CODEWORD©

THE OFFICIAL NEWSLETTER OF THE BOARD OF BUILDING REGULATIONS & STANDARDS

~October 1999~

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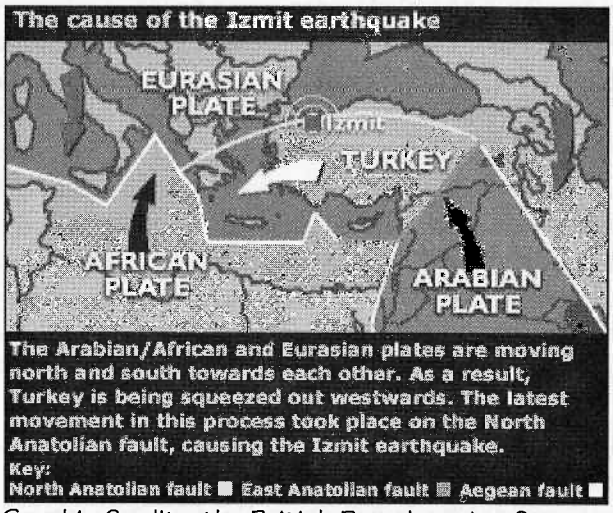
EARTHQUAKE IN TURKEY RAISES CODE AND EMERGENCY RESPONSE ISSUES

by Brian Gore, P.E. Technical Director

A Toppled Building Underscores the Devastating Effects of an Earthquake
(Photo credit United States Geological Survey (USGS))

On Tuesday 17, August 1999 a powerful earthquake measuring 7.4[1] on the Richter scale struck Turkey. The earthquake epicenter was approximately 11 kilometers[1] south east of the city of Izmit (population approximately 500,000) at a depth of approximately 17 kilometers[1] below the surface of the earth. Coupled with the magnitude of the earthquake, its shallow location produced devastating effects. The Turkish landmass is a small tectonic plate being continually squeezed by the movements of the huge Eurasian, African and Arabian plates. As a result, Turkey is moving westwards towards the Aegean Sea. Periodic movements due to earthquakes occur along two main faults, the North Anatolian Fault and the East Anatolian Fault which are both "strike/slip" faults in which tectonic plates slide past each other horizontally.

The Izmit earthquake occurred in the North Anatolian Fault, the site of 11 previous earthquakes of over 6.7 magnitude since 1939. The last earthquake occurring on the East Anatolian fault was a magnitude 6.3 in June 1998, which killed 144 people.



Graphic Credit - the British Broadcasting Company (BBC) - Online News

Although most of the World's developed countries have building codes which incorporate design and construction requirements to resist lateral loads and shaking resulting from earthquakes, the largest single problem in earthquake prone areas continues to be the existing buildings constructed before today's seismic design standards were in place.

In 1990 the Massachusetts Emergency Management Agency (MEMA) commissioned a study known as the

"Boston Loss Study" whose purpose was to assess the effects of damage from an earthquake to the Boston Metropolitan area based on the largest probable anticipated earthquake for this area.

Massachusetts has experienced sizable earthquakes in the past-1727 Newburyport (5.5) & 1755 Cape Ann (6.0). The study earthquake selected was a 6.25 magnitude earthquake epicentered in the Atlantic Ocean, off Cape Ann an entirely probable scenario according the study report.

In the 200 plus years following the Cape Ann earthquake Boston and its environs has undergone significant development - much of it without the incorporation of the construction techniques associated with modern seismic design provisions. The report concluded that possible damage estimates would be between $2 billion and $ 10 billion dollar and that many deaths could be expected.

The study included a recommendation that the BBRS investigate the further development of the State Building Code to include adequate seismic requirements for existing buildings. The BBRS Seismic Advisory Committee spent the next two years in the development of regulations which could be applied to existing buildings to increase their seismic resistance in the event an earthquake should strike Massachusetts. The BBRS adopted the regulations in the sixth edition of the building code and to the best of our knowledge Massachusetts is the first state in the country to take this proactive approach to strengthen its seismically vulnerable buildings.

Following the earthquake questions were raised relative to the preparedness and government response to the event and to the building practices and construction oversight.

