The Commonwealth of Massachusetts
STATE BOARD OF BUILDING REGULATIONS AND STANDARDS
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October, 1989

AFTERMATH OF A COLLAPSE

In recent years there have been numerous examples of structural failure in buildings throughout our nation. The most current instance is, of course, the collapse of the roof at the West Roxbury YMCA. As building officials we feel the effects of such a tragedy even more than the general public. Surely, all are saddened by such an event, but we are angered as well. How could such a thing happen?

Well, there have been many theories tossed about in the past few days, ranging from failure due to excessive snow and rain loads to possible miscalculations during the design stage. It appears that the cause may have been corrosion of the reinforcing steel contained within the concrete plank construction due to the absorption of chlorine vapors. Apparently this condition is suspected to have caused problems in other indoor swimming facilities in the Commonwealth and elsewhere. The chlorine used in the water purification system makes the structure susceptible to corrosion.

Unfortunately, this is a condition that does not readily present itself to naked eye. Testing would need to be performed in order to determine its existence. In accordance with Section 104 of the Code it is the responsibility of the owner to conduct such investigations. Specifically, Section 104.2 states that: "The owner, as defined in Article 2, shall be responsible for the safe and sanitary maintenance of the building or structure...". Although the Code does not cite an inspectional program as part of this criteria, it is a sound practice to follow.

The Code further directs the reader, under Section 841.1 "...to conform to the requirements of ACI 318..." in crafting reinforced concrete structures. This document is specific to the minimum design standards for reinforced concrete; identifying depth of concrete coverage for steel reinforcing in particular situations, maximum percentages of admixtures to the concrete, etc.. It is not, however, the intention of this manual to speak to matters of upkeep or maintenance.

Thankfully, the YMCA has agreed to test all of their locations housing swimming pools to avoid any future disasters. In fact, they plan to conduct structural inspections on a yearly basis. We certainly commend such actions, but we cannot merely dismiss this event as a lesson learned. Luckily, there were no fatalities from the accident, as the potential for loss of life was there. We need to prevent such happenings, not merely learn from them.

In this case, there was not much a building official could have done. The problem, as mentioned, was maintenance not Code related. The matter does, however, illustrate the importance of inspection, both during the construction process and throughout the life of the structure. Possibly, with a scrupulously followed maintenance and inspection schedule, the tragedy could have been averted.

COLLAPSE - CONTINUED

We hope we will not experience a repeat performance of this type. If, in the unfortunate event something similar were to occur, such as a collapse, construction accident or other serious problem, there are procedures that building officials need to observe. First, the local inspector should respond to the situation in a timely fashion to address any issues involving potential code violations. Next, he should advise either the state inspector for the district immediately, or should directly inform the State Board of Building Regulations and Standards. We ask that all inspectors take these steps particularly if someone is injured as a result of the accident. Working together, we can assist the local building official in such a situation, and can also investigate whether or not the accident is indicative of a need to change our codes.

It is our most sincere wish that this is a directive which you will never need to follow. However, when these unfortunate situations do arise, your help and input as building officials is essential.

NOVEMBER PUBLIC HEARING

The State Board of Building Regulations and Standards will hold its regular November Public Hearing on November 28, 1989 at One Ashburton Place, Boston, MA 02108, beginning at 1:00 pm. The Board will hear testimony on petitions to amend the State Building Code. The Board will also take testimony from the public on any provisions of the State Building Code, although the law only permits the Board to enact changes which were filed and available for public examination at least sixty (60) days in advance of the hearing. Copies of the filed petitions may be examined at the Board's offices in Room 1301, One Ashburton Place between the hours of 8:45 am and 5:00 pm, Monday through Friday. Persons wishing to file written statements or arguments concerning any of the petitions must do so at the Boards office no later than the hearing date. We encourage building officials and all other interested parties to attend the November Public Hearing.

