

A Review on Evaluation of Speed Breakers in India

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Abstract:

The easiest and traditional way to control the traffic is calming devices, which are well known as vehicle speed reducers, and these calming devices are used to avoid accidents. Two types of speed breaker vertical as well as horizontal are used around the world to reduce speeds at acceptable levels for the execution of laws with ease. Some faulty designed and abnormal speed breakers also cause various accidents hence these speed breakers always in limelight of objections but today the world is moving towards intelligent speed breakers which could be safe and more environmentally friendly as compared to traditional speed breakers. This review article has investigated the smart and modern speed breakers around the world.

Keywords: Speed breakers, Designs and Types of speed breakers, Health impact

I. INTRODUCTION

In the fast and furious world, the excessive feast is always on the shore-line of topmost vehicle producer companies. As soon as technology approaching on the floor of the beast these vehicle companies trying to design more and more furious vehicles without thinking the influences of such pace full vehicles over the environment and which leads to speedy driving with increasing the chances of disastrous accident but the question is arises here how to control such "Over-speeding" which is the main cause of fatal accidents. Nowadays it becomes very challenging for developing as well as developed countries to control over-speeding, mostly fatal accidents occur due to over-speeding [1]. It is exposed by a literature review that the main cause of accidents is over-speeding, lack of road safety awareness, drunk driving, reckless

driving, over-taking, violation of traffic rules, and distraction this can include talking on cell phones,

eating, texting, and adjusting radio or music player [2]. Driving while being tired may seem like an innocent activity but it is proven to be quite deadly and could be one of the causes of fatal accidents [3].

According to one survey of the World Health Organization, accidents caused 1.35 million death globally. Highways ministry of India reported that 97,588 people were died in 2018 due to accidents caused by over-speeding which accounts the 64.4% of total deaths in India and also confirmed that road accidents increased 0.49% as compared to the previous year 2017. States and Union Territories (UTs) have reported a total of 4,67,044 road accidents in the recent year with claiming 1.5 lac deaths and causing injuries to 4, 69,418 persons where over-speeding is only caused 97, 588 deaths. As per the report of World Road Statistics India placed in rank first for the number of road accidents across the 200 countries and India accounts for almost 11% of accident-related deaths in the world. The cheapest and easiest way to control the speed of vehicles is speed breakers or speed bumps, which are traffic calming devices, speed breakers are installed for the safety of users [4]. If these speed breakers are implemented imperfectly and the design abnormally without the use of proper parameters then they can act as vehicle destroyers and may increase traffic noise [5]. Poorly-designed speed breakers that stand tall or with too-sharp an angle can be disruptive for drivers and may be difficult to navigate for vehicles with low ground clearance even at very low speeds, many sports cars have face kinds of problem with such speed bumps [6].

According to a report of The New York Times which discloses that speed bumps were installed in Chatham, New Jersey in 1906, this scheme of retarding vehicle speed has been discussed in various corporations, but initially put in practice at Chatham [7]. The great physicist Arthur Holly Compton where he was chancellor of Washington University



invented the speed breakers in 1953 and called it traffic control hump afterward he began to designs various speed breakers [8]. As per the one of published articles of the Institute of Transportation Engineers reported that the first speed bump was installed in Europe in 1970 in the Netherland. According to one comprehensive report of the British Transport and Road Research Laboratory which exposes the behavior of vehicles at various geometry of speed bumps was studied extensively in the year 1973. The reports also confirmed that the installation of speed breakers on public roads is prohibited but it was allowed to install on private roads [9].

II. TYPES OF SPEED BREAKERS

Generally, calming devices (speed breakers) are divided into four different forms including speed bump, speed hump, speed cushion and ultimately speed table.

A. Speed Bumps

A small portion of the road surface is deliberately raised to force the public to safe and slow driving; the speed bumps are in the rounded structure. The height of speed bumps usually from three to six inches which can vary in length. Mostly these speed bumps are installed in parking lots and on private roads. Speed bumps are mostly not utilized in public roadways because it generates substantial driver discomfort if encountered at too high speed so it is concluded for speed bumps vehicles should slow to about five miles per hour or maybe less.



