

# CTC Meeting #26

## April 8 – 9, 2013

### Climbable Guards

The following 2013 Group B changes have been compiled for the above noted CTC Area of Study. Code changes with an (\*) indicate CTC sponsored code changes. These changes are intended to serve as the agenda for the CTC in order to establish CTC positions, if any, for the upcoming 2013 Group B Committee Action Hearings.

**RB143-13**

**RB145-13**

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## **RB143 – 13**

### **R312.1.1**

**Proponent:** Rick Davidson, City of Maple Grove, Association of Minnesota Building Officials  
(rdavidson@maplegrovern.gov)

#### **Revise as follows:**

**R312.1.1 Where required.** *Guards shall be located along open-sided walking surfaces, including the open sides of floors, stairs, ramps and landings that are located more than 30 inches (762 mm) measured vertically to the floor or grade below at any point within 36 inches (914 mm) horizontally to the edge of the open side.* Insect screening shall not be considered as a *guard*.

**Reason:** The first portion of the proposal deletes the requirement that guards be located along open sided walking surfaces and replaces it with the same language found in the previous IRC. This is necessary because the term “open sided walking surfaces” is so broad in scope that it could be and is being applied to almost any surface on or in a building or a lot. It could be interpreted to require guards being installed around window wells, on the top of retaining walls, along driveways and sidewalks, on landings near window wells, at the edge of swimming pools, and even at the edge of flat roofs. The definitions for floors, stairs, ramps, and landings are well established. Everyone understands the application with these terms. It is reasonable to use terms that are understandable to all.

The second part of the proposal deletes the reference to measuring the height of the walking surface three feet from the edge of the walking surface and returns it to the language that existed in the IRC since its inception and in the previous model codes for decades.

It seems to be a widely held belief that the Uniform Building Code required that a measurement from floor to grade be taken at a point five feet from the floor to determine if a guard was required.

But, the Uniform Building Code never said that is how the distance should be measured nor did the BOCA National Building Code or the Southern Building Code. They all stated that the 30 inch height (15 ½ inches in the National Building Code and 30 inches in the Southern Building Code) be measured to the floor or grade below or very similar language.

Then where did the five foot measuring requirement come from? It came from the definition of “grade”. For years, ICBO staff taught that the use of the term “grade” in the phrase “30 inches above floor or grade below” was defined and that the definition in the UBC required that grade be measured five feet from the building or if the property line was less than five feet from the building then it would be measured from a point between the building and the property line.

This creates at least two inconsistencies if the argument was that the five foot distance was safety oriented. First, you only measured five feet over if what was below the walking surface was “grade”. If it were a floor, you just measured straight down. Second, if the building was near a property line, you only measured to the property line even if there were a severe drop at the property line. Theoretically under the UBC, one could have a walking surface that was adjacent to a property line with a 30 foot drop at the property line and no guard.

The idea that one should measure the 30 inch distance at some point other than the base of the walking surface was strictly an ICBO opinion and not binding on any building official. Based on the inconsistencies cited, there is certainly room for other opinions. Because a portion of the language in the UBC definition that stated that grade was between the building and the property line did not make it into the IRC, the IRC version requires that the measurement extend to adjoining lots in some cases.

But there is more.

The BOCA National Building Code required guards be provided when the walking surface was more than 15 ½ inches above the floor or grade below. But the BOCA code did not define “grade”, only “grade plane”. And the definition of “grade plane” was

used exclusively to determine the reference point for the height and number of stories of a building for purposes of determining compliance with height and number of stories limitations based on use and type of construction. It is not known how BOCA staff taught how to measure for guards but the language in the BOCA code is the same as it has been in the IRC since its inception.

The Southern Building Code provided a definition for "grade" but the method of measuring the height of a floor surface was stated to be "30 inches above *finished ground level* or a floor below". While grade required measuring a distance of six feet away, that term was not used in defining when a guard was required. It is not known how SBCCI staff taught how to measure guards but it doesn't appear the Southern Building Code provided any means to take the measurement at any location but straight down from the edge of the walking surface.

More about the UBC. Was it really intended that the measurement requiring guards be taken five feet from the walking surface or was that just happenstance and poor choices of terms in the code sections?

I would argue that it was never intended that the method used to determine whether or not a guard was required be five feet from the walking surface. Besides the inconsistencies above, the UBC definition of "grade" states that it is the distance "between the *building* and the property line". The term "building" does not appear to mean a floor or walking surface that could be used to determine guard requirements.

And then there is more. The UBC contained references to measuring grade at a distance away from the building dating back at least into the 1930's. Apparently the game of piling dirt next to a building to reduce the height or number of stories is not new. Grade was always about height and number of stories of the building, not as a means to require a guard.

An explanation of the term "grade" from the "*Design Guide – 1988 UBC*" by Alfred Goldberg is provided below. Mr. Goldberg states that the "determination of the grade level is important to the designer for several reasons, including the qualification of a level as a basement and the measurement of the allowable overall height of the building." Mr. Goldberg goes on to explain the nuances of application of the term "grade" and cautions on the "repercussions" of errors in applying the rules. Not once in Mr. Goldberg's book does he reference that "grade" has anything to do with guards.

In the "*Handbook to the Uniform Building Code, An Illustrative Commentary*" published by ICBO, the statement is made in regards to "grade" that "This definition is important in determining the number of stories within a building as well as its height in feet." There is also a discussion on the issue of guards but never once is there a reference to how one determines whether a guard is required. One would think it is important to create the link because the section regarding guards only states measuring to the floor or grade below.

That brings us to today. Given that the Southern Building Code, the National Building Code, the CABO One and Two Family Dwelling Code, and possibly the Uniform Building Code (depending on how it was interpreted) all directed that the measurement used to determine whether or not a guard was required be taken by measuring to the area below the edge of the walking surface, did an unsafe condition exist? No evidence has been submitted with any prior code change to suggest that it did.

Then there are the practical aspects. What distance should a "landing area" be if one were to create one? Should that landing area extend onto another property? The code has always regulated building construction based on situations on the lot in question and given no credence to what occurs on an adjoining lot.