In 1995 the BBRS, in conjunction with the Massachusetts Emergency Management Agency provided training to the State's Building Officials on "Post Earthquake Damage Assessment of Buildings".

This training was based on a document published by the Applied Technology Council entitled ATC 20, *"Post Earthquake Safety Evaluations of Buildings"* which provides systematic guidelines on the evaluation of the structural condition of a building following an earthquake. The ATC 20 guidelines comprise of an educational component which describes various building structure type and how they resist lateral loads together with methodologies on initial evaluation of the structural safety of buildings following an earthquake.

The principles of this training were immediately implemented following the Great Barrington Tornado of May 29, 1995 when a number of state and local building officials were mobilized by MEMA to assist in the post tornado damage assessments.

(1) United State Geological Survey (USGS)

EAST QUABBIN AREA BUILDING OFFICIALS HOST SPAN TABLE SEMINAR

On August 12, 1999 District State Inspector David Holmes and the East Quabbin Area Building Officials of District 6 hosted a seminar entitled *"How to Use the Span Tables"*. The seminar was given by Brian Gore, P.E., Technical Director of the BBRS. Over 20 building officials attended the seminar and each attendee received 2 hours of continuing education credits towards maintenance of building official certification.

If you are a building official or builder and wish to host a seminar please contact the BBRS at (617) 727- 3200 extension 25214. Seminars will be held to accommodate the audience. Cost to builders is a modest $20.00 per person - come and learn how to effectively use the joist and rafter span. The only requirement is that the sponsor locates and secures a suitable facility and to co-ordinate the registrations through the BBRS.

BBRS DEVELOPING BUILDING OFFICIAL PROCEDURES MANUAL

BBRS Staff is in the final stages in the preparation of a Building Official's Operations and Procedures Manual.

The manual includes a commentary on Chapter 1 requirements and a series of standard forms which are intended to provide municipal building departments the administrative tools necessary to effectively administer the code thereby leading to a greater level of uniformity throughout the state,

The BBRS staff is planning a series of two-day seminars early next year to introduce the manual.

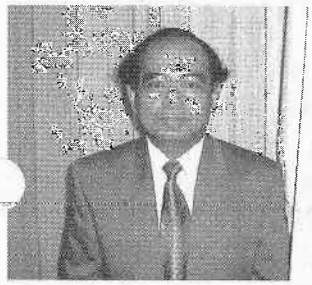
REMINDER TO CONSTRUCTION SUPERVISOR LICENSE HOLDERS

The grace period to renew a Construction Supervisor License is ONE YEAR from the date of expiration - see Massachusetts State Building Code R5.2.4. Any license, which has expired for ONE YEAR or more, becomes invalid and the license holder must take or retake the construction supervisor license examination before a new license can be issued.

It is the license holder's responsibility to inform the BBRS of a change in address as renewals are mailed prior to license expiration. If we do not have your current address you will not receive a renewal.

Remember that your construction supervisor's license expires ON YOUR BIRTHDAY.

BBRS MEMBER PROFILE ASESH K. RAYCHAUDHURI, P.E.



This edition of *Codeword* profiles BBRS member Asesh Raychaudhuri, P.E. Asesh was appointed to the Board as the Registered Professional Mechanical Engineer member in 1996. In addition to his regular duties at the BBRS Asesh also serves on the State Building Code Appeals Board.

Asesh earned his Master of Science degree in Mechanical Engineering from the University of Birmingham, England and his Masters in Business Administration from North Eastern University, Boston.

Asesh is a registered professional mechanical engineer and is employed by Sverdrup Corporation in Boston. Asesh is also a part time faculty member at Northeastern University.

Asesh is a member of the American Society of Heating Refrigeration and Air-conditioning Engineers (ASHRAE) and the Association of Energy Engineers (AEE). He is an active participant in ASHRAE meetings and has presented numerous seminars at the society's annual meetings.

In his spare time Asesh enjoys playing tennis and swimming

EXISTING BUILDINGS - THE IMPORTANCE OF A FIELD SURVEY [1] IN THE RENOVATION OF EXISTING BUILDINGS

by Brian Gore, P.E. Technical Director

To emphasize the importance of the evaluation of an existing building by qualified professionals, consider the following real life story which recently came to the attention of the BBRS staff.

