

**'Pedestrian falls' as necessary addition to the current definition of traffic crashes for improved public health policies**

Methorst, Rob; Schepers, Paul; Christie, Nicola; Dijst, Martin; Risser, Ralf; Sauter, Daniel; van Wee, Bert

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# 1 'Pedestrian falls' as necessary addition to the current definition of 2 traffic crashes for improved public health policies.

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## 6 1. Introduction

7 Key to the development of public health policies and strategies is the accurate  
8 definition of the problem(s) under review. Accurate problem definition fences off  
9 undesirable circumstances, highlighting some aspects and throwing others in the  
10 shadow (Weiss, 1989). Widely accepted definitions of traffic crashes focus on vehicle  
11 crashes (sometimes further restricted to *motor* vehicle crashes) occurring on public  
12 roads. These definitions exclude incidents such as pedestrians slipping, tripping or  
13 colliding with objects resulting in falls in public spaces leading to injury or death. Such  
14 incidents are hereafter denoted in short as Pedestrian Falls (PFs)

15 The current definition is understandable from a historical perspective, but it  
16 may no longer be accurate or justifiable. The exclusion of PFs by definition and,  
17 subsequently, in statistics is likely to lead to biased conclusions in transport and  
18 safety policies, which do not serve public health interests. This paper focuses on the  
19 problem regarding definition only and not on reporting issues even though these are  
20 important as evidenced from frequently missing single-bicycle crashes (which, unlike  
21 PFs, are defined as traffic crashes in most countries) (Veisten et al., 2007).

22 The current definition of traffic crashes emerged in the early 20<sup>th</sup> century  
23 when motorisation led to increasing numbers of people losing their lives in motor  
24 vehicle crashes (Norman, 1962). As a consequence, traffic crashes were defined and  
25 measured as (motor) vehicle crashes. Indeed, Norman (1962) described that in the  
26 United States in 1957, deaths following motor vehicle crashes exceeded the  
27 combined deaths from all infectious and communicable diseases at all ages. The risk  
28 of pedestrian-motor vehicle crashes was particularly high, with pedestrian deaths  
29 following motor vehicle crashes in New York City in 1959 amounting to 70% of all  
30 officially recorded traffic crash deaths (Norman, 1962). It is likely that, compared to  
31 the number of official traffic crash deaths, the number of deaths following PFs was  
32 negligible. Nowadays, PFs no longer appear to be a negligible problem, especially in  
33 developed countries with their ageing populations as older people have a high risk of  
34 serious PFs. Currently in the Netherlands more elderly people are fatally injured from  
35 a pedestrian fall in public space than from pedestrian-vehicle collisions (Den Hertog  
36 et al., 2013).

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## 39 2. Recent research on pedestrian falls

40 Although there have been very few, if any, official statistics of PFs until recent times,  
41 first studies show the size of the problem. According to Den Hertog et al. (2013) a  
42 little more than half of all pedestrian deaths and the vast majority of non-fatal  
43 pedestrian casualties in the Netherlands are now as a result of a PF. Table 1, which  
44 also includes data from Switzerland and Austria, shows that in the present-day road  
45 system, figures based on the current definition of traffic crashes do not provide a  
46 comprehensive overview of crash victims on public roads. Also, Mindell et al. (2015)  
47 found that of all pedestrian casualties hospitalised in England (2007-2009) with a

48 specified International Classification of Diseases (ICD) coding 23,528 were involved  
 49 in a road traffic accident and 76,087 were injured in falls on the public highway,  
 50 therefore the number of PF casualties were, similar to Dutch figures (Den Hertog et  
 51 al., 2013), over three times greater than those involving a motorised vehicle. Both  
 52 Den Hertog et al. and Furian et al. (2011) found that about three quarters of the PFs  
 53 were related to bad or slippery pavement conditions, i.e. lack of 'walkability' as  
 54 defined by how conducive, friendly and safe the urban environment is for walking  
 55 (Abley, 2005). It is however beyond the aims of this paper to discuss the literature on  
 56 walkability and factors having an impact on the level of walkability and related PFs.

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Table 1 The Proportion of SP casualties on public roads in the Netherlands, Switzerland, and Austria.

	the Netherlands 2011(Den Hertog et al., 2013)		Switzerland 2011(BFU, 2014)		Austria 2009 Furian et al., 2011)	
	numbers	%	numbers	%	numbers	%
total number of injured road users	180,000	100	138,000	100	104,000	100
Injured pedestrians	48,000	27	56,700	41	36,500	35
of which traffic crash	5,000	3	2,400	2	4,000	4
of which PFs	43,000	24	55,300	40	32,500	31
total number of hospitalised road users	41,000	100	n.a.	n.a.	n.a.	n.a.
hospitalised pedestrians	11,000	27	n.a.	n.a.	n.a.	n.a.
of which traffic crash	2,000	5	n.a.	n.a.	n.a.	n.a.
of which PFs	8,600	21	n.a.	n.a.	n.a.	n.a.
Total number of fatalities	747	100	n.a.	n.a.	n.a.	n.a.
pedestrian fatalities	160	21	n.a.	n.a.	n.a.	n.a.
of which traffic crash	74	10	n.a.	n.a.	n.a.	n.a.
of which PFs	86	12	n.a.	n.a.	n.a.	n.a.

