Australian Safety Assessment Program

Test and Assessment Protocol

AUSAP

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The Australian Safety Assessment Program (AuSAP) Test and Assessment Protocol has been developed by Mobility and Accessibility for Children in Australia Ltd (MACA).

MACA is a registered charity dedicated to advancing the rights of children with disabilities and medical conditions to safe and equitable transport. For more information, visit macahub.org

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Test and Assessment Protocol

This document is the protocol for the Australian Safety Assessment Program's (AuSAP) independent testing and assessment of special purpose child restraint (SPCR) and special purpose occupant restraint (SPOR) systems by Mobility and Accessibility for Children in Australia Ltd (MACA).

AuSAP assessments contribute to MACA achieving its vision for every child to have access to safe and equitable transport.

1. Introduction

The Australian/New Zealand Standard (AS/NZS) 1754 *Child Restraint Systems for Use in Motor Vehicles* is one of the most demanding child restraint standards in use. It requires the child restraint to undergo a series of sled tests with different sized dummies and configurations. The sled tests include a frontal impact test with a speed of 49 km/h and a side impact test at 32 km/h that includes a structure representing a door and side window. It is only recently that standards/regulations in other parts of the world have included a side impact test.

AS/NZS 1754:2013 (current version) Clause 3.13 states that "where child restraints are designed for children with disabilities requiring special needs, the child restraint shall comply with the intent of this Standard." AuSAP is not intended to determine whether the SPCR or SPOR is likely to pass (or fail) AS/NZS 1754 (as it uses selected criteria only); however, it provides valuable information relating to the safety and performance of SPCR or SPOR.

AuSAP generally uses two sled tests based on AS/NZS 1754 to assess the protection provided to a typical occupant in these types of severe crashes. The purpose is to give an indication of the ability of the SPCR or SPOR to protect the occupant when subjected to similar tests to a child restraint that is certified to AS/NZS 1754. Selected safety-related assessments of design are also conducted as a supplement to the sled tests.

The following protocol describes how the tests are to be conducted and what information is to be recorded.

2. Child restraint system "Types"

The Type of Child Restraint System (CRS) refers to definitions in AS/NZS1754:2013. They can be summarised as:

- Type A - rearward facing with a crash harness
- Type B - forward facing with a crash harness
- Type D - rearward facing with a crash harness
- Type G - forward facing with a crash harness
- Types E & F — forward facing booster seat that relies on the vehicle seatbelt for occupant restraint
- Harnesses Type C1 (used with CRS)
- Harnesses Type C2 (used without CRS)

The above categories also cover the range of CRS specified in USA and Canadian regulations (FMVSS 213 & CMVSS 213)

The following are not covered by AS/NZS 1754 but may be encountered in SPCR or SPOR assessments:

- Special Purpose Harnesses (not included in Types C1 and C2).
- Child and occupant restraint system with built-in harness with occupant mass limit above 36 kg (from US/Canada/Europe)

Note: "Crash harness" refers to providing primary occupant restraint in a crash. This does not include a harness that is only intended for postural support or to prevent self-extrication (escape) - these must be used in conjunction with the vehicle seatbelt that provides primary occupant restraint in a crash. These harnesses are sometimes referred to as a "postural harness" or "positioning harness" and are intended to assist the occupant maintain their sitting posture, not primary occupant restraint in a crash.

3. Multiple tests with the same SPCR or SPOR

In view of the limited availability of some models of SPCR or SPOR, consideration will be given to conducting up to three sled tests with the same SPCR or SPOR. This is at the sole discretion of MACA. Where a SPCR or SPOR is to be subjected to subsequent dynamic tests the following conditions apply:

a) the tests are conducted in order of severity, with the most demanding test first

b) a thorough visual inspection of the SPCR or SPOR after the previous test reveals no visual evidence of damage to the restraint that could adversely affect the next test

c) harness components, seatbelt clamps and top tether adjusters operate correctly

d) the subsequent test does not result in a structural failure or a failure in occupant retention components (e.g., crash harness components)

e) Where restraints are suitable for larger children or adults that is suitable for a an occupant over 36 kg, taller than 1.5 m or over 12 years of age. If the restraint has these allowances then an additional frontal test shall be conducted.

In effect this provision only applies where the SPCR or SPOR performs well in all dynamic test scenarios. Any failures in a subsequent dynamic test (i.e., any tests after the initial dynamic test) mean that the outcomes of the subsequent test where a "marginal" failure occurred are not used and a new test with an untested SPCR or SPOR needs to be arranged to complete the suite of dynamic tests.

4. Anthropomorphic Test Devices (ATD or crash test dummies)

The preferred test dummy (ATD), the particular model of SPCR or SPOR and installation configuration will be nominated in the request for testing. Normally the tests include an ATD that is equivalent to the largest child nominated for the SPCR or SPOR in that configuration. Dummies can be TNO P-series, Humanetics Q-Series or Hybrid III child dummies.

Head injury data is required for the side impact test. It is preferred that instrumented ATDs be used for a frontal impact test so that injury data (e.g., head acceleration and chest acceleration) is available for analysis but injury criteria are not applied to the assessments. Slings specified in AS3629.1:2013 7(h) are not required. Where ATDs will not be instrumented (or where injury data will not be recorded) for the frontal impact test the lab must contact MACA and confirm these arrangements.

For the side impact test the ATD head should be appropriately painted in order to show any contacts with components.

5. Test records

Test labs are provided with the AuSAP assessment parameters (internal use only) which indicate the measurements and other information to be recorded by the lab. In addition, the sled velocity and deceleration are to be recorded. As above, where ATDs will not be instrumented (or where injury data will not be recorded) the test lab must contact MACA and confirm these arrangements.

