TECHNICAL SPECIFICATION

ISO/TS 13396

First edition

Road vehicles — Sled test method to enable the evaluation of side impact protection of child restraint systems — Essential parameters

Véhicules routiers — Méthode d'essai sur chariot pour permettre l'évaluation de la protection en choc latéral des dispositifs de retenue pour enfants — Paramètres essentiels

PROOF/ÉPREUVE

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 22 *Road vehicles*, Subcommittee SC 36, *Safety and impact testing*.

This document cancels and replaces ISO/PAS 13396:2009, which has been technically revised.

The main changes compared to ISO/PAS 13396 are as follows:

— accident statistics data have been further reviewed;

— input parameter data related to intrusion have been reviewed and supplemented with new data;

— based on the new and supplementary data presented, a judgement is made whether the ISO/PAS 13396 parameter recommendations are still valid.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

In 2008, the United Nations (UN) GRSP Informal Working Group on Child Restraint Systems (CRS) sent a request to ISO asking ISO's CRS working group to support their work on defining a side impact test procedure for CRS type approval based on state-of-the-art research and experience. It was specifically requested to define the **essential parameters** of a simplified test method, to ensure that a CRS has a sufficient capacity to contain the child and to absorb energy in the case of side impact exposure.

In response, a Publicly Available Specification was developed, published as ISO/PAS 13396:2009[1)]. This comprised a series of essential parameters that a side impact test procedure should seek to replicate. Much of the technical content was derived from a previous Technical Report, ISO/TR 14646:2007, with updated information where available.

In conjunction with a systematic review of ISO/PAS 13396:2009, it was decided to verify its applicability in relation to more recent accident data and the vehicle technology development.

This document reflects the review of ISO/PAS 13396:2009 considering the relevant accident data updates available and the in-depth vehicle data.

Since this document is a check of the applicability of the ISO/PAS 13396 data (on which the CRS side impact method in UN Regulation No. 129 is based), the ISO/PAS 13396 parameter recommendations are included together with the supplementary information, to judge whether an update of the parameter recommendations should be made.

1) Cancelled and replaced by this document (ISO/TS 13396:2021).

Road vehicles — Sled test method to enable the evaluation of side impact protection of child restraint systems — Essential parameters

1 Scope

This document comprises a set of essential input parameters that can be used to develop or evaluate side impact test procedures for child restraint systems.

Although children are undoubtedly involved in side impact collisions of differing configurations and severities, these input parameters are, in general, associated with the impact test scenario in UN Regulation No. 95 (lateral collision protection of vehicles). This vehicle type-approval regulation comprises a full-scale crash test in which the stationary test vehicle is struck at right angles by a mobile deformable barrier travelling at 50 km/h. This test scenario is the basis for most of ISO's previous work on side impact testing for child restraint systems.

NOTE Countries and regions that do not recognise UN regulations can evaluate vehicles under different conditions and can apply input parameters that reflect the vehicle crash tests in their own regulatory jurisdictions.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

