BASIC BUILDING CODE

Student Manual

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APPENDICES

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BASIC BUILDING CODE ONLINE COURSE

Scope: The Basic Building Code is a 3-4 hour course for new inspectors. This course is based on the current editions of the ICC International Building Code (IBC) and Oregon Structural Specialty Code (OSSC). This course provides a conceptual introduction to fire and rescue personnel about the regulatory conditions that are typically enumerated in building codes.

Goal: The mission of this module is to assist the fire inspector become capable of using the OSSC that are referenced in the Oregon Fire Code (OFC).

COURSE OVERVIEW

Lesson 1 History of Model Codes: This lesson will identify attempts at preventing fires through regulation, describe the development of model codes, list model code groups within the United States, describe local code administration, and identify the purpose of codes. From the University of Maryland Fire and Rescue Institute.

Lesson 2 The Building Official Scope and Administration: The purpose of this lesson is not to teach you the codes, but to help you understand the principles of fire prevention, code enforcement, and how to conduct the related inspection. With this knowledge you can begin the process of learning how to study your codes and properly apply them during an inspection. From Chapter 1 of the OSSC: Scope and Administration.

Lesson 3 Use and Occupancy Classification: In this lesson you will review each occupancy classification and expand your knowledge by learning how to inspect and classify multiple occupancies, identify occupancy classification construction elements in structures, and demonstrate knowledge of classifying a business into correct occupancy classification. From Chapter 3 Oregon Structural Specialty Code (OSSC): Use and Occupancy Classifications.

Lesson 4 Special Detailed Requirements: This lesson takes a look at additional special detailed requirements that are not in the fire code but are essential to fire inspectors. If you are unable to find information in the fire code, it will probably be in Chapter 4 of the Oregon Structural Specialty Code (OSSC) or the International Building Code (IBC).

Lesson 5 Construction Types: OSSC utilizes five construction classifications. These classifications are indicated by Roman numeral designation: Types I, II, III, IV, V. The number indicates the minimum fire-resistance rating hours associated with the structural elements. Some of these classifications are further broken down into subgroups. This lesson will review the construction types. From Chapter 6 of the OSSC.

Lesson 6 Allowable Heights and Area: In this lesson you will learn how to determine the allowable height and area for a given occupancy. These limitations are based upon occupancy classification and type of construction. There is a decreased risk of fire based upon occupancy size. From Chapter 5 of the OSSC.

Lesson 7 Allowable Heights and Area: In this lesson you will learn to identify fire-resistance-rated construction requirements that are governed by the following:

- Materials and assemblies used for structural fire resistance
- Fire-resistance-rated construction practices
- Requirements for the separation of adjacent spaces that safeguard against the spread of fire and smoke within a building, as well as the spread of fire between buildings. From Chapter 7 of the OSSC.

Lesson 8 Allowable Heights and Area: In this lesson you will learn basic information on interior finishes, fire detection and alarm systems, water supply systems, and principals of egress elements. From Chapter 9, 10, 11, 12 of the OSSC.

Objectives:

- Participants will develop a basic understanding of uniformity in fire and life safety administration through building and fire codes
- Participants will develop a basic understanding how building officials regulate
- Participants will develop a basic understanding of use and occupancy classifications and the hazard potential associated with each
- Participants will develop a basic understanding of reducing potential hazards by limiting the area and height of a building
- Participants will develop a basic understanding of mixed occupancies and fire resistive rated assemblies; providing fire separation distance between buildings and interior finish, fire protection systems, and egress

Estimated total time: 3-4 hours (including test)

Evaluation: Test that must be completed with 80% accuracy. Sharing answers is cheating and will invalidate the test. The user has two attempts. If the user does not pass on the second attempt, retake the course and then email the iLearn administrator at anita.horsley@state.or.us

References:

- Permission was granted to reprint portions of this course by 2009 International Building Code, copyright 2009, Washington, DC: International Code Council. All rights reserved. www.iccsafe.org
- Free Version of 2006 International Building Code
- ICC Oregon Structural Specialty Code
- International Fire Service Training Association (IFSTA)
- National Fire Protection Association
- Maryland Fire and Rescue Institute
- Oregon Building Codes Division
- Permission was granted by the instructor, Dale Bohannan and all the class participants at the Oregon Fire Marshal Association Conference who were in the videos
- Oregon Office of State Fire Marshal

Course identifiers:
Red writing signifies there is a definition or more information (check Glossary in iLearn)
Underlined blue words are a web link

LESSON 1 INTRODUCTION AND ROLES AND RESPONSIBILITES

The Oregon State Building Code Division is a mandatory mini-maxi code and can not be amended by local jurisdictions. The Oregon State Building Codes Division is responsible for the enforcement and administration of the Oregon State Structural Code (OSSC), which is based on the current edition of the International Building Code (IBC). The building code is a legal document that establishes the building requirements necessary for the protection of public safety, health, and welfare.

This course provides a conceptual introduction to the regulatory conditions that are typically enumerated in building codes, with emphasis on the Oregon Structural Specialty Code (OSSC) and International Building Code (IBC). Topics covered include use and occupancy, type of construction, building size, egress, access for persons with disabilities, federal standards and requirements, compliance, state and city building codes, and planning and zoning codes.

As a fire inspector, you should have a high level of understanding of building codes to enforce safety, prevention, and fire code.

Slide 14 History Introduction

Regulations aimed at preventing fires date back centuries. “Curfew is a French word meaning “cover fire.” And there was a regulated time to put all fires out. In 1189 in London the city major required all new buildings to have stone exterior walls and slate or tile roofs. In 1638 in Maryland, USA, the first arson law was passed and carried the death sentence.

Audio
The first insurance company was founded in 1752 by Benjamin Franklin; they based rates on the risk associated with the type of construction and hazards with the use of occupancy. Benjamin Franklin stated “an ounce of prevention is worth a pound of cure.”

Slide 15 Lesson Objectives

This lesson will identify attempts at preventing fires through regulation, describe the development of model codes, list model code groups within the United States, describe local code administration, and identify the purpose of codes

- Identify attempts at preventing fires through regulation
- Describe the development of model codes
- List model code groups within the United States

Slide 16 History

- 1896 National Fire Protection Association: incorporated in 1933: published first National Building Code in 1911: produced almost 300 codes and standards through 205 technical committees
- 1915 Building Officials and Code Administrators: published first Basic Building Code in 1950: published plumbing, mechanical, fire prevention, property maintenance, and private sewage disposal codes: served NE US to Virginia & West to Kansas

- 1921 International Conference of Building Officials: published first Uniform Building Code in 1927: member of IFCI International Fire Code Institute which maintained Uniform Fire Code: served Western and Midwestern states.
- 1940 Southern Building Code Congress International: Published first 'Standard Building Code' in 1945, served Southern states
- 1972 Council of American Building Official: established to promote uniformity among model codes: developed Model Energy Code: maintained ADA, Accessible and Usable Buildings and Facilities: administers Certified Building Official (CBO) program and CBO certification exam
- 1994 International Code Council: umbrella of all groups: facilitates development and maintenance of International Codes Council including:
  - International Plumbing Code
  - International Mechanical Code
  - International Building Code
  - International Fire Code

Slide 17 Dillon's Rule
The provision for authority originates with the Tenth Amendment to the United States Constitution.

Police power is the fundamental power of the states to place restraints upon personal freedom and property rights.

- It is an inherent power of the states
- It was possessed by the states before adoption of the U.S. Constitution

Local governments have only those powers conferred by state constitutions, state statutes, or home rule charters since all local governments are instruments or creations of state government.

- Created because of rampant corruption by local officials in some jurisdictions
- Resulted from arguments before the Iowa Supreme Court regarding powers of local government

Web link for internet history of Dillon's Rule http://nmml.org/files/2008/01/dillon.pdf

Audio
Dillon wrote: The Tenth Amendment does not reserve power for local government. Local governments are a creation of the states, and have no inherent power. Home rule charters adopted by many states have broadened the powers of local entities.

Slide 18 Codes and Model Codes
Codes
A code is a collection or compilation of rules and regulations enacted by a legislative body to become law in a particular jurisdiction

- Legal documents that govern activities at various levels of government
- Only enforceable when the authority having jurisdiction (AHJ) adopts them
- Can be adopted composed partially or entirely of standards

- Must have administrative provisions to explain how and when the standards are to be applied

Model code

- Set of requirements similar to a standard
- Developed by organizations such as NFPA or ICC
- Contain agreed-upon requirements for such areas as fire and life safety or electrical equipment designs and installations

Model Code Organizations

1. Canadian Commission on Building and Fire Codes (CCBFC)
   a. National Fire Code of Canada (NFC)
   b. National Building Code of Canada (NBC)
2. International Code Council (ICC)
   a. International Fire Code (IFC)
   b. International Building Code (IBC)

Slide 19 Local Code Administration

The Oregon State Building Code is a mini-maxi code* and cannot be amended by local jurisdictions. It is responsible for the enforcement and administration of the Oregon Structural Specialty Code (OSSC), which is based on the current edition of the International Building Code (IBC). The Building Code is a legal document that establishes the building requirements necessary for the protection of public safety, health, and welfare.

* Mini-maxi ORS 455 Building Code Division Authority to adopt minimum and maximum standards

- Legal advertisement required
- Public hearings must occur
- Adoption of a specific edition of code is necessary
- It must designate the enforcing agency within the adopting ordinance

Audio

Repeat of first paragraph

Slide 20 Purpose of Codes

Codes regulate:

- Height and area of buildings
- Construction
- Plumbing
- Heating
- Electrical Wiring
- Automatic fire detection systems
- Hazardous activities and materials
- Means of egress

Code provisions control:

- Use of structure
- Number of occupants
- Maintenance of fire life safety features

Slide 21 Fire and Life Safety
Oregon statutory authority
Office of State Fire Marshal (Fire Code ORS Chapter 479)
Buildings Codes Division (Building Code ORS Chapter 455)
- Electrical Code
- Mechanical Code
- Plumbing Code

Application of codes to new or existing structures
1. The current adopted edition of building code applies to all structures built while that code is in effect (Oregon Structural Specialty Code and Oregon Fire Code)
2. Additions/alterations will be regulated by the International Code Council
3. Alterations to a building that meet certain criteria may require the entire structure to be brought into compliance with current code requirements
4. Requirements usually remain the same as those applied during original construction

Audio
Several codes have an affect on fire safety. They may be model codes. Codes describe construction or installation of major structural components. The greatest impact of fire safety for a community is to adopt fire and building codes.

Slide 22 Fire Code vs. Building Code
Synergy of the codes: the working together of two or more things (fire codes and building codes) to produce an effect greater than the sum of their individual effects
Oregon Fire Code ~ Mini Code* OAR 837, Div. 39 Oregon Fire Code: Mini-Code: Authority to approve fire code modifications
Fire prevention code regulates:
- Storage, handling, production, and use of hazardous materials
- Sets the requirements for testing and maintaining fire suppression and fire detection systems
- General fire safety requirements

Fire Codes are generally divided into three basic sections:
1. General Provision
2. Administrative Provisions
3. Changes in Use

Oregon State Structural Code ~ Mini-maxi Code* ORS 455 Building Code Division
Authority to adopt minimum and maximum standards
Building code regulates:
- Structural requirements
  - Egress requirements, fire detection systems, and special provisions
- Occupancy classification
  - Construction height and area

Audio

You cannot substitute one for the other. Fire codes help keep fires from occurring, building codes manage fire's impact.

Slide 23 Video

Slide 24 Summary
Do not think that any of the adopted codes are stand alone -
For example: building codes tells us the 'when' and 'where' for fire sprinklers; NFPA 13 tells us the 'how'

- Remember that the codes we use are exceptional
- Every time you make an absolute statement there will be an exception to change the main premise statement
- With the amount of information there is, it is a good habit to check several sources for the answers and always think about the potential exceptions

Audio
There are over 600 pages in the IBC, approximately 400 pages in the IFC and about 300 pages in the IMC, not to mention the Oregon amendments. Without continued application of the material, personal study, education and experience, there is no way to interpret and digest this material. This course references the current edition of the Oregon Fire Code with the Oregon Structural Specialty Code and acquired the information that was not duplicated in the Oregon Fire Code.

LESSON 2 ADMINISTRATION OF THE BUILDING OFFICIAL

Slide 12 Introduction.
As a new inspector there is no expectation that you have a thorough knowledge of the codes you will enforce. In fact, if you are really new you may have had little or no exposure to your jurisdiction's codes. Do not be alarmed. This is a highly technical field that requires years of experience and study. Inspectors must continue to study and do research throughout their careers.

Audio
The purpose of this course is not to teach you the codes, but to help you understand the principles of fire prevention, code enforcement, and how to conduct the related inspection. With this knowledge you can begin the process of learning how to study your codes and properly apply them during an inspection.

