LEGACY REPORT

ER-3627

Reissued March 1, 2006

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Legacy report on the 1997 *Uniform Building Code*™

DIVISION: 03—CONCRETE
Section: 03520—Lightweight Concrete Roof Insulation

LITE-CRETE CELLULAR CONCRETE ROOF-CEILING CONSTRUCTION

LITE-CRETE, INC.
1911 NORTH FINE AVENUE, #100
FRESNO, CALIFORNIA 93727

1.0 SUBJECT

Lite-Crete Cellular Concrete Roof-ceiling Construction.

2.0 DESCRIPTION

2.1 General:

Lite-Crete is a cellular concrete used in fire-resistive and nonfire-resistive roof-ceiling construction. Assemblies using Lite-Crete cellular concrete are assigned structural diaphragm capacities as set forth in this evaluation report.

2.2 Materials:

Material specifications used in the roof construction are as shown in Sections 2.2.1 through 2.2.8.

2.2.1 Lite-Crete Cellular Concrete: Lite-Crete and Lite-Crete Plus are cellular concretes produced by the addition of an air-entraining agent, and are controlled by testing in accordance with ASTM C 796. The addition of one part of the agent to 40 parts of water, by volume, produces a stabilized foam when applied through a nozzle at 90-psi (620 kPa) pressure. The mixture rate for the agent is 2.43 cubic feet (0.07 m^3) foam to 94 pounds (42.6 kg) of Type II portland cement and 4.78 gallons (18 L) of water. The average dry density of the Lite-Crete cellular concrete is 29 ± 3 pcf (464 ± 48 kg/m^3), and the compressive strengths are from 125 to 500 psi (862 to 3447 kPa). The density of Lite-Crete Plus can be varied from 20 to 120 pcf (320 to 1920 kg/m^2), and compressive strengths are from 20 psi to 3,000 psi (138 Pa to 20.7 MPa).

2.2.2 Plywood Sheathing: Plywood sheathing must be listed in Table 23-II-H of the 1997 *Uniform Building Code*™ (UBC).

2.2.3 Steel Decking: Roof deck $1^5/_{16}$ inches (33 mm) deep with a nominal flute pitch of $4^1/_2$ inches (114 mm) must be corrugated using steel that conforms to ASTM A 653 SS Grade 80 and must have a minimum thickness shown in the tables of this evaluation report. The cover width varies from 32 inches (813 mm) to 36 inches (914 mm).

Roof deck $1^1/_2$ inches (38 mm) deep with a nominal flute pitch of 6 inches (152 mm) must be made using steel that conforms to ASTM A 653 SS with a minimum Grade 33, and must have a minimum thickness shown in the tables of this evaluation report. The cover width is nominally 36 inches.

Both deck types must have a minimum G60 galvanizing coating designation.

The steel decks must be recognized in a current ICC-ES evaluation report.

2.2.4 Welding Electrodes: Filler metal must be made using E70 rods in conformance with AWS D1.3.

2.2.5 Welding Accessories: Weld washers must be No. 14 gage [0.068 inch (1.73 mm)] steel and must have a $^3/_8$-inch-diameter (9.5 mm) prepunched hole. See Figure 6.

2.2.6 Welded Wire Mesh: Welded wire mesh is No. 12 gage by No. 14 gage [0.106 inch by 0.080 inch (2.7 mm by 2.0 mm)], 4 inches by 8 inches (102 mm by 203 mm), conforming to ASTM A 185.

2.2.7 Keydeck Wire Mesh: Mesh is Keydeck Style No. 2160-2-1619 wire mesh, which is No. 19 gage [0.041 inch (1.0 mm)] galvanized steel wire, twisted to form hexagons having 2-inch (51 mm) sides, and a No. 16 gage [0.062 inch (1.6 mm)] galvanized steel wire woven into the mesh at 3 inches (76 mm) on center. The mesh is manufactured by Keystone Steel and Wire Company of Peoria, Illinois.

2.2.8 Insulation Board: The insulation board is expanded polystyrene foam plastic board that must have a Class I flame-spread classification and must be recognized under a current ICC-ES evaluation report. Each board must be 2 feet (610 mm) wide by 4 feet (1220 mm) long, with thicknesses varying from $^3/_4$ inch to 8 inches (19.1 mm to 203 mm). Each board must contain six 3-inch-diameter (76 mm) holes, configured in two rows of three holes each. The board density must be a minimum of 1.0 pcf (16 kg/m^3). See Figure 5.

2.3 Fire-resistive Roof-ceiling Assemblies:

2.3.1 One-hour Fire-resistive Wood Roof-ceiling Construction: A minimum $1^1/_2$-inch-thick (38 mm) layer of cellular concrete is applied over a plywood deck covered either with an approved building paper or with a liquid membrane, consisting of hydrocarbon wax resin and mineral spirits, which is brushed, rolled or sprayed onto the deck at the rate of 1 gallon per 300 square feet (0.4 L/m^2) of deck area. A 4-inch-wide (102 mm) strip of 20/20 kraft paper is stapled in place to cover the joints. In lieu of the kraft paper, a United States Gypsum all-purpose caulking compound is permitted to be used to seal the joints. Blocking of plywood

must comply with Table 23-II-H of the UBC. The cellular concrete density must be a minimum of 100 pcf (1601 kg/m^3) when used in this fire-resistive assembly. The mix proportions for one cubic yard (0.765 m^3) of the cellular concrete must comply with the following: cement, 658 pounds (296 kg); sand, 2,000 pounds (900 kg); water, 374 pounds (168 kg); and air, 35 percent. When the concrete is used on the exterior and is exposed to the weather, it must not be aerated and must have a minimum compressive strength of 500 psi (3447 kPa).

