Chapter ILHR 21

CONSTRUCTION STANDARDS

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Note: Chapter Ind 21 was renumbered to be chapter ILHR 21, Register, February, 1985, No. 350, eff. 3–1–85.

Subchapter I —Scope

ILHR 21.01 Scope. The provisions of this chapter shall apply to the design and construction of all one– and 2–family dwellings.

History: Cr. Register, November, 1979, No. 287, eff. 6–1–80.

Subchapter II —Design Criteria

ILHR 21.02 Loads and materials. Every dwelling shall be designed and constructed in accordance with the requirements of this section.

(1) DESIGN LOAD. Every dwelling shall be designed and constructed to support the actual dead load, live loads and wind loads acting upon it without exceeding the allowable stresses of the material.

(a) *Dead loads.* Every dwelling shall be designed and constructed to support the actual weight of all components and materials. Earth–sheltered dwellings shall be designed and constructed to support the actual weight of all soil loads.

(b) *Live loads.* 1. Floors and ceilings. Floors and ceilings shall be designed and constructed to support the minimum live loads listed in Table 21.02. The design load shall be applied uniformly over the component area.

TABLE 21.02

Component	Live Load (pounds per sq. ft.)
Floors	40
Garage floors	50
Exterior balconies, decks, porches	40
Ceilings (with storage)	20
Ceilings (without storage)	5

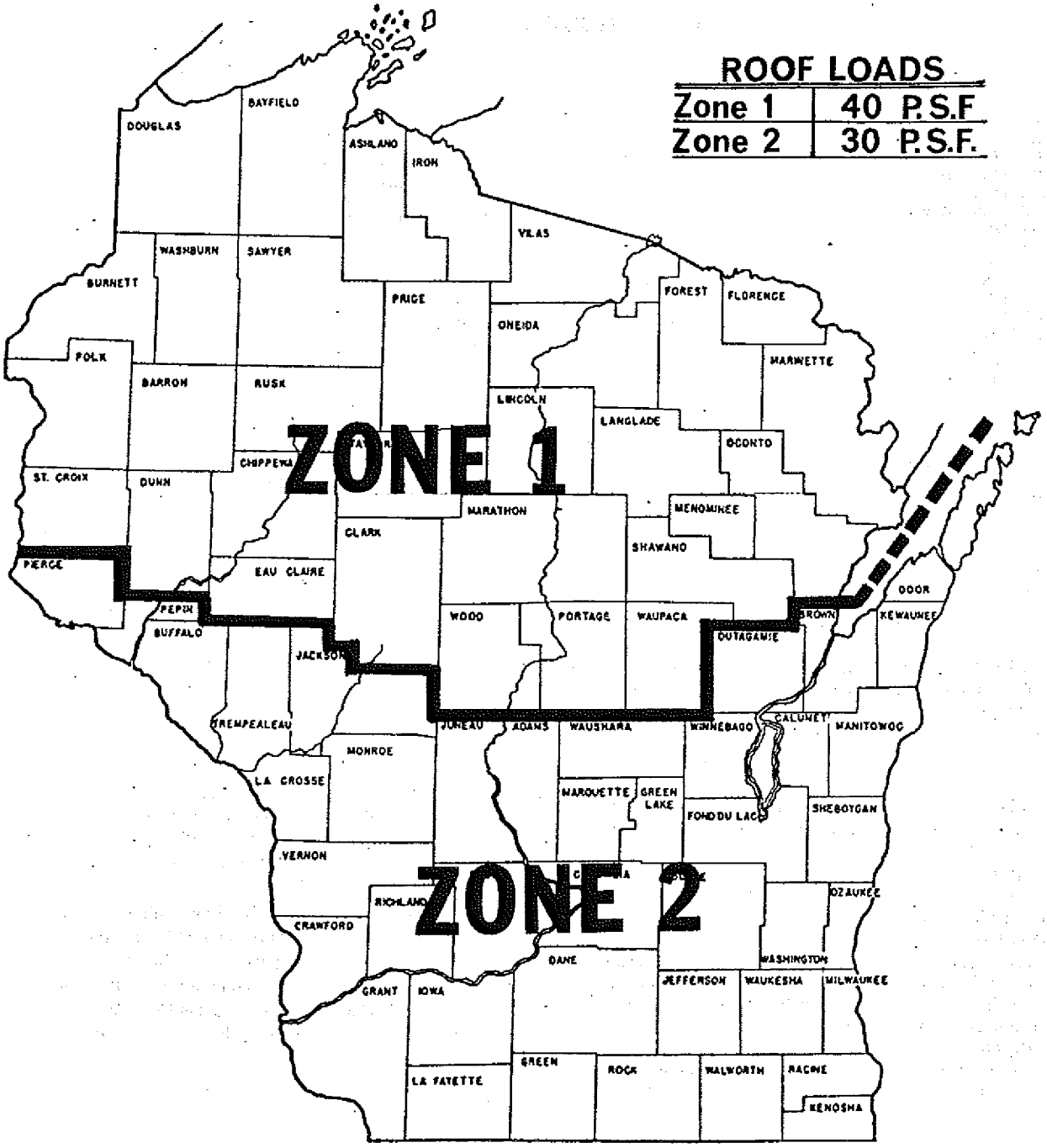
2. Snow loads. Roofs shall be designed and constructed to support the minimum snow loads listed on the zone map. The loads shall be assumed to act vertically over the roof area projected upon a horizontal plane.

(c) *Wind loads.* Every dwelling shall be designed and constructed to withstand a horizontal and uplift pressure of 20 pounds per square foot acting over the surface area.

(d) *Fasteners.* All building components shall be fastened to withstand the dead load, live load and wind load. Where the effect of the dead load exceeds the wind load effect, the dwelling need not be anchored to the foundation.

Note: See the Appendix for a schedule of fasteners that will be acceptable to the department for compliance with this subsection. Other fastening methods may be allowed if engineered under s. ILHR 21.02 (3).

Figure 21.02
ZONE MAP FOR ROOF LOADS



(2) METHODS OF DESIGN. All dwellings shall be designed by the method of structural analysis or the method of accepted practice specified in each part of this code.

Note: See ch. NR 116, rules of the department of natural resources, for special requirements relating to buildings located in flood plain zones. Information regarding the elevation of the regional flood may be obtained from the local zoning official.

(3) STRUCTURAL ANALYSIS STANDARDS. Structural analysis shall conform to the following nationally recognized standards.

(a) *Wood.* 1. Except as provided in subd. 1. a. and b., structural lumber, glue–laminated timber, timber pilings and fastenings shall be designed in accordance with the "National Design Specification for Wood Construction" and the "Design Values for Wood Construction," a supplement to the National Design Specification for Wood Construction.

a. Section 2.2.5.3. The cumulative effects of short–time loads, such as snow, shall be considered in determining duration of load. For snow load, no greater duration of load factor than 1.15 shall be used.

b. Section 4.1.7. The provisions of this section shall also apply to reused lumber. Reused lumber shall be considered to have a duration of load factor of 0.90.

2. Span tables for joists and rafters printed in the appendix or approved by the department may be used in lieu of designing by structural analysis.

Note: The department will accept designs and installations in conformance with the following: (1) "Plywood Design Specification" including Supplement No. 1, "Design and Fabrication of Plywood Curved Panels"; Supplement No. 2, "Design and Fabrication of Plywood–Lumber Beams"; Supplement No. 3,"Design and Fabrication of Plywood Stressed–Skin Panels"; Supplement No. 4, "Design and Fabrication of Plywood Sandwich Panels"; and Supplement No. 5, "Design and Fabrication of All–Plywood Beams"; (2) "Plywood Diaphragm Construction"; (3) Laboratory Report 121, "Plywood Folded Plate Design and Details"; and (4) Laboratory Report 93, "Load–Bearing Plywood Sandwich Panels"; (above publications available from the American Plywood Association, P.O. Box 11700, Tacoma, Washington 98411); (5) Design Guide HP–SG–71, "Structural Design Guide for Hardwood Plywood" (available from the Hardwood Plywood Manufacturers Association, 2310 S. Walter Reed Drive, Arlington, Virginia 22206); (6) U.S. Product Standard PS 1–83 for Softwood Plywood Construction and Industrial (available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402); (7) TPI–85, "Design Specification for Metal Plate Connected Wood Trusses" (available from Truss Plate Institute, Inc., 583 D'Onofrio Dr., Madison, Wisconsin 53719); (8) "Wood Structural Design Data," 1986 edition (available from National Forest Products Association, 1250 Connecticut Ave. NW, Washington, D.C. 20036).

Note: The department will accept plywood treated in accordance with the standards of the American Wood Preservers Association.

3. Engineered wood products shall be used in accordance with structural analysis or with load tables supplied by the manufacturer, provided those tables were developed using structural analysis or load testing.

(b) *Structural steel.* The design, fabrication and erection of structural steel for buildings shall conform to Specification for Structural Steel Buildings, Allowable Stress Design and Plastic Design and the provisions of the accompanying commentary as adopted under s. ILHR 20.24 (3).

(c) *Concrete.* Plain, reinforced or prestressed concrete construction shall conform to the following standards:

1. ACI Standard 318, "Building Code Requirements for Reinforced Concrete".

2. ACI Standard 318.1, "Building Code Requirements for Structural Plain Concrete".

(d) *Masonry.* The design and construction of masonry shall conform to the provisions of the Concrete Masonry Handbook for Architects, Engineers, Builders as adopted under s. ILHR 20.24 (9)

History: Cr. Register, November, 1979, No. 287, eff. 6–1–80; r. and recr. (3) (a), am. (3) (c) and Table 21.02, cr. (3) (c) 2., Register, February, 1985, No. 350, eff. 3–1–85; cr. (3) (a) 3., am. (3) (b), renum. (3) (e) to be (3) (d), and am., Register, November, 1995, No. 479, eff. 12–1–95.