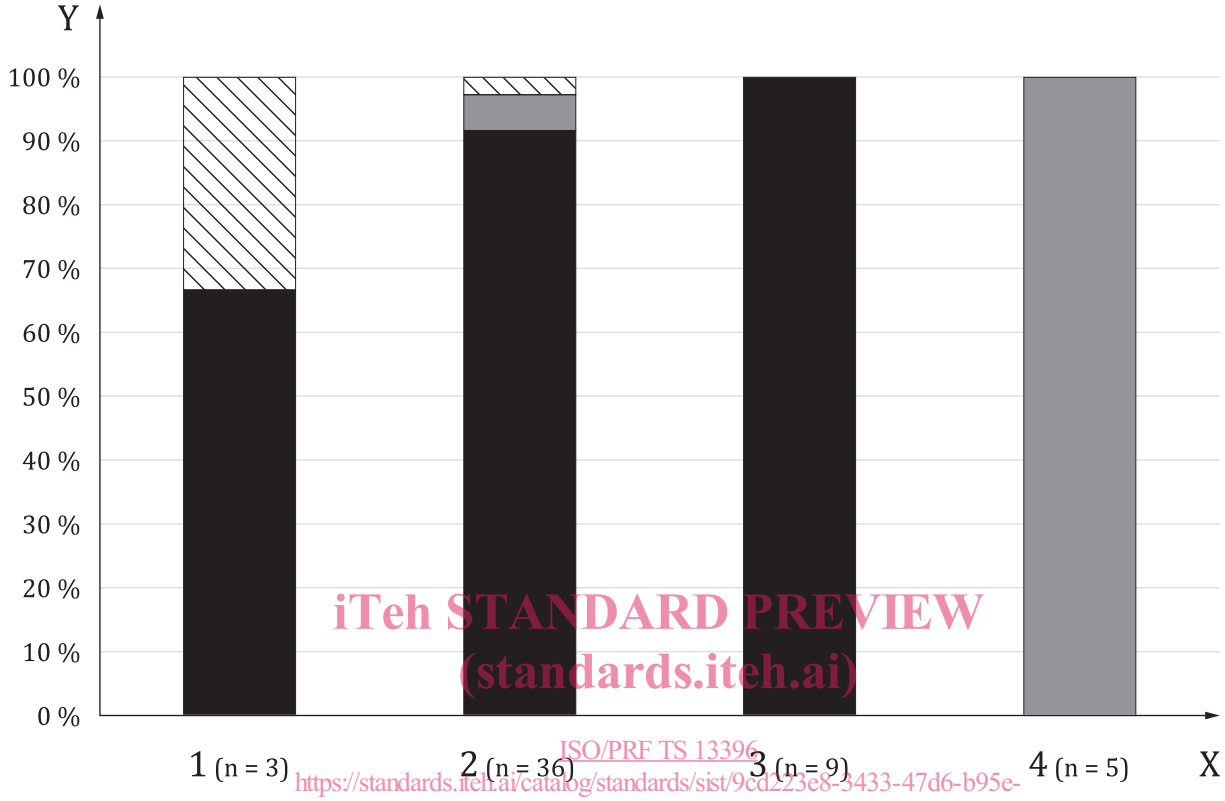
4 Accident statistics review

ISO has been studying injuries to children in side impact collisions since the mid 1990's. Early in that period, the risk of serious injury in a side impact was greater compared with other impact directions[3]. Furthermore, the risk was greater on the struck side of the car[4]. The European Enhanced Vehicle safety Committee (EEVC) recommended that increasing protection of the head should be the priority, following a wide-ranging review of European collision databases (EEVC, 2006). EEVC also reported that intrusion was an important parameter and influence on the injury severity level. These findings, along with other studies from the time, informed ISO's work on a side impact test procedure for child restraints.

