

# Railway Development

## 1.1 Introduction

### History

**“Ring Out, oh bells. Let cannons roar  
In loudest tones of thunder  
The iron bars from shore to shore  
Are laid and Nations wonder”**

This quote from the May 11, 1869 The Chicago Tribune celebrated the completion in Utah of the first transcontinental railway connection in North America. By 1885 the Canadian Pacific completed the first single company transcontinental line and the Atlantic and Pacific were also first linked in Mexico in the 19<sup>th</sup> century. The exciting impact of a technology that reduced a six-month to a six-day trip can hardly be imagined today. In the lifetime of anyone reading this, we have seen nothing with the impact on all aspects of life as the development of the railway.

Only 44 years earlier on October 27, 1825 George Stephenson’s steam locomotive, “Locomotion Number 1” hauled a 90 ton load consisting of 36 cars carrying more than 500 passengers and some freight at a sustained speed of 12 mph along the Stockton and Darlington Railway in northern England. This was the culmination of decades of imagination, promotion, engineering and experimentation.

What is a railway? A railway can be defined as an engineered structure consisting of two metal guiding rails on which cars are self-propelled or pulled by a locomotive. In his book John Armstrong defines a railway as:

“A railroad consists of two steel rails which are held a fixed distance apart on a roadbed. Vehicles, guided and supported by flanged steel wheels and connected into trains, are propelled as a means of transportation.” Webster’s Dictionary (1986) defines a railroad as “1. A road laid with parallel steel rails, along which cars carrying

passengers or freight are drawn by locomotives, 2. A complete system of such roads, including land, rolling stock, stations, etc. 3. The persons or corporation owning and managing such a system.”

The terms railway and railroad are sometimes used interchangeably. However, for this book, railway will generally refer to the track and other closely associated items, i.e., signals, crossings, bridges, etc. Railroad will be used where the usage connotes the bigger system.

In commencing a railway engineering career, you are joining many fellow workers in a complex and increasingly coordinated activity that is an integral part of any civilized society. About one-seventh of the workers in advanced economies are involved in some phase of transportation. Transportation, the movement of persons and goods, of which railroading is a large and vital part, is tied in with the location and magnitude of all kinds of human activity which depend on the timely availability of quality goods and services. This ranges from the necessities of food and fuel and work to leisure pursuits.

Many of you will be considered as transportation engineers specializing in railway engineering (not operating trains). We can define railway engineering as that branch of civil engineering involved in the planning, design, construction, operation and maintenance of railway land facilities used for the movement of people and goods serving the social and economic needs of contemporary society and its successors. The complete railway engineer is active in all aspects of civil engineering practice, surveying, geotechnics, hydrology, hydraulics, environmental and sanitary and structural design as well as construction technology.

You will frequently encounter the word “mode” in your railway practice. A mode of transportation is no more than a particular type of transportation defined in enough detail for the purpose at hand. It can be as general as the medium through or on which transportation takes place; for example, air, sea and land modes. The walking or pedestrian mode involves the moving human. The public transportation mode includes those systems such as rail commuter lines and public bus and taxi service. Often, far more detailed descriptions are needed for effective analysis, communication and understanding. The railway mode is a type of a land transportation mode as defined above. The light rail transit mode is a further more specifically defined type of rail service, typically today an urban, electrically powered system operating on its own right of way with intersections with intersecting public streets. Other terms used in railway engineering are listed and defined in the Glossary found at the end of this Manual.

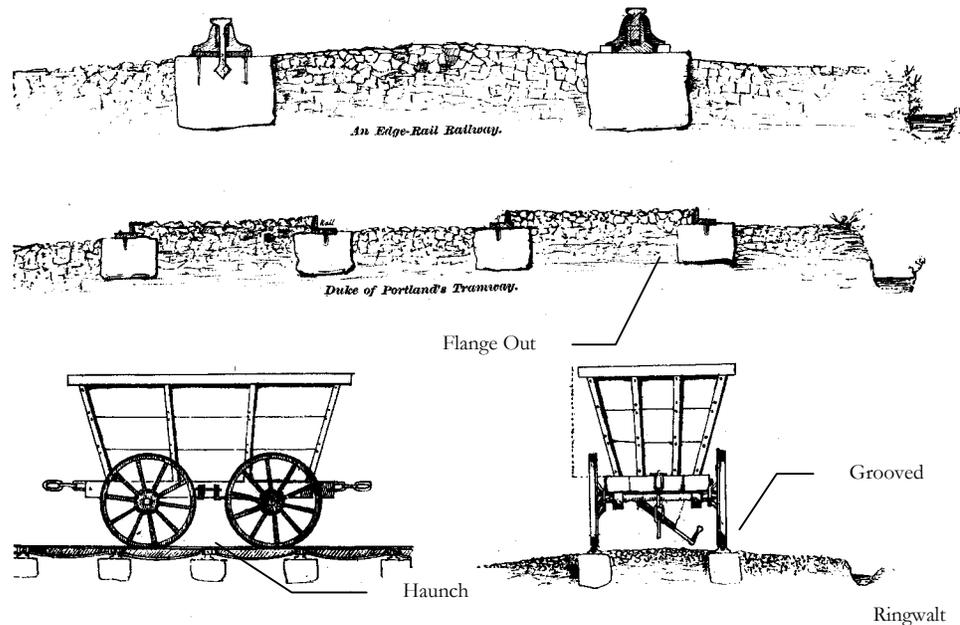


Figure 1-5 English Railways and Freight Cars, as Illustrated in Strickland's Report, 1826

Railways quickly became a major factor in accelerating the great westward expansion, as well as tying the older eastern population and industrial centers together, by providing a reliable, economic and rapid means of transportation. As additional lines were built, they facilitated the establishment and growth of towns in the West. Except for the trip from farm to railhead in town, the poor roads and limited canals became irrelevant. The Federal government and states encouraged and provided financial support through land grants and loans, which were paid back with reduced rates for half a century.

Since the first railways, there have been many improvements in all aspects of railroading. For example, the development of the iron flanged "T" rail was achieved by 1840. (See Figure 1-8 for an early track section) Until mass steel making was developed, there was a continuing controversy between the use of malleable iron vs. cast iron for rail. By 1840 wooden ties kept in place by ballast stone had replaced simple stone surface support.