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EUROPEAN NEW CAR
ASSESSMENT PROGRAMME

Technical Bulletin

Data format and Injury Criteria Calculation

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TB 021

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Preface

Euro NCAP makes use with a number of different test laboratories around Europe, who perform the official Euro NCAP tests. This Technical Bulletin describes how the test data should be acquired and supplied to Euro NCAP to ensure consistency throughout all data used.

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1 TEST DATA

1.1 Data Format

All test data needs to be provided in ISO-MME 1.6 or ISO-MME 2.0 format and needs to be fully compliant with the ISO/TS 13499 standard.

1.1.1 Folder structure

The folder structure and the files contained in these folders follow the ISO/TS 13499 standard. The main directory contains seven folders and two files as detailed in the paragraphs below.

1.1.1.1 ISO-MME 1.6

The following folders and files need to be provided for every test performed, where the testnumber is the testnumber as provided by Euro NCAP:

<testnumber>	**Main Directory**
- **Channel**	**Sub Directory**
o <testnumber>.xxx	Channel data file
o <testnumber>.chn	Channel overview file
- **Document**	**Sub Directory**
o <name of document file 1>	Document file 1
o ...	
o <name of document file d>	Document file d
o <testnumber>_Document.txt	Document comment file
- **Movie**	**Sub Directory**
o <name of movie file 1>	Movie file 1
o ...	
o <name of movie file m>	Movie file m
o <testnumber>_Movie.txt	Movie comment file
- **Object**	**Sub Directory**
o <testnumber>_Reference.txt	Reference system comment file
o <name of object file 1>	Object information file 1
o ...	
o <name of object file o>	Object information file o
o <testnumber>_Object.txt	Object comment file
- **Photo**	**Sub Directory**
o <name of photo file 1>	Photo file 1
o ...	
o <name of photo file p>	Photo file p
o <testnumber>_Photo.txt	Photo comment file
- **Report**	**Sub Directory**
o <name of report file 1>	Report file 1
o ...	
o <name of report file r>	Report file r
o <testnumber>_Report.txt	Report comment file
- **Static**	**Sub Directory**
o <name of static measurment file>	Static measurement file
o <testnumber>_Static.txt	Static measurement comment file
- <testnumber>.mme	Test information file
- <testnumber>.txt	Test comment file

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1.1.1.2 ISO-MME 2.0

The following folders and files need to be provided for every test performed, where the testnumber is the testnumber as provided by Euro NCAP:

<testnumber> **Main Directory**

- **Channel** **Sub Directory**
  - <testnumber>_Channel.mmi — Channel information file
  - <name of channel file 1>.mmd — Channel data file 1
  - ...
  - <name of channel file c>.mmd — Channel data file c
  - <testnumber>_Channel.txt — Channel comment file
- **Document** **Sub Directory**
  - <testnumber>_Document.mmi — Document information file
  - <name of document file 1> — Document file 1
  - ...
  - <name of document file d> — Document file d
  - <testnumber>_Document.txt — Document comment file
- **Movie** **Sub Directory**
  - <testnumber>_Movie.mmi — Movie information file
  - <testnumber >_Movie.mmd — Movie data file
  - <name of movie file 1> — Movie file 1
  - ...
  - <name of movie file m> — Movie file m
  - <testnumber>_Movie.txt — Movie comment file
- **Object** **Sub Directory**
  - <testnumber>_Reference.mmi — Reference system information file
  - <testnumber >_Reference.mmd — Reference system data file
  - <testnumber>_Reference.txt — Reference system comment file
  - <name of object file 1> — Object information file 1
  - ...
  - <name of object file o> — Object information file o
  - <testnumber>_Object.txt — Object comment file
- **Photo** **Sub Directory**
  - <testnumber>_Photo.mmi — Photo information file
  - <name of photo file 1> — Photo file 1
  - ...
  - <name of photo file p> — Photo file p
  - <testnumber>_Photo.txt — Photo comment file
- **Report** **Sub Directory**
  - <testnumber>_Report.mmi — Report information file
  - <name of report file 1> — Report file 1
  - ...
  - <name of report file r> — Report file r
  - <testnumber>_Report.txt — Report comment file
- **Static** **Sub Directory**
  - <testnumber>_Static.mmi — Static measurement info file
  - <testnumber>_Static.mmd — Static measurement data file
  - <testnumber>_Static.txt — Static measurement comment file

