

Transport for NSW | Centre for Road Safety

An initial study of motorcyclists' perceptions of Audio Tactile Line Marking

Research report
October 2020

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1 Details of the study

1.1 Background

ATLM, or rumble strips, are a key element of safe system infrastructure, and are a low cost, but effective measure for reducing run-off road, head-on and fatigue-related crashes. ATLM is installed along the edge (as shown in Figure 1) or centre line of a road and produces a noise and vibration when driven over to alert drivers they are veering out of their lane and allow them to correct their path to avoid a crash.

Figure 1: Examples of ATLM installed on top of an edge line (left) and adjacent to an edge line (right)



ATLM is estimated to reduce the number of fatalities and injuries caused by crashes where vehicles leave the road by 15 to 25%. It is increasingly being rolled out in NSW to improve safety on rural roads. An additional 12,000 km of ATLM will be installed on NSW roads by 2020/21 through the NSW Safer Roads and Stimulus Programs.

While the safety benefits of ATLM have been well documented for vehicles, the safety benefits for motorcyclists are less clear. A number of motorcyclists and the Motorcycle Council of NSW have raised concerns about stability and steerability when riding over ATLM.

CRS engaged Safe System Solutions Pty Ltd to undertake an initial study of motorcyclists' concerns about stability and steerability over ATLM.

1.2 Research approach

Two samples of motorcyclists were recruited to participate in the study – experienced riders and less experienced riders. Both groups were asked to participate in a survey and a focus group prior to, and following, a series of test rides over ATLM in different layouts and under different conditions, in a controlled environment. The surveys and focus groups asked riders about their perceptions of riding over ATLM under different conditions.

1.2.1 Participants in the study

Recruiting motorcyclists who were willing to participate in the study was quite challenging, due to safety concerns around ATLM. A range of strategies were used to recruit participants, including requests through NSW Police Force, TfNSW, and personal networks and social media posts, particularly targeted at motorcycle groups. Five experienced motorcyclists (six or more years riding experience) and five less experienced motorcyclists (less than six years riding experience) were recruited for the study. All were fully licenced (or provisionally licenced for some of the less experienced riders), owned their own motorcycle and rode regularly.

The experienced riders included five males, aged between 35-64 years of age, with between 6-30+ years riding experience. Two were police motorcyclists, one was a motorcycle rider trainer and two were casual motorcycle riders, with one of the participants from TfNSW. Four of the five had previously ridden over ATLM, either intentionally or unintentionally.

The less experienced riders included four males and one female, aged between 18-54 years of age, with between 1-6 years riding experience and a mix of commuter and recreational riders, with one of the participants from TfNSW. Three had previously ridden over ATLM, either intentionally or unintentionally.

Participants were offered a small financial remuneration to cover the cost of fuel required for the testing.

1.2.2 Motorcycles used in the study

Experienced riders used their own motorcycles, or a hired motorcycle, for the study. The motorcycles used were – Honda CB500F (500cc), Kawasaki Versys (650cc), Yamaha FJR1300 (1300cc).

Hired motorcycles were provided for the less experienced riders, to ensure a wider range of motorcycles were included in the testing. These were – Honda City Fly (150cc scooter), Honda CB 125e (125 cc commuter bike) and a BMW F700 (700cc adventure tourer) which was ridden by fully licenced riders only.

1.2.3 The test site

The study was undertaken in two phases in a controlled environment at TfNSW's Crashlab - a crash testing facility at Huntingwood, NSW. Phase 1 involved the experienced riders and took place in March 2019. Phase 2 involved the less experienced riders and took place in October 2019.

The ATLM was installed in five separate configurations for the study, some of which are shown in Figure 2 –

- Straight (length of 60m)
- Left hand curve (arc length 46m, radius 52.5m)
- Right hand curve (arc length 46m, radius 52.5m)
- Left hand tight curve (arc length 28m, radius 13.1m)
- Right hand tight curve (arc length 28m, radius 13.1m)

ATLM typically used on edge lines was installed on the asphalt sealed road surface in line with standard TfNSW requirements (i.e. Traffic Engineering Technical Direction for ATLM (TETD 2019/01) and by a pre-approved NSW government contractor), to be representative of that used on NSW roads.

