

THE FIRST RAILWAYS IN TURKEY

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The nineteenth century witnessed an immense and rapid technical revolution. Till then the railways were simply considered as roadways having one or several parallel track made of steel rails. Then it became one of the most important modes of land transportation. Between the years 1800 and 1850, railways provided an element that was very essential to the full realisation of surging industrial revolution, namely, a reliable low-cost, high volume system of land transportation.

The first railway originated in Great Britain. The first rail line was used in 1550 for the transportation of coal and in the eighteenth century horse-drawn railways of this kind appeared in several places in Great Britain. Their numbers increased greatly with the use of iron and steel, wheels and plateways.

There is no doubt that steampower also had an influence. It was already mentioned by Heron in 59 A.D., but was rediscovered in the seventeenth century by Giovanni Branca. In the second half of the eighteenth century, Isaac Wilkinson took out the patent of a new steam engine which was developed step by step between the years 1800 and 1850. Its development can be seen in the following simple list¹.

- 1718 Newcomman
- 1767 Smeaton
- 1774 Smeaton
- 1775 Watt
- 1792 Watt
- 1816 Woolf's compound machine
- 1828 improved cornishe machine
- 1838 Corless compounds machine

(1) Singer, Charles and others, "A History of Technology", Oxford, vol. 4, p. 165.

The first locomotive was made by Richard Trevitick in 1804². It could carry 10 tons and run 9 miles on a straight rail, but it was very bulky and heavy. Following Trevitick, the first successful locomotive was built by John Blenkinsop in 1812. It ran only on cast iron rails and had two vertical cylinders driving two shafts geared to a toothed wheel which engaged a rack rail. In the following years, George Stephenson, a pioneer of the railway and locomotive builder, completed his first engine, the Blücker.

In 1830 the first inter-city train began to run between Liverpool and Manchester in England, and in 1835, between Nurnberg and Führ in Germany².

There is no doubt that the British were the first people to realise the importance of trains. They also offered to build railways in the Ottoman Empire where the westernization began in the nineteenth century and, all kinds of innovations were wellcome. English companies thought that the shortest way to India would pass through the lands of the Ottoman Empire. At this time the Suez Canal had not been opened yet. The first railway in Turkey was built between Izmir and Aydın and commenced operating in 1866.

The railways in Turkey can be divided into two main groups:

a) *Balkans railways*, namely, the railways in the European part of the Ottoman Empire; one of which connected Istanbul to the important European centres such as Paris and London. The second line connected Salorica to Bosnia and Macedonia³.

b) *Anatolian railways*, as mentioned above, the first railway in Turkey was built by an English company between Izmir and Aydın. They also built the Adana and Mersin line⁴.

The line between between İzmir and Kasaba (Turgutlu) was constructed by the French. They also constructed railways between Yafa and Jerusalem, Beyrut and Damascus, Halep and Damascus, Bursa and

(2) Brosius, J. and H. Koch, "Die Schule des Locomotiveführers", Berlin 1923, p. 10.

(3) "Balkan Yarımadası Demiryolları", trans. Mehmed Ali, Demiryolları Dergisi, vol. 6, p. 131.

(4) Letters du Président de la Campagne son Excelence le Ministre des Travaux Public de l'Empire Ottoman, Londre 1875.

Mudanya⁵. Later, German companies became interested in building railways in Turkey and surveyed Anatolia in detail and prepared reports and maps of possible railways. Wilhelm Pressel was one of the the engineers who presented his detailed report and map to Ethem Pasha, the Minister of Commerce in 1872. All the valleys, mountains, roads, the connection of the roads with maritime lines, utility of railways and the financial feasibility were explained in his report as extensively as possible⁶.

In 1888 the German Company (Würtembergische Vercin Bank and Deutche Bank) began to construct the railways, called The Bagdad Line. in Anatolia. They also prepared a detailed map of Anatolia showing the ways through which the railway could be built.

The first line reached Ankara in 1893. The same company (La Societe de Chemin de Fer Ottoman d'Anatolie) possessed the right to construct the line between Konya and Eskişehir. The same company built nearly 1000 km. railways in Anatolia.

All the railways in Turkey were built as single lines. During the construction of the railways, generally the scale of maps was 1 / 1000 or 1 / 5000.

The location of stations were very important from the point of view of strategy and economy. The stations, therefore, were built according to the significance of their location and the distance between two stations was 20 kilometres. The railway bridges were built by the Ottoman Empire, keeping to the standard measurements of the agreement between the foreign company and the Ottoman Empire. The height of the bridges had to be 4.30 m., their width 4.50 m.

