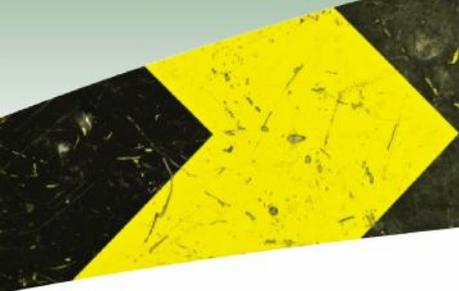


iRAP Road Attribute Risk Factors

Centreline Rumble Strips



This factsheet describes the road attribute risk factors used in the iRAP methodology for Centreline Rumble Strips. Centreline Rumble Strips (also referred to as raised profile centre lines or audible centre lines) can be used to delineate the centre of paved roads. As well as providing visual delineation, Centreline Rumble Strips can also be heard and felt by drivers and riders.

About risk factors

Risk factors, sometimes called crash modification factors (CMF), are used in the iRAP Star Rating methodology to relate road attributes and crash rates. Risk factors (or CMF) are described by the Crash Modification Factor Clearing House as follows:

A crash modification factor (CMF) is a multiplicative factor used to compute the expected number of crashes after implementing a given countermeasure at a specific site.

For example, an intersection is experiencing 100 angle crashes and 500 rear-end crashes per year. If you apply a countermeasure that has a CMF of 0.80 for angle crashes, then you can expect to see 80 angle crashes per year following the implementation of the countermeasure ($100 \times 0.80 = 80$). If the same countermeasure also has a CMF of 1.10 for rear-end crashes, then you would also expect to also see 550 rear-end crashes per year following the countermeasure ($500 \times 1.10 = 550$).

Related documents

This factsheet should be read in conjunction with:

- *Star Rating Roads for Safety: The iRAP Methodology.*
- *Safer Roads Investment Plans: The iRAP Methodology.*
- *Star Rating and Investment Plan Coding Manual.*
- *Road Safety Toolkit* (<http://toolkit.irap.org>).

Risk factors

Risk factors by road attribute category, road user type and crash type

Centreline rumble strips	Vehicle occupant head-on	Motorcyclist head-on
Not present	1.2	1.2
Present	1.0	1.0

Selection of risk factors

The most reliable evidence of the effectiveness of Centreline Rumble Strips is found in a study conducted by the Insurance Institute for Highway Safety (Persaud et al. 2003):

In this study the researchers collected and analyzed all data in the United States that they considered reliable and, using the Empirical Bayes method and data from 7 states with 210 mi of CLRS, concluded that overall motor vehicle crashes at sites treated with CLRS were reduced by 14%. In addition, it was estimated that injury crashes were reduced by 15%, frontal and opposing-direction sideswipe crashes were reduced by 21%, and front and opposing-direction sideswipe crashes involving injuries were reduced by 25%. When the crashes were disaggregated into night-time and daytime crashes, the percent reduction at night was greater than during the day—19% versus 9%—however, the difference was not statistically significant at the 5% level ($p = 0.096$). Data on fatalities were insufficient to draw any conclusions.

Research published by the Transportation Research Board (TRB) was also influential in the selection of the risk factors for use in the iRAP methodology (Russell and Rys, 2005).

The review by ARRB (Turner et al., 2012) states: “There is a mean crash reduction of 20% (from 15 studies) based on the average reduction of Miller (29%, 10%), Creasy and Agent (30%), Agent et al. (35%) and Elvik et al. (1%). There is a low level of confidence in this estimate due to the discrepancy between the figure given by Elvik et al. and the other three studies”. A risk factor of 1.2 has been selected.

Background research and model development

Lynam (2012) did not consider the centreline rumble strip in explaining the research background to the values used in previous versions of the iRAP model.

Risk factors in earlier versions of the iRAP model

Centreline rumble strip	Vehicle occupant and motorcyclist	Motorcyclist run-off
Centreline only	4.0	2.0
Centreline rumble strip	3.3	1.6

Primary references

The following publications are the primary references used in the selection of the iRAP road attribute risk factors. A complete list of citations is available in: *iRAP Road Attribute Risk Factors: Full Reference List*.

Elvik, R, Høy, A, Vaa, T, and Sørensen, M. (2009). *The Handbook of Road Safety Measures*, Second Edition (2009) Emerald Group Publishing Limited. ISBN 978-1-84855-250-0.

Lynam, D (2012). *Development of Risk Models for the Road Assessment Programme*. RAP504.12 and TRL Report CPR1293, Published by iRAP and TRL and available at: <http://www.trl.co.uk> and at <http://www.irap.org>.

Mak, K. and Sicking, D. (2003). *Roadside Safety Analysis Program – Engineer’s Manual*. Transportation Research Board (TRB) National Cooperative Highway Research Program (NCHRP) Report 492. ISBN 0-309-06812-6.

Turner, B. Steinmetz, L., Lim, A. and Walsh, K. (2012). *Effectiveness of Road Safety Engineering Treatments*. AP-R422-12. Austroads Project No: ST1571.

Turner, B., Affum, J., Tziotis, M. and Jurewicz, C. (2009). *Review of iRAP Risk Parameters*. ARRB Group Contract Report for iRAP.

Turner, B., Imberger, K., Roper, P., Pyta, V. and McLean, J. (2010). *Road Safety Engineering Risk Assessment Part 6: Crash Reduction Factors*. Austroads AP-T151/10. ISBN 978-1-921709-11-1.

University of North Carolina Highway Safety Research Center and U.S. Department of Transportation Federal Highway Administration (2013). *Crash Modification Factors Clearing House*: <http://www.cmfclearinghouse.org/>.