

Submitted by the expert from Finland

Estimate of the cost and impact of three-point seat belts in buses in Finland

1 Seat belt costs

An average of 73 buses have been first registered each year in category M3 subcategory III (table 1). These buses have had an average of 47 seats. These new buses have a total of about 3 470 seats a year. We estimate that a three-point seat belt costs €30-50 more than a two-point seat belt. Thus, equipping new buses with three-point seat belts instead of two-point seat belts would incur an additional cost of €104 000–174 000 per year.

Table 1. Vehicle category M3 subcategory III first registrations and their average number of seats in Finland in 2016–2020. Source: Traficom Transport register.

Year	Number of first registrations	Average number of seats	Number of seats, total
2016	87	53	4650
2017	109	46	4970
2018	66	49	3250
2019	56	48	2660
2020	48	38	1800
Average 2016–2020	73	47	3470

2 Bus passenger fatalities and injuries in Finland

Statistics Finland's road accident statistics is based on police-reported accidents and it is Finland's official road accident statistics. According to their data, approximately one bus passenger is killed and 50 slightly injured annually in Finland (table 2). The number of seriously injured bus passengers may be too low in Statistics Finland's database, because the police does not always record personal identity numbers for injured bus passengers, when the police investigate the accident, and therefore those injured passengers are not linked with hospital data on injury severity.

Table 2. Accident consequences for bus passengers in Finland in 2010-2019. Injuries are classified as slight or serious by combining hospital data to police data from year 2014 onwards. Source: Statistics Finland.

	2010-2019	Annual average
Fatalities	9	0,9
Serious injuries (2014-2019)	2	0,3

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Slight injuries (2014-2019)	300	50
Injuries, no information on severity (2010-2014)	223	56

According to insurance companies' data, approximately one bus passenger is killed, 4 seriously injured and 470 slightly injured annually in Finland (table 3). Most injuries take place in urban areas and therefore buses involved are probably mainly city buses without seatbelts. An average of 85 bus passengers are injured in road accidents outside urban areas.

Table 3. Accident consequences for bus passengers in Finland in 2010-2019, road accidents indemnified by insurance companies. Source: Finnish Crash Data Institute.

	2010-2019	Annual average	Annual average, outside urban areas
Fatalities	13	1,3	0,3
Serious injuries	37	3,7	0,5
Slight injuries	4641	464	85

Statistics Finland data and insurance company data do not contain information on seat belts and their use.

3 Estimated impact of three-point seat belts in accident investigation reports

The official accident statistics in Finland do not contain information on the use of seat belts or their effect. This information is available in two sources:

- Investigation reports by Safety Investigation Authority, Finland. Safety Investigation Authority investigates only the most serious road accidents, with more than 3 deaths. They have investigated 3 bus accidents in 2010–2019.
- Investigation reports by Road Accident Investigation Teams. The road accident investigation teams investigate all fatal road accidents. In addition, the teams investigate on a project basis some other accidents, for example heavy vehicle accidents that could have been very serious. In 2010–2019 the investigation teams investigated 36 fatal accidents and 59 other accidents involving a bus carrying passengers.

There were 7 accidents in 10 years in these two sources, where the investigation report recommended three-point seat belts for bus passengers. In 5 accidents (1 fatal accident and 4 other accidents) bus passengers, who were using two-point seat belts, were injured when they hit their faces or heads. The exact number of injured passengers was not given one of the investigation reports, but there was approximately 30 persons, who would probably have avoided injuries, if their seat belts were three-point belt instead of two-point belts. These figures are summarized in table 4. In other two investigated accidents, there were only slight injuries because of high seat belt wearing rate and relatively low speed, but the

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investigation reports recommended three-point seat belts to prevent injuries in similar accidents in the future.

Table 4. Accidents involving bus passengers in 2010–2019 investigated by Safety Investigation Authority or Road Accident Investigation Team.

