Plumbing installation

Level IV

Based on October 2023, Curriculum Version 2

Module Title: Building Codes and Standards for Medium Rise Building Projects

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ACRONYMS

JPEG .....Joint Photographic Experts Group

LAP Test .....Learning Activity Performance Test

LG .....Learning Guide

PDF .....Portable Document Format

IBC.....International Building Code

ISO ..... International Standardization Organization

EBCS .....Ethiopian building construction standard

IS ..... International Standardization

BS .....Building Standard

INTRODUCTION TO THE MODULE

A medium rise building is a building between 5 to 11 stories. A code is a law or regulation that sets forth minimum requirements and, in particular, a building code is a law or regulation that sets forth minimum requirements for the design and construction of buildings and structures. These minimum requirements, established to protect the health and safety of society, attempt to represent society's compromise between optimum safety and economic feasibility. Although builders and building owners often establish their own requirements, the minimum code requirements of a jurisdiction must be met. Features covered include, for example, structural design, fire protection, and means of egress, light, sanitation, and interior finish. This module cover skill, knowledge and attitude required to apply building codes and standards for medium Rise Building Projects.

This module is designed to meet the industry requirement under the plumbing installation work occupational standard, particularly for the unit of competency.

MODULE UNITS

- Code and standard requirements.
- Building Classification
- Analyzing and applying a range of solutions to a construction problem.
- Applying fire protection requirements.

LEARNING OBJECTIVES OF THE MODULE

At the end of this session, the students will able to:

- Access and interpret relevant code and standard requirements.
- Classify buildings.
- Analyze and apply a range of solutions to a construction problem.
- Apply fire protection requirements.

Module Instruction

For effective use these modules trainees are expected to follow the following module instruction:

1. Read the information written in each unit
2. Accomplish the Self-checks at the end of each unit
3. Perform Operation Sheets which were provided at the end of units
4. Do the “LAP test” given at the end of each unit and
5. Read the identified reference book for Examples and exercise

Unit One: Code and Standard Requirements

This learning unit is developed to provide the trainees the necessary information regarding the following content coverage and topics:

- Performance Requirements to Medium Rise Building Projects
- Requirements of Building Code of Ethiopia
- Referencing and Applying of Ethiopian Standards
- Accessing and Interpreting Building Code of Ethiopia

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Identify relevant performance requirements that apply to medium-rise building projects based on Ethiopian Building Code Standard (EBCS).
- Determine requirements of relevant Building Code of Ethiopia and other related building codes that are practiced and accepted in Ethiopia Deemed-to satisfy provisions.
- Refer and apply requirements of relevant Ethiopian standards based on specific project.
- Access and interpret Building Code of Ethiopia appropriately in relation with particular project plan and specification.

1.1. Performance Requirements to Medium Rise Building Projects

A building structure should satisfy the following basic design and performance requirements

- The structure should have adequate margin of safety (factor of safety) in addition to that necessary to support its normal loading.
- It must have sufficient stiffness so that its distortion does not offend the eye or reduce the efficiency of the structure for its normal purpose.
- The building should be planned to provide sufficient comfort and convenience to the occupants of the building.

To accommodate the basic functional requirements, a building should satisfy the following requirements in its design and construction works:

- **Strength and stability:** Any structural component of a building should be strong enough to carry or support all possible types of loads to which it is likely to be subjected. The Loads in a building are commonly classified as: dead loads, super imposed or live loads and wind loads.
    1. **Dead loads:** are static loads due to the weight of the respective structural members, i.e. the wall partitions, roofs, slabs and all other permanent fixtures in the building.

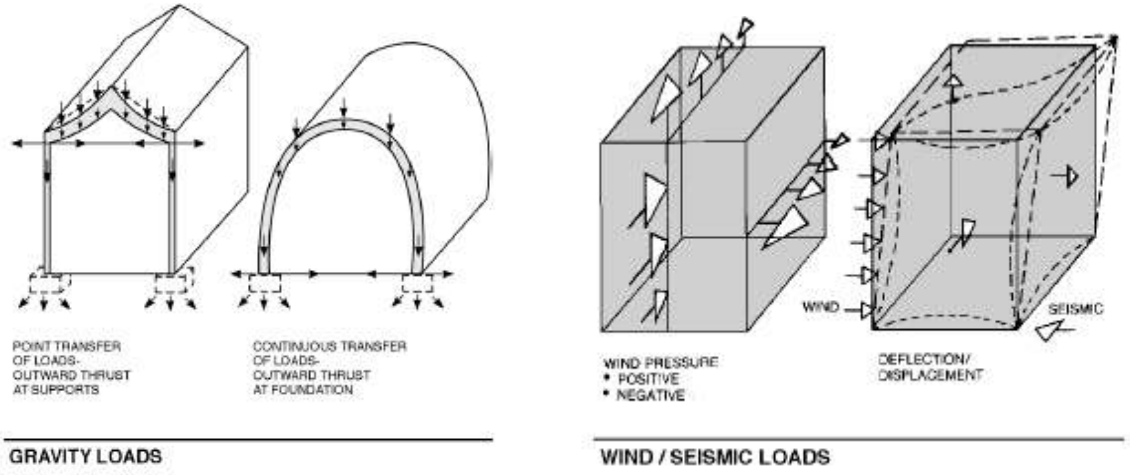

Fig. 1.1 Loads in buildings

2. **Live loads:** also called as super-imposed loads, consist of moving or variable loads, due to people or occupants, their furniture, temporary stores, machinery, etc.

3. **Wind loads:** are loads, which can cause uplift on a building and reduce the pressure on the foundation on the windward side and increase pressure on the leeward side. The effect of wind pressure increases with the height of the building.

- **Dimensional stability:** Refers to the resistance to dimensional changes in building materials and structures caused due to:
  1. Elastic and plastic deformations as a result of applied loads
  2. Expansion and contraction due to changes in temperature and moisture content.
- **Comfort and convenience:** Should be satisfied by proper planning of the buildings and its units. The designer can achieve this by optimum utilization of space, lighting considerations and by providing good orientation
- **Resistance to moisture penetration:** The presence of moisture in any building structure deteriorates the materials strength, reduces durability and could cause partial or total failure of the structure.
- **Fire protection:** A building structure should not ignite easily and should be designed to reduce the spread of fire. Plus, a building should provide means of fire escape
- **Heat insulation:** The building should be designed in such a way to maintain fairly constant temperature of the internal environment independently of the varying climatic conditions externally.
- **Day light and ventilation:** Day lighting is essential to promote the activities carried in the building and to create pleasant inside environment. Ventilation is essential to prevent undue concentration of odors, fumes, dust, etc. and maintain suitable condition for the user of the building.
- **Sound insulation:** The insulation of noise is a very important requirement for buildings such as hospitals, educational institutions, offices and residential building located in noisy areas.
- **Durability:** The durability of a building is defined as the time over which a building remains serviceable and depends mainly on, type of building materials, environmental exposure, quality of workmanship and degree of maintenance, etc.
- **Security:** Due considerations should be given in designing and constructing external walls and openings to protect a building against burglary or theft

- **Economy:** The designer must exercise economy at every stage of planning, design, construction, maintenance and operation.

1.2. Requirements of Building Code of Ethiopia

The Building Code of Ethiopia, officially known as the "Ethiopian Building Code Standard (EBCS)," provides a comprehensive set of regulations and standards for the construction industry in Ethiopia. EBCS covers various aspects of building design, construction, safety, and environmental compliance.