- <testnumber>.mme — Test information file
- <testnumber>.txt — Test comment file

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1.1.2 MME-file

The mme-file shall contain at least the following header:

```
Data format edition number   1.6 or 2.0
....
Customer name                Euro NCAP
Customer test ref number     <testnumber>
Title                        Euro NCAP <year of test>
Type of the test             <see list in 1.1.2.1>
Subtype of the test          <see list in 1.1.2.1>
Regulation                   <protocol version>
Name of test object 1        <make and model>
Class of test object 1       <Euro NCAP vehicle class>
Ref. number of test object 1 <VIN number>
...
```

1.1.2.1 List with type and subtype of the test

Euro NCAP test	**Type of Test**	**Subtype of test**
Frontal ODB	Frontal	ODB
Frontal FW	Frontal	FW
Side MDB	Side	MDB
Side Pole	Side	Pole
Whiplash	Whiplash	Low Medium High
Pedestrian	Pedestrian	Headform Upper Legform Lower Legform

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1.2 Channel names and filters

For each dummy, impactors and test objects used in the different Euro NCAP tests the following channel names shall be used. All channels shall be supplied unfiltered/prefiltered. The appropriate filters for calculation of injury criteria and plotting of these channels will be performed by the analysis software used.

1.2.1 Hybrid III 50% Male

Location	Parameter	ISO code	CFC	Injury Calculation
Head	Accelerations, A_x A_y A_z	??HEAD0000H3AC[X,Y,Z]P	1000	Peak Resultant acceleration HIC_{15} Resultant 3msec exceedence
Neck	Forces, F_x F_y F_z	??NECKUP00H3FO[X,Y,Z]P	1000	Tension continuous exceedence Shear (F_x) continuous exceedence Peak Extension (M_y)
	Moments, M_x M_y M_z	??NECKUP00H3MO[X,Y,Z]P	600	
Chest	Accelerations, A_x A_y A_z	??CHST0000H3AC[X,Y,Z]P	180	Peak resultant acceleration Resultant 3 msec exceedence Peak deflection Viscous Criterion
	Deflection, D_{chest}	??CHST0003H3DSXP	180	
Pelvis	Accelerations, A_x A_y A_z	??PELV0000H3AC[X,Y,Z]P		
Lumbar Spine	Forces, F_x F_z	??LUSP0000H3FO[X,Z]P		
	Moments, M_y	??LUSP0000H3MOYP		
Femurs (L & R)	Forces, F_z	??FEMR[LE,RI]00H3FOZP	600	Compressive Axial Force ($-F_z$) continuous exceedence
Knees (L & R)	Displacements, D_{knee}	??KNSL[LE,RI]00H3DSXP	180	Peak displacement
Upper Tibia (L & R)	Forces, F_x F_z	??TIBI[LE,RI]UPH3FO[X,Z]P	600	Peak Tibia Compression ($-F_z$) Tibia Index
	Moments, M_x M_y	??TIBI[LE,RI]UPH3MO[X,Y,Z]P	600	
Lower Tibia (L & R)	Forces, F_x F_z (F_y)	??TIBI[LE,RI]LOH3FO[X,Y,Z]P	600	Peak Tibia Compression ($-F_z$) Tibia Index
	Moments, M_x M_y	??TIBI[LE,RI]LOH3MO[X,Y,Z]P	600	

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1.2.1.1 Hybrid III 5% Female