Slide 13 Objectives
- Explain the duties of an inspector
- Describe the categories of inspections
- Introduction to permits

Slide 14 Powers and Duties
It is the duty of the building official to enforce codes. The building official may, at times, have to interpret the building code and has the authority to do that in order to determine compliance. Construction documents are required to be submitted to the building official with drawings and specifications. A detailed description of the work must be submitted. The building official can delegate review of the construction document to fire officials and give them the opportunity to provide comments.
Code enforcement by a Building Department
a. Usually civilian (non-uniformed) employees
b. Generally responsible for:
    I. Reviewing and approving all new construction and alterations to existing structures
    II. Conducting plans reviews
    III. Issuing permits related to buildings and their use
    IV. Making field inspections to verify that approved plans are followed in the construction and alteration process

Audio
The building official's duty includes inspections and determining compliance with the code. The fire official must know his/her authority and when to refer compliance issue to a building official.

Slide 15 Powers and Duties
Inspections
- Temporary structures that are anticipated to be in existence for greater than 180 days are required to conform to code requirements for permanent structures and uses
- The building official may grant extensions if the applicant provides valid reasoning
- The building official has the authority to inspect the work where a permit has been issued

- The building official has the authority to approve the permit and all materials must remain accessible
- An operational permit is issued to allow a person or group to conduct an operation or business for a specified time or until the permit is renewed or revoked
- The fire official must understand these permit requirements
- Building officials may accept reports approved from other inspection agencies

Audio
The permit holder must arrange for the required inspections when completed work is ready and allow sufficient time for the building official to schedule a visit to the site.

Slide 16 Building Code Permits
Permits are issued for a specific condition, at a specific location, and for a specific period of time. A permit authorizes, by law, the right of entry at anytime for inspection purposes to ensure compliance with the code and permit requirements.

- A permit is required for all activities that are regulated by the code or its referenced codes.
- A permit is needed if there is a change of occupancy of a building or portion of a building, even if no work has taken place.
- The building official is authorized to issue a permit for temporary structures and temporary use not to exceed 180 days.

NOTE: the OFC has construction and operation permits that are different from the building permits.

Many local communities throughout Oregon have established fees to issue permits. These charges offset the community's cost for the time and resources required to approve the permit. Commonly asked questions about obtaining permits http://www.bcd.oregon.gov/pdf/3019t.doc

Slide 17 Building Permits are NOT required for:

- One-story detached accessory structures, such as a tool shed
- Fences not over 6'
- Oil derricks
- Retaining walls not over 4'
- Water tanks supported directly on grade if the capacity doesn't exceed 5,000 gallons
- Sidewalks and driveways not more than 30 inches adjacent grade
- Painting, papering, tiling, carpeting, cabinets, countertops and similar finish work
- Temporary motion picture, television, and theater stage sets and scenery
- Prefabricated swimming pools accessory to a Group R-3 occupancy that are less than 24" deep and don't exceed 5,000 gallons and are installed above ground
- Shade cloth structures constructed for nursery or agricultural purposes
- Swings and other playground equipment accessory to detached one and two family dwellings
- Window awnings supported by an exterior wall that do not project more than 54" from the exterior wall and do not require additional support of Group R-3 and U occupancies

- Non-fixed and movable fixtures, cases, racks, counters and partitions not over 5'9" in height

Slide 18 Certificate of Occupancy

- The tool that the building official uses to control the uses and occupancies of various buildings and structures within the jurisdiction is the certificate of occupancy. It is unlawful to use or occupy a building or structure unless a certificate of occupancy has been issued. Its issuance does not relieve the building owner from the responsibility for correcting any code violation that may exist
- As a fire inspector, it may be important to research the occupancy history to determine what the original Certificate of Occupancy was. If the occupant is leasing the building, they may not have this document
- A new building cannot be occupied until a Certificate of Occupancy is issued by the building official, which means that the permit is no longer needed

Slide 19 Change of Occupancy

- No change shall be made in the use of occupancy of any structure that would place the structure in a different division of the same group or occupancy, unless such structure is made to comply with the requirements of this code and the Building Code
- Subject to the approval of the building code official, the use or occupancy of an existing structure shall be allowed to be changed and the structure is allowed to be occupied for purposes in other groups without conforming to all the requirements of this code and the International Building Code for those groups, provided the new or proposed use is less hazardous, based on life and fire risk, than the existing use
- How does and inspector handle change in occupancy or use?
- Search building construction history to confirm change in use or occupancy
- Send referral to the appropriate department if there are significant changes to occupancy (do not close the fire inspection case until confirmation is received that change of use or occupancy has been completed)

Right of Entry
The building official has the right to enter the premises in order to make the permit inspections required. Permit application forms typically have a signature by the owner that grants the authority of the building official to enter areas covered by the permit. Before an interior inspection the owner must grant the building official permission. The building official must have proper identification. Access may be denied by the owner, unless the inspector has reasonable cause to believe that a violation exists (ORS 476 Fire Code and ORS 455 Building Code).

Audio
NO change in occupancy of an existing structure is permitted without obtaining a certificate of occupancy for the new use. If there is a change in occupancy, as a fire official, you should refer the building back to the building official.

Slide 20 Scenario

There is a structure that is two stories in height with the ground floor a Group S-2 occupancy parking garage and the second floor a Group B occupancy office space with an occupant load of more than 50. According to Chapter 11 in OSSC, it would seem that access to the second floor for persons with disabilities is required insofar as there are no offices or toilet facilities on the ground floor. In this instance, there is no possibility of providing a ramp.
The cost of elevators would make construction costs too high (an approximate 50 percent increase). Consequently, the builders are requesting an exception under Section 104.10* of the International Building Code.

> *104.10 Wherever there are practical difficulties involved in carrying out the provisions of this code, the building official shall have the authority to grant modifications for individual cases, upon application of the owner or owner's representative, providing the building official shall first find that special individual reason makes the strict letter of this code impractical and the modification is in compliance with the intent and purpose of this code and that such modification does not lesson health, accessibility, life and fire safety, or structural requirements. The details of action granting modification shall be recorded and entered in the files of the department of building safety.

Chapter 11 would require access for persons with disabilities in this case.
Section 104.10 was not intended to provide a procedure whereby the building official can issue variances to the code. The exception requested by the builders, which would be *not* to provide access, is actually a variance, and that is not the intent of Section 104. 10. The intent of Section 104.10 is to provide for modification of the code where, in addition to their qualifying requirements, the modification conforms to the spirit and purpose of the code. A variance that would permit the builder not to provide the required access would not be in accordance with the spirit and purpose of the code.

Slide 21 Summary
When deficiencies are identified, it is critical that the fire inspector understand federal regulations, state laws, and municipal ordinances that determine the codes and standards that apply to their respective jurisdiction.
It is extremely important to understand that an inspector, especially a new inspector, can become proficient only through extensive training and experience.

> ORS 455.150(8) requires municipalities to create a WRITTEN PLAN that specifies how cooperation with the State Fire Marshal or designee of the State Fire Marshal will be achieved and how the Uniform Fire Code will be considered in the review process of the design and construction phases of buildings or structures

Audio
Time alone is not a teacher. To become a competent inspector it is imperative that you study your profession, use each experience as a learning tool, and build on those experiences.

LESSON 3: INITIAL OBSERVATIONS AND READING FIRE INDICATORS

Slide 13 Introduction
Every building or portion of a building has a specific use.
A building can be mixed use where a building can contain two or more occupancies or use.
These uses are characterized by their unique characteristics "occupancies."
Basis of classification

- Occupant characteristics for self-preservation
- Types of processes and activities
- Types of regulated materials

Audio
In this lesson you will review each occupancy classification and expand your knowledge by learning how to inspect and classify multiple occupancies. Occupancy classifications are specified in the Oregon Structural Specialty Code Chapter 3.

Slide 14 Objectives

- Identify occupancy classification construction elements in structures.
- To demonstrate knowledge of classifying a business into correct occupancy classification.

Slide15 Occupancy Classifications
Transition slide: click on each for definitions and explanations

Slide 16 Assembly Group A
The fire inspector first must be able to identify that the building is assembly occupancy, then determine the category of assembly occupancy and the capacity.
Assembly group occupancies generally are easy to identify because they are places we go for entertainment, dining, instruction, and worship. They fall into many different uses.

Assembly Group A1 Occupancies include fixed seating for the production and viewing of performance arts such as movie theaters, symphony and concert halls, etc.
Specific interests to keep in mind with A-1

- Concentrated occupant load
- Low lighting levels
- Above-normal sound levels
- Moderate fuel load
- Life safety hazards exist
  - High occupant loading & density
  - Potential for injuries and fatalities high
  - Allowed area and height limitations
  - Egress potential major factor
  - Five assembly categories

Every building and every space within a building is classified during the design process and/or plan review.

Assembly Group A2 uses are intended for food and/or drink consumption and include: restaurants, nightclubs, taverns, bars, etc.
Specific interests to keep in mind with A2:

- Social entertainment involving eating and/or drinking
- Non-standard lighting levels
- Above normal sound levels
- High occupant loading
  - Delayed awareness of emergency
  - Confused response
  - Defined means of egress

Assembly group A3 occupancies are intended for worship, recreation, amusement or other assembly uses not classified elsewhere in Group A. Generally this includes amusement parks, bowling alleys, churches, gymnasiums, lecture halls, courtrooms, dance halls, health clubs, and libraries.
Specific interests to keep in mind with A-3

- Worship, recreation or amusement areas that are not Group A-1, A-2, A-4 or A-5
- Lower occupant load
- Normally lower fuel load, but widely varies
- Generally lower risks to life safety

A-4 assembly uses are intended for viewing of indoor sporting events and activities with spectator seating including: indoor arenas, pools, rinks, etc.
Specific interests to keep in mind with A-4:

- Indoor spectator sporting events
- Low occupant load on sports floor
- High occupant load surrounding
- Grandstand style seating
- Low levels of combustibles
- Means of egress critical

A-5 assembly occupancies are intended for participation in or viewing of outdoor activities including stadiums, bleachers, grandstands and coliseums.
Be aware that A-5 occupancies are:

- Outdoor assembly
- Low fuel loads
- Fire/smoke vents rapidly
- High occupant load
- Potential panic in emergencies
- Sufficient exiting critical

<u>Audio</u>
Assembly occupancies are generally places where more than 50 people gather in a building or structure for the purposes of civic, social or religious functions, recreation, and food or drink consumption or awaiting transportation. OSSC breaks Assembly Group A occupancies into five distinct categories.

Slide 17 Business Group B
Business Group B occupancies are generally places where people gather in a building for the purpose of office, professional or service type transactions including storage of records and accounts.
Examples include: offices, professional services, banks, governmental offices, city halls, courthouses, some colleges and university buildings.

- Civic administration
- Outpatient clinics
- Education above 12th grade
- Motor vehicle showrooms
- Varied fuel loads
- Usually familiar surrounding
- Critical means of egress
- **Lockout facility (slide 18)**

Note: Most communities have what are commonly referred to as strip shopping centers. These are made up of a variety of individual businesses and are considered mixed occupancies.

Slide 18 Lockout Facility
From ORS 169.005 (4) (4) "Local correctional facility" means a jail or prison for the reception and confinement of prisoners that is provided, maintained and operated by a county or city and holds persons for more than 36 hours.
And Section 304.2 of the Oregon Structural Specialty Code, buildings containing lockup facilities shall comply with the following provisions: Click here to view PDF with full definition

Slide 19 Video B

Slide 20 Education Group E
Educational Group E occupancies are where more than six people at any one time gather in a building for educational purposes through the 12th grade. Examples include kindergartens, elementary schools, middle or junior high schools, high schools.

- 6 or more students through the 12th grade
- Education/care for more than 5, less than 100, children older than 2 ½ years of age

Note: Religious educational rooms and religious auditoriums accessory to places of worship with occupant loads less than 100 are A-3

Slide 21 Video E

Slide 22 Factory Group F
Factory Group F occupancies include buildings that are used for the purpose of assembling, disassembling, fabrication, finishing, manufacturing, packaging, repair or processing operations that are NOT classified as a Group H occupancy.
This occupancy type is broken into two categories: moderate and low hazard occupancies.

- FI Moderate Hazard Occupancies: occupied for the purpose of fabrication, finishing, manufacturing, packaging, assembly or processing of materials that are combustible for the use of combustible products in the production process ~ includes but is not limited to:
  Aircraft (manufacturing, not repair)
  Automobiles and other motor vehicles
  Clothing
  Cabinet shops
  Higher fire risk
  Occupant familiarity
  Note: this is not an inclusive list, refer to OSSC Ch. 3

- F2 Low Hazard Occupancies: factory industrial uses that involve the fabrication or manufacturing of noncombustible materials which during finishing, packing or processing do not involve a significant fire hazard, are classified as F2 occupancies and shall include, but not limited to, the following:
  Beverages
  Brick and masonry
  Ceramic products
  Glass products
  Wood barrel and bottled wine wineries
  Gypsum
  Ice
  Metal products (fabrication and assembly)
  Foundries

Slide 23 Video F

Slide 24 High Hazard Group H

High Hazard group H occupancies involve the manufacturing, processing, generation or storage of materials that constitute a physical or health hazard.