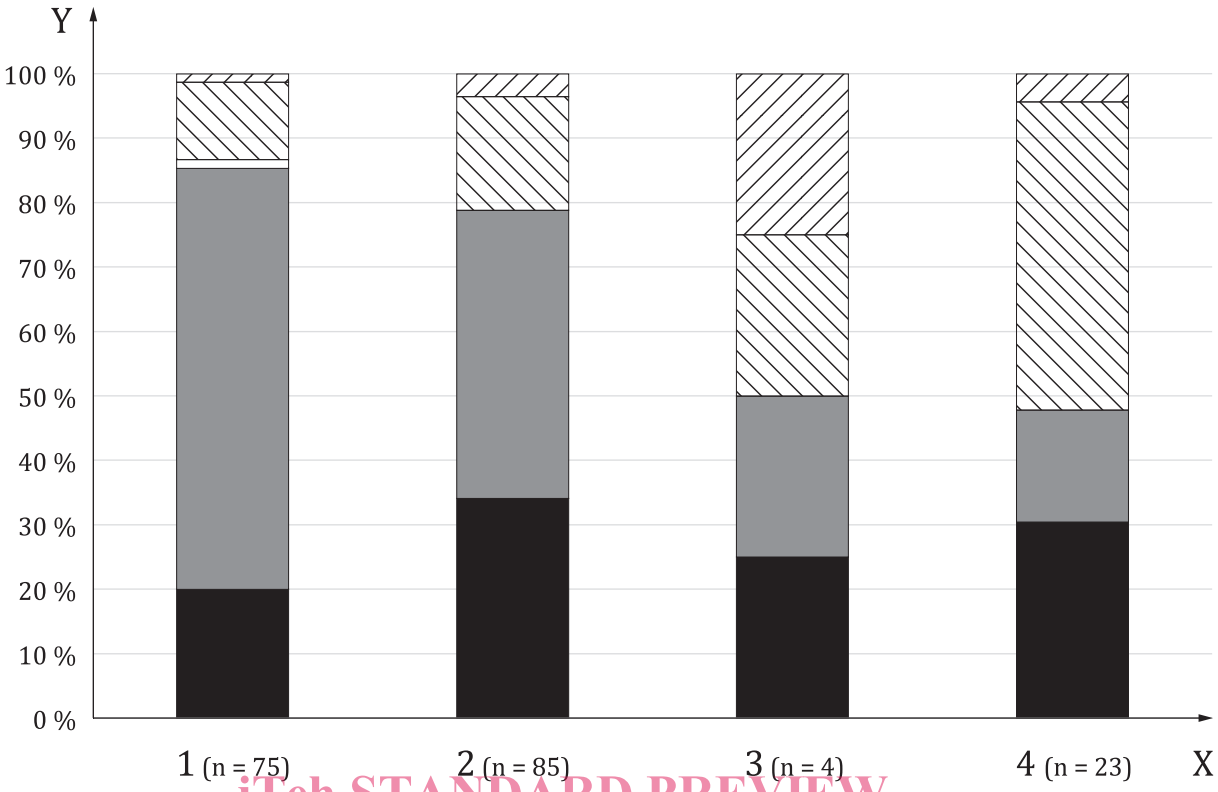
Since that time, the vehicle fleet has undergone significant changes, primarily in response to new regulatory and consumer test procedures. The side stiffness of cars has increased and although they are now also being struck by cars with increased frontal stiffness, it is possible that the boundary conditions for child restraint systems and injury outcomes for children in side impact collisions have changed.

Unfortunately, the literature on child restraint system performance in side impact is sparse and is limited to countries with on-going, in-depth collision studies. In the United Kingdom, data from the

Cooperative Crash Injury Study (CCIS) (1998-2010) and the Road Accident In-depth Study (RAIDS) (2012-2017) show a high proportion of children in child restraints with no or minor (MAIS1) injury in side impact; 79 %and 98 %respectively (see Figure 1). The newer, RAIDS data, appear to have fewer injuries, but both samples are relatively small. Therefore, any differences are unlikely to be statistically significant and neither sample may be nationally representative of the study period.



a) RAIDS data (2012-2017)



