

### 1.0 General

**1.1** The primary function of a roof deck is to provide structural support and restraint for the roofing system. The deck must have adequate strength and rigidity to support all anticipated live and dead loads, foot or construction traffic, wind, rain and snow loads. The deck must have adequate strength and rigidity to carry the weight of the roofers and their equipment during construction, without deflecting to the point where roofing components rupture, delaminate, or are weakened.

**1.2** Some decks are designed to furnish inside appearance as well as sound control, however, JM's concern is for the roof deck as a base for the roofing system. To perform this function, the deck must be rigid. It must be smooth and free of large cracks, holes or sharp changes in elevation of the surface. It must be able to receive the roof system by some method which will hold the system securely, either by adhesion, ballast or mechanical fasteners. Before roofing work is started, the deck should be inspected carefully by the roofing contractor, the deck contractor, and the owner's representative, to determine that it satisfies these conditions. The roofing contractor and JM are only concerned that the surface of the deck will accept the roofing system. Neither JM nor the roofing contractor have any responsibility regarding the adequacy of the deck from a structural standpoint.

**1.3** Surface preparation should include filling and smoothing all holes, depressions, irregularities, etc. before the roof is applied.

**1.4** Providing a deck for the roof system that meets these criteria is the responsibility of the designer of the building, who is in a position to integrate these requirements with other structural and use considerations. JM can only assume that the deck is manufactured and installed in accordance with the manufacturer's current specifications.

**1.5** Roof-mounted equipment should not rest on the deck or roofing system. It should be supported by the structural framing of the building. Leaks resulting from improperly mounted rooftop equipment are excluded from coverage under the JM Peak Advantage Guarantee.

**1.6** To be a satisfactory substrate for any roofing system, a roof deck must have:

- A. Proper construction, following the deck manufacturer's instructions.
- B. Proper design to carry maximum anticipated live and dead loads which may be encountered during and after construction, without excessive deflection.
- C. Positive drainage which will not allow water to pond. **(See Roof Drainage paragraphs in this section.)**
- D. Expansion joints to allow for movement of the structure without causing strain on the roofing membrane. To be effective, expansion joints must extend through all elements of the roof and structural system.

- E. A smooth, dry and properly cured surface to which the roofing system can be installed.
- F. A solid, rigid assembly when using pre-cast deck units. Units must be securely fastened to supporting members to prevent movement.
- G. A continuous, uninterrupted surface. Installation of conduits on the top surface of a roof deck is not acceptable, unless the area between the conduits is filled with an acceptable roof insulation, properly secured, and a full thickness of roof insulation installed over the conduits.
- H. A clean surface. Before roofing application is started, the deck should be free of all dust, dirt, debris and foreign material. Only the roofer's tools and equipment should be allowed on the deck during roof application.
- I. The proper resistance to wind uplift to prevent rupture of the roof membrane.
- J. Adequate means of membrane securement. Provisions for special attachment procedures must be made on steep-slope decks.
- K. Appropriate termination details. Under certain conditions, consideration should be given to isolating the roof membrane from stresses caused by deck or structural movement. This can be accomplished by securing base flashing to curbs attached to the structural deck. **(See System Application section for flashing details.)**

**1.7** Any decks or substrates not listed in the current JM Single Ply Roofing Systems Manual must be approved by a JM Technical Service Specialist in writing prior to the installation of a roof which is to receive a JM Guarantee. Such approval only indicates that JM accepts the deck surface to receive a JM roofing system. **By such acceptance, JM accepts no responsibility of the structural adequacy or performance of the deck.**

**1.8** If a JM Peak Advantage Guarantee is required, the use of under-deck insulation must be approved in writing by a JM Technical Service Specialist prior to installation of the roofing system.

### 2.0 Wood Nailers

**2.1** Wood nailers or curbs should be installed around the perimeter and openings in the roof deck for securement of roofing membranes, edging, gravel stops, and roof fixtures. Nailers should be installed to provide a minimum of 200 lbs. (890 N) uplift resistance, at any point. Nailers should be installed so that the top of the wood nailer is flush with the membrane substrate (which is typically a rigid roof insulation material).

