

Lecture 1

MSc Transportation Engineering

Railroad Engineering

College of Engineering

University of Babylon

Introduction to Railway Engineering

- **Railway Mode Of Transport**
- **Early Beginnings**
- **Railways in Iraq**

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- Classification Schemes for Transportation Engineering

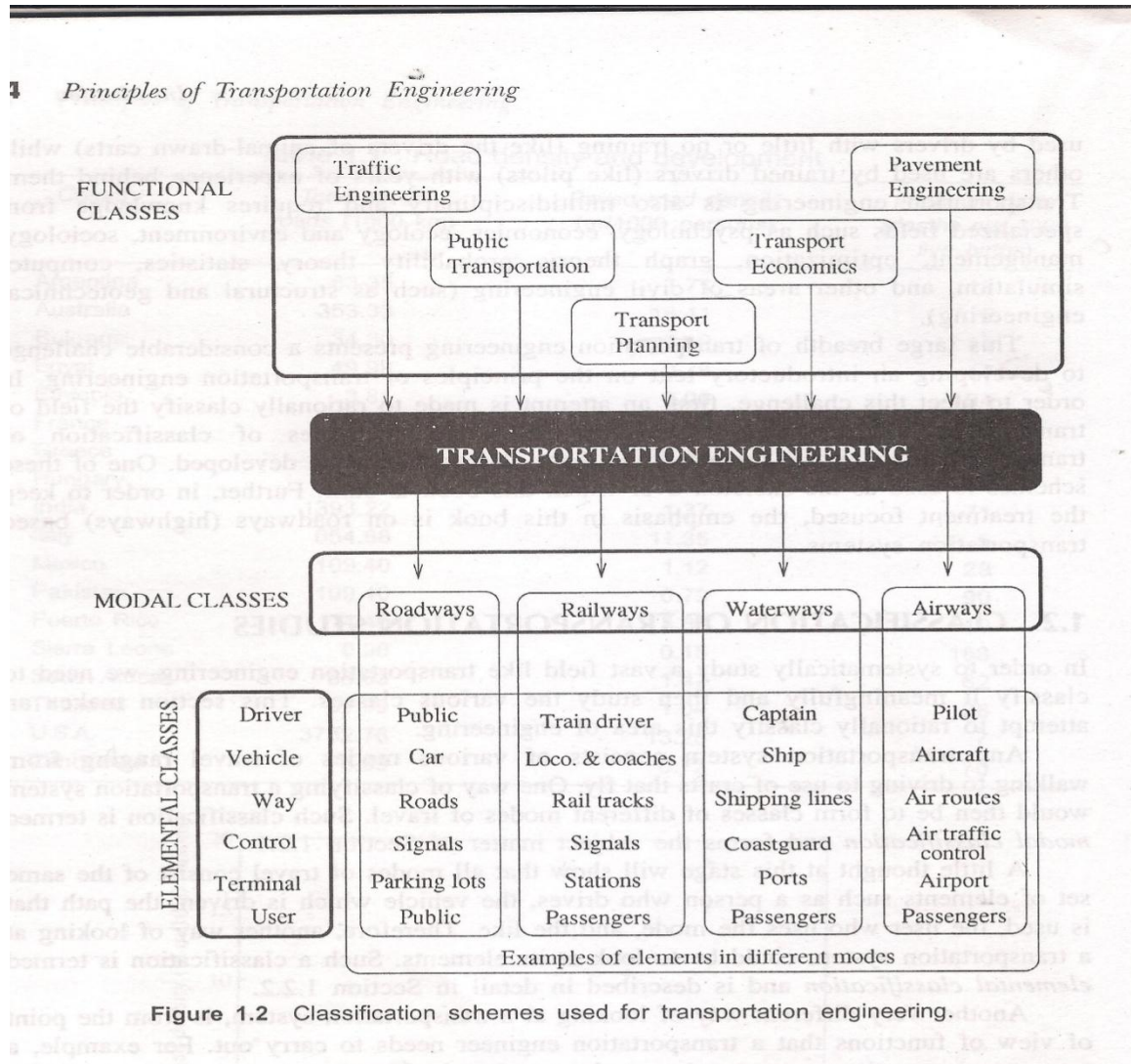


Figure 1.2 Classification schemes used for transportation engineering.

