

Al-Mustensiryah University
College of Engineering-Civil Engineering Department
Graduate Studies-Structures

Bridge Engineering

Assist. Prof. Dr. Ali H. Aziz

T.D Building and Construction 1988
BSc. Civil Engineering 1994
MSc. Civil Engineering-Structures 2000
Ph.D. Civil Engineering-Structures 2006
Assist. Prof. 2010

Al-Mustenseria University
College of Engineering-Department of Civil Engineering
Bridge Engineering -Graduate Course 2012-2013

SCOPE

This course will provide the student with an overview of the design procedures of highway bridges. The central focus will be the structural behavior of the most common reinforced concrete bridges. Other types of bridges (composite bridges) will also be discussed.

INSTRUCTOR

Assist. Prof. Dr. Ali Hameed Aziz
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TEXTBOOKS

- 1- R. M. Barker and J. A. Puckett, "*Design of Highway Bridges-An LRFD Approach*", 2nd Edition, John Wiley & Sons, Inc. USA, 2006.
- 2-C. P. Heins and D. A. Firmage, "*Design of Modern Steel Highway Bridges*", John Wiley & Sons, Inc. USA, 1979.

GRADING

1) Project & Weekly Assignments	10%
Presentations are to be Prepared in PowerPoint, with:	
a) Text in WORD;	
b) Tables and graphs in EXCEL; and	
c) Figures in AutoCAD.	
2) Mid Term Exam	20%
3) Final Exam	70%
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Total	100%

REFERENCES

- 1-AASHTO Standard Specifications, "*American Association for State Highway and Transportation Official*"
- 2-BS-5400, "*British Standards*".
- 3-*Iraqi Standards Specifications for Road Bridges-Loading*
- 4- *Iraqi Standards Specifications for Railway Bridges-Loading*
- 5-ACI Committee 318, "*Building Code Requirements for Structural Concrete*", (ACI 318-08) and Commentary (ACI 318R-08), American Concrete Institute, Farmington Hills, MI, 2008.
- 6-J. R. Libby and N. D. Perkins, "*Modern Prestressed Concrete Highway Bridge Superstructures*", Grantville Publishing Company. USA, 1976.
- 7- C. P. Heins and R. A. Lawrie, "*Design of Modern Concrete Highway Bridges*", John Wiley & Sons, Inc. USA, 1984.
- 8-W. P., Jr and J. M., Muller, "*Construction and Design of Prestressed Concrete Segmental Bridges*", John Wiley & Sons, Inc. USA, 1982.
- 9- Y. T. Tamsah and L. Jaber, "*Introduction to Building Stability and Bridge Design*", Dar El-Rateb Al-Jamiah, Lebanon.
- 10- Nawy, E. G. , "*Reinforced Concrete -A Fundamental Approach*", 6th Edition, Pearson Education International, New Jersey, USA, 2009.

Course Outline

1- Introduction

1-1- What is Bridge?

1-2- Bridge Forms

1-3- Classification of Bridge

1-3-1- Purpose of construction (Road, Railway, Pedestrian, Water or Patrol lines....).

1-3-2- Construction materials (Wood, Brick, Stone, Steel, Reinforced Concrete..).

1-3-3- Construction method (Slab, Truss, Arch, Pre-cast, Composite, Box,...).

1-3-4- Relationship between spans and method of supports (Simple, Continuous,...).

1-3-5- Type and duration for use (Temporarily, Permanent, Military).

1-4- Components of Bridge

1-4-1- Superstructure

1-4-1-1- Wearing surface

1-4-1-2- Deck

1-4-2- Substructure

1-4-2-1- Abutment

1-4-2-2- Piers

1-4-2-3- Footing

1-4-3- Bearing

1-4-3-1- Expansion bearing

1-4-3-2- Fixed bearing

1-4-4- Expansion Joint

1-5- Transportation Planning (Route Selection, Functional Requirements and Geometric Design).

1-6- Preliminary Site Investigation (Site Survey to determine topography).

1-6-1- Geotechnical Investigation

1-6-2- Environmental Investigation

1-6-3- Hydraulic Investigation

1-7- Structural Design

1-8- Structural Design Steps

1-9- Loads to Consider

2- Loads on Bridges

2-1- Influence Line & Influence Function

2-2- Dead Load

2-3- Superimposed Dead Load

2-4- Highway Bridges Live Load

2-4-1- AASHTO Standard Truck and Lane Load

2-4-1-1- Applications of AASHTO Live Load

2-4-1-2- AASHTO Military Loading

2-4-1-3- Side walks Loading (AASHTO)

2-4-1-4- AASHTO Reduction in Load Intensity

2-4-1-5- Impact (AASHTO)

2-4-2- British Standards (BS-5400 Part-2)

- 2-4-2-1-Primary Live Load
 - 2-4-2-1-1-HA-Loading
 - 2-4-2-1-2-HB-Loading
 - 2-4-2-1-3-Number of Design Lanes
 - 2-4-2-1-4-Applications of HA-Loading
- 2-4-2-2-Secondary Live Load
- 2-4-3-Iraqi Standards Specifications for Road Bridges-Loading
 - 2-4-3-1-UDL & KEL (Civilian Loading)
 - 2-4-3-2-Military Loading
 - 2-4-3-3- Applications of Iraqi Loading
 - 2-4-3-4- Impact (Iraqi Standards)
 - 2-4-3-5-Longitudinal Force due to Military Loading
- 2-5- Other Loading

3-Deck Slab Design and Slab Bridge (One-way Slab)

- 3-1-Deck Slab Design
- 3-2- Deck Slab Reinforcement
 - 3-2-1-Main Reinforcement Perpendicular to Traffic
 - 3-2-2- Main Reinforcement Parallel to Traffic
- 3-3- Edge Beam Design (For Slab Bridges)
- 3-4- Design Example-1
- 3-5-Design Example-2
- 3-6-Design Example-3
- 4-Multi-Beam Bridge Deck
 - 4-1-Concept of Composite and Non-composite Beams
 - 4-2-Shear connectors
 - 4-2-1-Design of Shear Connectors for Fatigue
 - 4-2-1-Design of Shear Connectors based on Ultimate Strength
 - 4-3-Design Example-4
 - 4-4-Courbon's Method for Load Distribution on Bridge Deck
 - 4-5- Longitudinal Force
 - 4-6-Design Example-5
- 5-Sub-Structure
 - 5-1-Abutment
 - 5-2-Piers
 - 5-3-Abutment & Piers loads
 - 5-4-Footing
- 6-Design of Elastomeric Bearings
 - 6-1-Design Example-6