

# Krockprov cykel – bil

Folksam, Autoliv och POC (Hövding med initialt)



# Bakgrund – vanligaste olyckssituationerna

baserat på dödsolycksstudier som Folksam gjorde 2018-2020

- Landsbygd: Cyklist påkörd bakifrån då den cyklar längs sidan av vägen



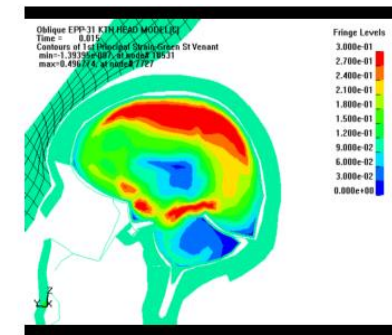
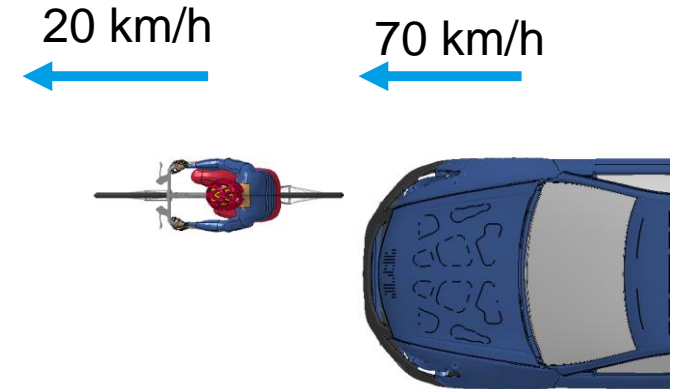
- Tätort: Påkörd från sidan vid korsande trafik



- Totalt 43% dog då de korsade vägen (51% tätort, 33% landsbygd)

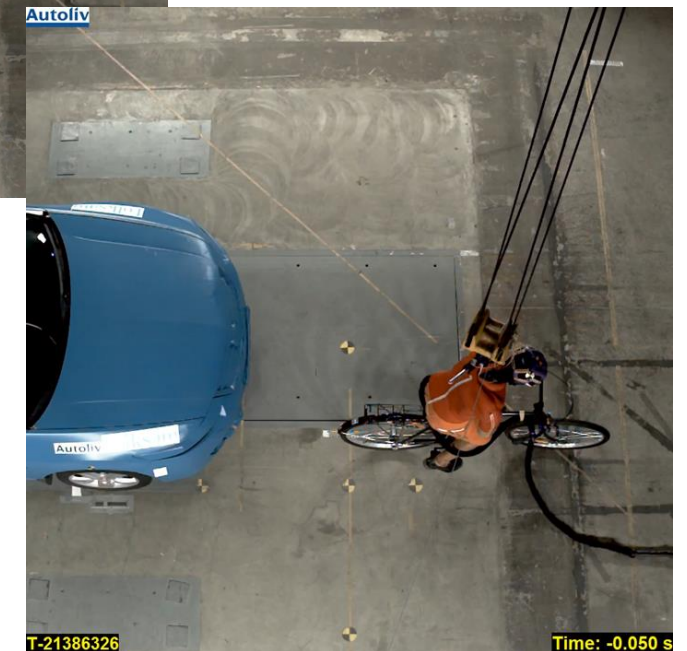
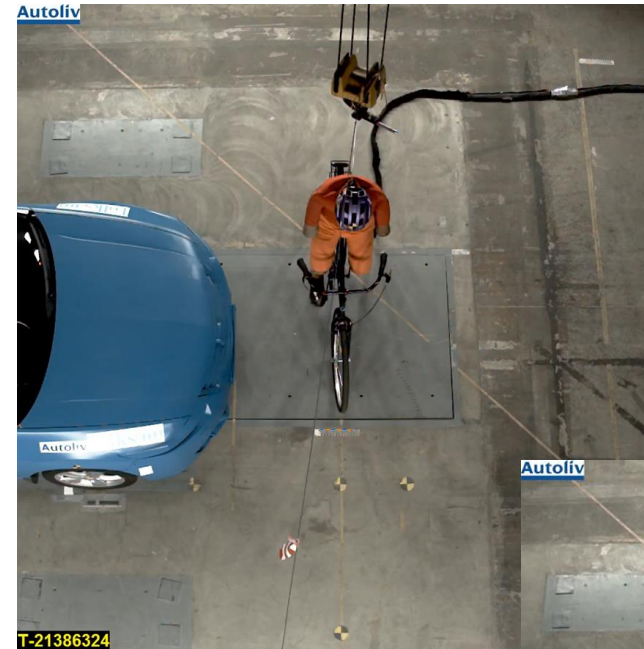
# Syften

- Utvärdera om cyklist kan undvika dödlig skada och helst allvarlig skada i de vanligaste dödsolyckstyperna då de blir påkörda av en bil med bra passivt skydd och använder en bra hjälm i påkörningshastigheter av 50 km/h (70-20) resp 40 km/h
- Ökad kunskap om möjligheten att skydda i svåra kollisioner
- Utvärdera om förbättrade testmetoder krävs för att spegla även dessa kollisionstyper