The length of viaducts varied between 3 m. and 10 m. Their minimum measurements were 5 m. in height and 4.30 m. in width.

The first step in building a railway line, after the route is surveyed and cleared of brush and trees, is to grade the right of way. Ideally a railway should be in a straight line over level ground. But this cannot always be realised since there are always flat lands as well as a lot of slopes and sharp curves which need to be cut across or filled. In early

(5) Mustafa İbrahim Bey de Courten, "Les Chemins de Fer en Turquie d'Asie", Paris 1910, p. 7.

(6) Rapport de l'Ingenieur Wilhelm Pressel, "Chemin de Fer de l'Anatolie". Ex. Ethem Pasha, Constantinople 1872, p. 42.

railways in Turkey, generally the curvatures were normally 20 mm. per metre, but sometimes as it happened in the Bagdad Line, it was 25 mm. per metre. At the Eskişehir / İzmit line it was 24 mm. per metres. Nowadays it is 12 mm. per metre, because of the modern equipment like graders, bulldozers, etc., to smooth out the roadbed easily and cheaply⁷.

Gauge is the distance between the inside faces of the two rails. The gauge in early railways in Turkey was about 1.44 m. or 1.45 m. They were the standard gauges which were used during the construction of railways in Turkey by the British and German Companies. But a narrower, 1.06 m. gauge was used by the French company in building the Jerusalem-Yafa, Bursa-Mudanya and Damascus-Beyrut lines. In those days of advantages of the narrow gauge versus the wide gauge was in discussion. In England and in Northern America standard gauges were accepted. Nowadays in Turkey gauges are 1.435 m. as a standard scale.

The rails used in the first railways were made of iron or steel graded in four types according to their length. The 18 m. black rail was the standard, the other three were shorter. These different lengths of rails were used according to the condition of the roadbed.

During the construction of a railway, the first layer of ballast (usually crushed rock or slag) was first packed over the roadbed and then railway sleepers (cross ties) with 0.20 m. x 0.13 m. x 1.80 m. dimensions were laid over it.

The cross ties were generally made of wood while nowadays the ties are made of concrete blocks and measure 0.17 m. x 0.27 m. x 260 m. In the early railways, the distance between two ties was 0.706 m., but today it varies between 0.40 m. and 0.60 m.

When the rails were aligned on the ties, the ballast was tamped down and compacted around and under the ties. It was necessary to check whether there were any irregularities in track alignment or not, as it is done today⁸.

Under heavy traffic, the rail could dig into the cross ties, shortening the lifespan of the ties, as well as distorting the gauge and track alignment. To overcome these difficulties, tie plates were used between the base of the rail and the top of the tie.

(7) Edward Head Earle, "Bağdat Demiryolu Savaşı", trans. Kasım Yargıç, İstanbul 1972, p. 42.

(8) Ali Necip, "Ameli Demiryolu Risalesi", İstanbul 1323 (H.), pp. 129, 141.

Another problem was that because of the changes in the climate, the rails expanded. To overcome this effect, metal spacing-plates were inserted between the two rails. They were made of iron (varying between number 0 to 3; for instance 0.010 m., 0.05 m. etc.)

Nowadays this problem can be minimized by extensive anchorage of rails against the ties to prevent them from moving with the temperature changes. In Turkey nearly 60.000 kilometres of welded rails exist.

After using horses as a motive of power for transportation of coal as it happened in New-Castle Upon-Tyne, the locomotive was developed as a separate unit which generated steam power, incorporating the steam engine principle.

A steam locomotive consisted of a multitube boiler, a system for exhausting, a manometre measuring the pressure and also a firebox, minute tubes and wheel etc. The supplies of coal and water could be carried on the locomotive itself or might be carried in a separate vehicle attached to the locomotive⁹. As in the case of other engines that were used during the construction of railways in Turkey, the first steam locomotives were brought into the country by foreign railway construction companies. Although the Ottoman Empire paid for all expenses of the railways and the construction, the foreign companies had the right to any decision given in this matter.

The first locomotives, product of the Stephenson Company¹⁰, were brought to Turkey by an English firm from Newcastle for the İzmir / Aydın line. They had 4 wheels on two axles. The boiler pressure was nearly 3840 kg / cm². They could only run on a curvature less than 1 / 36. The curvature of the above-mentioned line varied between 1 / 100 and 1 / 67. It was 1 / 150 in Torbalı.