CHANGE IN LEGISLATION

Please be aware of the following amendments to the Massachusetts General Laws, Chapters 306 and 330, respectively:

1.) **AN ACT FURTHER REGULATING THE INSTALLATION OF AUTOMATIC SPRINKLERS**

Section 26A 1/2 of chapter 148 of the General Laws, as appearing in the 1988 Official Edition, is hereby amended by striking out the first paragraph and inserting in place thereof the following paragraph:

Every building or structure of more than seventy feet in height above the mean grade and constructed prior to January first, nineteen hundred and seventy-five, shall be protected with an adequate system of automatic sprinklers in accordance with the provisions of the state building code; provided , however, that sprinklers shall not be required to be installed in patient rooms in hospitals, or in public or private libraries, or in houses of religious worship; provided, further, that sprinklers shall not be required to be installed in buildings where construction has commenced prior to January first, nineteen hundred and seventy-five and which have been submitted to the provisions of chapter one hundred and eighty-three A; and provided, further, that automatic sprinklers shall not be required in rooms or areas of a telephone central office equipment building when such rooms or areas are protected with an automatic fire alarm system.

2.) **AN ACT RELATIVE TO AUTOMATIC SPRINKLER SYSTEMS**

Section 26H of chapter 148 of the General Laws, as appearing in the 1988 Official Edition, is hereby amended by adding the following paragraph:

Any lodging or boarding house subject to the provisions of this section shall be equipped with automatic sprinklers within five years after acceptance of this act by a city or town.

THE TEN MOST COMMON VIOLATIONS IN NEW HOME CONSTRUCTION

These days it seems that there is a top ten for everything. The music industry has its top ten countdown each week, television has its top rated programs, so it seemed only fitting that we at **CODEWORD** should develop our own top ten list. Here it comes, as voted for by a select group of our very own state inspectors in a very mini-survey, they are:

1. **Size and depth below grade of footings at decks.** Section 2102.3.4 specifies that: "Footings of adequate size shall be provided when necessary to properly distribute the load within the allowable bearing pressure of the soil. All permanent supports of buildings and structures shall extend a minimum of four (4) feet below finished grade ..."

   Possibly the term "when necessary" is the confusing language. The fact is, that decks are "structures" and must be treated as such for code purposes. It is important to note that whether or not a footing is needed to achieve adequate soil bearing capacity, the permanent support must extend **at least** four (4) feet below grade.

2. **Notching of structural members to allow passage of utility lines.** Section 2103.2.5 outlines the allowable standards for notching structural members stating: "It shall be unlawful to notch, cut or pierce wood beams, joists, rafters or studs in excess of the limitations herein specified unless proven safe by structural analysis, or suitably reinforced to transmit all calculated loads."

   The dangers of excess cutting are apparent. Unfortunately, because of the nature of home building, sufficient care is not always taken in the design process to allow for the passage of necessary utility lines.

3. **Clearance of structural members from outside face of fireplace.** Section 2108.3.3.1 states: All wood beams, joists and studs shall be trimmed away from chimneys. Headers, beams, joists and studs shall not be less than two (2) inches from the outside face of a chimney or rom masonry enclosing a flue."

   Again the dangers of having combustible materials too close to these surfaces are apparent. The proper construction of a masonry chimney is an art which is difficult to master. Regardless of the beauty of the structure, safety must be the foremost concern.

4. **Heights of railings at stairways.** According to Section 615.5.1.1 and reiterated in Section 2101.11 "Handrails shall not be less than thirty (30) inches, nor more than thirty-four (34) inches measured vertically, above the nosing of the treads."

   Many confuse the requirements of these sections with that of Section 2101.11.1 which specifies: "Porches, balconies or raised floor surfaces located more than thirty (30) inches above floor or grade below shall have guardrails not less than thirty-six (36) inches in height."