**2.2** Nailing strips and wood edging or curbs should be of #2 or better lumber. **Oil base preservatives such as creosote are not acceptable, as they are not compatible with single ply roofing materials.**

**2.3** Nailers may not be required at perimeters of roof areas that include parapet walls, if an approved securement detail is used to adequately attach the membrane to the wall.

**2.4** The use of tapered edging strips is recommended to direct water away from roof edges. Wood nailers should be equal in thickness to tapered edge strips and insulation, and wider than the flange of metal edge strips or gravel stops, to provide adequate nailing. If interior drains are not practical, scuppers should be provided to drain water from the roof.

### 3.0 Roof Drainage

**3.1** Roof decks should be constructed to have adequate slope, to drain all water to appropriate outlets. Drains or other outlets should be set below the plane of the roof surface, at low points in the roof. Lower level roofs should be protected from water running off or down from higher points.

**3.2** Water standing for more than 24 hours on roof areas is hazardous in many ways:

- A. Possible seepage of moisture through the membrane into the roof system.
- B. Damage to the roof from freeze-thaw cycles during the winter.
- C. Deformation of the deck structure.
- D. Major interior damage from minor punctures.
- E. Relatively small amounts of moisture, beneath the roof membrane, reduce the thermal efficiency of the insulation and cause serious damage to both the insulation and membrane through repetitive cycles of evaporation, condensation, freezing and thawing.
- F. Ponding of water on roofs, in areas subject to winter freeze and thaw, can create further hazards. Ice formations move constantly with temperature changes. This movement can “scrub” the roof surface to such an extent that considerable physical damage to the membrane can result.
- G. Insufficient number of drains or inadequate sized drain leaders may restrict immediate run off of surface water. In such cases, water may back up under the drain flanges or accumulate on the roof surface to a depth which exceeds the height of the base flashings or other perimeter flashings. Overflow through wall scuppers should be considered in areas of excessively heavy rainfall or where delayed drainage is required. Internal drain systems, which provide drainage from the body of the roof, should be planned to ensure that drains are located at low areas to facilitate water run off. All roof decks should be sloped to the drains, or crick-

ets installed to ensure proper drainage. The JM Tapered Design Group can provide full service manufacturing and roof drainage design capability on tapered insulation systems. These designs utilize Tapered Fesco Foam or Tapered ENRGY 3 to obtain roof slope and are particularly useful in reroofing applications where ponded water is a problem. **(See System Application section for details.)**

**3.3** The effects of ponded water have been studied by members of the roofing industry for many years. The roofing industry unanimously recommends that roof design provide slope for roofs so that the roof drains freely throughout the life of the building.

**3.4** This recommendation has also received the approval and concurrence of not only JM, but the National Roofing Contractors Association and the American Institute of Architects, as well as other regional roofing contractors associations and governmental agencies.

**3.5** JM will not be responsible for roof damage, or failure of the roofing system, due to standing water. Any standing water must evaporate within 24 hours, or crickets or saddles must be installed using JM tapered insulation board. JM defines ponded or standing water as water that remains on the roof for more than 24 hours.

**3.6** One method of obtaining slope in structural decks is by varying the height of columns and girders to design positive drainage into the deck surface. In theory, dead-level or low-slope decks should drain, but they rarely do. Elevations of columns are never exact, or deck units may have a slight camber or curvature, which under normal deflection of the deck from the weight of roofing and rooftop equipment can cause portions of the roof deck to sag below the level of drains, especially if the drains are located at columns. Even if the deck is designed to drain immediately after construction, it may not do so after the building settles. A clogged drain can also allow a build-up of water which could permanently deform the deck.

