

**ARC 112**  
**CONSTRUCTION MATERIALS AND METHODS**

**COURSE DESCRIPTIONS:**

Prerequisites: None

Corequisites: None

This course introduces construction materials and their methodologies. Topics include construction terminology, materials and their properties, manufacturing processes, construction techniques, and other related topics. Upon completion, students should be able to detail construction assemblies and identify construction materials and properties. Course Hours per Week: Class, 3. Lab, 2. Semester Hours Credit, 4.

**LEARNING OUTCOMES:**

A student who successfully completes this course should be:

- a. Able to identify construction methods.
- b. Able to identify traditional and sustainable construction materials and their properties.
- c. Able to describe basic construction sequences for residential and commercial applications.
- d. Able to demonstrate an understanding of construction related terminology.

**OUTLINE OF INSTRUCTION:**

- I. Course Introduction
  - A. Course Outline and Policies
  - B. General Planning Constraints
    - 1) Building Codes
      - (a) Model Codes
      - (b) State Codes
      - (c) Occupancy Types
        - (1) Construction Types
      - (d) Fire protection issues
    - 2) Zoning
      - (a) Setbacks
      - (b) Parking Requirements
      - (c) Fire zone
    - 3) Owner's Programs
    - 4) Budget
    - 5) Site
      - (a) Landform
      - (b) Access
      - (c) Climate
      - (d) Circulation
      - (e) View

- C. Project manual organization
  - 1) CSI Master format
  - 2) Unifomat
  - 3) EJDOC

## II. Site work and site preparation

- A. Soil types
  - 1) Particle size
  - 2) Classification system
  - 3) Permeability
  - 4) Bearing Capacity
  - 5) Shrink/ Swell potential
- B. Soil testing
- C. Site preparation
  - 1) Soil erosion control
  - 2) Grading
  - 3) Excavation
    - (a) Sheet piling Techniques
      - (1) Bracing
    - (b) Dewatering considerations
    - (c) Permanent sheet piling
  - 4) Backfill
- D. Foundation systems and types
  - 1) Piling V.s. Caissons
  - 2) Grade Beams
  - 3) Mat Foundations
  - 4) Turned down footings
  - 5) Spread footings
- E. Retaining Walls
  - 1) Gravity
  - 2) Cantilever
  - 3) Weep holes
  - 4) Failure modes
- F. Geotextiles
  - 1) Soil reinforcement
  - 2) Filter fabrics
- G. Paving
  - 1) Concrete
  - 2) Asphalt
  - 3) Permeable
  - 4) Pavers

## III. Concrete

- A. Ingredients
- B. Additives and their effects on concrete
- C. Cement types and properties
- D. Reinforcement
  - 1) Size

- 2) Grade
- 3) Support
- 4) Lap
- 5) Hooks
- 6) Mesh categories
- E. Formwork
- F. Placement
- G. Finishing
- H. Testing
  - 1) Compression
  - 2) Slump

#### IV. Site Cast Concrete

- A. Slabs
  - 1) On grade
  - 2) Void
- B. Joists
  - 1) Distribution ribs
- C. Drop panels
- D. Columns
- E. Special systems
  - 1) Lift slab
  - 2) Tilt up
  - 3) Shotcrete
  - 4) Slip forming

#### V. Precast Concrete

- A. Types and sizes
- B. Joints
- C. Span capabilities
- D. Economic and production considerations.

#### VI. Masonry

- A. Types of masonry
- B. Brick
  - 1) Sizes
  - 2) Bond patterns
    - (a) Orientation of bricks
      - (1) Header
      - (2) Stretcher
      - (3) Rowlock
      - (4) Sailor
      - (5) Soldier
      - (6) Shiner
  - 3) Manufacturing techniques

