6th Conference on Sustainability in Civil Engineering (CSCE'24)
*Department of Civil Engineering*
*Capital University of Science and Technology, Islamabad Pakistan*

# ASSESSING THE COMBINED EFFECTS OF STEEL SPEED HUMPS AND ROAD STUDS ON SPEED REDUCTION

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***Abstract-*** The safety and efficiency of roadway design greatly influence traffic flow and accident prevention. In this paper, the effects of road studs and steel speed bumps on vehicle behavior when combined are studied. The study is intended to provide an in-depth understanding of traffic calming devices on vehicle dynamics and road safety. To investigate the effects, selected designs, or a combination of designs of steel speed hump and road studs were used to conduct an extensive field study of two months from Dec-2023 to Feb-2024 in a controlled urban area. The number of vehicles tested were hundred in total which involved 50 Cars, 30 Bikes, and 20 Heavy Traffic vehicles. The test area consisted of steel speed humps and strategically placed road studs. In our study, we analyzed data that profiled a sample of cars based on the speed data readings and the acceleration and deceleration patterns in graphical charts. The findings show that using road studs in combination with a steel speed hump adequately reduces the speed of a vehicle and by extension help in a safer way of driving in areas where illegal speeding is rampant. Road studs enhance the visual perception of the driver and, thus, consistent engagement in the deceleration and speed decline. Moreover, a drastic decrease in the number of cases of sudden braking occurred when both speed bumps and road studs were implemented as cars rolled over the humps rather than braking to drive over them. Although the implementation of the above components dramatically improves traffic safety, our study identifies numerous challenges. Firstly, humps and studs should be designed optimally as cars experience increased wear and tear of the suspensions and wheels, whereas, at high speeds, the drivers may feel uncomfortable. Based on our study outcomes, substantial attention seems appropriate regarding speed bump height and spacing and the number and location of road studs that should be factored into their use to avoid unfavorable effects and maximize safety benefits. In summary, combining steel speed humps and road studs has great potential to improve road safety. More investigations should focus on designing and positioning them to achieve a traffic-calming-vehicle performance tradeoff in a balanced way. This article contributes to the body of knowledge for urban planners, traffic engineers, and policymakers to make roads safer in urban areas.

***Keywords-*** Traffic calming, Speed Humps, Road Studs, Traffic Engineering.

## 1 Introduction

One of the primary risk factors for road traffic safety is speed, which affects the likelihood and seriousness of accidents[1]. Ensuring drivers adhere to speed restrictions is one of the primary responsibilities of the organizations in charge of road safety[2]. Traffic engineers use a variety of physical speed control techniques that can be used individually or in combination to lower the speed to a reasonable level[3]. A research report highlights the issue of speeding in Denmark and the use of speed hump to reduce the matter of speeding[4]. It's critical to evaluate the effects of safety measures on road safety after a predetermined amount of time has passed since they were installed. Different studies have been made regarding this topic one of the studies concludes that installing TRS (Transverse Rumble Strips) with road studs effectively reduces speed, which is consistent with the results of the public opinion poll[5]. In this study, we concluded that It's important to ascertain whether road safety precautions placed in specific areas have a beneficial effect. For a traffic planner who is primarily looking to address the problem and come up with a plan that would satisfy predetermined objectives, it is crucial to understand the relative impact of different traffic calming mechanisms. From a scientific perspective, in

addition to the technical aspect, an economic assessment should be made, including a societal cost-benefit analysis, to assess whether safety benefits justify the cost. Steel speed humps and road studs can be combined to reduce speed and make the road safer[6].

One critical factor resulting from these methods that must be considered is their impact on driver behavior and traffic flow. The various methods, including speed humps, road width narrowing, and blocking, circles, and signage, can affect road behavior and safety[7]. Therefore, traffic control should only be concerned with specific aspects and how others would be overly positive or burdensome and determine that point will minimize the harm to achieve the optimal balance between safety and efficiency. This focus is essential with a long-term view of creating a safe and feasible traffic regulatory regime.

Economic analysis should also be conducted to determine the cost-effectiveness of traffic-calming measures in other locations. Policymakers would be able to balance the conduct-related costs with those related to the installation and maintenance of security measures and compare the benefits of security using the open-cost technique. The most cost-effective types of investments in terms of traffic safety superiority and the decrease in accident frequency are more financially rational using this method.

