

Transportation Engineering

Transportation is movement or transferring from location to another. It has a main role in moving people and goods to search for food, work, and exploration. In addition it has played a significant role by facilitating trade and social interactions is also has an important role in the growth and development of cities and societies.

Transportation Engineering: is a main branch of civil Engineering. It considers the application of technologies and scientific principles in planning, design, building, operating and management of the movement system the system safely and economically. It also considers providing rapid, comfortable, and environmentally compatible movement of people and goods.

The elements of the Transportation system

1. The user: drivers, pedestrians and others
2. Vehicle: mean of movement
3. Links (Transportation Infrastructure): connecting the origin and destination
4. Terminals: nodes where a trip begins or ends
5. Labour: Who constructs, operate, and manage the movement within the transportation network.

Modes of transportation

- Highway Engineering
- Railway Engineering
- Airfield Engineering
- Water transportation engineering

- Mass transit system

Syllabus:

- 1- Highway functional classification.
- 2- Principles of highway location.
- 3- Earthwork quantities, Mass haul diagram and sustainable waste management.
- 4- Volume and flow rate, speed, spot speed, running speed, journey speed, average travel speed, free-flow speed, density, critical density, spacing, and headway.
- 5- Relationship among basic parameters, delay, average daily traffic, average annual daily traffic, maximum annual hourly volume, design hourly volume, capacity, and level of service.
- 6- Traffic volume forecasting.
- 7- Elements of Geometric design: Stopping sight distance, passing sight distance, decision sight distance.
- 8- Geometric design: Vertical alignment, types of vertical curves, Design of crest vertical curves, minimum length for crest alignment, Design of sag vertical curves.
- 9- Geometric design: Horizontal alignment, types of horizontal curves, sight distance for horizontal curve, pavement widening on curves, super elevation.
- 10- highway cross-section elements: travel lanes (numbers and width), roadway cross slope, types of roadway surfaces, shoulders and sidewalks, curb and gutter, medians, highway roadside, right-of way and vertical clearance.
- 11- Intersections: types of at-grade intersections (three-leg intersections and four-leg intersections), channelization at intersections and speed change lanes.
- 12- Interchanges: justification of interchanges (elimination of bottlenecks, elimination of hazards and road-user benefits), design classification, types of interchanges (three-leg interchanges, four-leg interchanges, diamond interchanges, split-diamond

interchanges, cloverleaf interchanges, partial cloverleaf ramp arrangements and directional interchanges), selection of interchanges and ramps of interchanges.

13- Highway Paving Materials: Asphalt Concrete, desirable properties of asphalt cement, asphalt types and testing, prime and tack coats, fractional components of asphalt cement, rheological behaviour, aggregate and mineral filler, job-mix formula, classification or source of asphalt, Asphalt mixture volumetric, asphalt mix design by Marshall test.

14- Flexible pavement: layers of flexible pavement, AASHTO design method for flexible pavement, traffic loads, subgrade support for flexible pavements, flexible pavement material, structural numbers for flexible pavements and determination of course thickness.

15- Rigid Pavement: subbase for a rigid pavement, types of concrete pavements (jointed reinforced concrete pavement and continuously reinforced concrete pavement), reinforcing steel for concrete pavement, reinforced concrete pavement slabs, tie bars, load-transfer devices, joints in concrete pavement (transverse expansion joints, longitudinal joints and construction joints) and joint sealing.

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Volume 1: Highways, Traffic planning and Engineering
Volume 2: Highway Engineering
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- Standard Specification for Roads and Bridges (SCRB) (2005), Highway Design Manual, Republic of Iraq, Ministry of Housing and Construction.

Standards:

- Iraqi Highway Design Manual (1982)
- Standard specification for Roads and Bridges (1983)
- AASHTO Guide for Design of Pavement Structures (1993)
- AASHTO Policy for Geometric Design of Highways and Streets (2004)
- ASTM Publication
- SCRB الهيئة العامة للطرق و الجسور

Year	1987	1997	2004	2011
Population (millions)	17 million	22 million	25 million	33 million

- **Highway Network in Iraq:**

Vehicles	910,000	1,250,000	2,000,000	3,501,183
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Average number of people per vehicle 2004

Iraq	12.5 person/veh
USA	2 person/veh
Japan	4 person/veh

Rural Network Length (2004):

Iraq	42,000 Km (including Express way No. 1083 Km)
Kuwait	4,600 Km
Saudi Arabia	172,615 Km
Egypt	47,000 Km
Syria	7,000 Km
USA	4,000,000 Km

Some bridges across Tigris River in Baghdad:

Year	Bridge	Length	Cost (ID)	Company
1939	<i>Al-Shuhada</i>	<i>5 span/219m</i>	<i>250,000</i>	<i>British</i>
1940	<i>Al-Ahrar</i>	<i>7 span/303m</i>	<i>300,000</i>	<i>British</i>
1951	<i>Al-Sarafiya</i>	<i>7 span/450m</i>	<i>3,000,000</i>	<i>British</i>
1957	<i>Al-Jumhuriya</i>	<i>8 span/390m</i>	<i>1,570,000</i>	<i>Germany</i>
1982	<i>Al-Jadiriya</i>	<i>29 span/1276m</i>	<i>30,000,000</i>	<i>Germany</i>