Fig. 1 Speed bump preparation and installation in parking lots

B. Speed Humps

Speed humps are usually circular, parabolic, or sinusoidal shaped which is the slightly raised area across the road which gently produces the rocking motions of vehicles that leads to slowdown vehicle velocity up to 15-20 miles per hour.



Fig. 2 Speed hump on roads

The size of speed humps is 3 to 4 inches in height with having travel length of up to 22 feet. It is very effective at controlling the velocity of vehicles without any accidents and discomfort of driving.

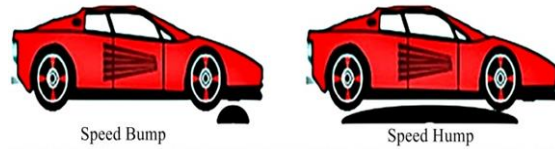


Fig. 3 Speed bump and speed hump

C. Speed Cushions

These are the series of small speed humps that are installed across the road with wheel cut-outs installed at designated widths at a particular distance. Speed cushions are splitting the form of speed humps. Speed cushions are selectively designed to control the speed of ordinary passenger vehicles while allowing free passage for emergency vehicles.



Fig. 4 Speed hump in small lots

D. Speed Tables

These are the flat-topped midblock traffic calming devices is also described as an extended and wide speed hump. Speed tables are generally used in residential areas or busy pedestrians. The main aim of the speed table is to slow down the speed of motor vehicle traffic to a safe speed. It is also used to divert the traffic towards the other non-traffic route. As we discussed previously that there is a total of four types of speed breakers but out of these four two are most common and extensively utilized all around the world, these verticals obstacles are designed to slow down vehicle speed by creating mild discomfort [10].



Fig. 5 Flat-topped midblock calming extended speed hump

III. DISADVANTAGES OF SPEED BREAKERS

As we discussed earlier speed breakers reduce

over-speeding vehicles and avoid the risk of accidents. Many pieces of evidence show speed-breakers can reduce the over-speeding of vehicles and diminishes the risk of accidents, but we can't deny that these speed breakers have also famous to cause accidents and injuries [11].

A. Serious injuries caused by speed breakers

The influences of speed breakers have been evaluated in numerous study which concluded that not only speed breakers are the cause of accidents but also lead to serious damage to the human body such as [12].

- 1) Spinal-cord
- 2) Vertebral-compression
- 3) Disk-prolapse
- 4) Neck-pain
- 5) Slip-disk
- 6) Spine-injuries
- 7) Back-pain



Fig. 6 Injuries caused by speed breakers

B. Unscientific and abnormal speed breakers cause road accidents

Road transport and highway ministry of India reported that 9 people get loosed their lives in a day because of faulty and unscientific speed breakers and almost cause 30-50 accidents daily. According to one report of The Indian express that says unwieldy speed breakers could be equally deadly for those traveling on a bus or in any other automobiles. In June 2016, 20 years old civil engineer fell from a PMPML bus after it bumped by a faulty speed breaker on the Pune-Mumbai highway at Phugewadi on the same day of the incident a girl who was a resident of Chinchwad fell off the bus and sustained a serious head injury and a few days later she passed away [13].

C. Damaging effects of speed breakers on vehicles

Most vehicles are getting declined and disintegrated due to bottom level damage such as the front bumper, engine oil pan gasket, brakes, suspension, tube tires, and many other critical internal parts get damaged by speed breakers [14-15]. Fig.7 shows damaging effects.