The specific requirements of the Building Code of Ethiopia include:

1. **Structural Design and Integrity**: Requirements for the structural design and integrity of buildings to ensure they can withstand various loads, including dead loads (permanent), live loads (occupant and movable), wind loads, and earthquake forces.
2. **Materials and Construction Methods**: Standards for construction materials, including concrete, steel, masonry, and timber, as well as guidelines for construction methods to ensure quality and safety.
3. **Foundation Design**: Guidelines for foundation design, including soil testing, bearing capacity determination, and recommendations for suitable foundation types based on site conditions.
4. **Fire Safety**: Regulations related to fire safety, including fire-resistant construction materials, fire protection systems, fire alarm systems, and evacuation plans.
5. **Energy Efficiency and Sustainability**: Requirements for energy-efficient building design and construction, including thermal insulation, ventilation, and lighting systems. EBCS also encourages sustainable building practices and the use of renewable energy sources.
6. **Occupant Safety and Accessibility**: Guidelines for barrier-free design to ensure that buildings are accessible to people with disabilities. This includes provisions for ramps, elevators, and accessible facilities.

7. **Environmental Compliance**: Provisions for environmental impact assessment (EIA) and regulations for construction projects to mitigate environmental impacts. EBCS encourages the responsible use of natural resources and environmental sustainability.
8. **Occupancy and Land Use**: Regulations specifying the permissible land use and occupancy types for different zones and areas. Compliance with zoning regulations is essential.
9. **Safety Standards**: Safety requirements for construction sites, including the use of personal protective equipment (PPE), site safety plans, risk assessments, and safety procedures to protect workers and the public.
10. **Quality Control and Inspection**: Standards for quality control and inspections during construction to ensure that materials and workmanship meet EBCS quality standards.
11. **Testing and Verification**: Procedures for testing and verification to confirm that construction materials and methods meet the prescribed standards.
12. **Life Safety and Building Evacuation**: Regulations for life safety, including the design and placement of emergency exits, fire suppression systems, and evacuation plans.
13. **Building Codes and Standards Compliance**: Mandatory compliance with the EBCS, other national building codes, and local regulations in the design and construction of buildings.
14. **Land Use and Zoning**: Adherence to land use and zoning regulations, including setbacks, building heights, and land use categories as defined by local authorities.
15. **Documentation and Approvals**: Documentation and record-keeping requirements, including the submission of construction plans for approval by regulatory authorities, as well as the maintenance of project records and as-built drawings.
16. **Occupancy Load Limits**: Calculations and restrictions on the maximum allowable occupancy load based on building design and safety features.
17. **Health and Sanitation Standards**: Requirements for sanitation facilities, water supply, and sewage disposal, particularly for buildings with public or residential occupancy.

18. **Resilience and Climate Adaptation**: Provisions for resilience in construction, considering climate adaptation and natural disaster preparedness, such as seismic or flood-resistant design.
19. **Accessibility for People with Disabilities**: Specific requirements for buildings to be accessible to individuals with disabilities, including the use of ramps, elevators, and other accessible features.

It's essential for architects, engineers, contractors, and building professionals to be familiar with the Building Code of Ethiopia and ensure that construction projects comply with its requirements. Adherence to these standards is critical for safety, quality, and environmental sustainability in construction in Ethiopia.

1.3. Referencing and Applying of Ethiopian Standards

1. In the course "Building Codes and Standards for Medium Rise Building Projects," understanding and applying Ethiopian standards is crucial for ensuring that construction projects comply with regulatory requirements, maintain safety, and meet quality standards.
2. Steps to reference and apply Ethiopian standards effectively within the context of medium-rise building projects:
3. **Identify Relevant Ethiopian Standards:** Start by identifying the specific Ethiopian standards that are relevant to medium-rise building projects. These standards may cover structural design, construction materials, safety, and other critical aspects.
4. **Access and Obtain Standards:** Access the Ethiopian standards from authorized sources, such as the Ethiopian Standards Agency (ESA) or accredited standards publishers. Ensure that you have the latest versions of these standards.
5. **Understand Standards and Requirements:** Carefully review and understand the content of the selected Ethiopian standards. Pay close attention to the technical specifications, performance criteria, and compliance requirements relevant to medium-rise building construction.

6. **Integrate Standards into Project Planning:** Integrate Ethiopian standards into the project planning and design phases. Use these standards as the basis for developing design specifications, material selections, and construction methods.
7. **Training and Education:** Provide training and education to project stakeholders, including architects, engineers, contractors, and construction workers, to ensure they understand and can apply the relevant Ethiopian standards.
8. **Design Compliance:** Ensure that the architectural and structural design of medium-rise buildings complies with Ethiopian standards. This includes following structural design codes, load calculations, and other relevant criteria.
9. **Material Selection and Procurement:** Select construction materials and products that meet the Ethiopian standards for quality and performance. When procuring materials, verify their compliance and request certifications from suppliers.
10. **Quality Control and Testing:** Establish quality control procedures and conduct testing to verify compliance with Ethiopian standards throughout the construction process. This includes material testing, structural testing, and quality assurance protocols.
11. **Document Compliance:** Maintain comprehensive documentation that demonstrates compliance with Ethiopian standards. This includes records of material certifications, inspection reports, and testing results.
12. **Inspect and Monitor:** Conduct regular inspections to monitor the construction process and ensure that work is being carried out in accordance with the applicable standards.
13. **Third-Party Verification:** Engage third-party inspection and verification services if needed to provide independent confirmation of compliance with Ethiopian standards.
14. **Conformity with Regulatory Requirements:** Verify that the medium-rise building project aligns with any regulatory requirements that reference Ethiopian standards. Compliance with these standards may be a legal obligation.
15. **Continuous Improvement:** Continuously assess the construction processes and products to identify areas for improvement in compliance with Ethiopian standards. Make adjustments as necessary to enhance performance.

16. **Collaboration with Authorities:** Maintain a collaborative relationship with local building authorities to ensure you stay informed about any changes in standards or compliance requirements.
17. **Certification and Conformity Marking:** If your medium-rise building project requires certification or conformity marking, follow the procedures established by the Ethiopian Standards Agency for obtaining the necessary approvals.
18. Applying Ethiopian standards effectively in the context of medium-rise building projects is critical to achieving structural integrity, safety, and quality. This ensures that the construction is in line with the legal requirements and industry best practices while meeting the needs of stakeholders and the community.

1.4. Accessing and Interpreting Building Code of Ethiopia

Accessing and interpreting the Building Code of Ethiopia (Ethiopian Building Code Standard - EBCS) is crucial for the course "Building Codes and Standards for Medium Rise Building Projects."

Steps to effectively access and interpret the EBCS:

Accessing EBCS:

A. **Ethiopian Standards Agency (ESA):** Visit the official website of the Ethiopian Standards Agency (ESA). ESA is responsible for developing and maintaining the Ethiopian Building Code Standards. You can typically find the EBCS documents and standards available for download or purchase on their website.

B. **Library Resources:** Many educational institutions and libraries may have copies of the EBCS documents available for reference. Check with your course instructor or the library staff to access physical or digital copies.

Identify Relevant Standards: Determine which specific EBCS documents and standards are relevant to medium-rise building projects. These standards may encompass structural design, materials, safety, environmental compliance, and other pertinent aspects.

Read and Understand EBCS:

A. Begin by reading the EBCS documents carefully. Pay close attention to the table of contents and section headings to identify the relevant sections for medium-rise building projects.