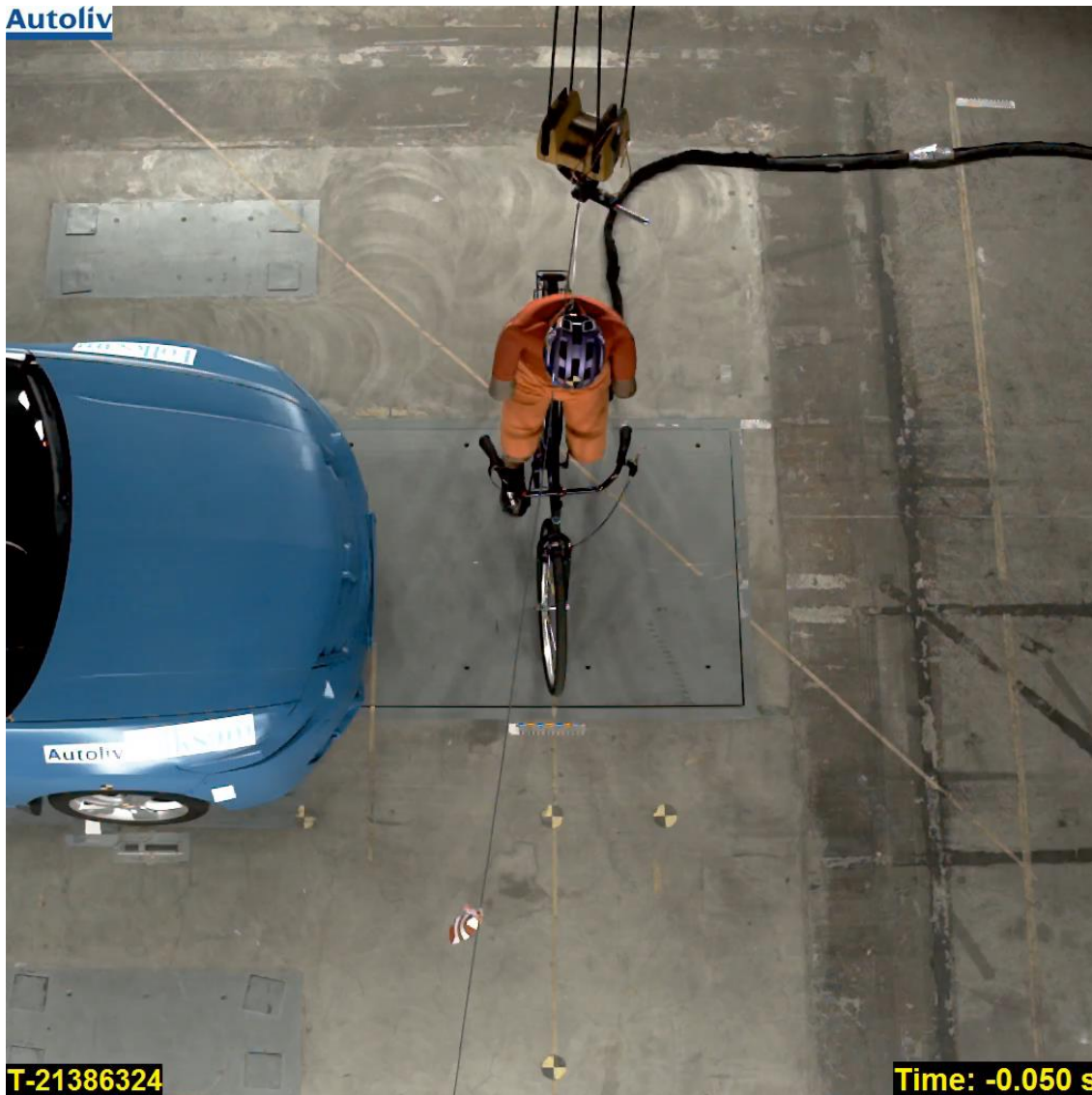
# Metod

- Krocktester med de två utvalda olyckssituationerna
- Datasimuleringar av olyckssituationerna där olika variabler varieras – utförs av Autoliv