2.3.2 Two-hour Noncombustible Fire-resistive Unrestrained Roof Construction: Steel decking must be either minimum No. 24 gage [0.024 inch (0.61 mm)], $1^5/_{16}$-inch-deep (33 mm) or minimum No. 22 gage [0.030 inch (0.76 mm)], $1^1/_2$-inch-deep (38 mm), galvanized corrugated steel deck sections with cellular concrete poured to a thickness of $2^3/_4$ inches (70 mm) above the top of the deck flutes. The $1^5/_{16}$-inch (33 mm) steel decking must be arc-spot welded to the steel framing with weld washers at a maximum of 14 inches (356 mm) on center as indicated in Figure 1. The $1^1/_2$-inch (38 mm) steel decking must be welded to the steel framing using arc-spot welds as indicated in Figure 2, with no weld washers required for decks having gage thicknesses greater than 24 gage [0.024 inch (0.61 mm)].

Deck unit spans must be based on structural requirements but must not exceed the maximum span of 8 feet (2438 mm). Lite-Crete cellular concrete must be placed to a minimum thickness of $2^3/_4$ inches (70 mm) above the top of the deck flutes, and must have an average 28-day compressive strength of 190 to 350 psi (1.3 to 2.4 MPa) when tested in accordance with ASTM C 495. The cellular concrete must be reinforced with wire mesh as described in Section 2.2.6 or 2.2.7 of this report. The wire mesh must be placed with the heavier wires normal to the span of the deck flutes. The concrete must be covered with an approved fire-retardant roof covering complying with Chapter 15 of the UBC or a current ICC-ES evaluation report. Structural steel beams supporting the roof construction must have a minimum two-hour unrestrained fire-resistive protection. The roof construction specified in a recognized fire-resistive beam assembly shall have an equal or lower capacity for dissipating heat from the beam than the roof construction recognized in this report. For concrete-over-steel-deck roof constructions, a lower capacity for heat dissipation exists when the concrete has an equal or lesser density and equivalent thickness.

2.3.3 Two-hour Noncombustible Fire-resistive Unrestrained Roof Construction with Rigid Insulation Board: Steel decking must be either minimum No. 24 gage [0.024 inch (0.61 mm)], $1^5/_{16}$-inch-deep (33 mm), or minimum No. 22 gage [0.030 inch (0.76 mm)], $1^1/_2$-inch-deep (38 mm) galvanized corrugated steel deck sections. The $1^5/_{16}$-inch (33 mm) form deck must be arc-spot welded to the steel framing with weld washers at a maximum of 14 inches (356 mm) on center as indicated in Figure 3. The $1^1/_2$-inch (38 mm) roof deck must be welded to the steel framing using arc-spot welds as indicated in Figure 4, with no weld washers required for decks having gage thicknesses greater than 24 gage [0.024 inch (0.61 mm)].

Deck unit spans must be based on structural requirements but must not exceed the maximum span of 8 feet (2438 mm). The steel deck must be covered with a minimum-$^1/_8$-inch-thick (3.2 mm) Lite-Crete cellular concrete slurry coat over the top of the deck flutes. Perforated insulation board described in Section 2.2.8 must be firmly embedded in the wet slurry with the long dimension parallel to the span of the deck flutes. The insulation board end joints must be staggered and side and end joints butted. Wire mesh described in Section 2.2.6 or 2.2.7 must be installed over the insulation board with the heavier wires placed normal to the span of the deck flutes. A 2-inch-thick (51 mm) layer of Lite-Crete cellular concrete must be placed over the insulation boards and reinforcing mesh. The concrete must be covered with an approved fire-retardant roof covering complying with Chapter 15 of the UBC or a current ICC-ES evaluation report.

Structural steel beams supporting the roof construction must have a minimum two-hour unrestrained fire-resistive protection. The roof construction specified in a recognized fire-resistive beam assembly must have an equal or lower capacity for dissipating heat from the beam than the roof construction recognized in this report. For concrete-over-steel-deck roof constructions, a lower capacity for heat dissipation exists when the concrete has an equal or lesser density and equivalent thickness.

2.3.4 Two-hour Noncombustible Fire-resistive Restrained Roof Construction: This fire-resistive construction must be the same as that described in Section 2.3.2 or 2.3.3, except the allowable span for the restrained assembly must be a maximum of 10 feet with two or more spans.

2.3.5 Two-hour Noncombustible Fire-resistive Roof Construction: Lite-Crete cellular concrete is permitted to be applied on top of a code-complying, two-hour, fire-resistive reinforced-concrete assembly or steel-deck composite slab assembly without changing the assigned hourly rating.

2.4 Nonfire-resistive Applications:

2.4.1 Nonfire-rated Roof Assembly: This construction is identical to the fire-rated construction described in Section 2.3.2, except that a minimum $1^1/_2$-inch (38 mm) depth of Lite-Crete cellular concrete over the top of the steel deck flutes is permitted, and the minimum thicknesses of the steel decks are those given in Section 2.2.3. The deck spans are limited by structural requirements, and the roof covering must be as required by the code.

2.4.2 Nonfire-rated Roof Assembly with Insulation Board: This construction is identical to the fire-rated construction described in Section 2.3.3, except that a minimum $1^1/_2$-inch (38 mm) depth of Lite-Crete cellular concrete over the top of the insulation board is permitted, the minimum thicknesses of the steel decks are those given in Section 2.2.3, the use of the reinforcing wire mesh is optional, and the spans are limited by structural requirements. The roof covering must be as required by the code.

