ISO TC 22/SC 12 N

Date: 2009-01-20

ISO/PDPAS 00000

ISO TC 22/SC 12/WG 1

Secretariat: AFNOR

Road vehicles — Sled test method to enable side impact testing of child restraint systems — Essential parameters (request of ECE/GRSP)

Véhicules routiers — Méthode d'essai sur chariot pour permettre l'évaluation de la proctection en choc latéral pour dispositifs de retenues pour enfants — Paramètres essentiels (requête de l'ECE/GRSP)

Warning

This document is not an ISO International Standard. It is distributed for review and comment. It is subject to change without notice and may not be referred to as an International Standard.

Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Preliminary version

Document type: Publicly Available Specification
Document subtype:
Document stage: (20) Preparatory
Document language: E

T:\Internationella Sekretariat\ISO\ISO-TC 022-SC 12-WG 1\04 Projects\29062_Side_impact\GRSP request\ISO_PAS_00000_CRS_Side_impact_GRSP-20090120.doc STD Version 2.2

Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of normative document:

— an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;

— an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed after three years in order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn. If the ISO/PAS or ISO/TS is confirmed, it is reviewed again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/PAS 00000 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 12, *Passive safety crash protection systems*.

Introduction

The informal Working Group on Child Restraint Systems formed in January 2008 send the following request to ISO TC22 / SC12 to support their work on defining a side impact test procedure for CRS homologation based on the state of the art research and experience.

“To answer to the mandate that has been fixed by GRSP to the Informal Working Group on CRS (Child Restraint Systems) that I chair, and after agreement of GRSP (See abstract of minutes of 43rd GRSP enclosed) this group should have a demand to formulate towards ISO/TC22/SC12.

The Group shall introduce, in its draft Regulation on the CRS, requirements dealing with the level of protection of such systems in case of side impact. Having considered that to date there was not yet an International consensus on a dynamic test method and taking into account of the target date fixed (December 2009) to propose a text to GRSP, the Working Group has considered that, based on works already carried out within ISO/TC22/SC12, ISO could define essential parameters (energy, orientation, speed, position, ... lateral loads) of a simplified test method that should allow to ensure that the Child Restraint System has, at minimum, a sufficient capacity to manage the position of the child and to absorb energy in case of lateral impact solicitation.

Wishing that ISO/TC22/SC12 could be able to help us in the achievement of our mandate”.

The aim of this PAS is to answer the GRSP request.

Road vehicles — Sled test method to enable side impact testing of child restraint systems — Essential parameters (request of ECE/GRSP)

1 Scope

This Publicly Available Specification mainly summarises the content of ISO/TR 14646 to allow the Informal Group on CRS of GRSP the development of a simplified side impact method based on commonly agreed input data. In addition to the content of ISO/TR 14646 new data and further recommendations are now included.

The input parameters mentioned below are applicable for accessory child restraint systems offering any side impact protection.

2 Accident statistics

The accident data presented in ISO/TR 14646 shows that side impact accidents are severe ones especially for those children sitting on the struck side. Head, neck and chest are the body regions showing most frequently severe injuries. Comparison of accident data from different years (1985 to 1990; 1991 to 1996 and 1997 to 2001) and without any filter on product age shows decreasing risk for head injuries and increasing risk for neck injuries compared to older data. The head in particular needs to be protected.

Based on results of the EC funded CHILD project and EEVC WG18 Report (Feb 2006), non-head containment combined with intrusion loading are found to be one of the major reasons for head injuries in lateral impact accidents involving rearfacing and forward facing harness type CRS as well as high back booster and backless booster [Johannsen, 2006].

Analysis of accident data involving children in lateral impact accidents from different sources and different regions of the world (Germany, Sweden and USA) indicates that the purely lateral impact (due to the accident data coding with ± 15° deviation) is more dangerous than angled ones while the share of perpendicular and angled impacts with forward component is nearly equal [Johannsen, 2007].

3 Input parameters for side impact test procedure

Relevant input parameters for defining a side impact test procedure for CRS based on experience from accident data analysis, full-scale tests and sled tests are presented below. These input parameters are divided into the sections body regions to be protected, occupant kinematics, test severity, validation and field of application.

3.1 Body regions to be protected

Based on accident data, the body region to be protected with highest priority is the head followed by neck and chest. Especially for the protection of the head, body kinematics as well as energy management capabilities of the CRS are important.

