Attachments Mounted onto an Approved Motorcycle Helmet

Basuki Suratno, Dan Leavy

Centre for Road Safety, Transport for NSW

Abstract

There has been a growing demand for fitting aftermarket attachments onto motorcycle helmets. A recent study aimed to determine whether mounting two types of attachments – a video camera and a Bluetooth communications device – affected motorcycle helmet compliance with design standards. A series of tests were conducted, And the results indicated that in some cases, attaching the devices caused the helmet to fail one of the tests specified in a number of design standards. A further study now underway is investigating how this relates to an increased risk of injury to the wearer in a crash.

Background

In NSW, the Road Rules 2014 require motorcyclists wear an approved helmet, which is one that complies with either the Australian Standard (AS/NZS) 1698 or the UNECE Regulation 22.05. Both have strict conditions for fitting attachments – AS/NZS 1698 requires the attachment be approved by the helmet manufacturer, while UNECE R22.05 requires evidence that the attachment does not affect the helmets compliance with the standard. Both standards require helmets with projections be tested by dropping the helmet fitted to a head form onto an anvil that measures the force at impact. The peak longitudinal force and the duration of the positive impulse on the anvil are recorded. If these exceed specified levels, the helmet fails the test and does not comply with the standard.

Previous tests

Method

A popular motorcycle helmet was fitted with either a video camera or a communications device – two types of aftermarket attachments most commonly used by motorcyclists. Two different sizes for each device were examined, designated as “large” and “slim-line”. The attachments were mounted onto the helmet using the adhesive mounting provided by their respective manufacturers in accordance with their mounting instructions.

The oblique impact test as specified in both AS/NZS 1698 and UNECE R22.05 were conducted on the helmets fitted with an attachment. A new helmet was used for each test. The peak longitudinal force and its impulse (integral with respect to time) measured from the load cell in the anvil were recorded in each test. The test matrix is outlined in the first three columns of Table 1 and examples of the fitting configurations are shown in Figure 1.

The helmets fitted with a device were also tested to the energy attenuation test specified in AS/NZS 1698 to determine if their ability to attenuate impact energy is compromised, and if the attachment penetrates through the helmet shell. A series of punch tests were also conducted to investigate the whiplash force created by snagging the attachment.

Results

The results of the oblique impact tests are presented in Table 1. The maximum limit for peak longitudinal force specified in the standards is 2.5kN and 12.5N.s for its impulse, and the helmet fitted with the slim-line Camera Type 3 failed the oblique impact requirements in both tests as the

peak longitudinal forces exceeded the maximum limit. The helmet fitted with the slim-line Bluetooth Type 2 device and its battery pack also failed the oblique impact requirements, while the helmet fitted with the large Bluetooth Type 1 device was still under the maximum limits allowed by the Standards.

Table 1. Results from oblique impact tests

Test	Device – Make & Model	Device Position	Peak Longitudinal Force (kN) (max 2.5 kN)	Impulse (N.S) (max 12.5 N.s)	Pass/ Fail
1	Camera Type 1 – Large	Helmet crown	1.4	1.1	Pass
2	Camera Type 1 – Large	Helmet LH side	1.84	1.19	Pass
3	Camera Type 2 – Large	Helmet crown	0.88	0.0	Pass
4	Camera Type 2 – Large	Helmet LH side	1.88	0.58	Pass
5	Camera Type 3 – Slim-line	Helmet crown	3.51	2.90	Fail
6	Camera Type 3 – Slim-line	Helmet LH side	2.82	2.21	Fail
7	Bluetooth Type 1 – Large	Lower LH side	2.07	7.68	Pass
8	Bluetooth Type 2 – Slim-line	Lower LH side	2.96	4.90	Fail
9	Battery pack	Rear	3.29	7.95	Fail

Figure 1. Examples of mounting camera and communication device onto the helmet

Further research

The tests stipulated in the standards were introduced in 1986 and focuses on ensuring external projections incorporated within the helmet design would detach easily, rather than causing the helmet to catch during impact. This testing arrangement does not form a reliable indicator of a head injury risk as a result of helmet attachments, as the testing focuses on the performance of the helmet.

Crash test technology has advanced considerably, with the ability to now undertake world first testing with an instrumented more biofidelic headform (Hybrid III head form), which could provide a more realistic response to the forces imposed on a person in a crash when wearing a helmet fitted with an attachment.

A series of tests in accordance with the current test requirements is currently being conducted. This will provide insight into the level of trauma sustained to the head, neck and body. Additional tests will also be carried out using a unique test rig developed specially for the Consumer Rating and Assessment of Safety Helmets (CRASH) test program. The design of this rig has undergone scientific peer review. This testing is now underway and outcomes of the testing regime are expected to be available soon.

This further research is also investigating whether the material used to attach a device to a helmet affects the injury outcome, and if an adhesive can be used that will allow the helmet pass the oblique impact test regardless of the type of device attached to it

As the implications of this research may be far reaching and affect established design standards, it is intended that the reserach will be subjected to a rigorous peer review process to verify its findings.

Conclusions

The previous study found that mounting an attachment such as a video camera or a communication device to an approved motorcycle helmet can cause the helmet to become non-complying with the AS/NZS 1698 and UNECE R22.05, which affects its status as an approved helmet under the Road Rules 2014. Results from all energy attenuation and punch tests remained under the prescribed limit.

The new research currently being conducted will provide a more realistic profile of the injury risks of attaching devices to motorcycle helmets Once the peer review process is completed, the results and test methodology will be made available to key stakehoders for their consideration, including helment maufacturers, and the AS 1698 and UNECE R22.05 drafting committees.

References

Australian/New Zealand Standard 1698:2006 (AS/NZS 1698:2006). Protective helmets for vehicle users, Standards Australia/Standards New Zealand.

British Standard 6658:1985 (BS 6658:1985), Specification for protective helmets for vehicle users, BSI 14 October 2005.

United Nations Economic Commission for Europe Regulation No 22.05 (UNECE22.05) Uniform provisions concerning the approval of protective helmets and their visors for drivers and passengers of motor cycles and mopeds.