**3.7** Standing water can increase the load on structural decks. If the water stands for long periods, algae or other vegetation may form. A continuously wet or moist environment can also attract undesirable insects or vermin. This can damage the roof membrane and create a possible hazard to health. Vegetation and debris will clog drains so that even more water ponds, which in winter can freeze and block water from entering the drain. As more water accumulates, the deck may deflect, increasing ponding of water. This has been known to cause collapse of the roof deck.

**3.8 JM will not be responsible for any damage caused to the roofing system or the structure and contents due to ponding water.** JM cannot be held responsible for determining if a roof deck will pond water or will drain properly, either before or after application.

**3.9** JM recommends that roofing contractors and designers use the following guidelines to ensure adequate drainage of the roofing system:

- A. Provide maximum number and size drains practical for the roof area, and locate the drains at low areas in the roof system.
- B. Design raised edges and gravel stops by incorporating tapered edge strips at the perimeters when internal drains are employed.
- C. Install drains in sumps to ensure drains are below the roof level, or taper the deck or roof insulation to eliminate ponded water at drain locations.
- D. Drain outlets should have proper strainers to prevent debris from clogging carry-off pipes. Strainers must be maintained to prevent blocking.
- E. Provide scuppers secured to wood nailers and flashed into the roofing system when interior drains are not used.
- F. Follow the recommendations of local plumbing and building codes for number and size of drains and carry off pipes.
- G. Drains should be located in every area of the roof, preferably not more than 75' (22.9 m) apart, with no leader or carry-off pipe less than 3" (76 mm) in diameter. It is recommended that two drains minimum be installed on any roof area as a safety factor; if one should cease to function, the second drain will be available to prevent excessive build-up of water. Roof areas surrounded by parapets must have through-wall scuppers to allow for overflow in the event drains become blocked.

**3.10** JM manufactures the JM Flex-I-Drain® which may be used in original installations as well as retrofit projects to provide adequate drainage. Details are included in the **Specialty Roofing Products and System Application sections** of the current JM Single Ply Roofing Systems Manual. Flex-I-Drains can be included in a JM Peak Advantage Guarantee when installed according to published specifications.

**3.11** JM offers RetroDrains designed specifically for use when reroofing an existing roof system with existing roof drains. They are installed in the new system with sleeves designed to tie into the existing drains. For information, see the **Specialty Roofing Products** of the current JM Single Ply Roofing Systems Manual.

### 4.0 Expansion Joints

**4.1** Every designer of a building must consider the reasonably anticipated movement of the structure in his design, and compensate for it by placing construction and expansion joints in the structure. The decision as to the use and location of expansion joints is the professional responsibility of the designer and structural engineer. Only the design professionals are familiar with all the factors involved in structural design.

**4.2** JM offers the following suggestions where expansion joints may be employed:

- A. Whenever roof deck materials change or deck materials of a similar type change in direction (i.e., steel deck changing direction or interfacing with a dissimilar deck material).
- B. Whenever roof structures change in direction, such as, "T", "H", "L", and "U" shaped buildings.
- C. At each building expansion joint or expansion joint in roof deck material, the roof should have a corresponding expansion joint.
- D. Whenever an addition is made to an existing structure.
- E. When seismic movement is anticipated.

**4.3** Expand-O-Flash® expansion joint covers can be included in the Peak Advantage Guarantee if installed in accordance with JM instructions.

### 5.0 Steel Decks

**5.1** Today, steel decks are the most common substrate for commercial/industrial roofing systems and can provide an excellent base for built-up, modified bitumen and single-ply roofing systems, when properly specified and installed.

**5.2** Factory Mutual Research Corporation's Loss Prevention Data Sheet 1-28, 1-29 and the Factory Mutual Research Corporation Approval Guide contain comprehensive and specific information concerning the design and use of this deck system and roofing systems used above this deck. To be eligible for a JM Peak Advantage Guarantee, all requirements contained in these three documents must be met.