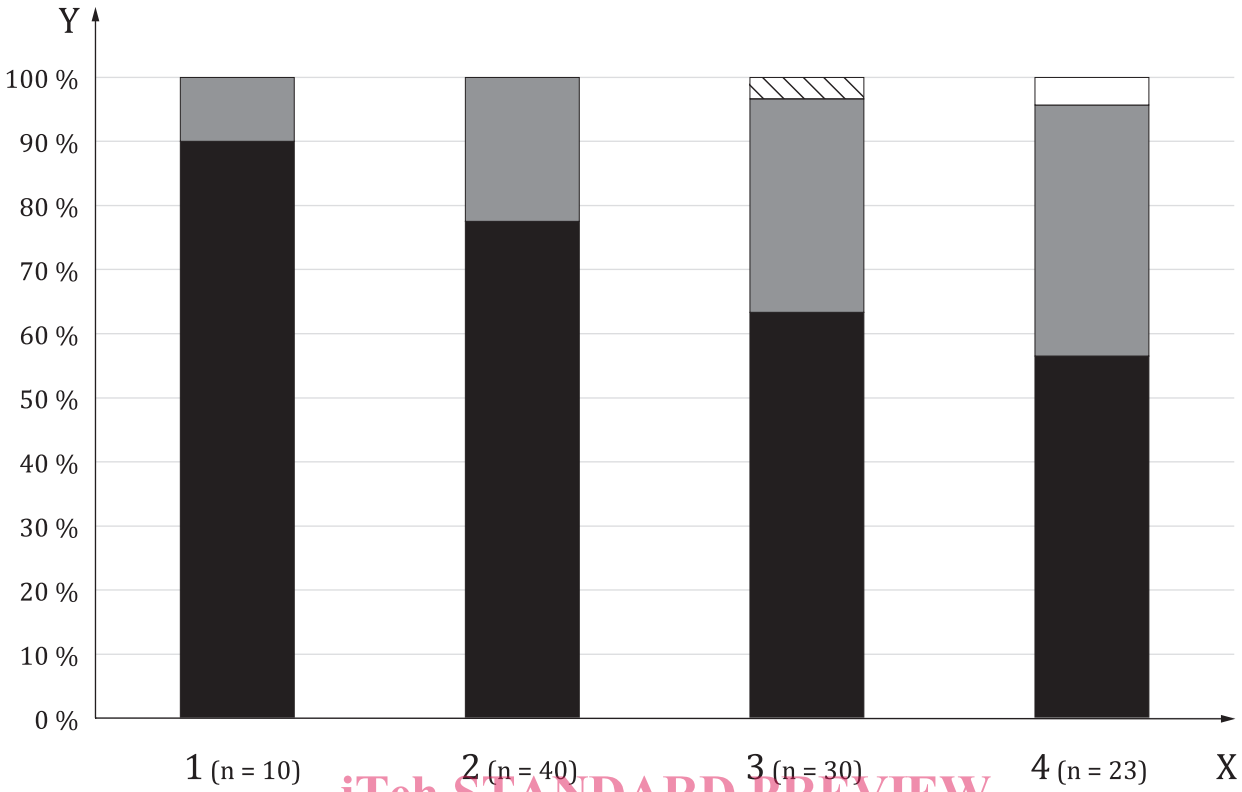
b) CCIS data (1998-2010)