Autoliv



## Prov 1: Cyklist påkörd i sida 40 km/h

Autoliv



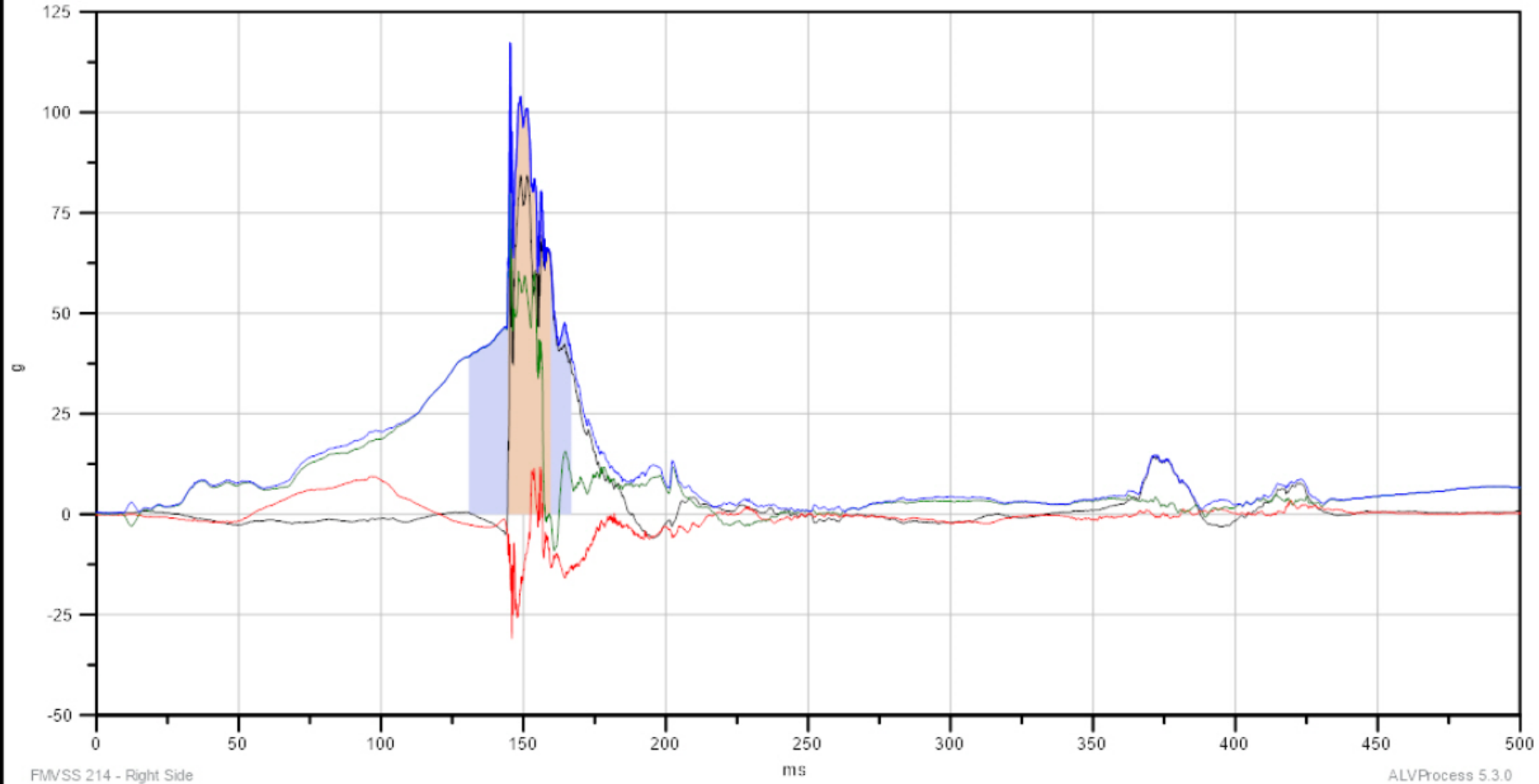
Test Number: TO-21056300 / T-21386324  
Test Date: 29-Nov-2021  
Test Description: Folksam Head Injury, bicycle side impact.

Pos. 1 Head Acceleration (CFC1000)  
ATD Type: EuroSID-2



- 11HEAD0000E2ACXA (Pos. 1 Head X Acceleration) - (CFC 1000) - (Max. 88.6g at 145.4ms) - (Min. -8.0g at 195.6ms)
- 11HEAD0000E2ACYA (Pos. 1 Head Y Acceleration) - (CFC 1000) - (Max. 11.9g at 155.9ms) - (Min. -30.9g at 145.9ms)
- 11HEAD0000E2ACZA (Pos. 1 Head Z Acceleration) - (CFC 1000) - (Max. 79.7g at 145.3ms) - (Min. -9.1g at 160.8ms)
- 11HEAD0000E2ACRA (Pos. 1 Head Resultant) - (CFC 1000) - (Max. 117.3g at 145.3ms) - (Min. 0.3g at 4.1ms)

HIC15 Value: 923.8 from 144.6ms to 159.6ms  
HIC36 Value: 1007.0 from 130.9ms to 166.9ms  
HPC Value: 1034.4 from 122.1ms to 169.9ms  
3ms Head Clip (cumulative): 98.8g from 145.2ms to 151.6ms  
Orange shaded area delimits HIC15  
Blue shaded area delimits HIC36