2.5 Diaphragm Shear and Flexibility:

2.5.1 General Attachment Requirements: Shear transfers between diaphragms and interior tie or strut lines perpendicular to the deck flutes must not exceed the shear values listed in this report. Attachments at these lines of shear transfer are identical to those used for exterior support connections. Two lines of connections are permitted to develop the total shear transfer from each side of the strut. Where individual panels are cut, the partial panel must be fastened in a manner to fully transfer the required shears at that point of the diaphragm to the adjacent full panel.

2.5.2 Unstiffened Roof Diaphragms with $1^5/_{16}$-inch and $1^1/_2$-inch Steel Decks: Allowable diaphragm shears and flexibility factors are set forth in Table 1 for construction using $1^5/_{16}$-inch-deep (33 mm) form decks, and are set forth in Table 2 for construction using $1^1/_2$-inch-deep (38 mm) roof decks with Lite-Crete cellular concrete construction described in Section 2.3.2, except that the Lite-Crete cellular concrete must have a minimum compressive strength at 28 days of 250 psi (1.72 MPa) when tested in accordance with ASTM C 495.

Arc-spot welds with weld washers must be used for $1^5/_{16}$-inch (33 mm) form deck, to fasten the deck to the support

framing members as shown in Figure 1. Arc-spot welds attaching the deck to framing members parallel to the flutes must be spaced to transfer the required shear based on a shear strength of 600 pounds (2.67 kN) per fastener.

Arc-spot welds must be used for $1^1/_2$-inch (38 mm) roof deck, to fasten the deck to the support framing members as shown in Figure 2. Weld washers must be used for decks with a thickness less than No. 22 gage [0.030 inch (0.76 mm)]. For arc-spot welds attaching deck to framing members parallel to the flutes, see Footnote 4 to Table 2.

Flexibility limitations for diaphragms must conform to those in Table 4. Decks must conform to the requirements of Section 2.2.3, except that the decks have a G90 coating.

2.5.3 Unstiffened Diaphragms with $1^5/_{16}$-inch Deck with Insulation Board: An allowable diaphragm shear of 710 plf (10.4 kN/m) and a flexibility factor of 4.0 [micro-inch deflection of diaphragm web in a one-foot (304.8 mm) span under a shear of one pound per foot (14.59 N/m)] is permitted for the construction described in Section 2.3.3, with the following limitations:

1. The $1^5/_{16}$-inch (33 mm) form deck must conform to Section 2.2.3 and have a minimum thickness of No. 22 gage [0.030-inch (0.76 mm) base-metal thickness].
2. The deck must be fastened to the steel frame using arc-spot welds with weld washers at each flute at supports and at 8 inches (203 mm) on center on parallel framing members.
3. Reinforcing wire mesh described in Section 2.2.6 or 2.2.7 must be installed over the insulation board. The reinforcing wire mesh must be placed with the heavier wires normal to the span of the deck flutes.
4. Diaphragms must conform to the flexibility limitations shown in Table 4.

2.5.4 Stiffened Diaphragms with $1^1/_2$-inch Deck with Insulation Board: Allowable diaphragm shears and flexibility factors set forth in Table 3 are for nonfire-rated roof systems with construction as described in Section 2.3.3 of this report, with the following conditions:

1. The $1^1/_2$-inch (38 mm) roof deck must conform to the requirements of Section 2.2.3, except that the deck must have a minimum thickness of No. 22 gage [0.030-inch (0.76 mm) base-metal thickness].
2. Panel ends must be stiffened in accordance with the deck manufacturer's standards, but stiffener elements are equivalent to those shown in Figure 7. The stiffening element must have a thickness of at least No. 18 gage [0.0478 inch (1.2 mm)]. The length of the arc-seam welds on top of the standing seam shall be $1^1/_2$ inches (38 mm). Fasteners attaching the deck to framing members must be arc-spot welds having a fusion diameter of $^1/_2$ inch (13 mm) or arc-seam welds with a fusion area not less than $^3/_8$ inch by 1 inch (9.5 mm by 25.4 mm). The interior end lap of sheets must be a minimum of 2 inches (51 mm).
3. Arc-spot or arc-seam welds must fasten deck to ties, chords and struts that are parallel to the flutes of the deck. The spacing (in feet) must be equal to 32,000 times the deck sheet thickness (in inches), divided by the required diaphragm shear strength (in pounds per lineal foot) (see Footnote 4 to Table 2 for SI information). In any case, the spacing must not exceed 24 inches (610 mm).

2.5.5 Stiffened Diaphragms with $1^5/_{16}$-inch Deck with Insulation Board: An allowable diaphragm shear of 730 plf (10.7 kN/m) and a flexibility factor of 7.0 [micro-inch deflection of diaphragm web in a one-foot (304.8 mm) span under a shear of one pound per foot (14.59 N/m)] is permitted for nonfire-rated roof systems with construction as described in Section 2.3.3 of this report, with the following limitations:

