# SUMMARY OF Ph.D. DISSERTATION


| School | Student Identification Number | SURNAME, First name |
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Title

## Compatibility of Traffic Safety between Sedan-Type Vehicles and Sports Utility Vehicles


Abstract

It is important to improve the safety of occupants in crashes between different type vehicles such as SUVs and sedan-type vehicles.

In the present study, the author analyzes the frontal collisions between SUVs and sedans, by the statistical traffic accident data stored in Institute for Traffic Accident Research and Data Analysis (ITARDA), to investigate the general aspect of SUV to sedan collisions. From the statistical analysis of drivers' injury, it is supposed that the upper parts of sedan cabins are crushed by the front-ends of SUVs caused by the vertical offset configuration between SUVs and sedan-type vehicles.

To investigate the reasons underlying these results, precise 1:10 scale model vehicles are used for flat barrier tests, deformed barrier tests, and car-to-car crash tests. In the case of a collision with a flat barrier, the compartment force of the sedan is mainly supported by lower structures. Conversely, for the collision with the deformed SUV-type barrier, the compartment force of the sedan is supported by the door-beltline structure. In the case of the car-to-car crash test, the SUV cabin compartment force is mainly supported by lower structures, and for the sedan cabin compartment, force is supported by the door-beltline structure. New diagrams are proposed to indicate these differences in compartment forces. It can be concluded that the results of the above-mentioned traffic accident data are attributed to the input force transferred along the door-beltline in the passenger compartment of a sedan.

Chapter 1 summarizes the background, the problems with previous studies, and the aims of this study.

Chapter 2 describes a method of classification between the data of SUVs and sedans stored in ITARDA. The author analyzes the data of the frontal collisions between the same weight SUVs and sedans. From the result of analysis, the author concluded that the rate of fatal or severe injuries of SUV drivers is lower than that of sedans although these vehicles have almost the same weight.

In Chapter 3, the author investigates the accidental cases for other weight combinations, e.g., light SUV to heavy sedan collision or heavy SUV to light sedan collision, etc. From the analysis of drivers' injury, author concluded that the upper bodies of drivers are influenced by the intrusion of the front-ends of SUVs caused by the vertical offset configuration between SUVs and sedan-type vehicles.

Chapter 4 describes the precise 1:10 scale model vehicles to study the reasons underlying above results of traffic accident data analysis. A plastic sedan model is constructed of more than 100 separate components. A new diagram for the expression of internal compartment force is proposed, in which the integration of forces indicates the position of the centre of compartment force. In the case of a flat-barrier collision, the force centre of the sedan compartment is mainly located at the height of the floor structures. On the other hand, in the collision with the SUV-type barrier, the force centre of the sedan compartment is located around the door-beltline structures.

In Chapter 5, scale models of an SUV and a sedan are used for the car-to-car crash tests. With regard to the SUV, the cabin compartment force is mainly supported by lower structures, whereas for the sedan, the cabin compartment force is supported by door-beltline structures. In order to improve the compatibility between SUVs and sedans, it is important to reinforce the cabin compartments to prevent the different type intrusions.

Chapter 6 summarizes the conclusions of the present study.