Key

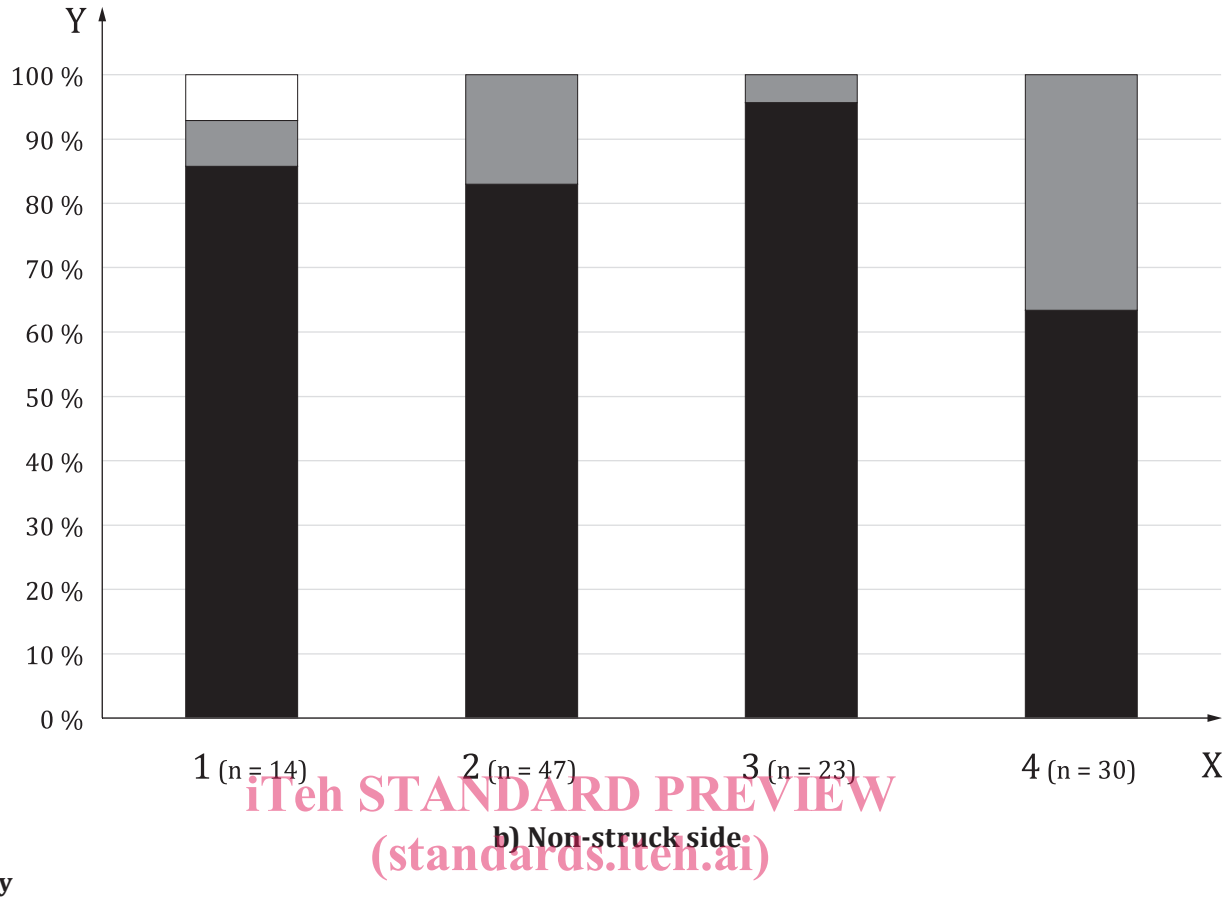
X	restraint type		no injury
Y	proportion of child occupants		MAIS1
1	adult seat belt		MAIS2
2	CRS		MAIS3+ (survived)
3	restrained, not specified		fatal
4	unrestrained		

Figure 1 — Distribution of injury severity by restraint type (Reference [6])

The German In-depth Accident Study (GIDAS) also shows a high proportion of children in child restraints receiving no or minor injury in side impact (see Figure 2). In this instance, the sample size is larger than the UK RAIDS and CCIS samples but covers a single period of 20 years (1999-2019). Although, it was possible for the authors to break down the data by child restraint type and proximity to the striking vehicle, this also resulted in relatively small numbers. Struck side impacts had the lowest proportion of children with no injury for each child restraint type; however, the majority of injuries were minor (MAIS1).



