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Shoulder & Median Rumble Strips

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Shoulder and median rumble strips

Practices in CEDR member states and relevant literature

This report is: **FOR INFORMATION PURPOSES ONLY**

1 General

A review of literature on rumble strips was performed in 2007 by the members of CEDR's TG Road Safety.

Member states were asked to answer the following questions:

- Does your country have any experience with rumble strips (noisy strips along the road to warn drowsy or inattentive drivers)?
- What is the main source of information on rumble strips in the context of their impact on road safety, technology, efficiency, cost etc.?

This paper sums up the answers received from CEDR's member states. It focuses on longitudinal shoulder or median rumble strips only; it does not deal with the transversal rumble strips put on the pavement to get drivers to reduce their speed or as a warning, e.g. on big slopes or before a junction.

Rumble strips can be milled, rolled, or raised.



2 Practices in CEDR member states

Austria

Rumble strips are used in conjunction with tunnel safety. Since 2003, rumble strips have been used at the entrance to tunnels and along the central road marking in counter flow tunnels. The rumble strips are generally made by grooving the asphalt or concrete pavement. In recent years, rumble strips have been applied on some rural roads and on some selected stretches of motorways; they have proven very cost-effective to reduce run-off accidents and will be used on motorways even more often in the future

Estonia

Rumble strips are not used along the road with the exception of the so called ‘comb-marking’ (a thermoplastic roadside marking). Scandinavian examples are used for this kind of marking; rumble strips are not yet included in the Estonian standards.

Finland

Rumble strips have been in use for several years. It is a relatively cheap and effective measure. However, it has been observed that on older pavements, the strips cause the pavement to break up faster, thereby reducing the life-time of older pavements.

France

The guidebook “*Equipements des routes interurbaines”,* Sétra, 1998, states on p. 98 that ‘driving on motorways can make drivers drowsy and reduce their attention span; noisy transverse strips can wake them up’. Rumble strips are not in widespread use in France, except as ‘night visible markings’ on the right-hand shoulder line of some motorways. One motorway company is currently testing milled rumble strips.

Germany

Milled rumble strips were tested along a 36-km section of motorway over a period of four years. The resulting study is very interesting and its results are very positive. The effects of these milled rumble strips on motorcyclists are currently being investigated.

Iceland

Rumble strips were tested in the summer of 2007. In autumn 2007, 70 km of rumble strips were applied to national roads in the south western corner of Iceland. There did not seem to be any problems regarding winter maintenance. The effects on road safety have not yet been studied because the test period was too short.

Ireland

Rumble strips (vibroline usually) are applied in the direction of travel along an edge or median line to alert drivers when they drift from their lane. They are used quite commonly on the Irish motorway, dual carriageway and 2-plus-1 network, as well as an edge treatment on some single carriageway roads.

Italy

Some experimental work has been carried out with raised rumble strips (in relief) in tunnels.

Luxemburg

Only marked rumble strips are used. The effects are very positive.

The Netherlands

Median and lateral rumble strips are not generally applied on motorways as a result of Dutch noise legislation.

Sweden

A pilot project is currently underway to investigate if rumble strips have a positive effect on road safety and speed; so far, rumble strips seem to have a positive impact on road safety. The number of people killed and severely injured has been reduced by 10–15%. Motorcyclists are satisfied with the rumble strips as the Swedish motorcycle organisation was involved in the working group and was able to influence the design. Sweden has a long-term strategy to equip different types of roads with rumble strips.

The aim with rumble strips in the middle of the road is to increase drivers' alertness and observance and thus reduce the number of accidents.

Rumble strips should not be used within a distance under 100 m to areas where a maximum of 70dB(A) is not allowed to be exceeded.

The Road Administration is of the opinion that it is not recommended to have rumble strips on roads that are narrower than 7.5 m because of the discomfort created to drivers of buses and heavy goods vehicles.

UK

The edge of carriageway markings are referred to as ‘raised profile edge lines’. They consist of a continuous line marking with ribs across the line at regular intervals. The vertical edges of the raised ribs stand clear of the water film in wet conditions, improving the retro-reflective performance under headlight illumination. The ribs also provide an audible vibratory warning to drivers should they stray from the carriageway and run onto the marking.

Raised profile edge lines are used on motorways and all-purpose roads.

