Motor Vehicle Safety Standards and NCAP

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Motor Vehicle Safety Standards and NCAP

Introduction

Motor Vehicle Safety Standards

Dummies

NCAP
Introduction to Dummies

• What is a dummy?
  Dummies are mechanical surrogates of the human body. Thus, they are also called:
  
  ANTHROPOMORPHIC TEST DEVICES

• What uses do they have?
  To measure the impact loading of different body parts (By using a suite of instrumentation built into the Dummy)

  To correctly load a vehicle to assess type and severity of injury by mimicking human dynamic impact responses
Dummy Terminology

- Percentile
- Anthropometry
- Biofidelity
- Measuring capability
- Repeatability
- Reproducibility
- Durability
- Sensitivity
- Simplicity and ease of use
Percentile

Sizes of adult dummies are expressed as ‘Percentiles’

Three percentile masses are used:

- 5th percentile
- 50th Percentile
- 95th Percentile

Example:
A 5th percentile indicates that 5% of the adult population is smaller than the Dummy
Hybrid III percentiles on a stature and mass scale in comparison to the resp. distribution of the population

Anthropometry

- Dummies should have and duplicate the following:
  - Have similar mass distribution to that of a living human
  - Have similar shape to that of a living human

- I.E. ATTRIBUTED WITH HUMAN
- CHARACTERISTICS
Biofidelity

DUMMIES SHOULD:
Duplicate the biomechanical response behaviour of a living human exposed to the same impact conditions

ACHIEVED BY:
Dummy matching the human cadaver test corridor response
Biofidelity: Human Corridors

Force min/max envelope: “Corridors”

Fig. 16 – Thoracic impact responses to blunt impacts at 6.7 m/s are shown relative to the Neathery 50th percentile male corridor
Measuring Capability

The dummy should be instrumented to provide the following measurements:

- Appropriate forces
- Deflections
- Accelerations
Repeatability & Reproducibility

Different Dummies of same design should:

  Receive the same response (output) to the same impact conditions (input)

Repeatability is assessed from responses to tests with the same dummy, and

Reproducibility from responses to tests with different dummies of the same design.
Durability

Durability implies that the Dummy should:

- Be structurally sound (intact) following an impact
- Have responses that remain repeatable

Durable Exceptions:

- Deliberate designed replacement parts
Environmental Sensitivity

The dummy should not be sensitive to temperature and humidity. These factors may affect its biofidelity and repeatability.

**Examples for calibration**

Hybrid II and US SID temperature limits between 18.9°C and 25.6°C

Hybrid III, BIOSID temperature limits between 20.6°C and 22.2°C

The relative Humidity limits between 10% RH and 70%RH
Simplicity and Ease to Use

The Dummy should....

Be easy to calibrate

Require minimal external support equipment

Be readily repairable

Have parts that are easy to change and replace
The Dummy Family

Frontal Impact

Adult Dummies

Hybrid III
5th, 50th, 95th
Pregnant 5th% female

THOR
50th percentile male
5th percentile female
(in development)

Child Dummies

CRABI
3, 6, 12, 18 month
Hybrid 3
3, 6, 10 year old

P series (P0, P3/4, P3, P10)
Q series (Q0, Q1, Q1.5, Q3, Q6, Q10)

Side Impact

(US SID)
BioSID
EuroSID
SIDIs
WorldSID

Rear Impact

BioRID
EvaRID

Other

Pedestrian
Example of Frontal Impact Dummies

Hybrid III cutaway

50th%ile   95th%ile   5th%ile
THOR – The New Frontal Impact Dummy

THOR = Test Device for Human Occupant Restraint


TAD-50M Prototype  THOR Alpha  THOR-NT USA  THOR Mod Kit  THOR Metric

2000 - 2009  THOR-FT Europe

Modified after Dan Parent: THOR 50TH PUBLIC MEETING 20.01.2015. NHTSA
Example of Side Impact Dummies

SIDIls

US SID  EuroSID  BioSID

WorldSID
## Dummies in Legislation & NCAP

### Frontal Impact Dummies

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Source: Carhs, 2018
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Introduction

Motor Vehicle Safety Standards

Dummies

NCAP
NCAP: New Car Assessment Programme

Introduction

US NCAP

Euro NCAP

Japan NCAP
NCAP: New Car Assessment Programme

- Consumer Tests provides motoring consumers with a realistic and independent assessment of the safety performance of some of the most popular cars.

- The following NCAPs exist:
  - US NCAP started with model year 1979 cars
  - Japan NCAP started with model year 1996 cars
  - Euro NCAP established in 1997 (similar: Australasian NCAP)
  - Korea NCAP established in 1999
  - China NCAP established in 2006
  - Latin NCAP established in 2010
  - Global NCAP established in 2011
  - Asean NCAP established in 2013
  - Bharat NCAP tbd.

- Several changes occurred since the introduction.