Quantifying Existing Speed Control Measures and Correlating its Influence on Traffic Behaviour

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Abstract- *A speed breaker is a hump surface across the roadway having a rounded shape with width greater than a wheel base of most of the vehicles using the road. Over speeding has been a major cause of accidents therefore for controlling speed & traffic speed breaker plays a major role. Speed breakers alert drivers and cause them to slow down the vehicle. Improper design of speed breaker also causes various health problems & wear tear in vehicles. As speed breaker is very important factor in controlling traffic. So, it is necessary to provide standard speed breaker. In Amravati city it is seen that at many places irrespective of authorization, need, technical design and serviceability speed breakers are provided in willy-nilly fashion at unwanted locations in bulk number creating health problems for citizens also wear-tear & maintenance problem for vehicle. Based on all season news and comments regarding exiting unwanted speed breaker and haphazard traffic situation in Amravati city. For this research field study is carried out on main roads of Amravati city. Also, other existing traffic control measures and situation thereof is also studied. From research it is found that 62% speed breakers are having single hump speed breaker and 38% locations multiple humps are provided.*

Keywords- Speed breakers; accidents; over speeding; health problems; traffic control.

I. INTRODUCTION

Rural roads are generally designed for design speed of 50 km/h in plain and 40 km/h in rolling terrain. On the low volume roads drivers have tendency to cross these limits. Over speeding has been a major cause of accidents on certain location and most vulnerable are pedestrians and riders of two wheelers. To control the speed of vehicles on rural roads at such locations, some engineering measures are available. Constructing a speed breaker with sigh post and marketing has been most effective measure in regulating the speed of vehicle. Speed breakers, where permitted to be installed, provide visual, audible and tactile stimuli which alert drivers and cause them to slow down. Speed breakers can have different heights, lengths and spacing. In fact, no particular design is suitable for all the types of vehicles using the road. For example, a speed breaker designed for trucks can be dangerous to motor cyclists and one designed for motor cyclists will be not effective for trucks.

Driving at a certain speed involve risks on the drivers and pose danger to the passengers and pedestrians. Hence, measures are taken to control and reduce speed especially at road sections where the right-of-way for different road-users is in conflict. Speed control or reduction not only can maintain steady traffic flow in accordance with the design road capacity, but can also ensure safety for drivers, passengers and pedestrians. Among the various means of speed control/reduction, speed hump is one of them. Although speed humps are very effective in keeping vehicle speed down, their use is sometimes controversial as they can cause noise and possibly rider discomfort and vehicle damage if taken at too great a speed. As a traffic-calming tool designed to limit driving speed, circular profile speed hump is raised. A road hump is a raised segment of a roadway that is installed primarily to control vehicular speed. This traffic calming device is generally employed on residential streets where low speeds (30 – 40 km/h) are highly desired. When traversing a hump, drivers are compelled to reduce the speed of their vehicles in order to minimize uncomfortable bumping and vibrating sensations. There are many factors that influence a driver's choice of speed when negotiating a hump. The perceived speed for safe and comfortable passing plays a major role in the driver's decision on how slow he would need to steer his vehicle over the hump. Equally, the design of the hump has a huge impact on speed choice. Road humps are designed to promote orderly traffic movement and improved safety. However, at certain locations such as approaches to manned & unmanned level crossings, sharp curves, accident prone locations, congested residential streets, control of speed may become necessary to allow smooth flow of traffic. However, in an uninterrupted flow facility, with a strong emphasis on traffic safety & management, use of road humps can't be underestimated. Road humps, where permitted to be installed, provide visual, audible and traffic stimuli which alert drivers and cause them to slow down. These can have different heights, base widths and shape. In fact, no particular design is suitable for all the types of vehicles using the road. Though speed control humps are commonly used, well accepted design guidelines are not readily available. The design recommended

herein is a compromise design to suit average Indian urban road traffic conditions and is based on design given by IRC. In this regard existing situation of speed breakers provided in Amravati city are inspected in this research.

II. OBJECTIVES

1. To carry out the literature survey and theoretical study regarding speed breaker.
2. To collect the data of existing speed breaker for experimental study.
3. To analyze the other data and situation of existing speed breaker.
4. To study current traffic control measures existing in Amravati city.

