

INTERIOR ENVIRONMENT

Chapter 12 deals with quality of interior environment beyond considerations of structural safety, fire resistance and egress. These issues include air quality, natural and artificial lighting, sound transmission, temperature control, sizes of occupied spaces, access to unoccupied spaces and durability of materials.

Ventilation

- *Attic spaces* - ventilation opening of not less than 1/300 of the total area, protected from intrusion by vermin
- *Under-floor spaces* - ventilation opening of not less than 1/150 of the total area, protected from intrusion by vermin
- *Natural ventilation* – occupied spaces shall be ventilated through access to outdoors with openable area not less than 4 % of total floor area; if occupied spaces are ventilated through adjoining spaces the openings to these spaces shall be 8% of total floor area, but not less than 25 sq.ft.

Temperature Control

Interior spaces intended for human occupancy shall be provided with active or passive space-heating systems capable of maintaining a minimum indoor temperature of 68°F at a point 3 feet above the floor on the design heating day.

Lighting

Every space meant for human occupancy shall be provided by either natural light or artificial light, per this section.

- *Natural light* - minimum net glazed area shall not be less than 8 percent of the floor area of the room served and openings shall open directly into public way, yard or court; adjoining room shall be considered part of space of naturally lit space if one-half of the area of the common wall is open and unobstructed and provides an opening of not less than one-tenth of the floor area of the interior room or 25 square feet
- *Artificial light* - Artificial light shall be provided that is adequate to provide an average illumination of 10 foot-candles (107 lux) over the area of the room at a height of 30 inches above the floor level, at 1 foot-candle (11 lux) at residential stairs (for other stair conditions see Chapter 10)
- *Yards* – shall be not be less than 3 feet in width for buildings two stories or less above grade plane; for buildings more than two stories above grade plane, the minimum width of the yard shall be increased at the rate of 1 foot for each additional story; for buildings exceeding 14 stories above grade plane, the required width of the yard shall be computed on the basis of 14 stories above grade plane
- *Courts* - shall not be less than 3 feet in width; courts having windows opening on opposite sides shall not be less than 6 feet in width; courts shall not be less than 10 feet in length unless bounded on one end by a public way or yard. For buildings more than two stories above grade plane, the court shall be increased 1 foot in width and 2 feet in

length for each additional story; for buildings exceeding 14 stories above grade plane, the required dimensions shall be computed on the basis of 14 stories above grade plane

Sound Transmission

Wall and floor-ceiling assemblies separating dwelling units or guest rooms from each other and from public or service areas such as interior corridors, garages and mechanical spaces shall provide airborne sound insulation for walls, and both airborne and impact sound insulation for floor-ceiling assemblies.

- *Airborne Sound Transmission* - all acoustically rated separating wall and floor-ceiling assemblies shall provide airborne sound insulation equal to that required to meet a sound transmission class (STC) rating of 50 based on laboratory tests as defined in ASTM E 90 and E 413.

- *Impact Sound Transmission* - all acoustically rated separating floor-ceiling assemblies shall provide impact sound insulation equal to that required to meet a IIC rating of 50 based on laboratory tests as defined in ASTM E 492 and E 989

- *Exterior Sound Transmission* – interior noise levels attributable to exterior sources shall not exceed 45 db in any habitable room

Interior Space Dimensions

- *Minimum room widths* - Habitable spaces, other than a kitchen, shall not be less than 7 feet in any plan dimension. Kitchens shall have a clear passageway of not less than 3 feet between counter fronts and appliances or counter fronts and walls.

- *Minimum ceiling heights* - Occupiable spaces, habitable spaces and corridors shall have a ceiling height of not less than 7 feet 6 inches. Bathrooms, toilet rooms, kitchens, storage rooms and laundry rooms shall be permitted to have a ceiling height of not less than 7 feet.

- *Room area* - Every dwelling unit shall have at least one room that shall have not less than 120 square feet of net floor area. Other habitable rooms shall have a net floor area of not less than 70 square feet. Every kitchen in a one- and two-family dwelling shall have not less than 50 square feet of gross floor area.