1. The $1^5/_{16}$-inch-deep (33 mm) steel deck must conform to Section 2.2.3 and have a minimum thickness of No. 22 gage [0.030-inch (0.76 mm) base-metal thickness].
2. The deck must be fastened to the steel frame with arc-spot welds with weld washers at each flute at supports as shown in Figure 3, using a Type 3 weld pattern, and at 8 inches (203 mm) on center on parallel framing members.
3. Panel ends must be stiffened in accordance with the deck manufacturer's standards, but, at a minimum, shall be equivalent to stiffening elements shown in Figure 8. The stiffening element must conform to ASTM A 653 with a minimum thickness of No. 16 gage [0.058 inch (1.47 mm)]. Interior end laps of the deck must be a minimum of 3 inches (76 mm). Maximum deck span must be 8 feet (2438 mm).
4. Reinforcing mesh described in Section 2.2.6 or 2.2.7 must be installed over the insulation board. The reinforcing wire mesh must be placed with the heavier wires normal to the span of the deck flutes.
5. Arc-spot weld spacing must be based on a shear transfer value not exceeding 600 pounds (2.7 kN) per fastener in flutes parallel to the framing. In any case, the spacing must not exceed 24 inches (610 mm).
6. Diaphragms must conform to the flexibility limitations shown in Table 4.

2.5.6 Diaphragm Design Considerations:

The diaphragm design must take into account the following considerations:

1. Diaphragm classification (flexible or rigid) must comply with Section 1630.6 of the UBC; the diaphragm deflection (Δ) must be calculated using the equations noted in Table 4.
2. Diaphragm flexibility limitations shall comply with Table 4.
3. Diaphragm deflection limits shall comply with Section 1633.2.9 of the UBC.
4. Horizontal shears must be distributed in accordance with Sections 1630.6 and 1630.7 of the UBC.

2.6 Vertical Loads:

Vertical loads on the system are beyond the scope of this report. A non-composite design must be in accordance with the code.

2.7 Special Inspection:

A special inspector, approved by the building official, must provide continuous inspection of welding of steel decks and placement of concrete. The special inspector must provide to the building official a report that specifies the observation procedures, verification of sampling of concrete specimens, verification of welding procedures and verification of qualification of welders.

2.8 Identification:

All containers of Lite-Crete air-entraining agent are labeled with the manufacturer's name and the word "Lite-Crete," and all containers of "Lite-Crete Plus" air-entraining agent are labeled with the manufacturer's name (Cellular Concrete LLC), the Lite-Crete Corporation name, and the word "Lite-Crete Plus." A card noting the name of the installer and the date of installation must be issued to each project owner. Steel decks must bear a label stating the product name and the manufacturer's name and address. Foam plastic insulation must be labeled in accordance with the evaluation report on the insulation.

3.0 EVIDENCE SUBMITTED

Descriptive literature, specifications, reports on fire tests conducted in accordance with UBC Standard 7-1, and reports of load tests.

4.0 FINDINGS

That the use of Lite-Crete Cellular Concrete Roof-ceiling Construction described in this report complies with the 1997 *Uniform Building Code*™, subject to the following conditions:

4.1 The cellular concrete is applied by factory-approved applicators.

4.2 The size of slab, measured between screeds, is limited to a maximum of 20 feet by 20 feet (6096 mm by 6096 mm).

4.3 Where the slab widths change at alcoves and other similar recesses, the slabs are reinforced with a 12-inch-wide-by-16-inch-long (305 mm by 406 mm) strip of 4-inch-by-4-inch (102 mm by 102 mm) No. 14/14 gage [0.080 inch (2.0 mm)] welded wire mesh, extending to each side of the corners at a 45-degree angle.

4.4 In lieu of the condition in Section 4.3, plates may be inserted through a weakened plane joint. The plates are made from a continuous $1^1/_2$-inch-by-1-inch (38 mm by 25.4 mm) light gage steel angle divider. This alternative is not to be used in one-hour fire-resistive wood floor or horizontal diaphragm systems.

4.5 The slab is scored at doorways serving rooms larger than 200 square feet (18.6 m^2).

4.6 Special inspection is required for all welding and concrete fill as set forth in Section 1701 of the code.

This report is subject to re-examination in two years.

TABLE 1—ALLOWABLE DIAPHRAGM SHEAR (*q*) IN POUNDS PER LINEAL FOOT AND FLEXIBILITY FACTORS (*F*) FOR $1^5/_{16}$-INCH STEEL DECK WITH LITE-CRETE INSULATING CONCRETE FILL[1]

FASTENER TYPE[2]	SPAN L (feet)	FILL THICKNESS (inches)	SHEAR AND FLEXIBILITY[3]	DECK GAGE [and (THICKNESS) in inches]			
				20 (0.036 inch)	22 (0.030 inch)	24 (0.024 inch)	26 (0.018 inch)
2	4	2	*q*	615	606	573	503
			(*F*)	(1.7)	(2.3)	(3.2)	(4.5)
		$2^3/_4$	*q*	870	649	622	557
			(*F*)	(1.4)	(2.5)	(3.4)	(4.8)
	6	2	*q*	615	606	524	440
			(*F*)	(2.3)	(2.9)	(3.9)	(5.2)
		$2^3/_4$	*q*	870	649	573	493
			(*F*)	(1.9)	(3.2)	(4.2)	(5.4)
	8	2	*q*	565	516	464	408
			(*F*)	(2.7)	(3.4)	(4.4)	(5.6)
		$2^3/_4$	*q*	793	558	512	462
			(*F*)	(2.3)	(3.7)	(4.7)	(5.8)
3	4	2	*q*	832	832	814	735
			(*F*)	(1.2)	(1.7)	(2.4)	(3.6)
		$2^3/_4$	*q*	870	878	867	804
			(*F*)	(1.4)	(1.9)	(2.6)	(3.9)
	6	2	*q*	832	832	730	610
			(*F*)	(1.7)	(2.2)	(3.1)	(4.3)
		$2^3/_4$	*q*	870	878	783	679
			(*F*)	(1.9)	(2.5)	(3.3)	(4.6)
	8	2	*q*	756	689	624	548
			(*F*)	(2.1)	(2.7)	(3.6)	(4.8)
		$2^3/_4$	*q*	793	733	677	616
			(*F*)	(2.3)	(3.0)	(3.9)	(5.0)

For **SI:** 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per lineal foot = 14.6 N/m, 1 pcf = 16.02 kg/m^3, 1 psi = 6.89 kPa.