B. Take note of definitions, abbreviations, and references used in the standards to ensure a clear understanding of terminology.

C. Study the objectives and scope of the EBCS documents to understand the standards' purpose and application.

D. Examine the specific technical requirements and guidelines outlined in the EBCS that are applicable to medium-rise building design, construction, and safety.

Navigation and Cross-Referencing:

A. Learn to navigate the EBCS documents effectively, including how to find specific sections, figures, and tables within the standards.

B. Cross-reference relevant sections of the EBCS with your project's requirements and design specifications to ensure alignment.

Seek Guidance:

A. Reach out to course instructors or professors who specialize in building codes and standards. They can provide valuable insights and guidance on interpreting and applying the EBCS.

B. Collaborate with professionals, such as architects and structural engineers, who have experience working with the EBCS on medium-rise building projects.

Practice Interpretation: Practice interpreting the EBCS through sample exercises and case studies. Apply the standards to hypothetical medium-rise building scenarios to gain practical experience.

Review and Updates: Regularly check for updates, revisions, or amendments to the EBCS. Building codes and standards are subject to periodic changes, so it's essential to stay informed about the latest versions.

Use Reference Guides: Some educational resources, textbooks, and reference guides provide commentary and explanations for building codes and standards. These guides can help you interpret and apply the standards effectively.

Apply the EBCS to Projects: Apply your knowledge of the EBCS to medium-rise building projects. Ensure that your design and construction plans align with the relevant standards and safety requirements.

Continual Learning: Building codes and standards evolve over time. Keep learning and stay updated on best practices and any changes in the EBCS to ensure compliance and safety in your projects.

Accessing and interpreting the Building Code of Ethiopia is a foundational skill for professionals in the construction and engineering fields. It ensures that medium-rise building projects are designed and constructed in compliance with legal requirements and industry best practices, promoting safety and quality in the built environment.

Self-Check-1

Part I: Matching

Instruction: Match the correct answer form Column A to B.

Column A	Column B
1.	
2.	
3.	
4.	
5.	

Part II: Fill the Blank Space.

Instructions: Fill the blank space by the correct answer.

1. AutoCAD is a computer-aided design (CAD) software developed by _____.

Part III: Essay

Instruction: Answer the following questions accordingly.

Unit Two: Building Classification

This learning unit is developed to provide the trainees the necessary information regarding the following content coverage and topics:

- Classification of a Building according to Use
- Classification of a Building according to Type of Construction
- Classification of a Building according to Arrangement
- Classification of a Building according to Codes and Standards on Construction
- Classification of a Building according to Building Code of Ethiopia
- Classification of a Building according to other Related Building Codes

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Determine nature of a building according to use, type of construction, arrangement according to the local and related codes and standards on construction.
- Apply Building Code criteria of Ethiopia and other related building codes that are practiced and accepted in Ethiopia to determine the defined classification.

2.1. Classification of a Building According to Use

Building is an assemblage that is firmly attached to the ground and that provides total or nearly total shelter for machines, processing equipment, performance of human activities, storage of human possessions, or any combination of these. Building design is the process of providing all information necessary for construction of a building that will meet the owner's requirements and also satisfy public health, welfare, and safety requirements. Building construction is the process of assembling materials to form a building based on the building design.

Buildings can be classified according to their use into various categories. Here are common classifications:

1. **Residential buildings:** include houses occupied by persons where living accommodations are provided, such as private residences, apartments, dormitories, hotels, etc.
2. **Educational buildings:** include any building used for educational instructions such as schools and universities.
3. **Assembly buildings:** include any building where group of people gather for amusement, recreation, social, political, religious and similar purposes, like theatres, halls, places of worship, etc.
4. **Business buildings:** any building which is used for the transaction of business, for professional services and for keeping accounts & records for similar purpose, such as garages, barbershops, city halls, courthouses, libraries, etc.
5. **Mercantile buildings:** any building which is used as shops, stores, market, and for display and sale of merchandise like Shopping malls.
6. **Industrial buildings:** Any building or structure, in which products or materials of all kinds are fabricated, assembled, finished or processed such as assembly plants
7. **Institutional buildings:** any building which is used for purposes such as medical or other treatment or care or for penal or correctional detention such as hospitals, prisons, etc.
8. **Storage buildings:** any building which is used for storage or sheltering of goods, merchandise, agricultural products, raw materials such as ware houses, barns, etc.

9. **Hazardous buildings:** any building used for storage, handling, manufacturing or processing of highly inflammable, combustible or explosive materials such as explosive storage.

It's important to note that some buildings can fall into multiple categories as they may have different uses within the same structure. Additionally, there may be specific subcategories within each classification depending on the specific purpose or function of the building.

2.2. Classification of a Building According to Type of Construction

Buildings can be classified according to the type of construction used. Here are some common classifications:

- **Type-1 Fire-resisting construction:** Type of construction in which the elements of the building, which include the floors, walls, columns and the roof itself, are non-combustible. The building is sufficiently fire resistant that it withstands the effect of fire and prevents its spread to other rooms.
- **Type-2 Non-combustible construction:** Construction in which the walls, partitions, structural elements etc. are non-combustible with less fire resistance than Type 1.
- **Type-3 Heavy timber construction:** Exterior walls are out of masonry or other noncombustible material. Interior structural members, floors and roofs are constructed out of timber either in solid or laminated forms.
- **Type-4 Ordinary construction:** Exterior walls are out of masonry or other noncombustible material. Interior structural members could be partially or wholly out of wood of relatively smaller sections unlike Type 3.
- **Type-5 Wood frame construction:** Type of construction in which practically the whole of the building is out of wood or other combustible materials.

These classifications are based on the International Building Code (IBC) and can vary slightly depending on the local building codes and regulations in different regions.

2.3. Classification of a Building According to Arrangement

Buildings can be classified according to their arrangement into various categories:

1. **Detached Buildings:** These are standalone buildings that are not connected to any other structure.
2. **Semi-detached Buildings:** These are buildings that share a common wall with another building, but each unit has its own separate entrance.
3. **Terraced Buildings:** Also known as row houses, these buildings are connected in a continuous row, sharing multiple walls with their neighbors.
4. **Apartment Buildings:** These buildings consist of multiple units or apartments, usually stacked on top of each other, sharing walls and common areas.
5. **Duplexes:** These are buildings with two separate living units, usually side by side or one above the other. Each unit has its own separate entrance.
6. **Townhouses:** Similar to terraced buildings, townhouses are multi-story buildings that share walls with adjacent units. They often have individual entrances and may feature gardens or small outdoor spaces.
7. **Mansions:** These are large, grand houses often featuring multiple floors and extensive grounds. They are typically designed for single-family occupancy and are known for their luxurious features.
8. **Cottages:** Cottages are usually small, single-story houses, often situated in rural or semi-rural areas. They are typically cozy and may have a rustic or traditional aesthetic.
9. **Skyscrapers:** These are tall buildings with multiple floors, often exceeding a specific height limit, and are primarily used for commercial or residential purposes. Skyscrapers are characterized by their vertical arrangement and unique architectural design.
10. **Industrial Buildings:** These buildings are designed for industrial purposes such as manufacturing, warehousing, or research facilities. They are usually large and open in layout, with emphasis on functionality and utility rather than aesthetics.

2.4. Classification of a Building According Codes and Standards on Construction

The classification of a building according to codes and standards in the construction industry helps ensure that buildings are designed, constructed, and maintained in a safe and compliant manner. Different codes and standards may be applied to various types of buildings based on their intended use, occupancy, and specific characteristics.