ILHR 21.03 Exits, doors and hallways. Exits, doors and hallways shall be constructed as specified in this section.

(1) EXITS FROM THE FIRST FLOOR. Every dwelling unit shall be provided with at least 2 exits from the first floor. One of the exits shall discharge to grade. The second exit may discharge to an outside balcony or discharge to grade or discharge into an attached garage provided with an exit door which discharges to grade. An overhead garage door may not be used as an exit door. The 2 required exits from the first floor shall be located as far apart as practical.

Note: Although not a requirement, the department recommends that the 2 required exits from the first floor be placed at least as far apart as half the length of the longest diagonal of the first floor. See appendix for examples.

(2) EXITS FROM THE SECOND FLOOR. (a) At least 2 exits shall be provided from the second floor. One of the exits shall be a stairway or ramp and lead to the first floor or discharge to grade. The second exit may be via a stairway or ramp which discharges to grade or may discharge to a balcony which complies with sub. (10).

(b) Except as provided in par. (c), windows which comply with sub. (6m) may be provided in each second floor bedroom in lieu of the second exit from the floor.

(c) Where the second floor is the lowest floor level in a dwelling unit, as in an up–and–down duplex, windows may not be provided as the second exit from the floor.

(3) EXITS ABOVE THE SECOND FLOOR. At least 2 exits shall be provided for each habitable floor above the second floor. The exits shall be located such that in case any exit is blocked some other exit will still be accessible to the second floor. The exits shall be stairways or ramps that lead to the second floor or discharge to grade.

(4) EXITS FROM LOFTS. (a) At least one stairway exit shall be provided, to the floor below, for a loft exceeding 400 square feet in area.

(b) At least one stairway or ladder exit shall be provided to the floor below for a loft, 400 square feet or less, in area.

(5) EXITS FROM BASEMENTS. (a) Basements which are not used for sleeping shall be provided with at least one exit. The exit shall be a stairway or ramp which leads to the floor level above or discharges to grade.

(b) Basements which include spaces used for sleeping shall be provided with at least 2 exits. The 2 exits shall not be accessed by the same stairway or ramp and shall be located as far apart as practical. One exit shall be a stairway or ramp which leads to grade or a door located at the basement level which leads to grade via an exterior stairs. The second exit may be via a stairway or ramp which leads to the floor level above the basement. Windows which comply with sub. (6m) may be provided in each basement bedroom in lieu of the second exit from the basement.

(6) EXITS FROM GROUND FLOORS. (a) Ground floors which are not used for sleeping shall be provided with at least one exit. The exit may be a swing door or a sliding glass door which discharges directly to grade or may be via a stairway which leads to the first floor.

(b) Ground floors which include spaces used for sleeping shall be provided with at least 2 exits. The 2 exits shall not be accessed by the same stairway or ramp and shall be located as far apart as practical. One exit shall discharge to grade. The second exit may be via a stairway or ramp which leads to the first floor. Windows which comply with sub. (6m) may be provided in each ground floor bedroom in lieu of the second exit from the ground floor.

(6m) WINDOWS USED FOR EXITING. Windows which are installed for exit purposes shall comply with the requirements of this subsection.

(a) The window shall be openable from the inside without the use of tools or the removal of a sash. If equipped with a storm or screen, it shall be openable from the inside.

(b) 1. The nominal size of the net clear window opening shall be at least 20 inches in width by 24 inches in height. Nominal dimensions shall be determined by rounding up fractions of inches if they are $^1/_2$–inch or greater or rounding down fractions of inches if they are less than $^1/_2$–inch.

2. Except as provided in subd. 3., no portion of the window, including stops, stools, meeting rails and operator arms of awning windows, shall infringe on the required opening.

3. The movable sash of casement windows may infringe on the required opening width. The net clear opening width of casement windows shall be measured between the stops.

(c) The area and dimension requirements of par. (b) may be infringed on by a storm window.

(d) The sill height shall not be more than 46 inches above the floor or the top of a permanent platform, with or without steps, installed below the window. The platform and steps, if provided, shall be as wide as the actual egress opening and have a minimum tread depth of 9 inches and maximum riser height of 8 inches.

(e) If a window which is provided as an exit is located below grade, then an areaway shall be provided. The width of the areaway shall be at least equal to the width of the exit window. The bottom of the areaway shall not be more than 46 inches below grade. The areaway shall be a minimum of 3 feet measured perpendicular from the wall. The areaway shall be constructed to prevent rainfall flowing into the areaway from entering the dwelling.

(7) DOORS USED FOR EXITING. One of the required exit doors from a dwelling unit shall be a swing type door at least 3 feet wide by 6 feet 8 inches high. All other required exterior exit doors shall be at least 2 feet 8 inches wide by 6 feet 4 inches high. Where double doors are provided as a required exit, the width of each door leaf shall be at least 2 feet 6 inches and the doors shall not have an intermediate mullion.

(8) INTERIOR CIRCULATION. All passageway doors or openings to at least 50% of the bedrooms, at least one full bathroom, and the common–use areas such as kitchens, dining rooms, living rooms, basements, garages and family rooms shall be at least 2 feet 8 inches wide or provide a net clear opening of 30 inches and shall be 6 feet 8 inches high.

(9) HALLWAYS. Hallways shall be at least 3 feet in width except that door hardware, finish trim and heating registers may infringe upon this dimension.

(10) BALCONIES. (a) Balconies shall be made of concrete, metal or wood which is treated, protected or naturally decay–resistive in accordance with s. ILHR 21.10.

(b) Balconies shall be provided with guardrails in accordance with s. ILHR 21.04 (2).

(c) Balconies which are required for exit purposes shall also comply with all of the following requirements:

1. The balcony guardrail shall terminate no more than 46 inches above the floor level of the balcony.

2. The floor level of the balcony shall be no more than 15 feet above the grade below.

3. The floor of the balcony shall have minimum dimensions of 3 feet by 3 feet. The guardrail and its supports may infringe on the dimensions of the required area.

(11) SPLIT LEVEL DWELLINGS. In determining the exit requirement in a split level dwelling, all levels that are to be considered a single story shall be within 5 feet of each other.

(12) TWO–FAMILY DWELLINGS. In a 2–family dwelling, each dwelling unit shall be provided with exits in compliance with this section.

History: Cr. Register, November, 1979, No. 287, eff. 6–1–80; r. and recr. Register, February, 1985, No. 350, eff. 3–1–85; emerg. am. (1) (b), (2) and (5) (b) 2., eff. 5–7–85; r. (1) (b), renum. (1) (a) to be (1), am. (2), (7) and (8), r. and recr. (5) to (6), cr. (6m) and (10) to (12), Register, January, 1989, No. 397, eff. 2–1–89; am. (3) and (7), r. and recr. (10) and (11), Register, March, 1992, No. 435, eff. 4–1–92; am. (8), r. and recr. (10) (a), Register, November, 1995, No. 479, eff. 12–1–95.

ILHR 21.04 Stairs and elevated areas. Every interior and exterior stairs, including tub access steps but excluding nonrequired basement stairs which lead directly to the building exterior and stairs leading to attics or crawl spaces, shall conform to the requirements of this section.

(1) STAIR DETAILS. (a) *Width.* Stairs shall measure at least 36 inches in width. Handrails and associated trim may project no more than 4 $^1/_2$ inches into the required width at each side of the stairs.

(b) *Headroom.* Stairs shall be provided with a minimum headroom clearance of 76 inches. The clearance shall be measured vertically from a line parallel to the nosing of the treads to the ceiling or soffit directly above that line.

(c) *Treads and risers.* 1. Except as provided in pars. (d) and (e) for spiral stairs and winders, risers may not exceed 8 inches in height measured vertically from tread to tread. Treads shall be at least 9 inches wide measured horizontally from nosing to nosing.

2. Within individual stairways, tread widths and riser heights may vary in uniformity by a maximum of 3/16 inch. Variations in uniformity may not cause either dimension in subd. 1. to be exceeded.

(d) *Winders.* Winder steps may be used provided the length of the tread is at least 36 inches and the width of the tread is at least 7 inches measured at a point 12 inches from the narrow end. The riser height shall be uniform and may not exceed 8 inches measured vertically from tread to tread.

(e) *Spiral stairs.* Spiral stairs may be used as exit stairs. The tread shall measure at least 26 inches from the outer edge of the supporting column to the inner edge of the handrail and at least 7 inches in width from nosing to nosing at a point 12 inches from the narrow end of the tread. The riser height shall be uniform and may not exceed 9$^1/_2$ inches.

(2) HANDRAILS AND GUARDRAILS. (a) *General.* Stairs with more than 3 risers shall be provided with at least one handrail for the full length of the stairs. Handrails or guardrails shall be provided on all open sides of stairs consisting of more than 3 risers and on all open sides of areas that are elevated more than 24 inches above the floor or exterior grade. Handrails and guardrails shall be constructed to prevent the through–passage of a sphere with a diameter of 6 inches or larger. Handrails and guardrails shall be designed and constructed to withstand a 200 pound load applied in any direction. Exterior handrails and guardrails shall be constructed of metal, decay resistant or pressure–treated wood, or shall be protected from the weather.

