16.63 Assignment 7

Fault Tree Analysis: Roller coaster car design

You have just been hired by Disney. They would like to know if fault tree analysis can help them do a better job engineering the cars used in their roller coasters. Your first task is perform a pilot study by applying fault tree analysis to a standard roller coaster car. If your study is done well, project management intends to use your results to drive the design of a new generation of roller coaster cars that can handle faster speeds, heavier loads, and a more narrow track while simultaneously reducing the existing accident rate.

Because this is a pilot study with limited time and funding, it is sufficient to analyze the system at a basic conceptual level without an incredible amount of detail. You are free to choose the specific car design to be analyzed, but it should be representative of a traditional launched car with under-friction wheels (up-stop wheels) and modern passenger restraints.
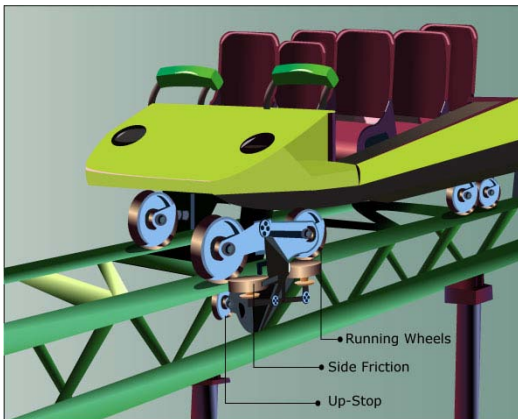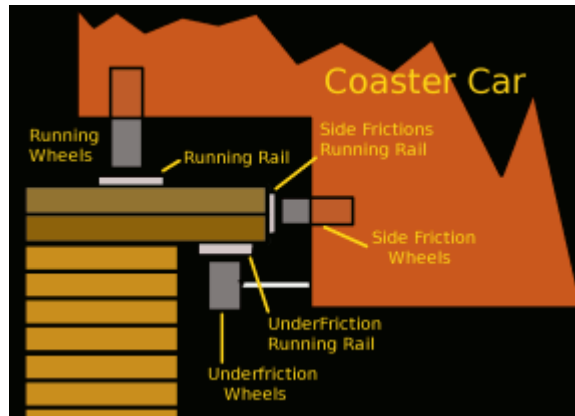

Image by MIT OpenCourseWare.

Courtesy of Lincoln Park Comet Fan Site. Used with permission.

Traditional launched coaster car examples

Due to several recent accidents, the project management is most concerned about passengers ejected from the car or the car separating from the track. Therefore your pilot study should include two fault trees: one with "Passenger ejected from car" as the top-level event, and one with "Car derails from track" as the top-level event. They expect about 10 boxes per fault tree and you must use the correct symbols. To be sure the fault trees are clear and understandable, ensure that no two gates connect directly to another gate (i.e. there must be a labeled rectangle box between every gate).

Resources

You are encouraged to seek and use any information you can find online about roller coaster car design. Of course, you should cite any resources used. To get you started, the following short list is provided:

Coasters 101

http://www.lpcomet.com/roller-coasters/wooden-coasters-101

Coaster train technical info

http://www.coasterforce.com/coasters/technical-info/coaster-trains

Coaster basic safety features

http://en.wikipedia.org/wiki/Train_%28roller_coaster%29

Standard coaster types

http://www.oocities.org/ultimatethrillparks/woodtrackwheels.htm

In addition, these recent roller coaster accidents may be helpful:

http://www.amusementsafety.org/

http://www.coasterforce.com/coasters/accidents

Deliverables

The following deliverables must be submitted for this pilot study
- Word document
    - o 3-4 pages single spaced
    - o Describe the basic coaster design you analyzed, including the safety features of the design (about ½ to 1 page)
    - o Two fault trees
        - ▪ Use top events described above
        - ▪ Include about 10 boxes per fault tree
        - ▪ Use correct symbols and logic (use Vesely standard symbology)
    - o Brief description of your fault tree analysis (about ½ to 1 page)
        - ▪ Describe at least 2 plausible accident scenarios
        - ▪ Identify at least 2 minimum cut sets for each fault tree
- Powerpoint presentation
    - o ~5 minutes
    - o Describe the basic coaster design you analyzed
    - o Describe one of your fault trees

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