Non-standard speed bump recognition

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**Abstract**—This paper approach application difficulties and possibilities on a non-standard speed bumps recognition system in unstructured environments.

**Index Terms**— ADAS, Obstacle avoidance, Speed bumps, Unstructured environments.

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# 1 Introduction

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Peed bumps are commonly wide used in countries such Brazil, in order to reduce the vehicles speed. The regulation CONTRAN Standard “resolução 600" [1] defines speed bump application just in cases where a technical study of traffic engineering shows a significant index or potential accidents risk whose determining factor is the high speed practiced on region and where other alternatives of traffic engineering are ineffective. Even with the standard defined by CONTRAN regulation, the most part doesn’t follow the regulation. Some has been applied before the standard definition, some require repair and some others has been applied without a technical study or traffic engineering support.



Fig. 1. Almost invisible speed.

Officially there are two speed bumps types, Type A and B. The first can be installed in places where there is a need to limit the maximum speed to 30 km/h (18 miles per hour) on highways crossing urbanized zones, on primary and secondary local roads, normally with low traffic. The second type can be applied in local urban road, whose intention is to reduce the speed to 20 km/h (12 miles per hour), as long as there are no public bus transport regular lines.

The speed bumps Type A should be 8 to 10 cm (3 1/8 – 3 15/16 inches) high and 3.70 m (12.13 ft) long, while Type B should be 6 to 8 cm (2 3/8 - 3 1/8 inches) high and 1.5 m (5 ft) long. In both cases the width is the same as the track. In addition, there is a mandatory signaling with speed bump symbol before the speed bump, limit speed, oblique marks inclined clockwise at 45 ° to the track cross-section with a minimum width of 0,25 m, painted in yellow and spaced a maximum of 0,50 m alternately on the place, also the painting of all the transverse ondulation in the yellow color.

The number of speed bumps are increasing so fast, Morais Neto, O. L. D. et all [2] show an increase of 3 times more speed bumps application on big cities like Belo Horizonte-MG since 2010-2012.

The high amount of speed bumps application standardless, the drivers visualization difficulty as well as the damages caused in the vehicle has created a demand for speed bumps recognition system considering also unstructured environment avoidance.

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Fig. 1. Magnetization as a function of applied field. Note that “Fig.” is abbreviated. There is a period after the figure number, followed by one space. It is good practice to briefly explain the significance of the figure in the caption.

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TABLE 1  
Units for Magnetic Properties



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aGaussian units are the same as cgs emu for magnetostatics; Mx = maxwell, G = gauss, Oe = oersted; Wb = weber, V = volt, s = second, T = tesla, m = meter, A = ampere, J = joule, kg = kilogram, H = henry.

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**Acknowledgment**

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