Chapter 1

# Introductory Chapter: Modern Bridges

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## 1. Introduction

Bridge engineering is an engineering discipline branching from civil engineering that involves the planning, design, construction, operation, and maintenance of bridges to ensure safe and effective transportation of vehicles, people, and goods. Among transportation of vehicles, maglev (magnetic levitation) systems have become a focus of the worldwide transportation industries. The need for rapid transit systems has become vital in both urban and intercity travels. Application of magnetically levitated trains has attracted numerous transportation industries throughout the world. Contrary to the traditional railway trains, there is no direct contact between the maglev vehicle and its guideway. These vehicles travel along the magnetic fields that are established between the vehicle and its guideway. There are already many countries attracted to maglev systems (see **Figure 1**) [1–16].

## 2. Maglev elevated guideways

In maglev guideways, contrary to the traditional railroad tracks, there is no need to ballast, sleeper, rail pad and rail fastenings to stabilize the rail gauge. Basically, there are two main elements in a maglev system, including its vehicle and the guideway. The guideway is the structure that maglev vehicles move over it and are supported and guided by it. It is the main element in maglev system and holds big share of costs for the system. It is vital for maglev trains. Guideway consists of superstructures and substructures. In fact, a guideway consists of a beam (girder) and two levitation (guidance) rails. Guideways can be constructed at grade (ground-level) or elevated including columns with concrete, steel, or hybrid beams. Concrete guideway girders can be as reinforced or prestressed. Majority of the existing maglev guideways are elevated and completely built on bridge (see **Figure 2**). Guideway provides

**Figure 1.** China maglev guideway.

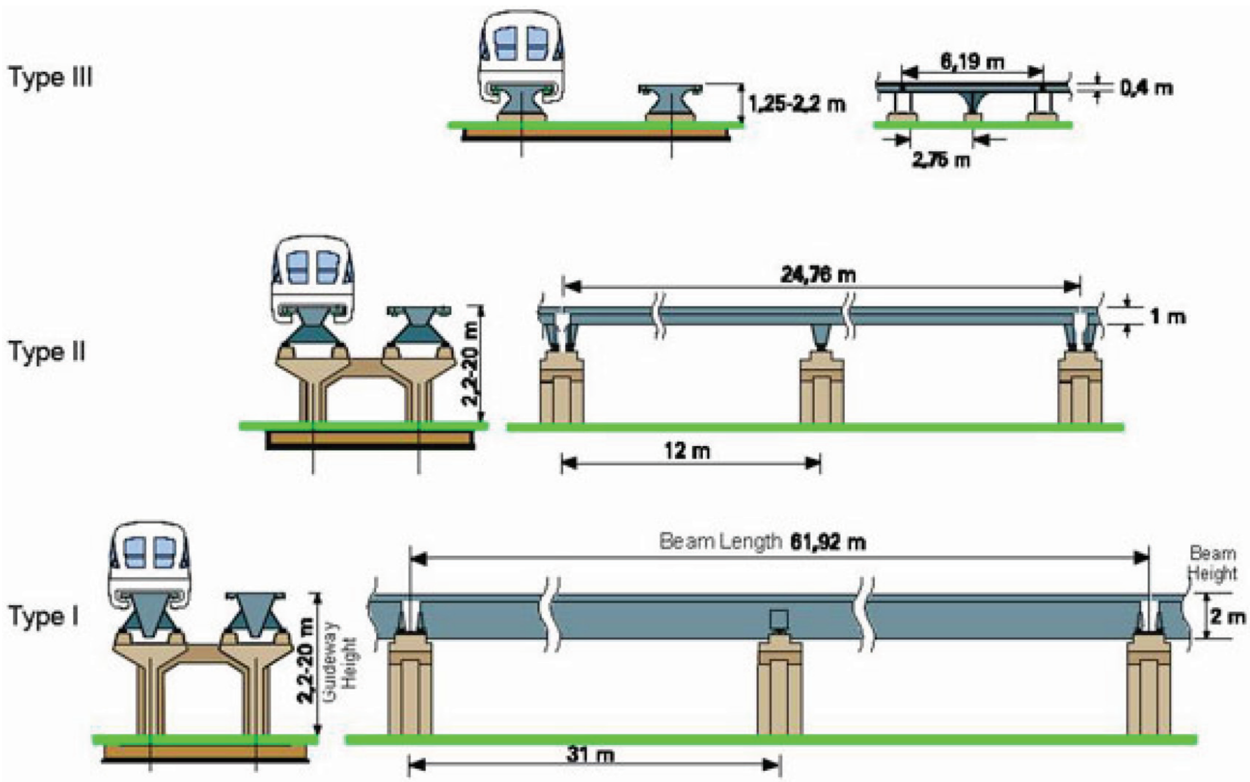


**Figure 2.** Standard guideway types.

guidance for the movement of the vehicle, to support the vehicle load, and to transfer the load to the ground. The loading of the maglev vehicle is an important parameter in the practical application. It is related to the magnetic forces. Guideway girder is evaluated for different load cases. Magnetic forces are generated by the maglev vehicle and cause structural loading that transmits to the guideway. This can happen while such a vehicle is stationary or in motion. There are a variety of designs for maglev systems, and engineers keep revealing new ideas about such systems. Many systems have been proposed in different parts of the world, and a number of corridors have been selected and researched. During the past three decades, different guideways have been developed, constructed, and tested [1–16].

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