	Total	Annual average
Investigated accidents	96	9,6
Accidents where seat belt wearing bus passengers were injured and three-point belt might have prevented injury	5	0,5
Injured bus passengers wearing two-point seat belt, and three-point belt might have prevented injury	27-32 4 serious and 23-28 slight injuries	3 0,4 serious and 2-3 slight injuries

4 Accident costs

Statistical unit values for road fatalities and injuries in Finland are determined as a part of directions for the road and rail transport project appraisal. Values are updated every four years. The newest unit value publication is from year 2020, in year 2018 prices ¹.

Unit values consist of real economic costs and loss of individual well-being, also called human cost in many sources. Real economic costs include material damage, medical and rehabilitation costs, rescue, police and judicial costs and production loss. Loss of well-being is estimated with willingness-to-pay method. Statistical unit value for road fatality is €2,56 million, for serious injury €1,27 million, and for slight injury €0,13 million (table 2). Finnish unit values for road fatalities and injuries are of the same order of magnitude as most other western European countries, as listed in the Horizon Indev project deliverable 5.1 ².

Table 5. Statistical unit values for road fatalities and injuries in Finland, €.

	Real economic cost component	Loss of individual well-being	Total
Fatality	164 513	2 400 000	2 564 513
Serious injury	639 095	900 000	1 269 095

¹ Metsäranta, Iikkanen, Ristikartano and Reimi: Determination of unit values for road and rail transport project appraisal for 2018. Finnish Transport Infrastructure Agency. Helsinki 2020. Publications the FTIA 48/2020. ISSN 2490-0745, ISBN 978-952-317-806-9. (In Finnish, with summary in English)

² Kasnatscheew, Heini, Schoenebeck, Lerner and Hosta: Review of European Accident Cost Calculation Methods – With Regard to Vulnerable Road Users. InDeV project. Deliverable 5.1. European Union’s Horizon 2020 research and innovation programme.

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Slight injury	44 735	127 200	171 935
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Three-point seat belts would prevent at least 3 injuries per year, based on accident investigation reports (chapter 4). Thus the minimum monetary benefit of three-point seat belts is the cost of three slight injuries, which is €516 000. If we calculate only the real economic cost component for three slight injuries, it is €134 000 per year. If we expect that 0,4 serious injuries are reduced to slight injuries and 2,6 slight injuries prevented, then the monetary benefit is €886 000 per year.

Only a small proportion of bus accidents are investigated by accident investigations teams, so the reduction of three injuries per year is probably too low estimate. Reduction of injuries by means of three-point seat belts was possible, according to investigation reports, in 5/96 of the bus accidents investigated, i.e. 5% of accidents. If we expect that three-point seat belts would prevent injuries for 5 % of bus passengers injured outside urban areas according to insurance data, 4 passengers per year would avoid being injured. If we expect that three-point seat belts would prevent 5 % of all bus passengers injuries indemnified by insurance companies, approximately 20 slight injuries per year would be prevented. This can be considered a maximum value for the road safety effect.

Table 6. Monetary value for the safety effect of three-point seat belts compared to two-point seat belts, in €, calculated by using Finnish statistical unit values.

Safety effect of three-point seat belts compared to two-point belts	Injury cost, using unit values for injuries	Injury cost, only real economic cost component included
Minimum: three prevented slight injuries	516 000	134 000
0,4 serious injuries reduced to slight injuries and 2,6 prevented slight injuries	886 000	354 000
Maximum: 20 prevented slight injuries	3 439 000	895 000

5 Summary

An average of 73 buses are first registered each year in category M3 subcategory III in Finland. Equipping these new buses with three-point seat belts instead of two-point seat belts would incur an additional cost of €104 000–174 000 per year. Three-point seat belts would prevent approximately 3–20 bus passenger injuries per year. Saved accident costs (€0.5–3.4 million) exceed the seat belt costs. Even if we consider only real economic accident costs like medical and rescue costs, the minimum monetary safety benefit is approximately the same as seat belt costs.