3.2 Occupant kinematics

As head containment and head loadings are crucial issues with respect to the assessment of the performance of a CRS in lateral impact, it is necessary to utilise a test procedure, which is capable of simulating real world occupant kinematics and realistic loading conditions.

Head containment is more a challenge for the larger dummies in a given CRS than with smaller ones based on experience with different side impact test procedures within the development of ISO/TR 14646 and ISO/TS 29062 (note not yet finalised).

3.3 Test characteristics

When designing a sled test method, the ambition should be to replicate the characteristics of a full scale side impact test situation, but in a simplified way and as generic as possible. The characteristics are derived from vehicle acceleration, vehicle velocity and also by intrusion depth and intrusion velocity, but also by geometrical measurements such as the distance of the CRS in relation to the structure and the coverage/profile of the intruding vehicle structure, etc.

The analysis of full-scale side impact tests presented in ISO/TR 14646 shows that the performance of current cars has been significantly improved, especially with respect to intrusion velocity during the last years. However, the test severity of the full-scale test is subject to several discussions as it is felt to be too moderate. One example for higher severity tests is the IIHS test procedure, where the mass of the barrier as well as the stiffness and shape of the barrier face, causes a more aggressive contact with the car in comparison to ECE Regulation No. 95 and FMVSS 214 test conditions.

Summing up the results presented in ISO/TR 14646 and the statements above, the following properties defining the test characteristics are suggested as a generic and representative (for a majority of cars in use) side impact sled test method.

3.3.1 Intrusion velocity

Figure 1 shows the intrusion velocity characteristics measured in a large number of cars of different manufacturing dates in ECE R95 tests. In these tests the lateral intrusion was measured close to the dummies head using either string potentiometers or cross tubes. Intrusion velocity was computed from the intrusion.

The corridor lines shown in Figure 1 are meant as borders for defining a suitable intrusion velocity corridor. However, the allowed tolerance is too large to define a proper test procedure. It is crucial to define the intrusion velocity carefully, as it is an input parameter with considerable influence on the dummy measurements.

A maximum intrusion velocity between 7 m/s and 10 m/s at approximately 30 ms close to the dummy's head is required to represent realistic loading conditions.