**5.3** In conjunction with, or in addition to, the Factory Mutual Research Corporation 1-28 and 1-29 requirements, the following guidelines must also be followed to qualify for a JM Peak Advantage Guarantee:

- A. Steel deck must be minimum 22 gauge (0.76 mm) and, at a minimum, have a shop coat of priming paint. Galvanized steel deck is recommended.
- B. Steel deck units should be welded or, preferably, mechanically fastened to the structural frame, with a minimum of weld holes. Side laps should be fastened with sheet metal screws on not over 3'-0" (0.91 m) centers.

- C. Individual deck units should be flat and without large dents, buckles, or holes. Individual deck pieces should not be more than ¼" (6 mm) out of plane with one another.
- D. Deck openings exceeding 12" x 12" (305 mm x 305 mm) should be reinforced, and wood nailers of the same thickness as the proposed insulation installed, or prefabricated curbs installed, which provide nailing facilities for flashing.
- E. A wood nailer must be installed at all roof edges, gables, or curbs, equal in thickness to the proposed insulation and tapered edge strip.

**5.4** Roof insulation of the proper thickness to afford adequate support for the roofing system and typical construction traffic, must be installed over all steel decks. To prevent damage to the first or bottom layer of insulation, JM requires that the thickness of this layer of roof insulation be in accordance with the chart below:

**Minimum Thickness of JM Foam Insulation Products Over Steel Decks\***

	Width of Rib Opening		
	Up to 2 <sup>5</sup> / <sub>8</sub> " (67 mm)	Up to 3 <sup>3</sup> / <sub>8</sub> " (86 mm)	Up to 4 <sup>3</sup> / <sub>8</sub> " (111 mm)
Thickness	1.0" (25 mm)	1.2" (30 mm)	1.3" (33 mm)

\*Avoid concentrated loads

**5.5** Roof insulation must be uniformly secured to the steel deck with approved mechanical fasteners. Fasteners must penetrate at least ¾" (19 mm) through the steel deck. Hot asphalt or cold adhesive is not acceptable. JM will not issue a roof guarantee for any roof system in which the insulation is applied directly over a steel deck with only a cold or hot adhesive.

**5.6** JM requires attachment of the base layer of insulation to steel decks by mechanical fasteners. Insulation installed in two layers should preferably have the first layer mechanically fastened and the second layer secured in hot steep asphalt or an approved adhesive. When done in this fashion, the individual pieces of roof insulation in the second and succeeding layers must be restricted to a maximum size of 4' x 4' (1.22 m x 1.22 m).

**5.7** Insulation that is loose from the deck or not uniformly adhered not only adds to blow-off potential, but also can contribute to premature failure of the roof membrane.

**5.8** To reduce attachment problems with insulation to steel decks, Factory Mutual requires the use of mechanical fasteners. The approved number and types of fasteners for the field of the roof for the insulation board being used is given in the current Factory Mutual Approval Guide. Additional fasteners are required by Factory Mutual Loss Prevention Data Sheet 1-28 at the corners and perimeters. The size of the corners and perimeters are calculated by:

1. 0.1 times the building's lesser plan dimension.
2. 0.4 times the eave height.
3. In no case shall the corners and perimeters be less than 4 ft. (1.22 m).

Factory Mutual also requires increasing the number of fasteners in the roof perimeter and the roof corners. See the current Factory Mutual Loss Prevention Data Sheet 1-28 and 1-29 for more details.

**6.0 Poured Concrete Decks**

**6.1** Properly placed poured structural concrete decks of good mix can provide a satisfactory deck for application of most roof systems. Control joints properly installed, and a relatively smooth surface, are primary considerations. Concrete decks must be dry. The individual pieces of roof insulation are restricted to a maximum size of 4' x 4' (1.22 m x 1.22 m) when adhesive is used for attachment.

**6.2** Should rain occur during application, the work should be stopped and should not be resumed until the deck has been found to be dry.

