

**General:** For this assignment, you will design a roller coaster to replace an existing roller coaster at any amusement park in the world. You may work alone or in groups of up to 4.

**Purpose:** This project will help exemplify the considerations which go into running an amusement park, which includes deciding what roller coasters would be good additions to the park. Furthermore, it will exemplify a challenging consideration parks must work with, which is when to remove a ride from the park.

The project will also help show technical aspects of coaster design, including calculating speeds and forces as well as using design software. With more freedom than the 1990s coaster design project, students will be able to make almost any coaster they want with novel elements or mix of elements to make an exciting ride experience. That said, the coaster designed should work well in the context of the whole park.

**Real Life Examples:** Here are some recent examples of parks removing one coaster and adding a new one on the same area of land.

- Cedar Point removed Disaster Transport in 2012 to make way for Gatekeeper in 2013. Disaster Transport was a prototype Intamin bobsled coaster which while not a failure didn't live up to the expectations put forth by Intamin and had become a bit of a money sink for CP with continual efforts to add themeing. Gatekeeper resented an opportunity to make a large roller coaster easily visible from the park entrance to wow guest coming to the park.
- Kings Island removed Son of Beast in 2012 and added Banshee on the same location. Son of Beast was a complete train wreck of a coaster so its removal was obvious. Banshee represented a much better coaster for the park, which lacked a large inverted coaster.
- Busch Gardens Williamsburg removed Big Bad Wolf in 2009 and later put Verbolten on the same plot of land, even re-using some of the foundations. The decision to remove Big Bad Wolf was poorly received by some enthusiasts who had nostalgia for the coaster.

**How To:** Do some research into amusement parks you have heard of or have been mentioned in class, looking for coasters which could be candidates for removal. After selecting a park and coaster to removed, consider what kind of coaster would be a good replacement. Then, design that coaster, planning a layout and performing some necessary calculations.

There are three sections

- Park and Coaster Selection
- Layout Diagram
- Statistics, Calculations, and Estimations

**Park and Coaster Selection:** Randomly picking a park, coaster to remove, and coaster to add is a bad choice. For instance, removing Millennium Force at Cedar Point in order to add a 150ft tall Wing Coaster is a terrible idea. Thus, you should think carefully about the park and coaster you are selecting and justify the choice. Here are the required parts.

- **Park and Ride Removal Justification:** State the park you chose and the coaster you are removing. Then, justify the decision. Part of this will be justifying why the park needs a new coaster (e.g. if they just got a major one this past year, adding a new one doesn't make sense) and why the coaster you chose to remove should be removed. The latter is critical, and there must be a good reason as to why you are making the park part ways with the coaster. You may find it useful to describe your vision for how that area of the park would be better off with something else (such as with a re-themeing).
- **Coaster Research:** Reflect on the coasters you watched as part of your video watching assignment and come up with 3 traits you especially liked about the coasters you saw which you hope to incorporate into your final design, and 3 traits you especially disliked which you want to avoid. It is okay if your final design doesn't incorporate everything you come up with. You may find it helpful to re-watch some of the videos.
  - If working in a group, **all members of the group must come up with their own 3 likes and 3 dislikes.** This is the only part of the project in which members of a group must complete individual parts; the rest is one single product.
- **Coaster Basic Info:** List the coasters name, type, manufacturer, major elements, and inversions (if any).
- **Coaster Justification:** Justify the coaster in the context of the park. This includes the park's line-up of other coasters as well as how the ride fits on the site of the coaster removed. A good coaster will not only complement the other coasters at the park but utilize the site effectively and possibly creatively (Gatekeeper is a great example of this).

**Layout Diagram:** You must create a layout diagram of your new coaster. This is similar to the layout diagram you made for your 1990's Coaster Design assignment, but should be neater and more detailed. It should clearly indicate with labels the location of maximum height (as well as any other important or calculated height markers), location of maximum speed, the inversions and other major elements, and so on. It should also make it very clear where the coaster resides in the context of the park, with the layout diagram also including other park landmarks, like paths, other rides, and terrain features. It should be easy to envision how the coaster would look inside the park looking only at the layout diagram and none of the accompanying materials.

Please follow the proper formatting for your layout diagram (see the course website for a description and example of proper formatting).

**Statistics, Calculations, and Estimations:** You should set the following statistics for your ride

- Height and drop of the first hill, or if a launch, the launch speed
- The maximum positive, negative, and lateral G-forces you want the coaster to pull
- The number of trains and size of trains (make sure your blocks allow for that number)

You must calculate the following (work must be shown for credit)

- If a lift hill, then the speed at the bottom of the first drop
- If a launch, then the height of the first hill after the launch based on a desired speed over the top
- The radius of the bottom of one of your hills, based on a calculated speed and desired forces
- The radius of one of your turns, and the banking required so the lateral forces will be 0 G's (or a desired amount)

You must estimate the following

- Capacity (first use the equation provided, then briefly explain in which direction and why the estimation is off)
- Cost
- Length of the ride

You don't need to cite existing coasters for your estimations, but it is expected that you'll put some time into researching them and that they'll be reasonably accurate.

**Constraints:** Your final project is subject to the following constraints. If you are unsure if you are violating a constraint or need to for your design due to some special reason, ask me.

- You may select any park from around the world
- You must remove a roller coaster from the park, and the coaster must be a significant installation (i.e. you cannot remove a 10ft tall kiddie coaster)
- Your coaster must be a significant installation itself, which for your design is defined as at least 100ft tall and at least 2,000ft long
- Your coaster must use the site of the removed coaster. It can venture into other areas of the park, but must utilize the site in some significant way.
- You are not allowed to expand the boundaries of the park for your roller coaster (you are removing a coaster to give you space for your ride)
- You have a (very generous) budget of \$25 million dollars, and it should be realistic that your coaster could be built for that amount (not including the removal of the old coaster)
- While it's a cool idea, you are not allowed to do an RMC-style transformation of an existing coaster (like Iron Rattler or Medusa Steel Coaster)

**Submission:** Submissions should be made via email (to [jzink@andrew.cmu.edu](mailto:jzink@andrew.cmu.edu)). If working in a group, only one student should send an email, but they should CC the other group members. Submissions should consist of a cover sheet (template on the course website) and then a single .doc or .pdf file with the required parts of the project.

**Due Date:** 11:59pm April 28<sup>th</sup>, or a week later for half credit.

**Grading:** The projects will be graded as follows

- (35pts) Park and Coaster Selection
  - (10pts) Park and Ride Removal Justification
  - (10pts) Coaster Research
  - (5pts) Basic Coaster Info
  - (10pts) Coaster Justification
- (30pts) Layout Diagram
  - (20pts) Clearly shows/describes the coasters layout
  - (10pts) Contains park landmarks to indicate the coasters location and size
- (35pts) Statistics, Calculations, and Estimations
  - (10pts) Fixed statistics
  - (15pts) Calculations
  - (10pts) Estimations

Besides the coaster research, all team members will receive the same grade.