SOME QUESTIONS OF SPEED HUMPS APPLICATION ON THE ROADS

Yuri Vrubel, Denis Kapskij, Dmitrij Mazalevskij, Tatiana Samoylovich, Tonja Korzhova, Vasilij Kuzmenko

Belorussian National Technical University
Nezavisimosty avenue, 65, Minsk, 220013, The Republic of Belarus
Ph: +375 2312968. Fax: +375 2373631. E-mail: OAPDD@BNTU.BY

In the article questions of application of humps in streets and roads from the point of view of their effective application are considered. Efficiency of application should be estimated by losses in road traffic (emergency, ecological, economic and social). The analysis of results of preliminary researches is given.

Keywords: *speed bump, losses in road traffic*

1. The ways of Speed Reduction

Development of automobilization has led to significant growth of accident rate and it has become a national problem for a number of the countries. Especially it concerns the West-European countries with high population density and specialties of settlements' design with narrow streets of ancient building. Searches of the problem solution which often were made on "fresh tracks" and were not fundamental and systematical, have led to requirements of abrupt reduction of traffic speed. At the beginning it tried to realize by installation of set of traffic signs for speed limitation, however it has not given special effect, because the more limitations were established and the more severe were these limitations, the more drivers broke them [1,2,4,14]. In different countries the share of infringers was various, however the order of figures remained stable - approximately 75-95 % of drivers broke requirements of abrupt speed limitations.

Then it was started searching and finding ways of compulsory speed limitation. One of them, psychological compulsion, includes the various devices which create the driver psychological need to reduce the speed - the effect of narrowing or a curvature of movement trajectory; the effect of break of movement trajectory, a special marking which becomes more frequent; chokers; rumble strips with increasing frequency of sound influence, etc.

The second way is physical compulsion. It includes different kind of devices causing physical need of speed reduction under threat of loss of controllability or breakage of the automobile with an opportunity of accident occurrence. It includes roundabouts with small diameter of central island (or different inside road pavement); physical narrowing or a curvature of a lane by application of protected safety islands for pedestrians with an opportunity of pedestrians movement "on a curve"; an abrupt physical curvature roads ("zigzag", chicane) by application of the ledges protected by an onboard stone; raised above a carriage way pedestrian crossings across a street; cross-section deepenings (ditches) on a surface of carriage way and, at last, prominent obstacles (speed humps) of diversified designs and the sizes.

The last appeared the cheapest and easy applicable to various conditions and consequently have become widespread.

2. Problems of Speed Humps Application

It seemed that the decision of a problem of speed reduction has been found at last - cheap, effective, not demanding the control - and in Europe it started the real boom of speed hump's application. A lot of new updatings were developed, process of their interaction with traffic was investigated, their efficiency in increasing traffic safety was advertised and etc. However, there has soon come sobering up - it is appeared that application of speed humps, except for positive influence on traffic safety, also has a wide area of negative influences in the field of economy, ecology and social relations. Application of speed humps conflicts to fundamental tasks of road transport - improvement of quality and reduction of the cost price of transport service which are based on the balanced ratio of such properties of traffic as safety, profitability, ecological compatibility and influence on society, and not just based on safety as it seemed before. Not having an opportunity to estimate this balanced ratio precisely - as far as it is known (anyway, we did not manage to find), such method of traffic quality estimation in Europe has not been present yet - they have started to limit application of speed humps in "obvious" typical situations. In particular, in many countries, certainly, with different variations, installation of speed humps is forbidden on country roads, in city streets with intensive and moderate movement, on roads with bus movement, in streets with trucks movement, etc. Gradually the scope of speed humps is being narrowed and

limited by streets of ancient building, domestic territories, areas of schools, etc. It is considered, that «speed humps - last tool from a tooling, intended for increase of traffic safety». Therefore Europeans today search for other, less unhealthy ways of traffic safety increasing, including speed reduction in the necessary places, in the necessary limits and during necessary time, for example, by means of flexible traffic light controlling with the obligatory automatic videocontrol. As to other countries (not West-European) their need in speed reduction ("calming") is not so obvious, thus they frequently have a little bit other material and spiritual values. Therefore application of speed humps in these countries goes with significant time shift and not so smoothly, frequently getting features of the regular campaign. For example, at the end of 80th years in Brazil during 2 years 17600 speed humps have been established, however in 2 years there remained only about 800 - temperamental Brazilians did not want to submit to the "European" violence.