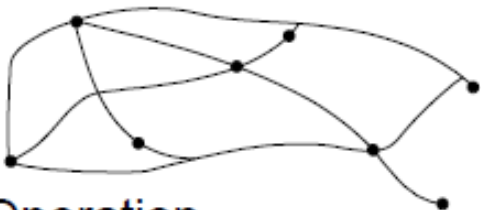
Railways: Introduction

- In this mode of transport, all vehicles use rail tracks to move from one point to another.
- Vehicles consist of a long train of coaches attached to a locomotive.
- The coaches and the locomotive have steel wheels which run on steel rail tracks.
- The locomotive either uses diesel or use electricity as fuel (locomotives which run on coal are hardly used these days).
- Since the rail tracks provide a dedicated right-of-way for the train services, these are good for high speed transit facilities.
- Trains stop at pre-specified locations called stations.

Elements of Railway Engineering

Railroad Network

System operation affects efficiency and service reliability



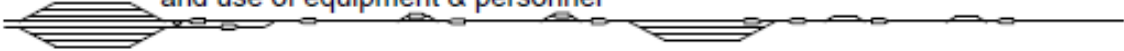
Traffic Control System

Safe, efficient operation of many trains on same tracks



Line & Terminal Operation

Timely and efficient train operation and use of equipment & personnel



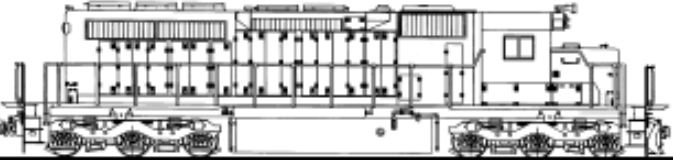
Rail Cars

Design and size affect operating efficiency



Locomotive

Efficient conversion of energy into tractive force to pull train



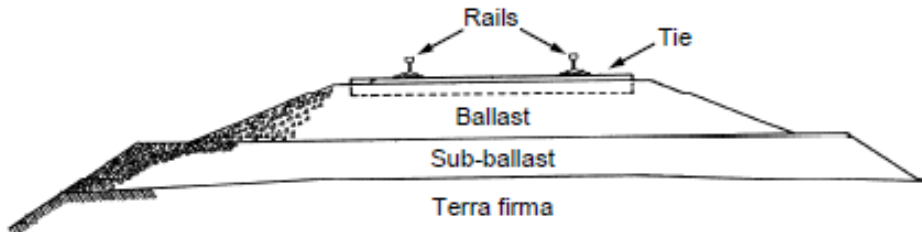
Brake System

Safe stopping distance affects train spacing and line capacity



Track System

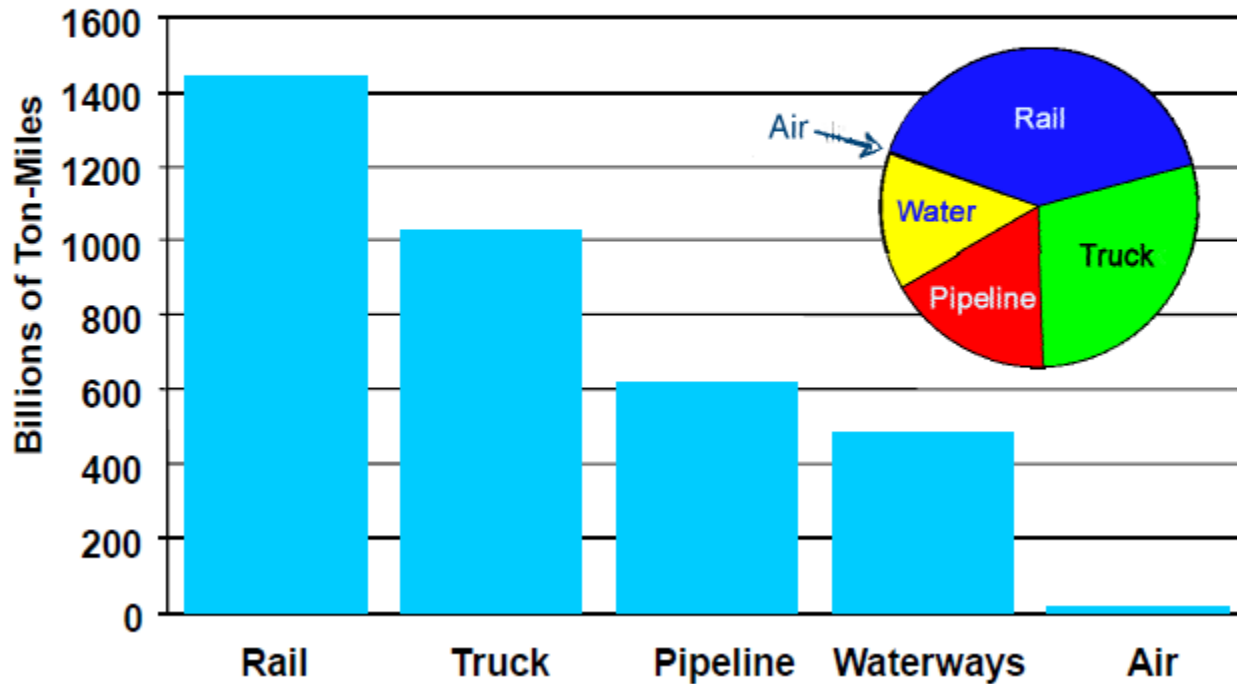
Structure & condition affects speed and maintenance requirements



Wheel/Rail Interface

Complex dynamics affect stability & speed

North American freight transportation volume by mode



Important aspects related to the railway mode of transport

- Safe and efficient operation and control of rail traffic.
- Layout of rail tracks.
- Structural design of the subgrade on which rail tracks run.
- Planning of stations or terminals for railway vehicles.

Early Beginnings

- By the time steam locomotives came on the scene, in the early nineteenth century, wrought iron rails and later steel rails were developed which were strong enough to support these heavy axle loads without assistance from longitudinal timbers.
