Pedestrian fatality risk

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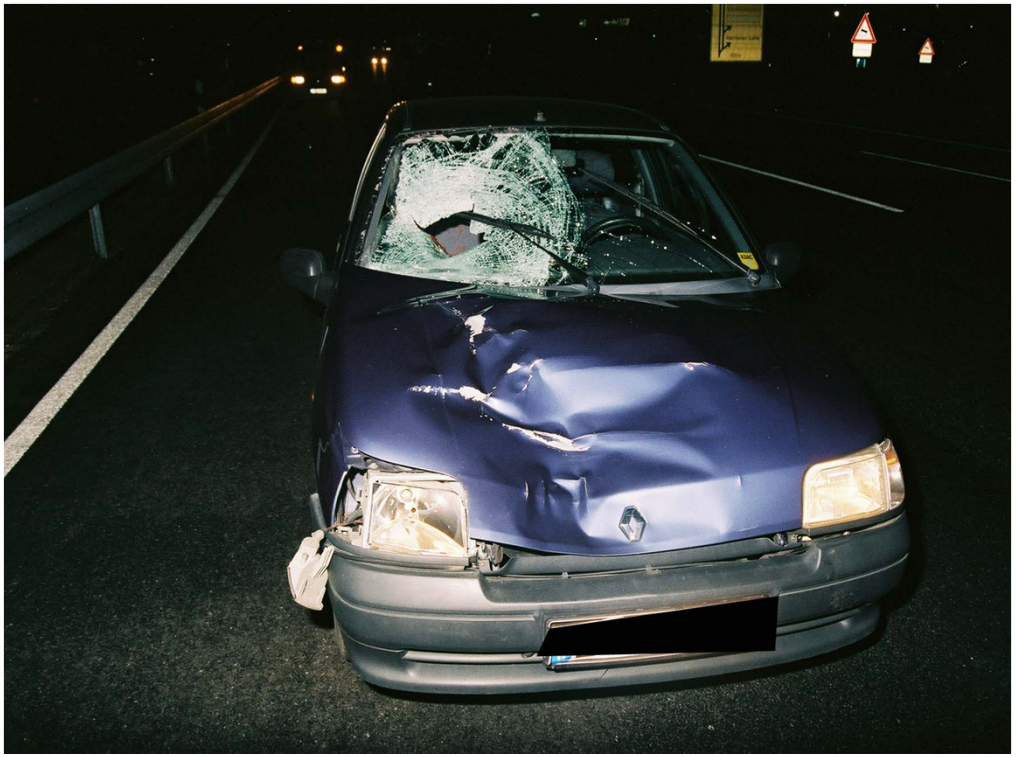
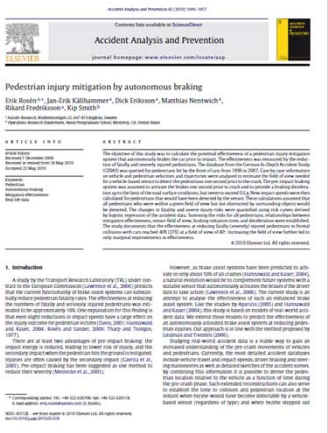
Based on work with Ulrich Sander (Autoliv) and Helena Stigson (Folksam)



Presented in Åbo, 13 May 2011

Publications

- *Pedestrian fatality risk as a function of car impact speed*
  - Rosén E, Sander U
  - Accid. Anal. Prev. 2009(41), 536–542
- *Pedestrian injury mitigation by autonomous braking*
  - Rosén E, Källhammer J-E, Eriksson D, Nentwich M, Fredriksson R, Smith K
  - Accid. Anal. Prev. 2010(42), 1949–1957
- *Literature review of pedestrian fatality risk as a function of car impact speed*
  - Rosén E, Stigson H, Sander U
  - Accid. Anal. Prev. 2011(43), 25–33