Access to Unoccupied Spaces

- *Crawl spaces* - shall be provided with a minimum of one access opening not less than 18 inches by 24 inches

- *Attic spaces* - an opening not less than 20 inches by 30 inches shall be provided to any attic area having a clear height of over 30 inches

Surrounding Materials

- *Floors and wall base finish materials* - in other than dwelling units, toilet, bathing and shower room floor finish materials shall have a smooth, hard, nonabsorbent surface and minimum 4" vertical base

- *Walls and partitions* - within 2 feet of urinals and water closets shall have a smooth, hard, nonabsorbent surface, to a height of 4 feet above the floor

SECTION 1201 GENERAL

1201.1 Scope. The provisions of this chapter shall govern ventilation, temperature control, lighting, *yards* and *courts*, sound transmission, room dimensions, surrounding materials and rodent proofing associated with the interior spaces of buildings.

SECTION 1202 DEFINITIONS

1202.1 General. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

THERMAL ISOLATION. A separation of conditioned spaces, between a sunroom addition and a *dwelling unit*, consisting of existing or new wall(s), doors and/or windows.

SECTION 1203 VENTILATION

1203.2 Attic spaces. Enclosed *attics* and enclosed rafter spaces formed where ceilings are applied directly to the underside of roof framing members shall have cross ventilation for each separate space by ventilating openings protected against the entrance of rain and snow. Blocking and bridging shall be arranged so as not to interfere with the movement of air. A minimum of 1 inch (25 mm) of airspace shall be provided between the insulation and the roof sheathing. The net free ventilating area shall not be less than $\frac{1}{300}$ of the area of the space ventilated, with 50 percent of the required ventilating area provided by ventilators located in the upper portion of the space to be ventilated at least 3 feet (914 mm) above eave or cornice vents with the balance of the required ventilation provided by eave or cornice vents.

1203.2.1 Openings into attic. Exterior openings into the *attic* space of any building intended for human occupancy shall be protected to prevent the entry of birds, squirrels, rodents, snakes and other similar creatures. Openings for ventilation having a least dimension of $\frac{1}{16}$ inch (1.6 mm) minimum and $\frac{1}{4}$ inch (6.4 mm) maximum shall be permitted. Openings for ventilation having a least dimension larger than $\frac{1}{4}$ inch (6.4 mm) shall be provided with corrosion-resistant wire cloth screening, hardware cloth, perforated vinyl or similar material with openings having a least dimension of $\frac{1}{16}$ inch (1.6 mm) minimum and $\frac{1}{4}$ inch (6.4 mm) maximum. Where combustion air is obtained from an *attic* area, it shall be in accordance with Chapter 7 of the *California Mechanical Code*.

1203.3 Under-floor ventilation. The space between the bottom of the floor joists and the earth under any building except spaces occupied by basements or cellars shall be provided with ventilation openings through foundation walls or *exterior walls*. Such openings shall be placed so as to provide cross ventilation of the under-floor space.

1203.3.1 Openings for under-floor ventilation. The minimum net area of ventilation openings shall not be less than 1 square foot for each 150 square feet (0.67 m² for each 100 m²) of crawl-space area. Ventilation openings shall be covered for their height and width with any of the following materials, provided that the least dimension of the covering shall not exceed $\frac{1}{4}$ inch (6 mm):

1. Perforated sheet metal plates not less than 0.070 inch (1.8 mm) thick.
2. Expanded sheet metal plates not less than 0.047 inch (1.2 mm) thick.
3. Cast-iron grilles or gratings.
4. Extruded load-bearing vents.
5. Hardware cloth of 0.035 inch (0.89 mm) wire or heavier.
6. Corrosion-resistant wire mesh, with the least dimension not exceeding $\frac{1}{8}$ inch (3.2 mm).

1203.4 Natural ventilation. Natural ventilation of an occupied space shall be through windows, doors, louvers or other openings to the outdoors. The operating mechanism for such openings shall be provided with ready access so that the openings are readily controllable by the building occupants.

1203.4.1 Ventilation area required. The minimum openable area to the outdoors shall be 4 percent of the floor area being ventilated.

1203.4.1.1 Adjoining spaces. Where rooms and spaces without openings to the outdoors are ventilated through an adjoining room, the opening to the adjoining room shall be unobstructed and shall have an area of not less than 8 percent of the floor area of the interior room or space, but not less than 25 square feet (2.3 m²). The minimum openable area to the outdoors shall be based on the total floor area being ventilated.