5. **Venting rafter spaces.** Sections 507.2.4 and 2121.1.3 states: "... adequate baffling shall be provided to deflect the incoming air above the surface of the insulation. Baffles shall be installed prior to insulation , and shall be installed over the exterior at an angle to provide a two (2) inch minimum clearance under the roof deck for upward flow of ventilation air to the fixed vents in the upper portions of the attic."

   With the institution of more stringent energy code requirements for roof-ceiling insulation, proper ventilation becomes an even more important part of home construction. Without adequate air flow, condensation, mildew and a host of related difficulties can cause severe problems in areas above insulated spaces.

TEN MOST COMMON VIOLATIONS - CONTINUED

6. **Omission of required perimeter drains.** Section 2102.5 states: "Drains shall be provided around concrete and masonry foundations enclosing habitable or usable spaces located below grade and which are subjected to ground water conditions."

   In order to be relieved from this requirement, documentation must be presented to show the area is not subjected to groundwater conditions.

7. **Shingling of flat roofs.** Sections 2107.3.2, 2107.5.2 and 2107.9.3 dictate the use of shingle installation with respect to roof pitch. In short, "Composite shingles shall not be installed on a roof having a pitch of less than four (4) inches in twelve (12) unless approved by the building official" or "... are installed over an underlayment of not less than fifteen (15) pound felt." And "asbestos cement roofing shall not be installed on a roof having a slope of less than three (3) and twelve (12) unless approved by the building official."

   This condition appears to be more of a problem with porches and additions where shallow pitch roofs are common.

8. **Omission of foundation anchor bolts.** Section 854.5 requires 1/2" minimum diameter anchor bolts to "be embedded in foundations to a depth of not less than eight (8) inches poured in place concrete, and not less than fifteen (15) inches in grouted unit masonry. There shall be a minimum of two (2) anchor bolts per section of plate and anchor bolts shall be placed twelve (12) inches from the end of each section of plate with intermediate bolts spaced a maximum of eight (8) feet on center."

9. **Misuse of energy code requirements, specifically foundation walls and basement slabs on grade.** Table 2009.1 specifies that foundation walls and slabs on grade beneath conditioned spaces shall maintain an R-value of 12.5 and 10 respectively.

   Various methods may be employed to achieve the desired R-value for foundation walls, ie: furring-out interior wall areas and providing adequate batt insulation, or installing rigid insulation on the exterior of the foundation wall. The thing to keep in mind is that a continuous seal must be developed. Often times individuals will omit insulation in certain areas thinking it will not make much of a difference. This is particularly true when insulating the outside face of the wall because of the area left exposed above the grade line. To relieve this unsightly condition and to protect the insulation, many manufacturers recommend covering the insulation with a decorative layer of stucco or some other similar material.

   There are many common errors in construction that relate to this topic. For instance, Section 2006.4.6.1 calls for "Perimeter insulation for slab on grade construction in buildings of Use Group R of three stories or less shall be installed so that the concrete to concrete contact between the foundation wall and the floor slab is broken and the insulation extends four (4) feet vertically down from, or four (4) feet horizontally beneath, the floor slab." The key language here is slab on grade. Many apply the requirements of this section to an excavated basement floor slab which is a different condition.

   An important feature of this section is the concrete to concrete contact. As in an aluminum window system it is important to provide a thermal break between like materials. To maintain a monolithic substance is to allow for the transmittance of heat and cold freely along this path. By breaking this path, however, we reduce the flow.

   Some additional requirements that are often overlooked are; the proper insulation of stairway walls leading to basements, proper choice and installation of basement doors and the appropriate placement of vapor barriers in floor construction.

