ATLAS SAFETY & SECURITY DESIGN, INC.

Part 1 of 2

Code Changes Affect Stair Design: Watch Your Step

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By Randall Atlas, Ph.D., AIA, CPF
Atlas Safety & Security Design, Inc.
Miami, Florida

This article is the first in a two-part series of updated information on changes in the building code governing the design of stairs, handrails, ramps and steps. This information was last published in Florida Architect in 1987, prior to code changes.

Falls are the second leading cause of accidental death in the United States. Only motor vehicle accidents kill more people. In 1988, there were over 12,000 people killed in falls or about 12% of the accidental death total. Of these, 6,500 people were killed in falls around the home and 5,500 deaths occurred in public places. There are more than 300,000 disabling injuries in work-related falls each year according to a 1989 report by the National Safety Council.

Loss of footing is usually the primary event involved in a fall, with loss of balance or losing grip on an object as secondary events. More than 80% of the falls occurred while the worker was descending a stairway, according to the U.S. Bureau of Labor

Statistics. As a result of the frequency and devastating effects of slip and fall injuries, the 1988 codes have updated their requirements for user safety.

An analysis of the National Building Codes: BOCA, the Building Owners and Code Administrators 1989; UBC, Uniform Building Code 1988; SBC, Southern Building Code 1988; SFBC, South Florida Building Code 1988; and LSC, Life Safety Code 1988 reveals the variations in risers and treads for stairway construction.

1) There shall be no variation exceeding 3/16 of an inch in the depth of adjacent treads or in the height of adjacent risers and the tolerance between the largest and smallest riser or between the largest and smallest tread shall not exceed 3/8 of an inch.

2) SBC stair treads less than 10 inches shall have a one inch nosing on the overhang.

3) For existing stairs, the maximum riser heights for Class A and B are 7 1/2 and 8 inches, respectively.

4) For existing stairs, the minimum tread depth for Class A and B are 10 and 9 inches, respectively.

Despite some minor variations between codes, the established standards provide the necessary critical dimensions that are required for safe use of stairs. The first point in designing a safe and compliant stair and ramp is to understand and meet the locally applicable code requirements. A well-designed and properly-constructed stair system will have hand rails on both sides of the steps which are elevated 34 to 38 inches above the nosing of the tread. This is an increase of 4 inches over earlier codes. Tread surfaces should have a static anti-slip coefficient of friction of at least 0.50.

Stairs should have uniform height and have a minimum of ten risers per flight. Landings should have an effective depth at least equal to the width of the stairs. Stairs with one, two, or three risers must have a wider tread of 13 inches and be designed more stringently (LSC, 1988) than normal stairways.

Stair designers should keep in mind the possibility that a stair, originally designed without a resilient covering, may someday be carpeted, thereby significantly reducing the effective tread depth of the steps. Designing such stairs to provide slightly more than the minimum required tread depth is especially prudent in these cases. In addition, those responsible for maintaining stairs should keep in mind that the addition of resilient coverings may reduce the steps' tread dimensions to below the standard, and this will be made even worse if the coverings are not installed and maintained to be tight to the underlying steps.

Floor coverings, whether rugs or hard surface materials, should be avoided if they have busy patterns or they produce optical illusions, especially when people with weakened eyesight will be using the area. It is recommended that a subtle or solid light-colored floor covering is safest. Obstructions can be seen more easily on this type of surface. Do not use dark carpeting on stairs because dark colors obscure the shadow cast by the step and make it difficult to judge where to place one's foot on the next riser.

It is further recommended that carpet specifications include mention of non-skid backing for area rugs. Tacks or double-faced tape can be used. If ceramic tile is used, specify those with slip-resistant glazes.

Slip and fall accidents often occur in transition zones between carpet and highly-buffed floors because of the change in coefficients of friction and texture. Thus, care must be taken in areas where surface textures change. Standards for coefficients of friction do not exist in the Southern Building Code, Uniform Building Code, BOCA code, or Life Safety code. Thus, an architect must use national standards from the National Bureau of Standards, American National Standards Institute, or the American Society of Testing Materials.

