Forensic Science International 266 (2016) 102–108

Contents lists available at ScienceDirect

Forensic Science International

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

Front blind spot crashes in Hong Kong

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ARTICLE INFO

Article history:
Received 19 February 2016
Received in revised form 4 May 2016
Accepted 16 May 2016
Available online 21 May 2016

Keywords:
Blind spot crash
Front blind spot mirror
Blind spot
Traffic accident investigation

ABSTRACT

In 2012–2014, our laboratory had investigated a total of 9 suspected front blind spot crashes, in which the medium and heavy goods vehicles pulled away from rest and rolled over the pedestrians, who were crossing immediately in front of the vehicles. The drivers alleged that they did not see any pedestrians through the windscreens or the front blind spot mirrors. Forensic assessment of the goods vehicles revealed the existence of front blind spot zones in 3 out of these 9 accident vehicles, which were attributed to the poor mirror adjustments or even the absence of a front blind spot mirror altogether. In view of this, a small survey was devised involving 20 randomly selected volunteers and their goods vehicles and 5 out of these vehicles had blind spots at the front. Additionally, a short questionnaire was conducted on these 20 professional lorry drivers and it was shown that most of them were not aware of the hazards of blind spots immediately in front of their vehicles, and many did not use the front blind spot mirrors properly. A simple procedure for quick measurements of the coverage of front blind spot mirrors using a coloured plastic mat with dimensional grids was also introduced and described in this paper.

1. Introduction

The large size and high driving position of goods vehicles create difficulties for their drivers in seeing other road users around their vehicles, which sometime result in serious accidents. This type of blind spot crashes [1–4], due to negligence of lorry drivers, remains a major issue of the road safety authorities. Blind spot zones around goods vehicles are mostly situated at the front, the passenger side of the cab and the rear. Thorough studies of the blind spot zone on the passenger side of cab [5–7] had been carried out. There are also numerous detailed studies on the effectiveness of the mirrors/equipment on the rear blind spot [8,9] and the front [10]. Blind spots also exist at the rear of sedans when toddlers are behind reversing vehicles. [11] On the other hand, lack of pedestrian awareness of blind spots and their behaviour under those situations were the other major contributory factor to this type of crashes [4]. This paper is focused on the front blind spot of goods vehicles only.

Road users within the front blind spot zone are vulnerable to be rolled over by goods vehicles when the vehicles pull away from rest at cross junctions and traffic lights. In order to improve field of view of drivers to cover the front blind spot zone, goods vehicles are commonly equipped with front blind spot mirrors (also known as cyclops or cross view mirrors). Since 1st October 2012, heavy goods vehicles in the European Union must be fitted with front blind spot mirrors (Class VI mirrors) that conform to the requirement of Directive 2003/97/EC [12], which specified the field of view of the front blind spot mirrors. Similar law is also imposed in New York City of the United States under Section 375 of the Vehicle and Traffic Law [13] with effect from 13th January 2012.

In Hong Kong, there are no similar laws and requirements on fitment of front blind spot mirrors to any class of goods vehicles, including medium goods vehicle (MGV: gross vehicle weight from 5.5 to 24 tonnes) and heavy goods vehicle (HGV; gross vehicle weight from 24 to 38 tonnes). However, nearly all MGVs and HGVs in Hong Kong are equipped with front blind spot mirrors.

Hong Kong is one of the most densely populated places in the world. Our road network is saturated and vehicles and pedestrians often compete for street spaces. Instead of crossing at designated pedestrian crossings, it is not uncommon to see pedestrians, particularly the elderly, to jay-walk and cross the road immediately

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http://dx.doi.org/10.1016/j.forsciint.2016.05.013
0379-0738/

in front of vehicles, which have been stopped for stationary or slow-moving traffic. Between the years of 2012 and 2014, Hong Kong Traffic Police requested our Laboratory to investigate a total of 9 front blind spot crashes involving goods vehicles, in which the drivers alleged not seeing the victims through the windscreens or the front blind spot mirrors when the goods vehicles pulled away from rest. Subsequent examination revealed that 3 out of 9 of these goods vehicles had blind spots in the front, which were attributed to improper adjustments of the front blind spot mirrors or the absence of the mirror itself.

