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A Study on the Optimization of Wheelchair Geometry Using Mathematical and Mechanical Analysis JOO HYUN KIM, ANDY KIM, RICHARD KYUNG, Choice Research Group — Although wheelchairs in the twenty-first century are lighter and easier to use than those made in earlier years, there are over 40,000 wheelchair related accidents in the United States each year. Tipping and falling from wheelchairs make up approximately seventy-five percent of the total wheelchair related injuries. While the technology of these wheelchairs include anti-tipping and automatic brakes, injuries often occur when the user of the wheelchair leans, which decreases the mechanical static stability in the direction of the lean, and increases the stability of the opposite direction. This study examines the mathematical and physical relationship between the body position (center of gravity) and the dimensions (geometry) of wheelchair to assess the stability by using the force equilibrium equations and moment equilibrium equations. The study provides mathematical explanations by calculating the force required to climb on increasing curb heights and varied radii of wheels. To test for the optimized geometry and stability of the wheelchair, we loaded varying weights and placed them on a tilted landscape. We used commercial post processing tools to display the static forward, rear, and lateral stability on tilted platforms.

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