

ATCM-1300: FUNDAMENTALS OF CONCRETE CONSTRUCTION

Cuyahoga Community College

Viewing: ATCM-1300 : Fundamentals of Concrete Construction

Board of Trustees:

March 2020

Academic Term:

Fall 2020

Subject Code

ATCM - Appd Indus Tech-Cement Masonry

Course Number:

1300

Title:

Fundamentals of Concrete Construction

Catalog Description:

Study of concrete: ingredients, steps in production, factors of concrete mix design, uses for various types of concrete, admixtures and tests for various types of fresh concrete.

Credit Hour(s):

2

Lecture Hour(s):

2

Requisites

Prerequisite and Corequisite

Departmental approval: admission to Cement Mason's apprenticeship program.

Outcomes

Course Outcome(s):

Interpret specifications pertaining to various types of concrete including base ingredients and procedures followed in producing concrete.

Objective(s):

1. List and define terms related to concrete and concrete production.
2. Identify the different types of concrete used in residential, commercial, and industrial application.
3. Name the base ingredients of concrete and discuss the importance of quality selection with respect to concrete strength.
4. State the procedural steps followed in concrete production including clean water and quality sand.
5. Discuss the water to cement ratio with respect to concrete strength and explain the effects of admixture and concrete quality.
6. List the different types of Portland cement and describe applications of each.

Course Outcome(s):

Discuss the characteristics of concrete specific to the various types, the design steps considered in determining the optimal concrete design, and identify the proportions and procedures followed for mixing concrete including related aggregate size chosen with respect to different concrete types.

Objective(s):

1. List the characteristics of concrete specific to workable, fresh and economical concrete.
2. Identify the procedural steps followed in determining optimal concrete mix design.
3. List mix design factors including aggregate size, air content, and range of slump.
4. Differentiate between small and job size trial batches and rich and lean designs.
5. Identify the different types of concrete and list the application of each.

6. List the different types of available aggregated.
 7. Explain the importance of critical delivery and discharge times.
 8. Discuss the purpose of admixtures used in concrete installations and explain the role of weather conditions, with respect to admixture selection.
 9. List the classes and types of admixtures used.
 10. State the importance of careful interpretation of specifications for concrete placement.
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Methods of Evaluation:

All students will be evaluated during the first two weeks and mid-term. Progress reports will be issued per procedure. Additional course evaluations and final examination are detailed below:

1. Quizzes
2. Tests
3. Class participation

Course Content Outline:

1. Concrete: specifications and mixing
 - a. Terminology
 - i. Concrete
 - ii. Mix design
 - iii. Batch
 - iv. Optimum ratio
 - v. Water-cement ratio
 - vi. Aggregate
 - vii. Slump
 - viii. Rich
 - ix. Lean
 - x. Admixture
 - xi. Air entraining
 - xii. Retarding
 - xiii. Water reducing
 - xiv. Super plasticizer
 - xv. Pozzolan
 - xvi. Fiber
 - xvii. Bleeding
 - xviii. Permeability
 - b. Concrete types
 - i. Decorative
 - ii. Structural
 - iii. Standard
 - iv. Industrial
 - v. Architectural
 - vi. Residential
 - c. Base ingredients
 - i. Cement
 - ii. Aggregate
 - iii. Water
 - iv. Impurities
 1. Dirty water
 2. Dry sand
 3. Contaminated cement
 - d. Concrete production
 - i. Interpret specifications
 1. Adhere to standards
 2. Strength
 3. Admixtures
 4. Water-cement ratio
 5. Slump

- ii. Ingredient mixing
 - iii. Water addition
 - iv. Chemical reaction
 - e. Water – cement ratio
 - i. Importance
 - 1. Increased strength
 - a. Ideal water-cement
 - b. Additional cement
 - 2. Decreased strength
 - a. Excessive water
 - b. Reduced cement
 - ii. Calculation
 - 1. Weight of water
 - 2. Weight of cement
 - 3. Water divided by cement
 - f. Portland Cement types/applications
 - i. Type I normal
 - ii. Type II sulfate resistant
 - iii. Type III high early yield
 - iv. Type IV slow reacting
 - v. Type V high sulfate resistant
2. Concrete characteristics: types, design, and mix
- a. Characteristics
 - i. Workable
 - 1. Easily placed
 - 2. Easily consolidated
 - 3. Easily finished
 - ii. Economical
 - 1. Largest aggregate
 - 2. Stiffer mix
 - 3. Optimum ratio
 - iii. Hardened
 - 1. Freeze/thaw resistant
 - 2. Durable
 - 3. Wear resistant
 - b. Optimal design
 - i. Job requirements
 - ii. Mix design factors
 - 1. Use/application
 - 2. Environmental
 - iii. Trial batch
 - c. Design factors
 - i. Rich/lean
 - ii. Concrete type
 - 1. Normal weight
 - 2. Light weight
 - 3. Heavy weight
 - d. Trial batch: small versus job site
 - i. Small
 - 1. Lab tests
 - 2. Controlled environment
 - ii. Job site
 - 1. On site test
 - 2. Natural environment
 - iii. Lean
 - 1. Lightweight concrete
 - 2. Footing mix
 - iv. Rich
 - 1. High early yield
 - 2. Heavyweight

- e. Concrete types and application
 - i. Normal
 - 1. Standard mix
 - 2. Most common
 - 3. General use
 - ii. Lightweight
 - 1. Structural application
 - 2. Placement difficulties
 - iii. Heavyweight
 - 1. Industrial application
 - 2. Abrasion and crack resistant
- f. Aggregate types
 - i. Lightweight
 - 1. Shale
 - 2. Pumice
 - 3. Hadith
 - ii. Heavyweight
 - 1. River stone
 - 2. Hard rock
 - 3. #1's and #2's
 - iii. Normal
 - 1. Limestone
 - 2. #5 and #8
- g. Critical delivery and discharge times
 - i. Critical delivery
 - 1. Batch time
 - 2. Travel time
 - 3. Critical time- one hour
 - 4. Segregation potential
 - ii. Discharge time
 - 1. On site mix
 - 2. Premature setting
- h. Admixture types
 - i. Air entrained
 - ii. Retardants
 - iii. Accelerators
 - iv. Water reducers
 - v. Plasticizer
 - vi. Pozzolan
 - vii. Water proofing and dampening
 - viii. Fiber reinforcement
 - ix. Pigmentation
- i. Specification interpretation
 - i. Supplemental information
 - 1. Mix design
 - 2. Delivery
 - ii. Method of construction
 - 1. Reinforcement
 - 2. Thickness
 - iii. Description of construction standard
 - 1. Finish type
 - 2. Slump allowances

Resources

Herndrix, Laborn J. *Fundamentals of Concrete and Cement*. Stillwater, OK: Oklahoma State Dept. of Vocational and Technical Education, 1987.

"Guide for Use of Admixtures in Concrete" Revised 1982.

"Design and Control of Concrete Mixtures"

"Concrete Performance DATA Handbook"

"Design and Control of Concrete Mixtures"

Top of page

Key: 229