Part 2 of 2

Code Changes Affect Stair Design: Watch Your Step

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By Randall Atlas, Ph.D., AIA, CPF
Atlas Safety & Security Design, Inc.
Miami, Florida

This article is the second in a two part series on important changes in the building codes which affect the design of stairs, handrails, ramps, and steps.

Ramp fall accidents represent only about ten percent of slip and fall accidents. Ramp

accidents are increasing because many other buildings are being equipped with ramp systems and most new buildings have them at front entrances and at level changes on the interior.

Ramps accessible for the physically handicapped should have a maximum slope of 1 in 12 or approximately 5% grade. The slope should not vary between landings, with the landing being level. Directional changes should occur on the landing. Changes in elevation in areas constituting part of a means of egress shall be by stairs or by ramps (SFBC 1988, 3102.lc). Changes in elevations of 12 inches or less may be either ramps or stairs, provided that where a stair is to be used it shall be made more noticeable by methods such as the installation of prominent handrails, special markings, and special lighting. This is a change from the earlier codes. Furthermore, changes in elevation between 12 and 21 inches shall be by ramps.

The NFPA 101 Life Safety Code 1988 Edition section 5-1.6 now permits stairs to have fewer than three risers. However, they must meet even more stringent requirements than those for other stairs because of the record of accidents. Single risers and two-riser combinations must be designed more carefully, and hence the requirement for a larger minimum tread size of 13 inches.

Means of egress such as landings, balconies, corridors, passageways, floor or roof openings, ramps, aisles, porches or mezzanines that are more than 30 inches above the floor shall be provided with guards to prevent falls over the open side. Stairs that are provided with handrails need not be provided with guards.

The height of the guards shall be measured vertically to the top of the guard from the surface adjacent thereto. Guards shall not be less than 42 inches high. However, guards within dwelling units may be 36 inches high. Open guards shall have intermediate rails or an ornamental pattern such that a sphere six inches in diameter cannot pass through any opening.

Handrails shall not be less than 34 inches nor more than 38 inches above the surface of the tread, measured vertically to the top of the rail from the tread at the leading edge. Existing handrails shall not be less than 30 inches nor more than 38 inches above the upper surface of the tread, measured vertically to the top of the leading edge.

A clearance of at least 1 1/2 inches between handrail and wall is required to which fasteners shall be provided for new handrails. (Life Safety Code, 1988). Handrails shall have a circular cross section with an outside diameter of at least 1.25 inches and not greater than 2 inches.

SUMMARY

Architects have always used stairways and handrails as a creative and aesthetic design detail. If the handrail is not designed for the closing human hand, it poses a liability risk despite its aesthetic contribution. If the stairway or level change is not designed to alert the user to a difference in surfaces and heights and the materials chosen don't provide sufficient friction to resist loss of balance, it poses a liability risk.

Design details can contribute to significantly reducing the opportunity for stairway accidents by:

- Directing attention to the presence of the stairway or level change
- Focusing attention on the stairs and ensuring that the steps are clearly defined
- Providing handrails for support and assistance, and balustrades to prevent falls from the stairs
- Avoiding features likely to lead to the misuse of the stairway by children
- Avoiding increasing the hazards of stairs by requiring decoration and maintenance above the stairs
- Providing the quality and quantity of lighting for the stairs to be clearly visible.

Injury to the building user can be a liability issue for the architect, and preventative steps should be taken to reduce and limit exposure. Stairs, ramps, and walkway surfaces should meet all applicable codes and national standards. It may also be necessary to enclose operational directions on materials that are specified. For example, if a floor surface is not meant to be buffed or waxed, it should be so indicated. Even if all good measures are taken, there is no guarantee that injury and ensuring litigation will not occur. However, the issue of negligence and standard of care will be more sympathetic to the responsible architect.

(from Florida Architect Journal, January/February, 1990)