And there are other practicality issues. Permits are not required for a host of "walking surfaces". How does one enforce a guard requirement for things like concrete sidewalks? Do we really see sharp drops or cliffs adjoining low decks or are we more likely to see a gently sloping hill and are they a hazard? And suppose I create a floor or walking surface adjacent my property line and the land on the other side slopes sufficiently that a guard would be required but my neighbor has a fence at the top of the slope on his side of the property line. Do I still need to put up a guard right next to his fence? And if I can use the fence for the guard, does it need to meet the load requirement of 200 pounds at the top? And if I have a walking surface that doesn't require a guard but at a later date the neighboring property owner installs a retaining wall that places my walking surface in violation, is he required to install the guard? He was the one who created the hazard! Will the timing of events result in one situation requiring a guard and another not? How does one explain this to a homeowner and make sense of it?

And last is the issue of permitting of decks, porches, balconies, landings and other low floor surfaces. Low decks were exempted from permits in large part because guards were not required, and they might still not be required. One can only guess that proposals are being drafted to require permits for decks requiring guards. But the inquiry that comes into the building department regarding the need for a guard will go something like this. Q. "Do I need a permit for a deck that will be 28 inches above the ground?" A. "You will need a permit if the ground within X feet of the deck will be more than 30 inches below the floor of the deck at any point around the deck." Q. "I'm a homeowner. I know it will be less than 30 inches above grade around the perimeter of the deck but I don't know about X feet out. So do I need a permit or not? And if I take out a permit and it turns out I didn't need one, I will get my money back, right?"

Homeowners don't have access to sophisticated equipment. They will be dependent on string levels and garden hoses. Accuracy may not be a strong suit. Where will this place the building department?

It is necessary that there be clarity in where a guard is required so that there is uniformity of application and that intended safeguards are in place. It is also necessary that those requirements achieve in all cases what they set out to do. Because most, if not all, of the national model codes did not require that the determining factor of when a guard was required was anything but a direct measurement from the edge of the floor to the ground or floor directly below.

tion) to circulate the heated air to and from the unit. In the context of the code, the primary use of the term "furnace" refers to heating appliance units that combine a combustion chamber with related components, one or more heat exchangers and an air-handling system.

**GLAZING AREA.** The interior surface area of all glazed fenestration, including the area of sash, curbing or other framing elements, that enclose conditioned space. Includes the area of glazed fenestration assemblies in walls bounding conditioned basements.

❖ The glazing area includes not only the surface area of the exposed glazing but also the framing elements, including the sash and curbing. The amount of glazing area is regulated for natural light by Section R303; however, this definition applies to the energy efficiency provisions of Chapter 11.

**GRADE.** The finished ground level adjoining the building at all exterior walls.

❖ This is the point at which the finished exterior ground level intersects the exterior wall of the building. The grade around a building may remain relatively constant, such as on a flat site, or may change dramatically from one point to the next if the site is steeply sloping.

**GRADE FLOOR OPENING.** A window or other opening located such that the sill height of the opening is not more than 44 inches (1118 mm) above or below the finished ground level adjacent to the opening.

❖ In the requirements for emergency escape and rescue openings found in Section R310, the size of the openings may be reduced if they are grade floor openings. These are windows or other openings that are located within close proximity to the finished ground level. The sill of a grade floor opening may be located either above or below the adjacent ground level, provided it is located no more than 44 inches (1118 mm) vertically from the level of the ground.

**GRADE, PIPING.** See "Slope."

**GRADE PLANE.** A reference plane representing the average of the finished ground level adjoining the building at all exterior walls. Where the finished ground level slopes away from the exterior walls, the reference plane shall be established by the lowest points within the area between the building and the lot line or, where the lot line is more than 6 ft (1829 mm) from the building between the structure and a point 6 ft (1829 mm) from the building.

❖ This definition can be important in determining the number of stories within a building as well as its height in feet. In some cases, the finished surface of the ground may be artificially raised with imported fill to create a higher grade plane around a building to decrease the number of stories or height. The definition requires that the lowest elevation within 6 feet (1829 mm) of the exterior wall be used to determine the grade plane.

**GRIDDED WATER DISTRIBUTION SYSTEM.** A water distribution system where every water distribution pipe is

interconnected so as to provide two or more paths to each fixture supply pipe.

❖ These systems offer the advantage of a simplistic design, typically smaller sized distribution lines and aid water conservation. In a traditional water distribution system, the water contained in the larger diameter piping is wasted when the line is opened and the user has to wait until the water reaches the desired temperature.

Parallel or gridded water distribution systems differ from branch systems which have individual supply pipes that extend to each fixture or outlet from a central supply point [see Commentary Figure R202(1)]. The central supply point is a multiple-outlet manifold to which the distribution lines connect [see Commentary Figure R202(2)].

**GROSS AREA OF EXTERIOR WALLS.** The normal projection of all exterior walls, including the area of all windows and doors installed therein.

❖ The calculation for determining the gross area of exterior walls for energy efficiency purposes is based on the total area of the entire exterior surface, including openings such as windows and doors.

**GROUND-SOURCE HEAT PUMP LOOP SYSTEM.** Piping buried in horizontal or vertical excavations or placed in a body of water for the purpose of transporting heat transfer liquid to and from a heat pump. Included in this definition are closed loop systems in which the liquid is recirculated and open loop systems in which the liquid is drawn from a well or other source.

❖ This definition assists the user with a ready means of distinguishing ground-source heat pump loop systems from other hydronic systems.

**GUARD.** A building component or a system of building components located near the open sides of elevated walking surfaces that minimizes the possibility of a fall from the walking surface to the lower level.

❖ A guard is a component or system of components whose function is the prevention of falls from an elevated area. Placed adjacent to an elevation change, a guard must be of adequate height, strength and configuration to help prevent people, especially small children, from falling over or through the guard to the area below.

**HABITABLE SPACE.** A space in a building for living, sleeping, eating or cooking. Bathrooms, toilet rooms, closets, halls, storage or utility spaces and similar areas are not considered habitable spaces.

❖ An area within a building used for living, sleeping, dining or cooking is a habitable space. Those areas not meeting this definition include bathrooms, closets, hallways and utility rooms. Habitable spaces are typically occupied, and as such they are more highly regulated than accessory use areas.

**HANDRAIL.** A horizontal or sloping rail intended for grasping by the hand for guidance or support.

to assist ramp users. This provision differs from that of the IBC, where a slope of one unit vertical in 20 units horizontal (5-percent slope) and a ramp rise of 6 inches (152 mm) establishes the limits.

**R311.6.3.1 Height.** Handrail height, measured above the finished surface of the ramp slope, shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm).

❖ Where handrails are required, they must be installed at a height of at least 34 inches (864 mm) and not more than 38 inches (965 mm), measured vertically from the finished surface of the ramp slope. This height should be measured to the top of the handrail.