**6.3** In recent years, many specialty fasteners have been developed which will allow mechanical attachment of roof insulation directly to a poured structural concrete deck. The most current Factory Mutual Approval Guide should be consulted for the specific types of fasteners and the fastening rate for a particular roof insulation. Check with the JM Technical Service Specialist for the fasteners that are acceptable for use in JM Guarantee Systems.

**6.4 The decision to utilize mechanical fasteners on a poured structural concrete deck is a design issue and JM will not be responsible for problems related to the structural deck as a result of utilization of mechanical fasteners.**

**7.0 Poured Gypsum Decks**

**7.1** While not common today in new construction, poured gypsum decks are found in many existing structures. Whether new or existing, poured gypsum can provide a satisfactory substrate for built-up, modified bitumen, or single-ply roofing systems, when properly specified and installed.

**7.2** Gypsum decks are usually placed over form material, which in turn is placed on a bulb-tee support. The normal shrinkage which occurs in the deck during the curing stage causes cracks to form at the weakest points – generally over or adjacent to the bulb-tees. Poured gypsum decks should be placed over a substrate that will vent from below. Ventilation should be provided for any plenum or joist space between roof deck and ceiling assemblies. The venting of exposed air spaces should be accomplished by natural or artificial means, both during and after construction of the building. The deck should be installed according to the deck material manufacturer's requirements.

**7.3** Properly poured and cured gypsum is considered to be a nailable substrate. It is not acceptable to adhere a roof solidly to a gypsum deck. Adhering allows deck stresses to be transmitted directly to the roofing membrane.

### **7.4 Insulation Fasteners for Gypsum Decks**

There are several specialty fasteners available for attaching roof insulation to gypsum decks. Precautions to consider when using these fasteners are:

- A. Specialty insulation fasteners should not be used if the gypsum roof deck is wet, as this reduces the withdrawal resistance of the fastener. Moisture from a wet gypsum deck can also affect the performance of the roof insulation itself.
- B. Fastener pull-out tests should be done on the actual deck. Based on the fastener pull out, the number of fasteners needed for a given wind uplift force can be calculated. This number must be equal to or greater than the number of fasteners that would be required to pass the Factory Mutual wind uplift test for the insulation being used and the size and type of fastener plate being used.

**7.5** As gypsum decks dry out, they tend to crack, which can cause splitting of roof membranes. To overcome this problem, JM recommends the application of a minimum layer of approved JM roof insulation. JM will not be responsible for splits in a roofing membrane applied directly to the gypsum deck.

### **8.0 Pre-Cast Deck Units**

**8.1 Pre-Cast Concrete Slabs** (Not pre-stressed): If units are out of level by more than  $\frac{1}{4}$ " (6 mm), joints must be grouted to an even, smooth finish. A layer of approved JM roof insulation is required prior to installation of any JM roof system. The individual pieces of roof insulation are restricted to a maximum size of 4' x 4' (1.22 m x 1.22 m).

**8.2 Pre-Stressed, Pre-Cast T or TT Long Span Units:** These units have considerable variation in camber and in linear accuracy. Excessive "camber" or "set" must not allow progressive ponding of water, causing deflection of the units. Deflection can also be a result of applied loads such as air conditioning equipment or other roof loads.

If units are out of level by more than  $\frac{1}{4}$ " (6 mm), joints must be grouted to a smooth even finish. A layer of approved JM roof insulation is required prior to installation of any JM roof system. The individual pieces of roof insulation are restricted to a maximum size of 4' x 4' (1.22 m x 1.22 m).

Mechanical attachment of roof insulation or membrane systems directly to this deck type is not acceptable to JM under any condition.

### **9.0 Pre-Cast Gypsum**

**9.1** These are factory-formed units, usually tongue-and-groove, and metal bound. The manufacturer's recommendations should be followed carefully in design of the supporting structure and in placement and attachment. Pre-cast gypsum provides a satisfactory base for nailing. Fasteners to be considered should be approved by the fastener manufacturer, the deck manufacturer, and JM for suitability. Certain fasteners may require predrilled holes. Contact the fastener manufacturer for detailed installation instructions.