- Materials constituting a physical hazard
- Materials constituting a health hazard
- In excess of Tables 307.1(1) and 307.1(2)

Slide 25 Video H

Slide 26 High Hazard Exceptions

There are 15 exceptions listing conditions that are exempt from a high-hazard occupancy classification because of:

- A reduced quantity of materials
- Separation of hazard from production area
- The building's construction or use
- Special packaging of materials
- Precautions taken to prevent a fire or detonation

Two significant exceptions:

- limit the quantities of the hazardous material in the occupancy
- use control areas to provide separated storage areas

Purpose of tables

- Tables identify the maximum allowable quantity of hazardous materials to be present and NOT be considered a Group H Occupancy
- Based on the concept of control areas

Slide 27 Video H (Tables)

Slide 28 High Hazard Maximum Allowable Quantities and Control Areas
MAXIMUM ALLOWABLE QUANTITIES

- Table 307.1(1)
  - Maximum Allowable Quantity Per Control Area of Hazardous Material Posing a Physical Hazard

- Table 307.1(2)

Maximum Allowable Quantity per Control Area of Hazardous Material Posing a Health Hazard

CONTROL AREAS

- Provide alternate to being Group H
- Regulate quantities
- Reduce risk of simultaneous involvement
- Number of control areas limited
- Spaces enclosed by:
  - Exterior walls
  - Fire walls
  - Fire barriers
  - Roofs

Building may have multiple control areas per Table 414.2.2

Slide 29 Video Control Areas

Slide 30 Institutional Group I

Institutional Group I occupancies classification occurs when people are cared for or living in a supervised environment and have physical limitations because of health or age, are harbored for medical treatment, health care, personal care or when people are detained for penal or correctional purposes.

This occupancy is broken into four categories:

- Group I-1 The residents are capable of responding in an emergency without physical assistance from staff and are capable of self-preservation. Houses more than 16 persons. Ambulatory. 24 hr basis. People with mental disabilities live in a supervised residential environment that provides personal care services

- Group I-2 used for medical, surgical, psychiatric, nursing, health and custodial care
  - More than 5 persons
  - Custodial care required
  - 24 hr basis
  - Not capable of self preservation

- Group I-3 occupancies are inhabited by people who are generally not capable of self-preservation, due to security measures, not under the occupant's control. Detention and correctional occupancies under varied degrees of restraint or security. These conditions

include:

- Adult and juvenile substance abuse centers
- Adult and juvenile work camps
- Adult community residential centers
- Adult correctional institutions
- Jails
- More than 5 persons
- Secured or restrained
- Prisons and Reformatories

- Group I-4 occupancies provide custodial care for adult and child day care facilities
  - Day care services
  - Less than 24 hour care
  - Not capable of self preservation

Slide 31 Video I

Slide 32 Mercantile Group M

Mercantile group M occupancies are some of the most common occupancies in many communities. These are places we go to spend our money. There is a display of merchandise for sale. Department stores, grocery stores, portion shopping centers, etc.

- Display and sale of merchandise
- Includes storerooms accessible to public

Mercantile occupancies would include:

- Department stores
- Motor vehicle fuel-dispensing facilities (not repair garages)
- Retail or wholesale facilities

Slide 33 Residential Group R

Group R residential occupancies are used for the purposes of sleeping. Residential occupancies are where most fire deaths occur. This should serve as a warning to know the proper classification of a building so that the inspector can apply proper fire prevention and building codes.

This occupancy is broken into four categories.

- Group R-1 Residential occupancies where the occupants are primarily transient in nature including boarding houses, hotels and motels.

- Group R-2 Residential occupancies containing sleeping units of more than two dwelling units where the occupants are primarily permanent in nature including apartment, houses, dormitories, vacation time share properties etc.

- Group R-3 Residential occupancies where the occupants are primarily permanent in nature and do not contain more than two dwelling units.
  - Permanent one and two family dwellings
  - Townhouses

  Note: A facility such as a day care center that houses six or fewer people, as defined in OSSC Section 310.2 shall be classified as Group R-3.

- Group R-4 Residential occupancies that are subject to licensing by the state. These occupancies are personal care/assisted living facilities that house more than 5 persons but not more than 16 occupants.

Slide 34 Video M and R

Slide 35 Storage Group S

Storage Group S occupancies are structures used for providing shelter for goods that are not classified as hazardous. This occupancy is broken into three categories.

S-1**:** occupancies used to store moderate hazard storage include:

- Aircraft hangars (storage and repair)
- Cloth and clothing
- Books and paper in rolls
- Furniture, etc.

S-2: occupancies used to store low hazard storage noncombustible materials such as:

- Products on wood pallets or in paper cartons
- Beer or wine up to 16% alcohol
- Food products, meats
- Metal products, etc.

S-3 occupancies Mausoleums and Columbariums. The design life of structures in this occupancy is longer than other occupancies in the Oregon Structural Specialty Code. Except where specific provisions are made in Chapter 4 of the OSSC, other requirements of that code shall apply.

Slide 36 Special Residential

Special Residential occupancies are where personal care is administered. Assisted self preservation is the capability of all residents to evacuate to a point of safety with physical assistance. These residences are licensed by or are subject to licensure by the Department of Human Services.

This is an Oregon specific requirement.

Special Residence occupancies are broken into four categories:

- SR1 special residence uses for more than 16 residents
- SR2 special residence uses for more than five residents that may require assisted self preservation
- SR3 special residence uses for five or fewer residents
- SR4 special residence uses for more than five, but not more than 16 residents

Slide 37 Utility Group U

Utility Group U occupancies are typically accessory to another building and are not more appropriately classified in occupancy. Some structures may not fit any of the listed specifications for classification. These include agricultural buildings, barns, carports, green houses, stables, towers etc.

- Buildings accessory in character
- Fences over 6’

- Retaining walls over 4’
- Private garages
- Towers
- Greenhouses
- Sheds

The inspector can see that these occupancies can be difficult to inspect and may cause him/her to check the codes to help know the exact occupancy classification.

Note: the fire service does not regulate agriculturally exempt buildings.

Slide 38 Video S and U

Slide 39 Summary
Knowledge of buildings, their construction and their classification is necessary to protect the lives and property of the public. This knowledge is necessary to allow firefighters to control fires efficiently and effectively. Inspection of built-in fire protection is essential. The ability of the inspector to determine the construction type and occupancy classification of a structure is critical to the success or failure of an inspection. The next lesson discusses construction special detailed requirements in occupancies.

LESSON 4 SPECIAL DETAILED REQUIREMENTS

Slide 12 Introduction
This lesson takes a look at additional special detailed requirements that are not in the fire code, but are essential to fire inspectors. If you are unable to find information in the fire code, you may find it in Chapter 4 of OSSC or IBC.

Audio
This lesson will cover some of the issues that are not addressed in the Oregon Fire Code. An inspector may need to refer to Chapter 4 in the OSSC when there is an issue that can not be resolved by looking in the Oregon Fire Code

The following is a list followed by some examples to illustrate special use based on occupancy.

Slide13 OSSC Topics
- 402 Covered Mall and Open Mall Buildings
- 403 High-Rise Buildings
- 404 Atriums
- 405 Underground Buildings
- 406 Motor-Vehicle-Related Occupancies
- 407 Group I-2
- 408 Group I-3
- 409 Motion Picture Projection Rooms
- 410 Stages and Platforms
- 411 Spherical Amusement Buildings
- 412 Aircraft-Related Occupancies
- 413 Combustible Storage
- 414 Hazardous Materials
- 415 Groups H-1, H-2, H-3, H-4 and H-5
- 416 Application of Flammable Finishes
- 417 Drying Rooms
- 418 Organic Coatings
- 419 Live/Work Units
- 420 Groups I-1, R-1, R-2 , R-3
- 421 Hydrogen Cutoff Rooms
- 422 Ambulatory Health Care Facilities
- 423 Storm Shelters
- 424 Piers and Wharves
- 425 Mausoleums and Columbariums

Slide 14 Objectives
To become familiar with special use occupancy requirements that are not in the Oregon Fire Code

Slide 15 Covered Malls
Lease Plans
The owners of covered mall shall provide the building and fire department with a lease plan showing location of each occupancy and exits.
Often the developer does not know the required information at the time of construction; therefore, the required lease plan is permitted to be submitted after the certificate of occupancy. Once the lease plan has been submitted, no modifications or change in use can occur without approval.

Audio
"It is important that the fire department receives copies of current lease plans, since not only does this help the fire department while performing fire prevention inspections, but also the lease plans assist in fire department response to an emergency"

Slide 16 Atriums
Smoke Control for Atriums
Preventing smoke mitigation throughout interconnected levels of a building via an atrium, requires a mechanical smoke control system be installed in atriums connecting 3 or more stories (in accordance with section 909 in OSSC and IBC).

Slide 17 High-Rise Buildings
- Fire Command*: Fire department communication: in order to provide more efficient communication in high rise buildings, a fire department communication system must be installed to assist interior fire department personnel in communicating with firefighters working in various areas of the building.
- This system must be able to operate between the fire command center, every elevator, lobbies, standby power rooms, and fire pump rooms, areas of refuge and exit stairwells.
- Emergency escape and rescue: No emergency escape and rescue openings are required for buildings that have an automatic sprinkler system installed.

Audio
Definition of *Fire Command: *A command center in a location approved by the fire department will be provided in every high rise building. The room is usually located along the front of the building near the main entrance. The room must contain equipment that is able to monitor the fire protection and other building services systems.*

Slide 18 Motion Picture Projection Rooms
Fire code regulates motion picture projection rooms, stages, and platforms; however, the Oregon Structural Specialty code is where you find the requirements.
- Stage construction: stages are based on floor construction and therefore conform to those requirements
- Wood is the material of choice and there are 3 exceptions:
- Any stage can be built with 2 inch wood deck supported by unprotected noncombustible construction or heavy timber. Stage is separated from the audience by a proscenium wall.
- Stage floors do not have to be fire-resistance rated in buildings of Type IIA, IIIA and VA, where the space below the stage is equipped with an automatic fire-extinguishing system.

- The finished floor shall be constructed of wood or approved noncombustible material. It also permits openings in floors to be protected by tight fitting solid wood doors with safety locks to secure them.

Audio
Platform construction: permanent platforms can be of fire-retardant-treated wood in limited applications. Type I, II, and IV construction platforms can be of fire-retardant-treated wood if they are no more than 30 inches in height and no more than one-third of the room floor area and are 3,000 square feet or less in area. The platform must not significantly increase the fire hazard of the space or building. If the space beneath a permanent platform is utilized for anything other than electrical wiring or plumbing, the platform shall have a 1-hour fire-resistance rating.

Slide 19 Projection Rooms

Proscenium curtain: The proscenium opening is required to be protected with an approved fire curtain or water curtain in order to permit the audience to evacuate the seating area without being threatened by fire on the stage.

Smoke control**:** Emergency ventilation of stages is provided by roof vents and smoke control. If the stage area is greater than 1,000 square feet with a height of greater than 50 feet, the smoke layer interface must be maintained 6 feet above the highest level of the assembly seating or above the top of the proscenium opening when one is provided. This will prevent smoke from entering into the audience area.

Slide 20 Aircraft-Related Occupancies

- Aircraft-related occupancies: there are different requirements for different types of aircraft hangars. From residential aircraft hangars to those handling large commercial aircraft, as well as helistops and heliports.
- All commercial aircraft hangars must be regulated in regards to exterior walls, basements, floor surfaces, heating equipment, finishing and fire suppression. All these provisions serve to decrease the dangers associated with large aircraft and their integral fuel tanks to acceptable fire safety levels.
- The fire inspector needs to understand what the hanger was initially approved for. Section 412 in the OSSC will provide the details on which code requirements apply to which types of aircraft hangars.

Audio
In order to minimize the fire danger within aircraft hangars, fire suppression systems are required. The fire suppression system must be designed and installed in accordance with NFPA 409 (exception group II hangars for private aircraft).

Slide 21 Concealed Spaces

Attics, basements, and concealed spaces can be a high fire hazard if used to store combustible materials in an unprotected area. Therefore, the minimum level of separation required between storage areas and the main livable areas in non-sprinklered buildings is 1-hour fire-resistance rated construction. The doors to these areas must be self closing and of either noncombustible construction or a minimum 1 3/4 inch thickness of solid wood core.

Exceptions are:

1. Areas protected by approved automatic sprinkler systems
2. Group R-3 and U occupancies

Audio

The severity of a potential fire hazard increases when combustibles are located within concealed spaces and similar areas that provide limited access to manual fire fighting. These areas typically are not closely supervised; therefore, a fire can spread quickly and spread undetected throughout a building before being detected.

Slide 22 Summary

The fire inspector must have a thorough understanding of the occupancy classifications so that he or she will apply the proper code requirements to the building being inspected.