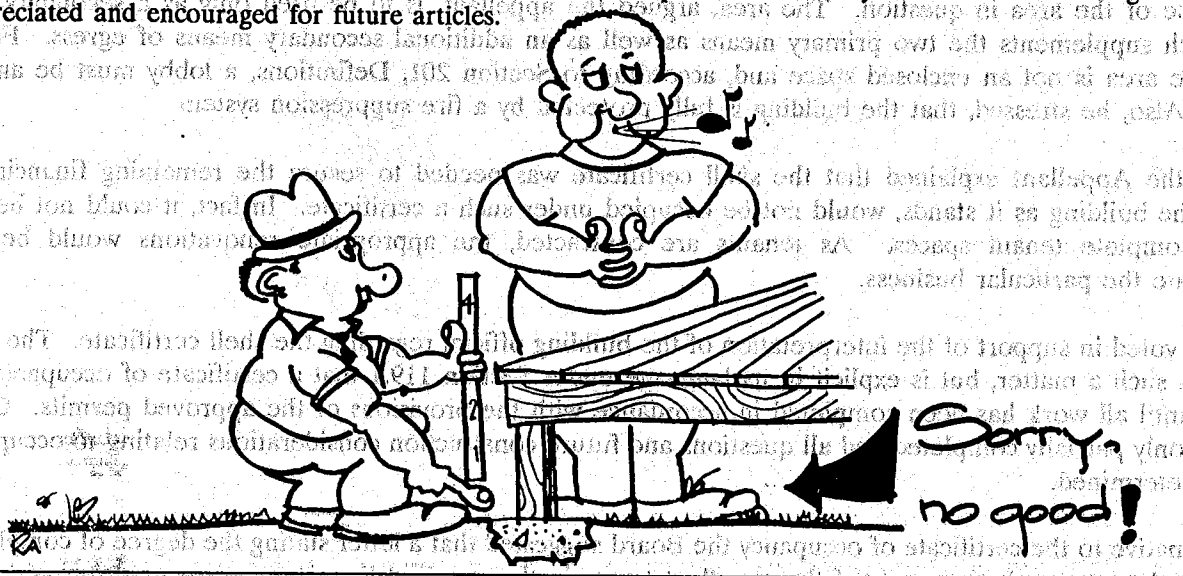
TEN MOST COMMON VIOLATIONS - CONTINUED

In order to create a truly energy efficient structure the entire building must be properly insulated. The basement area has traditional been a neglected space when it comes to this issue. It is time to correct this flaw.

10. **Fire stopping at stairways.** Section 2103.2.7 states: "Firestopping shall be installed to cut off all concealed draft openings (both vertical and horizontal) and form an effective fire barrier between stories, and between a top story and the roof space. ... in walls parallel to stair stringers."

This area is often overlooked, but is one of the most critical areas in need of firestopping.

We would like to thank all the building officials who took part in this survey. Your assistance is greatly appreciated and encouraged for future articles.



MODEL CODES APPLY TO FEDERAL BUILDINGS

September is not only a month which brings a change of seasons, it also begins the change of building regulations regarding federally owned structures. Starting this month, any federally owned building constructed or altered must comply with **s. 2186 "Public Building Amendments of 1988".**

The provisions of the new law require "each building constructed or altered by the General Services Administration (GSA) or any other federal agency shall be constructed in compliance with one of the nationally recognized model building codes and other applicable nationally recognized codes.

The Model Codes shall be used for regulating building, fire, safety, electrical and plumbing requirements. Local officials do not have any enforcement authority over federally owned buildings. However, the new law does instruct federal agencies to allow for local government consultation, review, inspection and recommendations to the federal agency head regarding construction of federally owned buildings.[1]

[1] Excerpted from the Codes and Standards as published by Kelly P. Reynolds & Associates, Inc., Volume VII, Number III, March 1989, Cover Story.

RECENT STATE BUILDING CODE APPEALS BOARD DECISIONS

Section 127.7.11 (Contents of Decisions) of the code states, "Any decision shall not be considered by any person or agency as a precedent for future decisions."

Appeal Docket # 88-61

The building official refused to issue a "shell certificate of occupancy" for a two story office building citing a violation of Section 611.3 of the building code. The official, upon review of the plans, determined that the perceived lobby of the building need be protected by automatic fire suppression system.

