	1 1/4	1 9/16	Other	0.90	7/16	3/4	15/16	1 3/8	1 13/16
7/16	3/4	15/16	1 1/4	1 9/16	Other	0.91	7/16	3/4	15/16	1 3/8	1 13/16
7/16	3/4	15/16	1 1/4	1 1/2	Other	0.92	7/16	3/4	15/16	1 3/8	1 13/16
7/16	11/16	15/16	1 1/4	1 1/2	Other	0.93	7/16	11/16	15/16	1 3/8	1 13/16
7/16	11/16	15/16	1 1/4	1 1/2	Other	0.94	7/16	11/16	15/16	1 5/16	1 13/16
7/16	11/16	15/16	1 3/16	1 1/2	Other	0.95	7/16	11/16	15/16	1 5/16	1 3/4
7/16	11/16	15/16	1 3/16	1 1/2	Other	0.96	7/16	11/16	15/16	1 5/16	1 3/4
7/16	11/16	15/16	1 3/16	1 1/2	Other	0.97	7/16	11/16	15/16	1 5/16	1 3/4
7/16	11/16	15/16	1 3/16	1 1/2	Other	0.98	7/16	11/16	15/16	1 5/16	1 3/4
7/16	11/16	15/16	1 3/16	1 7/16	Other	0.99	7/16	11/16	15/16	1 5/16	1 3/4
7/16	11/16	7/8	1 3/16	1 7/16	Other	1.00	7/16	11/16	7/8	1 5/16	1 3/4
7/16	11/16	7/8	1 3/16	1 7/16	Other	1.01	7/16	11/16	7/8	1 5/16	1 3/4
7/16	11/16	7/8	1 3/16	1 7/16	Other	1.02	7/16	11/16	7/8	1 5/16	1 3/4

.12x20.7

P.12

Tube Columns

Products: Monokote® MK-6/HY, MK-6s, Z-106, Z-106/G
Z-106/HY, Z-146 and Retro-Guard® RG