- C. Mortar
  - 1) Mixtures
  - 2) Joints
    - (a) Bed
    - (b) Collar
    - (c) Head
  - 3) Joint profiles
  - 4) Strength considerations
  - 5) Reinforcement
- D. Anchors
- E. Concrete masonry
  - 1) Sizes
  - 2) Types
    - (a) Standard
    - (b) Architectural
  - 3) lintel types
- F. Stone
  - 1) Types and uses
    - (a) Igneous
    - (b) Sedimentary
    - (c) Metamorphic
  - 2) Patterns
    - (a) Ashlar
    - (b) Rubble
  - 3) Anchoring
- G. Arches
  - 1) Types
  - 2) Terminology
  - 3) Structural behavior
  - 4) History
- H. Construction joints
  - 1) Control
  - 2) Expansion
- I. Flashing
  - 1) Locations
  - 2) Weep holes
- J. Wall types
  - 1) Solid
  - 2) Cavity
  - 3) Barrier
  - 4) Rainscreen

## VII. Steel, steel properties, and Steel Framing Methods

- A. Steel V.s. Iron
- B. Influence of trace elements on properties
  - 1) Carbon
  - 2) Metal alloys

- C. Elastic behavior
  - 1) Yield stress
  - 2) Ultimate stress
- D. Standard rolled shapes
- E. Steel Joists
- F. Decking
- G. Welded joints
  - 1) Detailing symbols
  - 2) Joint types
- H. Bolted joints
  - 1) Bolt types
  - 2) Friction V.s. Shear connections
  - 3) Moment V.s. Shear connections
  - 4) Eccentric V.s. Concentric connections
  - 5) Gage
- I. Joint types
  - 1) Beam to column connections
  - 2) Beam to girder connections
  - 3) Coping flanges and webs
- J. Avoiding galvanic corrosion by insulating dissimilar metals from one another.

## VIII. Wood and Plastics

- A. Wood properties
  - 1) Softwood V.s. Hardwood
  - 2) Non isotropic behavior
  - 3) Hygroscopicity
  - 4) Seasoning defects
    - (a) Warps
    - (b) Knots
    - (c) Insect damage
    - (d) Rot
- B. Lumber sizes
  - 1) Nominal V.s. Actual sizes
- C. Framing member terminology
- D. Connections
  - 1) Nailed joints
  - 2) Stapled joints
  - 3) Bolted joints
  - 4) Specialty connectors
- E. Sheet and panel products
  - 1) Plywood
  - 2) Engineered wood products
  - 3) Engineered woodboard products
  - 4) Grade stamps and performance

## IX. Thermal and Moisture Protection

- A. Waterproofing
- B. Dampproofing

- C. Insulation
  - 1) Board
  - 2) Batt
  - 3) Blown
- D. Roofing
  - 1) Roof styles
  - 2) Shingles
  - 3) Built up roofing
  - 4) Single ply membranes
  - 5) Sprayed applied

- X. Doors and Windows
  - A. Door types
    - 1) Swing doors
      - (a) Hand
    - 2) Fire doors and egress
  - B. Window types
  - C. Glazing types
    - 1) Annealed
    - 2) Heat strengthen
    - 3) Tempered
    - 4) Laminated
  - D. Glazing coatings
  - E. Glazing systems
  - F. Storefront

- XI. Finishes and Finish Carpentry
  - A. Plaster
  - B. Drywall
  - C. Partitions and demountable partitions
  - D. Ceilings
  - E. Interstitial ceilings

- XII. Curtain wall Systems
  - A. Stick built
  - B. Column and Spandrel
  - C. Units
  - D. Column and Cover
  - E. Panel Systems

- XIII. Storefront Systems and Glazing

- XIV. Paints and Coatings
  - A. Pigments
  - B. Driers
  - C. Extenders
  - D. Surface preparation
  - E. Sprayed applied
- XV. Roofing Systems and Types
  - A. Roofing
    - 1) Roof styles
    - 2) Shingles
    - 3) Built up roofing
    - 4) Single ply membranes
    - 5) Sprayed applied
- XVI. Fire Protection
  - A. Egress (doors/windows) (corridor sizing & stairwells)
  - B. Flame spread and fire dynamics
  - C. Wall ratings
  - D. Fire walls and smoke doors/partitions
  - E. UL wall and ceiling/roof assemblies
  - F. Wall penetration
  - G. Insulation materials
  - H. Sprinklers
  - I. Emergency lighting
  - J. Fire rated materials
  - K. Elevator shafts