(b) *Handrails.* 1. 'Height'. Handrails shall be located at least 30 inches, but no more than 38 inches above the nosing of the treads. Measurement shall be taken from the hard structural surface beneath any finish material to the top of the rail. Variations in uniformity are allowed only when a rail contacts a wall or newel post or where a turnout or volute is provided at the bottom step.

2. 'Clearance'. The clearance between a handrail and the wall surface shall be at least 1$^1/_2$ inches.

3. 'Winders'. Handrails on winder steps shall be placed on the side where the treads are wider.

4. 'Projection'. Handrails and associated trim may project into the required width of stairs and landings a maximum of 4$^1/_2$ inches on each side.

5. 'Size and configuration'. Handrails shall be symmetrical about the vertical centerline to allow for equal wraparound of the thumb and fingers.

a. Handrails with a round or truncated round cross sectional gripping surface shall have a maximum whole diameter of 2 inches.

b. Handrails with a rectangular cross sectional gripping surface shall have a maximum perimeter of 6$^1/_4$ inches with a maximum cross sectional dimension of 2$^7/_8$ inches.

c. Handrails with other cross sections shall have a maximum cross sectional dimension of the gripping surface of 2$^7/_8$ inches with a maximum linear gripping surface measurement of 6 $^1/_4$ inches and a minimum linear gripping surface of 4 inches.

Note: See appendix for further information on handrail measurement.

6. 'Continuity'. Handrails shall be continuous for the entire length of the stairs except in any one of the following cases:

a. A handrail may be discontinuous at an intermediate landing.

b. A handrail may have newel posts.

c. A handrail may terminate at an intermediate wall provided the lower end of the upper rail is returned to the wall or provided with a flared end, the horizontal offset between the 2 rails is no more than 12 inches measured from the center of the rails, and both the upper and lower rails can be reached from the same tread without taking a step.

(c) *Guardrails.* 1. 'Application'. All openings between floors, and open sides of landings, platforms, balconies or porches that are more than 24 inches above grade or a floor shall be protected with guardrails.

2. 'Height'. Guardrails shall be located at least 36 inches above the floor. Measurement shall be taken from the hard structural surface beneath any finish material to the top of the rail.

(3) LANDINGS. (a) *Intermediate landings.* A level intermediate landing shall be provided for any stairs with a height of 12 feet or more. Intermediate landings shall be at least as wide as the stairs and shall measure at least 3 feet in the direction of travel. For curved or semicircular landings, the radius of the landing shall be at least equal to the width of the stairs.

(b) *Landings at the top and base of stairs.* A level landing shall be provided at the top and base of every stairs. The landing shall be at least as wide as the stairs and shall measure at least 3 feet in the direction of travel.

(c) *Doors at landings.* Except as provided in subds. 1. to 4., level landings shall be provided on each side of any door located at the top or base of a stairs, regardless of the direction of swing. In the following exceptions, stairways to attached garages or porches are considered interior stairs:

1. A landing is not required between the door and the top of interior stairs if the door does not swing over the stairs.

2. A landing is not required between the door and the top of an interior stairs of 1 or 2 risers regardless of the direction of swing.

3. A landing is not required between a sliding glass door and the top of an exterior stairway of 3 or fewer risers.

4. The exterior landing, platform or sidewalk at an exterior doorway shall be located a maximum of 8 inches below the interior floor elevation. The landing, platform or sidewalk shall have a length at least equal to the width of the door.

History: Cr. Register, November, 1979, No. 287, eff. 6–1–80; r. and recr. Register, February, 1985, No. 350, eff. 3–1–85; am. (intro.), r. and recr. (1) (c), renum. (3) (f) to ILHR 21.042, Register, January, 1989, No. 397, eff. 2–1–89; r. and recr. (intro.) and (3) (c), am. (1) (a), (2) (a) and (c) 2. and (3) (a), cr. (2) (c) 6., March, 1992, No. 435, eff. 4–1–92; r. and recr., Register, November, 1995, No. 479, eff. 12–1–95; am. (1) (c) 1. and (d), renum. (2) (intro.) to (b) to be (2) (a) to (c) and am. (a), r. (2) (b) (intro.), Register, February, 1997, No. 494, eff. 3–1–97; **reprinted to restore dropped copy, Register, March, 1997, No. 495.**

ILHR 21.042 Ladders. Ladders which are used as part of a required exit shall conform to this section.

(1) DESIGN LOAD. Ladders shall be designed to withstand loads of at least 200 pounds.

(2) TREAD OR RUNGS. (a) Minimum tread requirements shall be specified in Table 21.042. Treads less than 9 inches in width shall have open risers. All treads shall be uniform in dimension.

TABLE 21.042

Pitch of Ladder Angle to Horizontal (degrees)	Maximum rise (inches)	Minimum Tread (inches)
41.6 to 48.4	8	9
greater than 48.4 to 55.0	9	8
greater than 55.0 to 61.4	10	7
greater than 61.4 to 67.4	11	6
greater than 67.4 to 71.6	12	5
greater than 71.6 to 75.9	12	4
greater than 75.9 to 80.5	12	3
greater than 80.5 to 90	12	2

(b) Rungs may only be used for ladders with a pitch range of 75° to 90°. Rungs shall be at least 1 inch in diameter for metal ladders and $1^1/_2$ inch for wood ladders. All rungs shall be uniform in dimension.

(3) RISERS. Risers shall be uniform in height and shall conform with Table 21.042.

(4) WIDTH. The width of the ladder shall be a minimum of 20 inches wide and a maximum of 30 inches wide.

(5) HANDRAILS. (a) Handrails shall be required for ladders with pitches less than 65°.

(b) Handrails shall be located at least 30 inches, but not more than 34 inches, above the nosing of the treads.

(c) Open handrails shall be provided with intermediate rails or an ornamental pattern such that a sphere with a diameter larger than 9 inches cannot pass through.

(d) The clearance between the handrail and the wall surface shall be at least $1^1/_2$ inches.

(e) Handrails shall be designed and constructed to withstand a 200 pound load applied in any direction.

(6) CLEARANCES. (a) The ladder shall have a minimum clearance of at least 15 inches on either side of the center of the tread.

(b) The edge of the tread nearest to the wall behind the ladder shall be separated from the wall by at least 7 inches.

(c) A passage way clearance of at least 30 inches parallel to the slope of a 90° ladder shall be provided. A passage way clearance of at least 36 inches parallel to the slope of a 75° ladder shall be provided. Clearances for intermediate pitches shall vary between these 2 limits in proportion to the slope.

(d) For ladders with less than a 75° pitch the vertical clearance above any tread or rung to an overhead obstruction shall be at least 6 feet 4 inches measured from the leading edge of the tread or rung.

History: Renum. from ILHR 21.04 (3) (f), cr. (intro.), Register, January, 1989, No. 397, eff. 2–1–89; am. (6) (b), Register, November, 1995, No. 479, eff. 12–1–95.

ILHR 21.045 Ramps. Every exterior or interior ramp which leads to or from a required exit shall comply with the requirements of this section.

(1) SLOPE. Ramps shall not have a gradient greater than 1 in 8 or one foot of rise in 8 feet of run. Walkways with gradients less than 1 in 20 or one foot of rise in 20 feet of run are not considered to be ramps.

(2) SURFACE AND WIDTH. Ramps shall have a slip resistant surface and shall have a minimum width of 36 inches measured between handrails.

(3) HANDRAILS. Handrails shall be provided on all open sides of ramps. Every ramp that overcomes a change in elevation of more than 8 inches shall be provided with at least one handrail.

(a) Ramps which have a gradient greater than 8.33% or 1:12 or one foot rise in 12 feet of run and which overcome a change in elevation of more than 24 inches, shall be provided with handrails on both sides.

(b) Handrails shall be mounted so that the top of the handrail is located between 30 to 34 inches above the ramp surface.

(c) Open–sided ramps shall have the area below the handrail protected by intermediate rails or an ornamental pattern to prevent the passage of a sphere with a diameter of 6 inches or larger.

(d) The clear space between the handrail and any adjoining wall shall be at least $1^1/_2$ inches.

(4) LANDINGS. A level landing shall be provided at the top, at the foot and at any change in direction of the ramp. The landing shall be at least as wide as the ramp and shall measure at least 3 feet in the direction of travel.

History: Cr. Register, January, 1989, No. 397, eff. 2–1–89; am. (3) (intro.), Register, March, 1992, No. 435, eff. 4–1–92; am. (3) (c), Register, November, 1995, No. 479, eff. 12–1–95.

ILHR 21.05 Light and ventilation. (1) NATURAL LIGHT. All habitable rooms shall be provided with natural light by means of glazed openings. The area of the glazed openings shall be at least 8% of the net floor area, except under the following circumstances:

(a) *Exception.* Habitable rooms, other than bedrooms, located in basements need not be provided with natural light.

(b) *Exception.* Natural light may be obtained from adjoining areas through glazed openings, louvers or other approved methods. Door openings into adjoining areas may not be used to satisfy this requirement.

(2) VENTILATION. (a) *Natural ventilation.* Natural ventilation shall be provided to all habitable rooms by means of openable doors, skylights or windows. The net area of the openable doors, skylights or windows shall be at least 3.5% of the net floor area of the room. Balanced mechanical ventilation may be provided in lieu of openable exterior doors, skylights or windows provided the system is capable of providing at least one air change per hour of fresh outside air while the room is occupied. Infiltration may not be considered as make–up air for balancing purposes.

(b) *Exhaust ventilation.* All exhaust ventilation shall terminate outside the building.