Exception: Exterior openings required for ventilation shall be permitted to open into a *thermally isolated* sunroom addition or patio cover provided that the openable area between the sunroom addition or patio cover and the interior room shall have an area of not less than 8 percent of the floor area of the interior room or space, but not less than 20 square feet (1.86 m²). The minimum openable area to the outdoors shall be based on the total floor area being ventilated.

1203.4.1.2 Openings below grade. Where openings below grade provide required natural ventilation, the outside horizontal clear space measured perpendicular to the opening shall be one and one-half times the depth of the opening. The depth of the opening shall be measured from the average adjoining ground level to the bottom of the opening.

1203.4.2 Contaminants exhausted. Contaminant sources in naturally ventilated spaces shall be removed in accordance with the *California Mechanical Code* and the *California Fire Code*.

1203.4.2.1 Bathrooms. Rooms containing bathtubs, showers, spas and similar bathing fixtures shall be mechanically ventilated in accordance with the *California Mechanical Code*. The minimum ventilation or exhaust rate shall not be less than that established by Table 4-4 "Minimum Exhaust Rates." See *California Mechanical Code* for additional provisions related to environmental air ducts.

1203.4.3 Openings on yards or courts. Where natural ventilation is to be provided by openings onto yards or courts, such yards or courts shall comply with [Section 1206](#).

1203.5 Other ventilation and exhaust systems. Ventilation and exhaust systems for occupancies and operations involving flammable or combustible hazards or other

contaminant sources as covered in the *California Mechanical Code* or the *California Fire Code* shall be provided as required by both codes.

SECTION 1204 TEMPERATURE CONTROL

1204.1 Equipment and systems. Interior spaces intended for human occupancy shall be provided with active or passive space-heating systems capable of maintaining a minimum indoor temperature of 68°F (20°C) at a point 3 feet (914 mm) above the floor on the design heating day.

Exceptions:

1. Interior spaces where the primary purpose is not associated with human comfort.

SECTION 1205 LIGHTING

1205.1 General. Every space intended for human occupancy shall be provided with natural light by means of exterior glazed openings in accordance with [Section 1205.2](#) or shall be provided with artificial light in accordance with [Section 1205.3](#). Exterior glazed openings shall open directly onto a *public way* or onto a *yard* or *court* in accordance with [Section 1206](#).

1205.2 Natural light. The minimum net glazed area shall not be less than 8 percent of the floor area of the room served.

1205.2.1 Adjoining spaces. For the purpose of natural lighting, any room is permitted to be considered as a portion of an adjoining room where one-half of the area of the common wall is open and unobstructed and provides an opening of not less than one-tenth of the floor area of the interior room or 25 square feet (2.32 m²), whichever is greater.

1205.2.2 Exterior openings. Exterior openings required by [Section 1205.2](#) for natural light shall open directly onto a *public way*, *yard* or *court*, as set forth in [Section 1206](#).

Exceptions:

1. Required exterior openings are permitted to open into a roofed porch where the porch:
 - 1.1. Abuts a *public way*, *yard* or *court*;
 - 1.2. Has a ceiling height of not less than 7 feet (2134 mm); and
 - 1.3. Has a longer side at least 65 percent open and unobstructed.
2. Skylights are not required to open directly onto a *public way*, *yard* or *court*.

1205.3 Artificial light. Artificial light shall be provided that is adequate to provide an average illumination of 10 foot-candles (107 lux) over the area of the room at a height of 30 inches (762 mm) above the floor level.

1205.4 Stairway illumination. *Stairways within dwelling units and exterior stairways serving a dwelling unit shall have an illumination level on tread runs of not less than 1 foot-candle (11 lux). Stairs in other occupancies shall be governed by [Chapter 10](#).*

1205.6 Campus lighting for parking facilities and primary walkways at California state universities, colleges and community colleges. *Artificial light shall be provided for parking facilities and primary walkways at California State Universities, colleges, and community colleges in accordance with provisions of this subsection. This subsection shall not apply to the University of California unless the Regents of the University of California, by resolution, make it applicable.*

1205.6.1 Lighting requirements. *Based on the recommendations of the most current edition of the Illumination Engineering Society lighting handbook, the following lighting standards shall be used for all new construction of open parking facilities, covered parking facilities and primary walkways:*

1. Open and covered parking facilities.

1.1 Medium-level activity usage when medium usage is present.

1.2 High-level activity usage when high usage is present.

2. Primary campus walkways.

2.1 Medium-level activity usage when medium usage is present.

2.2 High-level activity usage when high usage is present.

SECTION 1206 YARDS OR COURTS

1206.1 General. This section shall apply to *yards* and *courts* adjacent to exterior openings that provide natural light or ventilation. Such *yards* and *courts* shall be on the same property as the building.