**9.2** A layer of approved JM roof insulation is required prior to installation of any JM roof system.

### **10.0 Application of Pre-Cast Units**

- A. All units should be installed in accordance with approved erection drawings and details based on architectural drawings.
- B. Planks should be clipped or mechanically secured to joists or beams as required by the deck manufacturer.
- C. Planks should be neatly cut to fit around all openings and projections through the roof. Openings larger than 8" x 8" (203 mm x 203 mm) should be framed with wood curbs.
- D. Care should be taken not to overload deck units by placing any superimposed loads on the deck. This overloading could include rooftop mounted equipment, excessive construction loads, and units suspended from the underside of the deck which could cause deflection resulting in ponding of water.
- E. Protect deck units from the weather and install roofing and/or insulation to dry decks only.

### **11.0 Wood Tongue-and-Groove Boards, Planks, and Plywood**

**11.1** Wood was one of the original materials used in roof deck construction and is still widely used because of its economy, ease of application, and appearance. When properly installed, it makes an excellent substrate for a roofing system. Wood roof decks tend to expand and contract with changes in humidity conditions.

**11.2** Wood board decks should have the following characteristics:

- A. Boards should be kiln-dried and either tongue-and-grooved, ship-lapped or splined. Tongue-and-grooved or splined lumber is preferred to square-edge materials, as possible shrinkage of the boards may open joints and affect the roof system by causing buckling or splitting of the membrane.
- B. Boards should not be warped and should have a minimum of knot holes and cracks. Knot holes, and cracks greater in width than 1/4" (6 mm), should be filled or covered with sheet metal, nailed in place, being careful that the metal is smoothly installed so the roofing membrane will not be damaged.
- C. Boards should have a minimum nominal width of 4" (102 mm), a maximum nominal width of 6" (152 mm) and a minimum nominal thickness of 1" (25 mm).
- D. Boards should be securely fastened to the purlins for adequate strength and rigidity.
- E. Nailing must be done with long enough nails to secure the deck material to the joists or purlins without backing out of supporting members.
- F. Any preservative treatments must be of a non-oil, non-creosote type.

**11.3** Structural sheathing is a man-made wood product used in the construction of roof decks. Today the common types are plywood and oriented strand board (OSB). The American Plywood Association defines these products as follows:

- A. **Plywood:** All veneer panels consist of an odd number of cross-laminated layers, each layer consisting of one or more plies. Panels should meet all of the prescriptive or performance provisions of U.S. Product Standard PS-1 81/ANSI A199.1 for construction and industrial plywood. Fire-retardant treated plywood is unacceptable without certification from the manufacturer that the product will not be structurally damaged over the life of the roof due to the treatment process.
- B. **Oriented Strand Board:** Panels of compressed strand-like particles arranged in layers (usually three to five) oriented in right angles to one another. Panels should meet all of the prescriptive or performance provisions of U.S. Product Standard PS-1 81/ANSI A199.1 for construction and industrial plywood.

**11.4** Following are requirements for the application of a JM roofing system over plywood or OSB decks:

- A. Must be American Plywood Association (APA) labeled, CD Exposure 1, Struc 1, 5 ply and minimum thickness of 1/2" (13 mm).
- B. Minimum thickness of plywood or OSB considered acceptable by JM for a roof deck is 1/2" (13 mm). JM only accepts selected brands of OSB for guaranteed roofs; contact a JM representative for acceptable OSBs.
- C. All joints between plywood or OSB sheets should be blocked with wood framing. Ply-clips are not acceptable. Square edge joints should be loosely butted to prevent buckling of the panels.
- D. Securement must be in accordance with APA recommendations.
- E. Install plywood so the face ply grain is perpendicular to the joists. OSB should be installed with the long direction perpendicular to the joists.
- F. Plywood or OSB, as well as all other components of the roofing system, must be kept dry prior to the application of the roofing system.
- G. Spacing of joists or purlins should conform to the specifications shown in the table below.
- H. To prevent condensation on the lower side of the roof membrane, especially over buildings where insulation has been placed beneath the plywood deck, add enough roof insulation above the deck to raise the temperature above the dew point so condensation will not occur. For this reason, under-deck insulation is not recommended.