(3) ATTIC VENTILATION. Ventilation above the ceiling/attic insulation shall be provided as specified in either s. ILHR 22.05 (3) (a) or 22.11 (3) (a).

(4) CRAWL SPACE VENTING. Unheated crawl spaces shall be vented in accordance with either s. ILHR 22.05 (3) (b) or 22.11 (3) (b). All crawl spaces shall be provided with a vapor retarder that has a transmission rate of no more than 0.1 perm. All decayable organic material and topsoil shall be removed from crawl space floors prior to the placement of the vapor retarder.

(5) SAFETY GLASS. Glass in all interior and exterior doors, sliding doors, storm doors, adjacent sidelights of doors, bathtub enclosures, shower doors, and any fixed or operating flat glass panels within 2 feet of doors and less than 2 feet from the floor shall be safety glass.

History: Cr. Register, November, 1979, No. 287, eff. 6–1–80; r. and recr. (1) and (2), Register, February, 1985, No. 350, eff. 3–1–85; r. and recr. (3) and (4), Register, July, 1986, No. 367, eff. 1–1–87; am. (4), Register, January, 1989, No. 397, eff. 2–1–89; am. (2) (a), (4) and (5), Register, March, 1992, No. 435, eff. 4–1–92; am. (2) (a), Register, November, 1995, No. 479, eff. 12–1–95.

ILHR 21.06 Ceiling height. All habitable rooms, kitchens, hallways, bathrooms and corridors shall have a ceiling height of at least 7 feet. Habitable rooms may have ceiling heights of less than 7 feet provided at least 50% of the room's floor area has a ceiling height of at least 7 feet. Beams and girders or other projections shall not project more than 8 inches below the required ceiling height.

History: Cr. Register, November, 1979, No. 287, eff. 6–1–80; r. and recr. Register, February, 1985, No. 350, eff. 3–1–85.

ILHR 21.07 Attic and crawl space access. (1) ATTIC. Attics with 150 or more square feet of area and 30 or more inches of clear height between the top of the ceiling framing and the bottom of the rafter or top truss chord framing shall be provided with an access opening of at least 14 by 24 inches, accessible from inside the structure.

(2) CRAWL SPACES. Crawl spaces with 18 inches of clearance or more between the crawl space floor and the underside of the house floor joist framing shall be provided with an access opening of at least 14 by 24 inches.

Note: Access to plumbing or electrical systems may be required under chs. Comm 81–86, Plumbing Code or ch. Comm 16, Electrical Code, Volume 2.

History: Cr. Register, November, 1979, No. 287, eff. 6–1–80; am. Register, March, 1992, No. 435, eff. 4–1–92; am. (1), Register, November, 1995, No. 479, eff. 12–1–95.

ILHR 21.08 Firestopping, draftstopping and fire separation. (1) FIRESTOPPING LOCATIONS. Firestopping shall be provided in the following locations:

(a) In concealed spaces of walls and partitions, including furred spaces, at the ceiling and floor levels;

(b) At all interconnections between concealed vertical and horizontal spaces such as occur at soffits, drop ceilings and cove ceilings; and

(c) In concealed spaces between stair stringers at the top and bottom of the run.

(1m) EQUIVALENT FIRESTOPPING REQUIREMENTS FOR ENVELOPE DWELLINGS. Firestopping for envelope–type dwellings shall comply with this subsection.

(a) Vertical walls which form any air passageway shall be lined with gypsum wallboard or other material to provide a 15 minute thermal barrier.

(b) At least 3 smoke detectors shall be placed in the air passageways. A smoke detector shall be placed in the ceiling passageway and in two opposite walls or the smoke detectors shall be placed as far apart as practical. The smoke detectors shall be a hardwired type. The alarm of the detector shall be audible in the occupied areas of the dwelling, when actuated.

Note: Also see s. ILHR 23.08 (10), Air Passageways of Envelope Dwellings.

(2) FIRESTOPPING MATERIALS. Firestopping shall consist of 2–inches nominal lumber or 2 thicknesses of one–inch nominal lumber or one thickness of 23/32–inch plywood with joints backed by 23/32–inch plywood. Oriented strand board, particle board and waferboard may be used in place of plywood. Gypsum wallboard or other noncombustible material may also be used for firestopping. Noncombustible mineral–based insulation may be used where the least dimension of the opening to be firestopped does not exceed 4 inches.

Note: Any nonrigid material used as firestopping, such as batt insulation, must completely fill the opening and be tightly packed to maintain a permanent installation.

(3) DRAFTSTOPPING LOCATIONS. Draftstopping shall be provided in the following locations:

(a) In the attic, mansard, overhang or other concealed roof space above and in line with the tenant separation when tenant separation walls do not extend to the roof sheathing above. Where flat roofs with solid joist construction are used, draftstopping over tenant separation walls is not required; and

(b) At openings around vents, pipes, ducts, chimneys and fireplaces at ceiling and floor levels.

(4) DRAFTSTOPPING MATERIALS. Draftstopping shall not be less than $1/2$–inch gypsum board, $3/8$–inch plywood or other approved noncombustible materials. Noncombustible mineral–based insulation may be used where the least dimension of the opening to be draftstopped does not exceed 4 inches. Metallic firestops shall be used for metal vents and chimneys.

(5) FIRE SEPARATION. Garage space and accessory buildings shall be separated from the dwelling unit in accordance with Table 21.08 and the following requirements:

TABLE 21.08

Perpendicular Distance from Dwelling Wall to the Closest Garage Wall or Accessory Building Wall	Fire–rated Construction
0 to 5 feet	$3/4$–hour
5 to 10 feet with windows in either wall	$3/4$–hour
5 to 10 feet without windows in either wall	No requirements
10 feet or more	No requirements

(a) The garage shall be separated from habitable and nonhabitable areas of the dwelling unit, as well as attics and soffit areas. The vertical separation shall extend from the top of the concrete or masonry foundation to the underside of the roof sheathing or to fire–rated ceiling construction. The fire–rated construction shall conform with Table 21.08.

1. Exception. Gypsum drywall on the garage side may be untaped provided at least $5/8$–inch firecode drywall is used on the garage side and all edges are tightly fitted.

2. Exception. Gypsum drywall on the garage side may be untaped provided at least $1/2$–inch drywall is used on both sides of the wall separating the garage and the dwelling and all edges are tightly fitted.

3. Exception. Two layers of $1/2$–inch drywall on the garage side may be untaped where no drywall is installed on the interior provided all edges are tightly fitted.

(b) Beams, columns and bearing walls that are exposed to the garage and which provide support for separated spaces shall be

protected by one of the methods specified in par. (a) 1. to 3. or other minimum 45–minute fire–resistive rated protection.

(c) The door and frame assembly between the garage and the dwelling unit shall have a minimum fire rating of 20 minutes. A $1^3/_4$–inch solid core wood or insulated metal door may be installed with a pair of $1^1/_2$–inch steel hinges in a 1–inch minimum thick solid wood frame with a $^1/_2$–inch thick door stop.

Note: See s. ILHR 82.34 (4) (b), Uniform Plumbing Code, for floor drain requirements.

(d) Access openings in fire separation walls or ceilings shall maintain the required separation and shall have any drywall edges protected from physical damage. The cover or door of the opening shall be permanently installed with hardware which will maintain it in the closed position when not in use.

(6) LIVING UNIT SEPARATION. (a) *General.* In 2–family dwellings, living units shall be separated from each other, from common use areas, from shared attics, and from exit access corridors.

(b) *Doors.* Any door installed in the living unit separation shall:

1. Have a minimum fire rating of 20 minutes for both the door and the assembly; or

2. Consist of a minimum $1^3/_4$–inch solid core wood or insulated metal door installed with $1^1/_2$–inch steel hinges in a 1–inch thick solid wood frame with a $^1/_2$–inch thick door stop.

(c) *Walls.* Walls in the living unit separation shall be protected by not less than one layer of $^5/_8$–inch Type X gypsum wallboard or equivalent on each side of the wall with tightly fitted joints.

(d) *Floors and ceilings.* A fire protective membrane of one layer of 5/8–inch Type X gypsum wallboard with tightly fitted joints shall be provided on the ceiling beneath the floor construction that provides the separation.

(e) *Wall penetrations.* 1. 'Ducts'. All heating and ventilating ducts which penetrate the required living unit separation shall be protected by a $1^1/_2$–hour rated fire damper. The fire damper may be omitted in the following cases:

a. The duct has a cross sectional area not more than 20 square inches; or

b. There is a minimum of 6 feet of continuous steel ductwork on both sides of the separation.

2. 'Electrical and plumbing components'. Through–penetrations by electrical or plumbing components shall be firmly packed with noncombustible materials or shall be protected with a listed through–penetration firestop system with a rating of at least one hour.

History: Cr. Register, November, 1979, No. 287, eff. 6–1–80; r. and recr. Register, February, 1985, No. 350, eff. 3–1–85; cr. (1m), am. (2), (5) (c) and Table, Register, January, 1989, No. 397, eff. 2–1–89; am. (2), (4) and (5) (a) (intro.), renum. (5) (b) and (c) to be (5) (c) and (d) and am. (5) (d), cr. (5) (b) and (e), (6), Register, March, 1992, No. 435, eff. 4–1–92; r. (3) (a), (5) (d), renum. (3) (b) and (c), (5) (e) to be (3) (a) and (b), (5) (d), am. (5) (a) (intro.), (6), cr. (6) (c) to (e), Register, November, 1995, No. 479, eff. 12–1–95.