1206.2 Yards. *Yards* shall not be less than 3 feet (914 mm) in width for buildings two *stories* or less above *grade plane*. For buildings more than two *stories* above *grade plane*, the minimum width of the *yard* shall be increased at the rate of 1 foot (305 mm) for each additional *story*. For buildings exceeding 14 *stories* above *grade plane*, the required width of the *yard* shall be computed on the basis of 14 *stories* above *grade plane*.

1206.3 Courts. *Courts* shall not be less than 3 feet (914 mm) in width. *Courts* having windows opening on opposite sides shall not be less than 6 feet (1829 mm) in width. *Courts* shall not be less than 10 feet (3048 mm) in length unless bounded on one end by a *public way* or *yard*. For buildings more than two *stories* above *grade plane*, the *court* shall be increased 1 foot (305 mm) in width and 2 feet (610 mm) in length for each additional *story*. For buildings exceeding 14 *stories* above *grade plane*, the required dimensions shall be computed on the basis of 14 *stories* above *grade plane*.

1206.3.1 Court access. Access shall be provided to the bottom of *courts* for cleaning purposes.

1206.3.2 Air intake. *Courts* more than two *stories* in height shall be provided with a horizontal air intake at the bottom not less than 10 square feet (0.93 m²) in area and leading to the exterior of the building unless abutting a *yard* or *public way*.

1206.3.3 Court drainage. The bottom of every *court* shall be properly graded and drained to a public sewer or other approved disposal system complying with the *California Plumbing Code*.

SECTION 1207 [HCD 1& HCD 2] SOUND TRANSMISSION

1207.1 Purpose and scope. *The purpose of this section is to establish uniform minimum noise insulation performance standards to protect persons within hotels, motels, dormitories, apartment houses and dwellings other than detached single-family dwellings from the effects of excessive noise, including, but not limited to, hearing loss or impairment and interference with speech and sleep.*

1207.2 Definitions. *The following special definitions shall apply to this section:*

SOUND TRANSMISSION CLASS (STC) *is a single-number rating used to compare walls, floor-ceiling assemblies and doors for their sound-insulating properties with respect to speech and small household appliance noise. The STC is derived from laboratory measurements of sound transmission loss across a series of 16 test bands.*

Laboratory STC ratings should be used to the greatest extent possible in determining that the design complies with this section.

FIELD SOUND TRANSMISSION CLASS (FSTC) *is a single-number rating similar to STC, except that the transmission loss values used to derive the FSTC are measured in the field. All sound transmitted from the source room to the receiving room is assumed to be through the separating wall or floor-ceiling assembly.*

This section does not require determination of the FSTC, and field-measured values of noise reduction should not be reported as transmission loss.

IMPACT INSULATION CLASS (IIC) *is a single-number rating used to compare the effectiveness of floor-ceiling assemblies in providing reduction of impact-generated sounds such as footsteps. The IIC is derived from laboratory measurements of impact sound pressure level across a series of 16 test bands using a standardized tapping machine. Laboratory IIC ratings should be used to the greatest extent possible in determining that the design complies with this section.*

FIELD IMPACT INSULATION CLASS (FIIC) *is a single-number rating similar to the IIC, except that the impact sound pressure levels are measured in the field*

NOISE ISOLATION CLASS (NIC) *is a single-number rating derived from measured values of noise reduction between two enclosed spaces that are connected by one or more paths. The NIC is not adjusted or normalized to a standard reverberation time.*

NORMALIZED NOISE ISOLATION CLASS (NNIC) *is a single-number rating similar to the NIC, except that the measured noise reduction values are normalized to a reverberation time of one-half second.*

NORMALIZED A-WEIGHTED SOUND LEVEL DIFFERENCE (Dn) means for a specified source room sound spectrum, Dn is the difference, in decibels, between the average sound levels produced in two rooms after adjustment to the expected acoustical conditions when the receiving room under test is normally furnished.