- In essence the track itself, together with its supports, had and still has the basic function of safely transmitting the loads and forces imposed by passing trains to the ground beneath.
- Various other civil engineering skills were also involved in the construction of early railways. These included the building of bridges, tunnels and gravity walls as well as extensive earthworks and drainage.

Railways in Iraq

- Railway construction began in Iraq in 1902, part of the Berlin – Baghdad project, seen as a standard gauge through route.
- After the British invasion of 1914, Basra – Baghdad was built with surplus metre gauge equipment from India, and
- Iraq has a similar length now of both gauges. 2529 km, 19 steam locos, 163 Diesels, 4 DMUs, 240 carriages, 3 280 wagons, 1 377 staff.

Railways in Iraq

- The first section of railway in what was then the [Ottoman Empire](#) province of [Mesopotamia](#) was a 123 kilometres (76 ml) length of the [Baghdad Railway](#) between that city & [Samarra](#) opened in 1914.
- Work had started northwards from [Baghdad](#) with the aim of meeting the section being constructed across [Turkey](#) & [Syria](#) to Tel-Kotchek and an extension northwards from Samarra to Baiji was opened in December 1918

Railways in Iraq

- From 1916 onwards an invading [British Military](#) force brought [narrow gauge](#) equipment, firstly [2 ft 6 in](#) (762 mm) gauge and later 1,000 mm (3 ft 3 ³/₈ in) [metre gauge](#) from [India](#) to Southern [Mesopotamia](#) to construct various sections of line to support its offensive against the Turks.
- Britain defeated the Ottomans and Mesopotamia became a [League of Nations](#) mandate under British administration.
- In April 1920 the British military authorities transferred all railways to a British civilian administration, **Mesopotamian Railways**.