ILHR 21.09 Smoke detectors. (1) Listed and labeled smoke detectors shall be installed and maintained in accordance with ss. 101.645 (3) and 101.745 (4), Stats., and the specifications of the manufacturers of the detectors in each dwelling unit the initial construction of which was commenced on or after the effective date of this code, June 1, 1980.

Note: Section 50.035 (2), Stats., requires the installation of a complete low voltage, interconnected or radio–transmitting smoke detection system in all community–based residential facilities including those having 8 or fewer beds.

Note: Section 101.645 (3), Stats., requires the owner of a dwelling to install a functional smoke detector in the basement of the dwelling and on each floor level except the attic or storage area of each dwelling unit. The occupant of such a dwelling unit shall maintain any smoke detector in that unit, except that if any occupant who is not the owner, or any state, county, city, village or town officer, agent or employe charged under statute or municipal ordinance with powers or duties involving inspection of real or personal property, gives written notice to the owner that the smoke detector is not functional the owner shall provide, within 5 days after receipt of that notice, any maintenance necessary to make that smoke detector functional.

Note: Section 101.745 (4), Stats., requires the manufacturer of a manufactured building to install a functional smoke detector in the basement of the dwelling and on each floor level except the attic or storage area of each dwelling unit.

(2) For floor levels containing a sleeping area, the detector shall be installed adjacent to the sleeping area. If a floor level contains 2 or more sleeping areas remote from each other, each sleeping area shall be provided with an adjacent smoke detector.

(3) Smoke detectors required by this section shall be continuously powered by the house electrical service, and shall be interconnected so that activation of one detector will cause activation of all detectors.

(4) For family living units with one or more communicating split levels or open adjacent levels with less than one full story separation between levels, one smoke detector on the upper level shall suffice for an adjacent lower level, including basements. Where there is an intervening door between one level and the adjacent lower level, smoke detectors shall be installed on each level.

History: Cr. Register, November, 1979, No. 287, eff. 6–1–80; r. and recr. Register, February, 1985, No. 350, eff. 3–1–85; r. and recr. Register, April, 1990, No. 412, eff. 5–1–90; renum. to be (1), cr. (2) and (3), Register, March, 1992, No. 435, eff. 4–1–92; renum. (2) and (3) to be (3) and (4), cr. (2), Register, November, 1995, No. 479, eff. 12–1–95.

ILHR 21.10 Protection against decay and termites. (1) GENERAL. Except as provided in sub. (2), wood used in the following locations shall be either pressure treated with preservative or be a naturally durable, decay resistant species of lumber. Wood that is not pressure treated with preservative shall be protected against termites unless naturally termite resistant.

(a) Wood floor joists that span directly above and within 18 inches of earth or wood girders that span directly above and within 12 inches of earth;

(b) Sills and rim joists which are less than 8 inches above exposed earth, and rest on concrete or masonry walls or concrete floors;

(c) Ends of wood girders entering masonry or concrete walls and having clearances of less than $^1/_2$ inch on the tops, sides and ends;

(d) Wood siding having a clearance of less than 6 inches from the earth;

(e) Wood embedded in earth;

(f) Bottom plates of load bearing walls on slab floors of basements and garages; and

(g) Wood columns in direct contact with masonry, concrete or earth unless supported by a structural pedestal or plinth block at least 3 inches above the floor.

(2) EXCEPTION. Wood used in basements as furring or finish material or in nonbearing walls need not comply with this section.

(3) IDENTIFICATION. (a) All pressure–treated wood and plywood shall be identified by a quality mark or certificate of inspection of an approved inspection agency which maintains continued supervision, testing and inspection over the quality of the product in accordance with the adopted standards of the American Wood Preservers Association.

(b) Pressure–treated wood used below grade in foundations shall be labeled to show conformance with AWPA C–22 "Lumber and Plywood for Permanent Wood Foundations – Preservative Treatment by Pressure Processes" and labeled by an inspection agency accredited by the American Lumber Standards Committee.

Note: Heartwood of redwood, cypress, black walnut, catalpa, chestnut, osage orange, red mulberry, white oak, or cedar lumber are considered by the department to be naturally decay–resistant. Heartwood of bald cypress, redwood, and eastern red cedar are considered by the department to be naturally termite resistant.

History: Cr. Register, November, 1979, No. 287, eff. 6–1–80; r. and recr. Register, February, 1985, No. 350, eff. 3–1–85; am. (1) (b) and (3), Register, January, 1989, No. 397, eff. 2–1–89; r. and recr. (1) (intro.) and (b), am. (1) (f), renum. (3) (intro.) to be (3) (a), cr. (3) (b), Register, March, 1992, No. 435, eff. 4–1–92; am. (1) (a), (b), (3), cr. (1) (g), Register, November, 1995, No. 479, eff. 12–1–95.

ILHR 21.11 Foam plastic insulation. Foam plastic insulation shall have a flame–spread rating of not more than 75 and a smoke–developed rating of not more than 450.

Note: The department will accept foam plastic insulation tested in accordance with ASTM E–84.

(1) THERMAL BARRIERS. Foam plastic insulation shall be protected in accordance with this subsection. One half–inch gypsum wallboard, 19/32–inch plywood, oriented strand board, particle board or waferboard, or nominal one–inch tongue and groove or lap–jointed sawn lumber are acceptable as 15–minute thermal barrier materials.

(a) *Walls and ceilings.* Foam plastic insulation may be used within the stud space of a wood frame wall, or on the inside surface of a wall or ceiling if the foam plastic insulation is fully protected by a 15–minute thermal barrier.

(b) *Masonry or concrete components.* Foam plastics may be used within the cavity of a masonry wall, in cores of masonry units, or under a masonry or concrete floor system where the interior of the dwelling is separated from the foam plastic insulation by a minimum one–inch thickness of masonry or concrete or other approved 15–minute thermal barrier materials.

(c) *Roofs.* Roof coverings may be applied over foam plastic insulation where the interior of the dwelling is separated from the foam plastic insulation by plywood sheathing, oriented strand board, particle board or waferboard at least 15/32–inch in thickness, or other approved 15–minute thermal barrier materials.

(d) *Doors.* Foam plastic insulation having a flame–spread rating of 75 or less may be used in doors when the door facing is of metal having a minimum thickness of 0.032–inch aluminum or No. 26 gauge sheet metal. Overhead garage doors using foam plastic insulation do not require a thermal barrier or metal covering.

(2) SPECIFIC APPROVAL. Foam plastic insulation not meeting the requirements of this section may be approved by the department as specified under s. ILHR 20.18. Approval will be based upon diversified tests which evaluate materials or assemblies representative of actual end use applications.

Note: Approved diversified tests may include ASTM E–84 (tunnel test), ASTM E–119 fire test, full–scale corner test, enclosed room corner test and ignition temperature test.

History: Cr. Register, November, 1979, No. 287, eff. 6–1–80; am. (1) (b), Register, January, 1989, No. 397, eff. 2–1–89; r. and recr. (1) (intro.), am. (1) (a), renum. (1) (b) and (c) to be (1) (c) and (d) and am. (1) (c), cr. (1) (b), Register, March, 1992, No. 435, eff. 4–1–92; am. (1) (d), (2), Register, November, 1995, No. 479, eff. 12–1–95.

Subchapter III —Excavations

ILHR 21.12 Grade. The grade shall slope away from the dwelling to provide drainage away from the dwelling.

History: Cr. Register, November, 1979, No. 287, eff. 6–1–80.

ILHR 21.125 Erosion control procedures. (1) PERFORMANCE STANDARDS. (a) *General.* Perimeter erosion control measures shall be placed within 24 hours after beginning the excavating. Erosion control measures shall be placed along downslope areas and along sideslope areas as required to prevent or reduce erosion where erosion during construction will result in a loss of soil to waters of the state, public sewer inlets or off–site. The best management practices as defined in s. ILHR 20.07 (8m) or alternative measures that provide equivalent protection to these practices may be utilized to satisfy the requirements of this section. When the disturbed area is stabilized, the erosion control measures may be removed.

(b) *Stabilization by seeding and mulching.* Slopes greater than or equal to 12%, with a downslope length of 10 feet or more, are not considered stabilized with seeding and mulching unless used in conjunction with a tackifier, netting, or matting. Asphalt emulsion may not be used as a tackifier.

(c) *Tracking.* Sediment tracked by construction equipment from a site onto a public or private paved road or sidewalk shall be minimized by providing a non–tracking access roadway. The access roadway shall be installed as approved on the plot plan, prior to framing above the first floor decking. The sediment cleanup provisions of par. (d) are unaffected by the presence or absence of an access roadway.

Note: It is not the intent of par. (c) to require a gravel access roadway where natural conditions, such as sandy soils or solidly frozen soil, already provide non–tracking access.

(d) *Sediment cleanup.* Off–site sediment deposition occurring as a result of a storm event shall be cleaned up by the end of the next work day following the occurrence. All other off–site sediment deposition occurring as a result of construction activities shall be cleaned up at the end of the work day.

(e) *Public sewer inlet protection.* Downslope, on–site public sewer inlets shall be protected with erosion control procedures.

(f) *Building material waste disposal.* All building material waste shall be properly managed and disposed of to prevent pollutants and debris from being carried off the site by runoff.

Note: For proper disposal of flammable, combustible and hazardous liquids, contact the local fire department.

(2) BEST MANAGEMENT PRACTICES. (a) *General.* Appropriate best management practices, as defined in s. ILHR 20.07 (8m) or specified in chapter 3, Wisconsin Construction Site Best Management Practices Handbook, published by the department of natural resources, may be selected, installed, maintained and remain in place until the site is stabilized to meet the performance standards specified in sub. (1).