Thus, it is necessary to study constantly and to know the foreign experience of speed humps application. However, it should be applied with extra accuracy, taking into account our conditions and features. Also it is necessary to have an effective method of traffic quality estimation; in particular, estimation of efficiency of speed humps application that will allow balancing all basic properties of road traffic. It is necessary also to use already available domestic experience received as a result of application and research of speed humps. Thus one should be guided by positions of «Concepts of road traffic maintenance in Belarus», developed according to the Decree of the President of the Republic of Belarus №551 on the 28th of November, 2005 and authorized by the Council of Ministers Decision of the Republic of Belarus on the 14th of June, 2006 № 757.

3. Researched Specific Control Means

To researched specific technical control means we shall refer speed humps, rumble strips and rumble marking. They are characterized by combined influence on the driver and his automobile. In particular, speed humps influence the driver and his automobile by visual impact and physical (shock) impact. Rumble strips and rumble marking influence the driver by visual and ramble (vibrating) impact. Ramble and physical influence concerns to a category of compulsory, affecting the driver irrespectively of his desire or readiness. However, there are also essential differences between rumble objects and speed humps, the main thing from which is how they influence a driver.

4. Application of Rumble Strips

Rumble strips and, especially, rumble marking compulsorily give the driver only the information on the traffic situation developing (as rule an adverse situation), and managing influences he accepts itself on the basis of this information. At the same time, speed humps force the driver to accept beforehand ordered managing influence (to lower speed abruptly), irrespectively of a developing traffic situation. Thus, the purpose of rumble strips and rumble marking application is compulsory informing the driver on a developing adverse traffic situation, and the purpose of speed humps application is compulsory intervention in actions of the driver irrespectively of traffic situation. It is apparent, that compulsory intervention in actions of the driver, which is not connected with a developing traffic situation, not having the reasonable justification and being unnecessary, is never welcomed by any driver.

5. Application of Speed Hums

The most known representative of this category of control means is speed hump ("a sleeping policeman" or speed bump), introduced in STB 1300-2007. As it was mentioned above, it possesses a number of positive and negative properties. To positive properties it is possible to relate: compulsory speed reduction, that in some ways contribute to decrease of accident rate at the given place; and also, absence of the necessity of constant traffic controlling that somewhat reduces expenses for traffic management.

Accident rate. It was already mentioned, that speed humps influence ambiguously on accident rate. On the one hand, abrupt speed reduction of the vehicle cooperating with pedestrians, almost unequivocally leads to decrease in probability of accident occurrence and weight of accident. And as almost all accidents with pedestrians concern to a category of accident «with injuries» and must be included in the statistical reporting this reason is rather weightfull. Especially in comparison with other categories of accidents, the majority of which (85 %) are included in a category «without injures», and must not be included in statistic reporting. Accidents which concern the last category practically are unknown to wide public, and known only to a narrow circle of experts which, unfortunately, do not accept the decisions.

On the other hand, abrupt difference of traffic speed always was and remains a source of accidents on roads that can be proved by all special literature on this subjects. The world famous accident forecasting method based on the factor of the safety, developed by the Soviet scientist V. F. Babkov, just was constructed on the size of speeds difference between previous and the subsequent section of the road [2,6,12,8,9]. Let's remind,

however, that such accidents - side impacts, rear impacts, descent from road, arrival on motionless vehicle or a motionless obstacle - concern, mostly, to a category «without injuries», and mustn't be included into the state statistical reporting and thus decision-making are taken into account insufficiently.

Moreover if there is an alternative drivers choose other routes without speed bumps which are frequently less adapted to the passing of such transport flows. As a result, accident rate in a place of speed bumps installation can decrease, and on other sections it can increase. It is also necessary to note, that the time lost at passing the speed bumps, drivers aspire to compensate by increasing speed of the movement at other sections that is not always safe.

Thirdly, pedestrians get used to small speed of the automobile conflicting with them that is very dangerous. It is known, that pedestrians at acceptance of any decision suppose a so-called constant risk level.