DAY-NIGHT AVERAGE SOUND LEVEL (Ldn) is the A-weighted equivalent continuous sound exposure level for a 24-hour period with a 10 db adjustment added to sound levels occurring during nighttime hours (10 p.m. to 7 a.m.).

COMMUNITY NOISE EQUIVALENT LEVEL (CNEL) is a metric similar to the Ldn, except that a 5 db adjustment is added to the equivalent continuous sound exposure level for evening hours (7 p.m. to 10 p.m.) in addition to the 10 db nighttime adjustment used in the Ldn.

1207.6 Interdwelling sound transmission control.

1207.6.1 Wall and floor-ceiling assemblies. Wall and floor-ceiling assemblies separating dwelling units or guest rooms from each other and from public or service areas such as interior corridors, garages and mechanical spaces shall provide airborne sound insulation for walls, and both airborne and impact sound insulation for floor-ceiling assemblies.

Exception: Impact sound insulation is not required for floor-ceiling assemblies over nonhabitable rooms or spaces not designed to be occupied, such as garages, mechanical rooms or storage areas.

1207.7 Airborne sound insulation. All such acoustically rated separating wall and floor-ceiling assemblies shall provide airborne sound insulation equal to that required to meet a sound transmission class (STC) rating of 50 based on laboratory tests as defined in ASTM E 90 and E 413. Field-tested assemblies shall meet a noise isolation class (NIC) rating of 45 for occupied units and a normalized noise isolation class (NINIC) rating of 45 for unoccupied units as defined in ASTM E 336 and E 413.

ASTM E 597 may be used as simplified procedure for field tests of the airborne sound isolation between rooms in unoccupied buildings. In such tests, the minimum value of Dn is 45 db for compliance.

Entrance doors from interior corridors together with their perimeter seals shall have STC ratings not less than 26. Such tested doors shall operate normally with commercially available seals.

Solid-core wood-slab doors $1\frac{3}{8}$ inches (35 mm) thick minimum or 18 gauge insulated steel-slab doors with compression seals all around, including the threshold, may be considered adequate without other substantiating information.

Field tests of corridor walls should not include segments with doors. If such tests are

impractical, however, the NIC or NNIC rating for the composite wall-door assembly shall not be less than 30.

Penetrations or openings in construction assemblies for piping, electrical devices, recessed cabinets, bathtubs, soffits or heating, ventilating or exhaust ducts shall be sealed, lined, insulated or otherwise treated to maintain the required ratings.

1207.8 Impact sound insulation. *All acoustically rated separating floor-ceiling assemblies shall provide impact sound insulation equal to that required to meet a IIC rating of 50 based on laboratory tests as defined in ASTM E 492 and E 989. Field-tested assemblies shall meet a field impact insulation class (FIIC) rating of 45 for both occupied and unoccupied units as defined in ASTM E 1007 and E 989, with the exception that the measured impact sound pressure levels shall not be normalized to a standard amount of absorption in the receiving room.*

Floor coverings may be included in the assembly to obtain the required ratings. These coverings must be retained as a permanent part of the assembly and may be replaced only by other floor coverings that provide the required impact sound insulation.

1207.11 Exterior sound transmission control.

1207.11.1 Application. *Consistent with local land-use standards, residential structures located in noise critical areas, such as proximity to highways, county roads, city streets, railroads, rapid transit lines, airports or industrial areas, shall be designed to prevent the intrusion of exterior noises beyond prescribed levels. Proper design shall include, but shall not be limited to, orientation of the residential structure, setbacks, shielding and sound insulation of the building itself.*

1207.11.2 Allowable interior noise levels. *Interior noise levels attributable to exterior sources shall not exceed 45 db in any habitable room. The noise metric shall be either the day-night average sound level (Ldn) or the community noise equivalent level (CNEL), consistent with the noise element of the local general plan.*

SECTION 1208 INTERIOR SPACE DIMENSIONS

1208.1 Minimum room widths. *Habitable spaces, other than a kitchen, shall not be less than 7 feet (2134 mm) in any plan dimension. Kitchens shall have a clear passageway of not less than 3 feet (914 mm) between counter fronts and appliances or counter fronts and walls.*