An existing mercantile building, selling clothing had been unoccupied for some time was to be leased to a major retail chain which planned to re-open the building as a large retail store selling pool chemicals, housewares, clothing, toys, guns and ammunition, aerosols, lawn fertilizers, etc. A series of renovations were planned to accommodate the new owners store plan and layout. The building was equipped with an existing sprinkler system, which was not changed during the renovations. Following renovations, the retailer installed new sales floor fixtures, storage racks and stocked and occupied the building. During the fixturing of the store, the original plan for the fixtures changed. Higher racks were used to accommodate extra storage height necessitated by the method in which the storage pallets were assembled at the retailer's distribution center. All of these goods were stored in the rear storage area in racks with storage as high as 16 feet.

Following occupancy, local officials raised concerns about the appropriateness of the existing sprinkler system. Given the facts, is this concern warranted?

Before the question can be answered it is first necessary to explain the fundamental concepts utilized in the design of a water based fire suppression system.

In order to sustain combustion, 3 elements must be present; heat, an adequate supply of oxygen and an adequate supply of fuel.

In order to extinguish a fire either the heat, oxygen or fuel must be removed or reduced to a level insufficient to sustain combustion. When water based sprinkler systems discharge, the water cools the fire (removes the heat) thereby removing one of the 3 elements required to sustain combustion. The amount of water needed to provide sufficient cooling to extinguish the fire is a function of the heat release rate of the fire which is dependant upon the type of fuel. NFPA 13 [2] (Standard for the Installation of Sprinkler Systems) categorizes

fuel loads by occupancy classification based on heat release potential and potential for total energy release. After determining the hazard classification, NFPA 13 then establishes the minimum amount of water, in terms of gallons per minute per square foot (gpm/sf) over a specified design area.

If a retail store changes ownership and commodities or changes the method of storage of goods it is possible to introduce a different heat release and total energy release rate from a fire, thereby calling into question the ability of an existing sprinkler system to control a fire.

In conclusion, the seemingly innocuous replacement of storage racks and change of commodity can, in some circumstances effect the performance of a sprinkler system to the point that the system's capability to control a fire is in serious question.

Building officials must ensure that the building survey is completed and submitted at the building permit application stage - see section 110.9 of the Massachusetts State Building Code.

(1) See related articles in *Codeword* - July 1999
(2) NFPA 13 Standard for the Installation of Sprinkler Systems - 1996 edition - National Fire Protection Association, Quincy, MA.

ENERGY CORNER

by David Weitz, Energy Code Co-ordinator

New Commercial Code Adopted

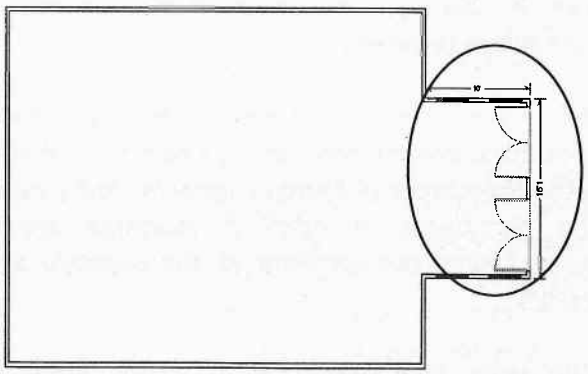
The BBRS adopted new energy conservation requirements for new construction commercial and high-rise residential buildings at their July 13 monthly meeting. The new provisions will take effect on January 1, 2001, and they represent an entire replacement of the current Chapter 13.

The change was made in order to update the stringency of the Code to reflect improvements in technology, design, and construction of buildings and energy systems since the current requirements were implemented in 1989. The new Chapter 13 is also significantly easier to use than the current one, with a clearer structure, simplified tables, and new software to demonstrate design compliance. These changes include elements from both the revised ASHRAE/IES Standard 90.1 and from the International Energy Conservation Code (IECC), as well as some requirements that are unique to Massachusetts.