**R311.6.3.2 Handrail grip size.** Handrails on ramps shall comply with Section R311.5.6.3.

❖ See the commentary for Section R311.5.6.3.

**R311.6.3.3 Continuity.** Handrails where required on ramps shall be continuous for the full length of the ramp. Handrail ends shall be returned or shall terminate in newel posts or safety terminals. Handrails adjacent to a wall shall have a space of not less than 1.5 inches (38 mm) between the wall and the handrails.

❖ The continuity requirement for the ramp handrail is similar to the continuity requirement for the stair handrail. See the commentary for Section R311.5.6.2

guards not less than 34 inches (864 mm) in height measured vertically from the nosing of the treads.

Porches and decks which are enclosed with insect screening shall be equipped with guards where the walking surface is located more than 30 inches (762 mm) above the floor or grade below.

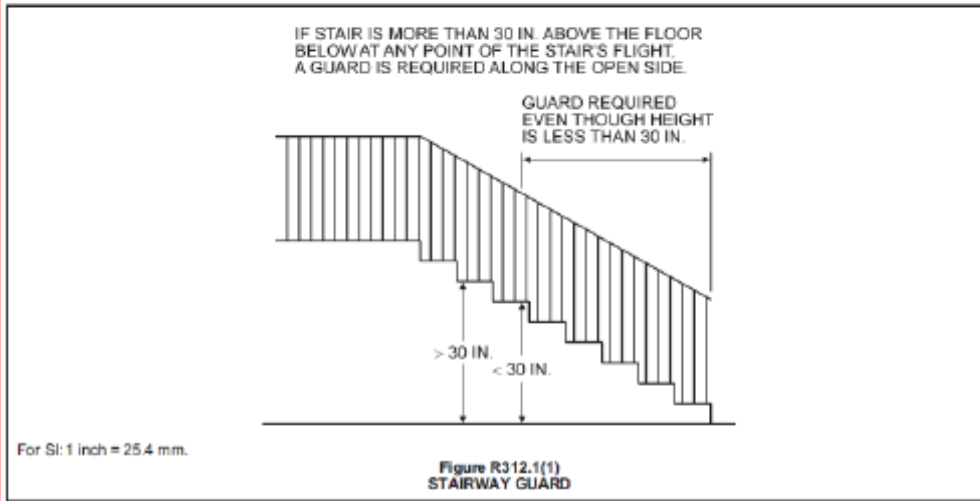
❖ The guard provisions of the IRC address the issue of protecting occupants from falling from any type of elevated walking surface. The provisions in Section R312 provide the scoping requirements as well as the general construction requirements for the guards. Besides this section, code users should be aware that Section R301.5 contains the design load criteria for guards.

Section R312.1 of the code establishes the requirement for and the minimum height requirements for guards. The code provides for guard protection at open sides along raised floor or walking surfaces such as those at balconies, mezzanines, stairways, ramps, porches and landings that are more than 30 inches (762 mm) above the grade or floor surface below.

The requirements for guards on stairs are different from other guard requirements in two ways. The first is the scoping requirements that establish the need for the guard, and the second is the required height of the guard. The scoping requirement for guards along open sides of stairs not only applies to the portion of a stairway that is more than 30 inches (762 mm) above the floor, but it will also apply to the entire open side of the stair, including the parts that are less than 30 inches (762 mm) above the floor. This requirement applies to the entire "open side" of the stairway, if any point of the open side is more than 30 inches (762 mm) high. See Commentary Figures R312.1(1) and (2) for examples of how this provision is applied.

**SECTION R312  
GUARDS**

**R312.1 Guards.** Porches, balconies, ramps or raised floor surfaces located more than 30 inches (762 mm) above the floor or grade below shall have guards not less than 36 inches (914 mm) in height. Open sides of stairs with a total rise of more than 30 inches (762 mm) above the floor or grade below shall have





**FIRE RESISTANCE** or **FIRE-RESISTIVE CONSTRUCTION** is construction to resist the spread of fire, details of which are specified in this code.

**FIRE-RETARDANT-TREATED WOOD** is any wood product impregnated with chemicals by a pressure process or other means during manufacture, and which, when tested in accordance with UBC Standard 8-1 for a period of 30 minutes, shall have a flame spread of not over 25 and show no evidence of progressive combustion. In addition, the flame front shall not progress more than 10<sup>1</sup>/<sub>2</sub> feet (3200 mm) beyond the center line of the burner at any time during the test. Materials that may be exposed to the weather shall pass the accelerated weathering test and be identified as Exterior type, in accordance with UBC Standard 23-4. Where material is not directly exposed to rainfall but exposed to high humidity conditions, it shall be subjected to the hygroscopic test and identified as Interior Type A in accordance with UBC Standard 23-4.

All materials shall bear identification showing the fire performance rating thereof. Such identifications shall be issued by an approved agency having a service for inspection of materials at the factory.

**FLAMMABLE LIQUID.** See the Fire Code.

**FLOOR AREA** is the area included that the surrounding exterior walls of a building or portion thereof, exclusive of vent shafts and courts. The floor area of a building, or portion thereof, not provided with surrounding exterior walls shall be the usable area under the horizontal projection of the roof or floor above.

**FM** is Factory Mutual Engineering and Research, 1151 Boston-Providence Turnpike, Norwood, Massachusetts 02062.

**FOAM PLASTIC INSULATION** is a plastic that is intentionally expanded by the use of a foaming agent to produce a reduced-density plastic containing voids consisting of hollow spheres or interconnected cells distributed throughout the plastic for thermal insulating or acoustical purposes and that has a density less than 20 pounds per cubic foot (320 kg/m<sup>3</sup>).

**FOOTING** is that portion of the foundation of a structure that spreads and transmits loads directly to the soil or the piles.

**FRONT OF LOT** is the front boundary line of a lot bordering on the street and, in the case of a corner lot, may be either frontage.

#### SECTION 208 — G

**GARAGE** is a building or portion thereof in which a motor vehicle containing flammable or combustible liquids or gas in its tank is stored, repaired or kept.

**GARAGE, PRIVATE,** is a building or a portion of a building, not more than 1,000 square feet (93 m<sup>2</sup>) in area, in which only motor vehicles used by the tenants of the building or buildings on the premises are stored or kept. (See Section 312.)

**GARAGE, PUBLIC,** is any garage other than a private garage.

**GAS ROOM** is a separately ventilated, fully enclosed room in which only toxic and highly toxic compressed gases and associated equipment and supplies are stored or used.