General classification of buildings according to common codes and standards:

1. **Residential Buildings**:
    - **Single-Family Residential**: These are standalone houses designed for single families.
    - **Multi-Family Residential**: This category includes apartment buildings, condominiums, and other structures that house multiple families.
    - **Mixed-Use Residential**: Buildings that combine residential units with commercial or retail spaces.
2. **Commercial Buildings**:
    - **Office Buildings**: Structures primarily used for office spaces and administrative activities.
    - **Retail Buildings**: Buildings designed for retail businesses, including shops, stores, and malls.
    - **Hospitality Buildings**: Hotels, motels, and other lodging establishments fall into this category.
    - **Restaurant Buildings**: These include standalone restaurants and food service establishments.

- **Entertainment and Recreation**: Theaters, cinemas, sports facilities, and recreational centers.
- **Educational Buildings**: Schools, colleges, and universities.
- **Healthcare Buildings**: Hospitals, clinics, and medical facilities.
- **Industrial Buildings**: Warehouses, factories, and manufacturing facilities.

3. **Institutional Buildings**:
    - **Government Buildings**: This category covers government offices, courthouses, and municipal structures.
    - **Religious Buildings**: Churches, mosques, synagogues, and temples.
    - **Correctional Facilities**: Prisons and detention centers.
4. **Specialized Buildings**:
    - **Transportation Buildings**: Airports, train stations, bus terminals.
    - **Agricultural Buildings**: Barns, silos, and agricultural storage structures.
    - **Utility Buildings**: Pumping stations, water treatment plants, and power stations.
    - **Infrastructure Buildings**: Bridges, tunnels, and dams.
    - **Recreational Buildings**: Stadiums, arenas, and sports complexes.
    - **Historical or Heritage Buildings**: Structures of historical or architectural significance.
5. **Mixed-Use Buildings**: Buildings that combine multiple occupancy types. For example, a building may have retail spaces on the ground floor and residential units on upper floors.
6. **High-Rise and Low-Rise Buildings**: High-rise buildings typically have multiple floors and may include skyscrapers, while low-rise buildings are shorter in height.

7. **Occupancy Classifications**: Buildings are often categorized based on their occupancy class, such as A (Assembly), B (Business), E (Educational), I (Institutional), M (Mercantile), R (Residential), and S (Storage). These classifications help determine the applicable building codes and standards.

8. **Hazards and Risk Classifications**: Buildings may be classified based on potential hazards, such as seismic risk, fire risk, or flood risk, leading to specific design and construction requirements.

It's important to note that the classification of a building can vary based on local building codes, zoning regulations, and specific project requirements. Local authorities and building professionals work together to determine the most appropriate classification for a particular building, and the design and construction process must comply with the relevant codes and standards for that classification.

2.5. Classification of a Building according to Building Code of Ethiopia

In Ethiopia, building classification is governed by the Ethiopian Building Code Standards (EBCS), which sets out the criteria for categorizing buildings based on their intended use, structural design, occupancy, and hazard considerations. The classification system in the Ethiopian Building Code is similar to international building classification systems.

Common building classifications according to the Ethiopian Building Code:

1. **Residential Buildings (R)**:
    - R1: Single-family residential buildings.
    - R2: Multi-family residential buildings, including apartment buildings.
2. **Educational Buildings (E)**:
    - E1: Educational buildings, including schools and universities.
3. **Healthcare Buildings (H)**:
    - H1: Healthcare facilities, such as hospitals and clinics.

4. **Institutional Buildings (I)**:
    - I1: Institutional buildings, including government offices and administrative structures.
5. **Assembly Buildings (A)**:
    - A1: Buildings used for assembly purposes, like theaters and auditoriums.
6. **Business and Mercantile Buildings (B & M)**:
    - B1: Business buildings, including offices.
    - M1: Mercantile buildings, such as retail stores and shopping centers.
7. **Industrial Buildings (I)**:
    - I2: Industrial buildings, which may include manufacturing facilities and warehouses.
8. **Assembly and Educational Buildings (A & E)**:
    - AE: Combined use of assembly and educational purposes.
9. **Hazardous and Special Occupancy Buildings (S)**:
    - S1: Hazardous buildings, which may involve higher risks due to storage of hazardous materials.
    - S2: Special occupancy buildings, such as parking garages and car repair facilities.
10. **Storage Buildings (S)**:
    - S3: Buildings designed primarily for storage purposes, like warehouses.
11. **Miscellaneous Buildings (U)**:
    - U1: Miscellaneous buildings, which don't fit into other classifications.
12. **Mixed-Use Buildings (MX)**:
    - MX1: Mixed-use buildings, which combine multiple occupancy types in one structure.

It's important to note that the Ethiopian Building Code Standards (EBCS) provide detailed guidelines for each building classification, specifying the structural and design requirements, occupancy load limits, fire safety measures, and other considerations to ensure that buildings are safe, functional, and compliant with local regulations.

The specific classification of a building in Ethiopia is determined based on its primary use and design features. Local authorities, architects, engineers, and builders work together to ensure that buildings are designed and constructed in accordance with the applicable building code requirements for their intended classification.

2.6. Classification of a Building according to other Related Building Codes

The classification of a building can vary based on the specific building code or standards used in a particular region or country. While I provided a general classification based on the Ethiopian Building Code Standards (EBCS) in a previous response, other building codes or standards may use slightly different classification systems. Here are some common building classifications according to widely recognized international building codes and standards:

1. **International Building Code (IBC)**: The IBC provides a classification system that is similar to the Ethiopian Building Code. It includes categories such as Residential, Educational, Institutional, Business, Mercantile, Industrial, Assembly, High-Hazard, and Storage.
2. **National Building Code of Canada (NBCC)**: The NBCC categorizes buildings into Group A (Assembly), Group B (Business and Personal Services), Group C (Residential), Group D (Institutional and Care Occupancies), and Group E (Mercantile and Industrial).
3. **British Building Regulations**: In the UK, buildings are categorized into various use classes, including residential (C), business (B), assembly and leisure (D), industrial (B), and more.

4. **NFPA 5000 (Building Construction and Safety Code)**: The NFPA 5000 classification system includes occupancy groups such as Assembly, Business, Educational, Factory and Industrial, Hazardous, Institutional, Mercantile, Residential, and Storage.
5. **ISO 216:2007 (Building Construction - Classification of Use and Occupancy)**: The ISO 216 standard provides a classification system for the use and occupancy of buildings, including categories like Residential, Commercial, Industrial, and Agricultural.
6. **United States Federal Building Codes**: The U.S. federal government has its classification system, categorizing buildings as
    - Group I (Institutional),
    - Group II (Assembly and Educational),
    - Group III (Business),
    - Group IV (Mercantile), and
    - Group V (Storage).

It's essential to understand that each region or country may adopt its building code or standards, and these codes may have unique classification systems or specific occupancy categories based on local building practices and regulations. When designing or constructing a building, it's crucial to adhere to the specific building code or standards applicable to the project's location. This ensures that the building is safe, compliant, and suitable for its intended use.