UK Media

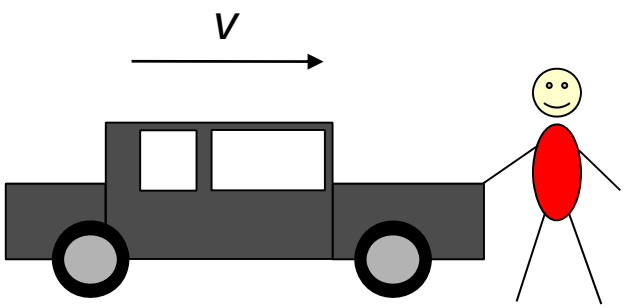
”Government admits speeding fatality statistics were exaggerated”

”Government admits to exaggerating accident statistics”

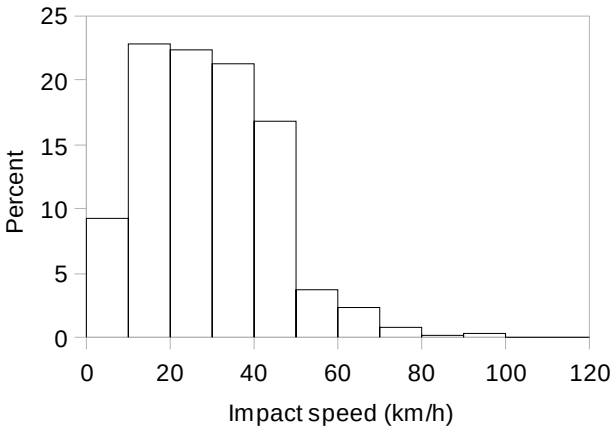
Real-World Accident Data

- GIDAS 1999–2007
- 15+ years
- Hit by front of passenger car
- Not lying on the ground

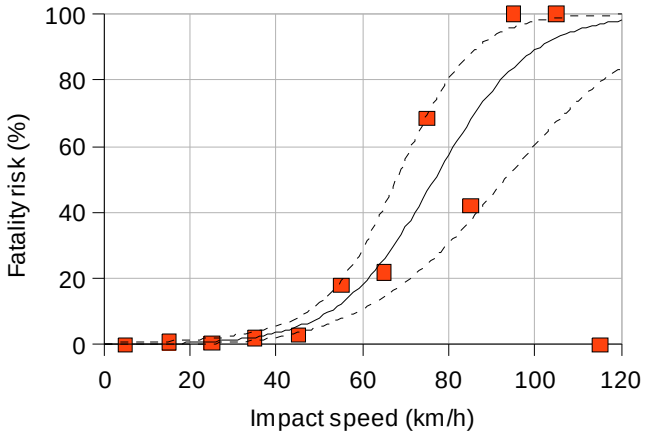
- 490 cases
- 36 fatalities
- Weight factors derived from national statistics



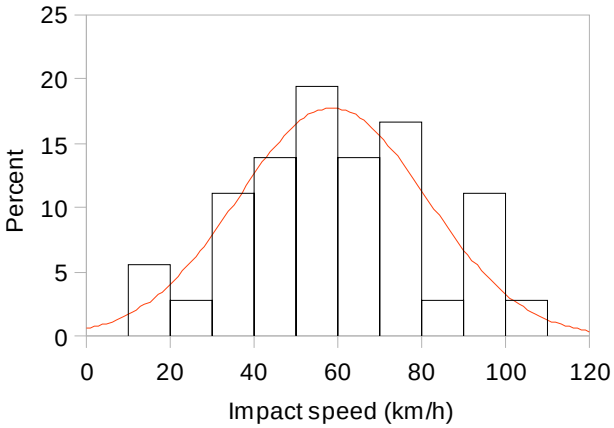
Exposure of crashes, *E*(*v*)