[1]Lite-Crete cellular concrete must have a minimum density of 29 ± 3 pcf and a compressive strength of 250 psi. Concrete thickness is measured from top of flute.
[2]For type of fasteners, see Figure 1. The type of fastener chosen must be used at both interior and exterior supports.
[3]The Flexibility Factor *F* is the average micro-inches a diaphragm web will deflect in a span of one foot under a shear of one pound per foot. See Table 4 for flexibility limitations.

TABLE 2—ALLOWABLE DIAPHRAGM SHEAR (*q*) IN POUNDS PER LINEAL FOOT AND FLEXIBILITY FACTOR (*F*) FOR UNSTIFFENED $1^1/_2$-INCH STEEL DECK WITH LITE-CRETE INSULATING CONCRETE FILL[1,4]

GAGE [and (THICKNESS) in inches]	FASTENER PATTERN[2]	SHEAR AND FLEXIBILITY[3]	SEAM FASTENING—BUTTON PUNCHES @ 24 INCHES ON CENTER		
			Span (feet)		
			6.0	8.0	10.0
24 (0.024)	4	*q* (*F*)	457 (3.2)	408 (3.6)	379 (3.8)
	7	*q* (*F*)	619 (2.6)	536 (3.0)	486 (3.3)
22 (0.030)	4	*q* (*F*)	540 (2.4)	463 (2.8)	418 (3.1)
	7	*q* (*F*)	731 (1.9)	610 (2.3)	538 (2.6)
20 (0.036)	4	*q* (*F*)	559 (1.9)	515 (2.2)	453 (2.5)
	7	*q* (*F*)	746 (1.4)	680 (1.8)	587 (2.0)
18 (0.048	4	*q* (*F*)	612 (1.2)	612 (1.5)	522 (1.7)
	7	*q* (*F*)	817 (0.9)	817 (1.1)	687 (1.3)

For **SI:** 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per lineal foot = 14.6 N/m, 1 pcf = 16.02 kg/m^3, 1 psi = 6.89 kPa.

[1]Lite-Crete cellular concrete must have a minimum density of 29 ± 3 pcf and a compressive strength of 250 psi. Concrete thickness is measured from top of flute.
[2]For fastener patterns, see Figure 2. The fastener pattern chosen must be used at both interior and exterior supports.
[3]The Flexibility Factor *F* is the average micro-inches a diaphragm web will deflect in a span of one foot under a shear of one pound per foot. See Table 4 for flexibility limitations.
[4]Spacing of arc-spot welds connecting the deck to framing members parallel to the flutes must not exceed in inches (mm) 32,000 (5.6) times the sheet thickness in inches (mm) divided by the required diaphragm shear strength in pounds per lineal foot (kN/m).

TABLE 3—ALLOWABLE DIAPHRAGM SHEARS (*q*) IN POUNDS PER LINEAL FOOT AND FLEXIBILITY FACTORS (*F*) FOR STIFFENED $1^1/_2$-INCH STEEL DECK WITH LITE-CRETE INSULATING CONCRETE FILL[1,2,3,5]

GAGE (thickness in inches)	SHEAR (*q*) AND FLEXIBILITY (*F*)[4]	SEAM FASTENING					
Maximum Span (feet)		Button Punches @ 24" o.c.			Top Seam Welds @ 24" o.c.		
22 (0.030)	*q* (*F*)	1,060 (6.5)	910 (6.5)	820 (6.5)	1,460 (2.5)	1,210 (2.5)	1,060 (2.5)
20 (0.036)	*q* (*F*)	1,180 (6.5)	1,000 (6.5)	890 (6.5)	1,660 (2.5)	1,360 (2.5)	1,180 (2.5)
18 (0.048)	*q* (*F*)	1,420 (6.5)	1,180 (6.5)	1,040 (6.5)	2,060 (2.5)	1,660 (2.5)	1,420 (2.5)

For **SI:** 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per lineal foot = 14.6 N/m.

[1]Decks must be welded to all structural supports with a minimum $^3/_4$-inch-diameter arc-spot weld at each flute.
[2]Construction details must be as shown in Figure 2 with the seven-weld pattern and in Figure 7.
[3]Construction Sequence:
a. A slurry of Lite-Crete cellular concrete must be applied of the deck to a depth of $^1/_8$ inch over the flute.
b. Insulation board must be embedded in the wet slurry with the long dimension parallel to the deck flutes followed by the reinforcing mesh.
c. Insulation board is covered with the specified 2-inch minimum thickness of Lite-Crete cellular concrete.
[4]The Flexibility Factor *F* is the average micro-inches a diaphragm web will deflect in a span of one foot under a shear of one pound per foot. See Table 5 for flexibility limitations.
[5]Spacing of arc-spot welds connecting the deck to framing members parallel to the flutes must not exceed in inches (mm) 32,000 (5.6) times the sheet thickness in inches (mm) divided by the required diaphragm shear strength in pounds per lineal foot (kN/m).