III. METHODOLOGY

1. Literature survey from published papers will be carried out.
2. The map of Amravati city will be collected and will study of various roads.
3. The main roads of Amravati city will be selected on the basis of map.
4. The instrument required for taking measurements of speed breakers will be collected.
5. Cross-section of every speed breaker will be drawn in AutoCAD.
6. The data of speed breakers on main road in Amravati city will be collected by visiting each location.
7. Along with collecting data of speed breaker we will distribute the survey form.
8. The data regarding sign boards and markings will be collected of speed breakers.
9. All the data will be fed into excel and then it will be interpreted and analyzed.
10. The speed breakers at every location will be checked, whether they are as per design and specification given by IRC or not.

IV. THEORETICAL CONTENTS

A. Speed breaker

Speed breaker is a hump surface across the roadway having a rounded shape with width greater than the wheel base of most of the vehicles using the road. Speed breakers are traffic management devices which use vertical deflection to slow down vehicles passing over them. They are sometimes hazardous, inspite of the precautions taken in their safe design and construction. Some authorities do not favor them, especially on main roads. They are also known as speed hump, sleeping policeman in some countries. 85th percentile hump crossing speed is defined as the speed below which 85% of all the vehicles are driven. This speed is considered to be the value at which the motorists are tempting the safety conditions of highways and which consequently should not be exceeded. This speed is often used as the criterion in establishing an upper limit for traffic management purposes.

B. IRC Provisions Regarding Speed Breaker

IRC: 99-1988 “tentative guidelines on the provision of speed breakers for control of vehicular speeds on minor roads” states the following thing for design of speed breaker.

i) Scope for Speed Breaker
ii) Causes of Unplanned Speed Breaker
iii) Design of Speed Breaker
iv) Placement of Speed Breakers
v) Specification for Speed Breaker

C. Scope for Speed Breaker

Use of speed breakers can be done at various places but use of speed breaker is justified primarily under the following three circumstances:

i) T-intersections of minor roads with rural trunk highways, characterized by relatively low traffic volumes on the minor road but very high average operating speed and poor sight distances. Such locations have a high record of fatal accidents and as such a speed breaker on the minor road is recommended.
ii) Intersections of minor roads with major roads where it is desirable to bring down the speeds.
iii) Selected local streets in residential areas, schools, college or university campuses, hospitals etc. Also, in areas where traffic is observed to travel faster than the regulated or safe speed in the area.

Other Places where speed breaker may be used:

iv) Any situations where there is a consistent record of accidents primarily attributed to the speed of vehicles.
v) Approaches of temporary diversions.
vi) Approaches to weak or narrow bridges and culverts requiring speed restriction for safety.
vii) Sharp curves with poor sight distance.
viii) At railway crossings.

D. Causes of Unplanned Speed Breakers

While speed breakers can help in slowing down traffic and reducing high speed crashes, an unplanned or illegal speed breaker can be as much dangerous than the high-speed crashes it is trying to prevent. It is very common across India to see speed breakers being laid willy-nilly. Some of the causes of unplanned speed breakers are given below:

i) Slows down emergency vehicles like ambulances, police vehicles and fire trucks.
ii) Cause traffic congestion and sudden braking.
iii) Reduces fuel efficiency and increases air pollution of vehicles.
iv) Causes rapid wear and tear of vehicles.
v) The impact can be harmful for patients in transit, senior citizens and pregnant women.
vi) Causes an increase in noise pollution due to sudden braking, honking.
vii) May scrape the under-body of low floor cars.
viii) Can cause vehicles (especially 2 wheelers) to skid and cause a collision due to loss of control.

V. DESIGN

Speed breakers are formed basically by providing a rounded hump of 17-meter radius, 3.7-meter width and 0.1-meter height for the preferred advisory crossing speed of 25 km/h for general traffic, as shown in Figure 1.

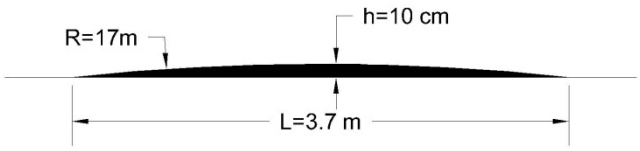

Figure 1: Recommended Specifications for Rounded Hump Type of Speed Breaker for General Traffic at Preferred Crossing Speed 25 Km/h

Trucks and buses having larger wheel base may feel greater inconvenience on passage at such humps. To facilitate appreciable and comfortable passage for larger and heavier vehicles humps may be modified with 1.5-meter-long ramp with 1:20 slope at each edge. This design will also enable these vehicles to pass the hump at about 25 km/h, as shown in Figure 2.