The information in this lesson is by no means a complete assessment of all the requirements for each of the topics. For more detailed information, fire inspectors should consult the Oregon Structural Specialty Code Chapter 4.

When preparing to inspect a building the fire inspector should know how it is constructed and what it is used for. The next lesson will review building construction.

LESSON 5 CONSTRUCTION TYPES

Slide 12 Introduction
As a fire inspector you should already be familiar with the five basic construction types. How a building is designed and constructed has major implications on fire growth and development. This module is an introduction to building construction presenting the types of construction and the typical components.

Audio
This lesson also features potential effects of these construction features on fire development. The inspector can determine the type of construction used to build the structure by observing the main structural elements of the building.

Slide 13 Objectives
- Identify the major types of building construction and describe each
- Discuss fire effects depending on the type of construction
- Identify common fire spread and safety issues that result from certain construction features

Slide 14 Video Introduction

Slide 15 Fire-safe Design
The objectives of a fire-safe design in building construction are life safety, property conservation, and the continuation of the building in its intended use. A design for fire safety may include various options.
The first step is to identify the occupant characteristics of the building. Considerations are:
- Evacuating occupants: This depends on both the availability of a path of escape and alerting the occupants
- Defending the occupants in place. This is used when evacuating has an unacceptable likelihood of success
- Providing an effective area of refuge. This involves movement through the building to a safe area

OSSC utilizes five construction classifications. These classifications are indicated by Roman numerical designation: Types I, II, III, IV, V. The number indicates the minimum fire-resistance ratings hours associated with the structural elements. Some of these classifications are further broken down into subgroups.

Slide 16 Five Construction Types
Type I Construction Fire Resistive
Type II Noncombustible
Type III Ordinary
Type IV Heavy Timber
Type V Frame

Slide 17 Type I

Type 1 construction is commonly referred to as fire-resistive construction. The structural members, including the walls, columns, beams, girders, trusses, arches, floors, and roofs are made of approved non-combustible or limited combustible materials.
With the exception of permanent nonbearing partitions that have a one or two hour rating and are not part of a shaft enclosure. These walls or partitions may have fire retardant wood in the assembly.
There are two types of Type I construction: IA and IB.

- Type IA: Fire-resistive, non-combustible: High rise buildings and Group I occupancies
  - 3 hr exterior walls
  - 3 hr structural frame
  - 2 hr floor/ceiling assembly
  - 1 ½ hr roof protection
- Type IB: Fire-resistive, non-combustible: Mid rise office and Group R buildings
  - 2 hr exterior walls
  - 2 hr structural frame
  - 2 hr ceiling/floor separation
  - 1 hr ceiling/roof assembly

Slide 18 Type I Video

Slide 19 Type II
Type II construction is commonly referred to as non-combustible or limited-combustible construction.
The primary difference between Type I and Type II construction is that Type II construction has a lower degree of fire resistance than Type I.
There are two subgroups of Type II construction: Type IIA and Type IIB

- Type IIA: Protected non-combustible; commonly found in new schools
  - 1 hr exterior walls
  - 1 hr structural frame
  - 1 hr floor/ceiling/roof
- Type IIB: Unprotected non-combustible, most commonly used non-combustible construction. Noncombustible has no requirements for fire-resistance, unless required by other sections of the code.

Slide 20 Type II Video

Slide 21 Type III
Type III construction, also known as ordinary construction, has exterior walls and structural members where portions of the exterior walls are made of approved non-combustible or limited-combustible materials.
There are two subgroups of Type III construction they are: Type IIIA and Type IIIB

- Type IIIA**:** Unprotected combustible; masonry exterior walls and 1 hr protected wood roof and floor assemblies
  - 2 hr exterior walls
  - 1 hr structural frame
  - 1 hr floor/ceiling/roof

  - Roof framing must be open
- Type III-B**:** Unprotected combustible ("ordinary") construction; masonry exterior walls with wood roof and floor assemblies without fire rating. Commonly used for warehouse construction.
  - 2 hr exterior walls
  - No fire ratings for interior frame, floors, ceilings.
  - Roof framing must be open

Slide 22 Type III Video

Slide 23 Type IV

Type IV construction is also known as heavy timber construction. The exterior and interior walls and structural members that are portions of the walls are required to be of approved noncombustible or limited-combustible materials. Also known as "mill" construction, minimum size requirements for beams and columns; timber columns 8" x 8"; floor beams 6" x 12"

- 2 hr exterior walls
- 1 hr structural frame or heavy timber
- Heavy timber floor/ceiling/roof assemblies

Slide 24 Type IV Video

Slide 25 Type V

Type V construction, also known as wood frame construction, offers the least amount of fire-resistance. The exterior walls, bearing walls, columns, beams, girders, trusses, arches, floors, and roofs are entirely or partially made of wood or other approved combustible material smaller than material required for type IV construction. You will generally find 2 - 4 inch (50 - 100 mm) stud construction in these types of facilities.

- Type V-A: Protected Wood Frame: Commonly used in construction of apartment and retail buildings; no exposed wood construction
  - 1 hr exterior walls
  - 1 hr structural frame
  - 1 hr floor/ceiling/roof
- Type V-B: Unprotected (without fire resistant protection) wood frame such as smaller retail and professional offices.

Slide 26 Type V Video

Slide 27 Table 601 (see Appendices A)

- Correct classification of a building by its type of construction is essential. Many code requirements applicable to a building are dependent on its type of construction.
- The purpose of classifying buildings or structures by their type of construction is to account for the response or participation that a buildings structure will have in a fire condition originating within the building as a result of its occupancy or fuel load.
- The provisions of Table 601 assist in establishing the basis for the "equivalent risk theory" on which the entire code is based. Table 601 provides the structural elements based on the type of construction of the building and fire separation distance.

Slide 28 Table 601 Diagram

Slide 29 Determining Construction Type Chart

Slide 30 Structural Frame

- The structural frame shall be considered to be the columns and the girders, beams, trusses and spandrels having direct connections to the columns and bracing members designed to carry gravity loads. The members of floor or roof panels which have no connection to the columns shall be considered secondary members and not a part of the structural frame.
- The structural frame includes the structural (load-bearing) components of the building frame. Any structural item that provides direct connections to columns and bracing members that are designed to carry a gravity load is considered part of the structural frame.
- To delay vertical load-carrying collapse of a building due to fire exposure for a theoretical amount of time, the components that make up the primary structural frame are required to maintain a minimum degree of fire resistance

Slide 31 Structural Frame Video

Slide 32 Summary

The OSSC outlines the types to assist the fire inspector in identifying the types of construction that may be encountered while conducting inspections. However, for more detailed information, fire inspectors should consult the code used within their jurisdiction.

- The ability of the inspector to determine the construction type and occupancy classification of a structure is critical to the success or failure of an inspection.
- During periodic inspections and when alterations are made, inspectors must ensure that fire and life safety requirements are consistent with current use and alterations.
- Model building and fire codes provide the inspector with guidelines for ensuring that life safety requirements are met.

LESSON 6: ALLOWABLE HEIGHT AND AREA

Slide 12 Introduction
In this lesson you will learn how to determine the allowable height and area for a given occupancy.

The area and height limitations are based upon occupancy classification and type of construction.

There is a decreased risk of fire based upon occupancy size.

Slide 13 Objectives
- Identify attempts at preventing fires through height and area
- Define area, story, height
- Determine height and area limitations using table 503
- Differentiate between mixed use occupancy and separated occupancy

Slide 14 Concepts
Based upon Occupancy Group & Type of Construction
The lesser the risk based upon occupancy the larger and taller a building may be.
The greater the fire resistance the larger and taller a building may be.
Area & Height Modifications allowed by
- Frontage increase
- Automatic sprinkler systems
- Number of stories

Unlimited areas permitted in specific instances
Mixed Uses, Incidental Uses, Accessory Uses

Audio
Repeat written material

Slide 15 Height and Area Requirements vs. Occupancy Requirements Transition

Slide 16 Height, Area, and Story Definition
- The area is the total square footage within the exterior walls of the stories of the building.
- A story is the vertical distance measured from the top of one finished floor surface to the top of the successive finished floor surface above it or from the top of a finished floor surface to the top of the ceiling joists or roof rafters directly above.
- The height of a building refers to the distance measured from the ground to the average height of the highest roof surface. If the highest roof is flat then it is the height of that roof; if the highest roof is pitched, then you would take the average of the height of the point and the gable. Height is also determined by the number of stories in a building. The OSSC provides not only the allowable height of a building but also gives the number of stories allowed for each type of occupancy based on the type of construction.

Slide 17 Height, Area, and Story Video

Slide 18 Height and Area Requirements
Table 503 (see Appendices B)

Audio
The OSSC provides charts to determine the allowable height, area and construction type for each occupancy classification. Let's pull this information together and look at Table 503 from the OSSC. The bottom section is the allowable areas per story. The side on the left is the occupancy classification

Slide 19 Height and Area Requirements
Table 503 Printable Version

Slide 20 Height and Area Requirements
Table 503 Practice

Slide 21 Height and Area Requirements
Video Table 503

Slide 22 Height and Area Requirements
Height Increase and Sprinklers
Buildings equipped *throughout* with an automatic sprinkler system may be:

- Increased in height by 20 feet
- Increased by one story in height

This increase may be in *addition* to the increases allowed to areas
Does not apply to:

- I -2 Occupancies of Types II-B, III, IV or V construction
- Group H-1, H-2, H-3 or H-5 fire areas
- If sprinklers used as 1-hr substitute

Slide 23 Height and Area Requirements
Video Sprinkler

Slide 24 Height and Area Requirements
Frontage Increase
To be Open Space

- On the same lot or dedicated for public use
- Be accessed from a street or approved fire lane
- If the space is not "accessible" its not "open"
- The minimum width must be 20' and accessible

Access must be provided
How much Increase?

- The amount of increase for "frontage" will depend upon:
  - The width of the open space around the building

- How much of the perimeter of the building is "open space"

To EVEN be eligible for the frontage increase, a building must have at least **25%** of its perimeter on a public way or open space. The maximum increase for "frontage" is 75%.

Audio
Frontage Increase: basic area is allowed to be increased when building has public ways or open spaces around the building that provides: access by fire service personnel: reduced fire exposure to and from adjacent buildings: temporary safe refuge for occupants in an emergency

Slide 25 Height and Area Requirements
Video Frontage Increase

Slide 26 Height and Area Requirements
Sprinkler Increase

- NFPA 13 system
- Increase 300 percent for single story
- Increase 200 percent for multistory
- This increase is *in addition* to the height and story increases allowed in Section 504.2

Once an "allowable area per story" has been determined, let's apply that to actual buildings.
Square Footage and Stories

- 1 story = allowable area as modified
- 2 stories = two times the allowable area
- 3 or more stories = three times the allowable area

No one story shall exceed the modified allowable area

Slide 27 Height and Area Requirements
Video Sprinkler Increase

Slide 28 Height and Area Requirements
Unlimited Area
Except for 507.2, buildings shall be equipped throughout with an automatic sprinkler system
The building is surrounded by increased open space, usually 60 feet

Non-Sprinklered Unlimited Area Buildings
The area of a one-story, non-sprinklered Group F-2 or S-2 shall not be limited when building is surrounded by public ways or yards not less than 60 feet in width

One Story Unlimited Area
Area of a one-story Group B, F, M or S shall not be limited when fully sprinklered and surrounded by public ways or yards of not less than 60'
Area of a one-story A-4, of other than Type V construction, shall not be limited if fully sprinklered and surrounded by public ways or yards of not less than 60'

Two Story Unlimited Area
The area of a two-story Group B, F, M or S building shall not be limited when fully sprinklered and surrounded by public ways or yards not less than 60'

Slide 29 Height and Area Requirements
Video Unlimited Area

Slide 30 Occupancy Requirements
Now lets look at the occupancy requirements when there are two or more types of businesses or occupancies in a building such as in a mall or in a school with an auditorium that seats 50 or more people.