### Rated Sheathing Roof Decks for Guaranteed Roofs

Allowable Grades	Minimum		
	Span Rating	Minimum Thickness	Max. Span (a)
APA Structural 1	32/16	1/2" (13 mm)	24" (610 mm)
Rated Sheathing	40/20	19/32" (15 mm)	32" (813 mm)
	48/20	23/32" (18 mm)	48" (1219 mm)

(a) Sheathing continuous over two or more spans with grain of face plies across supports.

**11.5** IT IS THE RESPONSIBILITY OF THE OWNER OR THEIR TECHNICAL REPRESENTATIVES TO DETERMINE IF THE DECK STRUCTURE CAN ADEQUATELY SUPPORT THE ROOFING SYSTEM OF CHOICE.

### 12.0 Lightweight Insulating Concrete

**12.1** Lightweight insulating concrete resembles poured-in-place structural concrete in that it starts with a mix of cement and water. The end result however, is quite different from structural concrete. Lightweight insulating concrete can provide a suitable base for built-up, modified and single ply systems when designed, specified and installed properly.

**12.2** There are two basic "families" of lightweight insulating concrete: aggregate and cellular. Both types have relatively low densities and are considered to be nailable substrates.

Both can be poured by themselves to create slope and provide insulation or they can be poured over a special expanded polystyrene insulation board to increase the thermal efficiency of the system. Both systems must be poured over some type of structural substrate. The most common structural substrates today include metal and structural concrete.

**12.3** Because of the amount of water involved in mixing and pouring, the use of either system is more sensitive to climatic conditions than many other deck systems. Extreme care should be taken when utilizing this deck system in areas that can experience freezing temperatures. **JM will not accept any type of lightweight insulating concrete fill in Region 1 that has been poured between October 1 and May 1 without specific prior written approval of a JM Technical Service Specialist.**

**12.4 Lightweight insulating concrete (aggregate base)** is a mixture of portland cement and water with a vermiculite or perlite aggregate. The perlite or vermiculite helps reduce the overall density and improve thermal efficiency of the material. A minimum pour thickness of 2" (51 mm) is normally required by the manufacturer. A typical 1:4 or 1:6 mix (cement: vermiculite/perlite by volume) contains as much as 94% water by weight. Because of the high percentage of water, to be eligible for a JM Roofing System Guarantee, this fill must be poured over a slotted metal deck. JM will not accept standard lightweight insulating concrete mix which has been poured over a non-venting substrate. If a JM Peak Advantage Guarantee is required, a Ventsulation venting base sheet may be used as the base sheet. FP-10 One Way Roof Vents must be installed at a rate of one vent per 1000 square feet (93 m<sup>2</sup>). Contact a JM Technical Service Specialist for specific information.

**12.5** In recent years, lower water content aggregate fills have been developed. These products utilize a 1:3.5 volume ratio (cement: vermiculite) and because of the higher strength, can be poured in a minimum 1" (25 mm) thickness. Contact a JM Technical Service Specialist for regional requirements involving this deck system.

**12.6 Lightweight insulating concrete (cellular)** is a mixture of portland cement and either a chemical to create bubbles in the cement, an air entraining agent that "foams" the cement, or a preformed foam that replaces the mineral aggregate in the cement. This type of lightweight insulating concrete typically uses 75% less water in the mix than traditional aggregate based lightweight insulating concretes. "Bubbles" in the concrete reduce the density and improve the thermal performance.

**12.7** Cellular lightweight insulating concrete may be poured over non-venting substrates such as metal and structural concrete. Because of a rapid drying time, some manufacturers of these products recommend that a roof be installed not more than 5 days after pouring the deck. Care should be taken to see that the cellular, lightweight concrete is dry, but not severely cracked due to rapid drying.