Railways in Iraq

- the metre gauge line from [Basra](#) to [Nasiriyah](#) was the most important section constructed during the war in terms of its significance as part of later efforts to construct a national railway network.
- Soon after the end of [World War I](#) this was extended northwards from Ur Junction outside Nasiriyah up the [Euphrates](#) valley with the complete Basra to Baghdad route being opened on 16 January 1920.

Railways in Iraq

- The other section of metre gauge line built during [World War I](#) that had ongoing significance was that from [Baghdad](#) East north eastwards to the Persian border.
- After the war the eastern end of this line was diverted to Khanaqin and the wartime built line north west from Jalula Junction was extended from Kingerban to [Kirkuk](#) in 1925.

Railways in Iraq

- In 1932 Iraq became independent from Britain.
- In March 1936 Britain sold Mesopotamian Railways to Iraq, which renamed the company **Iraqi State Railways**.[\[2\]](#)
- Work resumed on the extension of the [Baghdad Railway](#) between Tel Kotchek on the Syrian frontier and Baiji.
- The through route was opened and completed on 15 July 1940.

Railways in Iraq

- In 1947 the [Iraq Petroleum Company](#) opened a branch at Kirkuk, which it operated with its own [Hudswell Clarke](#) 2-8-4T's from 1951.
- ISR opened a new metre gauge line from Kirkuk to [Arbil](#) in 1949.
- A joint [road & rail bridge](#) was opened across the River [Tigris](#) in [Baghdad](#) in 1950, finally connecting the east and west bank metre gauge systems.

Railways in Iraq

- In 1958 when Iraq's Hashemite monarchy was overthrown and a republic declared, ISR was renamed **Iraqi Republic Railways**.
- In 1961 IRR began to replace its standard gauge [steam locomotive](#) fleet with diesels from [ČKD](#) and [ALCo](#).
- In 1972 several classes of steam locomotive were still in service on the standard gauge system but these were replaced by further classes of diesel from [Alstom](#), [Montreal Locomotive Works](#) and [MACOSA](#).^[22]

Railways in Iraq

- IRR did not begin to replace its metre gauge steam locomotives until after 1983.
- In 1964 IRR extended its standard gauge network with a line from Baghdad to Basrah which opened for freight in 1964 and for passengers in 1968.
- It has since been extended from Shouaiba Junction to the port of [Umm Qasr](#).