61  
 62 Probably owing to definitional bias and lack of accessible data, only a few  
 63 researchers with a transport and walkability focus (Den Hertog et al., 2013; Furian et  
 64 al., 2011; Methorst & Schepers, 2010; Öberg, 2011; Mindell et al., 2015, Oxley et al.  
 65 2016) have started to estimate the size of the PF problem; however, most research  
 66 into pedestrian injury/death incidents, is still restricted to pedestrian-motor vehicle  
 67 crashes (Elvik et al., 2009). By contrast, the problem of falls is well recognized  
 68 among researchers in the field of epidemiology. The World Health Organisation  
 69 estimates that globally approximately 37.3 million falls occur each year that are  
 70 severe enough to require medical attention, with an estimated 424,000 falls occurring  
 71 that result in fatal injuries (WHO 2014). This is the second leading cause of  
 72 unintentional injury death (WHO 2014).

73 Unfortunately for transport- and public space related researchers, these  
 74 figures also include falls indoors and in private gardens. As most studies on falls and  
 75 interventions by epidemiologists combine all falls regardless of location, the

76 outcomes are of limited use for road and public space authorities. It is, however,  
77 positive that some researchers recently have started to at least distinguish between  
78 indoor and outdoor falls (Kelsey et al. 2010).

### 81 3. Consequences of excluding pedestrian falls

82 The exclusion of PFs from transport research is likely to lead to biased conclusions  
83 about the link between road safety and the design of our road transport system. Elvik  
84 et al. (2009) described an interesting example based on Norwegian research. The  
85 risk of injuries (injuries per kilometre travelled) for car occupants is two times higher  
86 than that for bus passengers. This suggests that the number of injuries decreases  
87 when people shift from driving to using buses or trains. However, this conclusion only  
88 appears to apply to injuries falling within the official definition of road traffic crashes  
89 (excluding PFs). According to Elvik et al. (2009: 1064), “The unrecorded injuries from  
90 falls will, however, increase so much that no overall gain in safety can be expected if  
91 car users start using buses or trains.”

92 Similarly, it is difficult to rule out the possibility that results from studies on  
93 pedestrian crossings are biased by the restriction of research to motor vehicle  
94 crashes (Elvik et al., 2009). Nyman et al. (2013) recently found that PFs occurred  
95 most frequently while pedestrians were crossing a road. As Den Hertog et al. (2013)  
96 suggested, the large majority of non-fatal pedestrian casualties are PF victims. This  
97 may also be applicable to pedestrian crossings. This means that walkability factors  
98 such as differing kerb heights may have a similar or greater significance on overall  
99 safety outcomes than factors relevant to pedestrian-motor vehicle crashes.

100 We expect that the number of severe pedestrian injuries in motor vehicle  
101 crashes in developed countries will further decrease in the future. More speed-  
102 reducing measures and new mechanical systems such as automated braking and  
103 pedestrian airbags on car bonnets have the potential to reduce the risk of fatalities  
104 and the severity of pedestrian-motor vehicle crashes. However, our ageing  
105 population means that without the introduction of new public health and road safety  
106 policies severe injuries from PFs are likely to increase. This increase and related  
107 mobility and reduced physical activity problems among the elderly are unacceptable  
108 from the perspective of public health. If we are to address the problem of PFs, the  
109 first thing we have to do is agree on a comprehensive definition of incidents that  
110 include PFs on an equal basis besides traffic crashes.

### 113 4. Discussion

114 We recommend to consider changing the definition (for instance in the International  
115 Classification of Diseases) to the following: “any vehicle crash and pedestrian fall  
116 occurring on in the public road spaces.” For the same reasons of usability by  
117 authorities we recommend to broaden public roads to public spaces. The inclusion of  
118 PFs in the definition would lay the basis for the collection of more comprehensive  
119 data on injuries on public roads and in public spaces. This would inform more  
120 accurate research and analysis of traffic risks and lead to better input and guidance  
121 for road authorities, urban planners, and public health authorities, to enable them to  
122 design inclusive and safe public spaces, improve walkability and thereby helping the  
123 elderly to stay mobile, independent and (physically) active.

125

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Rob Methorst,<sup>a</sup> Paul Schepers,<sup>b</sup> Nicola Christie,<sup>c</sup> Martin Dijst,<sup>b</sup> Ralf Risser,<sup>d</sup> Daniel Sauter,<sup>e</sup> and Bert van Wee<sup>f</sup>

a external PhD candidate Delft University of Technology, Jan van Gelderdreef 15, 2253 VH Voorschoten, The Netherlands, e-mail: rob.methorst@telfort.nl

b Department of Human Geography and Spatial Planning, Faculty of Geosciences, Utrecht University, Heidelberglaan 2, Utrecht 3584 CS, The Netherlands, e-mail: M.J.Dijst@uu.nl

c Department of Civil, Environment & Geomatic Engineering, UCL Transport Institute, University College of London, Gower Street, London WC1E 6BT, United Kingdom, e-mail: nicola.christie@ucl.ac.uk

d Department of Psychology, Palacky University, Olomouc, Czech Republic; FACTUM OHG, Danhausergasse 6/4, Wien 1040, Austria, ralf.risser@factum.at

e Urban Mobility Research, Muehlebachstrasse 69, Zurich 8008, Switzerland, e-mail: daniel.sauter@urban-mobility.ch

f Faculty Technology, Policy and Management, Delft University of Technology, Jaffalaan 5, 2628 BX Delft, The Netherlands, e-mail: g.p.vanwee@tudelft.nl

Corresponding author: Rob Methorst, e-mail: rob.methorst@telfort.nl