Self-Check-2

I. ***Instruction:*** choose the best answer from the given alternatives

1. Which of the following is NOT a common building classification according to use?

   A. Residential
   B. Educational
   C. Industrial
   D. Hazardous
   E. Agricultural

2. Which of the following is NOT a common building classification according to type of construction?

   A. Type-1 Fire-resisting construction
   B. Type-2 Non-combustible construction
   C. Type-3 Heavy timber construction
   D. Type-4 Ordinary construction
   E. Type-6 Wood frame construction

3. Which of the following is NOT a common building classification according to arrangement?

   A. Detached Buildings
   B. Semi-detached Buildings
   C. Terraced Buildings
   D. Apartment Buildings
   E. Office Buildings

4. Which of the following is NOT a common building classification according to codes and standards on construction in Ethiopia?

   A. Residential Buildings
   B. Commercial Buildings
   C. Industrial Buildings
   D. Institutional Buildings
   E. Agricultural Buildings

5. Which of the following is NOT a common building classification according to the Building Code of Ethiopia?

A. A-1 Assembly Buildings
B. B-1 Business Buildings
C. E-1 Educational Buildings
D. I-1 Institutional Buildings
E. M-1 Mercantile Buildings

II. ***Instruction:*** write **true** if the statement is correct and write **false** if the statement is false

1. All buildings can be classified into a single category.
2. The type of construction used in a building can affect its classification.
3. The arrangement of a building can affect its classification.
4. Building codes and standards vary from country to country.
5. The Building Code of Ethiopia is similar to international building classification systems.

III. ***Instruction:*** give short answer for the following questions

1. What are the three most common building classifications according to use?
2. What are the five common building classifications according to type of construction?
3. What are the four common building classifications according to arrangement?
4. What are the three main categories of building classifications according to codes and standards on construction?
5. What are the five main categories of building classifications according to the Building Code of Ethiopia?

Unit Three: Analyzing and Applying A Range Of Solutions To A Construction Problem

This learning unit is developed to provide the trainees the necessary information regarding the following content coverage and topics:

- Range of Criteria for Construction Methods
- Alternative Solutions to a Design or Construction Problem
- Identifying and Documenting Performance-Based Solutions
- Analyzing and Applying Assessment Methods Based on EBCS
- Identifying and Completing Documentation in Accordance EBCS

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Determine range of criteria that ensures construction methods comply with the performance requirements of the Building Code of Ethiopia.
- Discuss and propose alternative solutions to a design or construction problem that will comply with the requirements of the Building Code of Ethiopia in accordance with company policies and procedures.
- Identify, approve, and document performance-based solutions in accordance with the requirements of the Building Code of Ethiopia.
- Analyze and apply assessment methods referenced in the Building Code of Ethiopia to determine whether a building solution complies with performance requirements and design requirement or 'Deemed-to-Satisfy Building Code of Ethiopia Provision' of the Building Code of Ethiopia.
- Identify and complete relevant documentation in accordance with the requirements of the Building Code of Ethiopia.

3.1. Range of Criteria for Construction Methods

The choice of construction methods for a project depends on various factors, including the project's scope, budget, timeline, location, and specific requirements.

Here's a range of criteria that are commonly considered when selecting construction methods:

1. **Project Type and Size**: The nature of the project, whether it's a residential building, commercial development, infrastructure, or industrial facility, influences the choice of construction methods.
2. **Budget and Cost**: The available budget often dictates the construction methods, materials, and technologies that can be employed. Some methods may be more cost-effective than others.
3. **Project Schedule**: The timeline for project completion is a crucial factor. Some construction methods may allow for faster construction, while others may be more time-consuming.
4. **Site Conditions**: The characteristics of the construction site, such as soil type, topography, accessibility, and environmental considerations, impact the choice of construction methods.
5. **Regulatory and Environmental Compliance**: Compliance with local building codes, environmental regulations, and zoning requirements is essential. Some methods may be more environmentally friendly or align better with regulations.
6. **Labor and Skill Availability**: The availability of skilled labor in the area can influence the choice of construction methods. Some methods may require specialized skills that may not be readily available.
7. **Materials Availability**: The availability of construction materials, including their cost and quality, can impact the choice of methods.
8. **Safety**: Safety considerations are paramount. The construction method should minimize risks to workers and the public.

9. **Quality and Aesthetics**: The desired quality of construction and aesthetic requirements play a role. Some methods may allow for greater precision or customization.
10. **Maintenance and Durability**: Consideration of the long-term maintenance and durability of the structure is important. Some methods result in more durable buildings with lower maintenance requirements.
11. **Innovation and Technology**: Advancements in construction technology and innovation can influence the selection of methods. Modern methods may be more efficient or offer better performance.
12. **Sustainability and Energy Efficiency**: The growing emphasis on sustainability and energy efficiency may lead to the choice of construction methods that reduce environmental impact and energy consumption.
13. **Resilience and Climate Considerations**: In regions prone to natural disasters, such as earthquakes or hurricanes, resilient construction methods may be preferred.
14. **Client Preferences**: The client's preferences and objectives, including their budget constraints, timeline, and sustainability goals, influence method selection.
15. **Risk Management**: Evaluation of potential risks, including those related to weather, supply chain disruptions, and unforeseen site conditions, is essential in method selection.
16. **Local Building Traditions**: In some cases, traditional or regional construction methods and styles are preserved for cultural or historical reasons.
17. **Legal and Contractual Considerations**: Contractual agreements and legal requirements may specify certain construction methods or constraints.

The selection of construction methods involves a careful analysis of these criteria and often requires collaboration among architects, engineers, contractors, and other stakeholders to ensure that the chosen method aligns with the project's objectives and constraints.

3.2. Alternative Solutions to a Design or Construction Problem

When faced with a design or construction problem, it's often beneficial to explore alternative solutions to find the most suitable and cost-effective approach.

Common methods and considerations for generating alternative solutions:

1. **Brainstorming**: Gather a diverse group of team members, including architects, engineers, contractors, and other relevant stakeholders, for a brainstorming session. Encourage creative thinking to generate a wide range of potential solutions.
2. **Problem Decomposition**: Break down the problem into its constituent parts. This can help identify specific challenges and potential solutions for each element.
3. **Research and Benchmarking**: Conduct research to explore how similar problems have been solved in the past. Benchmark against successful projects or industry best practices.
4. **Design Charrettes**: Organize design charrettes or collaborative workshops where participants can explore various design and construction ideas. These events foster collaboration and innovation.
5. **Technology Assessment**: Evaluate the potential use of new technologies, materials, or construction methods. Emerging technologies may offer innovative solutions.
6. **Simulation and Modeling**: Use computer-aided design (CAD) software and building information modeling (BIM) to simulate and visualize different design and construction options.
7. **Cost-Benefit Analysis**: Compare the costs and benefits of different solutions. Evaluate both the immediate construction costs and the long-term operational and maintenance costs.
8. **Environmental Impact Assessment**: Consider the environmental impact of various solutions. Sustainable or green building techniques may offer both ecological and financial benefits.