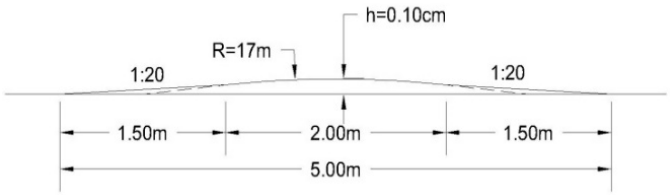

Figure 2: Recommended Specifications for Hump Type of Speed Breaker for Heavy Truck and Bus Traffic at Preferred Crossing Speed 25 Km/H

VI. EXPERIMENTAL STUDY

Data from 138 locations from all parts of Amravati city is collected. Information regarding name of place, number of speed breakers, transverse length of speed breakers, height of speed breakers, longitudinal length of speed breakers and spacing between speed breakers is recorded.Then from the recorded measurements of speed breaker details at various locations, the cross-section of the all the speed breaker has prepared in the Auto CAD.

*Other Existing Traffic Control Measures:*Some of the other traffic control measures which are used in controlling the traffic are listed below-

i) Sign Board
ii) Road Marking
iii) One Way
iv) Cat Eyes

VII. RESULTS AND DISCUSSION

All 138 locations are studied in two groups each for heavy vehicle traffic and light vehicle traffic. Out of 138 locations, 85 locations are of heavy vehicle traffic and remaining 53 locations are of light vehicle traffic. Based on these two groups further analysis is carried out.

i) Speed Breaker Data Analysis:

The distribution of various types of speed breaker on the basis of number of humps, their numbers and percentage among all is given in Table 1.

Table 1: Types, Numbers and % of Speed Breaker

Type	No. of speed breakers	Percentage
One hump	85	61.6%
Two humps	5	3.6%
Three humps	25	18.11%
Four humps	2	1.44%
Five humps	18	13.04%
Six humps	3	2.17%

From Table 1. it was analyzed that-

a) At 85 locations (62 %) there are single hump speed breakers.
b) At 5 locations (4 %) there are two hump speed breakers.
c) At 25 locations (18 %) there are three hump speed breakers.
d) At 2 locations (1 %) there are four hump speed breakers.
e) At 18 locations (13 %) there are five hump speed breakers.
f) At 3 locations (2 %) there are six hump speed breakers.

ii) Analysis for heavy and light vehicle traffic:

i) Data about Width of Road, Left Side and Right-Side Space as well as Space Violation:

for Heavy Vehicle Traffic: From 85 locations on heavy traffic roads at 30 locations (35.29 %) speed breaker have space / gap on left side and at no any location (0 %) speed breaker have gap on right side. It was analysed that out of 85 locations-

a) No location has below 0% violation in side space.
b) 55 locations have 0 % violation in side space.
c) 25 locations have 1-25% violation in side space.
d) 4 locations have 26-50% violation in side space.
e) 1 location have 51-75% violation in side space.
f) No location has 76-99% violation in side space.
g) No location has 100% violation in side space.

for Light Vehicle Traffic: At all 53 locations there is no left side space and right-side space left. At all location there is no any violation of left or right-side gap for speed breaker for light vehicle traffic roads.

ii) Longitudinal Length of Existing Speed Breakers and Recommended Longitudinal Length of Speed Breakers:

for Heavy Vehicle Traffic: It was analysed that out of 85 locations-

a) 2 locations have below 0 % violation in longitudinal length.
b) 3 locations have 0 % violation in longitudinal length.
c) 10 locations have 1-25% violation in longitudinal length.
d) 9 locations have 26-50% violation in longitudinal length.
e) 6 locations have 51-75% violation in longitudinal length.
f) 55 locations have 76-99% violation in longitudinal length.
g) No location has 100% violation in longitudinal length.

*for Light Vehicle Traffic:*it was analysed that out of 53 locations-

a) No location has below 0% violation in longitudinal length.
b) No location has 0 % violation in longitudinal length.
c) No location has 1-25% violation in longitudinal length.
d) No location has 26-50% violation in longitudinal length.
e) 1 location have 51-75% violation in longitudinal length.
f) 52 locations have 76-100% violation in longitudinal length.

iii) Height of Existing Speed Breaker and Recommended Height of Speed Breakers:

*for Heavy Vehicle Traffic:*it was analysed that out of 85 locations-

a) 11 locations have below 0 % violation in height.
b) 1 location have 0 % violation in height.
c) 7 locations have 1-25% violation in height.
d) 11 locations have 26-50% violation in height.
e) 47 locations have 51-75% violation in height.
f) 8 locations have 76-100% violation in height.
g) No location has 100% violation in height.