Slide 31 Occupancy Requirements
Mixed Use Definition
The definition of a mixed occupancy is where two or more occupancies are intermingled with one another located in one building. In a mixed occupancy, the requirements for each different occupancy included in the building apply.
In mercantile, business, industrial, storage, non-residential use occupancies, and other special requirements occupancies, an intermingled occupancy use area that is incidental to these occupancies may be considered as part of the main occupancy and referred to as incidental use areas*.
***** A space is considered to be incidental if it is not accessory to occupancy with high hazard contents and is not more than 25% of the area of main occupancy. Incidental spaces are not required to be separated by fire resistive construction. For example, a small office within a large department store would be considered incidental; therefore, it would not be classified as business occupancy. Instead, it would be classified as a mercantile occupancy, as is the department store.
Some examples of incidental use occupancies are:

- Furnace rooms
- Parking garages
- Incinerator rooms
- Laboratories and vocational shops
- Waste and linen collection rooms

The code requires fire resistance rated separation regarding incidental use
OSSC Table 508.2 shows Incidental Use Areas

Slide 32 Occupancy Requirements
What is Mixed Use?
Mixed Use: Building, or portion thereof, in which there are two or more uses of different occupancy classifications
Examples:

- Restaurant/hotel
- Office/warehouse
- Retail/arena
- Conference room/office

There are three types of mixed use occupancy

- Incidental Use
- Accessory Use
- True Mixed Use

Slide 33 Occupancy Requirements
Incidental Use

- Pose higher risks beyond those of primary use
- Separating Incidental Use areas is mandatory
- Separated from primary occupancy by:
  - Table 508.2, or
  - A "separated" occupancy

If Table 508.2 (see Appendix C) is utilized, incidental area simply becomes part of the primary use
Rated separations shall be fire barriers
Automatic sprinkler systems required for area only, not throughout the floor or building

Slide 34 Occupancy Requirements
Video Incidental Use

Slide 35 Occupancy Requirements
Accessory Use
Accessory Concepts

- Rooms or areas that are different from, but accessory to, the primary occupancy
- When limited in size, these areas may be considered as part of the primary occupancy
- Limited to 10% of the area of the story or area
- Not greater than allowed "tabular" area

Accessory Assembly Areas

- Assembly spaces may be considered a part of primary space if area is less than 750 square feet
- Spaces with less than 50 occupants may be considered a Group B

Slide 36 Occupancy Requirements
Video Accessory Use

Slide 37 Occupancy Requirements
True Mixed Use
Non-Separated Occupancies

- Principle is that different occupancies within a building would NOT need to be separated per Table 508.3.3 (see Appendices D) if the building complies with the code requirements of the most restrictive occupancy for area, height, automatic sprinklers, alarms, etc.
- Each occupancy is reviewed separately for:
  - Occupant loads
  - Fire separation distance
  - Means of egress
- If one occupancy requires an auto-sprinkler system, then the whole building, would require an auto- sprinkler system throughout
- Allowable area and height is based upon the most restrictive occupancy

Separated Occupancies

Where mixed occupancies are designed to be separated per Table 508.3.3. Where required certain adjacent occupancies require a one, two, or three hour fire resistance rated occupancy separation. When occupancy separations are provided, each occupancy is considered separate and follows the requirements for that occupancy.

Slide 38 Occupancy Requirements
Table 503.3.3 (see Appendices)

Slide 39 Occupancy Requirements
Mixed Use Example
The mall is an example of a mixed occupancy. It contains a movie theater, a restaurant, a retail store, a bank.
First note that the movie theater and restaurant are assembly occupancies. The retail stores are mercantile occupancies and the bank is a business occupancy.
None of these occupancies appear to be incidental to others, so the building code requirements for each separate occupancy would apply here.

Slide 40 Occupancy Requirements
Video True Mixed Use

Slide 41 Occupancy Requirements
Additional Requirements
There are a few additional items that may alter a buildings area and height requirements. Section 504 in the OSSC lists modifications that may be applied to the area and height requirements in certain cases. For example most Department of Defense buildings are required to have a sprinkler system. If a building has a sprinkler system throughout, the maximum height of the building listed in Table 503 can be increased by 20 feet, and the number of stories may be increased by one.
There are also limitations to the guidelines to Table 503. The guidelines may not apply in every situation such as:

- Basements
- Special industrial buildings
- Buildings on the same lot

Be sure to read carefully for all limitations when determining a building's area and height.

Slide 42 Summary
Every space must be classified during the design process. Mixed use occupancies can become very complicated. For more detailed information consult with your local building official, take a class and refer to the International Building Code and/or the Oregon Structural Specialty Code.

Audio
In this topic you learned to determine the allowable building height and area for various occupancies using the OSSC as your guide. These building requirements are in place to ensure the life safety of the building occupants. In the next topic you'll expand on this knowledge to determine mixed uses and their challenges.

LESSON 7: FIRE RESISTANCE RATED CONSTRUCTION

Slide 12 Introduction
Whenever code mandates the use of materials or assemblies required to be noncombustible, have a degree of smoke resistance or have a fire-resistance rating, the performance of the material or assembly is to be evaluated in accordance with the code provisions of Chapter 7 in the OSSC or the referenced standard. The required fire-resistance ratings are based on the potential fire hazard of the occupancy in terms of fire severity and fire duration.

Audio
Repeats written material

Slide 13 Introduction continued
In fire-resistance-rated construction, building codes specify that floor/ceiling, roof/ceiling, and wall assemblies be rated using a standard fire-resistance test, such as the ASTM E119 test standard.
In this lesson we will define specific words that may NOT be in the fire code but are a necessary component for fire inspectors.
This lesson also covers

- Occupancy separation
- Fire-rated assemblies
- Fire separation distance

Slide 14 Objectives
In this lesson you will learn to identify fire-resistance-rated construction requirements that are governed by the following:

- Materials and assemblies used for structural fire resistance
- Fire-resistance-rated construction practices
- Requirements for the separation of adjacent spaces that safeguard against the spread of fire and smoke within a building, as well as the spread of fire between buildings.

Slide 15 Definitions
Many of these definitions are not in the Oregon Fire Code but are a necessary component for fire inspectors. For a complete revision of these terms and conditions see Chapter 7 in the **OSSC**

> The annular space is the space created between the outer surface of a penetrating item and the construction penetrated if left unfilled, which provides a means of free passage of smoke, fire and products of combustion.
>
> A combination damper is used when the code requires not only a fire damper but also a damper designed to limit the passage of smoke from one side of fire-resistance-rated construction to the other. Fire and smoke dampers are required at duct penetrations of shafts. Fire Smoke dampers play an active role in isolating fire zones, reducing the spread of flame and smoke and keeping escape routes and firefighting access open.

Fire dampers are used primarily in heating, ventilating and air-conditioning (HVAC) duct systems that pass through fire-resistance-rated walls or floors. Dampers may also be installed in rated walls independent of HVAC duct systems. Dampers are provided to maintain the fire-resistance rating of the penetrated assembly. Fire dampers are regulated by UL 555, ceiling dampers by UL 555C and smoke dampers by UL 555S.

Draftstopping is required in concealed combustible spaces to limit the movement of air, smoke, and other products of combustion. Draftstopping materials are permitted to be combustible based on the rationale that a large and thick enough combustible material will act as a hindrance against the free movement of air or flame/fire and of the products of combustion. Although the term "draftstopping" would seem to imply that its primary purpose is to hinder the circulation of air within the space, its intended purpose is to stop the movement of fire and products of combustion, as evidenced by the fact that draftstopping can be omitted in some cases when appropriate automatic fire sprinkler protection is installed.

Fire Area: This term is used to describe an area within a building that may consist of a portion of the floor area within a single story, one entire story or the combined floor area of several stories, depending on how these areas are enclosed and separated from other floor areas. Where a fire barrier wall with a fire-resistance rating divides the floor area of a one-story building, each floor area on each side of the wall constitutes a separate fire area. If a horizontal assembly separated the stories in a two-story building, then each story is a separate fire area. In cases where mezzanines are present, the floor area of the mezzanine is included in the fire area calculations, even though the area of the mezzanine does not contribute to the building area calculations.

A fire door is the primary component of a fire door assembly.

Fire Assembly Door: Any combination of a fire door, frame, hardware and other accessories that together provide a specific degree of fire protection to the opening fire door assemblies (door, frame, hardware) are required to be tested using the appropriate standard.

Fire partitions subdivide areas within a building and can be attached to and supported by adjacent structural members. Fire partitions extend to the ceiling only and are constructed of less fire-resistive materials than fire barriers. However, they too must be built according to specifications certified by nationally recognized testing laboratories.
The terms barrier and partition are generally used interchangeably in the industry. However, there is a difference between the two structures.
Fire partitions typically only have a 1 to 2-hour fire-resistance rating. In all other respects, they are similar to fire barriers.

The term 'Fire Protection Rating' applies to the fire performance of an opening protective, such as a fire door, which is determined through tests performed in accordance with NFPA 252 UL10C.

Fire Resistance: All materials offer some degree of fire resistance. A sheet of plywood has a low level of fire resistance as compared to a concrete block, which has a higher level of fire resistance. The fire resistance of a material or an assembly is evaluated by testing performed in accordance with ASTM E119.
Tested materials will be assigned a fire-resistance rating consistent with the demonstrated performance.

Fire Resistance Rating: This refers to the period of time a building element, component or assembly maintains the ability to confine a fire, continues to perform a given structural function, or both as determined by the tests, or the methods based on tests, prescribed in the **OSSC Section 703.** Fire-resistance-ratings form the basis for different construction types and are recognized in the buildings codes. The rating is the period of time the assembly will perform satisfactorily when exposed to the fire test procedures that simulate fire conditions using the standard time-temperature curve.

Fire-Resistant Joint System: In order to maintain the fire-resistant integrity of fire-resistant-rated assemblies, joints that occur within an assembly or between adjacent assemblies must be in accordance with ASTM E1966 or UL 2079.
This test method evaluates, under the specified test conditions: (1) the ability of a fire resistive joint system to undergo movement without reducing the fire rating of the adjacent fire separating elements and (2) the duration for which test specimens will contain a fire and retain their integrity during a predetermined test exposure.

Fire Window Assembly: Are “opening protectives” and contain glazing. They are required to be tested in accordance with NFPA 257 and are then to be installed in accordance with NFPA 80, Standard for Fire Doors and Fire Windows.

Fireblocking is required to hinder the concealed spread of flame, heat and other products of combustion within hollow spaces inside of walls or floor/ceiling assemblies. This is done by periodically subdividing that space, as indicated in OSSC 717.2, using construction materials that have some resistance to fire and sealing the openings around penetrations through those materials.

Floor Fire Door Assemblies: Are required to be tested in accordance with ASTM E 119 and are used to protect the openings in fire-resistance-rated floors for horizontal floor assemblies. The code requires that these doors have a fire-resistance rating instead of just a fire protection rating. By requiring a fire-resistance rating, it will restore the opening in the horizontal assembly to the same level of protection that was originally established during the fire test by limiting the temperature transmission to the unexposed side of the assembly.

A horizontal assembly is a component for completing compartmenting. Horizontal assemblies have all openings and penetration protected equal to the rating for the fire-resistance-rated floor or roof assembly.

Membrane Penetration: An opening made through one side (wall, floor or ceiling membrane) of an assembly. Click to go to a National Fire Academy Coffee Break Training on how to identify fire protection requirements and exceptions for membrane penetrations.
The sprinkler escutcheon in this photograph has been pushed above the ceiling membrane, and the annular space filled with nonrated silicone sealant. This does not meet the fire-resistance membrane protection requirements of the building codes.

Membrane-penetration Firestop: A material, device or construction installed to resist for a prescribed time period the passage of flame and heat through openings in a protective membrane in order to accommodate cables, cable trays, conduit, tubing, pipes or similar items. Click for NFA Coffee Break Training
Firestop systems in wall assemblies must have an F rating of at least 1 hour, and be equal to the fire-resistance-rating of the wall in which they are located. The "F rating" is the time period that the through-penetration system limits the fire spread during the controlled laboratory testing to obtain its listing.

A through-penetration firestop or a membrane-penetration firestop. The picture illustrates a common problem with through-penetration firestop systems: improper installation that renders the system ineffective. Click NFA Coffee Break Training for full article

Shaft: An enclosed space extending through one or more stories of a building, connecting vertical openings in successive floors, or floors and roof. A shaft is required to be enclosed with fire-resistance-rated assemblies to help prevent the vertical spread of fire and resist the spread of products of combustion from story to story. Stairway and elevator floor openings are examples of shafts. Provisions for vertical shafts are found in OSSC section 708.

A smoke barrier is a fire-resistant-rated assembly that is different from a fire partition, fire barrier or fire wall. They include walls and floor/ceiling assemblies that are constructed with 1-hour resistance rating and are one of the components in a smoke compartment. The smoke barrier is intended to resist the spread of fire and hinder the movement of smoke.

Smoke Compartment: A space within a building enclosed by smoke barriers on all sides, including the top and bottom.

Smoke Damper: A listed device installed in ducts and air transfer openings designed to resist the passage of smoke. Click to go to the NFA Coffee Break Training on Fire Smoke Dampers

Slide 16 Fire Barriers

- The term represents wall assemblies with a fire-resistance rating that are constructed in accordance with Sections 706. Fire barriers typically have lower fire-resistance ratings than firewalls, however, fire barriers must also be designed and constructed according to specifications established by nationally recognized laboratories.

- Fire barriers are typically used to subdivide floors and can be attached to or supported by structural members. Fire barriers, typically rated for 2 to 3-hour fire-resistance, are usually non-load-bearing walls that extend from the floor-to-floor or floor-to-roof. All supporting structures should be noncombustible or fire resistant to a rating similar to the barriers they support.
- Fire barriers do not require parapets or endwalls, and are generally not freestanding. Fire barriers restrict the initial flow of heat within the area of origin and thereby help to limit the actuation of sprinklers outside the fire zone. Fire barriers also help to provide the building occupants with sufficient time to evacuate to adjacent safe areas. Fire barriers are most effective when heat and smoke vents are provided and sprinklers are operable.

