Byrne Seminar
The History and Future of High Speed Passenger Trains
Sweden and the United Kingdom

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Sweden High Speed Passenger Trains

Statistics

- Kingdom of Sweden
- Comparison with US

Item	*Sweden*	*US*
Area	0.45 M km^2	9.8 M km^2
Driving side	right‡	right
GDP (nom)	\$ 0.5 T	\$ 22.3 T
GDP (PPP†)	\$ 0.5 T	\$ 22.3 T
Population	10.3 M	328 M

†Purchasing Power Parity

‡Changed from left in 1967

Sweden High Speed Passenger Trains

Dagen H

- Högertrafikomläggningen" ("The right-hand traffic diversion")
- Sunday, 3 September 1967
- All non-essential traffic banned from 0100 h to 0600 h
- All vehicles stopped at 0450 h and change to other side of road
- Proceeded to drive at 0500 h
- One way streets required special consideration
- Stockholm) banned traffic from 1000 h on Saturday to 1500 h on Sunday

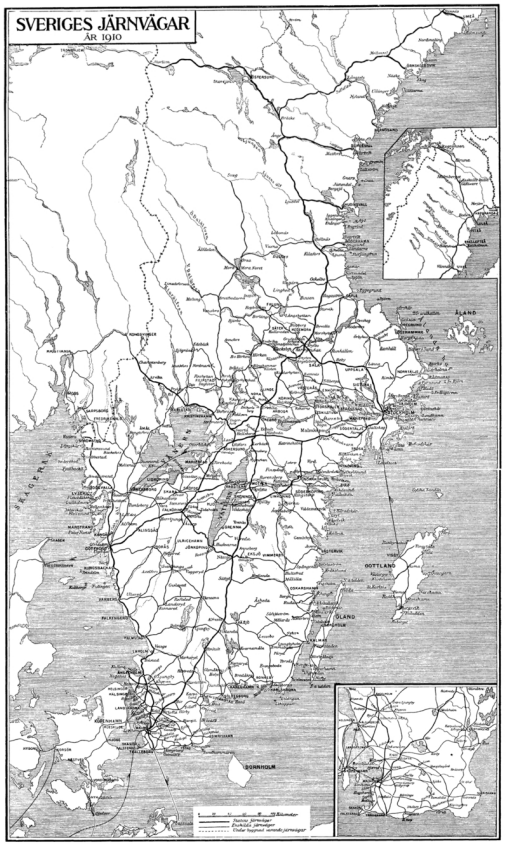
Stockholm on the day Sweden changed driving from left to right

Dagen H logo

Sweden High Speed Passenger Trains

History

- The first railway was built in 1845 between Köping and Hult to connect steamboats on Lake Mälaren and Lake Vänern
- Financed by British investors
- First public railway was Frykstadbanan connecting Frykstad and Klara Älvs with gauge of 1188 mm (3 ft 10.77 in) and converted to steam locomotives in 1855
- First railway built for steam locomotives was Nora-Ervalla - Örebro opening in 1856



Sweden railways in 1910

Sweden High Speed Passenger Trains

SJ AB

- Statens Järnvägar (SJ) is the former Swedish government agency responsible for operating state-owned railways
- SJ created in 1887
- Rail tracks transferred to Swedish Rail Administration (Banverket) in 1988

SJ AB logo

wikipedia.org/w/index.php?curid=54676678

- SJ disbanded in 2001 and seven separate companies formed

Company	*Function*
SJ AB†	passenger trains
Green Cargo†	freight trains
Jernhusen†	real estate
EuroMaint	train maintenance
Unigrid	information technology
TraffiCare	terminal services
TrainTech Engr	technical unit

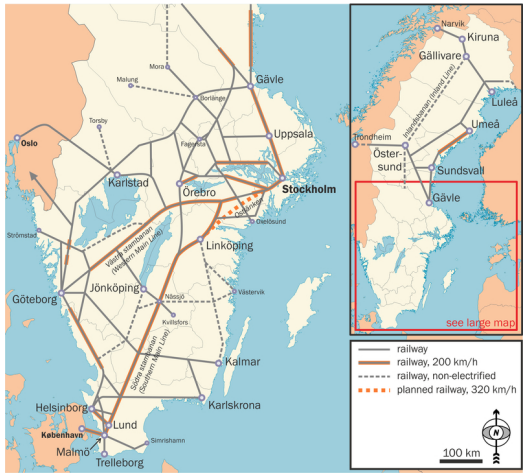
†Owned by Swedish government

Sweden High Speed Passenger Trains

SJ AB

- Statistics

Item	*Value*
Total rail track	15,006 km
Electrified	8,100 km
Electric	15 kV, 16.7 Hz
Gauge	standard
Passengers (2017)	229 M