*for Light vehicle traffic:*it was analysed that out of 53 locations-

a) No location has below 0% violation in height.
b) No any one location has 0 % violation in height.
c) 3 locations have 1-25% violation in height.
d) 14 locations have 26-50% violation in height.
e) 35 locations have 51-75% violation in height.
f) 1 location have 76-99% violation in height.
g) No location has 100% violation in height.

iv) Existing Distance of Sign Board from Speed Breaker and Recommended Distance of Sign Board from Speed Barkers:

*for heavy vehicle traffic:*it was analysed that out of 85 locations-

a) 1 location have below 0 % violation in sign board provision.
b) No location has 0% violation in sign board provision.

c) No location has 1-25% violation in sign board provision.
d) 4 locations have 26-50% violation in sign board provision.
e) 5 location have 51-75% violation in sign board provision.
f) 6 locations have 76-99% violation in sign board provision.
g) 69 locations have 100 % violation in sign board provision.

for Light vehicle traffic: It is seen that there is no speed breaker sign board provided at light vehicle traffic road.

VIII. CONCLUSION

From the above research, analysis and discussion following conclusions are drawn pertaining to study of speed breaker on main roads of Amravati city including other traffic control measures require to regulate haphazard situation of vehicular traffic on main roads of Amravati city.

i) At present at 62 % locations there are single hump speed breakers and at 38 % other remaining locations there are varying number of humps. It is recommended that at all location's standard designed single hump speed breakers should be provided.

ii) For heavy traffic roads, it is found that out of 85 locations only at 5 locations (only 5.88 % locations) there is 25% to 75 % violation in side space in speed breaker hump ranging. Though this is good, it should be insured that at all locations there should not be any side space left in speed breaker hump. Otherwise vehicle driver tries to pass one or all wheels to pass through this side space left. These situations create uncontrolled traffic at speed breaker locations.

iii) For light traffic roads, it is found that at all location there is no any violation of left or right-side gap for speed breaker for light vehicle traffic roads.

iv) For heavy traffic roads, it is found that out of 85 locations at 61 locations (71.76 % locations) there is 50 to 100 % violation in longitudinal length of speed breaker hump. This is very serious matter of concern showing wrong design of speed breakers are employed at most of places in Amravati city.

v) For light traffic roads, it is found that out of 53 locations at 52 locations (98.11 % locations) there is 75 to 100 % violation in longitudinal length of speed breaker hump. It proves that at most of the locations irrespective of traffic wrong designed speed breakers are provided both for light and heavy traffic roads.

vi) For heavy traffic roads, it is found that out of 85 locations at 58 locations (68.23 % locations) there is 50 to 75 % violation in height of speed breaker hump. It indicates that wrong design of speed breakers is employed at most of places in Amravati city.

vii) Similarly, for light traffic roads, it is found that out of 53 locations at 49 locations (92.45 % locations) there is 50 to 75 % violation in height of speed breaker hump. It proves that, irrespective of traffic speed and traffic volume wrong design of speed breakers are employed at most of places in Amravati city.

viii) For heavy traffic roads, it is found that out of 85 locations at 62 locations (72.94 % locations) there is 100 % violation in providing the sigh board indicating provision of speed breaker on road. This is very dangerous cause of accident for driver coming first time on such roads. At remaining 23 locations at 22 locations (95 % locations) sign board indication provision of speed breaker is placed at wrong location. This is more dangerous cause of accident that, instead of giving warning to driver regarding speed breaker locations, speed breakers are wrongly constructed which leads to sudden jumping of vehicle creating damage to vehicle as well as physical injury to passengers.

ix) For light traffic roads, it is found that out of 53 locations nowhere sign board indicating provision of speed breaker on road are not provided. This is move serious matter for light traffic roads where 100 % violation of standard is observed.

x) From above conclusions, it is strongly recommended that, at all locations properly designed speed breakers are needed. In this concern requirements of standard design of speed breakers should be referred before providing the speed breaker. In Annexure II typical estimate is given along with name of supplier for cost calculation of providing standard speed breaker.

xi) For good traffic control practice in Amravati city, based on this project study it is concluded that recommendations regarding provision of road markings, new signal locations, blinkers locations, new parking zones, closing road dividers gap should be strictly implemented as early as possible. We will give this report to AMC and Traffic Control office for reference of their planning to improve traffic control measures in city and minimizing traffic problems in Amravati city.

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