Figure 2: ATLM configurations used in the study



1.2.4 Test conditions

A range of test rides were specified which covered the ATLM in each configuration, in both wet and dry conditions, at increasing speeds depending on the configuration, under braking and acceleration, and along and across the ATLM. As participant safety was of paramount concern in the study, participants were not required to complete all test rides, but were able to choose the tests they undertook. All test rides started at low speeds (e.g. 20km/h) and increased gradually to a level where the participant felt in control of the motorcycle, but not comfortable to increase their speed further. The maximum speeds obtained in the study by the experienced riders were 95km/h and 80km/h on the straight configuration, for the dry and wet conditions, respectively, and 30km/h on the tight curve configuration for both dry and wet conditions. For the less experienced riders the maximum speeds obtained were 75km/h on the straight configuration for both dry and wet conditions, and 30km/h on the tight curve.

Figure 3: A test ride being completed on the ATLM with straight configuration



1.2.5 Pre and post surveys and focus groups

In both Phases, motorcyclists were surveyed and participated in focus groups both prior to, and following their test rides. The survey asked motorcyclists to rate their level of confidence (on a scale of 0 to 10, with 10 being the highest level of confidence) in riding over ATLMs and maintaining control of their bike in a range of different conditions (wet and dry, straight, curves and tight curves). The focus group sought more collective perspectives on ATLMs and the risk they pose to motorcyclists.

2 Results of the study

The results from the surveys and focus groups carried out with both groups of motorcyclists prior to, and following, completion of the test rides suggest their confidence in maintaining control of their bike while riding over ATLM increased following the test rides.

All five experienced motorcyclists rated their confidence levels as higher, following their test rides. Their average confidence ratings in riding over ATLM were higher following their test rides for both dry and wet conditions, as shown in Figure 4.

Four of the five less experienced riders rated their confidence levels as higher, following their test rides. Their average confidence ratings were also higher following the test rides, for both dry and wet conditions, as shown in Figure 5.

Figure 4: Experienced motorcyclists' average ratings of confidence in riding over ATLM, in dry and wet conditions, pre and post-test rides

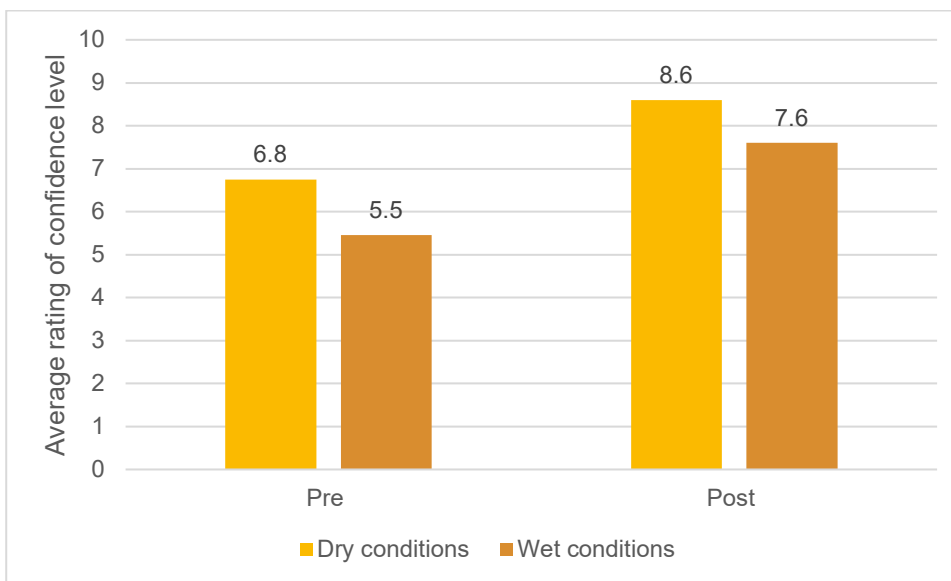
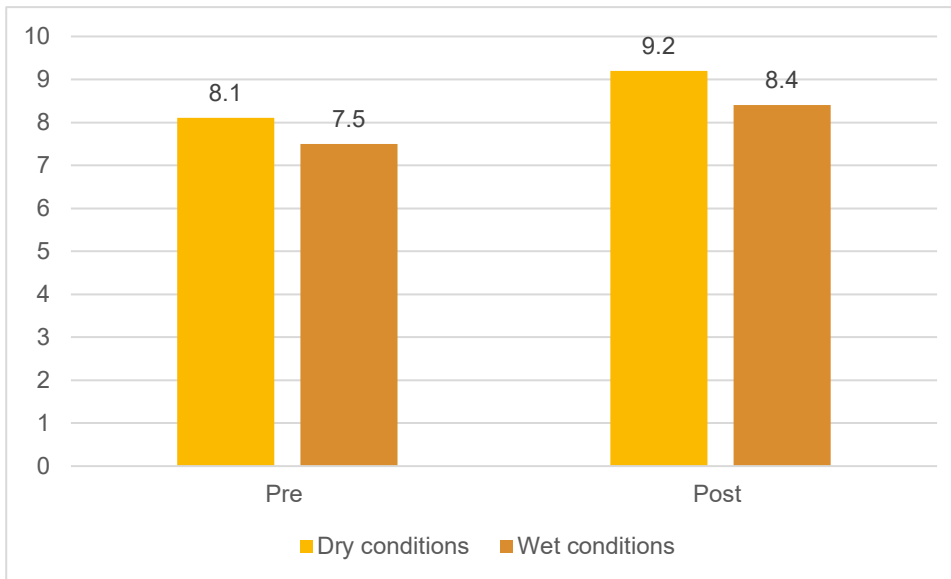