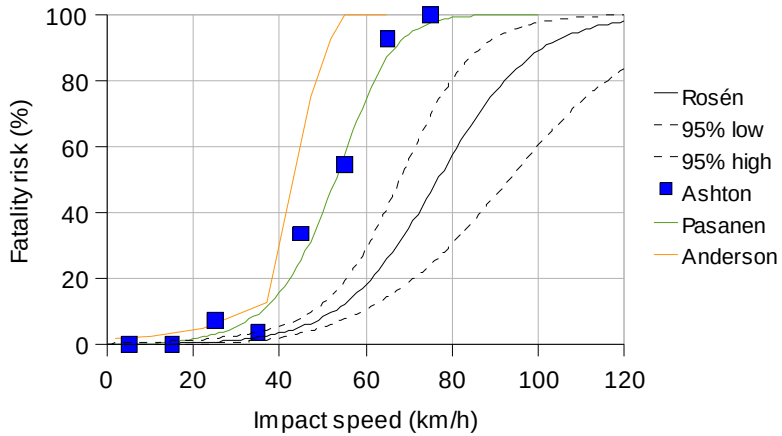
Risk of death, *R*(*v*)



Incidence of fatal crashes, *I*(*v*)



Comparisons

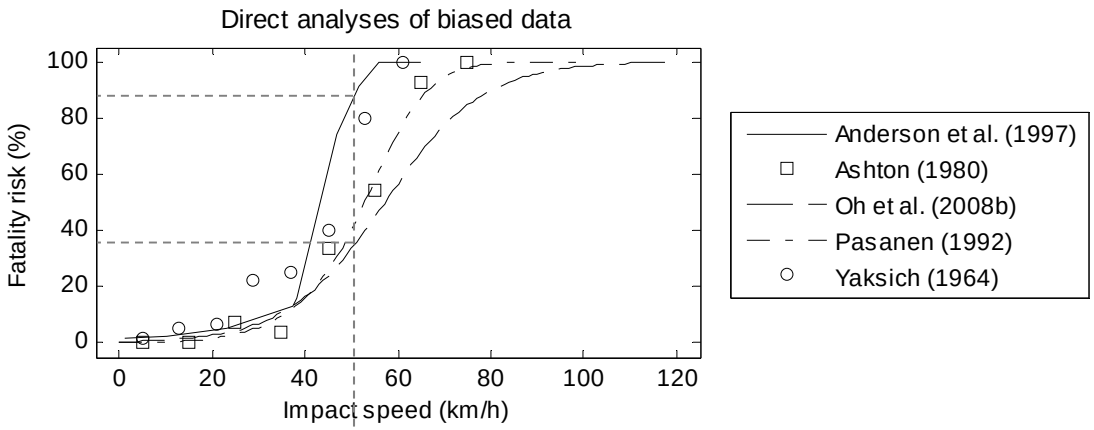


Sampling bias – an example

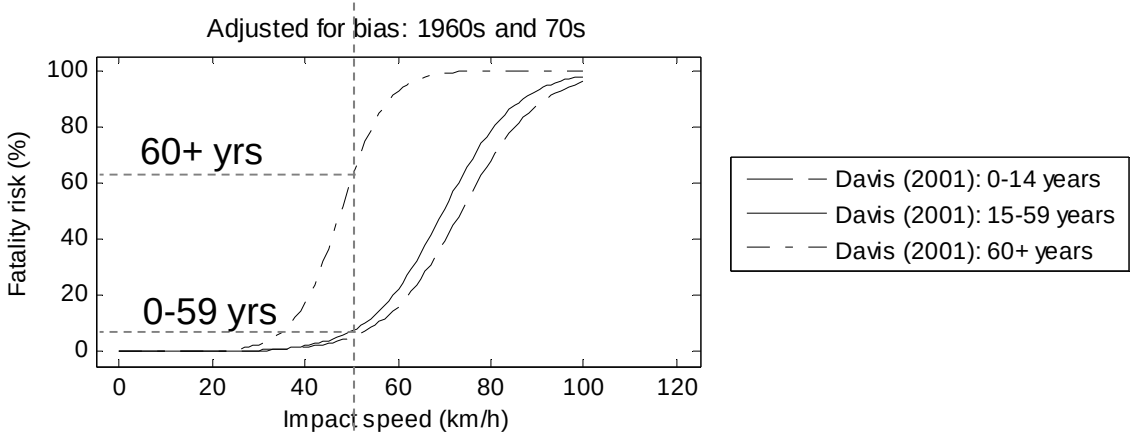
- Sampling scheme: Investigate
  - 1/2 of fatal crashes
  - 1/3 of non-fatal crashes
- Suppose 100 crashes occurred
  - 10 fatal
  - 90 non-fatal
  - Hence, true fatality risk is **P=10/100=10%**
- Database would include
  - 5 fatal
  - 30 non-fatal
  - Hence, unweighted fatality risk is **P=5/35=14%**