9. **Value Engineering**: Value engineering is a systematic process to identify and eliminate unnecessary costs while ensuring the project's essential functions and quality. It often results in cost savings.
10. **Life Cycle Assessment**: Assess the long-term environmental and economic impacts of each solution over the life cycle of the project, from construction to operation and maintenance to decommissioning.
11. **Stakeholder Input**: Gather input and feedback from all project stakeholders, including clients, end-users, regulatory bodies, and community members. Different perspectives may lead to new insights.
12. **Risk Analysis**: Analyze potential risks associated with each solution. Evaluate the likelihood and consequences of these risks and consider risk mitigation strategies.
13. **Phasing and Sequencing**: Explore different construction phasing and sequencing options. This can help optimize construction schedules and minimize disruptions.
14. **Material Selection**: Evaluate alternative materials and finishes that may offer cost savings, durability, or aesthetic benefits.
15. **Modularity and Prefabrication**: Consider off-site construction, prefabrication, or modular building solutions, which can streamline construction processes and reduce costs.
16. **Sensitivity Analysis**: Conduct sensitivity analyses to assess how changes in project parameters (e.g., schedule, budget, or scope) impact the feasibility of different solutions.
17. **Legal and Regulatory Review**: Consult with legal and regulatory experts to explore innovative ways to address compliance requirements while achieving project goals.
18. **Peer Review**: Engage third-party experts or peers to review and provide feedback on proposed solutions, offering an objective perspective.
19. **Prototyping and Testing**: Create prototypes or conduct physical or virtual tests to evaluate the feasibility and performance of various design and construction options.

20. **Scenario Planning**: Develop multiple scenarios for different solutions to anticipate possible changes or challenges that may arise during the project's lifecycle.

When evaluating alternative solutions, it's important to consider factors such as project objectives, constraints, risk tolerance, and stakeholder preferences. A rigorous evaluation process will help identify the most appropriate solution to address the design or construction problem effectively.

3.3. Identifying and Documenting Performance-Based Solutions

Identifying and documenting performance-based solutions is a crucial aspect of the construction and design process, as it allows for more flexibility and innovation in achieving project goals. Performance-based solutions focus on the desired outcome and performance requirements rather than prescribing specific methods or materials. Here are the steps involved in identifying and documenting performance-based solutions:

1. **Define Project Objectives**: Clearly define the project's objectives and performance requirements. Determine what the client, stakeholders, and regulatory bodies expect in terms of functionality, safety, sustainability, and other factors.
2. **Identify Constraints and Constraints**: Identify any project constraints, including budget limitations, scheduling requirements, regulatory restrictions, and site-specific challenges. Understanding these constraints is essential for designing realistic solutions.
3. **Engage Stakeholders**: Collaborate with all relevant stakeholders, including the client, architects, engineers, contractors, and regulatory authorities. Gather input and insights to ensure a comprehensive understanding of project goals.
4. **Performance Criteria**: Develop a list of specific performance criteria that the project must meet. These criteria should be measurable and include factors like structural integrity, energy efficiency, safety standards, and environmental sustainability.
5. **Risk Assessment**: Assess potential risks and uncertainties related to the project. Understanding the risks allows for better planning and mitigation strategies.

6. **Performance Targets**: Establish specific performance targets for each criterion. These targets define the level of performance expected for each aspect of the project.
7. **Functional Specifications**: Instead of prescribing specific materials or construction methods, focus on functional specifications. Describe what needs to be achieved rather than how to achieve it. For example, specify the required thermal resistance rather than dictating the type of insulation to be used.
8. **Performance-Based Codes and Standards**: Familiarize yourself with any performance-based building codes or standards relevant to the project. These codes often provide guidance on how to achieve performance requirements.
9. **Expert Consultation**: Consider consulting with subject-matter experts or specialists in areas where performance-based solutions are required. They can provide valuable insights and expertise.
10. **Alternative Solutions**: Encourage the generation of alternative solutions by the project team. Explore different approaches that can meet the performance criteria while considering the constraints.
11. **Risk Management Strategies**: Develop strategies for managing identified risks. These may include contingency plans, quality control measures, and monitoring processes.
12. **Performance Monitoring and Reporting**: Establish a system for monitoring and reporting on the project's performance against the defined criteria. This ensures that the project remains on track and meets the required performance targets.
13. **Documentation**: Document the performance-based solutions in a clear and detailed manner. Include the performance criteria, targets, risk assessments, and any relevant standards or codes. This documentation is essential for communication and compliance.
14. **Review and Approval**: Present the performance-based solutions to relevant stakeholders, including the client and regulatory authorities, for review and approval. Address any feedback and concerns as necessary.

15. **Testing and Verification**: During and after construction, carry out testing and verification to confirm that the project is meeting the defined performance criteria.
16. **Continuous Improvement**: Throughout the project's lifecycle, monitor performance and seek opportunities for continuous improvement.

Performance-based solutions offer flexibility and innovation, but they also require careful planning, documentation, and monitoring to ensure that project goals are achieved effectively and efficiently. Collaboration and clear communication among all project stakeholders are essential to the success of performance-based projects.

3.4. Analyzing and Applying Assessment Methods Based on EBCS

Analyzing and applying assessment methods based on the Ethiopian Building Code Standards (EBCS) is a fundamental aspect of construction and building projects in Ethiopia. The EBCS provides guidelines and standards for assessing various aspects of a construction project, including structural integrity, safety, and environmental compliance. Here are some key assessment methods based on the EBCS:

1. **Structural Analysis**: EBCS includes standards for the structural design and analysis of buildings and other structures. Engineers use structural analysis methods to evaluate the safety and stability of buildings, considering factors such as load-bearing capacity, earthquake resistance, and wind load calculations.
2. **Load Analysis**: The EBCS specifies methods for determining the loads that a structure will be subjected to, including dead loads (permanent), live loads (occupant and movable), and environmental loads (wind, earthquake). Engineers use load analysis to ensure that the structure can safely support these loads.
3. **Foundation Design**: EBCS provides guidance on foundation design, including methods for assessing soil conditions, bearing capacity, and settlement. Engineers use these methods to determine the appropriate type of foundation for a given site.

4. **Materials Testing**: Materials used in construction must meet EBCS standards. Assessment methods involve material testing to ensure compliance with specifications for concrete, steel, masonry, and other construction materials.
5. **Fire Safety Assessment**: EBCS contains provisions for fire safety in buildings. Assessment methods involve evaluating fire resistance of materials, designing fire-rated assemblies, and planning for fire protection systems such as sprinklers and fire alarms.
6. **Environmental Impact Assessment**: Environmental regulations and standards outlined in EBCS require assessments of the potential environmental impact of construction projects. Methods include conducting environmental impact assessments (EIAs) to evaluate and mitigate any adverse effects on the environment.
7. **Occupant Safety and Accessibility**: Assessment methods for occupant safety and accessibility involve ensuring that buildings meet EBCS requirements for barrier-free design, including provisions for ramps, elevators, and other accessible features for people with disabilities.
8. **Quality Control and Inspection**: The EBCS includes standards for quality control and inspection. Assessment methods involve on-site inspections to ensure that construction practices and materials meet the prescribed standards.
9. **Energy Efficiency and Sustainability Assessment**: The EBCS promotes energy efficiency and sustainability in construction. Assessment methods include energy modeling, daylighting analysis, and sustainability assessments to ensure that buildings meet the specified performance criteria.
10. **Compliance with Building Codes**: Assessment methods involve reviewing construction plans and inspecting completed work to ensure compliance with the EBCS and other relevant building codes.
11. **Risk Assessment**: Identify and assess potential risks associated with the construction project, including financial, safety, and environmental risks. Develop risk management strategies to mitigate and manage these risks.

12. **Safety Assessment**: Conduct safety assessments to ensure that the construction site and practices adhere to safety standards outlined in EBCS and other safety regulations.
13. **Occupancy and Land Use Assessment**: Evaluate how the building will be used and whether it complies with zoning and land use regulations as outlined in EBCS.
14. **Occupancy Load Assessment**: Calculate the maximum allowable occupancy load based on building design, exits, and safety measures.
15. **Fire Protection and Life Safety Assessment**: Ensure compliance with fire protection and life safety requirements, including fire exits, alarms, sprinkler systems, and fire-resistant construction.