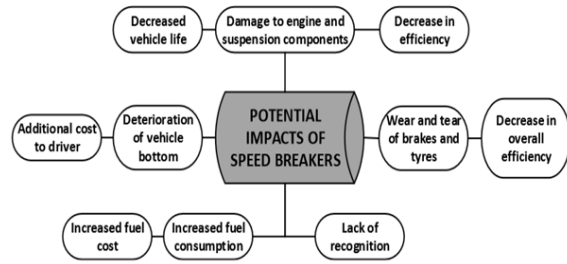


Fig. 7 Damaging effects of speed breakers on vehicles

D. Noise pollution by speed breakers

There are various sources of noise pollution such as industries, household gadgets like a mixer, grinder, vacuum cleaner, etc., constructions of City Street, highways, and public works but transportation is one of the major and consistent sources of noise pollution which is strenuous to avoid. Road automobiles, airlines, and railways the main cause of transportation noise. According to one recent research which examined the effect of speed bumps on road congestion noise levels, numerous voice samples of automobiles such as two-wheeler, three-wheelers, buses, cars, and lorries was measured before and after speed breakers under undisturbed traffic condition and it was found that highest noise volume diverse between 71 to 80 dB without speed bumps however noise volume elevated to 5 dB additional due to speed bumps specifically for lorries and three-wheelers. The results showed that there is a remarkable impact on the noise volume at a short distance from the speed bump by a few categories of automobiles [16].

IV. DESIGN AND DEVELOPMENT OF SMART SPEED BREAKERS TO AVOID THE ACCIDENTS AND INJURIES

To avoid the risk of accidents from faulty speed breakers many countries initiate developed smart speed breakers such as automated speed breakers, hydraulic speed breakers, liquid speed breakers, and three-dimensional speed breakers, etc.

A. Three dimensional (3D) painting speed breakers

The New Delhi Municipal Council (NDMC) has put forwarded the innovative idea in the traffic calming devices field by installing the newly well-designed three dimensional (3D) painting speed breakers to avoid the risk of accident from abnormal speed breakers on the Bajaj Marg, this virtual speed breaker exactly looks like the real speed breaker [17].



Fig. 8 3-D painting speed breakers

This innovative idea has taken as an initiative to make traffic movement smoother and to avoid the risk of accidents from abnormal speed breakers in the area under its jurisdiction. According to NDMC if this novel idea would be successful this practice can be applied in other areas that are under the NDMC. They also reported the input of traffic will be taken under the trial of this novel idea and the same practices have been under trial in the other region of India.

B. LED speed breaker

According to the newspaper Telangana today which reported that Hyderabad traffic control installed an innovative LED speed breaker at the KBR park junction to control the traffic and fast riders just for experiment and the results would be noted if it will be successful, they will install more devices around the entire city. This new idea could be safe and revolutionary for the future in the field of traffic control. Traffic police inspector M. Narsing Rao said that all implemented LED lights are waterproof and it not only helps the riders to obey the traffic guidelines but also helps to avoid the risk of accidents [18].



Fig. 9 LED speed breakers

C. Digital Image Processing (DIP) and AVI software tool method

As per one recent study of Indian researchers which reported the novel technique that is Digital Image Processing (DIP) method and AVI software tool which was utilized to trace speed breaker threat just before they come in the way of the driver by the aid of certain voice and display. The main objective of this invention was to sort out the problems of sudden damage by unrecognized speed breakers to delicate parts of classic and costly automobiles such as suspension, engine, etc. Damage is caused when vehicles moving at extreme speed over unrecognized speed breakers. The technique concluded that if the automobiles are automated afterward output of Digital Speed Processor (DSP) can be provided to automation control precisely. The research claimed that the DIP

technique is a more efficient and error-free tool as compared to other sensor detected or software-based speed breaker detected techniques [19].

D. Acti-bump anti-speeding system

A Swedish Company Edeva has developed an anti-speeding system; basically, they designed the smartest speed bump called Acti-bump. First Actibump was successfully installed in Sweden in 2010 at Linkoping then installed in other regions of Sweden [20]. The acti-bump is installed to control the heavy traffic roads where the limit of speed is 40-60 km/h. This smart system is also used at airports, Toll stations, etc. It is a powerful system that maximizes road safety and accessibility while lowering emissions and noise



Fig. 10 Acti-bump anti-speeding system on the road

E. BIV (Intelligent Speed Bump)

Spanish company Badennova designed the BIV (Intelligent Speed Bump). This speed reducer is completely different from the traditional speed breaker. This novel technique is designed to stops the motorist who drives too fast. The interior of such speed bumps is particularly filled with non-Newtonian viscous liquid which alters its viscosity when pressure is given at high velocity and the exterior made of soft deformable material. When the vehicle passes over the speed bump at very high speed the liquid becomes harden but when the vehicle passes slowly over the bump it becomes soft, the liquid will not allow rapid deformation and transfers its shock to the vehicle. This intelligent speed breaker has been tested over five year’s duration under proper observation after its successful trial it is installed across the country.