Literature review

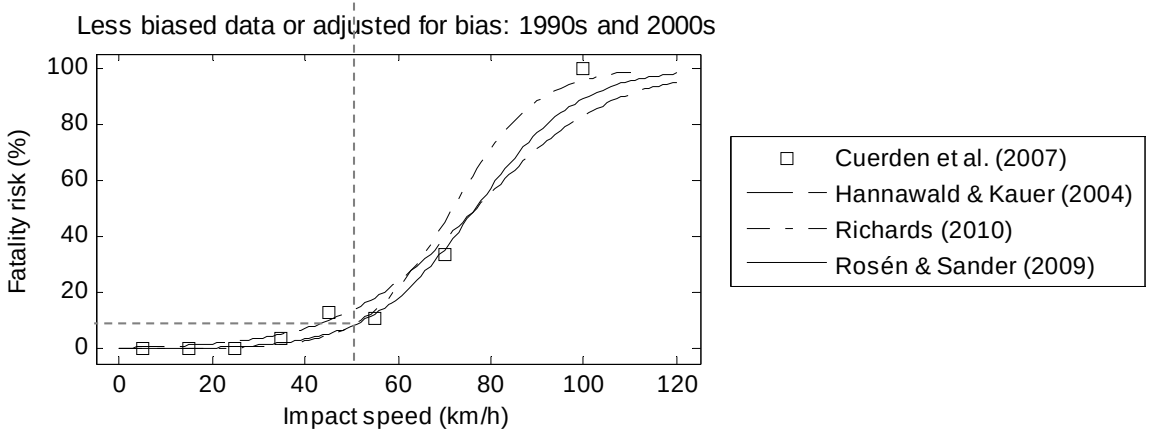
Sampling bias



Old data adjusted for bias



Less bias or adjusted for bias

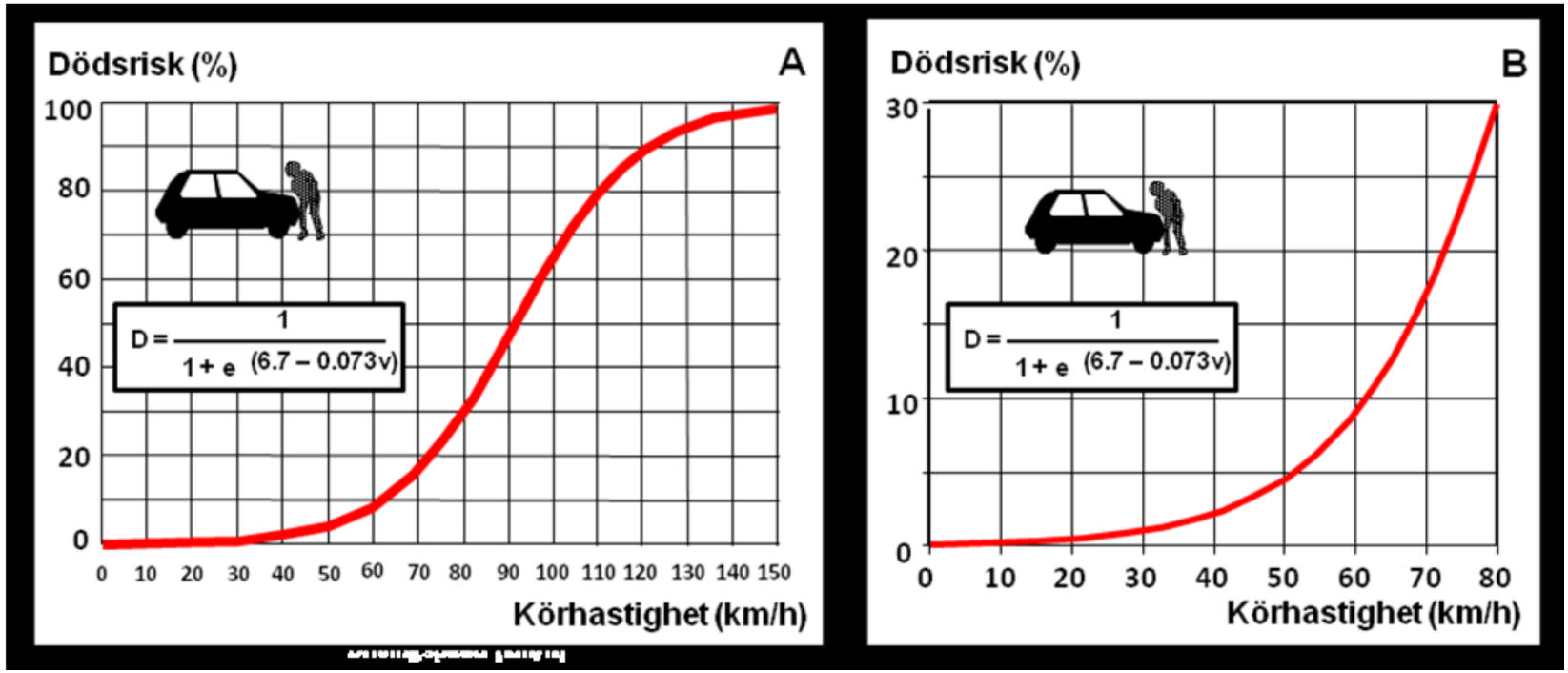


Confusion

- Waltz et al. (1983) → Anderson et al. (1995, 1997)
- Teichgräber (1983) → Yaksich (1964)
- Ashton (et al.) (1977, 1979, 1980)
  - Only provided data, but no risk analysis
  - Ashton et al. (1977) specifically pointed out bias in the data
- Pasanen (1992) fitted a risk curve to ”Ashton’s” biased data

Pasanen's approach

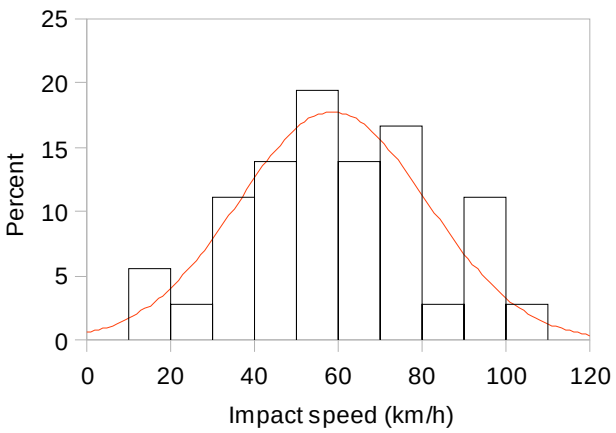
- Consider car TRAVEL speed
- Focus on the RELATIVE risk increase