Location	Parameter	ISO code	CFC	Injury Calculation
Head	Accelerations, A_x A_y A_z	??HEAD0000HFAC[X,Y,Z]P	1000	Peak Resultant acceleration HIC_{15} Resultant 3msec exceedence
Neck	Forces, F_x F_y F_z	??NECKUP00HFFO[X,Y,Z]P	1000	Tension continuous exceedence Shear (F_x) continuous exceedence Peak Extension (M_y)
	Moments, M_x M_y M_z	??NECKUP00HFMO[X,Y,Z]P	600	
Chest	Accelerations, A_x A_y A_z	??CHST0000HFAC[X,Y,Z]P	180	Peak resultant acceleration Resultant 3 msec exceedence Peak deflection Viscous Criterion
	Deflection, D_{chest}	??CHST0003HFDSXP	180	
Pelvis	Accelerations, A_x A_y A_z	??PELV0000HFAC[X,Y,Z]P		
Iliac (L & R)	Forces, F_x	??ILAC[LE,RI]00HFFOXP		
	Moments, M_y	??ILAC[LE,RI]00HFMOYP		
Lumbar Spine	Forces, F_x F_z	??LUSP0000HFFO[X,Z]P		
	Moments, M_y	??LUSP0000HFMOYP		
Femurs (L & R)	Forces, F_z	??FEMR[LE,RI]00HFFOZP	600	Compressive Axial Force ($-F_z$) Continuous exceedence
Knees (L & R)	Displacements, D_{knee}	??KNSL[LE,RI]00HFDSXP	180	Peak displacement
Upper Tibia (L & R)	Forces, F_x F_z	??TIBI[LE,RI]UPHFFO[X,Z]P	600	Peak Tibia Compression ($-F_z$) Tibia Index
	Moments, M_x M_y	??TIBI[LE,RI]UPHFMO[X,Y,Z]P	600	
Lower Tibia (L & R)	Forces, F_x F_z (F_y)	??TIBI[LE,RI]LOHFFO[X,Y,Z]P	600	Peak Tibia Compression ($-F_z$) Tibia Index
	Moments, M_x M_y	??TIBI[LE,RI]LOHFMO[X,Y,Z]P	600	

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1.2.1.2 WorldSID 50% Male

Location	Parameter		CFC	Injury Calculation
Head	Accelerations, A_x A_y A_z	??HEAD0000WSAC[X,Y,Z]P	1000	HIC_{15} Peak acceleration 3msec exceedence (cumulative)
Neck	Forces, F_x F_y F_z	??NECKUP00WSFO[X,Y,Z]P	1000	
	Moments, M_x M_y M_z	??NECKUP00WSMO[X,Y,Z]P	600	
Shoulder	Forces, Fx, Fy, Fz	??SHLD[LE,RI]00WSFO[X,Y,Z]P	600	Peak lateral force
	Displacement, D	??SHRI[LE,RI]00WSDS0P	600	Peak displacement Viscous criterion
	Rotation, α	??SHRI[LE,RI]00WSANZP	600	
Thorax	Displacement, D	??TRRI[LE,RI][01,02,03]WSDS0P	600	Peak displacement Viscous criterion
	Rotation, α	??TRRI[LE,RI][01,02,03]WSANZP	600	
Abdomen	Displacement, D	??ABRI[LE,RI][01,02]WSDS0P	600	Peak displacement Viscous criterion
	Rotation, α	??ABRI[LE,RI][01,02]WSANZP	600	
T12	Accelerations, A_x A_y A_z	??THSP1200WSAC[X,Y,Z]P	180	Peak acceleration Peak force Peak moment
	Forces, F_x F_y F_z	??LUSP1200WSFO[X,Y,Z]P	600	
	Moments, M_x M_y M_z	??LUSP1200WSMO[X,Y,Z]P	600	
Pelvis	Accelerations, A_x A_y A_z	??PELV0000WSAC[X,Y,Z]P	600	Peak acceleration Peak force
	Forces, F_y	??PUBC0000WSFOYP	600	
Femur	Forces, F_x F_y F_z	??FEMR[LE,RI]00WSFO[X,Y,Z]P	600	Peak force