**GRADE (Adjacent Ground Elevation)** is the lowest point of elevation of the finished surface of the ground, paving or sidewalk within the area between the building and the property line or, when the property line is more than 5 feet (1524 mm) from the building, between the building and a line 5 feet (1524 mm) from the building.

**GRADE (Lumber)** is the classification of lumber in regard to strength and utility.

**GUARDRAIL** is a system of building components located near the open sides of elevated walking surfaces for the purpose of minimizing the possibility of an accidental fall from the walking surface to the lower level.

**GUEST** is any person hiring or occupying a room for living or sleeping purposes.

**GUEST ROOM** is any room or rooms used or intended to be used by a guest for sleeping purposes. Every 100 square feet (9.3 m<sup>2</sup>) of superficial floor area in a dormitory shall be considered to be a guest room.

#### SECTION 209 — H

**HABITABLE SPACE (ROOM)** is space in a structure for living, sleeping, eating or cooking. Bathrooms, toilet compartments, closets, halls, storage or utility space, and similar areas, are not considered habitable space.

**HANDLING** is the deliberate movement of material by any means to a point of storage or use.

**HANDRAIL** is a railing provided for grasping with the hand for support. See also "guardrail."

**HAZARDOUS PRODUCTION MATERIAL (HPM)** is a solid, liquid or gas that has a degree of hazard rating in health, flammability or reactivity of 3 or 4 and that is used directly in research, laboratory or production processes that have, as their end product, materials that are not hazardous.

**HEALTH HAZARD** is a classification of a chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed persons. The term "health hazard" includes chemicals that are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents that act on the hematopoietic system, and agents that damage the lungs, skin, eyes or mucous membranes.

**HEIGHT OF BUILDING** is the vertical distance above a reference datum measured to the highest point of the coping of a flat roof or to the deck line of a mansard roof or to the average height of the highest gable of a pitched or hipped roof. The reference datum shall be selected by either of the following, whichever yields a greater height of building:

1. The elevation of the highest adjoining sidewalk or ground surface within a 5-foot (1524 mm) horizontal distance of the exterior wall of the building when such sidewalk or ground surface is not more than 10 feet (3048 mm) above lowest grade.
2. An elevation 10 feet (3048 mm) higher than the lowest grade when the sidewalk or ground surface described in Item 1 is more than 10 feet (3048 mm) above lowest grade.

The height of a stepped or terraced building is the maximum height of any segment of the building.

**HELIPORT** is an area of land or water or a structural surface that is used, or intended for use, for the landing and take-off of helicopters, and any appurtenant areas that are used, or intended for use, for heliport buildings and other heliport facilities.

**HELISTOP** is the same as a heliport, except that no refueling, maintenance, repairs or storage of helicopters is permitted.

**HIGHLY TOXIC MATERIAL** is a material that produces a lethal dose or a lethal concentration that falls within any of the following categories:

hour for unenclosed mezzanines. The clear height above and below the mezzanine floor construction shall not be less than 7 feet (2134 mm).

2. There shall not be more than two levels of mezzanines in a room. However, there is no limitation on the number of mezzanines within a room.

3. The aggregate area of mezzanines within a room shall not exceed one third of the area of the room in which they are located.

4. All portions of a mezzanine shall be open and unobstructed to the room in which they are located, except for columns and posts and protective walls or railings not more than 44 inches (1118 mm) in height.

**EXCEPTIONS:** 1. Partitions may be installed if either of the following conditions exist:

- 1.1 The aggregate floor area of the enclosed space does not exceed 10 percent of the mezzanine area, or
- 1.2 The occupant load of the enclosed area of the mezzanine does not exceed 10.

2. A mezzanine having two or more means of egress need not be open into the room in which it is located, provided at least one of the means of egress gives direct access to a protected corridor, exit court or exit.

3. In industry facilities, mezzanines used for control equipment may be glazed on all sides.

5. Two means of egress shall be provided from a mezzanine when two are required by Table 10-A.

6. If any required means of egress enters the room below, the occupant load of the mezzanine shall be added to the occupant load of the room in which it is located.

#### SECTION 508 — FIRE-RESISTIVE SUBSTITUTION

When an approved automatic sprinkler system is not required throughout a building by other sections of this code, it may be used in a building of Type II One-hour, Type III One-hour and Type V One-hour construction to substitute for the one-hour fire-resistive construction. Such substitution shall not waive or reduce the required fire-resistive construction for:

1. Occupancy separations (Section 302.3).
2. Exterior wall protection due to proximity of property lines (Section 503.2).
3. Area separations (Section 504.6).
4. Dwelling unit separations (Section 310.2.2).
5. Shaft enclosures (Section 711).
6. Corridors (Sections 1004.3.4.3.1 and 1004.3.4.3.2).
7. Stair enclosures (Section 1005.3.3).
8. Exit passageways (Section 1005.3.4).
9. Type of construction separation (Section 601.1).
10. Boiler, central heating plant or hot-water supply boiler room enclosures (Section 302.5).

#### SECTION 509 — GUARDRAILS

**509.1 Where Required.** Unenclosed floor and roof openings, open and glazed sides of stairways, aisles, landings and ramps, balconies or porches, which are more than 30 inches (762 mm) above grade or floor below, and roofs used for other than service of the building shall be protected by a guardrail. Guardrails shall be provided at the ends of aisles where they terminate at a fascia of boxes, balconies and galleries.

**EXCEPTION:** Guardrails need not be provided at the following locations:

1. On the loading side of loading docks.
2. On the auditorium side of a stage, raised platforms and other raised floor areas such as runways, ramps and side stages used for entertainment or presentation. Along the side of an elevated walking surface when used for the normal functioning of special lighting or for access and use of other special equipment. At vertical openings in the performance area of stages.
3. Along vehicle service pits not accessible to the public.

**509.2 Height.** The top of guardrails shall not be less than 42 inches (1067 mm) in height.

**EXCEPTIONS:** 1. The top of guardrails for Group R, Division 3 and Group U, Division 1 Occupancies and interior guardrails within individual dwelling units, Group R, Division 3 congregate residences and guest rooms of Group R, Division 1 Occupancies may be 36 inches (914 mm) in height.

2. The top of guardrails on a balcony immediately in front of the first row of fixed seats and that are not at the end of an aisle may be 26 inches (660 mm) in height.

3. The top of guardrails for stairways, exclusive of their landings, may have a height as specified in Section 1003.3.3.6 for handrails.