Audio
A fire barrier helps to supplement the sprinkler system. For example, a sprinkler system might be adequate for the area it protects. However, during a fire one or two sprinkler heads might malfunction due to lack of maintenance or a mechanical problem. In this situation, the fire barrier helps to contain the fire in the absence of a fully functioning sprinkler system.

Slide 17 Fire Protection Rating
Table 715.5 (see Appendix)
The term 'Fire Protection Rating' applies to the fire performance of an opening protective, such as a fire door, which is determined through tests performed in accordance with NFPA 252 UL10C.

Audio
The term 'Fire Protection Rating' applies to the fire performance of an opening protective, such as a fire door, which is determined through tests performed in accordance with NFPA 252 UL10C. The Building Code uses tables to assist the inspector in acquiring the fire rating for windows, doors, and walls. It is important that the fire inspector be familiar with these tables and how to use them while performing inspections. The next few slides will show the tables and provide short videos to assist in understanding how to read them.

Slide 18 Fire Protection Rating
Windows and Doors Video

Slide 19 Fire Protection Rating
Fire Door and Fire Shutter Fire Protection Ratings
Table 715.4 (see Appendix E)

Slide 20 Fire Separation Distance
Building protection concepts
The code limits the amount of openings, both windows and doors in exterior walls based upon:

1. Fire separation distance
2. Required fire rating of exterior wall

Distance to property line
The distance measured from the building face to one of the following:

1. The closest interior property line; or

2. To the centerline of a street, alley or public way; or
3. To an imaginary line between two buildings on the property
4. The distance shall be measured at right angles to the wall

Audio
Repeats written material

Slide 21 Fire Separation Distance
Video

Slide 22 Fire Separation Distance
Table 704.8 (see Appendices F) **Maximum Area of Exterior Wall Openings**

Slide 23 Fire Separation Distance
Exterior Wall Video

Slide 24 Fire Wall and Occupancy Separation
Now let's look at the separation requirements between occupancies within the same building. Occupancies can be separated with fire walls or occupancy separations.

Slide 25 Fire Wall

- A fire wall is a fire resistance-rated wall with protected openings. It extends continuously from the foundation to or through the roof. The purpose of a fire wall is to prevent the spread of fire within a structure or from one structure to another. This wall has the structural stability to resist and withstand fire conditions without collapsing.
- Firewalls are designed to separate each occupancy in this development. Notice that although the middle structure collapsed, the adjacent structures remained free-standing.
- Firewalls are capable of withstanding collapse on either side

Audio
When two occupancies are separated by a fire wall, they are considered separate buildings. Each building has its own requirements for area and height. The code applies the term to vertically constructed assemblies only

Slide 26 Occupancy Separation

- An occupancy separation is a fire resistance-rated wall that separates two or more occupancies with additional code requirements. This type of separation is vertical, horizontal, or both and provides complete separation between occupancies in the same building.
- However this separation does NOT extend from the foundation to or through the roof. The occupancies in a strip mall are typically separated by an occupancy separation. Required fire resistance ratings between occupancies can be found in the OSSC.
- Occupancy separations and fire walls are two examples of rated assemblies. When performing a plans review, check the building for these types of walls. Always check the Underwriters Laboratory (UL) or Gypsum Wall Board (GWB) manuals to make sure the assembly used meets code requirements.

- Rated assemblies provide critical, life safety fire-resistant protection in a variety of wall assemblies in many different building types. These assemblies can be constructed from a myriad of different building materials. Some of the most common include masonry and a combination of steel and gypsum. Steel and gypsum assemblies have become the preferred and most widely used fire-rated assemblies. They are lightweight, low-cost, high-performance systems that significantly reduce overall building weight and construction time.
- Two of the most common fire-rated assemblies are Area Separation Walls and Cavity Shaftwalls. Area Separation Walls are typically used to provide two-hour fire-rated protection between adjacent living units in apartment buildings, condominiums, townhouses and multifamily construction. Cavity Shaftwalls are commonly used to provide fire-resistant protection for elevator shafts, stairwells, vertical chases and mechanical enclosures in most multi-story structures. Cavity shaftwall systems are widely used in low-rise, mid-rise and high-rise buildings.
- To establish hourly ratings, fire assemblies are installed in a temperature-controlled propane gas-fired furnace, and the temperature is increased over a prescribe period of time in accordance with the criteria established in the American Society For Testing and Materials standard E119 "Test Methods for Fire Test of Building Construction Materials." This time-temperature relationship is called the Standard Time-Temperature Curve.
- If the assembly "survives" the fire test for a specific period of time, the assembly is recognized as meeting that hourly rating. For example, if a fire barrier assembly survives the increasing temperature fire test for 180 minutes, it is considered to be equivalent to a "three-hour assembly." That assembly could be installed in those locations where the model building codes require the installation of a three-hour fire barrier.
- Since a rated assembly may not provide the full hourly rating under real fire conditions, hourly ratings should be used for comparisons and not guarantees. A three-hour assembly should survive longer than either a two or one-hour assembly, but since fuel and ventilation in buildings likely does not match the controlled laboratory conditions, one should not expect the assembly to last the full three hours in an uncontrolled fire.

Audio
Repeats first paragraph

Slide 27 Summary

- A fire-resistance rating typically means the duration for which a passive fire protection can withstand a standard fire resistance test. This can be quantified simply as a measure of time, or it may entail a host of other criteria, involving other evidence of functionality or purpose.
- Chapter 7 in the OSSC specifies the requirements for and the maintenance of fire resistance rated construction and requirements for enclosing floor openings and shafts in existing buildings.

LESSON 8: INTERIOR FINISH, FIRE PROTECTION SYSTEMS, EGRESS

Slide 12 Introduction

- Chapter 8 in the OSSC governs the use of materials used as **interior finishes,** trim and decorative materials
- Chapter 9 in OSSC specifies where **fire protection systems** are required and shall apply to the design, installation and operation of fire protection systems
- Chapter 10 in the OSSC shall control the design, construction and arrangement of **means of egress** components required to provide an approved means of egress from structures and portions thereof

Slide 13 Objectives

- Give an overview of interior finish, identify interior finishes, and relate how interior finishes effect fire growth
- Identify fire protection systems, fire extinguishing systems, fire suppression systems, and fire detection and alarm systems
- Discuss the principals of egress elements

Slide 14 Interior Finish, Fire Protection Systems, Egress transition

Slide 15 Interior Finish Background

Coconut Grove

- Boston, MA
- 1942
- 492 dead

Beverly Hills Supper Club

- Southgate, KY
- 1977
- 164 dead

LaSalle Hotel

- Chicago, IL
- 1946
- 61 dead

MGM Grand Hotel

- Las Vegas, NV
- 1980
- 85 dead

Our Lady of Angels School

- Chicago, IL
- 1958
- 95 dead

Las Vegas Hilton

- Las Vegas, NV
- 1980
- 8 dead

Audio

Many famous fire incidents, such as the Coconut Grove and MGM Grand, involved buildings with multiple deficiencies. The lack of adequate exits and the highly combustible interior finish had a synergistic effect.

Slide 16 Interior Finish
Video
Video Simulations
These video simulations were created to determine how to prevent fires such as the Station Night Club. The interior finish affected the fire growth and tenability of the environment. One video shows how fire reacts with sprinklers and the other video shows fire involvement without sprinklers.

Slide 17 Interior Finish
Defined
Exposed interior surfaces of the building

- Ceiling
- Walls and partitions
- Floor finishes
- Wainscoting and paneling
- Other finishes applied structurally
  - Insulation
  - Fire-resistant materials
  - Acoustical materials
  - Decorations

Effects on fire growth

- Affects the flashover rate
- Contributes to fire extension
- Intensifies the fire by contributing fuel
- Produces smoke and toxic gases

Remember to observe the walls, floors, and ceilings for their finishes, coverings, decorations, curtains, etc., in all occupancies. These are usually controlled during building design by the codes; however, people rearrange and renovate after occupancy. These renovations may or may not create new code problems. The wood paneling, the paint, the wall covering, the carpet, and the ceiling tiles all can contribute to fire and life safety problems. You need to study the OSSC for the specifics in your area.

This lesson only scratches the surface. This brief discussion will, it is hoped, get you started.

Audio
Some of the key points in life safety are smoke generation, fuel contribution, and flame spread of the interior finish.

Slide 18 Fire Protection Systems
Introduction
The requirements for fire protections systems originate in building codes based on occupancy and use. When the certificate of occupancy is issued the fire inspector conducts the maintenance inspections of these systems.
Under the rather broad heading of fire protection systems, this lesson will examine the main components of alerting, suppression, containment features and systems. Consideration of these systems is a natural adjunct to a discussion of hazards and building construction features.

Audio
Repeats written material

Slide 19 Fire Protection Systems
Purpose

- This lesson will investigate the primary components of fire detection and alarm systems, water supply systems, automatic sprinkler systems, fire suppression agents and systems and portable fire extinguishers providing the novice inspector a basic foundation on which to build.
- As a fire inspector you must recognize the different types of fire protection systems and equipment and understand how they work. During an inspection, you will rely on this knowledge to evaluate the system in order to determine whether it is appropriate for occupancy and to assess its operational readiness.

Audio
Repeats written material

Slide 20 Fire Protection Systems Transition
As this course is a basic building codes course it is beyond the scope to go into too much detail. If you want more information on this topic consider taking **NFPA Fire Inspector I*and ICC Fire Inspector I.**

* NOTE: **DPSST** has the NFPA Fire Inspector I task book

To take an NFPA Fire Inspector I class check **Chemeketa Community College** and **Portland Community College**.

Oregon Office of State Fire Marshal will be building an IFSTA/NFPA Fire Inspector I course free to fire service personnel in 2011.

Slide 21 Fire Protection Systems Fire Suppression Systems
Introduction
The purpose is to describe the different types of water-based fire-suppression systems and learn how to perform inspections on these systems.

What types of water-based fire suppression systems equipment may an inspector encounter?

- Automatic sprinkler systems
- Water spray fixed systems
- Water mist systems
- Foam-water systems
- Standpipe and hose systems
- Fire pumps

Describing each of these systems goes beyond the scope of this course; however, we will provide a brief review of automatic sprinkler systems.

Slide 22 Fire Protection Systems Fire Suppression Systems
Sprinklers

- Automatic sprinkler systems are the first line of defense against fires and are considered an unsurpassed fire protection device.
- According to the National Fire Sprinkler Association (NFSA), there has never been a multiple loss of life due to fire or smoke in a sprinkler-equipped building, except in cases where the victims were in close proximity to the fire or as the result of an explosion.
- An accurate review of sprinkler system plans is necessary to ensure code compliance. Inspectors need to be familiar with different types of sprinkler systems, their operation, and the specification for each type of system. Before the sprinkler review begins, the inspector determines which standard applies and what the basic requirements are. This involves classifications of the hazard by occupancy and by storage commodity. The inspector must evaluate mixed occupancies very carefully to verify that the appropriate codes or standards have been followed. The system designer provides all necessary information, including calculations and applicable data, on the drawing or the specifications. All calculations must be reviewed for accuracy.

Audio
Repeats written material

Slide 23 Fire Protection Systems Fire Suppression Systems
Sprinkler Types
Sprinklers should be installed as required in the standard to assure complete coverage of the building. This includes closets, stairwells, storage areas, walk-in freezers and concealed spaces. The size of the sprinkler system is determined by the building's total square footage of floor area protected by a single riser and control valve. The installation standards determine the size of the systems, the number of individual systems, and the number of system control valves needed. There are five basic designs for automatic sprinkler systems. These systems may exist in some or all areas of a building.

Deluge sprinkler system: Consists of open sprinklers attached to unpressurized dry pipes. Activated when detection device in protected area senses fire and opens water-flow control valve. Causes all sprinklers to discharge water simultaneously

Dry-pipe sprinkler system: Continually charged with air or nitrogen under pressure Releases air when sprinkler activates, allowing the system to be charged with water. Used in areas where freezing temperatures are likely

Preaction sprinkler system: Continually charged with air that may or may not be under pressure. Only operates when both a sprinkler opens and a detection device in the same area activates the water-flow control valve

Residential sprinkler system: Designed for fast response in residential occupancies where life safety is primary concern.

Possible water sources are:

1. Public water system
2. On-site pressure tank
3. Storage tank with an automatic pump

Wet-pipe sprinkler system: Continually charged with water under pressure that discharges immediately when one or more sprinklers are activated by heat from a fire.