Applying these assessment methods in accordance with the Ethiopian Building Code Standards is essential to ensure that construction projects meet safety, structural, environmental, and regulatory requirements. Engaging qualified professionals, such as architects, engineers, and inspectors, is crucial to perform these assessments effectively and in compliance with EBCS.

3.5. Identifying and Completing Documentation in Accordance EBCS

Identifying and completing documentation in accordance with the Ethiopian Building Code Standards (EBCS) is a critical part of the construction process in Ethiopia. Proper documentation ensures that the construction project complies with EBCS requirements, is safe, and meets regulatory standards.

Key steps to identify and complete documentation in accordance with EBCS:

1. **Review EBCS Requirements**: Begin by thoroughly reviewing the relevant sections of the Ethiopian Building Code Standards that pertain to your project. These standards cover various aspects, including design, structural integrity, safety, environmental compliance, and quality control.
2. **Identify Required Documentation**: Identify the specific documentation that is mandated by the EBCS for your project. This may include architectural drawings, structural calculations, soil test reports, fire protection plans, environmental impact assessments, and other relevant documents.

3. **Engage Professionals**: Collaborate with qualified professionals, such as architects, structural engineers, electrical engineers, and other experts who are knowledgeable about the EBCS requirements. They can help you prepare the necessary documentation.
4. **Project Plans and Drawings**: Prepare detailed architectural and engineering drawings that meet EBCS specifications. These drawings should include floor plans, elevations, cross-sections, and details that illustrate how the building will be constructed.
5. **Structural Calculations**: If the project involves structural elements, provide structural calculations and drawings that demonstrate how the building will withstand loads, including dead loads, live loads, wind loads, and seismic forces, in compliance with EBCS requirements.
6. **Soil Reports**: Include geotechnical or soil test reports to assess the soil's properties at the construction site, which are essential for foundation design. These reports must comply with EBCS guidelines.
7. **Fire Protection Plans**: Prepare fire protection plans and documentation as required by EBCS. This may involve specifying fire-resistant materials, fire safety systems, and evacuation plans.
8. **Environmental Impact Assessment (EIA)**: If applicable, conduct an environmental impact assessment to address potential environmental impacts and mitigation measures. Ensure the EIA report aligns with EBCS environmental standards.
9. **Quality Control and Inspection Plans**: Develop quality control and inspection plans that detail the methods and frequency of inspections during construction to ensure compliance with EBCS quality standards.
10. **Energy Efficiency and Sustainability Documentation**: If the project aims to meet energy efficiency or sustainability standards outlined in EBCS, provide documentation that demonstrates compliance with these requirements.

11. **Safety Documentation**: Ensure that safety documentation, including safety plans, risk assessments, and safety procedures, is prepared in accordance with EBCS safety guidelines.
12. **Material Specifications**: Include specifications for construction materials, ensuring they meet EBCS standards for quality and performance.
13. **Compliance Records**: Maintain records of inspections, test results, and other documentation that demonstrate compliance with EBCS requirements throughout the construction process.
14. **Occupancy and Zoning Documentation**: Ensure that the project complies with zoning and land use regulations in accordance with EBCS. Document the intended occupancy and land use in the plans.
15. **Review and Approvals**: Submit the documentation to relevant authorities, including municipal building departments and regulatory bodies, for review and approval.
16. **Record Keeping**: Maintain comprehensive records of all documentation, correspondence, approvals, and changes made during the project. These records are essential for accountability and future reference.
17. **Continuous Updates**: Keep documentation up to date throughout the construction process. If any modifications or changes are made, update the documentation accordingly and seek the necessary approvals.
18. **Final Documentation and Handover**: Upon project completion, compile all final documentation, including as-built drawings, warranties, and maintenance manuals, to facilitate a smooth handover to the client.

By following these steps and ensuring that documentation is prepared in accordance with EBCS, you can demonstrate compliance with standards, facilitate project approvals, and help ensure the safety, quality, and regulatory compliance of the construction project.

Self-Check-3

I. ***Instruction:*** choose the best answer from the given alternatives

1. When preparing documentation in accordance with EBCS, which of the following professionals should you collaborate with to ensure compliance?

   A. Interior designers

   B. Electrical contractors

   C. Qualified professionals like architects and structural engineers

   D. Marketing specialists

2. Which part of the documentation includes detailed architectural and engineering drawings, such as floor plans, elevations, and cross-sections?

   A. Quality control plans
   C. Project schedules
   B. Structural calculations
   D. Project plans and drawings

3. What type of documentation is crucial for assessing the soil's properties at the construction site and determining foundation design?

   A. Fire protection plans

   B. Environmental impact assessments

   C. Soil test reports

   D. Material specifications

4. Which aspect of documentation is particularly relevant when addressing potential environmental impacts and mitigation measures for a construction project?

   A. Quality control and inspection plans

   B. Safety documentation

   C. Geotechnical reports

   D. Environmental Impact Assessment (EIA)

5. When you submit documentation for review and approval, who are the relevant authorities you should typically engage with?

    A. Legal consultants

    B. Human resources departments

    C. Municipal building departments and regulatory bodies

    D. Local news agencies

II. ***Instruction:*** write **true** if the statement is correct and write **false** if the statement is false

6. Documentation in accordance with EBCS typically includes project plans, structural calculations, and safety documentation.
7. Environmental impact assessments are not required for construction projects, according to the Ethiopian Building Code Standards.
8. Continuous updates to project documentation are not necessary and can be done after project completion.
9. Safety documentation is a crucial part of the documentation process and should address risk assessment and safety procedures.
10. Quality control and inspection plans are usually prepared after project completion as part of post-construction evaluation.

III. ***Instruction:*** give short answer for the following questions

11. Why is collaboration with qualified professionals like architects and structural engineers crucial when preparing documentation in accordance with EBCS?
12. Describe the role of environmental impact assessments in construction project documentation and how they align with EBCS.
13. Explain the significance of maintaining comprehensive records of all documentation throughout the construction process.

14. What are the key considerations when developing quality control and inspection plans, and why are they important in construction documentation?
15. Discuss the importance of keeping documentation up to date during the construction process and how it benefits the project's overall success.

Unit Four :Applying fire protection requirements

This learning unit is developed to provide the trainees the necessary information regarding the following content coverage and topics:

- . Identifying andApplying passive and active fire control.
- . Determining Level of fire resistance.
- . Identifying and applying Building Code of Ethiopia.
- . Carrying out passive and active fire protections.

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- . Identify andApply passive and active fire control.
- . Determine Level of fire resistance.
- . Identify and apply Building Code of Ethiopia.
- . Carry out passive and active fire protections.

4.1. Identifying and Applying passive and active fire control.

Fire protection is a critical aspect of building design and construction. It involves the application of various measures to prevent or mitigate the effects of fires on buildings and their occupants. Passive and active fire control are two important aspects of fire protection that must be considered when designing and constructing buildings.

Passive fire control refers to the use of materials and systems that resist the spread of fire and smoke within a building. These include fire-resistant walls, floors, and ceilings, as well as fire-rated doors and windows. Passive fire control measures are typically installed during the construction of a building and are designed to provide a barrier between the fire and the rest of the building.

Active fire control, on the other hand, refers to the use of systems and devices that actively detect and suppress fires. These include smoke detectors, heat detectors, and sprinkler systems. Active fire control measures are typically installed after the construction of a building and are designed to respond quickly to fires as they occur.