Railways in Iraq

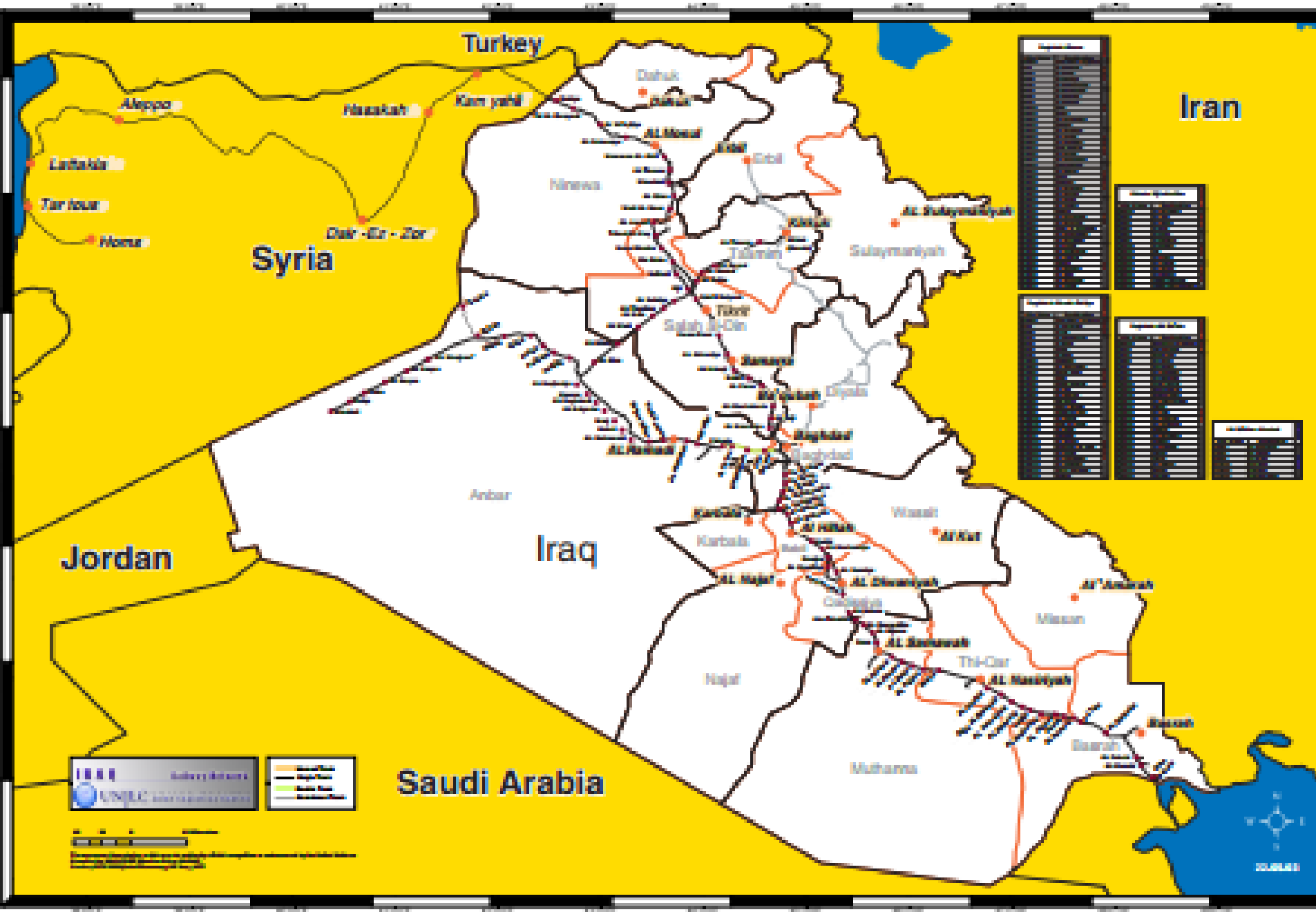
- Iraq possessed two separate railroads at independence, one standard gauge [S.G.] and one meter gauge [M.G.].
- The standard gauge line ran north from Baghdad through Mosul to the Syrian border and to an eventual connection with the Turkish railroad system, and the meter gauge line ran south from Baghdad to Basra.
- Because the two systems were incompatible, until the 1960s cargo had to be transloaded at Baghdad to be transported between the two halves of the country.

Railways in Iraq

- In the 1960s, development plans converted metric railroads to standard railroads.
- The Soviet Union helped extend the standard gauge system to Basra, and by 1977 fully 1,129 kilometers of Iraq's 1,589 kilometers of railroad were standard gauge.