Although the Appellant did not dispute the requirements of Section 611.3, he felt the inspector had misinterpreted the intended use of the area in question. The area, argued the appellant, is to be used only as a secondary means of egress which supplements the two primary means as well as an additional secondary means of egress. Further, he claimed, the area is not an enclosed space and, according to Section 201, Definitions, a lobby must be an enclosed vestibule. Also, he stressed, that the building is fully protected by a fire suppression system.

In closing the Appellant explained that the shell certificate was needed to secure the remaining financing for the project. The building as it stands, would not be occupied under such a certificate. In fact, it could not be occupied due to incomplete tenant spaces. As tenants are contracted, the appropriate renovations would be made to accommodate the particular business.

The Board voted in support of the interpretation of the building official regarding the shell certificate. The code does not address such a matter, but is explicit in its language under Section 119.1 that a certificate of occupancy may not be issued until all work has been completed in accordance with the provisions of the approved permits. Clearly the building is only partially completed and all questions and future construction considerations relating to occupancy have yet to be determined.

As an alternative to the certificate of occupancy the Board suggested that a letter stating the degree of compliance with the code to date may suit the needs of the appellant to attain the required financing.

Appeal Docket # 88-78

The building official rejected the design for a supply air system in the atrium of a seven story hotel citing a failure to comply with Section 437.2.1.2. This section specifies that in atriums in excess of fifty-five feet (55'-0") in height , "supply air shall be introduced mechanically from the floor of the atrium and shall be directed vertically at the exhaust outlet above. The capacity of the supply shall be seventy-five (75) percent of the exhaust."

The Appellant, a mechanical engineer, argued that, although the structure is sixty-five (65'-0") in height and in excess of 600,000 cubic feet of volume, his system of allowing supply air at the grade floor by gravity would be sufficient. He also expressed concern for the possibility of mechanical registers at the floor becoming blocked by flood water or misplaced accessories.

The building official agreed that the design appeared to be adequate, but argued that because it did not comply with the referenced section, he could only reject the design.

The Board, too, found the system to be in violation of Section 437.2.1.2. However, the Board felt the appellant had provided an adequate alternative for supplying air for smoke control in this instance and thus voted to grant relief from this requirement. As a requisite of the decision, the appellant is to furnish the supply and exhaust calculations to the building official to verify the necessary four (4) air changes per hour and to conduct a smoke test to ensure there is not any smoke migration from the atrium to other areas within the building.

CODEWORD

This issue's CODEWORD is **required stair width** as it pertains to Section 616.0 INTERIOR EXITWAY STAIRWAYS. The term as a whole is not defined in the Code. Referring to standard dictionary definitions and combining the words to create one meaning appears easy enough. Yet, as we explore its application to the Code, a seemingly simple term becomes clouded.

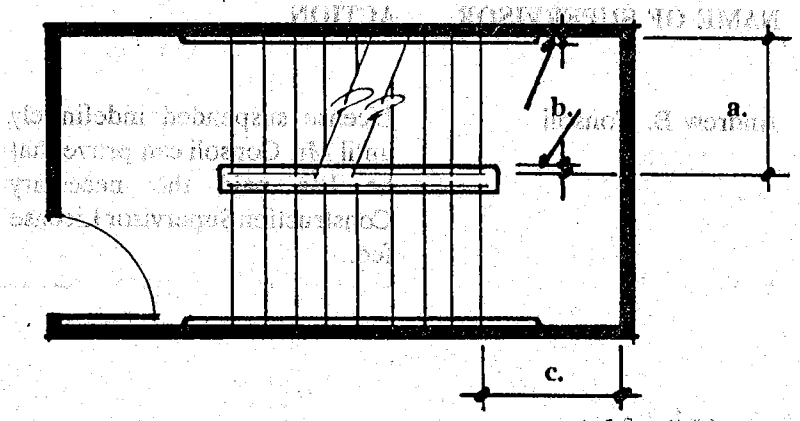
Section 616.2.1 requires: "All interior exitway stairways shall be not less than forty-four (44) inches in width, except that such width may be reduced to thirty-six (36) inches when serving an occupancy load of fifty or less." Although not directly stated, the **minimum required width** in each of these cases are 44" and 36" respectively.