When identifying and applying passive and active fire control measures, it is important to consider the level of fire risk associated with the building. This can be determined using a variety of factors, including the building's location, size, occupancy, and use. For example, a high-rise building in a densely populated area may pose a higher fire risk than a single-story residential building in a rural area.

4.2. Determining Level of Fire Resistance.

The level of fire resistance required for a building will depend on a number of factors, including the building's intended use, size, and location. In Ethiopia, the Building Code of Ethiopia provides guidelines for determining the appropriate level of fire resistance for different types of buildings.

The code divides buildings into three categories based on their intended use:

Category 1: Buildings used for low-risk activities, such as residential buildings and small commercial buildings.

Category 2: Buildings used for medium-risk activities, such as schools, hospitals, and large commercial buildings.

Category 3: Buildings used for high-risk activities, such as industrial facilities and large public gathering places.

The Building Code of Ethiopia also specifies the minimum requirements for fire resistance for different types of building components, such as walls, floors, and roofs. For example, walls in Category 1 buildings must be able to resist fire for at least 30 minutes, while walls in Category 3 buildings must be able to resist fire for at least 2 hours.

4.3. Identifying and Applying Building Code of Ethiopia

The Building Code of Ethiopia is a set of regulations that governs the design, construction, and maintenance of buildings in Ethiopia. The code is intended to ensure that buildings are safe for occupants and meet certain standards of quality and durability.

When identifying and applying the Building Code of Ethiopia, it is important to consider the specific requirements for fire protection that apply to the building being designed or constructed. This may involve consulting with experts in fire protection engineering and reviewing the relevant sections of the code to determine the appropriate level of fire resistance required for the building.

Steps on how to identify and apply the Building Code of Ethiopia (BCE) for fire protection:

1. **Identify the building type and occupancy.** The BCE classifies buildings into different types and occupancies, each with its own specific fire protection requirements. For example, assembly buildings, such as theaters and sports arenas, have different fire protection requirements than residential buildings.
2. **Determine the required level of fire resistance.** The BCE specifies the required level of fire resistance for different building types and occupancies. The level of fire resistance is determined by the length of time a building must be able to withstand a fire before it collapses.

3. **Select fire protection materials and systems that meet the BCE requirements**. The BCE specifies a variety of fire protection materials and systems that can be used to meet the code's requirements. For example, the code specifies the type of fire doors and fire sprinkler systems that must be used in certain types of buildings.
4. **Install fire protection materials and systems in accordance with the BCE requirements.** It is important to install fire protection materials and systems in accordance with the BCE requirements in order to ensure that they are effective in preventing and fighting fires.

Here are some examples of specific fire protection requirements that may be applicable to different types of buildings:

- **Assembly buildings:** Assembly buildings must have adequate exit facilities to allow occupants to evacuate the building safely in the event of a fire. The code also specifies the type of fire doors and fire sprinkler systems that must be used in assembly buildings.
- **Residential buildings:** Residential buildings must have smoke alarms installed in each sleeping room and on every level of the building. The code also specifies the type of fire doors and fire extinguishers that must be used in residential buildings.
- **Commercial buildings:** Commercial buildings must have fire sprinkler systems installed in certain areas, such as basements and storage rooms. The code also specifies the type of fire doors and fire extinguishers that must be used in commercial buildings.

4.4. Carrying out Passive and Active Fire Protections

Once the appropriate level of fire resistance has been determined, the next step is to carry out passive and active fire protections. This may involve installing fire-resistant materials and systems, such as fire-rated walls and ceilings, as well as active fire control measures, such as smoke detectors and sprinkler systems.

Passive fire protection measures are designed to prevent fires from starting or spreading.

Common examples of passive fire protection measures include:

- Fire-resistant construction materials, such as concrete, steel, and masonry

- Compartmentation, which involves dividing a building into separate sections to prevent the spread of fire
- Fire doors and shutters
- Smoke alarms

Active fire protection measures are designed to extinguish a fire or control its spread. Some common examples of active fire protection measures include:

- Fire extinguishers
- Sprinkler systems
- Alarm systems
- Firefighting equipment

Here are some tips for carrying out passive and active fire protections:

- **Use fire-resistant construction materials.** This includes using fire-resistant materials for walls, floors, and roofs.
- **Install fire doors and shutters.** Fire doors and shutters should be installed in accordance with the BCE requirements.
- **Install fire extinguishers.** Fire extinguishers should be installed in accordance with the BCE requirements.
- **Install sprinkler systems.** Sprinkler systems should be installed in accordance with the BCE requirements.
- **Install alarm systems.** Alarm systems should be installed in accordance with the BCE requirements.
- **Maintain and inspect fire protection systems regularly.** It is important to maintain and inspect fire protection systems regularly to ensure that they are in good working order.

It is important to note that passive and active fire protection measures should be used in conjunction with each other to provide the most effective fire protection. For example, fire doors

and shutters will not be effective if they are not installed in accordance with the BCE requirements. Additionally, sprinkler systems will not be effective if they are not maintained and inspected regularly.

It is important to ensure that all passive and active fire protection measures are properly installed and maintained to ensure their effectiveness in the event of a fire. This may involve regular inspections and testing of the systems to ensure that they are functioning properly.

Self-Check-4

Instruction: choose the best answer from the given alternatives

1. What is the primary difference between passive and active fire control measures?

    A. Passive measures prevent fires from starting, while active measures suppress fires.

    B. Passive measures detect fires, while active measures resist fire spread.

    C. Passive measures are installed after construction, while active measures are installed during construction.

    D. Passive measures include fire alarms, while active measures include fire-resistant materials.

2. Which of the following is an example of a passive fire control measure?

A. Smoke detectors

B. Fire extinguishers

C. Fire-resistant walls

D. Sprinkler systems

3. According to the Building Code of Ethiopia, how are buildings categorized based on their intended use and fire risk? a. By their architectural design b. By their geographical location c. By their structural materials d. By their occupancy and use

4. In the Building Code of Ethiopia, what level of fire resistance might be required for walls in Category 2 buildings?

    A. 15 minutes

    B. 30 minutes

    C. 1 hour

    D. 2 hours

5. When determining the level of fire resistance for a building, what factors should be considered?

    A. The number of windows in the building

    B. The building's location and size

    C. The color of the building's exterior

D. The availability of fire extinguishers

IV. ***Instruction:*** write **true** if the statement is correct and write **false** if the statement is false

6. True or False: Passive fire control measures are typically installed after the construction of a building.
7. True or False: Fire-resistant materials and systems are examples of passive fire control measures.
8. True or False: Smoke detectors are considered active fire control measures as they respond to fires.
9. True or False: The Building Code of Ethiopia categorizes buildings based on architectural design rather than their intended use and fire risk.
10. True or False: The level of fire resistance required for a specific building component in Ethiopia is uniform across all building types.

III. Instruction: give short answer for the following questions

11. Explain the primary purpose of passive fire control measures in a building's design and construction.
12. Describe the key factors that are considered when determining the appropriate level of fire resistance for a building in accordance with the Building Code of Ethiopia.
13. Provide an example of an active fire control measure and explain its role in fire protection.
14. What are the three categories used to classify buildings according to their intended use and fire risk in the Building Code of Ethiopia? Provide an example of each category.
15. Why is regular maintenance and inspection of fire protection systems crucial to ensuring their effectiveness in a building's safety?

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