Note: The best management practices for slopes is covered under section B. 1, chapter 3, Wisconsin Construction Site Best Management Practices Handbook. For a reprint, see appendix.

(b) *Exceptions and clarification.* All references to a model ordinance and planning considerations within chapter 3, Wisconsin Construction Site Best Management Practices Handbook, are not adopted by the department.

(3) MAINTENANCE OF EROSION CONTROL PROCEDURES. (a) *General.* During the period of construction at a site, all erosion control procedures necessary to meet the performance standards of this section shall be properly implemented, installed and maintained by the building permit applicant or subsequent landowner. If erosion occurs after building construction activities have ceased, some or all of the erosion control procedures shall be maintained until the site has been stabilized.

(b) *Exceptions and clarification.* The maintenance procedures and inspection sequences within chapter 3, Wisconsin Construction Site Best Management Practices Handbook, are not adopted as a part of this code.

Note: The handbook is available from Document Sales, 202 South Thornton Avenue, P.O. Box 7840, Madison, Wisconsin 53707–8480; phone (608) 266–3358.

Note: For examples of acceptable erosion control maintenance procedures, see appendix.

History: Cr. Register, September, 1992, No. 441, eff. 12–1–92; am. (1) (b), Register, November, 1995, No. 479, eff. 12–1–95; **am. (1) (a), renum. (1) (b) to (e) to be (1) (c) to (f) and am. (c), cr. (1) (b), Register, February, 1997, No. 494, eff. 3–1–97.**

ILHR 21.13 Excavations adjacent to adjoining property. (1) NOTICE. Any person making or causing an excavation which may affect the lateral soil support of adjoining property or buildings shall provide at least 30 days written notice to all owners of adjoining buildings of the intention to excavate. The notice shall state that adjoining buildings may require permanent protection.

(a) *Exception.* The 30–day time limit for written notification may be waived if such waiver is signed by the owner(s) of the adjoining properties.

(2) RESPONSIBILITY FOR UNDERPINNING AND FOUNDATION EXTENSIONS. (a) *Excavations less than 12 feet in depth.* If the excavation is made to a depth of 12 feet or less below grade, the person making or causing the excavation shall not be responsible for any necessary underpinning or extension of the foundations of any adjoining buildings.

(b) *Excavations greater than 12 feet in depth.* If the excavation is made to a depth in excess of 12 feet below grade, the owner(s) of adjoining buildings shall be responsible for any necessary underpinning or extension of the foundations of their buildings to

a depth of 12 feet below grade. The person making or causing the excavation shall be responsible for any underpinning or extension of foundations below the depth of 12 feet below grade.

History: Cr. Register, November, 1979, No. 287, eff. 6–1–80.

ILHR 21.14 Excavations for footings and foundations. (1) EXCAVATIONS BELOW FOOTINGS AND FOUNDATIONS. No excavation shall be made below the footing and foundation unless provisions are taken to prevent the collapse of the footing or foundation.

(2) EXCAVATIONS FOR FOOTINGS. All footings shall be located on undisturbed or compacted soil, free of organic material, unless the footings are reinforced to bridge poor soil conditions.

History: Cr. Register, November, 1979, No. 287, eff. 6–1–80.

Subchapter IV —Footings

ILHR 21.15 Footings. The dwelling shall be supported on a structural system designed to transmit and safely distribute the loads to the soil. The loads for determining the footing size shall include the weight of the live load, roof, walls, floors, pier or column, plus the weight of the structural system and the soil over the footing. Footings shall be sized to not exceed the allowable material stresses. The bearing area shall be at least equal to the area required to transfer the loads to the supporting soil without exceeding the bearing values of the soil.

(1) SIZE AND TYPE. Unless designed by structural analysis, unreinforced concrete footings shall comply with the following requirements:

(a) *Continuous footings.* The minimum width of the footing on each side of the foundation wall shall measure at least 4 inches wider than the wall. The footing depth shall be at least 8 inches nominal. Footing placed in unstable soil shall be formed. Lintels may be used in place of continuous footings when there is a change in footing elevation.

Note: Unstable soil includes soils which are unable to support themselves.

(b) *Column or pier footing.* The minimum width and length of column or pier footings shall measure at least 2 feet by 2 feet. The depth shall measure at least 12 inches nominal. The column shall be so placed as to provide equal projections on each side of the column.

(c) *Trench footings.* Footings poured integrally with the wall may be used when soil conditions permit. The minimum width shall be at least 8 inches nominal.

(d) *Chimney and fireplace footings.* Footing for chimneys or fireplaces shall extend at least 4 inches on each side of the chimney or fireplace. The minimum depth shall measure at least 12 inches nominal.

(e) *Floating slabs.* Any dwelling supported on a floating slab on grade shall be designed through structural analysis. Structures supported on floating slabs may not be physically attached to structures that are supported by footings that extend below the frost line unless a control joint is used between the structures.

(f) *Deck footings.* Decks attached to dwellings and detached decks which serve an exit shall be supported on a structural system designed to transmit and safely distribute the loads to the soil. Footings shall be sized to not exceed the allowable material stresses. The bearing area shall be at least equal to the area required to transfer the loads to the supporting soil without exceeding the bearing values of the soil.

(2) SOIL–BEARING CAPACITY. No footing or foundation shall be placed on soil with a bearing capacity of less than 2,000 pounds per square foot unless the footing or foundation has been designed through structural analysis. The soil–bearing values of common soils may be determined through soil identification.

Note: The department will accept the soil–bearing values for the types of soil listed in the following table:

Type of soil	PSF
1. Wet, soft clay; very loose silt; silty clay	2,000
2. Loose, fine sand; medium clay; loose sandy clay soils	2,000
3. Stiff clay; firm inorganic silt	3,000
4. Medium (firm) sand; loose sandy gravel; firm sandy clay soils; hard dry clay	4,000
5. Dense sand and gravel; very compact mixture of clay, sand and gravel	6,000
6. Rock	12,000

(a) *Minimum soil–bearing values.* If the soil located directly under a footing or foundation overlies a layer of soil having a smaller allowable bearing value, the smaller soil–bearing value shall be used.

(b) *Unprepared fill material, organic material.* No footing or foundation shall be placed upon unprepared fill material, organic soil, alluvial soil or mud unless the load will be supported. When requested, soil data shall be provided.

Note: The decomposition of organic material in landfill sites established for the disposal of organic wastes may produce odorous, toxic and explosive concentrations of gas which may seep into buildings through storm sewers and similar underground utilities unless provisions are taken to release the gases to the atmosphere.

History: Cr. Register, November, 1979, No. 287, eff. 6–1–80; am. (1) (a), Register, January, 1989, No. 397, eff. 2–1–89; cr. (1) (f), Register, March, 1992, No. 435, eff. 4–1–92; am. (1) (e), Register, November, 1995, No. 479, eff. 12–1–95.

ILHR 21.16 Frost penetration. (1) GENERAL. Footings and foundations, including those for ramps and stoops, shall be placed below the frost penetration level, but in no case less than 48 inches below grade measured adjacent to the footing or foundation. Footings shall not be placed over frozen material.

(2) EXCEPTIONS. (a) Floating slabs constructed on grade need not be installed below the minimum frost penetration line provided measures have been taken to prevent frost forces from damaging the structure.

(b) Grade beams need not be installed to the minimum frost penetration line provided measures are taken to prevent frost forces from damaging the structure.

(c) Stoops or ramps need not be installed below the minimum frost penetration level provided measures are taken to prevent frost forces from damaging the structure.

(d) Footings or foundations may bear directly on rock located less than 48 inches below grade. Prior to placement, the rock shall be cleaned of all earth. All clay in the crevices of the rock shall be removed to the level of frost penetration or $1\text{–}1/2$ times the width of the rock crevice. Provisions shall be taken at grade to prevent rain water from collecting along the foundation wall of the building.

(e) Portions of footings or foundations which are located directly below window areaways which are required to be installed in accordance with s. ILHR 21.03 (6m), are exempt from the requirements of sub. (1).

History: Cr. Register, November, 1979, No. 287, eff. 6–1–80; am. (intro.), Register, February, 1985, No. 350, eff. 3–1–85; renum. (intro.) and (1) to be (1) and (2) and am. (2) (d), cr. (2) (e), Register, January, 1989, No. 397, eff. 2–1–89; am. (1), Register, November, 1995, No. 479, eff. 12–1–95.

ILHR 21.17 Drain tiles. (1) WHERE REQUIRED. Drain tiles or pipe shall be provided around footings located in soils where ground water levels occur above the elevation of the footing.

(a) *Municipalities exercising jurisdiction.* Municipalities exercising jurisdiction under chs. ILHR 20 to 25 may determine the soil types, natural and seasonal groundwater levels for which drain tile is required.

(b) *All other areas.* Drain tiles shall be required whenever a soil test shows evidence of periodic or seasonal saturation at any depth less than 72 inches. When the on–site evaluation shows no evidence of saturation, drain tiles need not be installed. Under all other conditions, drain tiles shall be installed on each side of foundation walls at the footing level.

(2) MATERIALS AND INSTALLATION REQUIREMENTS. (a) Drain tiles or pipes used for foundation drainage shall be at least 3 inches inside diameter.

(b) Where individual tiles are used, they shall be laid with $^1/_8$–inch open joints. Joints between the tiles shall be covered with a strip of sheathing paper or asphalt or tar saturated felt.

