

## BOOK REVIEW

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### Review of: *Pedestrian and Cyclist Impact: A Biomechanical Perspective*

**REFERENCE:** Simms C, Wood D. **Pedestrian and cyclist impact; a biomechanical perspective.** Dordrecht, Heidelberg, London, New York: Springer Science+Business Media, BV, 2009, 230 pp.

This book could have been named *Everything You Ever Wanted to Know About the Biomechanics of Pedestrian and Cyclist Impact*. It analyzes the physics of pedestrian impacts along with accident databases and injury criteria to address problems that are commonly overlooked in more industrialized countries, those of injuries and fatalities of pedestrians and cyclists using the roadways. As the authors point out in their review, most of the content of this book has been previously published by them and others in various journals, but this book provides the first comprehensive treatment of the biomechanics of pedestrian impacts.

In industrialized countries, most travelers utilize motorized vehicles, so they and vehicle designers, lawmakers, public safety officials, and transportation planners concern themselves more with making crashes more survivable for the occupants of those vehicles. Also in these countries, it is generally considered that given the mass, stiffness, and speed ratios of motorized vehicles to pedestrians and cyclists, there is little that can be accomplished to improve the outcomes for the victims of impacts in which they are involved. For many years, there was no legislative impetus to improve vehicle design with pedestrians in mind. However, this book reveals that around the world three-quarters of road traffic fatalities are sustained by the most vulnerable of users, mostly pedestrians and cyclists. Even worse is the epidemic of seriously injured pedestrian and cyclist collision survivors whose disabilities represent approximately 80% of the financial and societal costs of traffic incidents. Barring more and better work on these issues, by 2020, road traffic injuries may become the third leading cause of worldwide health and safety problems.

This book discusses significant ways these encounters can be avoided or made much less severe. It provides guidance to vehicle designers, lawmakers, public safety officials, and transportation planners. One of the main general points is that where vehicular traffic is high speed, pedestrians and cyclists should be separated from it as completely as possible. Where they cannot be separated, vehicular speeds should be as low as practicable and better design of vehicle fronts, for the most part meaning lower, more sloping hoods with softer leading edges, can greatly reduce injuries. Even the possibility of air bags to raise hoods and provide more cushioning for head and upper body impacts and to reduce the severity of head to a-pillar strikes is presented. Obstacle sensing technologies

connected to automatic braking of vehicles would greatly reduce the number and severity of collisions.

While the information in this book may assist accident reconstructionists, that is not among its primary goals. In fact, it utilizes the results of reconstructed real world accidents in addition to staged cadaver and dummy trials in the data it has gathered.

A historical view of the very complex subject of pedestrians and cyclists collisions is well covered including the unfortunate dearth of data especially in countries where they are most needed. Gaps in previous research are identified and further studies recommended. Every chapter includes many excellent graphs and tables and a substantial list of references.

As outlined in Chapter 1, Introduction, Chapter 2 summarizes pedestrian and cyclist injuries from existing accident databases from around the world. A great deal of information is presented by country, age of victim, direction and severity of impact, body regions injured, vehicle impact speed, and types and areas of vehicle struck.

Chapter 3 analyzes the movements of pedestrians and cyclists during and after impacts with vehicles. Projection types and the variability of impacts are fully discussed. Time-lapse photographs of staged dummy and cadaver tests are presented.

Chapter 4 discusses how vehicle impact speeds, the most important factor in injury risk, influence victim projection distances. It points up the importance of lower speed limits in urban areas as well as more favorable design of vehicle fronts. Methods of estimating speed are compared.

Chapter 5 describes how injury mechanisms and prediction criteria can be used in considering vehicle design. Data showing the areas of the body most often struck along with their impact tolerances are well presented.

Chapter 6 covers safety standards and tests to evaluate them.

Chapter 7 is about impact modeling mathematical formulations. To completely understand the details of this chapter, the reader must be familiar with tools such as finite element analysis and higher level mathematics; for example, the equations of motion for particular cases are often presented in matrix format. However, it is not necessary to understand such mathematical details to benefit from the results.

Chapter 8 discusses simulation tools for pedestrian and cyclist impact modeling along with the pros and cons of each. The development of pedestrian dummies is explored.

Chapter 9 discusses the highly variable injuries from pedestrians and cyclists striking the ground after impact. The combination of such sliding, rolling, and bouncing often causes additional injuries, and at lower vehicle impact speeds injuries from ground strikes are more prevalent than those from impact with the vehicle. Higher vehicle fronts are problematic in this injury mechanism.

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Chapter 10 explores how vehicle design affects pedestrian and cyclist injuries. The mass ratio between vehicles and pedestrians is not a significant factor in safety improvement, but stiffness and shape are, and many details of these latter factors are discussed.

Chapter 11 ties together the information of the previous chapters very well and completely to present the conclusions and recommendations of the authors for safety improvements.

As this book points out numerous times, and for many areas, more research needs to be performed. Accordingly, as further

research is carried out, it will be important to update this text and publish future editions. It is also recommended that a larger font be used throughout and more attention given to the presentation of some of the charts, graphs, and illustrations; for example, yellow lines on white backgrounds are difficult to discern.

Finally, *Pedestrian and Cyclist Impact* is highly recommended to anyone new to or established in the field of working with problems and solutions relating to collisions between motorized vehicles and the most vulnerable roadway users.