A Review Paper On Smart Road & Safety

Ajinkya Ruthe[1], Minat R. Sarote[2], Harsh S. Agrawal[3], Ganesh N. Sayam[4], Vishal B. Walke[5], Prajakta P. Gajpure[6]
[1]Assistant Professor, Dept of Civil Engineering
[2, 3, 4, 5, 6]Dept of Civil Engineering
[1, 2, 3, 4, 5, 6] Smt.Radhikatai Pandav College Of Engineering, Nagpur.

Abstract- *India has the second largest road network in the world. In today world the traffic is a main problem for every people. This traffic occurs due to increasing availability of vehicle on the road as we see that every people. The effect of raise in vehicle count grows the traffic congestion. It results in wastage of energy, time and environmental pollution and road safety continues to be a major developmental issue, a public health concern and a leading cause of death and injury across the world. Every year, around 1.5 lakh people dies on India roads, which translate, on an average, into 1130 accidents and 422 deaths every day or 47 accidents and 18 deaths every hour. The Ministry of Road Transport and Highways has published the annual report 'Road accidents in India – 2021'.The report provides information on various factors of road accidents in the country during the calendar year 2021. Most important method to bring down accidents is strict enforcement of speed limits, 90% of accidents can be avoided by strict action of speed limits.*

Typically, there is very little technology that goes into roads. They tend to be made out of the Rolling Barrier, speed breakers using Non-Newtonian fluid and rain harvesting on road.

Keywords- Rolling barriers system, rolling barriers, accidents, horizontal curve, rolling barriers on horizontal curve, non –Newtonian fluid speed breaker, viscosity.

I. INTRODUCTION

India ranks top when it comes to number of accidents on the road. However, in the current years, improvement has been seen in this area. With the rapid increase in the number of vehicles on the road, the traffic are under a lot of pressure. Therefore, road safety is one of the most serious public health issues in our country. It has an impact on every person, whether one drives a vehicle, walks or rides a cycle.

II. LITERATURE REVIEW

Literature survey: A Study on the Behavior of Speed Breakers using Non-Newtonian Fluid and Comparison with Conventional Speed Breakers

1. **S. Revathi and A. Senthil Kumar (2020)** Compared to the state before the speed bumps were installed, statistically significant speed reducing was achieved. The values of the measured speeds became lower as the speed bumps height raises. At locations where larger pedestrian presence is expected, speed bumps can successfully reduce the speed of vehicles. The application of traffic calming measures, such as speed bumps, significantly provide to the safety of pedestrians.
2. **Teja Tallam and Jyothi Makkena (2017)** aims to find the different of speeds of different class of vehicles at speed breakers and to develop a model for finding the bump height that should be installed at that particular road for a given safe speed limits of different types of vehicles on that road.
3. **Mr. Kyusoo Chong and Hongki Sung (2015)** Authors aim is to study to investigate the prediction technology based road safety on the roads large volumes of data. This study examines actual cases of road management systems and technologies of road safety analysis in Korea and other countries. Types and ease of use of the information collected through the road of a road management system are analyzed. Based on the result, the limitations of existing technologies and management systems are analyzed.
4. **Sabhijit Singh Sandhu, et. al. (2015)** Performance traffic systems depends largely on its ability to react to changes in traffic patterns and different conditions. In traditional systems, traffic lights green track fixed time intervals regardless of the density of traffic.A traffic model-intelligent agent that manage the amount of time implemented a green light to run, based on the number of cars (density) standing in the light.
5. **Madhavi Vaidya and Shriniwas Deshpande (2012)** Traffic blockage on the road network is characterized by slower speeds, increased travel times and long queue of vehicles. We are all noting that the volume of vehicles is increasing day by day with high rate, but compared to it, the road infrastructure is not. It leads to increasedtraffic congestion. Different technologies are used to detect traffic congestion and congestion more effective decisions. Therefore, a lot of techniques have been discovered. In this paper, the author has studied the technique of radio frequency identification (RFID) used

to control traffic congestion. It created from data that has to be processed and then used by the several control systems of traffic on the road. The data processing can create a problem because of the large volumes of data.