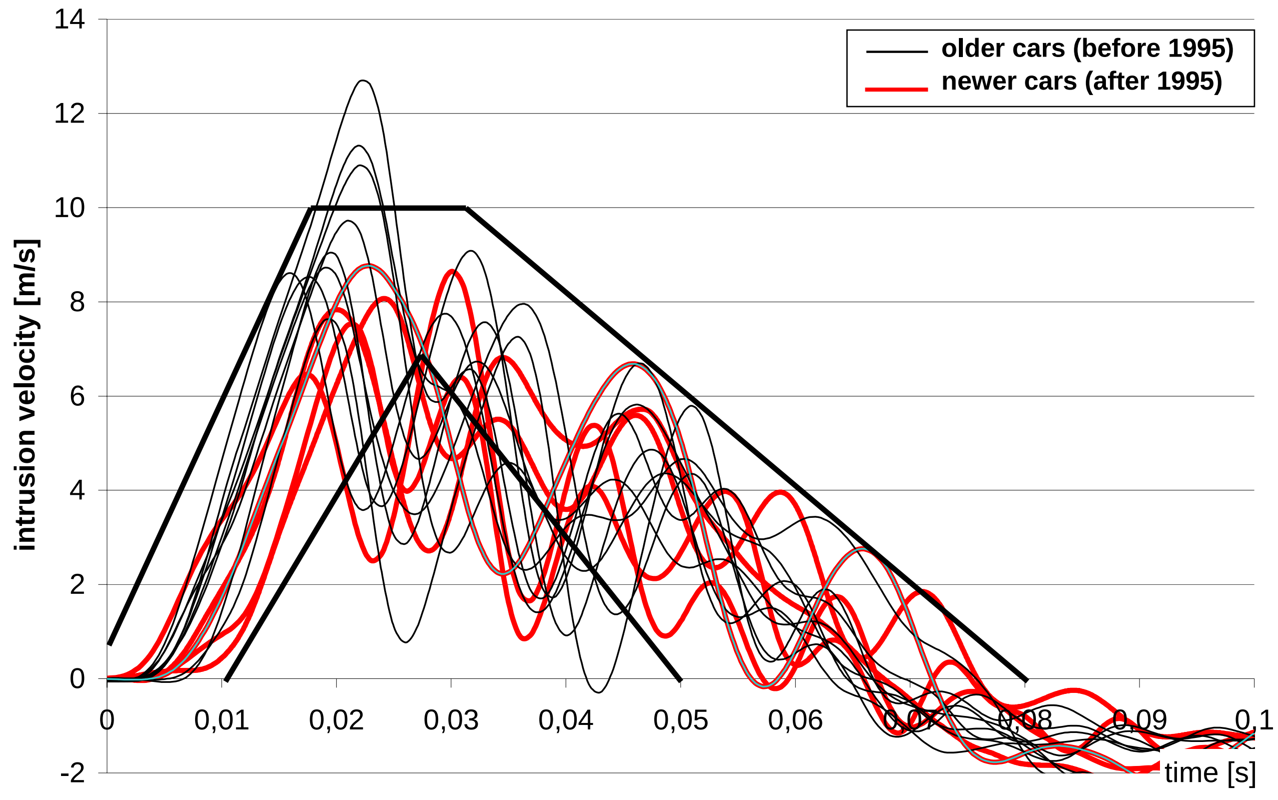


Figure 1 — General requirements for intrusion specification

For defining of a test procedure one has to take into account the combination of intrusion velocity and struck car velocity, defining the intrusion velocity relative to the ground.

3.3.2 Intrusion depth

Figure 2 shows the intrusion depth characteristics measured in a number of cars representing different sizes and different manufacturing dates in ECE R95 tests. In these tests the lateral intrusion was measured close to the dummies head using either string potentiometers or cross tubes.

The dynamic intrusion depths should be between 200 and 300 mm to represent realistic loading conditions.

