Research in Transportation Economics xxx (2014) 1–7

Contents lists available at ScienceDirect

Research in Transportation Economics

journal homepage: www.elsevier.com/locate/retrec

Safety as a key performance indicator: Creating a safety culture for enhanced passenger safety, comfort, and accessibility

Anders Wretstrand*, [1], Bengt Holmberg, Monica Berntman

Department of Technology and Society, Lund University, Lund, Sweden

ARTICLE INFO

Article history:
Available online xxx

JEL classification:
R410
R490

Keywords:
Safety
Injuries
Bus
City
Operation
Performance
Culture

ABSTRACT

Modal shift from private cars to high quality public transport is often seen as a means for improved traffic safety while simultaneously achieving other policy goals. This paper aims to describe safety from a travel-chain perspective and suggests an approach for using accident data as performance indicators. Findings from a recent Swedish case study of bus accidents show that the number of unreported injury cases was very large. Official statistics failed to provide full information and drivers frequently did not report accidents to the bus operators even though they might have resulted in moderate or severe injuries. Because injuries occur travelling to or from the bus stop, during boarding and alighting, and during the ride (braking/accelerating), passengers run the risk of being injured without the bus being involved in a vehicular collision. Non-collision injuries are indicators of poor accessibility, and even "near-injuries" might affect ridership, especially among older users. Thus, it appears that the pertinent organisational/corporate culture does not prioritize safety as a quality factor even though it is sometimes mentioned as a key performance indicator. We discuss means for improved safety culture for all stakeholders and reduce injuries, increase the use of buses, and increase travel quality and comfort.

1. Introduction

Public transport (PT) can support mobility and an active lifestyle in many ways and provides increased access to the labour market, to services, and to social networks. One indicator of quality PT as a transport system is that it is able to compete with private car use (Krug & Meinhard, 2008). For PT to be a real option for the majority of potential users who have access to a car, it must be fast, reliable, simple to understand and use, and reasonably priced. Two of the main objectives of EN 13816 "Transportation – Logistics and services – Public passenger transport – Service quality definition, targeting and measurement" are to focus on the needs and expectations of customers and to contribute to continuous quality improvement.

The basis of EN 13816 is the "quality loop", and the four main aspects of the quality loop are how service quality is sought, targeted, delivered, and perceived. Customers and the community are prime beneficiaries regarding the first and last quality aspects. The two other service aspects define the service provider's view. The total PT quality contains various criteria, and according to EN 13816 these are divided into the following eight categories: availability, accessibility, information, time, environmental impact, customer care, comfort, and security. The first five can be described as "hard factors", and the others contain "soft" aspects. Furthermore, PT quality is a shared responsibility between all stakeholders, most notably the public transport authority (PTA) and the operator (OP). The PTA has strategic responsibility to define the level of quality from a societal perspective, and the OP has the managerial and operational responsibility for delivering the end user product.

The quality of PT services will likely see an increased focus in the coming years due to demands for ecological and financial sustainability, the ageing of the population, and the need to promote PT. Attractive supply, access, comfort, reliability, and intermodal integration are some of the main characteristics of service quality, and seamless door-to-door mobility is a key issue in today's transport policies. Perhaps even more emphasised in its previous version, safety is also an important transport policy goal in the 2011 EU White Paper. In the "zero-vision" of road safety, the need for a comprehensive strategy of action on road injuries is paramount as are classifications of injuries and fatalities, adoption of injury reduction targets, a focus on training and education, and particular attention to vulnerable road users (ibid, pp.21–22).

* Corresponding author. Department of Technology and Society, P.O. Box 118, SE-221 00 Lund, Sweden. Tel.: +46 46 222 04 82.
E-mail address: anders.wretstrand@tft.lth.se (A. Wretstrand).
[1] Presenting author.

http://dx.doi.org/10.1016/j.retrec.2014.09.008
0739-8859/

The service quality emanating from the overarching strategic goals of the PT services should be monitored and evaluated through so-called key performance indicators (Hensher & Stanley, 2003). Gordon, Mulley, Stevens, and Daniels (2013) give several examples of safety performance indicators in various PT modes, and responsibilities (and risk taking) might vary and depending on the type of regulatory regime being used. Wretstrand and Marin-Lamellet (2011) suggested that the "security" category could be placed under the responsibility of PTAs (management contracts) or OPs (gross or net cost contracts). However, it is currently quite difficult to define roles and to divide responsibilities under such a simplified description of regimes. As stated by Stanley and van de Velde (2008), the institutional arrangements on the tactical level are in flux, the traditional net cost and gross cost dichotomy seems out-dated, and new regimes tend to evolve beyond the traditional forms; instead, performance-based regimes and trusting partnerships (Hensher & Stanley, 2003; Stanley & van de Velde, 2008) seem to be gaining ground in many countries.