It becomes apparent, for example, in the fact that the distance between a pedestrian passing a carriageway and coming nearer the automobile in the strongest degree depends on the speed of this automobile - the less speed, the less danger and less distance, and on some speed humps pedestrians pass a carriageway literally in front of the car. But also it is known, that at definition of the distance up to the coming nearer car and its speed pedestrians almost always make a mistake, the size of which depends on including got experience. To the pedestrian who has got used to the speed of the automobile on speed humps about 10 - 15 km/h, it is much more difficult to distinguish speed of 40 km/h from the speed of 60 km/h, and it is very dangerous for him in those places where speed humps are not established.

As appeared, speed humps is a means of compulsory speed reduction, but not unconditional. Tentative estimations show, that at single movement about 1 % of cars pass speed humps with speed of about 60÷70 km/h. For modern (light) cars passing speed humps on such speed causes neither seen destructions, nor loss of controllability or rigid discomfort.

Profitability. Reduction of traffic flow speed up to 10-15 km/h leads to very big economic costs connected with maneuvering (braking, passing an obstacle and the following acceleration), loss of time, deterioration of a vehicle on the road, the overexpenditure of fuel, etc. When use alternative routes the overrunning of a vehicle and also additional transport loading on sections of a road system of alternative routes are possible. The formation of congestions is also possible that essentially increase economic costs. The method of economic costs (and losses) calculation is developed in BNTU good enough, however additional calculation - experimental researches are required on an establishment of separate parameters, for example, speed of formation and relieve of automobile queue, laws of pedestrians and vehicles interactions in a zone of speed humps, cost of damage of a vehicle at passing speed humps, etc.

Ecological compatibility. Ecological costs increase strongly because of irregular modes of movement and speed reduction. Emissions in an atmosphere which at the speed of about 10 km/h increase more, than in 10 times in comparison with a speed of 60 km/h, and in view of irregular movement - up to 20 times and more (see Fig. 1).

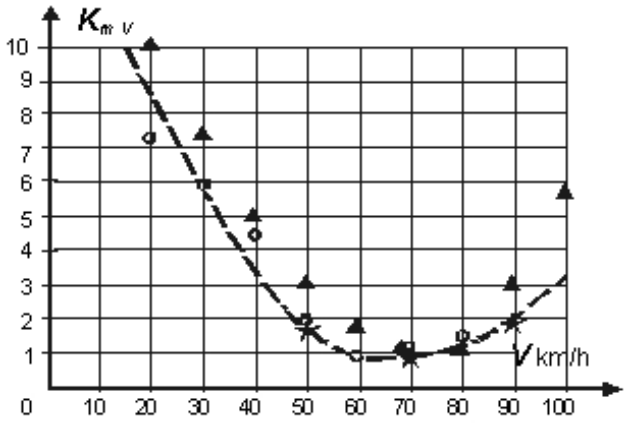

Fig. 1. Dependence on specific resulted (on CO) emissions of cars from traffic flow speed of movement [12]

The increase in transport noise can be explained by intensive braking and acceleration, and also passing of speed humps by vehicles, by cargo and passenger-and-freight cars especially. The place of installation of speed humps is the indisputable center of ecological costs, and in case of automobiles queue formation it is not simply the center, but the powerful center of ecological costs concentration.

Social compatibility. Social costs at installation of speed humps are so great that to ignore them is simply inadmissible. It is well-known, that each limitation should be supervised properly. In particular, if limitation is supervised less than on 50 % (that is each second infringer is revealed only) it brings only harm because develops proof feeling of permissiveness and impunity of road user [10]. Let's result some motives causing these

social costs. Speed humps operate on all drivers, irrespective of their attitude to legality, and it provide discomfort for everyone and leads to costs. Speed humps operate round the clock while the need for it is limited by 2 - to 3 hours totally. Hence, from 24 hours 20-22 hours its presence senselessly leads only to destruction. Speed humps operates not only on those transport flows for which they, ostensibly, are intended, but also on those flows to which they have no relation.

Total (general) efficiency of speed humps application can be determined as a result of the special calculation - experimental researches executed in an orientation, specified in the Concept. It is necessary to confirm, to specify, or to deny the conclusions made on the basis of preliminary researches developed in BNTU earlier, which state a negative estimation of efficiency and expediency of speed humps application in streets and roads in overwhelming majority of typical situations.

Conclusion

As these means of regulation are directed not on compulsory speed reduction, but on duplication of driver informing about a developing road and transport situation their application in some typical situations is quite proved. One of the tasks of forthcoming researches is, except for an estimation of application efficiency, definition of a circle of typical situations where their application is expedient.

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