Where an elevation change of 30 inches (762 mm) or less occurs between an aisle parallel to the seats (cross aisle) and the adjacent floor or grade below, guardrails not less than 26 inches (660 mm) above the aisle floor shall be provided.

**EXCEPTION:** Where the backs of seats on the front of the cross aisle project 24 inches (610 mm) or more above the adjacent floor of the aisle, a guardrail need not be provided.

The top of guardrails at the ends of aisles terminating at the fascia of boxes, balconies and galleries shall extend for the width of the aisle and be no closer than 42 inches (1067 mm) to the closest surface of the aisle where there are steps and 36 inches (914 mm) otherwise.

**509.3 Openings.** Open guardrails shall have intermediate rails or an ornamental pattern such that a sphere 4 inches (102 mm) in diameter cannot pass through.

**EXCEPTIONS:** 1. The open space between the intermediate rails or ornamental pattern of guardrails in areas of commercial and industrial-type occupancies which are not accessible to the public may be such that a sphere 12 inches (305 mm) in diameter cannot pass through.

2. The triangular openings formed by the riser, tread and bottom element of a guardrail at the open side of a stairway may be of such size that a sphere 6 inches (152 mm) in diameter cannot pass through.

For guardrail requirements at grandstands, bleachers or other elevated seating facilities, see Section 1008.3.7.

The floor area calculation is of such importance that the designer should establish this figure early in the preliminary discussions with the local enforcement agency.

**Sec. 408. GARAGE** is a building or portion thereof in which a motor vehicle containing flammable or combustible liquids or gas in its tank, is stored, repaired or kept.

**GARAGE, PRIVATE**, is a building or a portion of a building, not more than 1000 square feet in area, in which only motor vehicles used by the tenants of the building or buildings on the premises are stored or kept. (See Section 1101.)

**GARAGE, PUBLIC**, is any garage other than a private garage.

There are several definitions, and three different classifications, of garages. The least restrictive definition refers to a garage in conjunction with a dwelling or a small office building: a "private garage." It is classified as a Group M Occupancy.

When the garage is larger, or if it is in a larger building or serves occupants other than those in the building, it is called a "public garage." This garage is classified as a Group B, Division 1 Occupancy.

The third class of garage is a "repair garage" classed as a Group H, Division 4 Occupancy.

The reason for the three different garage classes is illustrated in Table No. 5-C. In a Type III-N building, a Group B, Division 1 Occupancy allows a floor area of 12,000 square feet. In a similar building, a Group H, Division 4 Occupancy limits the floor area to 7,500 square feet. The smaller allowable area is due to the presence of repair equipment, including torches and flammable liquids (oil and gasoline) which may permeate the area when repairs are made.

On the other hand, the Group M private garage is limited to 1,000 square feet with a maximum of 3,000 square feet in any one building. The provisions in Chapter 11 enable the private garage to reach the maximum of 3,000 square feet in the building provided each 1,000 square foot area is separated from another by a one-hour area separation wall.

**GRADE (Adjacent Ground Elevation)** is the lowest point of elevation of the finished surface of the ground, paving or sidewalk within the area between the building and the property line or, when the property line is more than 5 feet from the building, between the building and a line 5 feet from the building.

This definition requires that the elevation of the ground surface to be used be either:

- the level between the building and the property line, or
- where the property line is more than five feet from the building, the lowest point within a distance of five feet from the building.

The code intent is to establish what would be a "natural" ground line and to prevent someone from piling soil up against the foundation of the building and claiming that it represents the grade. By requiring the measurement to be the lowest elevation within five feet of the building, the code establishes a five-foot width to represent grade and not simply a mound of earth against the foundation. A retaining wall can be used to establish this five-foot level width.

The determination of the grade level is important to the designer for several reasons, including the qualification of a level as a basement and the measurement of the allowable overall height of the building. (See Figure 4-2.)

HEIGHT OF BUILDING is the vertical distance above a reference datum measured to the highest point of the coping of a flat roof or to the deck line of a mansard roof or to the average height of the highest gable of a pitched or hipped roof. The reference datum shall be selected by either of the following, whichever yields a greater height of building:

1. The elevation of the highest adjoining sidewalk or ground surface within a five-foot horizontal distance of the exterior wall of the building when such sidewalk or ground surface is not more than 10 feet above lowest grade.
2. An elevation 10 feet higher than the lowest grade when the sidewalk or ground surface described in Item 1 above is more than 10 feet above lowest grade.

The height of a stepped or terraced building is the maximum height of any segment of the building.

Height of building discussed in this definition relates to the provisions in Chapter 5 for considering the maximum height for a given type of construction and number of stories in a building.

Height and stories are interdependent in Table No. 5-D wherein the limitations for the height in feet and the number of stories are established. The provisions for measuring the height require reference to the ground surface. The five-foot horizontal width in Item 1 is comparable to the five-foot width measurement for determining "grade."

The concern with the method of height measurement is based on the fire and panic hazards presented by taller structures or those with more levels of occupancy. Many times the misinterpretation or misapplication of the height and story measurement has been the result of a desire to



avoid the added exit and fire protection requirements that apply when a building is three or more stories in height.

The designer is cautioned that any error in this part of the design can produce considerable repercussions; hence, the designer should use a conservative approach to the height measurement.

**HOTEL** is any building containing six or more guest rooms intended or designed to be used, or which are used, rented or hired out to be occupied, or which are occupied for sleeping purposes by guests.

The hotel is another sub-group of the R-1 Occupancy, multi-family usage. The controlling criterion is the number of guest rooms rather than dwelling units (as is used in the apartment house definition).

**MECHANICAL CODE** is the Uniform Mechanical Code promulgated jointly by the International Conference of Building Officials and the International Association of Plumbing and Mechanical Officials, as adopted by this jurisdiction.

One of the codes referenced in the UBC provisions is the Mechanical Code, in particular the Uniform Mechanical Code (UMC). It is adopted by a jurisdiction in a similar manner as is the UBC.

**MEZZANINE OR MEZZANINE FLOOR** is an intermediate floor placed within a room.

The construction provisions for mezzanines are contained in Section 1716. The key determinant in whether a level qualifies as a mezzanine is stated in Item 3 of that section, which reads:

3. The aggregate area of mezzanines within a room shall not exceed one third the area of the room in which it is located. Intermediate floor levels that are 6 or more feet above grade shall be considered a story when the area of such level exceeds one third the area of the room in which it is located.