Figure 5: Less experienced motorcyclists' average ratings of confidence in riding over ATLM, in dry and wet conditions, pre and post-test rides



The focus group discussions revealed similar findings with motorcyclists reporting less concerns about maintaining motorcycle stability when riding over ATLMs following their test rides. For example:

The motorcycle behaved as expected even under moderately heavy acceleration and deceleration [Experienced rider]

Be aware of their presence on the road, but they are not as bad as I thought they would be [Less experienced rider]

Other road features were seen more of a concern than ATLM by some study participants -

ATLMs are not generally a significant concern, especially when comparing to other road surface irregularities [Experienced rider]

A couple of study participants did however express concerns about motorcycle stability in the wet -

In the dry, when speed increases there is less of a concern of how ATLMs affect the motorcycle. However, in the wet as speed increases there is more of a concern of how ATLMs affect the motorcycle [Experienced rider]

The motorcycle wants to roll off the ATLM in the wet [Less experienced rider]

Study participants also provided some suggestions for improving motorcyclist safety around ATLM. These were to –

- include riding over ATLM as a component of motorcycle training
- place warning signs for motorcyclists where ATLM is installed.

3 Limitations of the study

This was an initial study to investigate motorcycle stability when riding over ATLM under different conditions and a necessary step to ensure that testing could be undertaken safely, with the safety of study participants maintained throughout the study.

Testing was undertaken, as far as possible, with different types of motorcyclists, different size motorcycles, under varying conditions (wet and dry, curved and straight), at different speeds, and with different ATLM configurations, to understand the circumstances where motorcycles might become unstable when ridden over ATLM.

The testing was necessarily limited in scale, and involved only a small number of motorcyclists and types of motorcycles and limited ATLM configurations. It was conducted under the controlled conditions at Crashlab. Different riding scenarios were tested, including braking and accelerating on the ATLM, however, this did not extend to any corrective type manoeuvres. In addition, no instrumentation was fitted to the motorcycles to collect quantitative data on measures such as motorcycle acceleration, as the primary concern was ensuring participant safety throughout the study.

No statistical testing was undertaken on motorcyclists' confidence ratings to determine whether the differences were statistically significant due to the small number of motorcyclists able to be recruited for the study. In addition, there is potential for response bias in the survey and focus group responses (participants may have tried to provide socially desirable responses that indicated their confidence increased following their test rides) given that some participants were recruited through known networks, and surveys and focus groups were conducted on site as part of the testing process.

Given the limited scale of the current study, it is unclear whether the results are generalisable to the wider population of motorcycle riders, other motorcycle types, alternative ATLM configurations or riding scenarios such as corrective type manoeuvres. There is a need to extend the work in this area to better understand motorcycle stability on ATLM on a broader scale and in a wider range of conditions.

4 Summary

In summary, while this study does have a number of limitations, it has demonstrated that motorcycle stability testing can be undertaken safely with ATLM. It has also shown that motorcyclists' average confidence ratings when riding over ATLM were higher, for both dry and wet conditions, following a series of test rides over ATLM in a controlled environment, under different conditions (wet/dry, straight/curved/tight curve), and at different speeds. Both experienced and less experienced motorcyclists' average confidence ratings were higher for both dry and wet conditions following the test rides.

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