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1.2.1.3 BioRID-II

Location	**Parameter**		**CFC**	**Injury Calculation**
Head	Accelerations, A_x A_y A_z	??HEAD0000BRAC[X,Y,Z]P	60	NIC
	Velocity, V_x	??HEAD0000BRVEXV	30	Head rebound velocity
	Contact	??HERE0000BREV00		Head contact time
Cervical Spine	Accelerations, A_x A_z	??CESP0400BRAC[X,Z]P	60	
Neck Upper	Forces, F_x F_y F_z	??NECKUP00BRFO[X,Y,Z]P	1000	Nkm Neck shear (+Fx) Neck tension (+Fz)
	Moments, M_x M_y M_z	??NECKUP00BRMO[X,Y,Z]P	600	Nkm
Neck Lower	Forces, F_x F_y F_z	??NECKLO00BRFO[X,Y,Z]P	1000	
	Moments, M_x M_y M_z	??NECKLO00BRMO[X,Y,Z]P	600	
Thoracic Spine T1 (L & R)	Accelerations, A_x A_z	??THSP01[LE,RI]BRAC[X,Z]P	60	T1-acceleration NIC
Thoracic Spine T8	Accelerations, A_x A_z	??THSP0800BRAC[X,Z]P	60	
Lumbar Spine	Accelerations, A_x A_z	??LUSP0100BRAC[X,Z]P	60	
Pelvis	Accelerations, A_x A_y A_z	??PELV0000BRAC[X,Y,Z]P	60	

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1.2.1.4 Q1 ½

Location	Parameter	ISO code	CFC	Injury Calculation
Head	Accelerations, A_x A_y A_z	??HEAD0000Q2AC[X,Y,Z]P	1000	Peak Resultant acceleration Resultant (+ve) 3msec exceedence
Neck	Forces, F_x F_y F_z	??NECKUP00Q2FO[X,Y,Z]P	1000	Peak Tensile Force F_z
	Moments, M_x M_y M_z	??NECKUP00Q2MO[X,Y,Z]P	600	Peak resultant acceleration Resultant (+ve) 3msec exceedence
Chest	Accelerations, A_x A_y A_z	??THSP0000Q2AC[X,Y,Z]P	180	Peak Acceleration
	Deflection	??CHST0000Q2DSXP	180	Peak Resultant acceleration Resultant (+ve) 3msec exceedence

1.2.1.5 Q3

Location	Parameter	ISO code	CFC	Injury Calculation
Head	Accelerations, A_x A_y A_z	??HEAD0000Q3AC[X,Y,Z]P	1000	Peak Resultant acceleration Resultant (+ve) 3msec exceedence
Neck	Forces, F_x F_y F_z	??NECKUP00Q3FO[X,Y,Z]P	1000	Peak Tensile Force F_z
	Moments, M_x M_y M_z	??NECKUP00Q3MO[X,Y,Z]P	600	Peak resultant acceleration Resultant (+ve) 3msec exceedence
Chest	Accelerations, A_x A_y A_z	??THSP0000Q3AC[X,Y,Z]P	180	Peak Acceleration
	Deflection	??CHST0000Q3DSXP	180	Peak Resultant acceleration Resultant (+ve) 3msec exceedence

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1.2.1.6 Adult Headform

Location	Parameter	ISO code	CFC	Injury Calculation
Head	Accelerations, A_x A_y A_z	D0HEAD0000PAAC[X,Y,Z]P	1000	HIC_{15}

1.2.1.7 Child Headform

Location	Parameter	ISO code	CFC	Injury Calculation
Head	Accelerations, A_x A_y A_z	D0HEAD0000PCAC[X,Y,Z]P	1000	HIC_{15}