Shape: Square

U. L. Design No. X-771, Y-710, X-794
ICBO 4607 Table 1B

Nominal Size	Wall Thickness	A/P	1 hr	1.5 hr	2 hr	3 hr	4 hr
2 X 2	1/4	0.22	7/8	1 3/8	1 7/8	2 7/8	3 15/16
2 X 2	5/16	0.26	3/4	1 1/8	1 9/16	2 7/16	3 5/16
2.5 X 2.5	1/4	0.23	13/16	1 5/16	1 13/16	2 3/4	3 3/4
2.5 X 2.5	5/16	0.27	11/16	1 1/8	1 1/2	2 3/8	3 3/16
3 X 3	3/16	0.18	1	1 5/8	2 1/4	3 9/16	NA
3 X 3	1/4	0.23	13/16	1 5/16	1 13/16	2 3/4	3 3/4
3 X 3	5/16	0.28	11/16	1 1/16	1 1/2	2 5/16	3 1/16
3 X 3	3/8	0.33	9/16	15/16	1 1/4	1 15/16	2 5/8
3 X 3	1/2	0.44	7/16	3/4	1	1 1/2	2 1/16
3.5 X 3.5	3/16	0.18	1	1 5/8	2 1/4	3 9/16	NA
3.5 X 3.5	1/4	0.23	13/16	1 5/16	1 13/16	2 3/4	3 3/4
3.5 X 3.5	5/16	0.28	11/16	1 1/16	1 1/2	2 5/16	3 1/16
4 X 4	3/16	0.18	1	1 5/8	2 1/4	3 9/16	NA
4 X 4	1/4	0.23	13/16	1 5/16	1 13/16	2 3/4	3 3/4
4 X 4	5/16	0.29	5/8	1 1/16	1 7/16	2 3/16	3
4 X 4	3/8	0.34	9/16	7/8	1 1/4	1 7/8	2 9/16
4 X 4	1/2	0.44	7/16	11/16	15/16	1 7/16	2
4.5 X 4.5	3/16	0.18	1	1 5/8	2 1/4	3 9/16	NA
4.5 X 4.5	1/4	0.24	3/4	1 1/4	1 11/16	2 11/16	3 5/8
4.5 X 4.5	5/16	0.29	5/8	1 1/16	1 7/16	2 3/16	3
4.5 X 4.5	3/8	0.34	9/16	7/8	1 1/4	1 7/8	2 9/16
5 X 5	3/16	0.18	1	1 5/8	2 1/4	3 9/16	NA
5 X 5	1/4	0.24	3/4	1 1/4	1 11/16	2 11/16	3 5/8
5 X 5	5/16	0.29	5/8	1 1/16	1 7/16	2 3/16	3
5 X 5	3/8	0.35	9/16	7/8	1 3/16	1 13/16	2 1/2
5 X 5	1/2	0.45	7/16	11/16	15/16	1 7/16	1 15/16
5.5 X 5.5	3/16	0.18	1	1 5/8	2 1/4	3 9/16	NA
5.5 X 5.5	1/4	0.24	3/4	1 1/4	1 11/16	2 11/16	3 5/8
5.5 X 5.5	5/16	0.29	5/8	1 1/16	1 7/16	2 3/16	3
5.5 X 5.5	3/8	0.35	9/16	7/8	1 3/16	1 13/16	2 1/2
6 X 6	3/16	0.18	1	1 5/8	2 1/4	3 9/16	NA
6 X 6	1/4	0.24	3/4	1 1/4	1 11/16	2 11/16	3 5/8
6 X 6	5/16	0.30	5/8	1	1 3/8	2 1/8	2 7/8
6 X 6	3/8	0.35	9/16	7/8	1 3/16	1 13/16	2 1/2
6 X 6	1/2	0.46	7/16	11/16	15/16	1 3/8	1 7/8
6 X 6	5/8	0.56	3/8	9/16	3/4	1 3/16	1 9/16
7 X 7	3/16	0.18	1	1 5/8	2 1/4	3 9/16	NA
7 X 7	1/4	0.24	3/4	1 1/4	1 11/16	2 11/16	3 5/8
7 X 7	5/16	0.30	5/8	1	1 3/8	2 1/8	2 7/8
7 X 7	3/8	0.35	9/16	7/8	1 3/16	1 13/16	2 1/2
7 X 7	1/2	0.46	7/16	11/16	15/16	1 3/8	1 7/8
7 X 7	5/8	0.57	3/8	9/16	3/4	1 3/16	1 9/16
8 X 8	3/16	0.18	1	1 5/8	2 1/4	3 9/16	NA
8 X 8	1/4	0.24	3/4	1 1/4	1 11/16	2 11/16	3 5/8
8 X 8	5/16	0.30	5/8	1	1 3/8	2 1/8	2 7/8
8 X 8	3/8	0.35	9/16	7/8	1 3/16	1 13/16	2 1/2