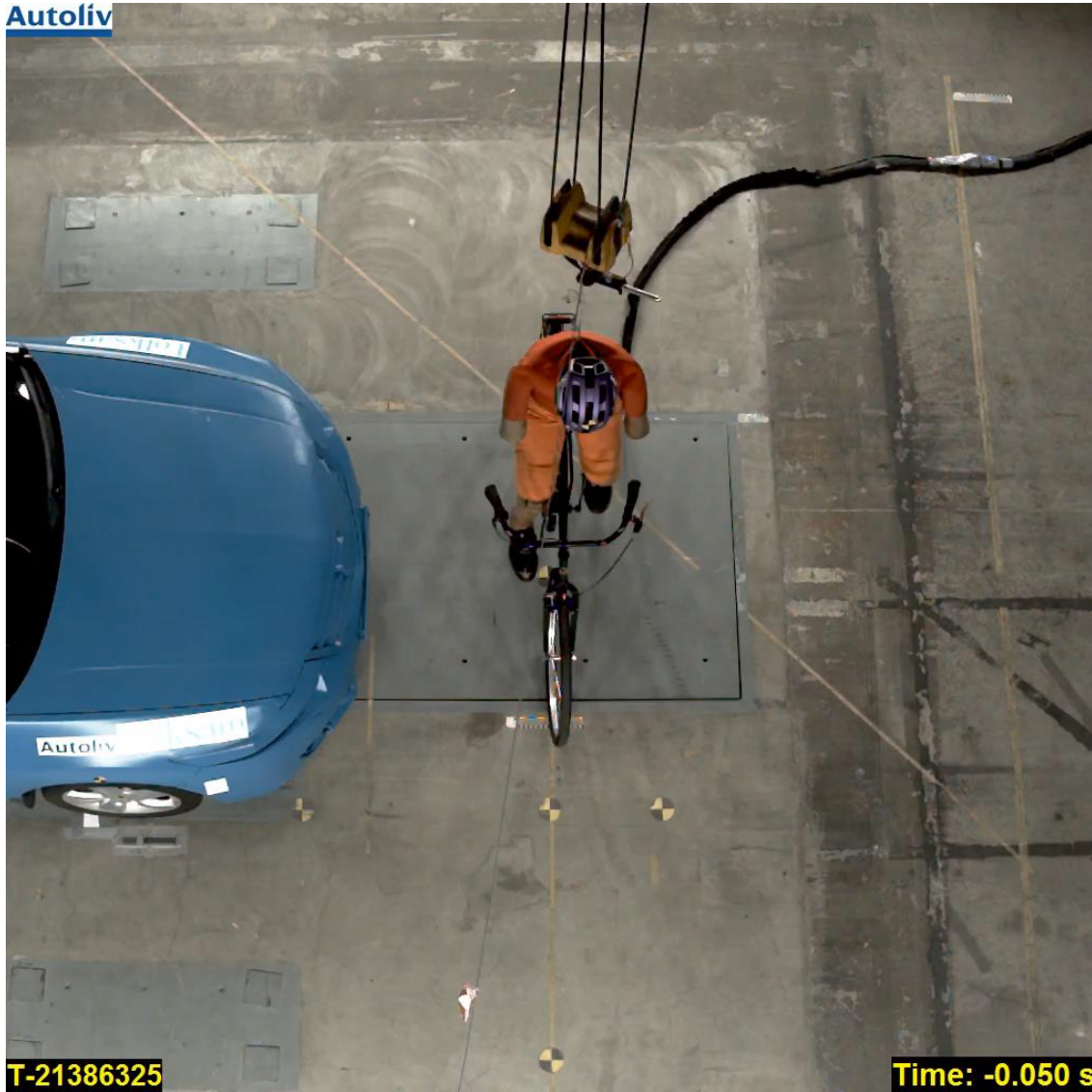








Autoliv



## Prov 2: Cyklist påkörd sida 40 km/h

Autoliv





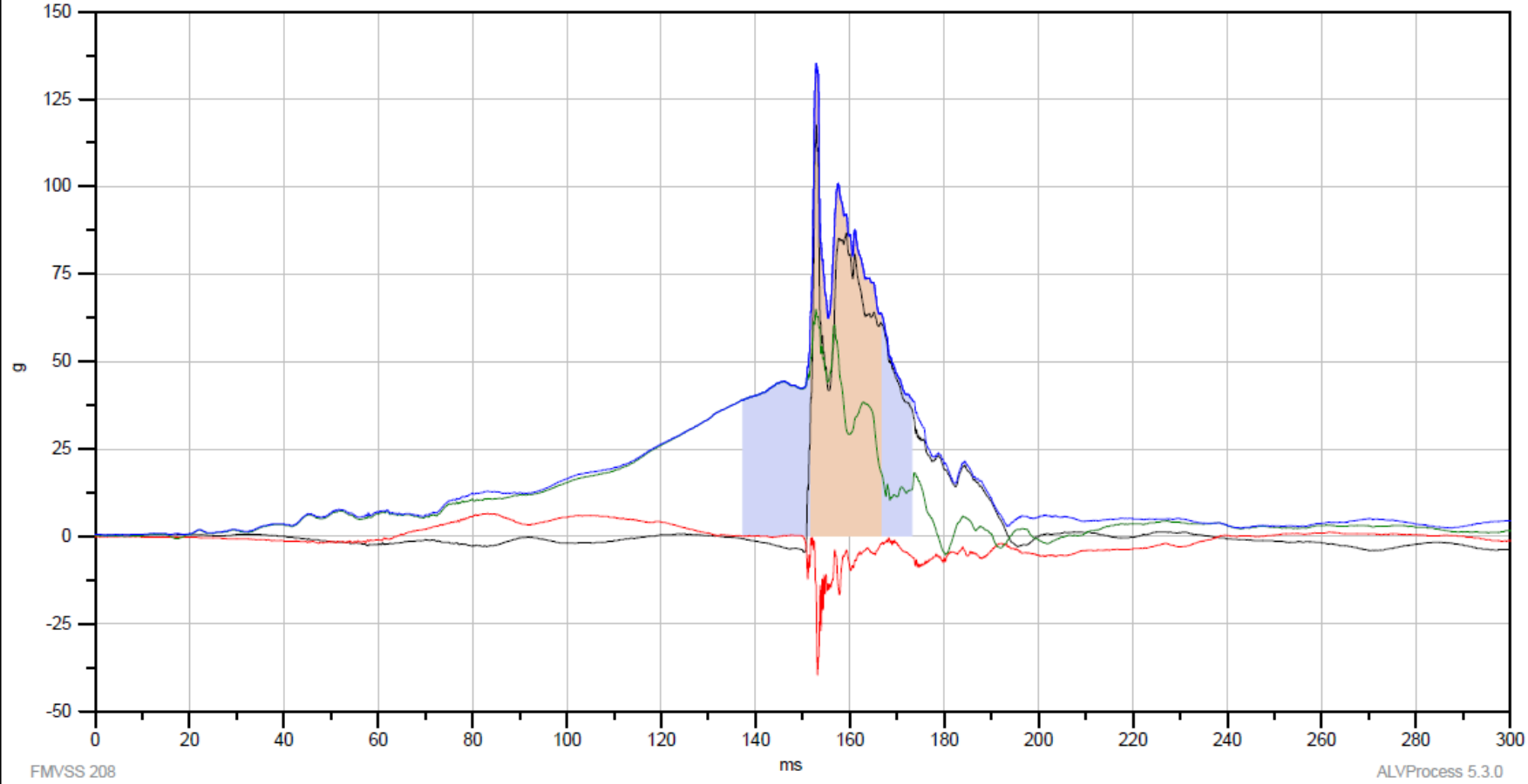
**Test Number:** TO-21056300 / T-21386325  
**Test Date:** 1-Dec-2021  
**Test Description:** Bicycle side impact, test 2.

**Pos. 1 Head Acceleration (CFC1000)**  
ATD Type : EuroSID-2



- 11HEAD0000E2ACXA (Pos. 1 Head X Acceleration) - (CFC 1000) - (Max. 117.6g at 152.9ms) - (Min. -4.6g at 150.2ms)
- 11HEAD0000E2ACYA (Pos. 1 Head Y Acceleration) - (CFC 1000) - (Max. 6.6g at 83.2ms) - (Min. -39.7g at 153.2ms)