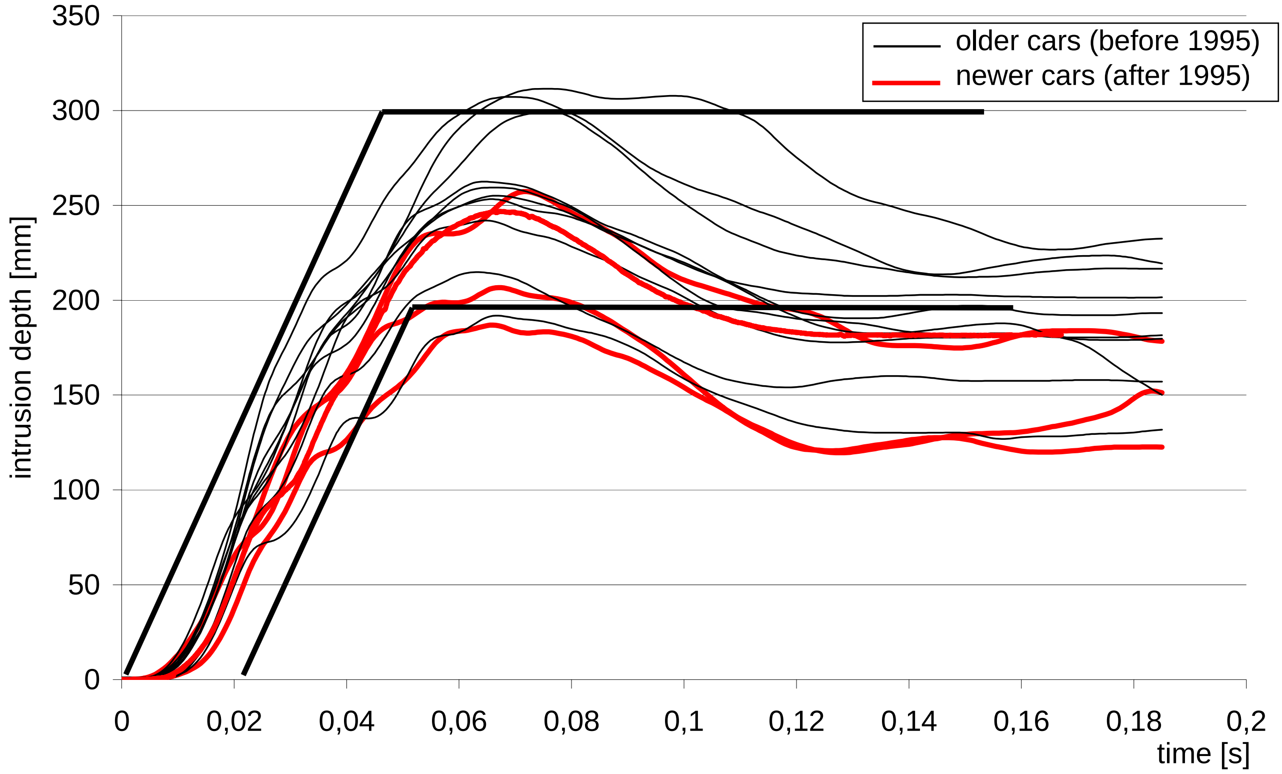


Figure 2 — General requirements for intrusion depth

3.3.3 Struck car acceleration range and struck car delta-v

Figure 3 shows the struck car acceleration measured at the non-struck side in a number of cars representing different sizes and different manufacturing dates in ECE R95 tests.

The sled acceleration should be between 10 and 14 g to represent realistic loading conditions.

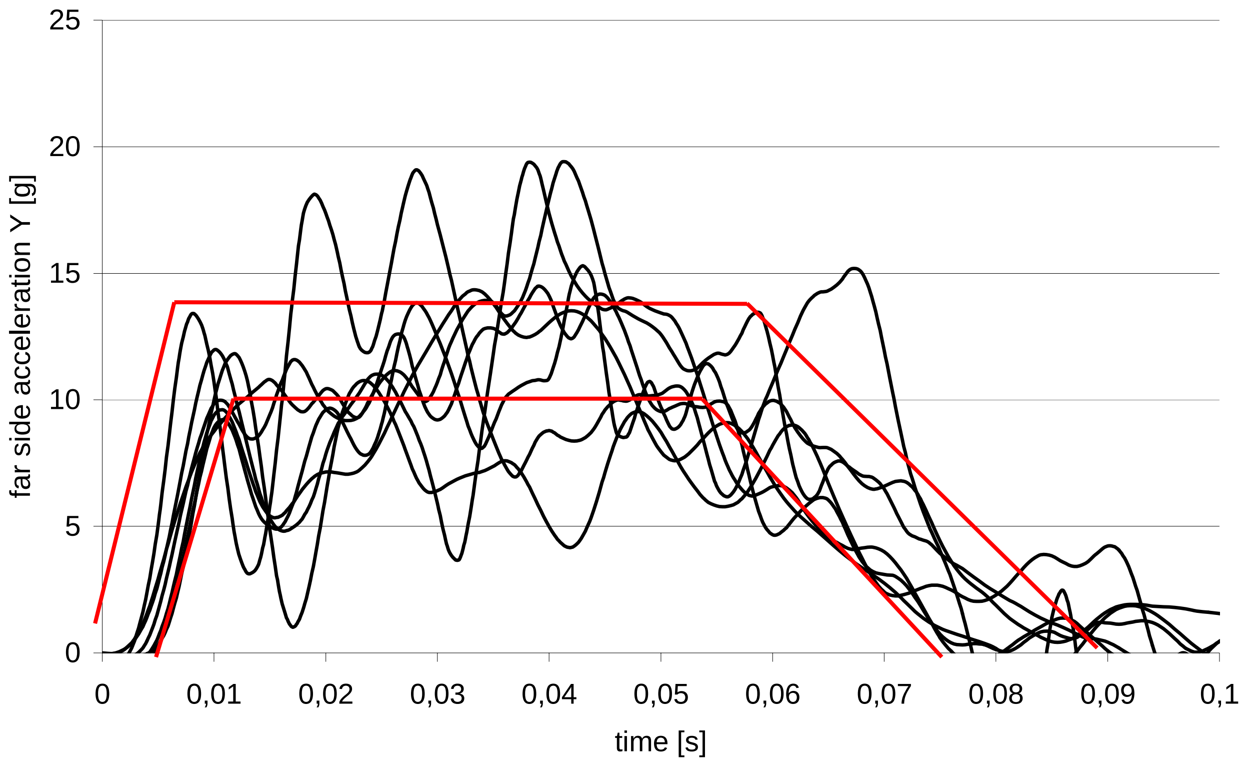


Figure 3 — General requirements for sled acceleration

Figure 4 shows the struck car delta-v computed from the acceleration presented in Figure 3.

The sled delta-v should be approximately 25 km/h to represent realistic loading conditions. The delta-v of 25 km/h also represents the theoretical delta-v if one car hits with 50 km/h another car of the same mass.