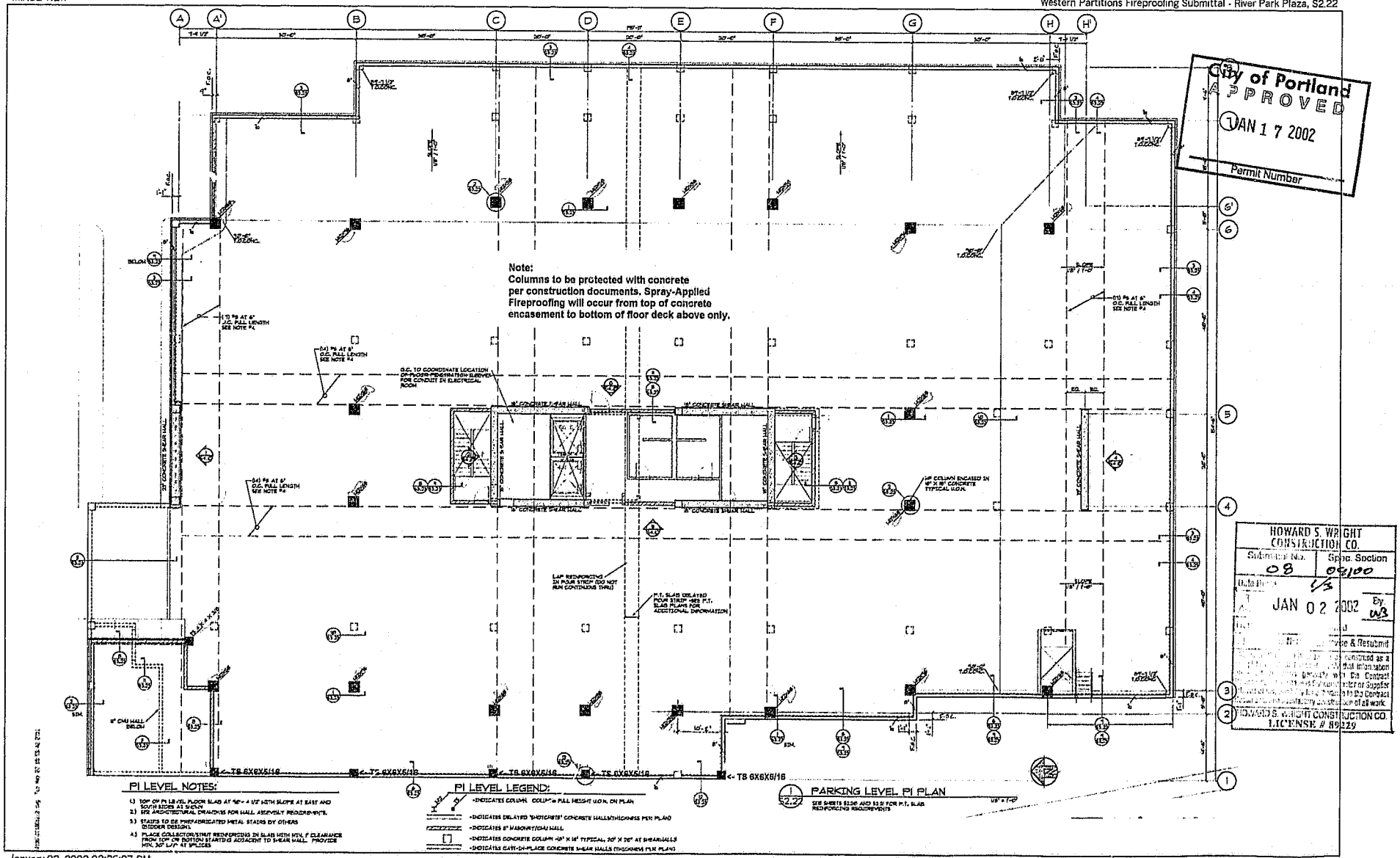
Wide Flange Columns

Products: Monokote® Type MK-6/HY, MK-6s, Z-106
Z-106/G, Z-146 and Retro-Guard® RG