- 11HEAD0000E2ACZA (Pos. 1 Head Z Acceleration) - (CFC 1000) - (Max. 64.9g at 152.8ms) - (Min. -5.2g at 180.2ms)
- 11HEAD0000E2ACRA (Pos. 1 Head Resultant) - (CFC 1000) - (Max. 135.2g at 152.9ms) - (Min. 0.3g at 2.3ms)

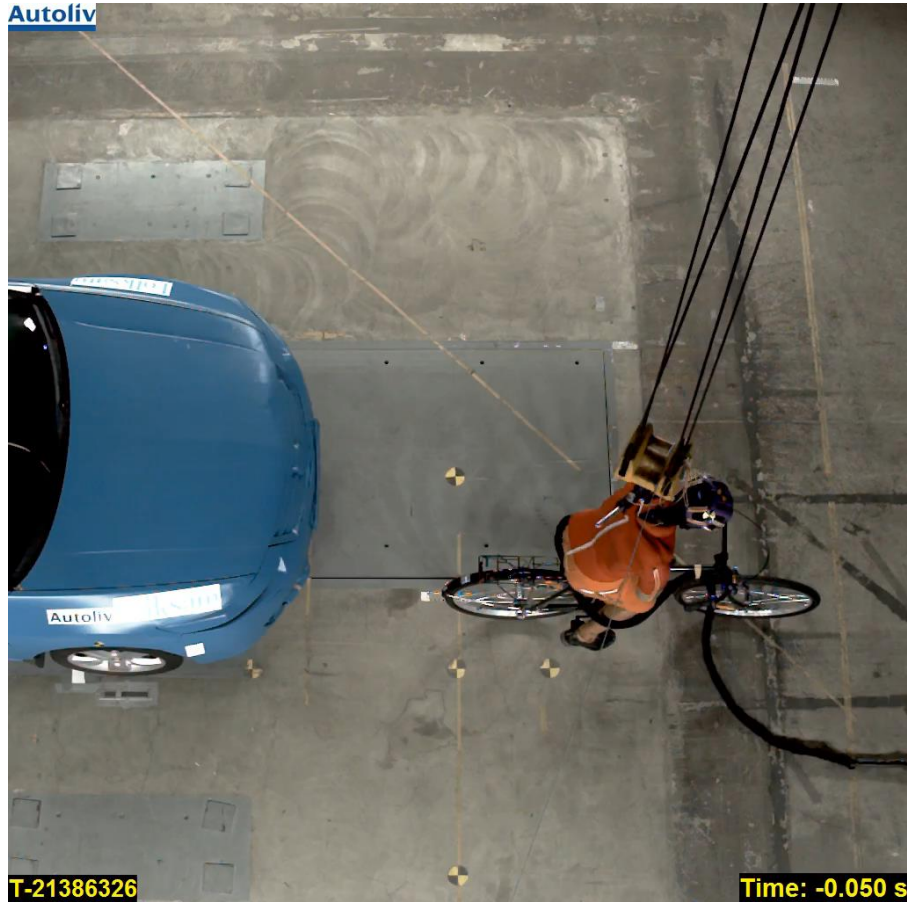
HIC15 Value: 939.0 from 151.7ms to 186.7ms  
HIC36 Value: 1019.5 from 137.3ms to 173.3ms  
HPC Value: 1035.8 from 130.0ms to 174.7ms  
3ms Head Clip (cumulative): 92.5g from 152.3ms to 158.6ms  
Orange shaded area delimits HIC15  
Blue shaded area delimits HIC36