BBRS will be offering training seminars on the new energy code throughout next year. Funding for these seminars comes from two sources: a U.S. Department of Energy grant that was recently awarded, and the state's gas and electric utilities, which have pooled funds to support the training plan. A total of 80 ½-day sessions will be given beginning in February, 2000. There will be three different session types focussing on the envelope, HVAC, or lighting aspects of Chapter 13. Architects, engineers, designers, contractors, and others are encouraged to attend. Building Officials are invited to attend these sessions also, and additional special trainings geared for Building Officials will be offered as well. Look for more information on trainings here, and on the BBRS website at www.state.ma.us/bbrs/energy.htm.

Residential Additions

There has been some confusion about how additions to existing residential low-rise buildings can comply with the requirements of Appendix J. Since additions are a type of new construction, a permit applicant may use any of the compliance approaches that are offered in Appendix J. (Remember that it is the applicant's choice which approach they use.) However, there is also a special compliance option that applies only to additions. This is found in Section J1.1.2.3.1, number 3, and Table J1.1.2.3.1. This section says that as long as the total glazing area of the additions (windows, skylights, glass doors, etc.) does not exceed 40% of the gross new wall plus ceiling area, then the insulation and U-factor values found in the Table are allowed. The following example will help to clarify:



This addition to an existing house is 10'x15'

15' x 10' footprint
9' wall height.
4 windows @ 3'x 5' (60 s.f.)
2 patio doors @ 6'x 6'-8" (80 s.f.)
total fenestration: 60 + 80 = 140 s.f.
gross wall area: 8 x 35 = 280 s.f.
gross ceiling: 10 x 15 = 150 s.f.
gross wall + ceiling: 280 + 150 = 430 s.f.
fenestration ratio: 140 ÷ 430 = 32%

This addition has less than 40% glazing so the applicant may use Table J1.1.2.3.1 to comply.

Table J1.1.2.3.1 - Prescriptive Envelope Criteria

Additions to Existing Low-Rise Residential Buildings

MAXIMUM U-Value	MINIMUM R-Values				
Fenestration[2]	Ceiling[3]	Wall	Floor	Basement Wall	Perimeter, Depth (slab)
0.39[2]	R-37	R-13	R-19	R-10	R-10, 4 ft

A BRIEF HISTORY OF THE RESIDENTIAL ENERGY CODE

by David Weitz, Energy Code Co-ordinator

Some Building Officials have asked for a summary of the development of Appendix J and the replacement window requirements, so here it is.

Effective Dates

When the 6th Edition of the Building Code was adopted in February 1997, it still contained the 5th Edition requirements for low-rise residential new construction, which remained in effect until February 28, 1998. On March 1, 1998, the old requirements were no longer allowed, and Appendix J became the only acceptable approach. All new homes for which building permit applications were filed after February 28, 1998 are required to meet the criteria in Appendix J.

Fenestration U-values

Although Appendix J took full effect in March 1998, it included some sunset language regarding the labeling of fenestration products (windows, doors and skylights.) From March 1, 1998 until January 1, 1999 there were three allowable ways to determine fenestration U-value: 1) NFRC listing/labeling, 2) Default Tables J1.5.3a and J1.5.3b, or 3) manufacturer's specification data. On January 1, 1999 option 3 was discontinued. The only acceptable ways to determine fenestration U-values are NFRC listing/labeling OR the default tables in Appendix J.

Alternative for Additions

Appendix J has also been amended since it was originally adopted. The most significant of these is a simplified prescriptive alternative for additions that took effect on June 8, 1998. This amended section (J1.1.2.3.1) includes a Table that lists the required minimum insulation levels and maximum window U-values. It can be used for additions only, and is limited to additions in which the total fenestration area is no greater than 40% of the combined gross wall and ceiling area. (This will include almost all framed construction.) Additions in which the fenestration is over 40% are exempt, but the homeowner must sign the *"Consumer Information Form – "Sunrooms"* before a permit is issued. (See Appendix B for the Form.) This exemption may be used only for additions with greater than 40% fenestration.

Replacement Windows

The requirements for replacement windows are found in Chapter 34, *Repair, Alteration, and Change of Use of Existing Buildings.* Section 3407 gives energy conservation criteria, and Note 2 of Table 3407 states that beginning January 1, 1999 all replacement windows in low-rise residential buildings must meet two criteria; 1) they must have NFRC listing/labeling, 2) they can have a maximum U-value of 0.44. There are some exceptions to these requirements: 1) replacement of single-pane true divided light windows with like-kind (with a storm); 2) basement windows with a unit dimension less than 24" high; 3) normal repairs. Note that the U-0.44 requirement does not apply to commercial buildings, residential buildings over 3 stories, or Use Group R-1 buildings (hotels/motels.)