3 Relevant literature

Most of the relevant literature was published in the USA and in northern European countries. The following documents are deemed to be very relevant to this subject:

[1] FHWA web site on rumble strips: http://safety.fhwa.dot.gov/roadway_dept/rumble

[2] FHWA "Technical Advisory - roadway shoulder rumble strips" T5040.35, December 20, 2001

[3] SPT: The Best Rumble Strip–Rolled or Milled?, http://www.rumblestrips.com/sub_level/project_rollmilled.htm

[4] N. E. Wood Shoulder rumble strips: a method to alert "drifting" drivers" Presented at the 73rd TRB Annual Meeting, Washington, January 1994

[5] J.J. Hickey Jr. "Shoulder rumble strip effectiveness: Drift-off-road accident reductions on the Pennsylvania Turnpike", Transportation Research Record 1573, 1997 pp. 105-109

[6] K. Perillo, "The Effectiveness and Use of Continuous Shoulder Rumble Strips", August 1998, FHWA web site http://safety.fhwa.dot.gov/roadway_dept/rumble

[7] M. S. Griffith "Safety evaluation of rolled-in continuous shoulder rumble strips installed on freeways" HSIS Summary report - FHWA-RD-00-032, December 1999

[8] NCHRP "Crash reduction factors for traffic engineering and intelligent transportation system (ITS) improvements: state-of-knowledge report" Research Results Digest 299, November 2005

[9] O. Carrasco, J. McFadden, P. Chandhok, R. Patel "Evaluation of Effectiveness of Shoulder Rumble Strips on Rural Multilane Highways in Minnesota" Transportation Research Board Annual Meeting 2004 Paper #04-4012

[10] R.B. Patel, F.M. Council, M.S. Griffith, "Estimating Safety Benefits of Shoulder Rumble Strips on Two-Lane Rural Highways in Minnesota: Empirical Bayes Observational Before-and-After Study" Transportation Research Board Annual Meeting 2007 Paper #07-1924

[11] PIARC "Road Safety Manual" PIARC Publication #103.03.B, Paris 2003

[12] R.C. Moeur "Analysis of gap patterns in Longitudinal Rumble Strips to accommodate bicycle travel", Transportation Research Record 1705, 2000

[13] FHWA "Synthesis of shoulder rumble strip practices and policies" – FHWA web site http://safety.fhwa.dot.gov/roadway_dept/rumble

[14] E.R. Russel, M.J. Rys "Centerline Rumble Strips - A Synthesis of Highway Practice" NCHRP Synthesis 399, 2005

[15] B.N. Persaud, R.A. Retting, CA. Lyon “Crash reduction following installation of centerline rumble strips on rural two-lane roads” Accident Analysis Prevention Volume 36, Issue 6, November 2004, Pages 1073-1079

[16] R Elvik, T Vaa “The Handbook of road safety measures” Elsevier 2004 ISBN 0-08-044091-6

[17] Torochy, Rod "E. Shoulder Rumble strips : Evolution, Current Practise and Research needs" Department of Civil Engineering, Auburn University. The 83rd annual Meeting of the TRB 2004.

[18] Harwood, D.W. "Use of Rumble Strips to enhance road safety" NCHRP Stnthesis 191, National Cooperative Highway Research program, TRB, 1993

[19] Rys, M.J. Russel, E.R. Brin, T.S. "Evaluation of the Effectiveness of Milled Centerline Rumble Strip Patterns", journal of the Transportation Research Forum, Vol. 57, N)4, 2003.

[20] Noyce D.A., Elango V.V. "Safety Evaluation of Centerline Rumble Strips: A Crash and Driver Behaviour Analysis". The 83rd Meeting of TRB, 2004.

[21] Porter R.J., Donnell E.T., Mahoney K.M., "Evaluation of the effects of centerline Rumble Strips on Lateral Vehicle Placement and Speed". TRB 2004 annual meeting.

[22] Morena, David. "Rumble Toward Safety". Public Roads Vol. 67 N° 2 – Sept:Oct 2003. US Department of transportation, Federal Highway Administration.

[23] Mikko Rasanen. "Effects of a rumble strip barrier line on lane keeping in a curve". Accident Analysis and Prevention 37 (2005) 575–581

[24] Anund, Anna "Milled rumble strips on the centre line on a two-lane road", 2005. VTI rapport R 508. www.vti.se/publications

[25] Anund A., Hjalmdahl M., Palmkvist G., Sehammar H. "Placement and design of milled rumble strips on centre line and shoulder – a driving simulator study", VTI rapport 523A, 2005 www.vti.se/publications

[26] TRB STATE OF THE ART REPORT N.1 “The Influence of Roadway Surface Discontinuities on Safety” Chapter 4 Positive Effects of Road Surface Discontinuities

4 Conclusion

Of the literature reviewed, the references [13] and [24] contain most of the present knowledge on rumble strips.

Some potential difficulties with the use of rumble strips have been identified:

- The problem of noise near inhabited areas (solutions are being tested),
- Acceptability by motorcyclists, and safety for cyclists;
- Misuse of rumble strips by lorries.

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