(c) The tile or pipe shall be placed upon at least 2 inches of washed rock and shall be covered with at least 12 inches of washed rock which meets the following criteria:

1. 90–100% of the rock must pass a $^3/_4$–inch sieve; and

2. 20–25% of the rock must pass a $^3/_8$–inch sieve.

(d) The basement slab shall be placed on at least 4 inches of gravel.

(e) Bleeder tiles shall be provided to connect the exterior footing drain tile to the interior footing tile and shall be placed in the footing such that the tiles are spaced at 8 foot intervals.

(f) The drain tiles or pipe which lead from the footing tiles to the sump pit shall be laid at a grade of not less than $^1/_8$ inch per foot leading to the sump pit. The remaining drain tiles or pipe shall be level or graded downward to the line which leads to the sump.

(3) DRAIN TILE DISCHARGE. Drain tiles shall be connected to a sump pit. The sump shall discharge to natural grade or be equipped with a pump to discharge water away from the dwelling via surface drainage channels.

(a) *Sumps.* 1. Construction and installation. The sump shall have a rim extending at least one inch above the floor immediately adjacent to the sump, except where the sump is installed in an exterior meter pit. The sump shall have a removable cover of sufficient strength for anticipated loads. The sump shall have a solid bottom.

2. Location. All sumps installed for the purpose of receiving clear water, basement or foundation drainage water shall be located at least 15 feet from any water well.

3. Size. The size of each clear water sump shall be as recommended by the sump pump manufacturer, but may not be smaller than 16 inches in diameter at the top, 14 inches in diameter at the bottom and 22 inches in depth.

(b) *Sump pump systems.* 1. Pump size. The pump shall have a capacity appropriate for anticipated use.

2. Discharge piping. Where a sump discharges into a storm building drain or sewer, a free flow check valve shall be installed.

(4) SUMP DISCHARGE DISPOSAL. (a) *Storm sewer.* Storm water, surface water, groundwater and clear water wastes shall be discharged to a storm sewer system or a combined sanitary–storm sewer system where available. Combined public sanitary–storm sewer systems shall be approved by the department of natural resources. Combined private sanitary–storm sewer systems shall be approved by the department.

(b) *Other disposal methods.* 1. Where no storm sewer system or combined sanitary–storm sewer system is available or adequate to receive the anticipated load, the storm water, surface water, groundwater and clear water wastes shall be discharged in accordance with local governmental requirements.

2. Where approved by the local governmental authority, storm water, surface water, groundwater and clear water wastes of the properties of one– and 2–family dwellings may be discharged onto flat areas, such as streets or lawns, so long as the water flows away from the buildings and does not create a nuisance.

(c) *Segregation of wastes.* 1. a. Except as provided in subd. 3., where a sanitary sewer system and a storm sewer system are available, the drain piping for storm water or clear water wastes may not connect to any part of the sanitary drain system.

b. Where a combined sanitary–storm sewer system is available, storm water wastes, clear water wastes and sanitary wastes may not be combined until discharging to the building sewer.

2. Storm water wastes and clear water wastes may not be combined until discharging into the storm building drain.

3. a. The clear water wastes from a drinking fountain, water heater relief valve, storage tank relief valve or water softener shall be discharged to either a sanitary drain system or a storm drain system.

b. The clear water wastes from equipment other than those listed in subd. 3. a. may be discharged to a sanitary drain system if not more than 20 gallons of clear water wastes per day per building are discharged.

Note: Subsections (3) (a) and (4) are excerpts from the state uniform plumbing code, s. Comm 82.36.

(5) OTHER SYSTEMS. Other equivalent engineered foundation drainage systems may be submitted to the department for review and approval.

History: Cr. Register, November, 1979, No. 287, eff. 6–1–80; r. and recr. Register, February, 1985, No. 350, eff. 3–1–85; r. and recr. (3) (a) 3. and (4), Register, May, 1988, No. 389, eff. 6–1–88; am. (2) (f), Register, January, 1989, No. 397, eff. 2–1–89; r. and recr, (4) (c) 3., Register, August, 1991, No. 428, eff. 9–1–91; cr. (5), Register, March, 1992, No. 435, eff. 4–1–92.

Subchapter V —Foundations

ILHR 21.18 Foundations. (1) GENERAL. (a) *Design.* Foundation walls shall be designed and constructed to support the vertical loads of the dwelling, lateral soil pressure, and other loads without exceeding the allowable stresses of the materials of which the foundations are constructed.

(b) *Lateral support.* 1. Lateral support such as floor slabs or framing shall be provided at the base of foundation walls.

2. Lateral support shall be provided at the top of foundation walls by one of the following:

a. Ledger blocks at the perimeter of the floor consisting of 2 by 4 inch nominal lumber attached with two 16 penny nails at each joist.

b. System design through structural analysis.

c. Structural steel anchor bolts, a minimum of 1/2 inch in diameter, embedded at least 7 inches into concrete or grouted masonry. The bolts shall be located within 18 inches of wall corners and shall have a maximum spacing of 72 inches.

d. Mechanical fasteners used in accordance with the manufacturer's instructions.

(2) CONCRETE FOUNDATION WALLS. Unless designed through structural analysis, the minimum thickness of concrete foundation walls shall be determined from Table 21.18–A, but in no case shall the thickness be less than the thickness of the wall it supports.

TABLE 21.18–A
CONCRETE WALL THICKNESSES

Type of Concrete	Nominal Thickness (inches)	Maximum Height of Unbalanced Fill[1] for Material of Wall Being Supported (Wood frame – feet)
3000 psi Unreinforced concrete	8	8
	10	9
	12[2]	10
	14	11.5

[1]Unbalanced fill is the difference in elevation between the outside grade and the basement floor.

[2]The maximum height of unbalanced fill for a 12–inch thick plain concrete wall may be increased to 12 feet provided the wall is constructed of concrete with a minimum compressive value of 6,000 psi at 28 days.

(3) MASONRY FOUNDATION WALLS. Unless designed through structural analysis, the masonry foundation walls shall be constructed in accordance with the following requirements:

(a) *Unreinforced masonry wall; thickness.* The minimum thickness of unreinforced masonry foundation walls shall be

determined by Table 21.18–B, but in no case shall the thickness be less than the thickness of the wall it supports.

(b) *Reinforced masonry wall; thickness.* Reinforced masonry walls shall be reinforced in accordance with the requirements of Tables 21.18–C or 21.18–D. In partially reinforced masonry walls, vertical reinforcement shall be provided on each side of any opening and at intervals indicated in Table 21.18–D.

(c) *Wall design.* The depth below grade, wall height, and pilaster or reinforcement spacing may exceed the maximum values indicated in Tables 21.18–B, –C or –D if the design is based on engineering analysis.

(d) *Subsurface drainage.* Subsurface drainage shall be provided if required by s. ILHR 21.17.

TABLE 21.18–B

MAXIMUM DEPTH BELOW GRADE* (HEIGHT OF FILL) AND THICKNESSES FOR VARIOUS CONCRETE MASONRY FOUNDATION WALLS WITHOUT PILASTERS

Wall Construction Nominal Thickness, In., and Type of Unit	Maximum Depth Below Grade, feet, when Walls Support: Frame Construction	Masonry, or Masonry Veneer Construction
Hollow Load–Bearing:		
8″	5′ (6′)	6′
10″	6′ (7′)	7′
12″	7′	7′
Solid Load–Bearing:		
8″	5′ (7′)	7′
10″	6′ (7′)	7′
12″	7′	7′

*In well drained sand and gravel soils, the height of the unbalanced fill may be increased to the values shown in parentheses.

TABLE 21.18–C

MAXIMUM DEPTH BELOW GRADE (HEIGHT OF FILL) FOR CONCRETE MASONRY FOUNDATION WALLS WITH PILASTERS

Nominal Wall Thickness (inches)	Type of Masonry (Load Bearing)	Type of Fill[1]	Minimum Nominal Pilaster[2] width × depth (inches)	Maximum Pilaster Spacing o.c. (feet)	Maximum Height of Fill[3] (feet)	Maximum Wall Height[4] (feet)
8	Hollow	Granular	16 × 12	20	6.5	7.5
8	Hollow	Other	16 × 12	10	6.0	7.5
8	Solid	Granular	16 × 12	20	7.0	7.5
8	Solid	Other	16 × 12	12	6.5	7.5
10	Hollow	Granular	16 × 14	18	8.0	8.0
10	Hollow	Other	16 × 14	15	7.0	8.0
10	Solid	Granular	16 × 14	30	8.0	8.0
10	Solid	Other	16 × 14	22	7.0	8.0
12	Hollow	Granular	16 × 16	30	8.0	8.0
12	Hollow	Other	16 × 16	20	8.0	8.0
12	Solid	Granular	16 × 16	30	8.0	8.0
12	Solid	Other	16 × 16	30	8.0	8.0

[1]Granular fill is sand, sand and gravel or washed gravel. See "Other" for all other fill types or soils which are not well drained.

[2]All cells of hollow units used to construct pilasters shall be filled with grout.

[3]The height of fill equals the vertical distance between the finished exterior grade and the basement floor or inside grade.

[4]The wall height equals the clear height between floors providing lateral support.

