

Evolution and classification of public transportation

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Mid 1800s

Horse-drawn omnibuses



Figure: Omnibus, London¹

¹Source: www.transportgeography.org

Early 1800s

Horse-drawn streetcars



Figure: Namaqualand Railway mule train ²

²Source: Wiki

Late 1800s

Steam-powered trains

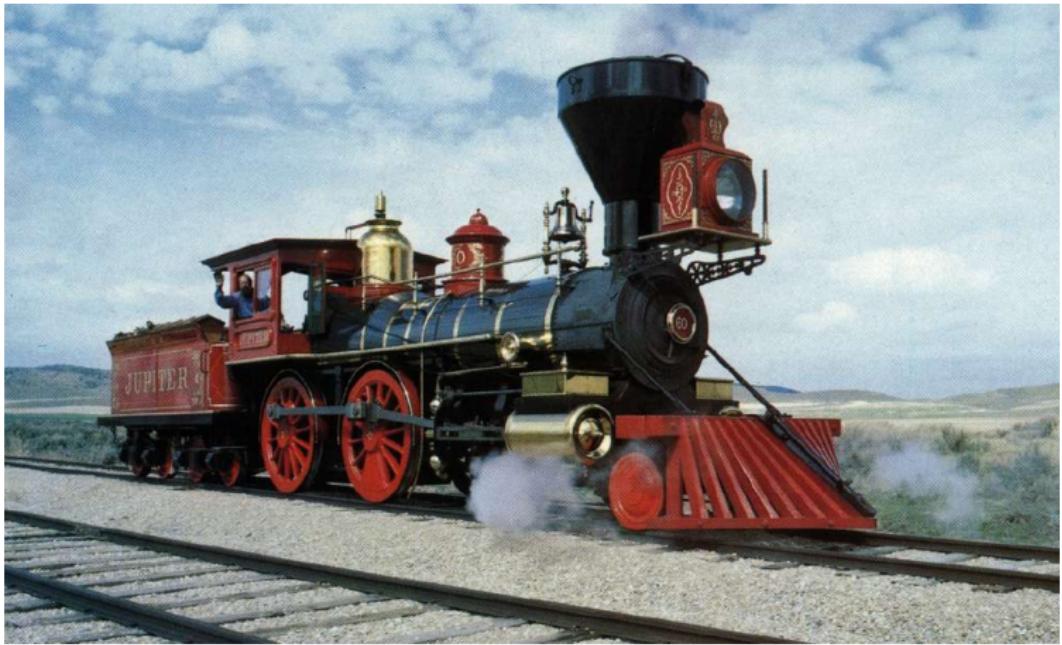


Figure: Steam locomotive CP No. 60 and UP No. 119 - American Type³

³Source: www.up.com

Late 1800s

Electric trams and cable cars

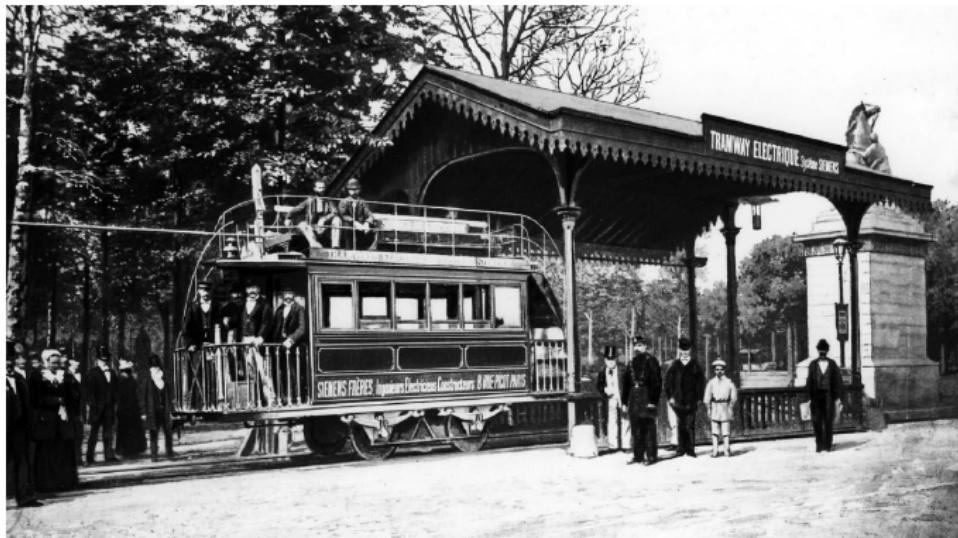


Figure: Electric streetcar, Lichterfelde 1881 ⁴

⁴Source: www.siemens.com

Early 1900s

Subway systems



Figure: City Hall Station postcard from 1904⁵

⁵Source: India Today

1920s

Revolution in automobile industry: Introduction of motorbuses

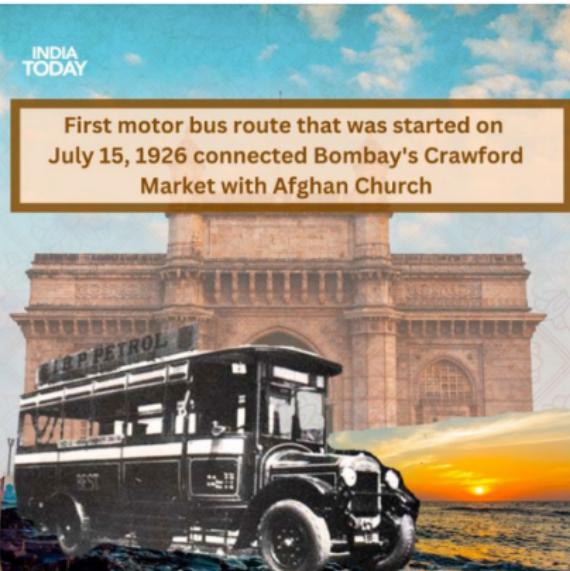
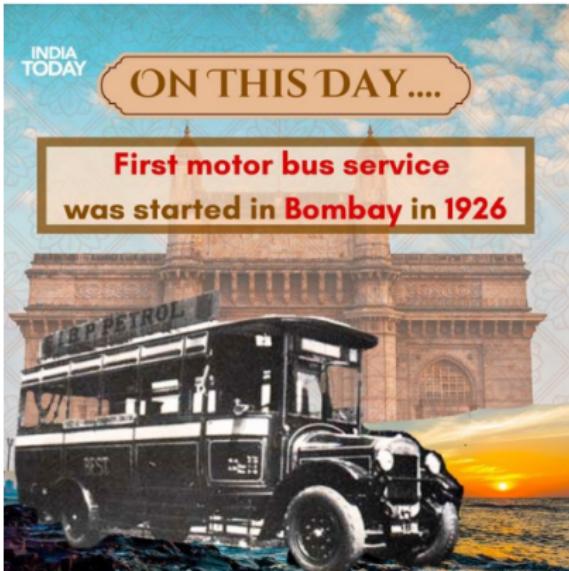


Figure: The first motor bus was started on 15th July 1926 that ran between Afghan Church and Crawford Market, Mumbai. The bus fare for the same journey was four annas.⁶

⁶Source: India Today

Public transportation during World War II

High-levels of ridership



Figure: Londoners slept in the city's Underground for protection during German bombing raids, 1940⁷

⁷Source: www.life.com

1950s

Bus as predominant mode



(Click-on photo to view larger image)

Figure: Buses in Detroit, Michigan

Public transportation during independence



Figure: Mass migration during partition ⁸

⁸Source: www.railpost.in

1950-80s

Expansion of railways



Figure: Old Delhi station⁹

⁹Source: Pinterest

1950-80s

Development of metro systems in many global cities



Figure: NYC Metro¹⁰

¹⁰Source: Pinterest

1990s

Light rail transit



Figure: Sydney LRT¹¹

¹¹Source: Wiki

2000s

high-speed rail



Figure: Bullet train at Linyi North Station in East China¹²

¹²Source: <http://en.people.cn/>

2010s

Bus rapid transit



Figure: Delhi BRT¹³

¹³Source: India Today

Modal characteristics

One can categorize transit systems based on the following characteristics:

1. Right of way (ROW)
2. Technology
3. Type of service

Right of way