Sweden rail system

Sweden High Speed Passenger Trains

Sweden Three Foot Railway

- Swedish three foot ("trefotsbanor") railways were actually 891 mm (2 ft 11 3/32 in)
- The gauge corresponds to three feet in the old Swedish system
- Most converted to standard gauge in 20th century, although a few remain as heritage railways
- Last remaining commercial trefotsbanor railway is Roslag Railway (Roslagsbanan) in northeastern Stockholm

Roslagsbanan in Stockholm county

Train at Rydbo
20 km NE of Stockholm

Sweden High Speed Passenger Trains

X2

- X2000 (also known as SJ X2 or X2) is high speed *tilting* train operated by SJ
- Tilting added to enable high speed on curved rail tracks
- Service began in 1990
- Refurbished in 2003 and 2019

Sweden high speed rail system

Sweden High Speed Passenger Trains

X2

- Statistics

Item	*Value*
Length (car)	24 m
Width	3.05 m
Height	3.8 m
Electric system	15 kV, 16.7 Hz
	25 kV, 50 Hz
Track gauge	standard
Passengers	76 (business)
	51 (first class)
Max speed	200 km/hr
Manufacturer	ASEA

X2 train in Jonsered, Sweden

Sweden High Speed Passenger Trains

Regina

- Regina is successor to X2 for local and regional service
- Variants denoted X51 to X55
- Began service in 2000

SJ X52

- Gröna täget (green train) project X52 set Swedish rail speed record 303 km/hr in 2008

Item	*Value*
Formation	2 or 3
Length	53.9 to 80.5 m
Width	3.45 m
Electric system	15 kV, 16.7 Hz
Track gauge	standard
Passengers	165 to 294
Maximum speed	180 to 200 km/hr
Number built	109

United Kingdom High Speed Passenger Trains

Statistics

- United Kingdom of Great Britain and Northern Ireland
- Comparison with US

Item	*UK*	*US*
Area	0.24 M km^2	9.8 M km^2
Driving side	left	right
GDP (nom)	\$ 2.7 T	\$ 22.3 T
GDP (PPP†)	\$ 3.1 T	\$ 22.3 T
Population	68 M	328 M

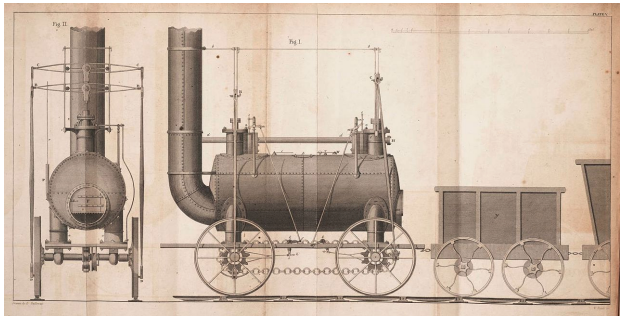
†Purchasing Power Parity

United Kingdom High Speed Passenger Trains

George Stephenson

- Developed first locomotive to use flanged wheels
- Incorporated cylinder rods directly connected to wheels
- Built Hetton colliery railway in 1820 using gauge of 4 ft 8 in

George Stephenson
(1781-1848)



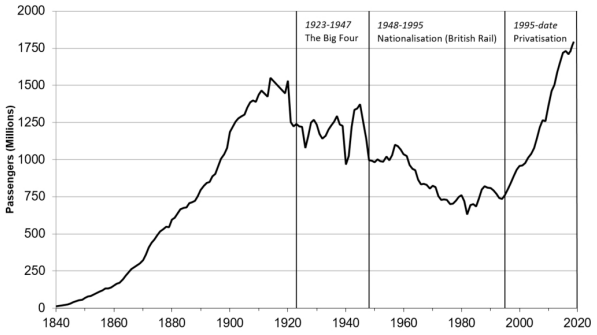
Blücher locomotive

Billy locomotive

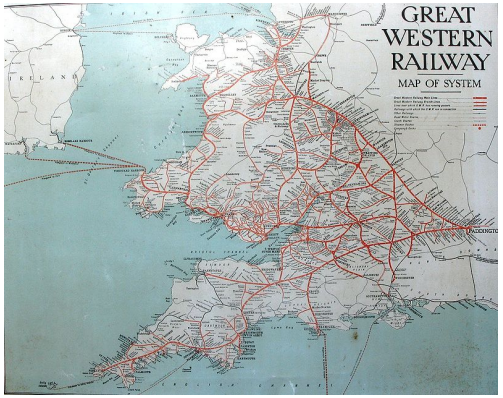
United Kingdom High Speed Passenger Trains