1208.2 Minimum ceiling heights. *Occupiable spaces, habitable spaces and corridors shall have a ceiling height of not less than 7 feet 6 inches (2286 mm). Bathrooms, toilet rooms, kitchens, storage rooms and laundry rooms shall be permitted to have a ceiling height of not less than 7 feet (2134 mm).*

Exceptions:

1. In one- and two-family *dwelling*s, beams or girders spaced not less than 4 feet (1219 mm) on center and projecting not more than 6 inches (152 mm) below the required ceiling height.
2. If any room in a building has a sloped ceiling, the prescribed ceiling height for the room is required in one-half the area thereof. Any portion of the room measuring less than 5 feet (1524 mm) from the finished floor to the ceiling shall not be included in any computation of the minimum area thereof.

1208.2.1 Furred ceiling. Any room with a furred ceiling shall be required to have the minimum ceiling height in two-thirds of the area thereof, but in no case shall the height of the furred ceiling be less than 7 feet (2134 mm).

1208.3 Room area. Every *dwelling unit* shall have at least one room that shall have not less than 120 square feet (13.9 m²) of *net floor area*. Other habitable rooms shall have a *net floor area* of not less than 70 square feet (6.5 m²).

Exception: Every kitchen in a one- and two-family *dwelling* shall have not less than 50 square feet (4.64 m²) of *gross floor area*.

1208.4 Efficiency dwelling units. [HCD 1] *Unless modified by local ordinance pursuant to Health and Safety Code Section 17958.1, efficiency dwelling units shall comply with the following:*

1. The unit shall have a living room of not less than 220 square feet (20.4 m²) of floor area. An additional 100 square feet (9.3 m²) of floor area shall be provided for each occupant of such unit in excess of two.
2. The unit shall be provided with a separate closet.
3. The unit shall be provided with a kitchen sink, cooking appliance and refrigeration facilities, each having a clear working space of not less than 30 inches (762 mm) in front. Light and ventilation conforming to this code shall be provided.
4. The unit shall be provided with a separate bathroom containing a water closet, lavatory and bathtub or shower.

SECTION 1209 ACCESS TO UNOCCUPIED SPACES

1209.1 Crawl spaces. Crawl spaces shall be provided with a minimum of one access opening not less than 18 inches by 24 inches (457 mm by 610 mm).

1209.2 Attic spaces. An opening not less than 20 inches by 30 inches (559 mm by 762 mm) shall be provided to any *attic* area having a clear height of over 30 inches (762 mm). A 30-inch (762 mm) minimum clear headroom in the *attic* space shall be provided at or above the access opening.

SECTION 1210 SURROUNDING MATERIALS

1210.1 Floors and wall base finish materials. In other than *dwelling units*, toilet, bathing and shower room floor finish materials shall have a smooth, hard, nonabsorbent surface. The intersections of such floors with walls shall have a smooth, hard, nonabsorbent vertical base that extends upward onto the walls at least 4 inches (102 mm).

1210.2 Walls and partitions. Walls and partitions within 2 feet (610 mm) of urinals and water closets shall have a smooth, hard, nonabsorbent surface, to a height of 4 feet (1219 mm) above the floor, and except for structural elements, the materials used in such walls shall be of a type that is not adversely affected by moisture.

Exceptions:

1. *Dwelling units* and *sleeping units*.
2. Toilet rooms that are not accessible to the public and which have not more than one water closet.

Accessories such as grab bars, towel bars, paper dispensers and soap dishes, provided on or within walls, shall be installed and sealed to protect structural elements from moisture.

1210.3 Showers. Shower compartments and walls above bathtubs with installed shower heads shall be finished with a smooth, nonabsorbent surface to a height not less than 70 inches (1778 mm) above the drain inlet.

1210.4 Waterproof joints. Built-in tubs with showers shall have waterproof joints between the tub and adjacent wall.

1210.5 Toilet rooms. Toilet rooms shall not open directly into a room used for the preparation of food for service to the public.

Next Week

Tue 11/08 - LEED, CALGreen and Energy Efficiency, pg. 243-262, In-class Assignment 2 due (with review), Assignment 2 space plans handed back

Thu 11/10 - Guest Speaker Steve Stenton of RMW – LEED, CALGreen & Sustainability in the Design Practice; last chance to review Assignment 2 design layout