**12.8** There are several types of fasteners available for securement to lightweight insulating concrete fills. Fasteners must be treated to resist corrosion. The current Factory Mutual Research Corporation Approval Guide should be consulted for approved types and fastening rates. When no outside agency approvals are required, the fasteners should provide a minimum 40 pounds (178 N) or more of pullout resistance.

### 13.0 Cementitious Wood Fiber Decks

**13.1** Cementitious wood fiber roof decks are made from coarse wood fibers bonded together with a water-resistant cementitious binder. These units offer insulating value and sound absorbing qualities in addition to providing an acceptable prefinished underside. They are supplied in the form of planks for mechanical securement to bar joists, or for application to the bulb-tees with grouted joints between planks.

**13.2** JM will issue roof guarantees for roofs installed only over cementitious wood fiber decks which are manufactured by the members of the Structural Cement Fiber Products Association, to the following specifications:

- A. The cementitious binder must be a moisture-resistant cement.
- B. The weight per square foot for various thicknesses must not be less than 2" - 6 psf (51 mm - 29.3 kg/m<sup>2</sup>), 2½" - 7 psf (64 mm - 34.2 kg/m<sup>2</sup>) and 3" - 8 psf (76 mm - 39.1 kg/m<sup>2</sup>).

Acceptance of these decks by JM as a substrate for a roofing system in no way guarantees their installation or performance as a roof deck material.

**13.3** Problems have arisen in the performance of roofing systems installed over these deck units. They are:

- A. Formation of wrinkles resulting from the accumulation of condensation in the open joints of the deck.
- B. Step-downs from slab to slab. These must be leveled off with a screed coat, troweled to a feather edge finish. The screed coat should be of a mix approved by the deck manufacturer, and should extend out onto the surface so as to provide a gradual transition between slabs, where necessary.
- C. Sagging or "bowing" of panels over time.

**13.4** The JM policy for issuing a guarantee for systems over these types of decks is:

- A. A minimum layer of approved JM roof insulation should be attached to the deck prior to installing a membrane. Insulation may be attached directly to the deck utilizing an approved specialty insulation fastener or by first attaching a base sheet and securing insulation with an approved adhesive.
- B. The roofing membrane is to be applied immediately, in strict accordance with the specification selected for application over approved roof insulation.

**13.5** The following precautions are recommended for application of this type roof deck unit:

- A. The deck manufacturer's specifications be followed regarding the installation of the roof deck, with special attention given to proper grouting.
- B. All deck planks should be dry, level, properly grouted and of sufficient density to hold an acceptable mechanical fastener.
- C. Individual planks should be securely fastened to the supporting member to prevent lateral and vertical movement.
- D. Only as much cementitious wood fiber deck should be erected as can be covered with completed roofing the same day.
- E. Cementitious wood fiber roof decks should not be used over high moisture areas where condensation can occur on the underside of the roofing system.
- F. All cementitious wood fiber roof decks should conform to the general roof deck requirements of this section.

### **14.0 Insulated Structural Steel Panel Decks**

**14.1** These deck systems consist of a lightweight, corrugated, structural steel decking with a rigid roof insulation board and a proprietary gypsum board. All three components are screwed together forming a rigid deck system. Check with a JM Technical Service Specialist for approved manufacturers and specific requirements regarding this deck type.

### **15.0 Mechanical Fastening**

**15.1** More comprehensive data now available concerning wind action on structures and roof coverings dictates that designers and architects be more aware of possible damage to roofs. Factory Mutual data sheets 1-7, 1-28, 1-29, 1-47 and 1-49, as well as the American National Standards Institute publication ANSI-A-58.1 (1982) call attention to the fact that some geographical locations are subject to wind conditions which require increased fastening at critical areas. It is the designer's and architect's responsibility to consider these factors in their design of a roofing system.