TABLE 21.18–D

MAXIMUM DEPTH BELOW GRADE FOR PARTIALLY REINFORCED MASONRY WALLS

Wall Construction Nominal Thickness and Type of Unit	Total Maximum Wall Height[1] (feet – inches)	Minimum Reinforcement Size and Maximum Spacing Center to Center	Maximum Depth Below Grade[2] (feet – inches) for Fill Type[3]	
			Granular	Other
8–inch Hollow	8–4	#5 bars @ 8 ft.	6–6	5–6
Load Bearing	8–4	#6 bars @ 8 ft.	7–6	6–6
	8–4	#7 bars @ 8 ft.	8–0	7–0
	8–4	#8 bars @ 8 ft.	8–4	7–6
10–inch Hollow	8–4	#5 bars @ 8 ft.	7–0	6–6
Load Bearing	8–4	#6 bars @ 8 ft.	7–6	7–0
	8–4	#7 bars @ 8 ft.	8–0	7–6
	8–4	#8 bars @ 8 ft.	8–4	8–0
12–inch Hollow	8–4	#4 bars @ 8 ft.	6–6	6–0
Load Bearing	8–4	#5 bars @ 8 ft.	7–6	6–6
	8–4	#6 bars @ 8 ft.	8–0	7–6
	8–4	#7 bars @ 8 ft.	8–4	8–0

[1]The height of the wall equals the clear height between floors providing lateral support.

[2]Depth below grade equals the vertical distance between the finished exterior grade and the basement floor or inside grade.

[3]Granular fill is sand, sand and gravel or washed gravel. See "Other" for all other fill types or soils which are not well drained.

(e) *Dampproofing.* 1. Masonry foundation walls of basements shall be dampproofed by applying to the exterior surfaces a continuous coating, from footing to finished grade, of one of the following:

a. Portland cement and sand coat mortar, at least $^3/_8$–inch thick;

b. Type M mortar, at least $^3/_8$–inch thick;

c. Structural surface bonding material, at least $^1/_4$–inch thick;

d. Equivalent dampproofing material, applied in accordance with the manufacturer's instructions and acceptable to the department.

(4) WOOD FOUNDATIONS. Wood foundations shall be designed and constructed in accordance with "The Permanent Wood Foundation System, Basic Requirements, Technical Report No. 7", as adopted under s. ILHR 20.24 (2) (b) and the following exception. The thickness of the foundation wall shall be no less than the thickness of the wall it supports.

(a) *Exception.* Section 3.3.1. *Fasteners.* Fasteners shall be of silicon bronze, copper or stainless steel types 304 or 316.

Note: Additional explanatory information regarding wood foundations can be obtained in "All–Weather Wood Foundation Systems, Design, Fabrication, Installation Manual", published by the American Forest & Paper Association.

(b) *Materials.* All lumber and plywood shall be pressure treated with preservative and labeled to show conformance with AWPA C–22 as adopted under s. ILHR 20.24 (6).

History: Cr. Register, November, 1979, No. 287, eff. 6–1–80; am. (3) (intro), Register, February, 1985, No. 350, eff. 3–1–85; cr. (2) (c) to (e), r. and recr. Tables C and D, r. (3) (a) 2., renum. (3) (a) 1. to be (a), Register, January, 1989, No. 397, eff. 2–1–89; am. (intro.), (2) (b), (3) (b) and Table 21.18–D, cr. Table 21.18, r. (2) (c), renum. (2) (d) and (e) to be (2) (c) and (d), Register, March, 1992, No. 435, eff. 4–1–92; renum. (1) to (3) to be (2) to (4), and am. (3) (b), (4) (intro.) and (b), Table 21.18–A, r. (intro.) and Table 21.18, cr. (1), (3) (e), Register, November, 1995, No. 479, eff. 12–1–95.

Subchapter VI —Floors

ILHR 21.19 Floor design. Floors shall support all dead loads plus the minimum unit live loads as set forth in s. ILHR 21.02. The live loads shall be applied to act vertically and uniformly to each square foot of horizontal floor area. Basements shall be provided with wood or concrete or similar type floors that comply with s. ILHR 21.20 or 21.205.

History: Cr. Register, November, 1979, No. 287, eff. 6–1–80; r. and recr., Register, March, 1992, No. 435, eff. 4–1–92.

ILHR 21.20 Concrete floors. When concrete floors are provided, the thickness of the concrete shall measure at least 3 inches. In clay soils, a 4–inch thick base course shall be placed in the subgrade consisting of clean graded sand, gravel or crushed stone. The base course may be omitted in sand and gravel soils.

History: Cr. Register, November, 1979, No. 287, eff. 6–1–80; am. Register, January, 1989, No. 397, eff. 2–1–89.

ILHR 21.203 Garage floors. (1) MATERIALS. Garage floors shall be constructed of concrete or other noncombustible materials which are impermeable to petroleum products. Slab–on–grade concrete garage floors shall be at least 4 inches thick and placed over at least 4 inches of granular fill.

Note: It is not the intent of sub. (1) to require a concrete floor to be sealed to make it completely impermeable.

(2) CONFIGURATION. The floor shall slope toward the main exterior garage opening or toward an interior drain.

Note: See s. Comm 82.34 (4) (b) for floor drain requirements.

History: Cr. Register, November, 1995, No. 479, eff. 12–1–95.

ILHR 21.205 Wood floors in contact with ground. Wood may be used for floors in contact with ground unless prohibited by ordinance by the municipality exercising jurisdiction in accordance with s. ILHR 20.20. The floor shall conform to the standards specified in s. ILHR 20.24 (4).

History: Cr. Register, January, 1989, No. 397, eff. 2–1–89.

ILHR 21.21 Precast concrete floors. Precast concrete floors shall be designed through structural analysis, or load tables furnished by the precast product fabricator may be used, provided the load tables were developed using structural analysis or load testing.

History: Cr. Register, November, 1979, No. 287, eff. 6–1–80; r. and recr. Register, March, 1992, No. 435, eff. 4–1–92.

ILHR 21.22 Wood frame floors. Unless designed through structural analysis, wood frame floors shall comply with the following requirements:

(1) FLOOR JOISTS. Wood floor joists shall comply with the requirements of s. ILHR 21.02 (3) (a). The minimum live loads shall be determined from s. ILHR 21.02. Where sill plates are provided, the sill plates shall be fastened to the foundation. Double floor joists shall be provided underneath all bearing walls which are parallel to the floor joists.

(1m) FLOOR JOISTS RESTING ON MASONRY WALLS. On masonry walls the floor joists shall rest upon a mortar filled core concrete block or a solid top concrete block or a sill plate. The dimensions of the sill plate shall not be less then 2 inches by 6 inches. The mortar used shall be determined as in s. ILHR 21.26 (3).

(2) FLOOR TRUSSES. Metal plate connected wood floor trusses shall be designed in accordance with the Design Specifications for Metal Plate Connected Parallel Chord Wood Trusses and the National Design Specification for Wood Construction. Truss members shall not be cut, bored or notched.

(3) GIRDERS AND BEAMS. Girders and beams shall be selected from Table 21.22–A1 or Table 21.22–A2 or shall be designed through structural analysis.

(a) Wood girders and beams shall be fitted at the post or column. Adjoining ends shall be fastened to each other to transfer horizontal loads across the joint. Beams shall also be fastened to the posts with framing anchors, angle clips, or equivalent.

(b) Where intermediate beams are used, they shall rest on top of the girders; or shall be supported by ledgers or blocks fastened to the sides of the girders; or they may be supported by approved metal hangers into which the ends of the beams shall be fitted.

(4) BEARING. The minimum bearing for wood joists shall be at least $1^1/_2$–inches on wood or metal and at least 3 inches on masonry or concrete. Wood beams and girders shall have at least 3 inches of bearing. Floor joists framing over beams from opposite sides shall either lap at least 3 inches and be securely fastened together, or when framed end–to–end, the joists shall be provided with blocking or shall be securely fastened together by ties, straps or plates. Tail ends of floor joists shall not go beyond the beam by more than 8 inches.

(5) NOTCHING AND BORING. Notching and boring of beams or girders is prohibited unless determined through structural analysis.

(a) *Notching of floor joists.* 1. Notches located in the top or bottom of floor joists shall not have a depth exceeding $^1/_6$ the depth of the joist, shall not have a length exceeding $^1/_3$ the joist depth nor be located in the middle $^1/_3$ of the span of the joist.

2. Where floor joists are notched on the ends, the notch shall not exceed $^1/_4$ the depth of the joist. Notches over supports may extend the full bearing width of the support.

(b) *Boring of floor joists.* Holes bored in floor joists shall be located no closer than 2 inches to the top or bottom edges of the joist. The diameter of the hole shall not exceed $^1/_3$ the depth of the joist. Where the joist is notched, the hole shall not be closer then 2 inches to the notch.

(c) *Engineered wood products.* Notching or boring of engineered wood products shall be done in accordance with the manufacturer's instructions provided those instructions were developed through structural analysis or product testing.

(6) OVERHANG OF FLOORS. (a) Unless designed through structural analysis under s. ILHR 21.02, floor joists which are at right angles to the supporting wall shall not be cantilevered more than 2 feet over the supporting wall, and shall support only the wall and roof above it.

(b) Where overhanging floor joists are perpendicular to the main joists, a double floor joist may be used to support lookout joists extending not more than 2 feet over the wall line below. The double joist shall be located a distance of twice the overhang from the lower wall. The lookout joists shall be fastened to the double joists with metal hangers. Lookout joists that extend more than 2 feet over the wall line below shall be designed through structural analysis under s. ILHR 21.02.

(7) FLOOR OPENINGS. Trimmers and headers shall be doubled when the span of the header exceeds 4 feet. Headers which span more than 6 feet shall have the ends supported by joist hangers or framing anchors, unless the ends are supported on a partition or beam. Tail joists (joists which frame into headers) more than 8 feet long shall be supported on metal framing anchors or on ledger strips of at least 2 inches by 2 inches nominal.

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