The aim of this study was to present and discuss the results of the forensic assessment of the 9 front blind spot crashes and determine their causes. The three traffic accidents with the pedestrians walking within the blind spots of the goods vehicles were discussed in detail. In addition, a preliminary survey of 20 goods vehicles was conducted to evaluate the current fitments and adjustments of front blind spot mirrors, and drivers were invited to take part in a simple questionnaire on their awareness of the presence of front blind spot and the use of the front blind spot mirrors. At the same time, our quick procedure for checking the coverage of front blind spot mirrors was introduced.

2. Methodology

2.1. Determination of field of view of the accident goods vehicles

The goods vehicles of the front blind spot crashes were all detained immediately after the accidents by the police for investigation. Before our measurements of the fields of view from the drivers' seat, witness documents, scene photos and relevant materials, including any footage of accident recorded by CCTVs or cameras, were reviewed. The heights of the drivers and/or drivers' ocular points from the drivers' seats were measured. Police also provided information on the heights, colours of clothing and the walking gestures of the victims, such as hunchback and using walking aids. If the lighting condition at the scene was an issue, reconstruction and measurements would be conducted at the scene; otherwise, measurements were made at vehicle pounds.

For each of the case, a dummy adjusted to the victim's height and wearing comparable shades of clothing and wig to those of the victim was used to assist the measurements of the field of view. The examiner, whilst sitting on the driving seat of the goods vehicle with a normal driving posture and ocular point set to that of the accident driver, would observe the dummy. The direct field of view of the dummy through the front windscreen and the indirect field of view through the front blind spot mirrors were assessed separately. If less than a quarter of the head of the dummy was seen through the front windscreen, that position was classified as a blind spot for the direct field of view. For the indirect field of view through the front blind spot mirror, no fixed rule was set and it depended on the examiner's ability to identify and distinguish a possible pedestrian/object, which may appear as a distorted image when it was near the edge of the mirror; for example, a pair of light coloured shoes would be more prominent than a pair of dark shoes when they both appeared near the dark edge of the front blind spot mirror. If an area of blind spot was found in front of the vehicle, the dummy was put in the blind spot zone for further confirmation.

2.2. The survey and questionnaire

The survey was conducted in an open car park for goods vehicles. Drivers of goods vehicles, either MGV or HGV, were randomly selected. A total of 20 drivers voluntarily participated in the survey. The drivers were asked to answer the following six questions:

1. Do you know what a blind spot is?
2. Do you know any blind spot existing around your vehicle?
3. Are you aware of any fatal traffic accidents caused by drivers not checking for blind spots?
4. Would you adjust the front blind spot mirror before driving?
5. When would you check the front blind spot mirror?
6. If the front blind spot mirror is missing or broken, would you still drive the vehicle?

2.3. Determination of field of view of the goods vehicles (right-hand-drive) in the survey

After the questionnaire, the details of the vehicles were recorded, and then examinations were conducted to determine any potential blind spots in front of the goods vehicles. A coloured plastic mat of 3 m by 6 m with dimensional grids was used to facilitate the measurements of the indirect field of view through the front blind spot mirrors. The plastic mat was put horizontally in front of the vehicle, and a pair of plumb bobs was hung from the two end of the front bumper to ensure proper alignment of the plastic mat. The grids on the mat mainly consisted of horizontal lines in front of the vehicles being measured with concentric quarter circles radiating from the nearside front corner at intervals of 0.1 m (Fig. 1).

The direct and indirect fields of view were measured with the examiner sitting on the driving seat with a 'normal' driving posture, e.g. sat upright with both hands on the steering wheel, then photos of the view through the front blind spot mirror of the plastic mat were taken whilst holding the camera at eye level to assess the coverage of ground level of the front blind spot mirror.

Afterwards, the examiner observed a pedestrian (an assistant) of 1.57 m tall, which is the average height of the Hong Kong population [14]. The pedestrian wore a pair of dark trousers and a pair of grey sports shoes, and was positioned at the front of the goods vehicles within pre-set grid squares of 25 cm by 25 cm; for example, there were a total of 48 grid squares for an area of 2 m wide by 3 m long (see Fig. 2). If the pedestrian was not seen through the windscreen and the front blind spot mirror, a definite blind spot was assigned to that grid square. If less than half of the legs was visible by the edge of the mirror and less than half of the head was visible through the windscreen, that grid square was assigned as a potential blind spot, within which a driver might miss the pedestrian with a quick glance or switching between mirrors.

Fig. 1. The coloured plastic mat with grids used for measurement of field of view of the front blind spot mirror.