History

- Railways expanded in the 19th century
- Companies consolidated into the Big Four in 1923
  - Great Western Railway
  - London and North Eastern Railway
  - London, Midland and Scottish Railway
  - Southern Railway
- The Big Four were nationalized in 1948 forming British Railways



Railway passenger traffic



Great Western Railway routes

United Kingdom High Speed Passenger Trains

British Railways

- Formed in 1948 by nationalization of Big Four
- Known as British Rail
- State owned company operated most of overground rail from 1948 to 1997
- Beginning in 1979 British government began to privatize
- Operations of British Rail were broken up and sold off following passage of Railways Act of 1993
- Ownership of infrastructure to Railtrack, while track maintenance sold to 13 companies
- Rolling stock ownership to three stock companies
- Railtrack failed in 2001 and assets passed to state-owned Network Rail

British Rail

United Kingdom High Speed Passenger Trains

High Speed Rail

- Four railway lines are high speed
  - East Coast Main Line
  - Great Western Main Line
  - Midland Main Line
  - West Coast Main Line
- HS1 (High Speed 1) connects London (St Pancras) to Channel Tunnel

UK High Speed Rail map

United Kingdom High Speed Passenger Trains

East Coast Main Line

- Principal operator is London North Eastern Railway

Item	*Value*
Line length	633 km
Number of tracks	double & quadruple
Track gauge	standard
Electrification	25 kV, 50 Hz
Max speed	200 km/hr

Class 802 Nova 1

Class 802 Paragon

United Kingdom High Speed Passenger Trains

Great Western Main Line

- Principal operator is London North Eastern Railway

Item	*Value*
Line length	190 km
Number of tracks	double & quadruple
Track gauge	standard
Electrification	25 kV, 50 Hz
Max speed	201 km/hr

Class 800

Great Western Rail route

Class 802

United Kingdom High Speed Passenger Trains

Midland Main Line

- Principal operator is East Midlands Railway

Item	*Value*
Number of tracks	double quadruple
Track gauge	standard
Electrification	25 kV, 50 Hz
Max speed	201 km/hr

Class 222

Class 700

United Kingdom High Speed Passenger Trains

West Coast Main Line

- Statistics

Item	*Value*
Line length	642 km
Number of tracks	double
	quadruple
	sextuple
Track gauge	standard
Electrification	25 kV, 50 Hz
Max speed	201 km/hr

Glasgow Central
Edinburgh Waverley
Carlisle
Lancaster
Preston
Wigan North Western
Wigan Main Station
Liverpool Lime Street
Manchester Piccadilly
Manchester Oxford Road
Manchester Piccadilly
Manchester Victoria
Salford Crescent
Salford Central
Salford Central Tram Stop
Manchester Deansgate
Manchester Oxford Road
Manchester Piccadilly
Manchester Victoria
Manchester Airport
Manchester Piccadilly
Manchester Victoria
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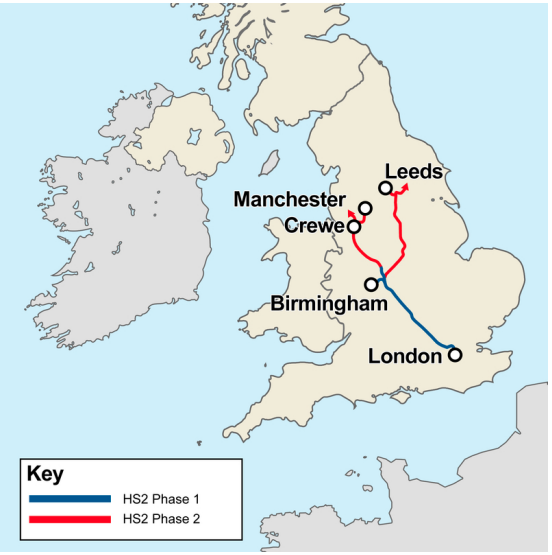
Manchester Piccadilly
Manchester Victoria

United Kingdom High Speed Passenger Trains

HS2

- High Speed Rail 2
  - HS1 is the 108 km link between St Pancras and Channel Tunnel
- Planned high speed railway linking London, Birmingham, Manchester and Leeds
- Maximum speed 360 km/hr
- Estimated cost 80.7 B pounds to 88.7 B pounds
- Construction began September 2020



HS2 map