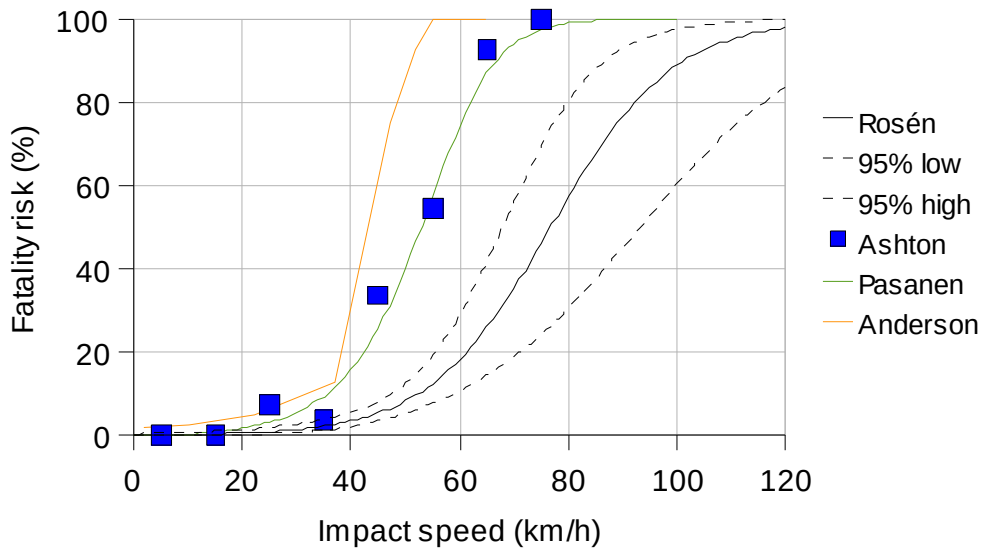


Conclusions

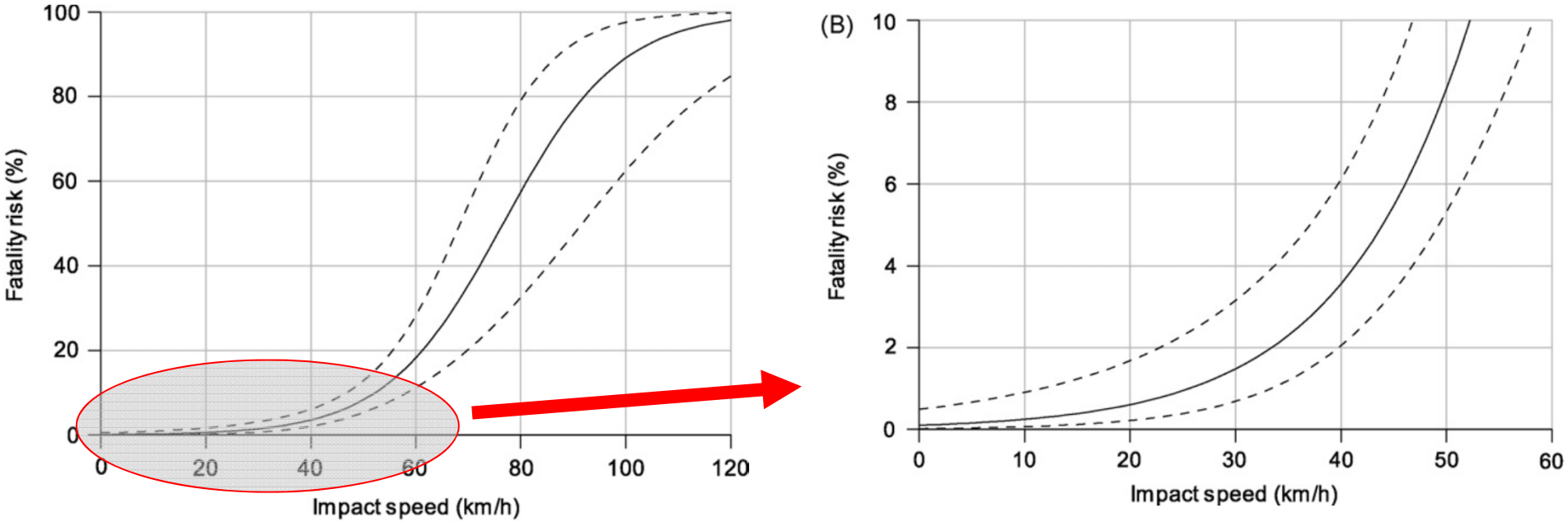
- A correct understanding of exposure of crashes and injury risks is needed to save and protect as many pedestrians as possible
- Decreasing impact speed is very effective both at high and low speeds