To conclude, the understanding of the comparative advantages of different ways of traffic calming and economic analysis are important parts of the creation of comprehensive and effective driving control measures. Road studs and steel speed bumps are the two most effective methods of reducing car speeds and improving the safety of roads, which, in turn, will allow an improvement in the transport system for everyone[8].

## 2 Literature Review

Analyzing the impact of traffic calming devices has always been a topic of study in the field of road safety. To determine their effectiveness, we need to collect data from different types of vehicles passing over different types of traffic calming devices to know the significance of different types of these devices. One of the studies concludes that the installation of TRS with road studs effectively reduces the speeds of vehicles from each category. To determine whether TRS with road studs is effective and how people feel about it, this research is carried out on a section of TRS with road studs[5]. Another study determined the variation in speeds by different categories of vehicles when encountering speed breakers and created a model for determining the appropriate height of bumps that should be implemented on specific roads, by the given safe speed limits for different vehicle types[9]. Several studies have shown that as the class of the vehicle increases, the percentage of speed reduction of vehicles increases at the location of traffic calming devices[9], [10].

*Figure 1: Steel speed hump along with Road studs*

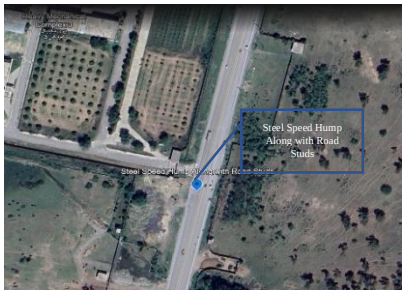


*Figure 2: Study Location on a dual carriageway*

## 3 Research Methodology

The purpose of the investigation was to ascertain how much steel speed hump along with road studs reduced vehicle speed. The investigation was conducted on an urban road with high traffic volume and a track record of speeding incidents. Using speed detection tools, including a radar gun, vehicle speeds were recorded at several points along the route. Before and after the installation of the traffic calming devices, data was gathered. After collecting the information, the average speeds were noted before and after Traffic calming devices. The effect of road studs was determined based on instantaneous speed and the vehicle type. The study site was divided into two points before 150ft and after 150ft. Speeds were noted at both points using a radar gun and speed data was collected for different types of vehicles.

## 4 Study Location

The study site we chose was at least 3 km away from the main city. It was an industrial area where the movement of different types of vehicles was repeated throughout the day. *Figure 2* shows that the study location was selected away from any traffic signal and any intersection. It was an industrial area and the road was dual carriageway.

## 5 Results

The results were analyzed to determine how well road studs and steel speed bumps work to slow down moving cars. In-depth tables and charts were used to present the results and show how the average speed and speed distribution changed before and after the traffic calming device. Comprehensive data tables and visual charts are used to show the difference in average speed and speed distribution before and after the steel speed humps. Graphical representations of distinct vehicle speeds before and past the Traffic calming devices are shown in *Figure 3* below.