a) Struck side



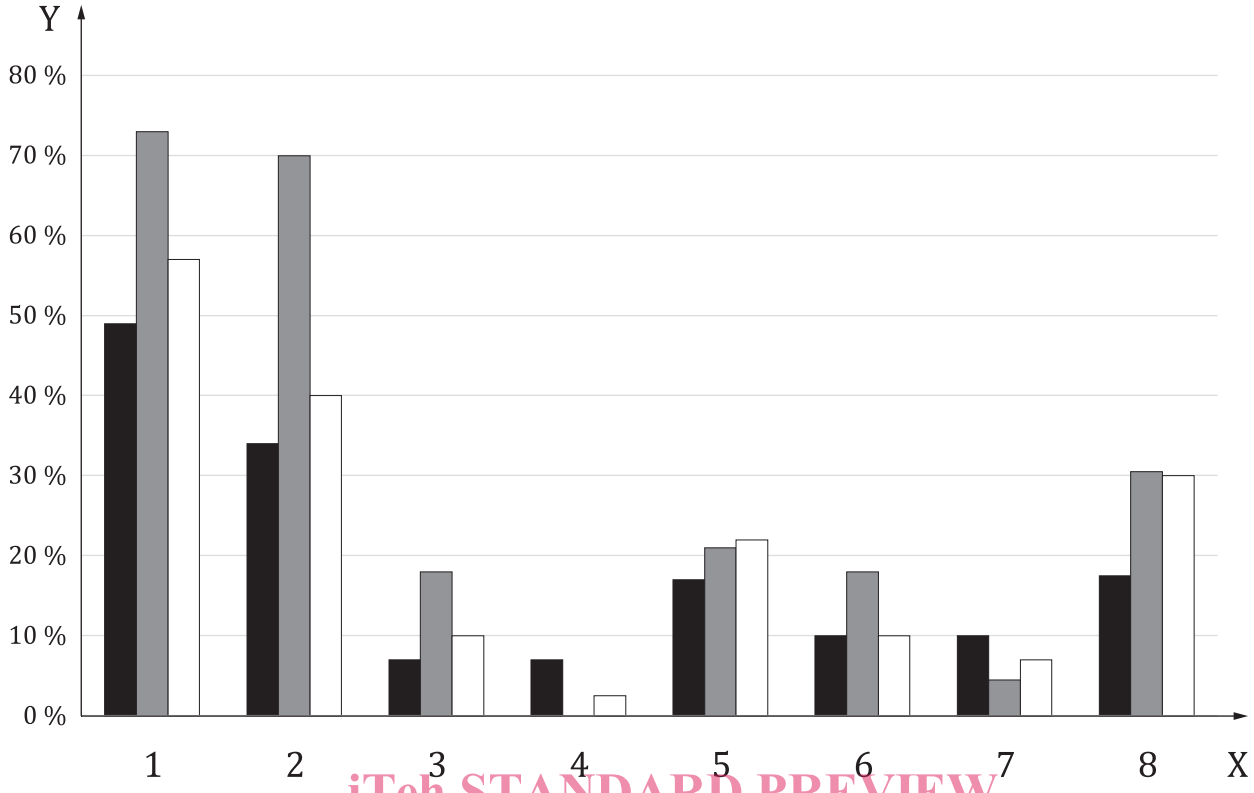
b) Non-struck side

Key

X	CRS type	3	booster seat (with backrest)		no injury
Y	proportion of child occupants	4	booster cushion (no backrest)		MAIS1
1	baby shell				MAIS2
2	forward-facing with harness				MAIS3+

Figure 2 — Distribution of injury severity by child restraint type – GIDAS data (Reference [7])

The head was the most frequently injured body region in the GIDAS sample reported by Reference [7]. However, the majority of these head injuries (94 %) were minor (AIS1). A non-representative sample of severe collisions was collected during the EU CASPER project (2009-2012). This included cases with moderate injury and above (MAIS ≥ 2) in side impact (see Figure 3). Although the sampling strategy and low numbers mean that comparisons cannot be drawn reliably between body regions and child restraint types, the data show the greatest proportion of injuries at this level were in the head and face. The data period for Figure 3 was not reported, but included cases from the previous project EU CHILD, which ran from 2002 to 2006.



Key

X	body region	4	neck		shell system
Y	MAIS ≥ 2 rate	5	thorax		booster seat/cushion
1	whole body	6	abdomen		adult seat belt
2	head	7	upper extremities		
3	face	8	lower extremities including pelvis		

Figure 3 — Body region distribution by child restraint type – CASPER data (Reference [8])

The limited information about child restraint system performance in real-world collisions means it is also difficult to determine the nature of side impacts involving children, particularly those that lead to injury. However, one attempt to analyse collision severity from GIDAS revealed that around 90 % of collisions involving children seated on the struck side occurred with a velocity change below 30 km/h, with most falling in the 11 km/h to 20 km/h band (see Figure 4). Similar findings were observed for children seated on the non-struck side. These included all injury severities.

