

Review on Types of Roadside Barriers and Its Influence on Motorcyclists

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Abstract— The wide range of safety barriers exists including w-beam barrier, wire rope barrier, and concrete barrier. The details of these barriers and development of wire rope barriers are included in this review paper with its testing in different countries. Safety barriers are used to avoid the errant vehicles entering in the opposite lane and create head-on collisions.

Key words: Wire rope safety barrier, motorcycle, w-beam, construction, impact

characteristics for full-scale crash tests of various kind of safety barrier. They decided two scenario to carry out the crash tests. One with the motorcycle driven in an upright position and second with the motorcycle with the rider sliding on the road surface. The velocity chosen was 60 km/h. The impact angle was 12° for the upright driven motorcycle and 25° for the motorcycle and rider sliding. All tests were carried out with the same make, model and type of motorcycle. The test dummy riding the motorcycle and wearing standard protective clothing.

I. INTRODUCTION

Wire rope safety barriers were designed in the late 1960's and still in development. The testing of the wire rope safety barrier was carried out by using different kind of vehicles and at various angles and velocities. The factors affecting in the design of the wire rope barrier are height of post, distance between the posts, distance between wire rope, etc. wire rope barriers have the potential to reduce the head-on collision. Apart from that w-beam barriers were also checked with various set-up and vehicles.

II. LITERATURE SURVEY

A. Brain A. Coon et al. [1]:

They had summarized the gradual evolution of wire rope safety barriers starting from 1960's in different countries. In the late 1960's, Graham et al., with the New York State Department of Public Works, revised all the existing designs of barriers and determined the best post for cable guardrail systems. Between 1967 and 1968, a series of impact tests were carried out on cable barriers for rural highways by the Ontario Department of Highways. It was determined that the height of the wire rope barrier is the important parameter of performance. In 1987, the Southwest Research Institute (SwRI) performed compliance testing on a modified cable barrier system transitioning into a standard 4-ft flare BCT (W-beam) terminal incorporating a 37.5-ft parabolic curve. Initial testing was with a 2126 kg (4690 lb) sedan impacting at 94.7 kmph (58.9 mph) and 27.3°. In 1990, The New York State Department of Transportation examined their cable barrier terminal ends. The terminal was redesigned due to snagging of small vehicles in departure impacts. In 1993, Laker examined a new cable barrier design that utilized four ropes at two heights with the lower pair of ropes interwoven between the posts. In 1992 and 1995, Yang, Bruno, and Kenyon examined the effects of cable tension on cable guardrail performance. In 1998, Bateman did computer simulation of the Brifen cable barrier system and then it was compared to full-scale testing. In April of 2001, the Federal Highway Administration notified Brifen that the Brifen Wire Rope Safety Fence met the requirements of NCHRP.

B. F. Alexander Berg et al. [2]:

They studied 57 real world crashes of motorcycles and rider impacting road side barriers to identify typical crash

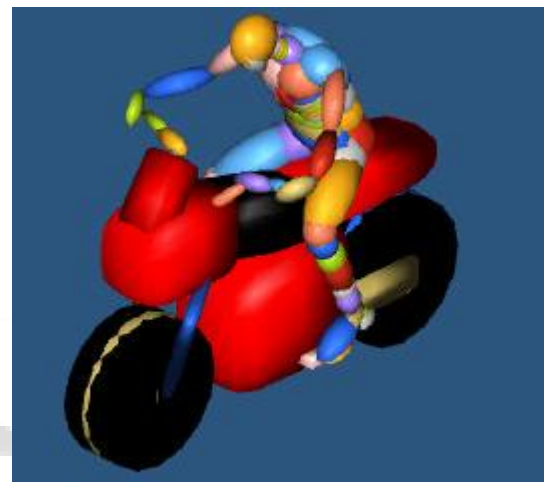


Fig. 1: Motorcycle model

C. Chantel Duncan et al. [3]:

They have listed the types of barriers used with its design feature in and their injury mechanism at Department of Transport and Regional Services Australian Transport Safety Bureau, Australia.

There are three main types of barrier used on Australian roads: rigid barriers, semi-rigid barriers and flexible barriers. Rigid concrete barriers, semi-rigid steel "W" shape beam barriers and flexible wire rope barriers (tensioned cables with frangible posts) have been satisfactorily crash tested.

Rigid barrier (Concrete Barriers): Generally concrete barrier systems are made up of separate interlocking sections joined together to make a rigid, continuous smooth surface. In Australia, concrete barriers are mainly used for median barriers on divided high-speed arterials or as bridge railings.

Semi-rigid Barriers (w-beam barrier): Semi-rigid barrier systems have greater deflection properties than rigid systems, but less than those of flexible barrier systems. W-beam guardrails have a 'W' shape surface that can be used with a variety of post configurations. They are not suitable for potential right angle impacts.