Slide 24 Fire Protection Systems Fire Suppression Systems
Automatic Sprinkler Systems

- Sprinkler systems consist of a series of nozzles, or sprinkler heads, connected to a central piping system that can automatically distribute water to the fire area.
- The sprinkler heads in the system are positioned and configured to distribute enough water over a fire either to extinguish the fire or to prevent a flashover until the fire department arrives. In nearly all types of sprinkler systems, with the exception of a deluge system, water will discharge only out of the sprinkler heads that activate in response to the heat, NOT from every sprinkler head in the system.
- Most sprinkler systems are kept closed by fusible links or other heating devices until a fire causes them to open automatically. Water supplies for sprinklers must be of sufficient capacity and pressure to satisfy the calculated requirements for hydraulically designed systems. The sprinkler system designer should include a graph that shows the water demand compared to the available water. Also, flow tests should also be conducted to determine the pressure and flow available from the city main. The fire inspector needs to check the total capacity of the water supply.

Slide 25 Fire Protection Systems Fire Suppression Systems
Automatic Sprinkler Systems
Fire inspectors need to check several system design factors including:

- Extent of coverage
- Type of system
- Size of system
- Water supply connections and valves
- Fire department connections
- Sprinkler types, temperature ratings, and locations
- Pipe sizes, lengths
- Number of pipe elbows and tees

Type and number of pipe hangers

Slide 26 Fire Protection Systems Fire Suppression Systems
Automatic Sprinkler Systems
There are four major areas of concern when you are inspecting a sprinkler system to ensure that the system is in a ready state. You'll want to note the condition of the:

1. Sprinklers*
2. Valves*
3. Piping
4. Water supply

*Sprinklers: Check sprinklers to make sure that they are clean, unobstructed, and free of paint and corrosion. Sprinklers showing wear or damage or that have been involved in a fire should be replaced. Standards require that an extra supply of sprinklers are to be kept on hand for quick replacement. In addition, nothing should be hung or suspended from a sprinkler, and nothing should be located near or around a sprinkler that could block the flow of water. When necessary, point out sprinklers that require a guard. Pay special attention to sprinklers in areas where there have been changes in occupancy classification, hazard of contents classification,

lighting, heating, or mechanical systems. Changes to any of these factors may require sprinklers with a different type of head or a different rating.
*Valves: All valves controlling the water supply to the sprinkler system and within the system must be open at all times. If you find a valve in the closed position, write it up and notify the fire department immediately.

Slide 27 Fire Protection Systems Fire Suppression Systems
Automatic Sprinkler Systems
Water-based fire-suppression systems have proven their value in controlling, containing, and preventing fires in many types of occupancies.
When such systems fail, the cause is generally human error. To prevent failures, it is up to fire inspectors to determine that water-based fire-suppression systems are designed, installed, tested, and inspected properly.
Possible causes of automatic sprinkler failure include:

- Improper maintenance
- Inadequate water supply
- Lack of water supply
- Incorrect design
- Obstructions
- Partial sprinkler protection
- Intentionally set fire

While it is the responsibility of the property owner/occupant to perform the various tests and inspections, it is the fire inspector who must verify the performance of the tests and inspections. An inspector must be familiar with the types of water-based fire-suppression equipment, types of tests required for the equipment, and intervals at which the tests and inspections must occur.

Slide 28 Fire Protection Systems Fire Extinguishing Systems
Introduction
The purpose of this lesson is to gain a better understanding of special-agent fire extinguishers and systems, appropriate agents, and inspection procedures. If an inspector recognizes the need for additional portable fire extinguishers and requires their presence in a given occupancy, they may prevent or mitigate loss of life by providing a means to extinguish the fire before it threatens lives.

Slide 29 Fire Protection Systems Fire Extinguishing Systems
Special Agent Extinguishers
Fire inspectors should be familiar with each type of special agent extinguishing system and the applicable requirements. Special agent extinguishing systems are used where standard systems may not be the best solution.
Locations include areas containing:

a. Flammable and combustible liquids and gases
b. Water-reactive metals or chemicals
c. Food-preparation equipment
d. File storage or archives
e. Sensitive electronic equipment
f. Electrical transformers and switches

Types of systems

a. Dry chemical
b. Wet chemical
c. Clean agent
d. Carbon dioxide (CO_2)
e. Foam

The architects, engineers, or contractors specifications should be detailed and include:

- Location and type of discharge nozzles
- Method of actuation and auxiliary alarm functions such as shutting off ventilation
- Type of pre-signaling devices used, if required
- Area and volume of the protected space
- Type of system
- Type of extinguishing agent being used
- Amount of agent required
- Concentration of extinguishing agent to be developed
- Storage container size
- Type of expellant gas
- Rate of discharge
- Duration of flow
- Layout and type of piping included, whether engineered or pre-engineered of the protected space

Slide 30 Fire Protection Systems Fire Extinguishing Systems
Extinguishers

One or more important duties will be to verify fire extinguishers are placed within the required travel distance. Travel distance from a hazard to an exit or to a fire extinguisher.

Class K: involves oils and greases Saponification - process by which extinguishing agents turn fats and oils into soapy foam that extinguishes fire.

Class D: involves combustible metals. May require special extinguishing agents or techniques.

Class C: involves energized electrical equipment where electrical conductivity of extinguishing agent is of major importance: involves Class A or Class B materials that can be extinguished once equipment is de-energized.

Class B: **i**nvolves flammable and combustible liquids and gases. Materials include gasoline, oil, lacquer, paint, mineral spirits, and alcohol.

Class A: involves ordinary, solid combustible materials. Materials include wood, cloth, paper, rubber, and many plastics.

Slide 31 Fire Protection Systems Fire Extinguishing Systems
Inspections

Portable fire extinguishers should never be considered a substitute for automatic fire-detection or fire-extinguishing system

- Inspection considerations

Rely on requirements of building and fire codes

*NFPA 10, Standard for Portable Fire Extinguishers.

- Value lies in speed with which they can be used by untrained individuals

*Standard for Portable Fire Extinguishers, provides specific placement guidelines for fire extinguishers based on their class and size and on whether the hazard being protected is classified as low, moderate, or high (OSSC 906)

Inspection should include review of the following observations:

- All system parts are in correct location
- All manual actuators are unobstructed
- Tamper indicators/seals are intact
- Maintenance tags are in place and up to date
- Any obvious damage is noted
- Gauges are within operational limits
- Any equipment modifications or repairs are noted

Slide 32 Fire Protection Systems Fire Extinguishing Systems
Characteristics

What characteristics are required of portable fire extinguishers for them to be effective?

- Readily visible and accessible
- Suitable for hazard being protected
- In working order
- Sufficient size to control incipient fire
- Appropriate wind and weather conditions to ensure effectiveness

The fire inspector inspects portable fire extinguishers but does NOT maintain them. Maintenance should be performed when inspection reveals the need or when due as required by manufacturer. Maintenance should be performed by trained, certified personnel and is the responsibility of the business owner to ensure proper maintenance.

Examples of improper mounting include an extinguisher mounted where it protrudes into a path of travel or one that is sitting on top of a workbench with no mount at all.

NFPA 10 recommends monthly inspections

Slide 33 Fire Protection Systems Fire Extinguishing Systems
Other Extinguishing Agents

As a fire inspector, you must be able to evaluate all types of fire protection systems to ensure they are approved for the hazards they are protecting, and you must verify the systems meet all installation requirements.

There are thee types of suppression systems

- Gaseous extinguishing systems
- Standpipe systems
- . Water spray systems

An inspector needs to learn how these systems operate, the types of suppressant they contain, and the types of applications in which they can be used.

Audio

Repeats first paragarpah

Slide 34 Fire Protection Systems Fire Detection Systems
Introduction
There are a variety of fire detection and alarm systems that can be employed for the protection of a building, its contents, and the people who are in the building. To review the alarm and detection system, fire inspectors need information from the specifications, floor plans, equipment list, and symbol list. The specifications should include the type and gauge of wire, protections provided for the wire, wiring methods, and methods of supervision. All fire alarm systems must have electrical supervision.

Many factors determine where and how fire alarm systems should be installed. Before conducting an inspection, read the applicable sections OSSC Ch. 9 and NFPA 72. The more you use your knowledge and your resources, the better you will be at evaluating a fire alarm system.

Slide 35 Fire Protection Systems Fire Detection Systems
Alarms
During your review of construction plans and fire inspections, you should know how to inspect and evaluate fire detection and alarm systems for each type of occupancy.
The initiation function of a fire alarm system provides an input signal to the system when the presence of a fire is detected. Activation of a fire alarm system is required by one of the following:

- Manual initiation
- Automatic detection
- Extinguishing system operation

Although not every area requires an audible and visual notification system, many areas do. Pay attention to the requirements for each type of occupancy, since they do vary.

Slide 36 Fire Protection Systems Fire Detection Systems
Communication
Detailed information about alarm plans and communication systems is not usually provided on the general construction plans. Typically, separate plans must be submitted and approved before these systems can be installed. Plans for alarm systems should include enough information for the fire inspector to evaluate the following:

- Signal initiation
- Signal notification
- Supervision of alarm systems
- Power Supply
- Elevator control
- Automatic door closers
- Stair pressurization
- Damper control
- Initiation of automatic extinguishing equipment
- Fire pumps
- Doors that unlock or close automatically when the alarm activates
- Lightning protection
- Battery load calculations
- Manufacturers' cut sheets
- Point-to-point wiring diagrams
- Smoke control

Slide 37 Means of Egress
Introduction

When conducting an inspection of any occupied building, life safety requirements must always be given primary consideration. History is marked with the loss of life from fire. A primary purpose of codes in general, and building codes in particular, is to safeguard life in the presence of fire. Integral to this purpose is the path of egress travel for occupants to escape and avoid the fire. Means of egress can be considered the lifeline of a building. The principles on which means of egress are based and that form the fundamental criteria for requirements are to provide a means of egress system:

- That will give occupants alternative paths of travel to a place of safety to avoid fire
- That will shelter occupants from fire and products of combustion
- That will accommodate all occupants of a structure
- That is clear, unobstructed, well marked and illuminated and in which all components are under control of the user without requiring any tools, keys or special knowledge or effort
- Determine occupant loads for occupant load certificates
- Type of door hardware required and not permitted
- Placement and maintenance of exit signs and emergency lighting
- Door swing requirements
- When doors are to be self-closing
- When are two or more exits required

Slide 38 Means of Egress Introduction Continued

Slide 39 Means of Egress
Fire History
Historical fires that resulted in large loss-of-life because of failures in the means of egress

- Iroquois Theater fire, Chicago, Il, 1903; 602 deaths
- Coconut Grove Nightclub fire, Boston MA, 1942; 492 deaths
- Beverly Hills Supper club fire, Southgate, KY, 1977; 165 deaths
- Happy Land Social Club, New York, NY, 1990; 87 deaths
- Imperial Food Products, Hamlet, NC, 1991; 25 deaths
- Station Night Club Fire, West Warwick RI, 2003,100 deaths
- Chicago Stampede at Epitome Nightclub, Chicago, IL, 2003, 21 deaths

Audio
Historically, many lives have been lost during emergencies because exits were blocked, locked, improperly marked, poorly designed, or otherwise inaccessible. Some of the largest loss-of-life fires in history were glaring examples of exit inadequacies.

Slide 40 Means of Egress
Definitions
The exit discharge is the portion of a means that is between the end of an exit and a public way. Such as an alley that joins a street or sidewalk is a typical exit discharge. Exit discharge begins when the building occupants reach the exterior at grade level.

- Provides a safe path of travel away from the building
- All components between the building and public way are considered to be the exit discharge regardless of distance

The exit is the portion of a means of egress that is separated from the area of the building from which escape is made by walls, floors, doors, or other means that provide the protected path necessary for the occupants to proceed with a reasonable safety to the exterior of the building. Exits are the critical element in the means of egress system that the building occupants travel through to reach exterior grade level.

Exit access is that portion of a means of egress that leads to the exit, such as, hallways, corridors, and aisles commonly serve as exit access.
The figure (see Appendix) illustrates that exit access begins at the furthest point within each room or space and ends at the entrance.

Slide 41 Means of Egress
System
Continuous and unobstructed path of vertical and horizontal egress or exit travel from any occupied point in a building or structure to a public way
Components

- Active fire-protection systems
- Exit signs
- Illumination
- Door hardware
- Handrails

Audio
Means of egress is the path traveled by building occupants to leave the building and the site on which it is located. It includes all interior and exterior elements that the occupants must travel through to reach a public way, such as a street or alley. The egress elements create the lifeline that occupants must successfully maneuver during an emergency.

Slide 42 Means of Egress
Components
Components may be active or passive
Automatic sprinkler systems are one example of an active means of egress component.
Passive components consist of: doors, walls, floors, ceilings, stairs, ramps, fire escapes, security devices etc.