- ▶ It refers to the path (way) which transit vehicles can (or have right to) travel
- ▶ Based on the degree of separation with other traffic we have three levels:
 - **Level I:** systems in which transit vehicles operate on surface city streets mixed with other traffic, e.g., bus transport, etc.
 - **Level II:** systems in which transit vehicles operate on surface streets but enjoys some separation from other modes, e.g., light rail transit (LRT), bus rapid transit (LRT), etc.
 - **Level III:** systems in which transit vehicle enjoy full separation from other modes, e.g., monorails, subways, metro, commuter rail, etc.
- ▶ ROW affects speed and capital/operational costs. Higher the level of separation, more is speed and capital/operational costs.

Technology¹⁴

1. Support - contact between vehicle and surface

- rubber tire on concrete
- steel wheel on steel rail
- others

2. Guidance - lateral control (what steers the vehicle)

- steered by driver
- guided by track
- others

3. Energy and propulsion

- diesel internal combustion engine (conventional or clean)
- compressed natural gas
- electric motor
- hybrid
- others

4. Control - longitudinal

- manual/visual
- manual/signal
- automatic

¹⁴Taken from MIT Courseware 1.258J

Type of Service

1. Based on whether or not fixed routes/stations are used
2. Express versus rapid versus local transit
3. Scheduled versus flexible transit

A few pictures



(a) City bus^a



(b) Double Decker bus^a



(c) Articulated bus^a

^aWiki

^aEconomic Times

^aWiki



(a) Trolley bus^a



(b) Tram^a



(c) BRT^a

^aWiki

^aEconomic Times

^awww.madison365.com

A few pictures



(a) LRT^a



(b) Automated guideway^a



(c) RRT (metro, subway)^a

^aWiki

^aspectra.mhi.com

^aZeenews



(a) Monorail^a



(b) Commuter rail^a



(c) Cable cars^a

^aWiki

^ametrorailnews.in

^awww.swarajyamag.com



Figure: Ferry¹⁵

¹⁵www.scroll.in

London Calcutta London Bus service



Figure: ¹⁶

¹⁶Source: Quora

London Calcutta London Bus service



Figure: 17

¹⁷ Read more at <https://www.travelandleisure.com/trip-ideas/bus-train/bus-to-london-70-day-18-country-tour>

Thank you!