1.2.1.8 Upper Legform

Location	Parameter	ISO code	CFC	Injury Calculation
Femur	Forces, F_x	D0FEMR[UP,LO]00PUFOXP	180	Sum of Forces
	Moments, M_y	D0FEMR[UP,MI,LO]00PUMOYP	180	Bending Moment

1.2.1.9 Lower Legform (Flex-PLI)

Location	Parameter	ISO code	CFC	Injury Calculation
Femur	Moments, M_x	D0FEMR[UP,MI,LO]00PFMOXP	180	
Knee	Accelerations, A_y	D0KNEE0000PFACYP	180	
	Displacement, D_{ACL}	D0KNEEAC00PFDSZP	180	ACL/PCL
	Displacement, D_{LCL}	D0KNEELC00PFDSZP	180	
	Displacement, D_{MCL}	D0KNEEMC00PFDSZP	180	MCL
	Displacement, D_{PCL}	D0KNEEPC00PFDSZP	180	ACL/PCL
Tibia	Moments, M_x	D0TIBI[UP,LO]00PFMOXP D0TIBIMI[UP,LO]PFMOXP	180	Tibia Bending Moment

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1.2.1.10 Vehicle

Location	Parameter	ISO code	CFC	Injury Calculation
B-Post	Accelerations, Ax Ay	[14,16]BPILLO0000AC[X,Y]P	60	
Seatbelt	Force, $F_{seatbelt}$	??SEBE0003B3FO0P	60	Seat belt force modifier

1.2.1.11 Trolley

Location	Parameter	ISO code	CFC	Injury Calculation
CoG	Accelerations, Ax	M0MBARCG0000ACXP	60	

1.2.1.12 Sled

Location	Parameter	ISO code	CFC	Injury Calculation
Sled	Accelerations, Ax	S0SLED000000ACXP	60	

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2 INJURY CRITERIA CALCULATION

This chapter describes the calculation for each injury criteria used within Euro NCAP, including the filters that are applied to each channel used in these calculations. The analysis software used by the Euro NCAP labs will follow these calculations in detail.

2.1 Head criteria

2.1.1 Head Resultant Acceleration

The Head Resultant Acceleration is calculated with the following formula:

$$A_R = \sqrt{{A_x}^2 + {A_y}^2 + {A_z}^2}$$

with:

A_x	Filtered Head Acceleration A_x	??HEAD0000??ACXA
A_y	Filtered Head Acceleration A_y	??HEAD0000??ACYA
A_z	Filtered Head Acceleration A_z	??HEAD0000??ACZA

2.1.2 HIC_{15}

The HIC_{15} value is calculated with the following formula:

$$HIC_{15} = (t_2 - t_1)\left(\frac{1}{(t_2 - t_1)}\int_{t_1}^{t_2} A_R dt\right)^{2.5}$$

with:

A_R	Head Resultant Acceleration

2.1.3 Head Restraint Contact Time

The Head Restraint Contact Time is calculated with the following formula:

$$T_{HRC} = T_{HRC,end} - T_{HRC,start}$$

with:

$T_{HRC,start}$	Time of first contact of head and HR after T=0	??HERE0000BREV00
$T_{HRC,end}$	Time where contact is lost	??HERE0000BREV00

Gaps up to 1ms are ignored if proven to be the result of poor electrical contact.