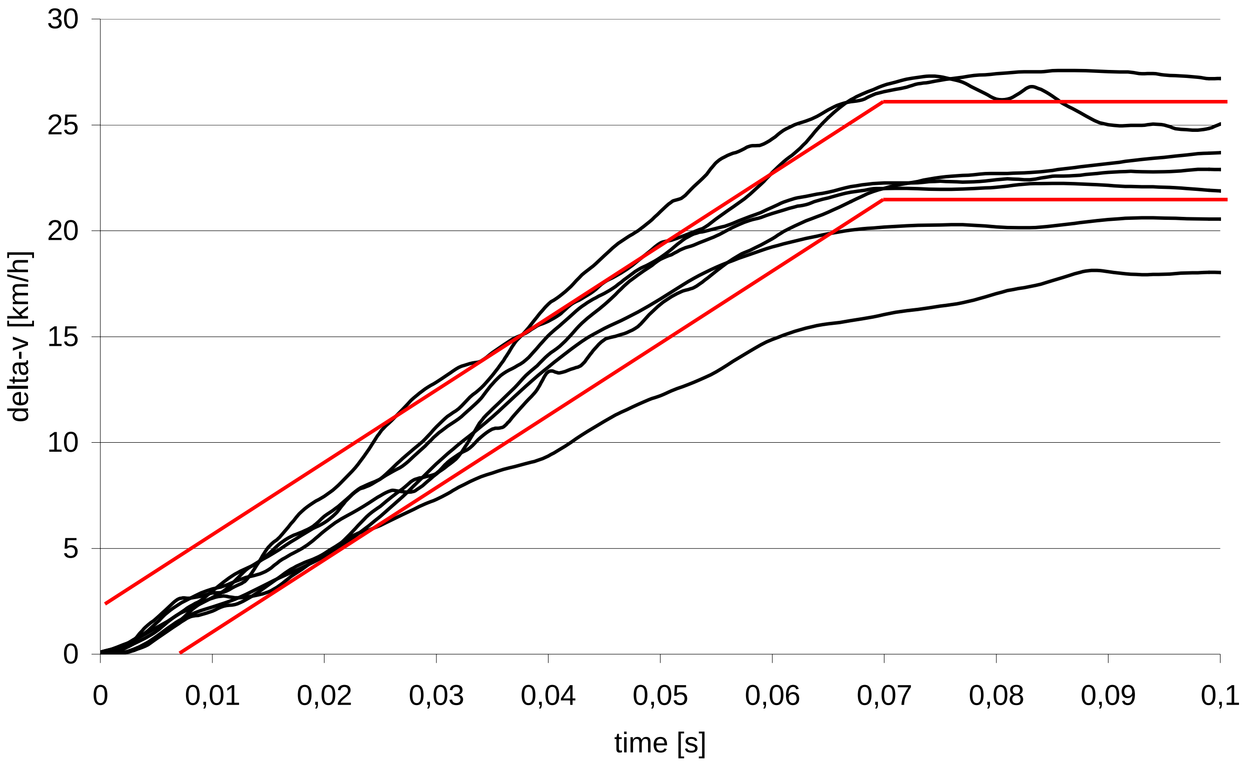


Figure 4 — General requirements for sled delta-v

Based on the results of the analysis of impact angles the test procedure should focus on a perpendicular impact.

3.3.4 Geometry requirements

The initial distance between the CRS centre line and the intrusion surface is approximately 300 mm.

The intrusion surface should have a height of approx. 500 mm with respect to the CR-point.