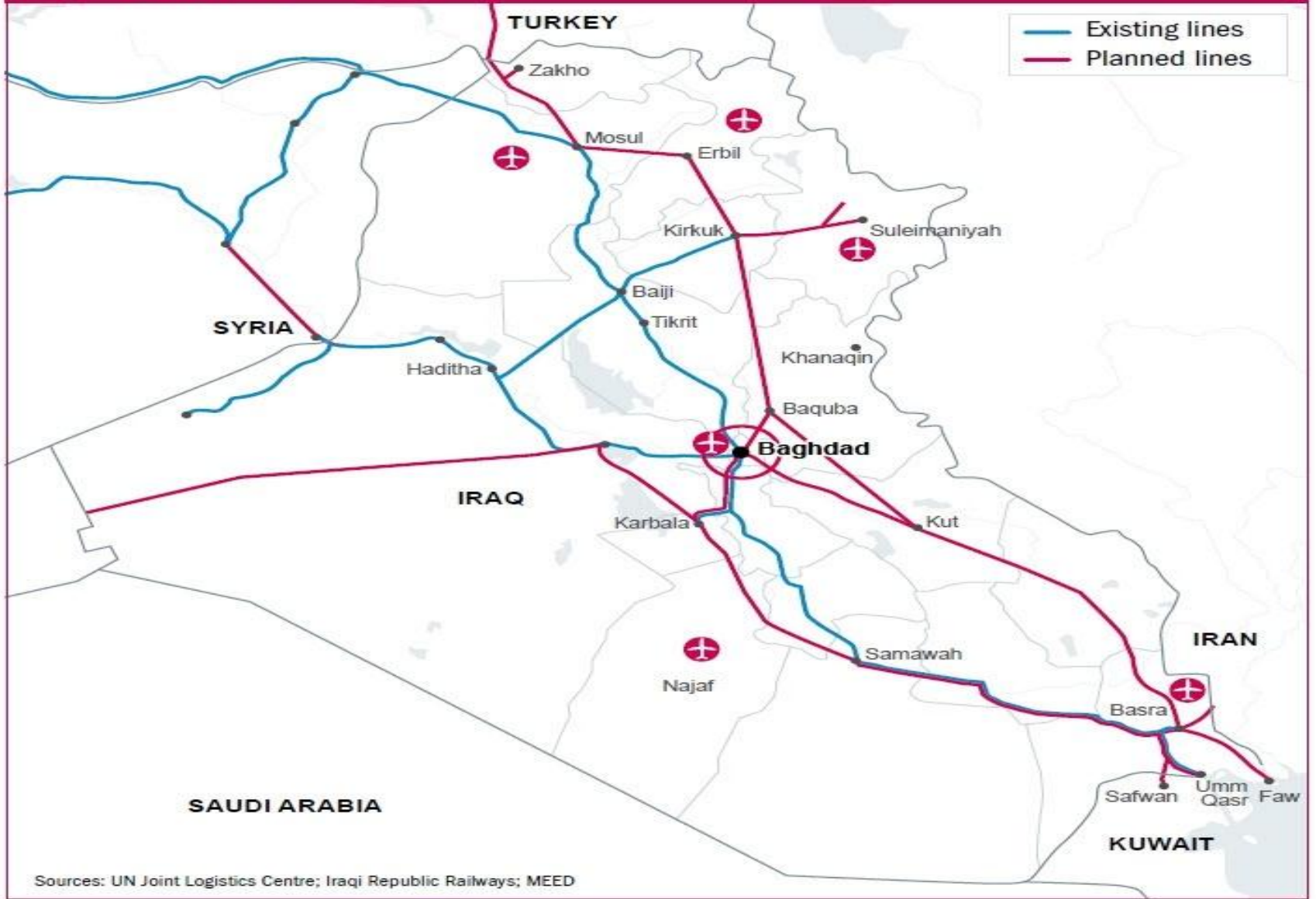
Railways in Iraq

- By 1985 the total length of railroad lines had been extended to 2,029 kilometers, of which 1,496 kilometers were standard gauge.
- In 1985 the railroads were being traveled by 440 standard-gauge locomotives that moved 1.25 billion tons of freight per kilometer



The [detailed map of the Iraqi railway network](#)

IRAQ RAIL NETWORK



Route	Length (Km)	Opened
Yurubiyah [El Yaroubieh] (on the Syrian border, on the route to Turkey) – Mosul (Al Mawsil) – Qayyarah – Baiji – Tikrit – Samarra - Baghdad	528	In stages 1939, 1940
Baghdad – Al Musayyib – Al Hilla – As Samawah – Al Nasiriyah (for Ur, possible 30 Km branch to Kut – Al Basrah	541	1964 (fright) 1968 (passenger) Replaced earlier meter gauge line, not same route.
Basra – Umm Qasr	68	1968
Baghdad – Al Fallujah – Haqlaniyah – Anah – Al Qaim – Qusaybah [Husaib] (on the Syrian border at Albu Kamal)	516	1987

Gauge: Distance between the inner sides of the two parallel rails that make up a single railway line