Photographs are required of the test set-up, including the dummy before and after the test. Any issues such as CRS component breakages are also to be photographed and reported.

Video of a frontal test must include a side view that shows potential head and knee excursion and covers the period from T0 to the end of the crash with a minimum of 1000 frames a second. If feasible, an overhead view should also be recorded. A diagram showing a plan view of the test set-up with dimensions (at T0) between the camera and the side of the seat and spacing between reference marks on the side of the seat is required to enable dummy excursion to be independently estimated from the video.

Video of a side test must include a side view (front-on to the seat) that shows potential head contact with the door and that covers the period from T0 to the end of the crash with a minimum of 1000 frames a second.

6. Frontal Sled Test

Method: A frontal sled test is conducted in accordance with AS/NZS 1754:2013 and AS 3629.1:2013, subject to the items described below.

Note: where the SPCR or SPOR is suitable for over 36 kg or 1.5m in height or 12 to 14 year old then an additional frontal test is conducted with larger ATD.

An ATD is installed in the CRS, which is attached to a rig representing the rear seat of a vehicle.

For all SPCR or SPOR it is preferred that a spacer, as specified in AS 3629.1 10(f) is used to create a set amount of slack in the harness. The spacer is removed prior to the test. The limits on head excursion and knee excursion assessments take into account use of the spacer to introduce slack in the restraint (AS/NZS 1754 requires separate tests without a spacer). In effect, where a spacer is not used the requirements are less stringent but no adjustment is made for this situation.

Head excursion at the peak of the crash is measured in accordance with AS/NZS 1754:2013 (CR point to centre of gravity of dummy head).

Knee excursion is based on the relative forward displacement of the knee (e.g., a bolt head or decal) at T0 and the point of maximum excursion. The lab may use any accurate, repeatable method for measuring excursion.

Either a rebound or a deceleration sled is acceptable for this test. A deceleration sled is subject to a T0 (entry) velocity of 49 km/h (+/-2 km/h) and a deceleration envelope in the range 27g to 29g*. Where required in the request for test the top tether is to be attached to the appropriate anchorage(s) on the test rig (note that some SPCR or SPOR might not have a top tether, some may have two top tethers^ or the top tether may be optional).

Notes for frontal test

* AS/NZS1754 sets a range of 24g to 34g but a narrower range is preferred to improve consistency between tests.

In effect AS/NZS1754 requires a rebound sled for type testing or certification testing. If a rebound sled is used then a delta V of 49km/h (+/-2 km/h) is used.

^ Some SPCR or SPOR sourced from the US and intended for small adults may require the use of dual top-tether anchorages. These are to be used, where requested, in accordance with the manufacturer's instructions.

7. Side Sled Test

Method: A side impact sled test is conducted in accordance with AS/NZS 1754:2013 and AS 3629.1:2013, subject to the items described below.

Note: If the SPCR or SPOR is suitable for over 36kg or 1.5m or 12- to 14-year-old an additional side impact test is not required using dummies larger than TNO P10 or Q10.

Only the test with a simulated door is to be conducted. An ATD is installed in the CRS, which is attached to the test seat nominated in AS/NZS 3629.1 or an equivalent test rig. A deceleration sled is subject to a T0 (entry) velocity of 32 km/h (+/-2 km/h) and a deceleration envelope in the range 18g to 20g. Where required in the request for test, the top tether is to be attached to the appropriate anchorage(s) on the test rig (note that some SPCR or SPOR may not have a top tether, some may have two top tethers^ or the top tether may be optional).

It is preferred that a 10 mm thick polystyrene foam panel** be fixed to the door to detect a close head contact. Head contact with the foam will then indicate that the gap is 10 mm or less (as specified in the Standard) and so video analysis will not be necessary.

There must be a means to ensure that the SPCR or SPOR is in the correct position at T0 and has not moved out of place due to the sled acceleration. Foam blocks positioned on the non-struck side are acceptable for this purpose.

Notes for side test

* AS/NZS 1754 sets a minimum value of 14g but a higher value is preferred to improve consistency between tests.

In effect AS/NZS 1754 requires a rebound sled for type testing or certification testing. If a rebound sled is used then a delta V of 32 km/h (+/-2 km/h) is used.

** The foam panel should be an equilateral triangle approximately 250 mm on each side and positioned so that it does not impede the CRS but is likely to be contacted by the dummy's head, if there is excessive head excursion. Conformance with clause 2.1 below can then be determined by paint transfer rather than measurement (as specified in AS/NZS 3629.1). The foam panel can be affixed with suitable self-adhesive tape.

^ Some SPCR or SPOR sourced from the US and intended for small adults may require the use of dual top-tether anchorages. These are to be used, where requested, in accordance with the manufacturer's instructions.

8. Assessment of design

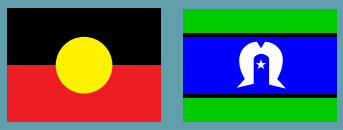
Assessment of design is carried out by AuSAP representatives. These parameters are assessed through observation and operation of various components. In particular the design assessments are intended to identify potential sources of misuse that could lead to extra risk of serious injury.

Although not part of the formal assessment process, lab staff are encouraged to report any observations about good or bad design features they encounter, breakage or unusual performance while conducting dynamic sled tests.

NOTE – ASSESSMENT PARAMETERS

The AuSAP Assessment Parameters sets out the parameters to be assessed, including the method of assessment and the AuSAP criteria for assigning a result of "good', "acceptable", "marginal" or "not acceptable".

The AuSAP Assessment Parameters are for internal use only and used as a basis for review by the AuSAP Expert Committee.



We pay respect to the Traditional Custodians of all lands, past, present & future. Honouring Elders & nurturing all young people.

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