# Prov 3: cyklist påkörd i 50km/h





Test Number: TO-21056300 / T-21386326

Test Date: 1-Dec-2021

Test Description: Bicycle rear impact.

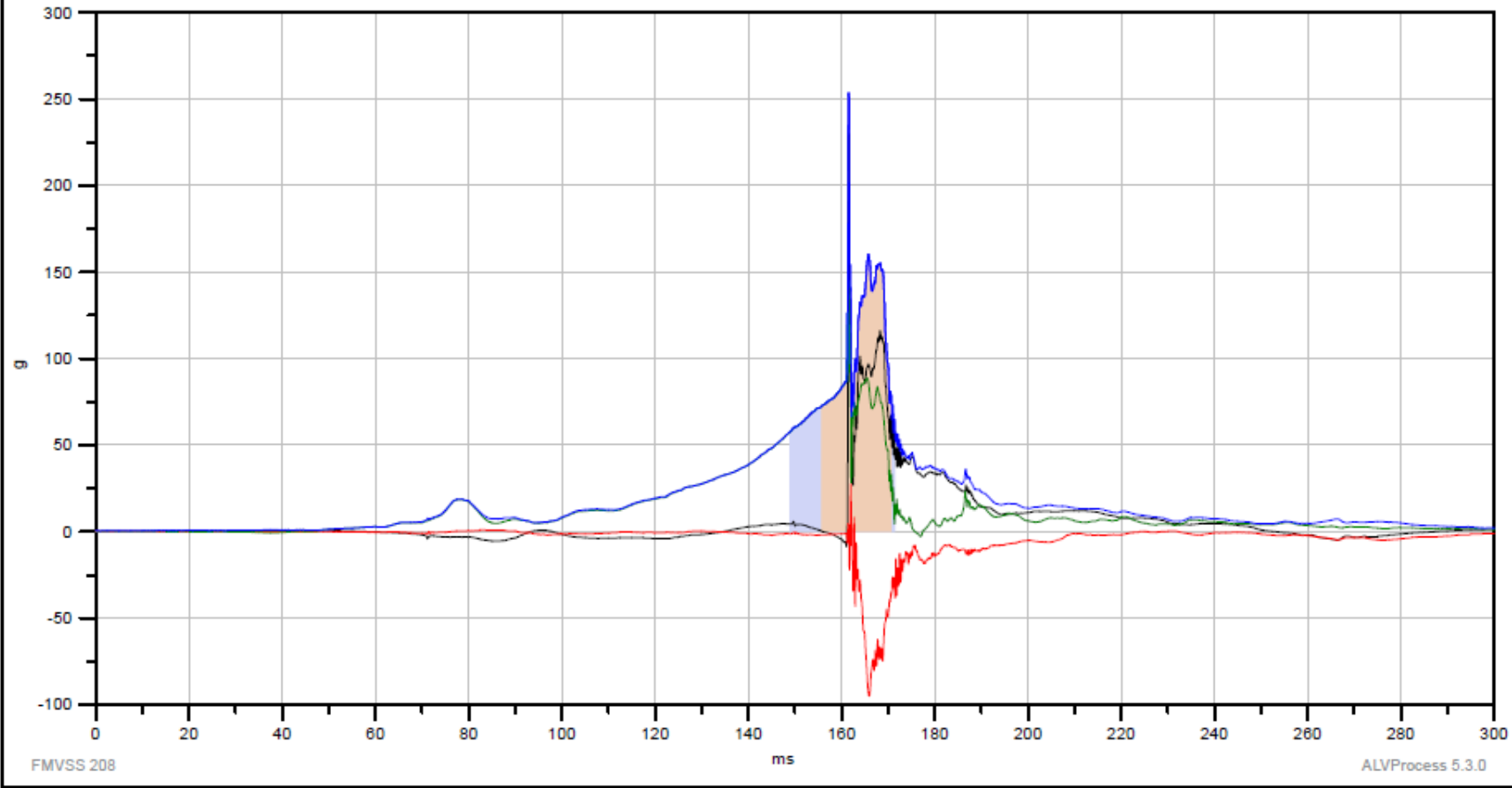
Pos. 1 Head Acceleration (CFC1000)