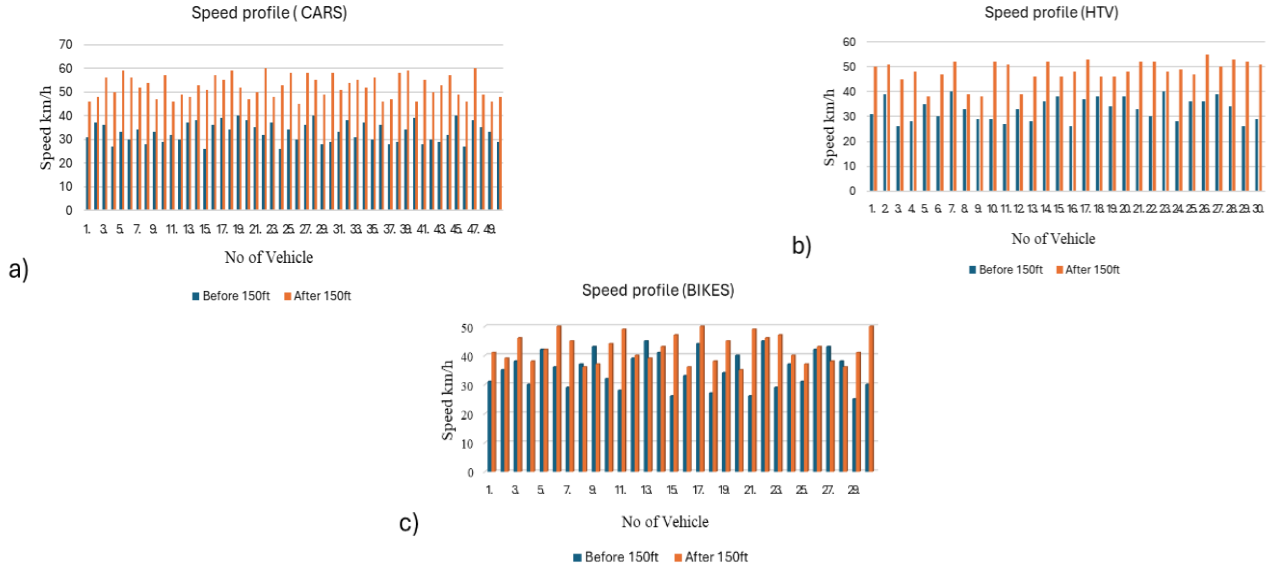


*Figure 3: Speed Profile graph for different types of vehicles, a. Speed profile of Cars, b. Speed profile for HTV, c. Speed Profile for Bikes*

From empirical studies, it has been determined that steel speed humps along with road studs could not positively impact the reduction of velocities of the vehicular type bike within the proximity of the Road Studs. The reason behind this was the difference in drivers' behavior. Behavior changes depend on the type of vehicle, region to region, etc. The speed of various kinds of vehicles was measured using a radar gun before and after the steel hump along with road studs, as illustrated in *Figure 1*. Vehicle speeds were shown to decelerate/decrease before 150 feet of the traffic calming device. Their average speeds were noted. The study of the obtained speed data demonstrated a considerable decrease in average vehicle speed following the installation of steel speed bumps and road studs, shown in *Table 1*.

*Table 1 Average speed before and after steel speed hump*

| Type of Vehicle | Average speed before hump (150ft) | Average speed after hump (150ft) | Average percentage difference |
|---|---|---|---|
| **Car** | 33.02 | 52.26 | 45.12% |
| **Bike** | 32.86 | 48.13 | 37.70% |
| **HTV** | 35.20 | 42.23 | 18.15% |

## 6 Practical Implementation

For anyone working in traffic engineering, urban planning, or policymaking who wants to improve road safety in urban areas, this article offers insightful information. This study opens new doors for finding the impact of different types of road

studs on different types of vehicles. The study provides the information that steel speed hump along with road studs have different impact on cars, bikes, and HTV, which shows the difference in drivers' behavior.

## 7 Conclusion

The study aimed to assess the extent to which road studs and steel speed bumps are effective in reducing the speed of cars in a dual-carriageway urban route. The study provides critical findings on using steel speed bumps given its comprehensive approach in terms of data collection before and after the installation of the road traffic-restraining measures.The obtained results undoubtedly demonstrated that adding road studs and steel speed bumps significantly reduced the speed of cars. Firstly, the mean speed had fallen by 10-15 km/h. This is a powerful speed reduction indicator. Secondly, the percentage of cars going over the limit again dropped, which means that the drivers' behavior improved.

In conclusion, the above study provides robust evidence that road studs and steel speed humps are effective in reducing vehicle speeds and encouraging safe driving behavior on urban roads having a dual carriageway. This work has immense policy implications by emphasizing the urgent need to implement effective traffic calming methods to promote road safety and enhance the overall quality of transport infrastructure. From a practical standpoint, these findings will be invaluable to agencies involved in activities related to urban integration, planning, and traffic management. In the end, more research in this field will help us in the future to improve our knowledge of the connection between traffic calming interventions and road safety, which will lead to the creation of safer environments and more efficient methods for reducing risks associated with traffic. This study also helps in future research, finding the optimal spacing of speed humps in different combinations of road studs, a valuable study tool for field engineers to design traffic calming devices geometry for speed control of vehicles. There is also no comparison between different income and socioeconomic groups, between different developing and underdeveloped countries. In the future, we can give names to different combinations of road studs as there are no such names given to them.

## Acknowledgment

The authors would like to thank every person/department who helped throughout the research work, particularly the CE Department, FWO, and Muhammad Bilal Khurshid

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