U.L. Design No. X-772, Y-715
ICBO 4607 Table No. 1A

Shape: W Shapes

FULL FLANGE TIP THICKNESS					Member			HALF FLANGE TIP THICKNESS				
1 hr	1.5 hr	2 hr	3 hr.	4 hr	Size	xWt.	W/D	1 hr	1.5 hr	2 hr	3 hr	4 hr
3/4	1 1/8	1 3/8	2	2 11/16	W12	x35	0.7	13/16	1 3/16	1 1/2	2 1/4	2 15/16
3/4	1 1/8	1 3/8	2	2 11/16	W12	x40	0.72	13/16	1 3/16	1 1/2	2 1/4	2 15/16
11/16	1 1/16	1 3/8	2	2 11/16	W12	x45	0.81	13/16	1 3/16	1 1/2	2 1/4	2 15/16
11/16	7/8	1 1/8	1 11/16	2 1/2	W12	x50	0.89	3/4	1 1/16	1 3/8	2 1/16	2 3/4
11/16	7/8	1 1/8	1 11/16	2 1/2	W12	x53	0.84	3/4	1 1/16	1 3/8	2 1/16	2 3/4
11/16	7/8	1 1/8	1 11/16	2 1/2	W12	x58	0.91	3/4	1 1/16	1 3/8	2 1/16	2 3/4
11/16	7/8	1 1/8	1 11/16	2 1/2	W12	x65	0.91	3/4	1 1/16	1 3/8	2 1/16	2 3/4
5/8	7/8	1 1/8	1 11/16	2 7/16	W12	x72	1	3/4	1 1/16	1 3/8	2 1/16	2 3/4
5/8	7/8	1 1/8	1 11/16	2 5/16	W12	x79	1.1	3/4	1 1/16	1 3/8	2 1/16	2 3/4
9/16	13/16	1 1/8	1 5/8	2 3/16	W12	x87	1.2	3/4	1 1/16	1 3/8	2 1/16	2 3/4
9/16	13/16	1 1/16	1 9/16	2 1/16	W12	x96	1.32	3/4	1 1/16	1 3/8	2 1/16	2 3/4
1/2	3/4	1	1 7/16	1 15/16	W12	x106	1.44	3/4	1 1/16	1 3/8	2 1/16	2 3/4
7/16	11/16	7/8	1 5/16	1 3/4	W12	x120	1.62	3/4	1 1/16	1 3/8	2 1/16	2 3/4
7/16	5/8	13/16	1 1/4	1 5/8	W12	x136	1.82	3/4	1 1/16	1 3/8	2 1/16	2 3/4
3/8	9/16	3/4	1 1/8	1 1/2	W12	x152	2.01	3/4	1 1/16	1 3/8	2 1/16	2 3/4
3/8	9/16	11/16	1 1/16	1 3/8	W12	x170	2.22	3/4	1 1/16	1 3/8	2 1/16	2 3/4
3/8	1/2	11/16	1	1 5/16	W12	x190	2.46	3/4	1 1/16	1 3/8	2 1/16	2 3/4
5/16	1/2	9/16	7/8	1 3/16	W12	x210	2.68	5/16	1/2	11/16	1 3/16	1 5/8
5/16	7/16	9/16	7/8	1 1/8	W12	x230	2.91	5/16	1/2	11/16	1 3/16	1 5/8
5/16	7/16	9/16	13/16	1 1/16	W12	x252	3.15	5/16	1/2	11/16	1 3/16	1 5/8
1/4	3/8	1/2	3/4	1	W12	x279	3.44	5/16	1/2	11/16	1 3/16	1 5/8
1/4	3/8	1/2	11/16	15/16	W12	x305	3.7	5/16	1/2	11/16	1 3/16	1 5/8
1/4	5/16	7/16	5/8	7/8	W12	x336	4.02	5/16	1/2	11/16	1 3/16	1 5/8
15/16	1 3/8	1 13/16	2 1/2	3 5/8	W14	x22	0.47	1 1/8	1 5/8	2 1/16	2 15/16	3 13/16
7/8	1 5/16	1 11/16	2 1/2	3 3/8	W14	x26	0.55	1 1/8	1 5/8	2 1/16	2 15/16	3 13/16
7/8	1 5/16	1 11/16	2 1/2	3 3/8	W14	x30	0.55	1 1/8	1 5/8	2 1/16	2 15/16	3 13/16
13/16	1 1/4	1 5/8	2 7/16	3 3/16	W14	x34	0.62	7/8	1 5/16	1 3/4	2 9/16	3 3/8
3/4	1 1/8	1 3/8	2	2 11/16	W14	x38	0.69	13/16	1 3/16	1 1/2	2 1/4	2 15/16
3/4	1 1/8	1 3/8	2	2 11/16	W14	x43	0.73	13/16	1 3/16	1 1/2	2 1/4	2 15/16
11/16	1 1/16	1 3/8	2	2 11/16	W14	x48	0.81	13/16	1 3/16	1 1/2	2 1/4	2 15/16
11/16	7/8	1 1/8	1 11/16	2 1/2	W14	x53	0.89	3/4	1 1/16	1 3/8	2 1/16	2 3/4
11/16	7/8	1 1/8	1 11/16	2 1/2	W14	x61	0.91	3/4	1 1/16	1 3/8	2 1/16	2 3/4
5/8	7/8	1 1/8	1 11/16	2 7/16	W14	x68	1.01	3/4	1 1/16	1 3/8	2 1/16	2 3/4
5/8	7/8	1 1/8	1 11/16	2 5/16	W14	x74	1.09	3/4	1 1/16	1 3/8	2 1/16	2 3/4
9/16	13/16	1 1/8	1 5/8	2 3/16	W14	x82	1.2	3/4	1 1/16	1 3/8	2 1/16	2 3/4
5/8	7/8	1 1/8	1 11/16	2 3/8	W14	x90	1.06	3/4	1 1/16	1 3/8	2 1/16	2 3/4
9/16	7/8	1 1/8	1 11/16	2 1/4	W14	x99	1.16	3/4	1 1/16	1 3/8	2 1/16	2 3/4
9/16	13/16	1 1/16	1 9/16	2 1/16	W14	x109	1.27	3/4	1 1/16	1 3/8	2 1/16	2 3/4
1/2	3/4	1	1 1/2	1 15/16	W14	x120	1.39	3/4	1 1/16	1 3/8	2 1/16	2 3/4
1/2	11/16	15/16	1 3/8	1 7/8	W14	x132	1.52	3/4	1 1/16	1 3/8	2 1/16	2 3/4
7/16	11/16	7/8	1 5/16	1 3/4	W14	x145	1.61	3/4	1 1/16	1 3/8	2 1/16	2 3/4
7/16	5/8	7/8	1 1/4	1 11/16	W14	x159	1.75	3/4	1 1/16	1 3/8	2 1/16	2 3/4
7/16	5/8	13/16	1 3/16	1 9/16	W14	x176	1.93	3/4	1 1/16	1 3/8	2 1/16	2 3/4
3/8	9/16	3/4	1 1/8	1 7/16	W14	x193	2.1	3/4	1 1/16	1 3/8	2 1/16	2 3/4
3/8	1/2	11/16	1	1 3/8	W14	x211	2.28	3/4	1 1/16	1 3/8	2 1/16	2 3/4
5/16	1/2	9/16	7/8	1 1/4	W14	x228	2.49	5/16	1/2	1 3/16	1 5/8	2 5/8