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2.1.4 T1 x-acceleration

The T1 x-acceleration value is calculated with the following formula:

$$T1 = \frac{T1_{left} + T1_{right}}{2}$$

with:

$T1_{left}$	Filtered left T1 acceleration	??THSP01LEBRACXD
$T1_{right}$	Filtered right T1 acceleration	??THSP01RIBRACXD

2.2 Neck criteria

2.2.1 Neck extension bending moment

The Neck extension bending moment is calculated with the following formula:

$$M_{OCy} = M_y - F_x \cdot d$$

with:

M_y	Filtered Bending Moment	??NECKUP00??MOYB
F_x	Filtered Shear Force	??NECKUP00??FOXB
d	0.01778m for HIII-50M and HIII-05F	

2.2.2 NIC

The NIC value is calculated with the following formula:

$$NIC = 0.2 \cdot A_{rel} + {v_{rel}}^2$$

with:

$$A_{rel} = T1 - A_{x,head}$$

$$v_{rel} = A_{rel}$$

T1	Average T1 acceleration	
$A_{x,head}$	Filtered Head Acceleration A_x	??HEAD0000BRACXD

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2.2.3 Nkm

The Nkm value is calculated with the following formula:

$$Nkm(t) = N_{ep}(t) + N_{ea}(t) + N_{fp}(t) + N_{fa}(t)$$

with:

$$N_{ep}(t) = \frac{M_{ye}(t)}{-47.5} + \frac{F_{xp}(t)}{-845}$$

$$N_{ea}(t) = \frac{M_{ye}(t)}{-47.5} + \frac{F_{xa}(t)}{845}$$

$$N_{fp}(t) = \frac{M_{yf}(t)}{88.1} + \frac{F_{xp}(t)}{-845}$$

$$N_{fa}(t) = \frac{M_{yf}(t)}{88.1} + \frac{F_{xa}(t)}{845}$$

$$M_{OCy}(t) = M_y(t) - D \cdot F_x(t)$$

$F_x(t)$	Filtered Upper Neck Shear Force F_x	??NECKUP00BRFOXB
$M_y(t)$	Filtered Upper Neck Moment M_y	??NECKUP00BRMOYB
D	0.01778m	

$F_{xp}(t)$	negative portion of $F_x(t)$
$F_{xa}(t)$	positive portion of $F_x(t)$
$M_{ye}(t)$	negative portion of $M_{OCy}(t)$
$M_{yf}(t)$	positive portion of $M_{OCy}(t)$

2.3 Shoulder criteria

2.3.1 Lateral Shoulder Force

The Lateral Shoulder Force is calculated with the following formula:

$$Fy_{shoulder} = \max(F_y(t))$$

with:

F_y	Filtered Shoulder Force F_y	??SHLD[LE,RI]00WSFOYB

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2.3.2 Lateral Shoulder Rib Displacement

The Lateral Shoulder Rib Displacement is calculated with the following formula:

$$Dy_{shoulder} = \max\left(D_y(t) - D_y(0)\right)$$

with:

$$D_y(t) = L(t) \cdot \cos(\alpha(t))$$

L(t)	Filtered Shoulder IR-TRACC length	??SHRI[LE,RI]00WSDS0C
α(t)	Filtered Shoulder IR-TRACC rotation	??SHRI[LE,RI]00WSANZC
$D_y(0)$	Lateral Shoulder Rib Displacement @ t=0	

2.4 Chest criteria

2.4.1 Chest Deflection

The Chest Deflection value is calculated with the following formula:

$$D_{chest} = \max(D_{chest}(t))$$

with:

$D_{chest}(t)$	Filtered Chest Deflection D_{chest}	??CHST0003??DSXC

2.4.2 Seatbelt force modifier

The Seatbelt force modifier is calculated with the following formula:

$$MA_{seatbelt} = \max(MA_{seatbelt}(t))$$

with:

$$MA_{seatbelt}(t) = \frac{1}{2n+1}\sum_{j=t-n}^{j=t+n} F_{seatbelt}(j)$$

$F_{seatbelt}$	Filtered Seatbelt Force	??SEBE0003B3FO0A
n	number of samples equivalent to 10ms	