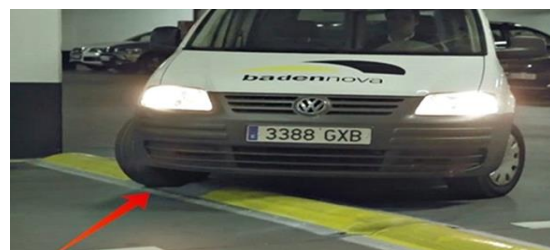


Fig. 11. BIV (Intelligent Speed Bump)

F. Speed-breaker early warning System (SWAS)

Indian researcher Mohit Jain, Ajeet Pal Singh, Sushant Bali, and Sanjit Kaul has reported the new smart technique named the Speed-breaker early warning System (SWAS) that utilizes smartphone-based software to inform the driver very earlier when the vehicle is arriving at a speed-breaker. These innovative techniques provide an alert warning to drivers for over-speeding. SWAS can warn the driver even when there are no warning signs or lights on the road, or when the markings are inconspicuous due to low visibility conditions. This advanced application of smartphones takes the aid of a GPS and downloads all speed-breakers in the vicinity after that it starts tracing the smartphone's GPS location and alerts the driver when the vehicle reaches a speed-breaker. A smartphone-based application is a smart and low budget solution for all countries [21].

G. Power generator Speed Breakers

It is very efficient to develop a pollution-free energy-producing system. In this contemporary world, the researcher designed the innovative mechanical speed breakers that can be used for dual purpose traffic control, as well as a power generator, these innovative genera of speed breakers, are referred to as speed breakers generator (SBG) or speed breaker power generator (SBPG).

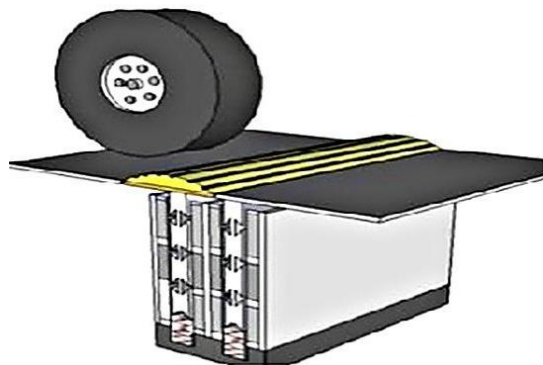


Fig. 12 Power generator Speed Breakers

This idea is extremely tremendous which based on utilizing the wasted kinetic energy of automobiles which are moves over speed breakers. SBG or SBPG utilizes a well-organized linear technology with two isolated translators which can be pulled down by disk of automobiles to absorb the kinetic energy of these vehicles and this kinetic energy converted to mechanical energy through an electromechanical principle and ultimately this mechanical energy will be converted to electrical energy by generator and stored in batteries [22].

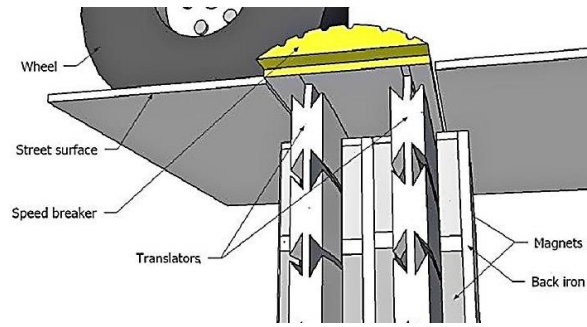


Fig. 13 Power generator Speed Breakers specifications

V. CONCLUSION

This review article emphasizes the short literature review on traffic calming devices and the latest technology regarding it. It will be helpful for researchers, analysts, and government agencies, who are researching smart speed breakers. This review article investigated the innovative ideas of research around the world for developing smart speed breakers. Nowadays to control the over-speeding, traffic traditional calming devices is not a complete solution as we discussed earlier that traffic calming devices possess various disadvantages but in this new technical era smart speed breaker could be the best and safe solution for traffic control and over-speeding, It is concluded that world needs more smart and innovative speed breaker for road safety in low cost.

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