Note:
Columns to be protected with concrete per construction documents. Spray-Applied Fireproofing will occur from top of concrete encasement to bottom of floor deck above only.
City of Portland
APPROVED
JAN 17 2002
Permit Number
HOWARD S. WRIGHT CONSTRUCTION CO.
Submittal No. 08
Spec. Section 09100
JAN 02 2002
HOWARD S. WRIGHT CONSTRUCTION CO.
LICENSE # 89229
PI LEVEL NOTES:
1) TOP OF PI LEVEL FLOOR SLAB AT 16'-4 1/2" WITH SLOPE AT EAST AND SOUTH EDGES AT SLAB #
2) SEE ARCHITECTURAL DRAWINGS FOR WALL ASSEMBLY REQUIREMENTS.
3) STAIRS TO BE PREFABRICATED METAL STAIRS BY OTHERS OUTDOOR DESIGN.
4) PLACE COLLECTOR/STRUT REINFORCING IN SLAB WITH MIN. 3" CLEARANCE FROM TOP OR BOTTOM START (3) ADJACENT TO SHEAR WALL. PROVIDE MIN. 30" LAP AT SPLICES
PI LEVEL LEGEND:
PARKING LEVEL PI PLAN

Note: Floor Deck Thickness Requirement - 11/16" @ crest and 1/2" @ valley per UL D779.
Note: See included Thickness Tables for beam and column thickness requirement.

Note: All members are to receive a 3 hour thickness requirement to achieve a 3hr occupancy seperation.

FIRST FLOOR FRAMING LEGEND:

-INDICATES SPAN OF CONCRETE SLAB AND METAL DECK. FLOOR DECKING TO BE 20 GAUGE VERCO TYPE 3/4N FORM-LOK OR EQUAL "3N-36 COMPOSITE" 3 SPAN MINIMUM LAYUP FOR UNSHORED CONSTRUCTION U.O.N. USE 18 GAUGE VERCO TYPE 3/4" FORM-LOK FOR 2 SPAN OR 1 SPAN UNSHORED CONSTRUCTION. PROVIDE MIN. 3" BEARING AT ALL DECK SUPPORTS. WELD DECK WITH (4) 1/2" DIA. PUDDLE WELDS EACH PIECE, EACH SUPPORT AND BUTTON PUNCH SEAMS AT 24" O.C. CONCRETE SLAB TO BE 5 1/2" TOTAL THICKNESS WITH #3 AT 18" O.C. EACH WAY, SEE PROVIDE MIN. (2) #6 PERIMETER BARS AT EDGES

-INDICATES HP COLUMN.