WHEN APPLYING TOO MUCH CODE CAN HAVE UNINTENDED CONSEQUENCES

by Brian Gore, P.E. Technical Director

What is the effect when a builder or designer specifies a life safety device, which is not listed for the application intended? In short, the builder would have violated the Massachusetts State Building Code if the specified device were installed in a building.

Consider the design of a main carrying beam which is required to be, say 4" x 8".

If the builder uses a 4 x 10 on the basis that bigger is better, the result, in this instance, is still a safe (if overly safe) design - too much code. Applying too much code, however, does not always yield the same result.

Consider the same scenario applied to a life safety system, for example the smoke detector system in a single-family dwelling. In order to assure that smoke detectors fulfill their intended purpose - to detect products of combustion and to sound an alarm - they must satisfy criteria established by a recognized test standard. The smoke detector testing standard referenced by the Massachusetts State Building Code is ANSI/UL 217 and ANSI/UL 268.

Section 3603.16.1 of the State Building Code mandates that all such devices must be installed in accordance with manufacturer's instructions and listing criteria. The test standard is developed so that all detectors function in a similar fashion and their performance can be reliably predicted. The test standard, in effect establishes acceptable uniform criteria. When tested to the criteria established by the standard a high degree of confidence exists that all detectors pass the "sameness" test, i.e. one is assured that they all perform predictably at similar levels of smoke obscuration. It is a violation of the State Building Code to install a life safety device outside the parameters for which it has been listed - doing so invalidates the installation as there is no assurance that the device will function correctly. Moreover, devices, which are electrically (or otherwise) linked to the device, may also be affected.

In certain areas of the State, builders and homeowners have been repeatedly required to install heat and smoke detectors in residential attics or unheated garages. Heat detectors are tested and listed to UL 521.

Residential attic spaces, in summer months can reach temperatures of over 130 degrees Fahrenheit and in winter, many degrees below freezing. Typically, heat-sensing devices are not listed to operate within the typical temperature ranges experienced in residential attics. Installing such devices outside of their listed criteria is a violation of the State Building Code.

The person who installs a device outside of the parameters for which it has been listed is;

- Gambling that the product will work outside of its tested envelope.

- Gambling that the code required smoke detectors will function properly if they are also connected to a device, or devices, which are installed outside of their listing limits and, more disturbingly;

- The installer has now violated the state building code by installing a life safety device outside of its listed operational parameters. Violation of the Building Code is a criminal act punishable by a fine of up to a thousand dollars or a year in jail for each offense. Each separate day the violation exists constitutes a separate offense

For these reasons the Fire Prevention/Fire Protection Advisory Committee has advised the BBRS to RESERVE section 3603.16.4 of the State Building Code dealing with heat detectors in residential one and two family dwellings until such time as a device becomes available and is tested and listed for use in such spaces.

As a final note LOCAL AMENDMENT OF THE BUILDING CODE either as a policy or by-law is expressly prohibited by Massachusetts General Law unless the process of MGL c 143 § 98 is followed.

REMINDER TO CONSTRUCTION SUPERVISOR LICENSE EXAMINATION APPLICANTS

As of the March 11 , 2000 test administration there will be a series of questions on the examination, which will require the candidate to interpret a typical set of plans.

Examination Dates for the Construction Supervisor License Examination

Registration Deadline	Examination Date
November 12, 1999	December 11, 1999
February 11, 2000	March 11, 2000
May 12, 2000	June 10, 2000
August 11, 2000	September 9, 2000

BRIGHTON DECK COLLAPSE INJURES PARTYGOERS

During a late summer private party, a wooden 3-story deck collapsed suddenly resulting in serious injury to partygoers.

Recognizing the potential for crowding on a deck, the State Building Code requires decks to be designed for a live load of 60 psf. Particular attention should be paid to the connection of the deck to the main structure and that the support columns are adequately attached to the floor structure in order to ensure that overall stability of the deck is achieved. Particular care should be exercised in design to ensure that tall slender columns are properly designed.