These locomotives were used nearly for 14 years on the same line, although from time to time other locomotives were brought from other foreign countries. The new locomotives were heavier and more powerful. One such locomotive was the production of Sharp and Stewart Company in Manchester. This was classified as type "B" and its number was 2203. Its driving wheel was larger than the wheels of passenger locomotives and other steam locomotives. Its maximum speed was 28 km. per hour, its axle load was 16.6 tons, and tractive effort was 49.59 tons. This locomotive began service in 1888 and was used until 1961.

(9) Fikret, "Fenni ve Ameli Şimendifericilik", İstanbul 1342 (H), p. 6.

(10) Lettres du Président de la Compagnie son Excellence le Ministre des travaux Publics de l'Empire Ottoman, Londres 1875, p. 16.

The German Krauss Company locomotive, number 2251 is another sample of a very good machine. It has also four wheels on two axles, its axle load being 12.62 tons. Its tractive effort was 36.52 tons, maximum speed 40 kilometres per hour. It was brought to Turkey in 1874 the in the first date of its production and served until 1967. At present is on permanent display in front the Sirkeci Station in Istanbul. The number of coupled wheels increased very rapidly and after the single pair of driving wheels, the four coupled locomotives appeared, and were followed by six coupled which were called type "C". This was a heavier locomotive but was suitable for the geological structure in Turkey and there were many steam locomotives of this type in the country.

One of them is number 33501. It was produced in 1872 and started service in Turkey in the same year. Its tractive effort was 59.23 tons and maximum speed was 45 kilometres per hour. It was characterized by framed wheels. This locomotive was a production of Honomog Company from Vienna.

Another example of this type of steam locomotives is number 3361 It was an English production made by Stephenson Company in 1887 and was brought to Turkey in the same year. It made a maximum speed of 28 kilometres per hour. Its axle load was 10.5 tons. As is mentioned above, although number 3361 was a later production, it was a less developed model than the former one, number 33501.

Number 3361 is now exhibited in the Museum of Siedeman. Another production of the same company, namely Stephenson, number 33012 was brought to Turkey in 1889.

Another type "C" steam locomotive was a production of Essling Company, number 33006, ans was brought to Turkey in 1891, on the same year it was produced.

In the course of time, steam locomotives continued to be developed and faster trains were put into the service. But the total weight of locomotives and their axle loads variered very slightly. The first locomotives which were used in Turkey was nearly the same type of locomotives used in the European countries. For instance, number 3355 which was the type "C", was produced in 1911 by Maffei Company and was brought to Turkey in the same year. Its total weight was 29.5 tons and tractive efforts was 69.10 tons with a maximum speed of 45 kilometres per hour.

After the foundation of the Turkish Republic in 1923, the new Government decided that the railways should be taken over by the Turkish State. Thus Anadolu Bağdat Demiryolları Müdüriyeti Umumiyesi was founded. It was followed by the foundation of another organisation, namely Devlet Demiryolları ve Limanları İdaresi Umumiyesi in 1927¹¹. The first electric traction was successfully applied in 1869 by Werner von Siemens and shown at an exhibition in Berlin. The first public electric railway commenced at Lichterfelde, near Berlin.

The earliest patent for the oil engine was granted in 1890 to a British pioneer, Akroyd Stuart. A small locomotive incorporating an engine of the Stuart design was built by Hornsby and Sons in 1896. But by the end of the Second World War, the diesel locomotives had proven themselves and became the standard type of motive power.

But steam locomotives kept up their popularity for 100 years and after the Second World War dwindled in favor of the more efficient diesel and electric traction. In Turkey the first electric traction was applied in 1955 on the line between Sirkeci and Halkalı in Istanbul. The diesel locomotives in Turkey commenced operating in 1957 because they had greater efficiency in their traction as well as being more economical than steam locomotives. However, steam locomotives continued to be operated until 1960 s.

The first locomotive factors started in Eskişehir in 1894. Actually, it was founded for repairs and maintenance of steam locomotives and cars. It was rearranged in 1924 and in the following years was renovated eight times. In 1958 the production of steam locomotives was stopped and the maintenance of diesel locomotives was continued. Then the production of diesel locomotives and freight wagons with bogie (ELMS) was started.

A second factory was also founded in Sivas in Eastern Turkey in 1939, to repair steam locomotives and cars (Sivas Traction Workshop). These concerns became a combination of factories which was enlarged under the title of Industry of Railway Equipments Establishments (Sivas Demiryolu Makinaları SIDEMAS) in 1972.

The latest unit for the same purpose was founded in Adapazarı in 1951, and rearranged in 1961¹².

(11) "Ulaştırma 50 yıl", T.C. Ulaştırma Bakanlığı, Ankara 1973, pp. 42-43.

(12) T.C.D.D. "Turkish State Railways, Locomotives and Railcars", Ankara 1981.