ATD Type : EuroSID-2

**Autoliv**

- 11HEAD0000E2ACXA (Pos. 1 Head X Acceleration) - (CFC 1000) - (Max. 229.7g at 161.6ms) - (Min. -8.7g at 161.1ms)
- 11HEAD0000E2ACYA (Pos. 1 Head Y Acceleration) - (CFC 1000) - (Max. 27.4g at 162.0ms) - (Min. -95.0g at 166.0ms)
- 11HEAD0000E2ACZA (Pos. 1 Head Z Acceleration) - (CFC 1000) - (Max. 144.8g at 161.5ms) - (Min. -2.8g at 177.0ms)
- 11HEAD0000E2ACRA (Pos. 1 Head Resultant) - (CFC 1000) - (Max. 253.4g at 161.6ms) - (Min. 0.4g at 1.1ms)

HIC15 Value: 1957.0 from 155.7ms to 170.7ms  
HIC36 Value: 2028.5 from 148.9ms to 171.5ms  
HPC Value: 2028.5 from 148.9ms to 171.5ms  
3ms Head Clip (cumulative): 147.0g from 161.4ms to 168.9ms  
Orange shaded area delimits HIC15  
Blue shaded area delimits HIC36



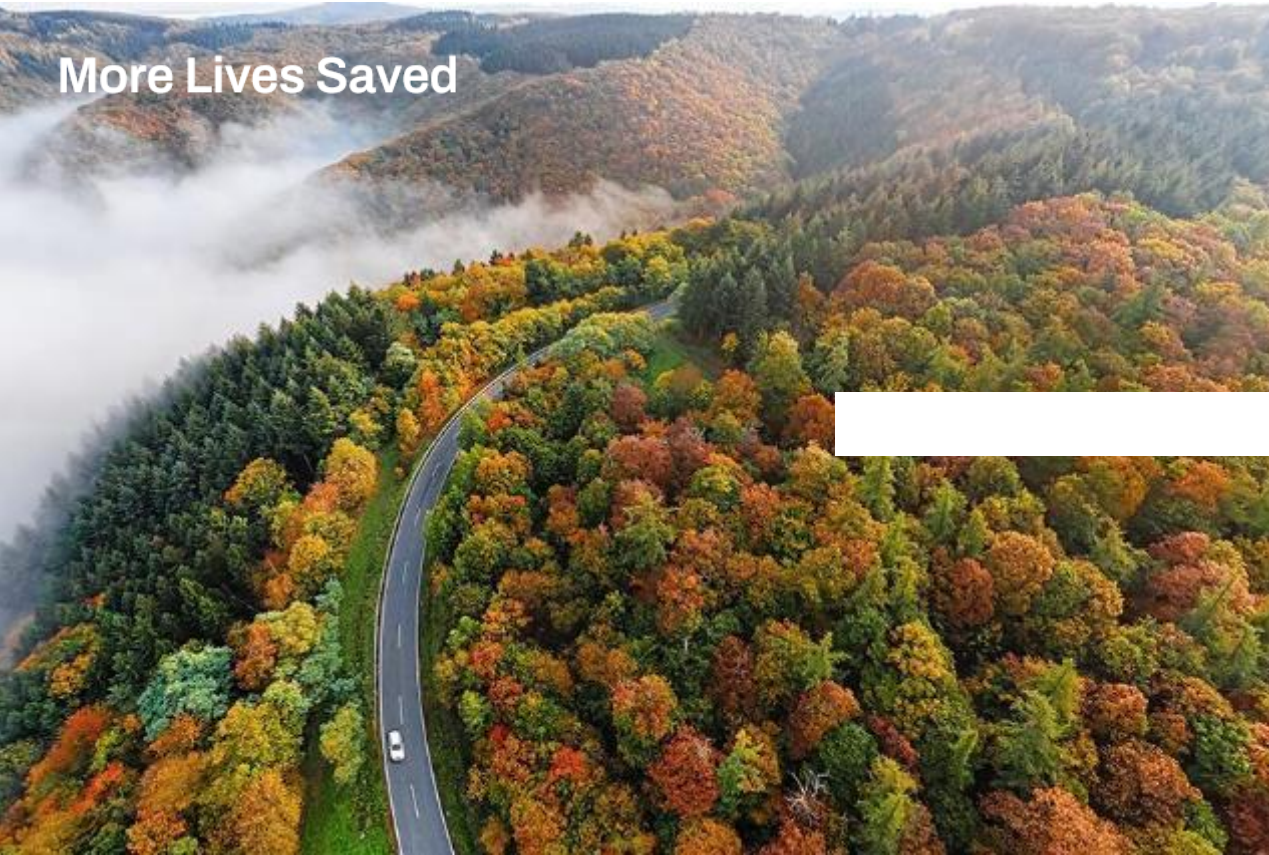


Injury Description	Prov 1 40km/h	Prov 2 40km/h	Prov 3 50km/h	Result Unit
Pos. 1 HIC15	923.8	939.0	1957.0	
Pos. 1 HIC36	1007.0	1019.5	2028.5	
Pos. 1 HPC	1034.4	1035.6	2028.5	