TABLE 4—DIAPHRAGM FLEXIBILITY LIMITATIONS[1,2,4,5]

FLEXIBILITY CATEGORY	*F*	MAXIMUM SPAN IN FEET FOR MASONRY OR CONCRETE WALLS	SPAN—DEPTH LIMITATION			
			Rotation Not Considered in Diaphragm		Rotation Considered in Diaphragm	
			Masonry or Concrete Walls	Flexible Walls[3]	Masonry or Concrete Walls	Flexible Walls[3]
Very Flexible	More than 150	Not used	Not used	2:1	Not used	$1^1/_2$:1
Flexible	70 - 150	200	2:1 or as required for deflection	3:1	Not used	2:1
Semi-flexible	10 - 70	400	$2^1/_2$:1 or as required for deflection	4:1	As required for deflection	$2^1/_2$:1
Sem-rigid	1 - 10	No limitation	3:1 or as required for deflection	5:1	As required for deflection	3:1
Rigid	Less than 1	No limitation	As required for deflection	No limitation	As required for deflection	$3^1/_2$:1

[1]Roof diaphragms must be investigated regarding their flexibility and recommended span-depth limitation. Refer to Tables 1, 2 and 3 for determination of *F*.

[2]When diaphragms are supporting masonry or concrete walls, the maximum deflection of the diaphragm must be computed using the code-prescribed lateral forces and it must be limited to the amount given by the following formula:

$$\Delta_{wall} = \frac{H^2 f_c}{0.01Et}$$

where:

H = Unsupported height of wall, in feet.

f_c = Allowable compressive strength of wall material in flexure, in pounds per square inch. ($f_c = 0.45\ f'_c$ for concrete and $f_m = 0.33\ f'_m$ for masonry).

E = Modulus of Elasticity of wall material for deflection determination, in pounds per square inch.

t = Thickness of wall, in inches.

[3]When applying these limitations to cantilever diaphragms, the span-depth ratio must be one-half of those shown.

[4]The total deflection Δ of the diaphragm must be computed from the equation:

$\Delta = \Delta_f + \Delta_w$

where:

Δ_f = Flexural deflection of the diaphragm determined in the same manner as the deflection of beams.

Δ_w = The web deflection is permitted to be determined from the equation:

$$\Delta_w = \frac{q_{avg} L_1 F}{10^6}$$

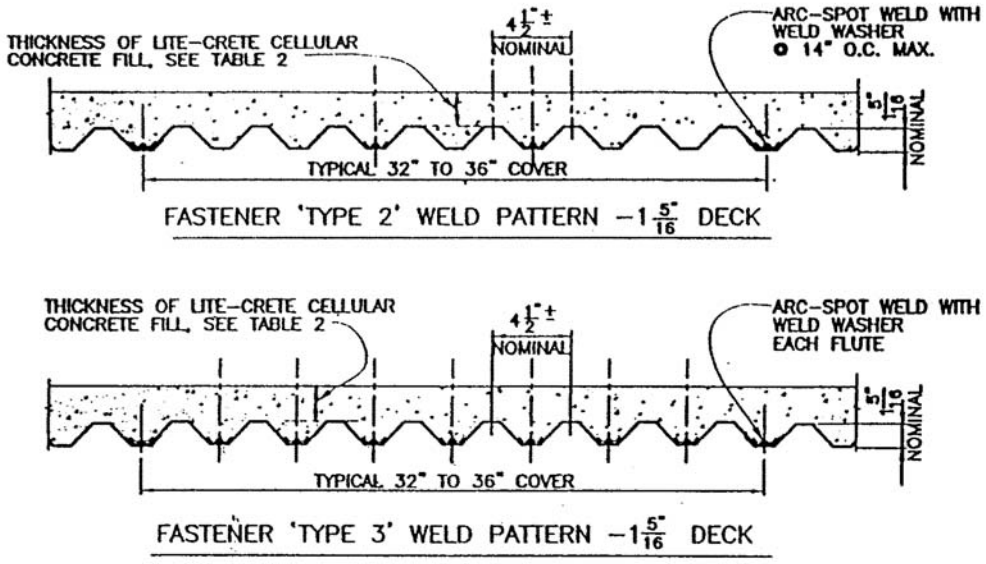
where:

q_{avg} = Average shear in diaphragm over length L_1, in pounds per foot.

L_1 = Distance in feet between vertical resisting element (such as shear wall) and the point to which the deflection is to be determined.

