

The Matterhorn Bobsled Ride: General Description

Term Project for 16.358
Spring 2001

A replica of the famous Swiss Matterhorn Mountain provides the scenic background for the *Matterhorn Bobsled Ride*. It is constructed at 1:100 scale and stands approximately 140 feet to its summit.

The ride is a gravity-propelled, roller-coaster-type, thrill attraction. Guests are loaded into “bobsled” vehicles that ride on tubular double rail tracks. The vehicles consist of a tandem connection of two individual bobsleds attached by a towbar and safety cables. Up to eight people can be accommodated, four per bobsled.

For discussion purposes, the ride can be divided into three areas: *Station Area*, *Lift Area*, and *Gravity Area*.

The *Station Area* is designed to accommodate guest ingress and egress, and to allow for fluctuations in the load and unload process (e.g., a disabled guest may require extra time to load and to unload). The station area consists of eight parking regions: Hold 4, Hold 3, Hold 2, Hold 1, Unload, Load, Ready, and Dispatch (listed in order of vehicle travel). Each parking area has a pair of brakes to stop/hold a vehicle. Hold 1 and Ready each provide a mechanism (transfer table) for operators to add/remove vehicles from the main track (for maintenance, etc.). Guests enter the vehicle at Load and exit the vehicle at Unload; vehicles must park precisely (4 in. tolerance) in the Load position in order to align with the handrail on the Loading platform. Once the operator ensures guests are properly seated and secured, the operator may advance the vehicle to the Ready position; the vehicle will proceed automatically to the Dispatch location when the Dispatch position is clear of vehicles. In order to support a maximum hourly capacity of 1300 guests/hr, vehicles must be “dispatched” into the ride from the Dispatch position every 22 seconds. However, the dispatch rate may be adjusted by an operator in order to support lower capacities. Vehicles are automatically released from Dispatch into the *Lift Area* as a function of the dispatch rate.

The *Lift Area* consists of a motorized chain lift, which is used to raise a vehicle to the maximum height of the ride. After ascending the chain lift, the vehicle is released into the *Gravity Area* of the ride.

It is in the *Gravity Area* that the guests are treated to the illusion of a high-speed downhill bobsled ride. (The actual maximum velocity is approximately 27 feet per second, or about 18 miles per hour.) The force of gravity, along with strategically placed frictional propelling units called “pacers” provides the energy to carry the vehicle down the mountain

on the twisting course.

Within the *Gravity Area*, there are eleven sets of brakes. These brakes are strategically placed so that:

- Any vehicle stopped in a brake will be capable of proceeding through the rest of the attraction when released from the brakes (i.e., the vehicle has sufficient potential energy to navigate the upcoming hills and valleys).
- Each set of brakes contains at least one more brake than necessary to stop the fastest, heaviest vehicle (this is also true of Hold 4 and Hold 3).
- The slowest time it takes a vehicle to traverse a set of brakes is less than 22 seconds—which is the necessary margin to compensate for the fact that some vehicles traverse the gravity area faster than others.
- A vehicle stopped in a set of brakes is guaranteed not to contact a vehicle stopped in any other set of brakes, regardless of the vehicles final stopping position within the set of brakes (note: this is not necessarily true of brake sets in the Station Area).

The ride concludes after the vehicles travel through a pond (located at the end of the gravity area) and re-enter the station area. Vehicles are slowed in the Hold 4 and 3 regions via pacers, and will only stop in that region if a vehicle occupies the region ahead. All vehicles stop briefly in Hold 2 and Hold 1 as a means to control speed, and proceed automatically to the next region. Vehicles also automatically stop in Unload, where the guests exit the vehicle and are advanced to Load under operator command.

Throughput is critical—people do not like waiting in line and large numbers of people visit the parks each day: There are about 170,000 visitors to Disney amusement parks around the world daily.

Additional control system requirements: (1) All faults must be reported to minimize repair time and (2) a *maintenance* mode must be available in order to exercise/repair equipment. The ride must not be operated in Maintenance Mode with guests aboard the vehicles.

Overall Safety Policy No hazard may result during operation of the attraction with guests, even as a result of a reasonable equipment failure. There must be only “one way down the mountain.”