Incidence of fatal crashes, $I(v)$





Final word: Speed is dangerous



By decreasing speed where pedestrians are at risk,

injuries will be prevented and

lives will be saved

Thanks for listening!

References

- Anderson, R.W.G., McLean, A.J., Farmer, M.J.B., Lee, B.H., Brooks, C.G., 1995. Vehicle travel speeds and the incidence of fatal pedestrian crashes. In: Proceedings of the 1995 International IRCOBI Conference on the Biomechanics of Impact, Brunnen, Switzerland, pp. 107–117.
- Anderson, R.W.G., McLean, A.J., Farmer, M.J.B., Lee, B.H., Brooks, C.G., 1997. Vehicle travel speeds and the incidence of fatal pedestrian crashes. Accid Anal Prev. 29, 667–674.
- Ashton, S.J., Pedder, J.B., Mackay, G.M., 1977. Pedestrian injuries and the car exterior. SAE, Technical Paper 770092.
- Ashton, S.J., Mackay, G.M., 1979. Some characteristics of the population who suffer trauma as pedestrians when hit by cars and some resulting implications. In: Proceedings of the 1979 International IRCOBI Conference on the Biomechanics of Impact, Gothenburg.
- Ashton, S.J., 1980. A preliminary assessment of the potential for pedestrian injury reduction through vehicle design. In: Proceedings of the 24th Stapp Car Crash Conference. SAE, Inc, Warrendale, Pa., pp. 609–635, Paper No. 801315.
- Cuerden, R., Richards, D., Hill, J., 2007. Pedestrians and their survivability at different impact speeds. In: Proceedings of the 20th International Technical Conference on the Enhanced Safety of Vehicles, Lyon, France, Paper No. 07–0440.
- Davis, G.A., 2001. Relating severity of pedestrian injury to impact speed in vehicle pedestrian crashes. Transport Res Rec. Record No. 1773, 108–113.
- Oh, C., Kang, Y.S., Youn, Y., Konosu, A., 2008b. Assessing the safety benefits of an advanced vehicular technology for protecting pedestrians. Accid Anal Prev. 40, 935–942.
- Pasanen, E., 1992. Driving speeds and pedestrian safety; a mathematical model. Helsinki University of Technology, Transport Engineering, Publication 77. Otaniemi, Finland.
- Richards, D., 2010. Relationship between speed and risk of fatal injury. Submitted for publication.
- Rosén, E., Sander, U., 2009. Pedestrian fatality risk as a function of car impact speed. Accid Anal Prev. 41, 536–542.
- Teichgräber, W., 1983. Die Bedeutung der Geschwindigkeit für die Verkehrssicherheit. Z f Verkehrssicherheit 2, 53–63.
- Walz, F.H., Hoefliger, M., Fehlmann, W., 1983. Speed limit reduction from 60 to 50 km/h and pedestrian injuries. In: Proceedings of the 27th Stapp Car Crash Conference with International Research Committee on the Biokinetics of Impact (IRCOBI), pp. 277–285.
- Yaksich, S.J., 1964. Pedestrians with milage: A study of elderly pedestrian accidents in St. Petersburg, Florida. American Automobile Association, Washington D.C.