The cause of failure of this deck remains under investigation at time of print.

BBRS APPROVES EMERGENCY CODE CHANGE

At its July 13, 1999 meeting the Board of Building Regulations and Standards approved an emergency code change which removes exception number 3 from section 3603.12.1 of the Sixth edition of the State Building Code. The exception will make clear that landings are required on the exterior side of all exit doors from 1 and 2 family dwellings when there is a difference in grade from interior to exterior of over 8 inches

CSL CONTINUING EDUCATION TAKES ANOTHER STEP FORWARD

At its September 14, 1999 meeting the BBRS took another step forward in requiring continuing education for Construction Supervisor License holders as a condition of license renewal. The Board requested staff to look further into the development of programs of education. - Watch this space for future developments.

HEATING APPLIANCE INSTALLATIONS IN ONE AND TWO FAMILY DWELLINGS

by Tom Riley - Code Development Manager

Chapter 36 (One and Two Family Dwelling Code) of the Sixth Edition of the State Building Code establishes the life-safety and energy conservation construction requirements for new construction one and two family detached buildings (R-4 USE GROUP).

Sections 3610 through 3617 and 3619 through 3621 of the Building Code provide criteria for heating and cooling equipment labeling, sizing and installation.

As heating appliances may be liquid or gaseous or solid fuel-fired or be multi-fuel-fired, the applicable portions of Sections 3610 through 3621 direct the reader to the proper Regulatory jurisdictions associated with the various fuel source appliances; i.e., 248 CMR (Plumbing and Gas Code) for gaseous fuel-fired appliances; 527 CMR (Fire Prevention Regulations) for liquid fuel-fired appliances and the Building Code (780 CMR) for solid fuel-fired appliances.

Although three distinct jurisdictions (248, 527 and 780 CMR) impact heating and cooling appliance installations there are certain installation criteria that are essentially common to all three Regulatory Codes.

- Manufactured equipment must be labeled and installed in accordance with the Manufacturer's listed requirements.
- Manufactured equipment will be accompanied by a Manufacturer's Installation Manual that is typically part of the listing process.
- The Installation Manual must be followed to ensure proper, safe operation of the appliance.
- Listing requirements include "allowed clearances to combustibles". If the manufacturer does not specifically list clearances, the respective codes will govern (i.e. 248,527 and/or 780 CMR).
- Listed "clearances to combustibles" should, but do not always include: top, front, back and side clearances and ideally should also include clearances below the appliance or otherwise guidance should be provided on whether or not a heating appliance can be mounted directly on combustible construction or whether it must be mounted on noncombustible construction.
- Requiring a noncombustible flooring under a heating appliance may not be sufficient since, for example, a metal pan (noncombustible) placed directly on top of a combustible floor may still allow a significant amount of heat energy to be transmitted to the combustible floor below the metal pan as metal has a relatively high thermal conductivity ("k"-Factor).
- Manufacturers should specify in the Installation Manual or via labeling, required clearances and/or specific floor protection when a heating appliance has the potential to radiate or conduct a

significant amount of heat energy into the floor on which the appliance is mounted.

- Combustion air requirements for the appliance must be satisfied. Too often heating equipment is "boxed" into a tight closet or utility room without adequate available combustion air.

- Chimney connector and/or vent connector clearances to combustibles must also be satisfied (refer to the connector pipe listing clearances or to the default clearances in 248 or 527 or 780 CMR).

- Adequate space is required around HVAC equipment to provide for repair and/or maintenance. Too often the HVAC equipment is installed too close to walls, ceilings or floors to permit repair or maintenance.

- HVAC equipment must have adequate structural support, and typically, via 780 CMR, must be appropriately insulated to minimize energy losses and in the case of attic-mounted equipment, to preclude ice damming of the roof system due to heat loss from the appliance to underside of the roof.

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Editor in Chief:	Thomas L. Rogers
Supervising Editor:	Brian Gore, P.E.
Graphic Design & Layout:	Brian Gore, P.E.
Subscriptions Accountant:	Anne Marie Rose

Codeword
Board of Building Regulations and Standards
One Ashburton Place, Room 1301
Boston, MA. 02108

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