Under these circumstances, this paper seeks to address the issue of PT safety by focussing on bus services. The aims are a) to provide a better description of causes of accidents and injuries and b) to present arguments for highlighting safety as a key performance indicator and the challenges associated with this. Findings from a case study on bus accidents in Sweden will serve as the empirical evidence, and general means to raise awareness and promote a safety culture will be discussed and proposed for the various PT regimes currently in place.

2. Bus safety

2.1. Safety – a neglected quality category?

Safety – meaning avoiding fatalities and personal injuries – is encompassed by the service quality category of security. This category contains the following three main facets: freedom from crime, freedom from accidents, and emergency management. As seen in Table 1, EN 13816 focuses as much (or even more) on "intentional threats" (security) as "unintentional threats" (safety).

One reason for this focus was indirectly given by Backer-Grøndahl, Fyhri, Ulleberg, and Amundsen (2009). They studied the concept of "worry" in transport as a predictor of travel behaviour, and the respondents in their study worried more about "unpleasant incidents" (e.g. intentional threats) than accidents while traveling with various modes of PT. These facts will undoubtedly emerge while monitoring the perceived security quality category (because accidents are probably less common than incidents) while downplaying or leaving out the issues of unintentional threats caused by poor passenger safety design.

There might be good reasons for focussing on security, but because there is already evidence that true accident rates are higher than official statistics (see Section 2.2), we argue that increased focus must be placed on safety. Such a focus is also necessary because current policy goals often contain ambitious targets for increased patronage such as "doubling ridership and market share".

Table 1
PT service qualities and related measurements of the Security criterion of EN 13816.

Security		
Freedom of crime	Freedom from accidents	Emergency management
Lighting	presence/visibility of supports	facilities and plans
visible monitoring staff/police presence identified help points	avoidance/visibility of hazards active safeguarding by staff	

2.2. Accident statistics

PT has been seen as a means to promote road safety. White, Dennis, and Tyler (1995) pointed to the fact that among 5000 PT-related fatalities in the UK during the 1990s, only 3%–5% were related to bus transport. The conclusion was evident: a modal shift from private cars to public buses would result in substantial safety effects. Other studies that have considered distance travelled have also shown increased safety benefits from bus travel. Estimates of the number of fatalities per 100 million person-kilometres show that risks when traveling by car are 8 times higher and that risks when walking are 50 times higher than when taking the bus (Albertsson & Falkmer, 2005; Evans, 1994; Lajunen, 1993).

Traditional vehicle accident data are related only to in-vehicle transport. However, Hedelin, Bunketorp, and Björnstig (2002) showed that three quarters of those injured in both bus and tram incidents sustained their injuries at bus or tram stops or at pedestrian crossings. Therefore, the surrounding infrastructure design is crucial not only for accessibility and to create liveable cities, but it is also critical for increasing safety. The safety of unprotected and vulnerable road users has long been an important issue for urban traffic planners, but the focus has only been applied to a limited extent to mainstream PT systems. However, when addressing the needs of older and disabled persons, research has been quite extensive. For example, Oxley, Charlton, Corben, and Fildes (2006) pointed to the facts that road accidents involving pedestrians are frequently serious in nature and that many involve older adults. Road environment complexity, high speed, and traffic volumes place high demands on pedestrians and cyclists and especially on mobility-impaired road users heading to or from a PT stop or terminal.

According to a study by Vaa (1993), the risk incurred during pedestrian movement to and from bus stops is approximately 100 times greater than the risk of travelling in a bus. The number of single accidents involving pedestrian movement is about 9 times higher than that of collision accidents. Several studies have compared the risks associated with different transport modes. For example, Jørgensen (1996) calculated the risks of travelling by car, bus, and train in central Copenhagen and its adjacent areas. He noted that travelling by train is safest followed by buses and then cars. The difference between bus and car travel is largest in the adjacent areas because the risk associated with pedestrian movement is lower than in central Copenhagen.

A comparison of cars and trains by Evans and Addison (2009) found that trains are about twice as safe as cars. Here, too, the risk on the way to and from the station is more dominant, and this means that the risk comparison is dependent on the distance to the station as well as the total length of the journey. Studies that assess the safety of travelling by bus show large differences in results with the risk measure differing by as much as a factor of 100. Some studies use police reports of accidents while others use hospital registers. However, police reports of accidents do not connect pedestrian movement to and from the bus stop with buses as the mode of transport. Nor do they include single accidents. As will be shown in Section 3, single accidents constitute a large percentage of all bus-related accidents.

3. Case study on urban bus safety

3.1. Aims, scope, and method

This study, reported in Berntman, Holmberg, and Wretstrand (2012), had two aims: a) to illustrate the total accident picture of travelling by bus and the reasons for the accidents and b) to compare the risk of a road user who travels by bus with one who

Please cite this article in press as: Wretstrand, A., et al., Safety as a key performance indicator: Creating a safety culture for enhanced passenger safety, comfort, and accessibility, *Research in Transportation Economics* (2014), http://dx.doi.org/10.1016/j.retrec.2014.09.008