Understanding Road Safety

Road safety refers to the measures which must be adopted by all while using roads. These safety methods are meant for reducing the risk of accidents and injuries or causalities on the road. These rules must be followed by every user of roads including pedestrians, cyclists, motorists, and bus and truck drivers.

Safety methods also relate to the construction, layout of roads as well as traffic regulation systems. So, we can summarize that road safety involves:

- The design of roads and highways;
- Laws pertaining to traffic and vehicles
- Systems of traffic safety and control;
- Driver education;
- School students & mass education
- Traffic regulation and road safety signs;
- Vehicle design;
- Motor vehicle safety inspection and maintenance.

III. ENABLING TECHNOLOGIES

3.1 Rolling Barrier

Rolling Barrier redirects errant vehicle to the right direction by effectively absorbing the impact energy with rollers, upper and lower rails (they convert that impact energy into rotational energy) to propel the vehicle forward preferably potentially breaking through an immovable barrier. When a car hits the barrier, the rotating barrel converts shock from the vehicle to rotational energy. Both the frames adjust tires of large and small vehicles to prevent the steering system from a functional loss. The Rolling Barrier can be productively used in curved roads sections, ramps, medians and entrance or exit ramps in parking garages.

If it hilly area then the vehicle can fall down or vehicle can go back of the road then other vehicles can hit the vehicle which is coming from opposite side. Both cases are can take lives of people. The rolling barriers do more than absorb impact energy. They convert that impact energy into rotational energy to propel the vehicle forward rather than potentially breaking through an fixed barrier.

Here our target is to save the lives of people after clashing. For this we are introduce an idea Rolling barrier to save the lives.

Fig. 1 Rolling barrier in hilly area

3.1.1 Reason of using barrier

Roadside barriers are typically placed to prevent errant vehicles from colliding with hazardous roadside objects such as signs trees, abutments (bridge, pier), rock, outcrops, culverts, bodies of water, embankments, cliffs, ditches, electricity substations, retaining walls, poles etc. Roadside barriers are also frequently used to protect pedestrians by standers or property. Road safety equipments are required to protect drivers, passengers, as well as other road users in case of an accident.

In the case of a steep decline, a truck may hit malfunction and start rolling down or back on the road like a runaway train. Where the road is a two carriageway, the diversion of other side of the lane may not be aware of such an emergency. At a sharp turn, the truck may be unable to steer the vehicle as properly and could drive straight to the other lane, thereby endangering the lives.

A well trained road divider can stop the truck from crossing over and knocking the oncoming traffic. Similar barriers in the form of bollards can also control a vehicle from rolling down a cliff in the case of a slippery road surface occasioned by snow and rainfall. Fixed road bollards significantly reduce the risks of major accidents as a result of placing of permanent road barriers along strategic and high-risk sections of the highway. There are instances where burglars use vehicles to ram into the shop fronts to gain access. These happening secluded areas where the criminals take benefit to implement such methods. With the erection of fixed barriers, this situation cannot occur.

As such, your business premises, as well as your employees and customers, are safely protected from ram riders. Protection of an out of control vehicle from breaching

the media lane to confront the opposite traffic. For this reason, a continuous fixed road barrier is typically erected to divide the two sections of the road. In figure 2 you can see a vehicle hit the barrier (rolling barrier) and that vehicle is still on the road if there had no barrier that it would go forward and if there had a hill then it would fall. That's why there use a barrier.