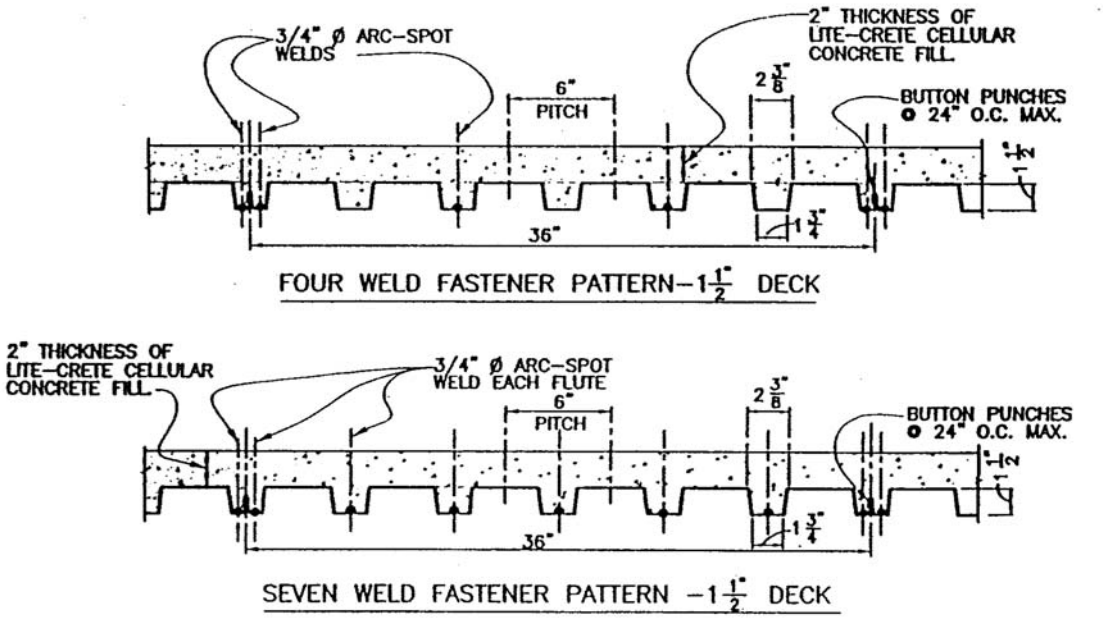
F = Flexibility factor (the average micro-inches a diaphragm web will deflect in a span of one foot under a shear of one pound per foot).

[5]Diaphragm classification (flexible or rigid) and deflection limits shall comply with Section 2.5.6.



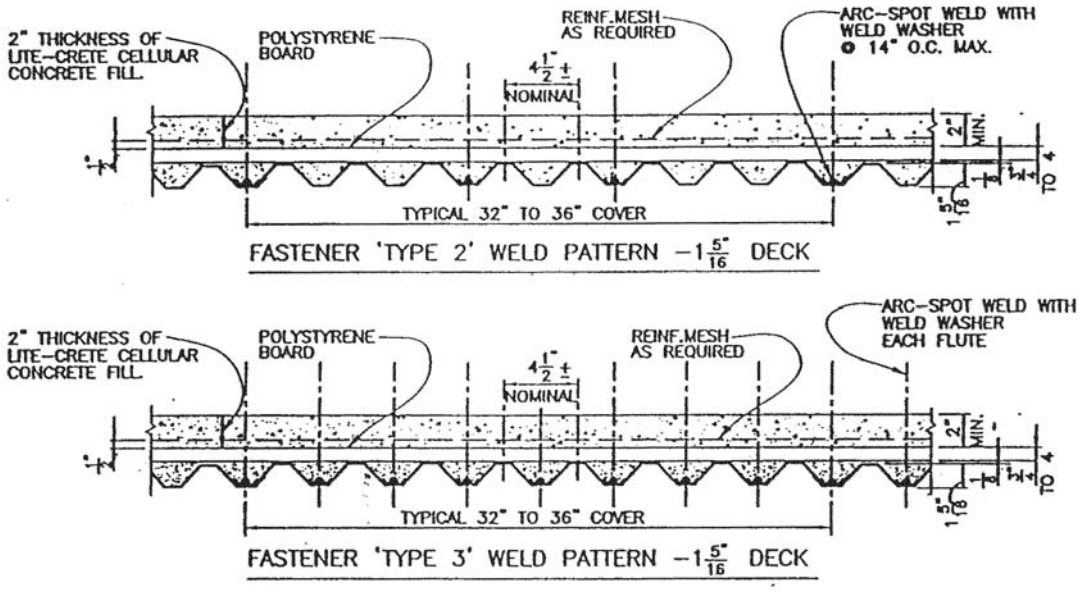
For **SI:** 1 inch = 25.4 mm.

FIGURE 1—UNSTIFFENED $1^5/_{16}$-INCH DECK SYSTEM WELD PATTERNS



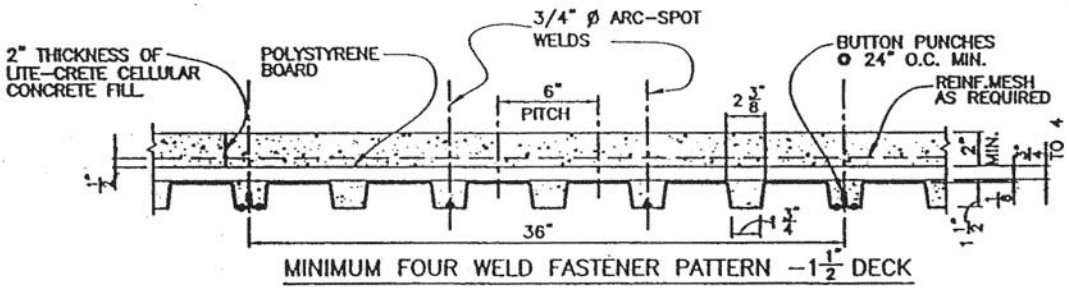
For **SI:** 1 inch = 25.4 mm.

FIGURE 2—UNSTIFFENED $1^1/_2$-INCH DECK SYSTEM WELD PATTERNS



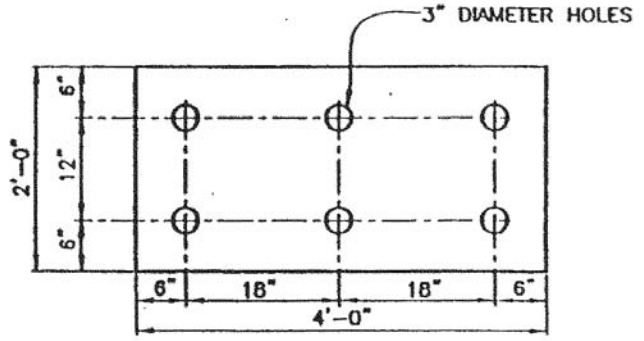
For **SI:** 1 inch = 25.4 mm.