2.4.3 Lateral Thoracic Rib Displacement

The Lateral Thoracic Rib Displacement is calculated with the following formula:

$$Dy_{thorax} = \max\left(D_y(t) - D_y(0)\right)$$

with:

$$D_y(t) = L(t) \cdot \cos(\alpha(t))$$

L(t)	Filtered Thoracic IR-TRACC length	??TRRI[LE,RI]01WSDS0C
α(t)	Filtered Thoracic IR-TRACC rotation	??TRRI[LE,RI]01WSANZC
$D_y(0)$	Lateral Thoracic Rib Displacement @ t=0	

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2.4.4 Viscous Criterion

The VC is calculated with the following formula:

$VC = sf \cdot V(t) \times C(t)$

With:

sf 1.3 for HIII-50M, 1.3 for HIII-05F and 1.0 for WorldSID

$$V(t) = \frac{8(D_{chest}(t+1) - D_{chest}(t-1)) - (D_{chest}(t+2) - D_{chest}(t-2))}{12\Delta t}$$

$$C(t) = \frac{D_{chest}(t)}{D_{constant}}$$

$D_{chest}(t)$	Filtered Chest Deflection D_{chest}	??CHST0003??DSXC
	for WorldSID use calculated Lateral Thoracic Rib Displacement Dy_{thorax}	
Δt	Time step	
$D_{constant}$	0.229 for HIII-50M, 0.187 for HIII-05F and 0.170 for WorldSID	

2.5 Abdomen criteria

2.5.1 T12 Resultant Acceleration

The T12 Resultant Acceleration is calculated with the following formula:

$$A_R = \sqrt{{A_x}^2 + {A_y}^2 + {Aa_z}^2}$$

with:

A_x	Filtered T12 Acceleration A_x	??THSP1200WSACXC
A_y	Filtered T12 Acceleration A_y	??THSP1200WSACYC
A_z	Filtered T12 Acceleration A_z	??THSP1200WSACZC

2.5.2 Lateral Abdominal Rib Displacement

The Lateral Abdominal Rib Displacement is calculated with the following formula:

$Dy_{abdomen} = \max\left(D_y(t) - D_y(0)\right)$

with:

$D_y(t) = L(t) \cdot \cos(\alpha(t))$

L(t)	Filtered Abdominal IR-TRACC length	??ABRI[LE,RI]01WSDS0C
α(t)	Filtered Abdominal IR-TRACC rotation	??ABRI[LE,RI]01WSANZC
$D_y(0)$	Lateral Abdominal Rib Displacement @ t=0	

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2.6 Lower extremities criteria

2.6.1 Iliac Force Drop

The Iliac Force Drop value is calculated with the following formula:

$IFD = \max(IFD(t))$

With:

$IFD(t) = F_{iliac}(t) - F_{iliac}(t - 0.001)$

F_{iliac} (t)	Filtered Iliac Force F_{iliac}	??ILAC[LE,RI]00??FOXP

2.6.2 Knee Displacement

The Knee Displacement value is calculated with the following formula:

$D_{knee} = \max(D_{knee}(t))$

With:

D_{knee}(t)	Filtered Knee Displacement D_{knee}	??KNSL[LE,RI]00??DSXC

2.6.3 Femur Force

The Femur Force value is calculated with the following formula:

$F_{femur} = \max(F_{femur}(t))$

With:

F_{femur}(t)	Filtered Femur Force F_{femur}	??FEMR[LE,RI]00HFFOZB

2.6.4 Tibia Index

The Tibia Index is calculated with the following formula:

$$TI(t) = \left(\frac{M_R(t)}{(M_R)_C}\right) + \left(\frac{F_z(t)}{(F_z)_C}\right)$$

with:

$$M_R(t) = \sqrt{M_x(t)^2 + M_y(t)^2}$$

M_x	Filtered Bending Moment M_x	??TIBI[LE,RI][UP,LO]??MOXB
F_z	Filtered Bending Moment F_z	??TIBI[LE,RI][UP,LO]??FOZB
$(M_R)_C$	225Nm for HIII-50M and 115Nm for HIII-05F	
$(F_z)_C$	35.9N for HIII-50M and 22.9N for HIII-05F	

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