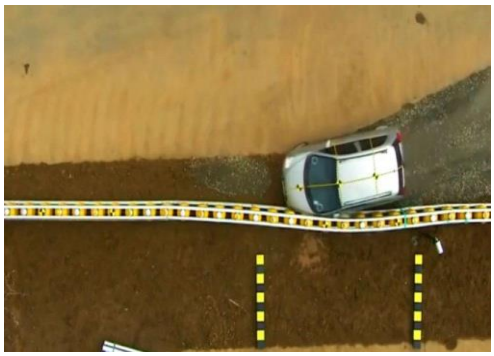


Fig. 2

3.1.2 Purpose of using rolling barriers:

- To reduce the accident numbers.
- To reduce the severity of accidents.
- To reduce the damage to vehicles.
- To reduce the injury to human body.
- To save lives from accidents

3.1.3 Advantages of rolling barriers are:

- It increases the safety of humans, animals and vehicles.
- It has shock absorbent system, which reduces sudden shocks on vehicles.
- It converts shock energy to rotary rotational energy.
- It is easy to install, and maintenance required is also less than normal barriers.
- It gives good visibility at night also, with help of reflective tape.
- It has more serviceable life than normal barriers.
- It prevents sudden stoppage and overthrowing of vehicles after collision.
- It can be made by recyclable materials, thus it's eco-friendly.
- It may have high initial cost but the final cost is less as maintenance required is less and it has more life.

3.2 Smart speed bump

The speed Bump is a pioneer product in the safety whose main purpose is to serve as a speed limiter for vehicle on any road. It is a smart and selective device since 90, it is an obstacle only for those vehicles exceeding the speed mentioned on a specific road and not affect to the vehicles that circulate respecting the speed limits.

The need to create a device with these characteristics is due to the serious deficiencies of the current speed bumps: Traffic accidents; Back injuries; Damages in nearby properties; Negative effects on adjacent. The Smart Speed BUMP (SSBUMP) resolves all these deficiencies detailed before, because it is highly innovative, thanks to technology patented worldwide by Badennova.

The SSBUMP properties are achieved due to the non-Newtonian material that is contained in the SSBUMP, which liquid state is its usual mode, but at the time it receives an impact at high speed it passes to a solid state until the end of the impact. In this sense, SSBUMP doesn´t offer any resistance to the drivers who respect the speed indicated, on the contrary it is an obstacle for the drives that don´t respect the speed limit. This material is biodegradable and nontoxic and non-polluting.

Fig.3 Smart Speed BUMP

3.2.1. Materials of Non-Newtonian Speed Breaker

The major materials used in making of non-Newtonian fluid speed breaker:1. Polyethylene glycol
Three types of fumed silica nano particles (figure 5) with different sizes, which are:

- OX50 with a primary spherical particle size of 40 nm and a specific surface area approximately 50m2/g.
- R972 with a primary spherical particle size of 16 nm and a specific surface area approximately 110 m2/g.
- R974 with a primary spherical particle size of 12 nm and a specific surface area approximately 170 m2/g 20.

3.2.2.Preparation

- The carrier fluid is Polyethylene glycol (figure 4) (H[OCH(CH3)CH2]nOH) with three different average molecular weight 400 g/mol, 1000 g/mol and 3000 g/mol Preparation.
- The carrier fluid was mixed with fumed silica particles by using a blender to mechanically stir the two components into uniform distribution. In order to get a good dispersion of STF, the suspensions after the stirring procedure were conducted to pass three-roll mill six times.
- A three-roll mill is a mechanical tool that utilizes the shear force created by three horizontally positioned rolls rotating in opposite directions and at different speeds relative to each other to mix, refine, disperse, or homogenize viscous materials fed into it. Finally, the fully mixed STFs were placed in a vacuum chamber to eliminate bubbles inside the STF. The concentrations of the STF conducted in this study are 7.5%, 10%, and 12.5 %w/w.
- Rheological Tests and Results: As for rheological property tests, rheological measurements were performed on a stress-controlled Rheometrics Scientific AR2000 exeheometer. Varied dynamic frequency tests were conducted by using a 40mm diameter cone-plate tool with a cone angle of 4 degree and a gap of 0.4 mm between the plate and the twitter. shows the experimental result of relationship between the viscosity and the shear rate of the carrier fluid applied under steady state. It shows that the polypropylene glycol matrix is a Newtonian fluid whose viscosity keeps at constant value under different shear rate.2.
- Polyurethene rubber sheet Polyurethane (PUR and PU) (figure is 5 a polymer composed of organic units joined by carbonate (urethane) links. While most polyurethanes are thermosetting polymers that do not melt when heated, thermoplastic polyurethanes are also available. Polyurethane polymers are traditionally and most commonly formed by reacting a di- or triisocyanate with a polycol.
- Since polyurethanes contain two types of monomers, which polymerize one after the other, they are classed as alternating copolymers. Both the isocyanides and polycols used to make polyurethanes contain, on average, two or more functional groups per molecule. In the speed breaker system the speed breaker is made up of mild steel strips (8mm thick)(figure 3).
- The dome is speed breaker is welded with the frame which is rectangular in shape and made of 3 mm angle iron made of mild steel sheets of 6 mm thickness. Dome of speed breaker is welded with the frame which is rectangular in shape and made of 3 mm angle iron.