FIGURE 3—UNSTIFFENED $1^5/_{16}$-INCH DECK SYSTEM WITH INSULATION BOARD



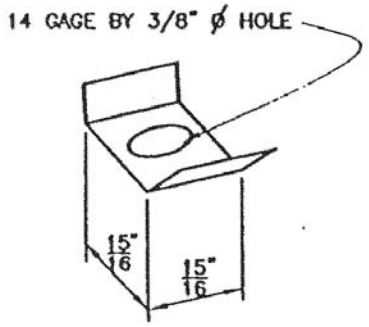
For **SI:** 1 inch = 25.4 mm.

FIGURE 4—UNSTIFFENED $1^1/_2$-INCH DECK SYSTEM WITH INSULATION BOARD



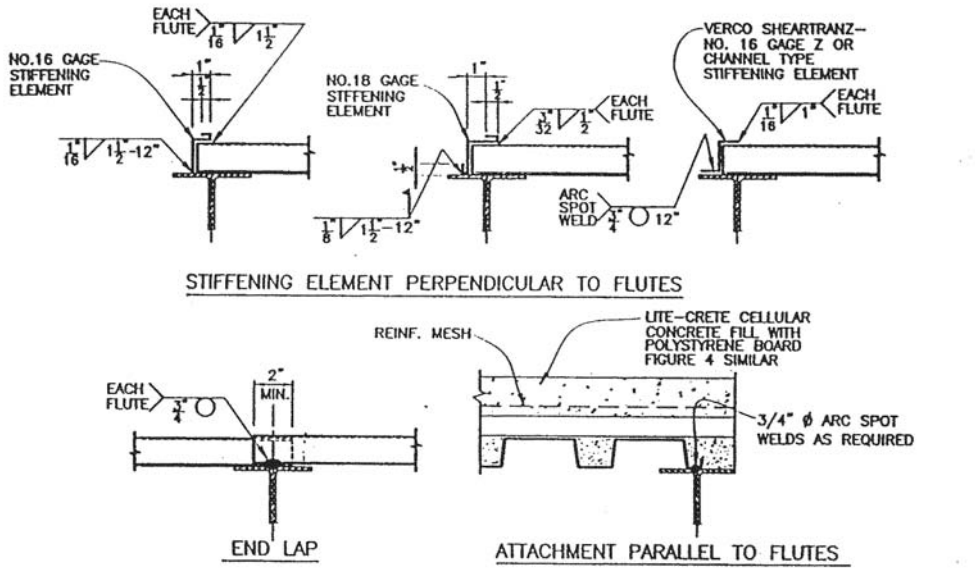
For **SI:** 1 inch = 25.4 mm.

FIGURE 5—POLYSTYRENE INSULATION BOARD



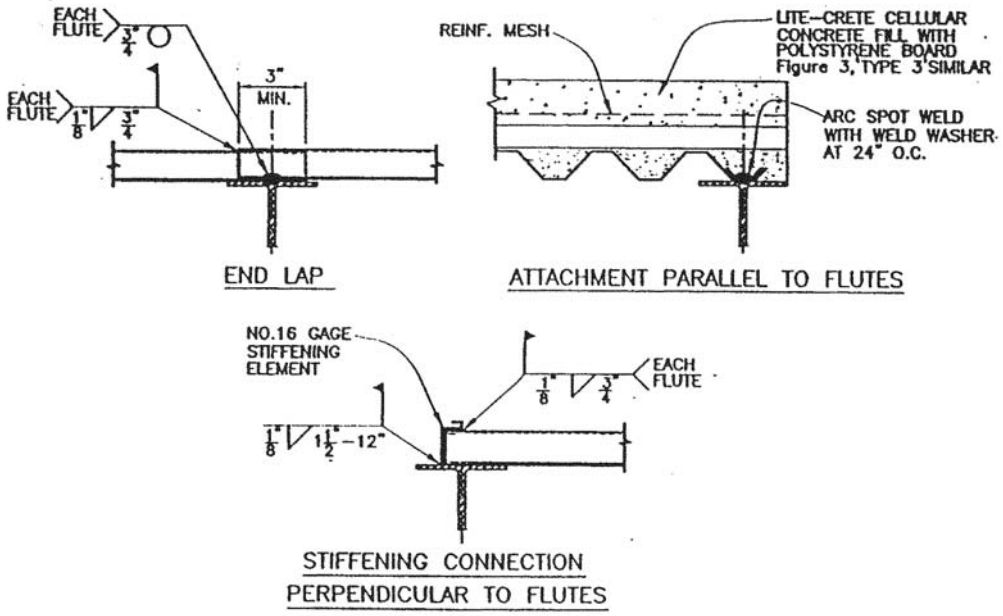
For **SI:** 1 inch = 25.4 mm.

FIGURE 6—WELD WASHER



For **SI:** 1 inch = 25.4 mm.

FIGURE 7—STIFFENED $1^{1}/_{2}$-INCH DECK SYSTEM WITH INSULATION BOARD



For **SI:** 1 inch = 25.4 mm.

FIGURE 8—STIFFENED $1^{5}/_{16}$-INCH DECK SYSTEM WITH INSULATION BOARD