Sec. 415. **NONCOMBUSTIBLE** as applied to building construction material means a material which, in the form in which it is used, is either one of the following:

1. Material of which no part will ignite and burn when subjected to fire. Any material conforming to U.B.C. Standard No. 4-1 shall be considered noncombustible within the meaning of this section.
2. Material having a structural base of noncombustible material as defined in Item No. 1 above, with a surfacing material not over 1/8 inch thick which has a flame-spread rating of 50 or less.

"Noncombustible" does not apply to surface finish materials. Material required to be noncombustible for reduced clearances to flues, heating appliances or other sources of high temperature shall refer to material conforming to Item No. 1. No material shall be classed as noncombustible which is subject to increase in combustibility or flame-spread rating, beyond the limits herein established,

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# HANDBOOK

TO THE

UNIFORM BUILDING CODE

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*An illustrative commentary*



International Conference of Building Officials

**SECTION 208 — G**

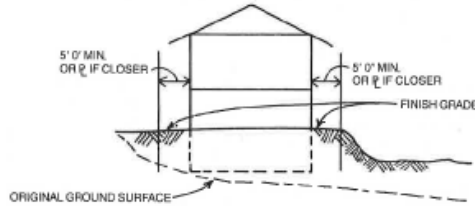
**GRADE (Adjacent Ground Elevation).** The code indicates that grade is the lowest point of elevation of the finished surface of the ground within an area between the building and property line or where the property line is more than 5 feet (1524 mm) from the building between the building and a line 5 feet (1524 mm) from the building.

This definition is important in determining the number of stories within a building as well as its height in feet. In some cases the finished surface of the ground may be artificially raised with imported fill to create a higher grade around a building so as to increase the number of stories or height in feet. The code does not prohibit this practice, and as long as a building meets the code definition and restrictions for height or number of stories, the intent of the code is met. See Figure 208-1.

**SECTION 209 — H**

**HEIGHT OF BUILDING.** The critical feature in the definition of height of building is the case where the building is on a sloping site. In the case of a sloping site, the height of the building is measured as depicted in Figure 209-1.

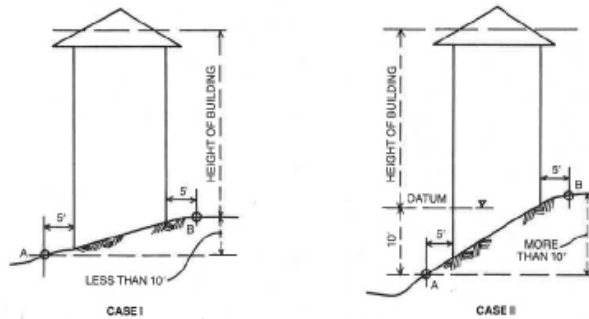
Where the building is stepped or terraced, the code intends that the height of such building is the maximum height of any segment of the building. It may be appropriate under certain circumstances that the number of stories in a building be determined in the same manner. Because of the varying requirements of the code which are related to the number of stories, such as exiting, fire resistance of construction, shaft enclosures, etc., each case should be judged individually based on the characteristics of the site and construction. In addition to those factors which are related to the number of stories, other items to consid-



For SI: 1 foot = 304.8 mm.

**USE OF BUILT-UP SOIL TO RAISE FINISH GRADE**

Figure 208-1



For SI: 1 foot = 304.8 mm.

**DETERMINATION OF BUILDING HEIGHT IN FEET (mm)**

Figure 209-1

Application Example 508-1

**GIVEN:** One-story building of Type V-N construction with an automatic fire-sprinkler system installed throughout. The building has no yards.  
**DETERMINE:** Maximum allowable floor area for the building housing either a Group B Occupancy or a Group A, Division 2.1 Occupancy.  
**SOLUTION:** Case I—Group B Occupancy:  
 The building can be evaluated with the automatic fire sprinklers used either to increase area according to Section 505.3 or to substitute for one-hour construction according to Section 508, thus upgrading the construction from Type V-N to Type V One-hour.  
 A. Section 505.3. Basic allowable area according to Table 5-B is 8,000 square feet for Type V-N construction.  
 Allowable Area = 8,000 x 3 = 24,000 square feet.  
 B. Section 508. Basic allowable area according to Table 5-B is 14,000 square feet for Type V One-hour. Obviously, it is more advantageous to use the provisions of Section 505.3.  
 Case II—Group A, Division 2.1 Occupancy:  
 Referring to Table 5-B, it is seen that a Group A, Division 2.1 Occupancy is not permitted to be of Type V-N construction. Thus, the automatic fire-sprinkler system must be used as a substitute for one-hour construction in order that the building will qualify as Type V One-hour construction. The allowable area for this type of construction is 10,500 square feet housing a Group A, Division 2.1 Occupancy.

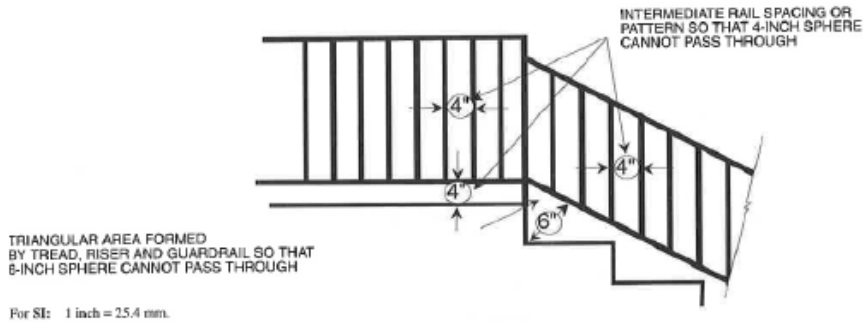


Figure 509-1

**SECTION 509 — GUARDRAILS**

In this section, the code provides for guardrail protection for unenclosed floor and roof openings, open and glazed sides of stairways, landings and ramps, and porches, which are more than 30 inches (762 mm) above grade or a floor or other surface below. Also, the protection is required for roofs which are used other than for service of the building and thus are subject to use by individuals walking on the roof. The need for guardrails in these circumstances is evident, although the arbitrary limit of 30 inches (762 mm) above grade or floor below is subject to conjecture. Nonetheless, in the case of the U.B.C., it is assumed that the height of 30 inches (762 mm) does not create a significant safety hazard.<sup>5</sup>