- Separate occupants from fire, smoke, and other hazardous elements during escape
- Consist of lighting and signs intended to guide or direct occupants to exits or areas of refuge

Slide 43 Means of Egress
Markings

- Illumination and markings are required by Building Code
- Vary with occupancy classification
- Must by continuous during periods of occupancy
- Must be arranged so that failure of unit will not leave any area in darkness
-

Exit signs shall be internally or externally illuminated at all times:

- Must illuminate if power is lost

- Signs plainly legible. Letters in contrast colors, letter height at least 6 in. high and 2 in. wide, except for letter "I"

If arrow is provided, construction shall not allow direction of arrow to be changed.
Where occupancy has two or more required exits or exit accesses, the means of egress must be provided with illuminated signs that readily identify the location of the exits and indicate the path of travel to the exit.

- Access to exits: Marked by readily visible exit signs if path of egress travel is not immediately visible
- Exit sign placement: No point in exit access corridor is more than 100 ft. from nearest visible exit sign; except if only one exit or exit access

Slide 44 Means of Egress
Occupant Load
Model Codes give the building official or plans examiner ability to determine number of people who may safely occupy a building.
Provide a means to determine how many people may safely exit a structure during an emergency.
Provide the building official or plans examiner the means to determine:

- Capacity of each individual means of egress
- Total capacity of all means of egress
- Number of exits required
- Maximum travel distance to an exit

Audio
Determining occupant load Net Floor Area ÷ Area per Person. The OSSC provides occupant load factors to be used in this equation. Refer to Section 1004 pg. 223 of OSSC.

Slide 45 Means of Egress
Summary

- Tragic events involving inadequate or blocked exits have led to model code requirements for means of egress for all types of occupancy classifications.
- An inspector is responsible for ensuring that building occupants have an unimpeded ability to evacuate a structure or move to an area of refuge within the structure.

Means of egress routes from a structure must conform to the requirements of the locally adopted fire and life safety code and must maintain access for emergency responders.
Today's inspectors must know the required life safety systems for different occupancies and be able to recognize when the system has been violated. Life safety from fire is a matter of successfully evacuating or relocating the occupants of a building to a place of safety. As a result, life safety is a function of time: time for detection, time for notification, and time for safe egress.
Refer to Means of Egress in Chapter 10 of the OSSC

Slide 46 Course Summary

- Fire inspectors face serious life safety challenges. Inspectors must deal with building owners who want to make a profit but may not want to be restricted by codes. An inspector knows they have done their job when an emergency occurs in occupancy and all systems work, and there is no loss of life or injuries to the occupants. Everyone is able to

safely exit the building and the total life safety package works. This is when all the hard work and time devoted to ensuring the system operates correctly pays off.

- Model codes provide a tool to design and enforce life safety for all occupancies. Occupancy classifications attempt to group the various risk factors associated with life safety. In certain instances, such groupings may not be applicable; the fire inspector should evaluate the risk and protection features to ensure that adequate life safety has been provided.

- We have covered a great deal of information in this course. The goal has been to expose new and potential fire prevention inspectors to the basics of the building code process. A number of topics have been introduced, including model code history, where inspection authority comes from, an overview of the assembly occupancies, construction types, allowable height and area, fire-resistance-rated constructions, and reviewing interior finishes, fire protection systems, and egress.

APPENDIX A TABLE 601
FIRE RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (HOURS)

BUILDING ELEMENT	Type I		Type II		Type III		Type IV	Type V	
	A	B	A[e]	B	A[e]	B	HT	A[e]	B
Structural frame[a]	3[b]	2[b]	1	0	1	0	HT	1	0
Bearing walls Exterior[g] Interior	3 3[b]	2 2[b]	1 1	0 0	2 1	2 0	2 1/HT	1 1	0 0
Nonbearing walls and partitions Exterior	see Table 602 in IBC								
Nonbearing walls and partitions Interior[f]	0	0	0	0	0	0	See section 602.4.6	0	0
Floor construction including supporting beams and joists	2	2	1	0	1	0	HT	1	0
Roof construction including supporting beams and joists	1 ½[c]	1[c,d]	1[c,d]	0[d]	1[c,d]	0	HT	1[c,d]	0

For SI: 1 foot = 304.8 mm.

a. The structural frame shall be considered to be the columns and the girders, beams, trusses and spandrels having direct connections to the columns and bracing members designed to carry gravity loads. The members of floor or roof panels which have no connection to the columns shall be considered secondary members and not a part of the structural frame.

b. Roof supports: Fire-resistance ratings of structural frame and bearing walls are permitted to be reduced by 1 hour where supporting a roof only.

c. Except in Group F-1, H, M and S-1 occupancies, fire protection of structural members shall not be required, including protection of roof framing and decking where every part of the roof construction is 20 feet or more above any floor immediately below. Fire-retardant-treated wood members shall be allowed to be used for such unprotected members.

d. In all occupancies, heavy timber shall be allowed where a 1-hour or less fire-resistance rating is required.

e. An approved automatic sprinkler system in accordance with Section 903.3.1.1 shall be allowed to be substituted for 1-hours fire-resistance-rated construction, provided such system s not otherwise required by other provisions of the code or sued for an allowable areas increase in accordance with Section 506.3 or an allowable height increase in accordance with Section 504.2. The 1-hour substitution for the fire resistance of exterior walls shall not be permitted.

f. Not less than the fire-resistance rating required by other sections of this code

g.Not less than the fire-resistance rating based on fire separation distance (see Table 602)

APPENDIX B TABLE 503
TYPES OF CONSTRUCTION

OSSC Table 503		TYPE OF CONSTRUCTION								
		TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
	HGT (feet)									
GROUP	HGT (S)	UL	160	65	55	65	55	65	50	40
A-1	S	UL	5	3	2	3	2	3	2	1
	A	UL	UL	15,500	8,500	14,000	8,500	15,000	11,500	5,500
A-2	S	UL	11	3	2	3	3	3	2	1
	A	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
A-3	S	UL	11	3	2	3	2	3	2	1
	A	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
A-4	S	UL	11	3	2	3	2	3	2	1
	A	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
A-5	S	UL	UL	UL	UL	UL	UL	UL	UL	UL
	A	UL	UL	UL	UL	UL	UL	UL	UL	UL
B	S	UL	11	5	4	5	4	5	3	2
	A	UL	UL	37,500	23,000	28,500	19,000	36,000	18,000	9,000
E	S	UL	5	3	2	3	2	3	1	1
	A	UL	UL	26,500	14,500	23,500	14,500	25,500	18,500	9,500

APPENDIX C TABLE 508.2
INCIDENTAL USE AREAS

TABLE 508.2
INCIDENTAL USE AREAS

ROOM OR AREA	SEPARATION AND/OR PROTECTION
Furnace room where any piece of equipment is over 400,000 Btu per hour input	1 hour or provide automatic fire-extinguishing system
Rooms with boilers where the largest piece of equipment is over 15 psi and 10 horsepower	1 hour or provide automatic fire-extinguishing system
Refrigerant machinery rooms	1 hour or provide automatic sprinkler system
Parking garage (Section 406.2)	2 hours; or 1 hour and provide automatic fire-extinguishing system
Hydrogen cut-off rooms, not classified as Group H	1-hour in Group B, F, M, S and U occupancies. 2-hour in Group A, E, I and R occupancies.
Incinerator rooms	2 hours and automatic sprinkler system
Paint shops, not classified as Group H, located in occupancies other than Group F	2 hours; or 1 hour and provide automatic fire-extinguishing system

APPENDIX D TABLE 503.3
REQUIRED SEPARATION OF OCCUPANCIES (HOURS)

TABLE 508.3.3
REQUIRED SEPARATION OF OCCUPANCIES (HOURS)

	A[e], E		I		R[d]		F-2, S-2[c,d], U[d]		B[b], F-1, M[b], S-1		H-1		H-2		H-3, H-4, H-5	
OCCUPANCY	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
A[e], E[e]	N	N	1	2	1	2	N	1	1	2	NP	NP	3	4	2	3[a]
I	—	—	N	N	1	NP	1	2	1	2	NP	NP	3	NP	2	NP
R[d]	—	—	—	—	N	N	1	2	1	2	NP	NP	3	NP	2	NP
F-2, S-2[c,d], U[d]	—	—	—	—	—	—	N	N	1	2	NP	NP	3	4	2	3[a]
B[b], F-1, M[b], S-1	—	—	—	—	—	—	—	—	N	N	NP	NP	2	3	1	2[a]
H-1	—	—	—	—	—	—	—	—	—	—	N	NP	NP	NP	NP	NP
H-2	—	—	—	—	—	—	—	—	—	—	—	—	N	NP	1	NP
H-3, H-4, H-5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	N	NP

For SI: 1 square foot = 0.0929 m^2.
S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.
NS = Buildings not equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.
N = No separation requirement.
NP = Not permitted.
a. For Group H-5 occupancies, see Section 903.2.4.2.
b. Occupancy separation need not be provided for storage areas within Groups B and M if the:
1. Area is less than 10 percent of the floor area;
2. Area is equipped with an automatic fire-extinguishing system and is less than 3,000 square feet; or
3. Area is less than 1,000 square feet.
c. Areas used only for private or pleasure vehicles shall be allowed to reduce separation by 1 hour.
d. See Section 406.1.4.
e. Commercial kitchens need not be separated from the restaurant seating areas that they serve.

APPENDIX E TABLE 715.4
FIRE DOOR AND FIRE SHUTTER FIRE PROTECTION RATINGS

TABLE 715.4
FIRE DOOR AND FIRE SHUTTER FIRE PROTECTION RATINGS

TYPE OF ASSEMBLY	REQUIRED ASSEMBLY RATING (hours)	MINIMUM FIRE DOOR AND FIRE SHUTTER ASSEMBLY RATING (hours)
Fire walls and fire barriers having a required fire-resistance rating greater than 1 hour	4	3
	3	3[a]
	2	1 1/2
	1 1/2	1 1/2
Fire barriers having a required fire-resistance rating of 1 hour:		
Shaft, exit enclosure and exit passageway walls	1	1
Other fire barriers	1	3/4
Fire partitions:		
Corridor walls	1	1/3 [b]
	0.5	1/3 [b]
Other fire partitions	1	3/4
	0.5	1/3
Exterior walls	3	1 1/2
	2	1 1/2
	1	3/4
Smoke barriers	1	1/3 [b]

a. Two doors, each with a fire protection rating of 1 1/2 hours, installed on opposite sides of the same opening in a fire wall, shall be deemed equivalent in fire protection rating to one 3-hour fire door.
b. For testing requirements, see Section 715.4.3.

APPENDIX F TABLE 704.8
MAXIMUM AREA OF EXTERIOR WALL OPENINGS

TABLE 704.8
MAXIMUM AREA OF EXTERIOR WALL OPENINGS[a]

CLASSIFICATION OF OPENING	FIRE SEPARATION DISTANCE (feet)							
	0 to 3[f,j]	Greater than 3 to 5[c,g]	Greater than 5 to 10[c,e,g,h]	Greater than 10 to 15[d,e,g]	Greater than 15 to 20[d,g]	Greater than 20 to 25[d,g]	Greater than 25 to 30[d,g]	Greater than 30
Unprotected	Not Permitted	Not Permitted[c]	10%[i]	15%[i]	25%[i]	45%[i]	70%[i]	No Limit
Protected	Not Permitted	15%	25%	45%	75%	No Limit	No Limit	No Limit

For SI: 1 foot = 304.8 mm.

a. Values given are percentage of the area of the exterior wall.

b. Deleted.

c. For occupancies in Group R-3, the maximum percentage of unprotected and protected exterior wall openings shall be 25 percent.

d. The area of openings in an open parking structure with a fire separation distance of greater than 10 feet shall not be limited.

e. For occupancies in Group H-2 or H-3, unprotected openings shall not be permitted for openings with a fire separation distance of 15 feet or less.

f. For requirements for fire walls for buildings with differing roof heights, see Section 705.6.1.

g. The area of unprotected and protected openings is not limited for occupancies in Group R-3, with a fire separation distance greater than 5 feet.

h. For special requirements for Group U occupancies, see Section 406.1.2.

i. Buildings whose exterior bearing wall, exterior nonbearing wall and exterior structural frame are not required to be fire-resistance rated by Table 601 or 602 shall be permitted to have unlimited unprotected openings.

j. Includes accessory buildings to Group R-3.

APPENDIX G TABLE 602
FIRE-RESISTANCE RATING REQUIREMENTS FOR EXTERIOR WALLS BASED ON FIRE SEPARATION DISTANCE

TABLE 602
FIRE-RESISTANCE RATING REQUIREMENTS FOR EXTERIOR WALLS BASED ON FIRE SEPARATION DISTANCE[a, e]

FIRE SEPARATION DISTANCE = X (feet)	TYPE OF CONSTRUCTION	OCCUPANCY GROUP H	OCCUPANCY GROUP F-1, M, S-1	OCCUPANCY GROUP A, B, E, F-2, I, R, S-2, U[b]
X < 5[c]	All	3	2	1
5 ≤ X < 10	IA Others	3 2	2 1	1 1
10 ≤ X< 30	IA, IB IIB, VB Others	2 1 1	1 0 1	1[d] 0 1[d]
X ≥ 30	All	0	0	0