Flexible Barriers (wire rope safety barrier): Flexible barriers have the greatest energy absorption properties among all the three types of barriers. Flexible barriers are

now used to various extents in all Australian states and territories, specifically wire rope safety barrier manufactured by Brifen.

D. Matteo Rizz et al. [4]:

They focused on the motorcycle crashes police reported onto road barrier in Sweden between 2003 & 2010, First to access if injury risk for motorcyclists is affected by collision with different types of barriers and the second, to examine the injury can be affected by being in an upright position during the collision, by using fatal-to-serious (FSI) injury ratio. The injury outcome in motorcycle crashes into different types of road barriers was analysed by the given formula.

$$\text{The FSI ratio} = \frac{\text{no. of fatally or severely injured motorcyclists}}{\text{total no. of injured motorcyclists}}$$

E. Tim Selby et al. [5]:

They reported a brief breakdown of motorcycle crashes and road safety barriers in New Zealand and summarizes the research findings relating to motorcyclists and WRSBs. In New Zealand over the five year period between 2001 and 2005, there have been a total of 3762 motorcycle injury crashes; only 55 (1.5%) of these involved collisions with a road safety barrier. Two of the crashes involved a WRSB. With respect to motorcycle fatalities alone, three out of the 162 (1.9%) motorcycle deaths involved a collision with a barrier; no accidents involved a WRSB.

The research notes that WRSBs have the potential to cause serious injury to errant riders. So, there is no reliable evidence to indicate that WRSBs present a greater risk than other barrier type. It is important to note that road safety barriers should only be installed where it is necessary to protect road users from hazards, where the risk of accidents is more serious and life threatening injuries exist without the barrier being installed.

Association of European Motorcycle Manufacturers (ACEM) identified that roadside safety barriers presented an infrequent but substantial danger to motorcycle riders, causing serious lower extremity and spinal injuries as well as serious head injuries when impacted. The probability of a motorcyclist being killed as a result of impacting with a crash barrier is more than double that for motorcycle crashes generally.

The literature review also identified two alternative forms of protection specifically designed for WRSBs. The two options include aluminium covers for the WRSBs designed by the Baltic Construction Company in Sweden, in response to the 'cheese cutter' concerns. Alternatively, the Santedge Road Safety Barrier design covers both posts and cables. The 2004 Monash report by Mulvihill and Corben notes that the latter product has not been tested nor is it known if such devices have been installed anywhere. Such measures are likely to require large scale expenditure.

F. Tymoteusz pieglowski [6]:

They summarized the construction, testing standards, foundation and repairing the wire rope barriers. The wire rope barriers can function as a central barrier, side barrier and slope barrier. The central barrier is intended to prevent vehicles from entering into oncoming traffic and potentially causing a head-on collision. It is either placed in the base course or in asphalt. The side barrier is used instead of an

ordinary W-beam barrier preventing vehicles from run-off accidents into the road side. The slope barrier have a similar function but are mounted further away from the carriageway, which allows the vehicles to redirect themselves by giving the driver more space and time to react. Generally the central barriers and side barriers have a similar construction with a top rope and 2 lower ropes on both sides whereas the slope barriers have ropes installed only on one side, facing the carriageway, and have longer posts. The wire rope and breakable posts absorbs some of the vehicle's kinetic energy and redirect the vehicle in a controlled manner back to the carriage way. When compared with other barrier types vehicles bounce off the barrier instantly in a hazardous manner.

G. C. Behera et al. [7]:

They studied ninety four cases of motorcycle fatalities received from South Delhi during April 2007 to March 2008 at All India Institute of Medical Sciences, Delhi. They analysed the data with regard to the pattern of injury, use of helmet and presence of alcohol in victim, cause of death, time of accident, mode of transportation of the victims to hospital, age and sex of the victim and offending vehicles. In 93.6% of cases victims were male as compared to female 6.4%. Commonest age group involved was 21-30 years (44.67%). Head injury, including cervical spine injuries, was the most common cause of death with 74.47%. Heavy motor vehicle was the offender vehicle in maximum number of cases (34.04%). Most of the deceased on motorcycle were drivers (78.72%), out of which only 54.05% wore a helmet at the time of accident. None of the pillion riders were found wearing a helmet at the time of the incident. Only six cases (6.38%) were found positive for alcohol.

III. CONCLUSION

The injuries and fatalities of injuries are different for different safety barrier in various countries. In the countries like Australia and Germany the injury outcome after full-scale crash test for wire rope barrier has been found contradictory to each other and the design of wire rope safety barrier is developed with a view to safety of cars and not to motorcyclists, though in the growing country like India the population of motorcycles are far more than that of cars. The impact of rider to the safety barrier sometimes exceeds the safe injury level which can be made safe by design and implementation of wire rope safety barrier.

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