The minimum dimension as well as the actual **required stair width** is based on a number of factors as presented in Section 608.1 and Table 608. Turning to these areas we find the approved unit of exit width to be twenty-two (22) inches. The minimum stair width dimension consists of two of these units. Realistically, most buildings house more occupants than can exit through the minimal stair width. For example, a stairway in an Assembly Use serving 225 individuals in a building without a fire suppression system would need a width of sixty-six (66) inches (75 occupants per unit of egress width, or 22" x 3 = 66"). In this case 66" is the **required stair width.**

Again this all seems fairly simple. However, there is more. Section 616.2.3 states: "Stairways shall not reduce in width in the direction of exit travel. Projections into a stairway are prohibited except for handrails as indicated in Section 616.5.1 and for stringers which may project not more than one-half (1/2) inches. Further, Section 616.5.1.1 states: "Handrails may project not more than three and one-half (3 1/2) inches into the required stair width."

Mistakenly, many believe the minimum required width is the result of the equation; required stair width (44") minus the seven (7) inch allowable projection (3 1/2" on each side) which equals 37. This dimension is often termed, clear width between rails. The term, although technically accurate, does not bear any meaning within the Code. The required stair width remains as forty-four (44) inches, measured from wall to wall (or edge of stair pan in a reversing stair, as shown).

The following sketch illustrates a stair (including the landing) in conformance with these sections.



LEGEND

a. Required Stair Width

b. Allowable Handrail Projection

c. Required Landing Width

While on the subject, an oft confused area is the text of Note 1., Table 616 which reads: "Within any flight of stairs, a three-sixteenths (3/16) inch minimum variation in riser height or tread width is permitted." The discrepancy is allowed per tread and or riser, not over the entire flight. That is, in a stairway with a required tread width of x, the actual width of any individual tread may be as great as (x + 3/16) or as little as (x - 3/16).

TERMS OF THE TRADE

Every profession tends to have terms that are peculiar to their field. The construction and architectural communities are particular examples. Often times, when confronted with such terms, either written or orally, we tend to skip over them as if they do not exist. If, for example, while perusing a National Geographic magazine the word archaeopteryx popped up, we merely jump to the next sentence. Chances are we will never come across the term again, so why bother with its meaning. However, as professionals dealing with architects, engineers and construction project managers on a regular basis, we should be familiar with their "jargon". To aid in this process, we at **CODEWORD** will examine the definitions of certain words and phrases as they relate to these industries.

This issue's term of the trade is **rustication strip.** As defined in the Construction Glossary, by J. Stewart Stein, AIA, FCSI it is a "strip of wood or other material attached to a form surface to produce a groove (or rustication) in concrete." This term often is used throughout the architectural design process of a concrete structure and may come up at the job site as well. The resultant groove is decorative in nature.

By the way, archaeopteryx is an extinct primitive bird of the genus Archaeopteryx, of the Jurassic period, having lizardlike characteristics and representing a transitional form between reptiles and birds.

CONSTRUCTION SUPERVISOR'S LICENSES REVOCATIONS AND SUSPENSIONS

On September 26, 1989 the Board of Examiners of the State Board of Building Regulations and Standards convened to hear testimony and to vote on the recommendations of the Board of Survey. The results are as follows:

LICENSE NUMBER	NAME OF SUPERVISOR	ACTION
045593	Andrew B. Consoli	License suspended indefinitely until Mr. Consoli can prove that he has paid the necessary Construction Supervisor License fee.

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