The guardrail must be of adequate height to prevent someone from falling over the edge of the protected areas and be designed to prevent someone, including small children, from falling through under the top rail. Therefore, the code establishes 42 inches (1067 mm) as the minimum height which is recognized nationally as the proper height for guardrail protection. The code also requires that for open-type rails, intermediate members be provided so that a sphere 4 inches (102 mm) in diameter cannot pass through between the intermediate members, a requirement which prevents small children from falling through the guardrail assembly. See Figure 509-1. The code also lessens the height for open sides of stairs; they may be protected with a guardrail hav-

ing a height the same as for stair railings as provided for in Section 1006.9. There are several more exceptions to the requirements for guardrails, as follows:

- Guardrails are not required on the loading side of docks or along vehicle service pits not accessible to the public for obvious reasons.
- Guardrails are required to be only 36 inches (914 mm) high in dwellings, Group U Occupancies, and within individual apartments or guest rooms in Group R, Division 1 Occupancies. This lower height is based on the good experience that has been exhibited in these uses; for several decades, the guardrail height in them has been no higher than 36 inches (914 mm).
- In commercial and industrial uses where the public is not invited (therefore, the guardrail is not subject to small children falling through), guardrails may have intermediate members spaced so that a 12-inch (305 mm) diameter sphere cannot pass through.
- In order to provide for proper viewing in theaters, a guardrail in front of the first row of fixed seats, and which is not at the end of an aisle, may be 26 inches (660 mm) in height.
- Again for obvious reasons, guardrails are not required on the auditorium side of a stage or enclosed platform.



THIRTEENTH EDITION  
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**1020.2 Vestibule:** Where an *exit* discharges into an interior vestibule, the vestibule shall be used for ingress and means of egress only, and the vestibule shall comply with Sections 1020.2.1 and 1020.2.2.

**1020.2.1 Depth and width:** The vestibule depth from the exterior of the building shall not be greater than 10 feet (3048 mm) and the width shall not be greater than 20 feet (6096 mm).

**1020.2.2 Separation:** The vestibule shall be separated from the remainder of the level of *exit discharge* by self-closing doors and the equivalent of 1/4-inch-thick wired glass in steel frames.

**1020.3 Lobby:** Where an *exit* discharges into an interior lobby located at the level of *exit discharge*, the lobby containing the lobby shall be equipped throughout with an *automatic sprinkler system* installed in accordance with Section 906.2.1 or 906.2.2. Opening protectives shall be required in accordance with Table 717.1 at the point in which an enclosed *exit stairway* discharges into a lobby.

**Exception:** An *automatic sprinkler system* is not required in areas that are separated from the lobby by fire separation assemblies (see Section 709.0) having a fire-resistance rating of not less than that required for *exit* enclosures.

**1020.4 Width and height:** The clear width of the passageway shall not be less than the width required for the capacity of the *exit stairways* leading thereto and all required *exit* doorways opening into the passageway. Such passageway shall have a minimum width of 44 inches (1118 mm) and a minimum clear ceiling height of 8 feet (2343 mm).

**1020.5 Maximum stairway limitations:** Not more than 50 percent of the required *stairways* shall discharge through the same passageway. Multiple lobbies constructed in accordance with Section 1020.3 located adjacent to one another shall be separated from each other in accordance with the requirements for enclosure of *exits*.

#### SECTION 1021.0 GUARDS

**1021.1 Design and construction:** Where required by the provisions of Sections 406.5, 408.3.2, 1005.5, 1014.7, 1016.5 and 825.5, guards shall be designed and constructed in accordance with the requirements of this section and Section 1606.4.

**1021.2 Height:** The guards shall be at least 42 inches (1067 mm) in height measured vertically above the leading edge of the tread or adjacent walking surface.

#### Exceptions

1. In other than occupancies in Use Group E, guards shall not be less than 36 inches (914 mm) in height above the leading edge of the tread along stairs which are not more than 20 feet (6096 mm) in height or which reverse direction at an intermediate landing with 12 inches (305 mm) or less measured horizontally between successive flights.
2. Guards along open-sided floor areas, *mezzanines* and landings within a single *dwelling unit* in Use Group R-2 and serving a single *dwelling unit* in Use Group R-3 shall not be less than 36 inches (914 mm) in height.

3. Guards along open-sided floor areas located less than 30 inches (762 mm) above the floor or grade below shall not be less than 36 inches (914 mm) in height.

**1021.3 Opening limitations:** In occupancies in Use Groups A, B, E, H-4, I-1, I-2, M and R, and in *public garages* and open parking structures, open guards shall have balusters or be of solid material such that a sphere with a diameter of 4 inches (102 mm) cannot pass through any opening. Guards shall not have an ornamental pattern that would provide a ladder effect.

#### Exceptions

1. The triangular openings formed by the riser, tread and bottom rail at the open side of a *stairway* shall be of a maximum size such that a sphere 6 inches (152 mm) in diameter cannot pass through the opening.
2. At elevated walking surfaces for access to and utilization of electrical, mechanical, or plumbing systems or equipment, guards shall have balusters or be of solid materials such that a sphere with a diameter of 21 inches (533 mm) cannot pass through any opening.

In occupancies in Use Groups I-3, F, H-1, H-2, H-3, S, (other than *public garages* and open parking structures), and along open-sided floor areas located less than 30 inches (762 mm) above the floor or grade below, balusters, horizontal intermediate rails or other construction shall not permit a sphere with a diameter of 21 inches (533 mm) to pass through any opening.

**1021.4 Railings:** Metal or other approved noncombustible railings shall be provided on balconies and galleries as prescribed in Sections 1021.4.1 through 1021.4.3.

**1021.4.1 At fascia:** Railings shall be provided at the fascia of boxes, balconies and galleries and shall not be less than 26 inches (660 mm) in height; at the end of aisles extending to the fascia for the full width of the aisle and shall not be less than 36 inches (914 mm) in height; and at the foot of steps for the full width of the steps and shall not be less than 42 inches (1067 mm) in height.

**1021.4.2 At cross aisles:** Railings shall be provided along cross aisles, and shall not be less than 26 inches (660 mm) in height except that railings are not required where the backs of the seats along the front of the aisles project 24 inches (610 mm) or more above the floor of the aisle.

**1021.4.3 Successive tiers:** Where seatings are arranged in successive tiers, and where the height of rise between *platforms* exceeds 18 inches (457 mm), railings not less than 26 inches (660 mm) in height shall be provided along the entire row of seats at the edge of the *platform*.