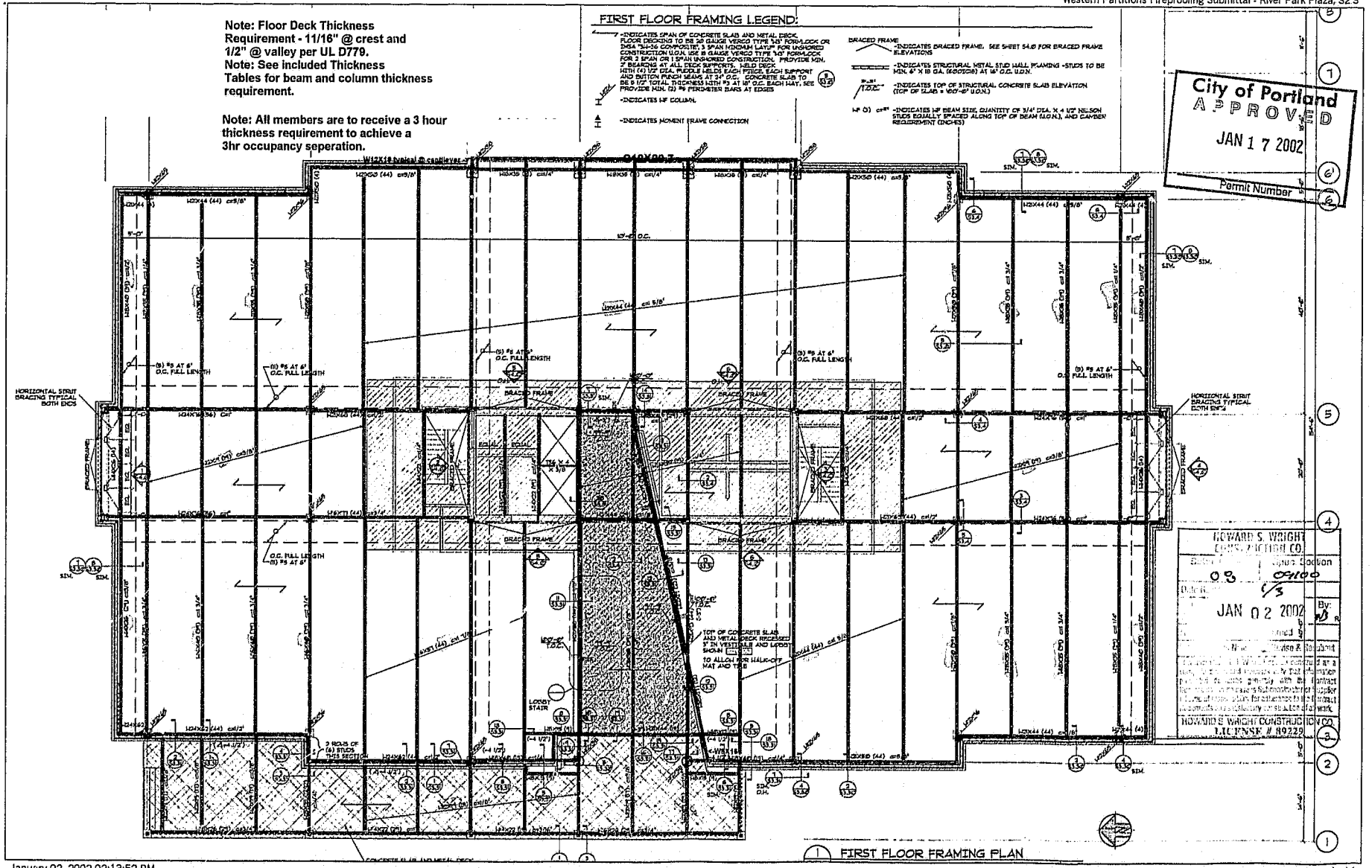
-INDICATES MOMENT FRAME CONNECTION

BRACED FRAME -INDICATES BRACED FRAME, SEE SHEET S4.0 FOR BRACED FRAME ELEVATIONS

-INDICATES STRUCTURAL METAL STUD WALL FRAMING -STUDS TO BE MIN. 6" X 18 GA. (600S162-68) AT 16" O.C. U.O.N.

-INDICATES TOP OF STRUCTURAL CONCRETE SLAB ELEVATION (TOP OF SLAB = 100'-0" U.O.N.)

HP 8) -INDICATES HP BEAM SIZE, QUANTITY OF 3/4" DIA. X 4 1/2" NELSON STUDS EQUALLY SPACED ALONG TOP OF BEAM (U.O.N.), AND CAMBER REQUIREMENT (INCHES)



1 FIRST FLOOR FRAMING PLAN

City of Portland
APPROVED
JAN 17 2002
Permit Number

HOWARD S. WRIGHT CONSTRUCTION CO.
Building Section
03 03100
1/3
JAN 02 2002
By:
HOWARD S. WRIGHT CONSTRUCTION CO.
LICENSE # 80229