

COURSE CODE: *CVE 312*
COURSE TITLE: *Transportation Engineering*
NUMBER OF UNITS: *3 Units*
COURSE DURATION: *Three hours per week*

COURSE DETAILS:

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COURSE CONTENT:

- √ Introduction to Transportation Engineering
- √ Modes of Transportation systems-Land, Air & Water transportation systems

READING LIST:

1. James H. Banks. Introduction to Transportation Engineering. McGraw-Hill Company, 2002.
2. Nicholas J. Garber & Lester A. Hoel. Traffic and Highway Engineering. Thomson Corporation, 2002.

LECTURE NOTES

INTRODUCTION TO TRANSPORTATION ENGINEERING

- **Importance of transportation in Economic Development of a Nation**

- ü Transportation and Economic growth
- ü Social Costs and Benefits of Transportation

- **Career Opportunities in Transportation Engineering**

- Planning
- Design
- Construction
- Traffic Operation & Management
- Maintenance

- **Involvement of Civil Engineers in Transportation Engineering**

Historically, the primary involvement of civil engineers in transportation has been in the provision of physical facilities and the devising of operation strategies for them.

§ Employed by facility-oriented organizations, railway-which provide their own physical facilities and urban transit operators.

§ Civil Engineering activity related to the provision of physical facilities such as design, construction and maintenance of fixed transportation facilities

§ Major highway project- design & construction of bridges and other structures requires- structural engineering, drainage design – hydraulic & hydrologic engineering, earthwork compaction & slope stability- geotechnical engineering, construction management and surveying.

§ Similar complexity and civil engineering involvement characterize other transportation projects, such as the construction of airports or urban rail rapid transit systems

- Transportation as an Inter-discipline related subject
- Transportation Management system in Nigeria.

TRANSPORTATION SYSTEM

Transportation is one of the major functional systems of modern society. A system in the sense intended here, is something that may be thought of as a whole consisting of parts or components. The description of a system involves identification of the system itself as distinct from its environment (that is, the rest of the world), identification of its components and a description of how the components interact.

The transportation system is a functional system in the context of society as a whole because it provides a service- the movement of goods and people from place to place.

The transportation system includes the following components:

- ü Physical facilities including streets, roads and highways, railroads, airports, sea and river ports, pipelines and canals
- ü Fleets of vehicles, vessels and aircraft
- ü Operating bases and facilities, including vehicle maintenance facilities and office space
- ü Organizations
- ü Operating strategies

MODES OF TRANSPORTATION

Different Modes of Transportation

- Ø Rail road
- Ø Airway
- Ø Highway
- Ø Waterway
- Ø Belt conveyor
- Ø Pipeline

Intrinsic Features of Different Modes

ü Classification

- Unit of carriage
- Guidance & Manoeuvrability
- Buoyancy & Stability

ü **Characteristics of Vehicles Used in Transportation**

- Highway
- Aircrafts
- Water-borne vessels
- Railroad vehicles

ü **Component**

- Motive Power
- Way or travel medium

RAIL TRACK ANALYSIS

Railroad track serves to provide guidance for rail vehicles and to spread wheel loads so as to keep bearing pressure on the sub grade within acceptable limits. This later function is similar to that of highway pavements, and the design of railroad tracks is similar in many ways to that of flexible highway pavements.

Track Structure

Overall track structure typically consists of sub grade, ballast, ties, rails and rail fastenings. Railways must also include special provisions to handle intersecting, merging, and diverging track.

Structural design of track is primarily a matter of selecting the correct rail sections and tie spacing. Rail sections are designated by shape, with several standard shapes being available, and by weight, usually given in pounds per yard.

A variety of design procedures are used for track design, ranging from comparatively simple formula to highly sophisticated finite-element computer programs.

BALLAST

Ballast has a number of functions, which include

- ü Distribute tie loads to the sub grade
- ü Anchoring track against lateral, vertical & longitudinal movement
- ü Providing for drainage of water away from rail & ties
- ü Facilitating maintenance, especially maintenance of track grade and replacement of ties
- ü Retarding growth of vegetation in the immediate vicinity of the track structure
- ü Providing some resilience to help absorb dynamic loads

- ⌚ **TIES** are used to maintain gauge and to transmit wheel loads from the rails to the ballast

In North America, wood ties are the most common variety, with some use of prestressed concrete ties. Elsewhere in the world, non-wood ties are fairly common. The action of ties under wheel loads is largely dependent on the type of support provided by the ballast.

- **RAILS-** support and provide guidance for the flanged wheels on rail vehicles and transmit wheel loads to the ties. Rails like ties rarely fail because of excessive bending stress, but they are subject to a variety of types of wear and to failures from metallurgical defects.

WATERWAYS

- ⌚ Natural waterways sometimes serve as travel ways without any intervention but sometimes require extensive intervention.
- ⌚ **Dams & Locks-** when sufficient depth of flow is not otherwise available, storage reservoirs are used to provide artificial pools and slack water navigation. Thus, dams and locks are used to obtain navigable channels over water whose flow would not otherwise support navigation.
- ⌚ Requirement for lock & dam

PORTS AND HARBOURS

- ⌚ These are simply the terminal facilities for the water mode.
- ⌚ **Harbour** is a partially enclosed area of water which serves as a place of refuge for ships while loading, unloading or being serviced. It provides a safe anchorage and protects ships from waves of the open seas.
- ⌚ **Features for Harbour sites**
- ⌚ **Port-** is that portion of the harbour which serves as a base for commercial activities.
- ⌚ **Planning & design of port facilities**

HIGHWAY

⌚ **Pavement Structure**

∅ Sub grade: is usually the natural material located along the horizontal alignment of pavement and serves as the foundation of the pavement structure.

∅ Sub base: located immediately above the sub grade

∅ Base course: lies immediately above the sub base

⌚ **Functions/ Standard requirement**

RAIL ROAD'S SIGNAL & TRAFFIC CONTROL

- ⌚ At all times, rail locomotives remain under a high degree of control- since their paths are restricted by the tracks.
- ⌚ Definitions of Side-tracks, turn-out, switch, etc.
- ⌚ Types of switch- Stub switch, split switch
- ⌚ Railroad signal system- the two principal signals used for control are- semaphore blades & light signals
- ⌚ Train control system can be categorised into the following classes: Time table/ train order; Automatic block system & Centralized traffic control
- ⌚ Yard: receiving, classification & departure

AIR TERMINAL

These include portions of airports other than the landing and take-off areas i.e. car-parking lots, aircraft parking aprons, terminal buildings and facilities required for inter-terminal as well as intra-terminal transportation.

§ Functional elements that can be identified in airport passenger terminals- **airside, terminal building & landside**

§ Layout concepts

§ Vehicle parking needs

§ Aircraft parking needs

§ Space Requirement for Terminal building