NZTA research summary

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Do changes to vehicle ride-height affect how advanced driver-assistance systems work?

Do modifications – such as changing a vehicle's height, or adding bull bars or extra lights – affect advanced emergency braking, lane keep assist and blind-spot detection?

Advanced driver-assistance systems (ADASs, such as lane keep assist and blind-spot detection) use sensors or cameras intended for specific height ranges, field of view and angle relative to the vehicle.

- When a vehicle's height has been changed or accessories added, does the ADAS still work correctly?
- What are the effects on ADAS performance?
- What has been done to address any issues?

In this study the researchers analysed international literature on ADASs in modified vehicles. Modifications can include:

- altered ride height or rake angle (also known as 'pitch': the angle of the car's floor to the road, which is usually modified so the back is higher than the front)
- adding aftermarket accessories (eg, bull bars, extra lights, styling or altered custom bumper paints, some of which may interfere with an ADAS sensor's field of vision).

Based on what they learned, the researchers recommended options for New Zealand policymakers, regulators and other stakeholders.

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Literature review results

The researchers found that modifying ride height and rake angle of vehicles affected the performance of some ADASs by altering the software's electronic sensor orientation, changing its frame of reference. The changes can mean that ADAS warnings or actions occur at a different time to its baseline (normal operation) – or in some cases they may stop working altogether.

Recalibrating the ADAS to manufacturer specifications returned its performance to around the baseline in at least some cases, but the before-and-after difference varied between vehicles.

Stakeholder interviews

The researchers also considered unpublished data and interviewed five stakeholders on their views and to gather technical information.

They found an organisation in the USA and one in Australia that are testing the effect of ride-height modification and aftermarket accessories on ADAS performance, but the results aren't available yet. However, recalibration experts confirmed that changing the vehicle's height likely affects the sensors' field of view and therefore ADAS performance.

If the modification is within vehicle manufacturer ride-height tolerances there is likely little effect on ADAS performance, but there is no data yet to confirm this.

Researcher recommendations

The researchers recommend the following actions by stakeholders.

Government

- Define or clarify ride-height and rake-angle limits that don't need certification in New Zealand. We don't yet have the data, but policymakers could base them on (for example) New South Wales' limits – or even better, on results from targeted tests.
  - Review the findings of the test programmes underway in the USA and Australia.
  - Test the effects of modifications on ADAS performance in New Zealand. This will help with setting certification thresholds.
- Provide information to vehicle hobbyists about the effects of modifications and how they may influence ADAS performance.
- ADAS recommendations may also need adapting for highly automated vehicles. Regulations for self-driving vehicles should ensure they can still operate if there is a system failure or ensure that they can't be used until the fault is fixed.

Vehicle manufacturers/technology providers

- Make sure that information on vehicle ride-height limits is easily available to drivers and vehicle modifiers.
  - Government could influence this by leading a voluntary or required industry agreement.
- Improve the diagnostic capability of vehicles' ADASs so they can adapt to changes in ride height and rake angle.
  - Government could help this by setting regulations.
- Make sure that ride height is included in the ADAS recalibration method.
  - Government could encourage this by starting a voluntary industry standard for ADAS recalibration.
- Inform buyers on what the system can and can't do. Include specific information on ride height and how this might affect ADAS performance.
  - Government could make this mandatory.

Repairers

- Develop a code of practice for vehicle repair and ADAS recalibration.
  - Make sure technicians are trained and follow the provider's guidance, including ADAS recalibration after a repair.
  - Identify maximum ride-height changes for effective recalibration of ADASs.
  - Make sure repairers give information to vehicle owners at repair and recalibration, either on how it may affect ADAS performance or on why it can't be done.
  - Government could facilitate this by chairing code of practice development with industry.
- Repairers could monitor and record the number of, and reasons for, recalibrations and any issues with modifications. Government could use this data to understand issues of recalibration in our fleet.

Aftermarket equipment suppliers

- Give information to users buying accessories that affect ride height and alter ADAS performance.
  - Government could require warning labels on these products.
- Aftermarket diagnostic tool providers could ensure that vehicle ride height can be entered by the recalibration technician, where appropriate.

Insurers

Ride-height modifications that exceed the manufacturer's threshold (or other agreed limit) could increase insurance premiums, or (if appropriate) in some cases even cancel the insurance cover.

RR 719: Calibration of advanced driver assistance systems (ADAS) on modified vehicles. NZ Transport Agency Waka Kotahi research report.
Available at **www.nzta.govt.nz/resources/research/reports/719**