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Case report

Flying roadside stones—a deadly risk in a crash

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Abstract: The crash of a coach with 58 occupants at 100 kmph revealed the danger of covering ditch areas with sharp stones 5–20 cm in size. Stones and dirt were sprayed into the coach compartment resulting in serious injuries and death. Road safety works need to address this factor in the future.

Keywords: stones, fatal, roadside hazard

1 Introduction

Roadside hazards such as concrete pillars and lampposts are well-known risk factors for vehicles that leave the road as, for example, noted by *Rechnitzer & Grzebieta (1999)*. Many road design rules have been established with the aim of reducing the consequences of a crash. However, a coach crash at 100 km/h has revealed the danger of material currently used on roadsides in Sweden (Figure 1).

Figure 1. The stones and dirt at a site where a coach with 58 occupants went off the road at 100 km/h because the driver was incapacitated. Photo: *SHK (2015)*

2 Aim

To shed light on the possible consequences of crashing on a modern common Swedish roadside where there are stones 2–5 kg sized up to 10–20 cm.

3 Material

A case report from a coach crash investigated by the Swedish Accident Investigation Authority (*SHK, 2015*).

4 Results

When the left side of the coach hit the ground, all the windows on that side broke and stones and dirt were thrown into the coach (Figure 2). Of the 15 passengers sitting in the window row on this side of the coach, 10 sustained serious or more severe injuries (MAIS 3+) (*AAAM, 2008*), many due to the stones and dirt that came flying into the coach. Four passengers had body parts (head, arm) partly ejected through the crushed window. They were injured by impact with the ground, and/or got their arms crushed between the side of the coach and the ground. Of these 15 injured passengers, 12 had used seat belts. One passenger in one of the 'safest seat positions' (according to several coach crash investigations) in the row nearest the aisle in the rear, sustained fatal head and neck injuries caused by a 5 kg/10×20 cm stone (right-hand picture in Figure 2).

Figure 2. Interior of the left side of the coach, showing stones and dirt sprayed into it and onto passengers during the crash at 100 km/h. Photo: *SHK (2015)*

5 Discussion

The risk of using this type of roadside material has not been discussed much. This case report may be an eye-opener in that regard, as any vehicle leaving the road–particularly at a high speed–would expose the occupants to this serious risk of injury if overturned. Gravel or sand traps are effective, on racing tracks, at safely reducing the speed of a crash; however, the roadside material used here seems to be very dangerous. This injury risk needs to be accounted for when new roads are built (Figure 3) or when the safety of current road systems are evaluated.

Road Safety Audits (*ETSC, 1997*) and evaluation of road safety within, for example, the European Road Assessment Programme (*EuroRAP, 1999*), may also consider taking this risk into account.

Figure 3. Recently built bypass around a Swedish city, belonging to the 'Trans European Network' of roads which in Sweden must be processed through a 'Road Safety Audit' during the building process. Clearly, the risk presented in this paper has not been taken into account. Photo: *Ulf Björnstig*

CRediT Contribution Statement

Ulf Björnstig: Conceptualization, Data curation, Formal Analysis, Investigation (member of the Swedish Accident Investigation Board team), Methodology, Visualization, Writing—original draft, Writing—review & editing. **Johanna Björnstig:** Project administration, Software, Writing—original draft, Writing—review & editing

Declaration of competing interests

None

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References

AAAM (2008) *Abbreviated Injury Scale*. International Injury Scaling Committee, Association for the Advancement of Automotive Medicine

ETSC (1997) *Road Safety Audit*. European Traffic Safety Council: *https://etsc.eu/road-safety-audit-and-safety-impact-assessment*

EuroRAP (1999) *European Road Assessment Programme*: *https://www.eurorap.org* (*Acc.* 27 April 2021)

Rechnitzer, G., R. Grzebieta (1999) *Crashworthy systems—a paradigm shift in road design*. Transport Engineering in Australia 5 (2), 74-82

SHK (2015) *Olycka med buss i beställningstrafik på riksväg 27 söder om Tranemo tätort, Västra Götalands län, den 4 december 2014*. Swedish Accident Investigation Authority. Report RO 2015:02: *https://www.havkom.se/assets/reports/RO2015_02_Bussolycka_Tranemo.pdf*

About the authors

Ulf Björnstig is a trauma and general surgeon at Umeå University (recently retired), with focus on trauma care, injury prevention and disaster medicine. Has also been Traffic Safety Director at the National Road Administration 1998-2000, Director of Emergency Medical Service (EMS) in County of Västerbotten, and has also experience as EMS and traffic safety consultant in Arabic and Eastern European countries, as well as medical expert of the National Accident Investigation Board.

Johanna Björnstig is a research assistant with many years experience of running the injury database at Umeå University Hospital including collecting and analyzing data, as well as producing reports, for example the "Annual Traffic Injury Report' based on hospital data. Today she is active at the Disaster Medical Center at Umeå University.