Fig.4 Polyethylene glycol

Fig.5 **Nano silica fumes**

3.3 Solar Road Paint:

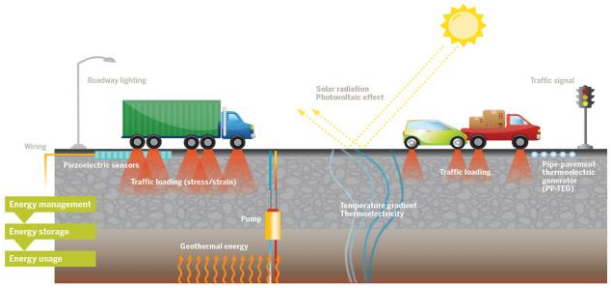
The Smart Highway project is a system of interactive and sustainable roads. Using new designs and modern technologies, designer Daan Roosegaarde and Heijmans Infrastructure are working to develop roads that are both sustainable and smart using light, energy, and signage that interact with traffic.

The project's first installment, Glowing Lines, was observed after a 3-month trial period in the Netherlands. These lines consist of solar paint that collects energy during the day and can glow for up to 8 hours to increase visibility and safety at night. Other components of this innovative project include Dynamic Paint, Interactive Light, Induction Priority Lane, and Road Printer. Another component is the Van Gogh Bicycle Path, which is a 600-meter-long light-emitting two-wheeler path made of thousands of twinkling stones and that inspired by Vincent Van Gogh's Starry Night.

3.4 Smart Pavement Technology:

Integrated Roadways has expand systems that communicate information about weather, traffic, accidents, and other roadway conditions both to vehicles and to central processing hubs or emergency response teams. Integrated Roadways is a Kansas City technology startup that is developing a technology called Smart Pavement that will not only help increase roadway safety but also serve as the Wi-Fi platform for cars and other mobility services.

The Smart Pavement road system uses high-resolution optic sensors and other technologies inside the pavement to detect vehicle positions and roadway conditions in real time as well as roadway situation. These embedded sensor systems can also detect accidents and inform emergency responders automatically. Integrated Roadways installed a pilot test of its Smart Pavement technology in Colorado in the spring of 2018; and in the spring of 2021, the company was reported to be moving ahead with plans to install the technology in Lenexa, Kansas.



IV. CONCLUSION

In the paper, we have discussed the recent 10 technological advances and developments in the area of smart roads. They include: (i) Rolling barrier, (ii) Smart speed bump (iii) Solar road paint, (iv) Smart Pavement Technology. These advances will aid in the progress, development and realization of smart transport for future smart cities. Just as highways changed the way of shopped, lived, worked and did business, smart roads will follow suit with increase in safety and efficiency of transportation there can be positive effects on the environment, businesses and the economy.

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[3] Dr.KVBSR Subrahmanayam, Dr. Ram Deshmuk, B.Abhilash, M.Ganesh, CH.Nirosha, S.Mahesh 1Associsative Professor, Department of Electrical Engineering, SR, Engineering collage, Warangal, Telangana, India. 2Head of department, Department of Electrical Engineering, SR, Engineering collage, Warangal, Telangana, India.

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