#### SECTION 1022.0 HANDRAILS

**1022.1 General:** Where required by the provisions of Sections 1012.5, 1013.0, 1014.6.6.1, 1014.7 and 1016.5, handrails shall be designed and constructed in accordance with this section and Section 1606.4.

**1022.2 Handrail details:** Handrails shall be continuous, without interruption by newel posts, other structure elements or obstructions. A handrail and any wall or other surface adjacent to the handrail shall be free of any sharp or abrasive elements. The clear space between the handrail and the adjacent wall or surface shall

## SECTION 502.0 DEFINITIONS

**502.1 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.

**Area, building:** The *area* included within surrounding exterior walls (or exterior walls and *fire walls*) exclusive of vent *shafts* and *courts*. Areas of the building not provided with surrounding walls shall be included in the building area if such areas are included within the horizontal projection of the roof or floor above.

**Basement:** That portion of a building which is partly or completely below grade (see "*Story above grade*").

**Grade plane:** A reference plane representing the average of finished ground level adjoining the building at all exterior walls. Where the finished ground level slopes away from the exterior walls, the reference plane shall be established by the lowest points within the area between the building and the *lot line* or, where the *lot line* is more than 6 feet (1829 mm) from the building, between the building and a point 6 feet (1829 mm) from the building.

### **Height**

**Building:** The vertical distance from *grade plane* to the average height of the highest roof surface.

**1005.5 Open-sided walking areas:** Guards shall be located along open-sided walking surfaces, *mezzanines*, *stairways*, ramps and landings which are located more than 15½ inches (394 mm) above the floor or grade below. The guards shall be constructed in accordance with Section 1021.0.

**Exception:** Guards are not required for the following locations:

1. On the loading side of loading docks.
2. On the auditorium side of *stages* and raised *platforms*.
3. On raised *stage* and *platform* floor areas such as runways, ramps and side *stages* utilized for entertainment or presentations.
4. At vertical openings in the performance area of *stages* and *platforms*.
5. At elevated walking surfaces appurtenant to *stages* and *platforms* for access to and utilization of special lighting or equipment.

SOUTHERN BUILDING

GALLERY that portion of the seating space of an assembly room having a seating capacity of more than ten located above a balcony.

**GRADE**-a reference plane representing the average of finished ground level adjoining the building at all exterior walls. When the finished ground level slopes away from the exterior walls, the reference plane shall be established by the lowest points within the area between the building and the lot line or between the building and a point 6 ft (1829 mm) from the building, whichever is closer to the building.

CODE **GRADE LUMBER** the division of sawn lumber into quality classes with respect to its physical

**1015 GUARDRAILS**

**1015.1 General**

All unenclosed floor and roof openings, open and glazed sides of landings and ramps, balconies or porches which are more than 30 inches (762 mm) above finished ground level or a floor below shall be protected by a guardrail. Guardrails shall form a vertical protective barrier not less than 42 inches (1067 mm) high. Open guardrails shall have intermediate rails or ornamental pattern such that a 6-inch (152 mm) diameter sphere cannot pass through any opening. A bottom rail or curb shall be provided that will reject the passage of a 2-inch (51 mm) diameter sphere. Construction of guardrails shall be adequate in strength, durability and attachment for their purpose as described in 1608.2.

**EXCEPTIONS:**

1. Guardrails are not required on the loading side of loading docks.
2. Guardrails shall be permitted in conformance with requirements for specific occupancies in 1018.

**1015.2 Glass**

Cost Impact: None

**RB145 – 13**  
**R312.1.2**

**Proponent:** Rick Davidson, City of Maple Grove, Association of Minnesota Building Officials (rdavidson@maplegrovern.gov); Steve Thomas, Colorado Code Consulting, LLC representing the Colorado Chapter ICC (sthomas@coloradocode.net)

**Revise as follows:**

**R312.1.2 Height.** Required *guards* at open-sided walking surfaces, including stairs, porches, balconies or landings, shall be not less than 36 inches (914 mm) high measured vertically above the adjacent walking surface, ~~adjacent fixed seating~~ or the line connecting the leading edges of the treads.

**Exceptions:**

1. *Guards* on the open sides of stairs shall have a height not less than 34 inches (864 mm) measured vertically from a line connecting the leading edges of the treads.
2. Where the top of the *guard* also serves as a handrail on the open sides of stairs, the top of the *guard* shall not be less than 34 inches (864 mm) and not more than 38 inches (965 mm) measured vertically from a line connecting the leading edges of the treads.

**Reasons:**

**Davidson:** This proposal deletes the term “adjacent fixed seating” from the rules on guards. The term “fixed seating” is not defined. This makes the intent ambiguous and unclear. This will result in a lack of uniformity. There is no evidence to suggest that this rule serves any purpose or that it corrects any problems. There was never any evidence submitted that there is a problem.



The intent of the current language could result in guards being five or six feet in height. Designing a guard to meet the load requirements at the top of such a guard will result in significant attachment concerns because the current load requirements were based on the assumption that the guard would only be 36 inches high and the code requires that the design load for guards be at the top. This code requirement is unreasonable because compliance with the rule will be extremely expensive yet provide little increase in safety over the previous rules.

Furthermore, it penalizes designs using fixed seating all the while ignoring chairs and other furniture than can be easily pushed next to a guard creating the same potential circumstances. If we really wanted to address a safety hazard, we would require self closing gates be installed across all stairways to prevent children from falling down stairs which is a much more frequent occurrence.

To avoid expensive and unintended design costs and to avoid confusion and a lack of uniformity of enforcement, this term must be deleted. It is reasonable to delete the term because the current language in the code has not been shown to cause unsafe conditions.

**Thomas:** This change is to delete the requirement to extend a guard 36 inches above the surface of fixed seating. The same requirement was deleted out of the 2012 IBC. Subsequent attempts to put it back in the 2015 IBC failed in Portland. This proposal will make the two codes consistent with each other in this area.

The original requirement was lumped in a larger change that was made to the guard provisions in the code. There was no technical justification to raise the height of the guard at the back of fixed seating. There was also no definition of what fixed seating is. This should never have been put in the IRC in the first place.

We feel that this requirement is over-restrictive. The responsibility of keeping children from climbing on the back of a deck bench or some type of landscape wall should not be placed on the code. At some point, parents need to be responsible for their children. Raising the height of the bench back rest to a height of 54 inches above the deck will not prevent children from climbing over and falling.

**Cost Impacts :**

**Davidson:** None

**Thomas:** This will reduce the cost of construction.

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