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Design of an Eddy Current Brake System for the Use of Roller Coasters Based on a Human Factors Engineering Approach

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Abstract : The goal of this paper is to converge upon a design of a brake system that could be used for a roller coaster found at an amusement park. It was necessary to find what could be deemed as a “comfortable” deceleration so that passengers do not feel as if they are suddenly jerked and pressed against the restraining harnesses. A human factors engineering approach was taken in order to determine this deceleration. Using a previous study that tested the deceleration of transit vehicles, it was found that a -0.45 G deceleration would be used as a design requirement to build this system around. An adjustable linear eddy current brake using permanent magnets would be the ideal system to use in order to meet this design requirement. Anthropometric data were then used to determine a realistic weight and length of the roller coaster that the brake was being designed for. The weight and length data were then factored into magnetic brake force equations. These equations were used to determine how the brake system and the brake run layout would be designed. A final design for the brake was determined and it was found that a total of 12 brakes would be needed with a maximum braking distance of 53.6 m in order to stop a roller coaster travelling at its top speed and loaded to maximum capacity. This design is derived from theoretical calculations, but is within the realm of feasibility.

Keywords : eddy current brake, engineering design, design synthesis, human factors engineering
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