3.3.5 Intrusion surface properties

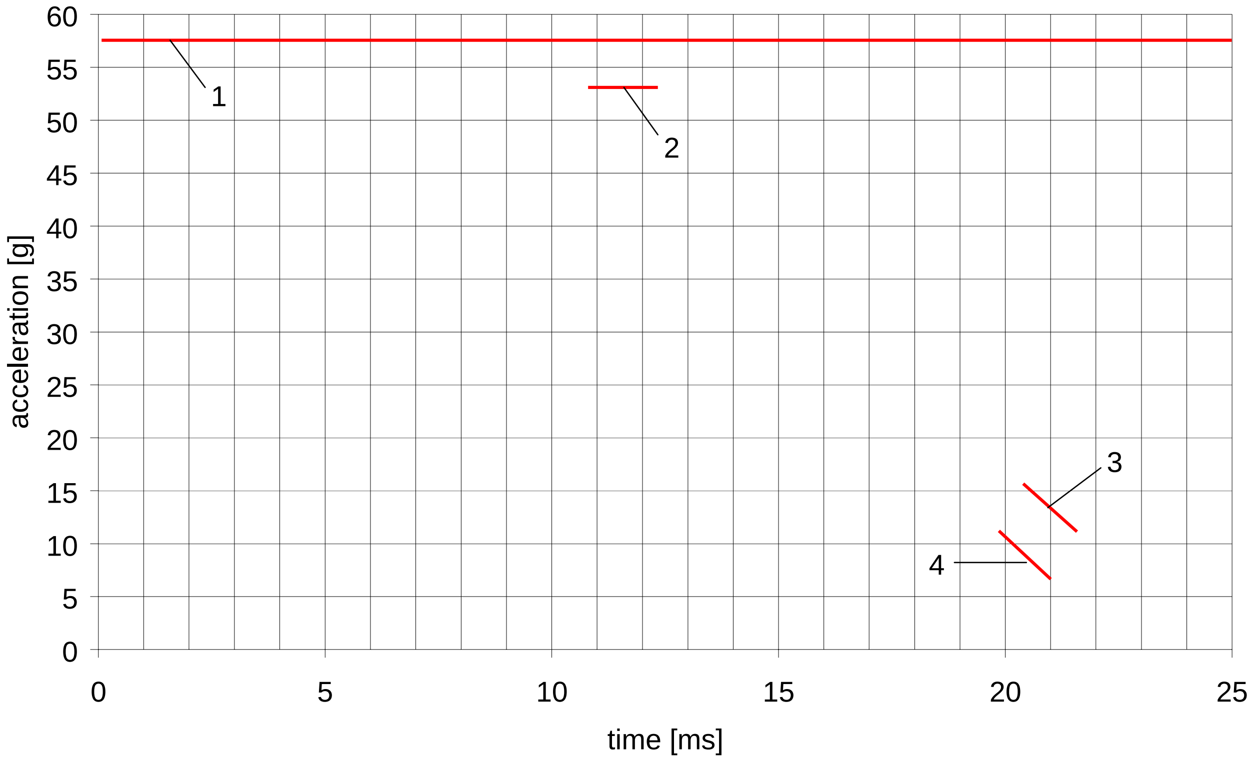
The rigid intrusion surface should be covered by 55 mm deformable material as described below.

The properties of the padding material for the intrusion surface are defined by performance criteria in a simple drop test. The test set up consists of a simple drop test using a spherical head form. The spherical head form has a diameter of 150 mm and a mass of 6 kg (±0.1 kg). The impact speed is 4 m/s (± 0.1 m/s). The instrumentation should allow the assessment of the time of first contact between the impactor and the sample as well as the head form acceleration at least in direction of impact (Z-direction).

The material sample should have the dimensions of 400 X 400 mm. The sample should be impacted in its centre.

The time of first contact between sample material and head form (t_0) is 0 ms.

The impactor acceleration shall not exceed 58 g.



Key

1 Upper limit of 58 g

2 Lower limit for the maximum peak at 53 g (11 to 12 ms)

3 Upper limit for the decline of acceleration (15 g at 20.5 ms to 10 g at 21.5 ms)

4 Lower limit for the decline of acceleration (10 g at 20 ms to 7 g at 21 ms)

3.4 Validation

For the validation of test procedure, the test severity as well as the CRS definition according to the scope (see below) needs to be approved. Concerning the test severity, accident statistics show that the most important body region to protect is the head. Therefore it is necessary to put special emphasis on the validation of head loads and the capability of child restraints to contain the head inside the CRS during the test. Furthermore the test procedure shall be repeatable, reproducible and impartial.

3.5 Field of application

The performance of test procedure needs to cater for all CRS types.

Bibliography

[1] ISO/TR 14646:2007, *Road vehicles — Side impact testing of child restraint systems — Review of background data and test methods, and conclusions from the ISO work as of November 2005*

[2] Johannsen, H.; Menon, R.A.: *"Short Report Forward Component in ISO Side Impact Test Procedure for CRS", ISO TC22 / SC12 / WG1 / TF1, 2007*

[3] Johannsen, H.; Weber, S.; Schindler, V.: *"CHILD Technical Report Selection of Side Impact Test Procedure"; 2006*

[4] EEVC Working Group 18: *Report Child Safety – February 2006*