

Drivers' understanding of temporary and permanent slippery road signage

Full report: www.nzta.govt.nz/resources/research/reports/607

Trialling slippery road surface signs

Drivers' understanding and responses to slippery road surface signs have been investigated as a first step towards introducing more consistent and effective signs.

In recent years, the number of areas being identified on New Zealand roads as having inadequate skid resistance has increased. This is largely due to changes in 2010 to the NZ Transport Agency's (the Transport Agency's) specification for measuring road surface friction. (The current version of the specification is NZTA T10 2013.) The changes raised the minimum standards for skid resistance on high-risk curves.

Where skid resistance was below the desired limits, it was standard practice to erect slippery road surface signs. However, previous research has suggested the signs currently used in New Zealand to warn drivers of lower than desired road surface friction are not well understood and it was not clear whether these signs resulted in a change in driver behaviour at these sites.

As a result of these factors, the Transport Agency identified there was a need to develop a consistent, understandable and cost-effective way of warning drivers of the potential for lower skid resistance. The method could be used both on high-risk curves and in other areas renowned for periodic slippery conditions.

As a first step in developing such an intervention, Opus Research completed an investigation into drivers' comprehension of and behavioural responses to slippery road surface signs. The findings have been reported in NZ Transport Agency research report 607: 'Drivers' understanding of temporary and permanent slippery road signage'. The investigation involved workshops with both road users and industry experts, and comprehensive on-road trials of the favoured signage options. From this, the report puts forward a number of recommendations for how slippery road surface signs should be designed and used in the future.

A focus on slippery roads

Skid resistance, or road slipperiness, can affect the grip between vehicle tyres and the road, and consequently the ability of drivers to maintain control of their vehicles.

Skid resistance varies depending on road conditions and is most often an issue when roads are wet. However, the exact conditions that can result in lower than desired road surface friction are often non-permanent and unpredictable in

terms of their location, duration and the nature of the hazard they represent to drivers.

In New Zealand, road surface friction for the state highway network and a number of lesser roads is measured using the sideways-force coefficient routine investigation machine (SCRIM) methodology. The machine measures the sideways-force coefficient of particular sections of road with reference to pre-determined investigatory and threshold levels of skid resistance. In areas where the SCRIM coefficient falls below the investigatory level for macrotexture and microtexture, the road section is prioritised for further investigation and potential treatment.

At present, those locations where skid resistance is confirmed to be lower than desired are signposted by either an orange sign for temporary situations (such as roadwork activities, where skid resistance is temporarily reduced), or a yellow sign for situations where non-temporary conditions, such as climatic conditions (ice, shade) can reduce surface friction.

New Zealand permanent (code WR3) and temporary (code TR2) slippery road surface signs



Testing the signs

The research began with a literature review to identify the features that influenced both how conspicuous and how easy it was to comprehend road signs.

Based on these findings, the research team held workshops with a public focus group, and subsequently with an industry expert focus group, to discuss, compare and develop current and alternative sign designs. The groups identified issues with the current signs, and explored ways the drivers' understanding and responses to the signs could be improved, whether through the sign's design, image or accompanying message.

From this process, two alternative supplementary plates were designed. The supplementary plates would be used together with the main sign plate. This approach was taken, rather than testing completely new sign designs, as both the literature review and the focus groups had indicated this was likely to be more effective than changing the main sign.

The effectiveness of the two supplementary plates was then compared with the current temporary slippery road surface signage in an on-road trial.

The three options trialled were:

- main plate only (currently in use)
- main plate, plus new supplementary plate reading: 'Slow when wet'
- main plate, plus new supplementary plate reading: 'Slippery when wet'.

All signs were constructed using the current design specifications for temporary road signs.

The signs were trialled in three locations, featuring differing curve radii.

Metrocounters were used to measure the vehicle speeds associated with each of the signs, at each of the three different curves, in both wet and dry conditions. The speeds associated with each sign were compared against a baseline option, where no sign at all was erected. The three sign designs and no-sign option were rotated between the three locations over a four-month period.

The results showed that, in dry conditions, the signs made no practical difference to vehicle speed. In wet conditions, however, the presence of a sign resulted in significant reduction in vehicle speeds at all three curves. What was less clear was the effectiveness of each type of sign, as comparisons showed the sign that led to the greatest speed reduction differed at each of the curves.

Using signs in the future

The main outcome of the research was a suite of recommendations about how slippery road surface signs could be used on New Zealand roads in the future. Some of the main recommendations are

given below. These and other recommendations are discussed in more depth in the research report.

- The presence of any slippery road surface sign, irrespective of its design, significantly reduced driver speed in wet conditions. It was recommended to continue to signpost all areas where reduced surface friction is likely to impact on driver safety.
- For two of the three curves tested in the on-road study, adding a supplementary plate to the main sign resulted in a significantly greater speed reduction than with the main plate alone. It was therefore recommended that one of the supplementary plates tested in this study should be added to the current sign in areas where there is a temporary reduction in surface friction.
- The supplementary plate 'Slow when wet' was associated with the greatest level of speed reduction at all three sites tested, when compared with no sign at all. Overall, vehicle speeds were approximately 7km/h slower when the 'Slow when wet' sign was in place than when no sign was in place. Given these results, it was recommended the existing main plate could be accompanied by the 'Slow when wet' supplementary plate in both temporary and permanent situations.
- Slippery road signs are also used in situations where surface friction may be reduced by factors other than wet, such as frost, gravel, concrete roads, and ice and grit. Supplementary signs already exist for each of these conditions and should continue to be used. However, it was recommended the same message format as that tested in the study should be adopted for these conditions too. For example, 'Slow when frosty' or 'Slow: ice/grit'.
- There is no need to change the existing signs in all locations immediately, as the study showed the current sign is effective at reducing drivers' speeds. Instead, the recommended changes could be made in conjunction with scheduled maintenance and when new signs are erected. Higher risk locations could be targeted earlier, if this is financially and logistically feasible.