Pos. 1 3ms Head Clip (cumulative)	98.8	92.5	147.0	g
Pos. 1 3ms Head Clip (continuous)	96.1	86.2	138.9	g
Pos. 1 Right Upper Rib V*C	0.00	0.00	0.18	m/s
Pos. 1 Right Mid Rib V*C	0.00	0.00	0.00	m/s
Pos. 1 3ms Lower Spine Clip (continuous)	17.5	20.0	36.1	g
Pos. 1 3ms Lower Spine Clip (cumulative)	17.8	20.6	36.1	g
Pos. 1 Right Lower Rib V*C	0.00	0.00	0.00	m/s
Pos. 1 3ms Pelvis Clip (continuous)	27.4	28.2	33.1	g
Pos. 1 3ms Pelvis Clip (cumulative)	29.9	31.3	36.8	g

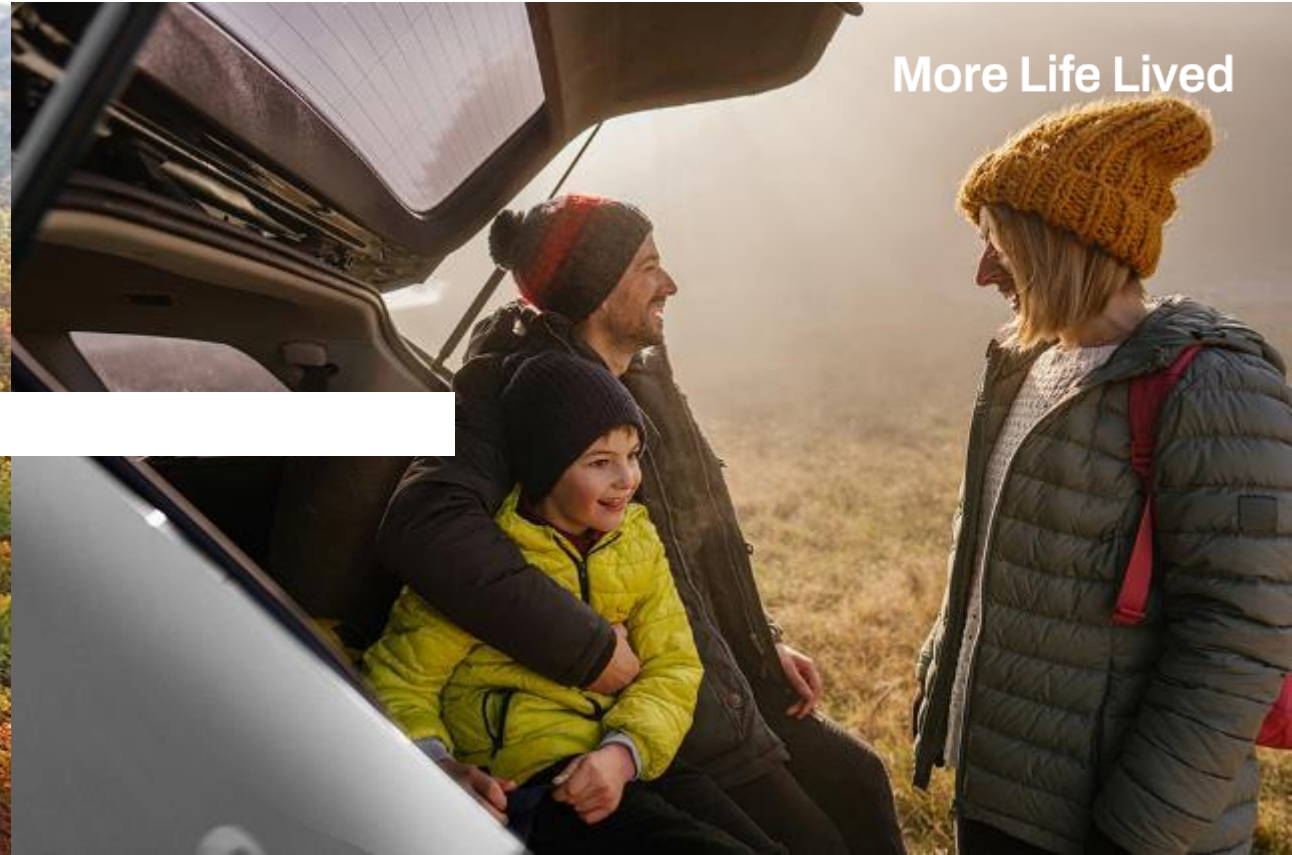


# Slutsatser av fysiska testerna

- Mätvärdena visar att det sannolikt inte går att klara sig från allvarlig skada i de situationer som testades
- Men dockans rörelsemönster såg inte korrekt ut. Jämförelse med virtuell provning ger ett helt annat rörelsemönster. Islagshastigheten är onormalt hög, vilket ger för höga mätvärden i huvudet.
- Autoliv gör en parallell virtuell provning med en HBM-modell.



More Lives Saved



More Life Lived

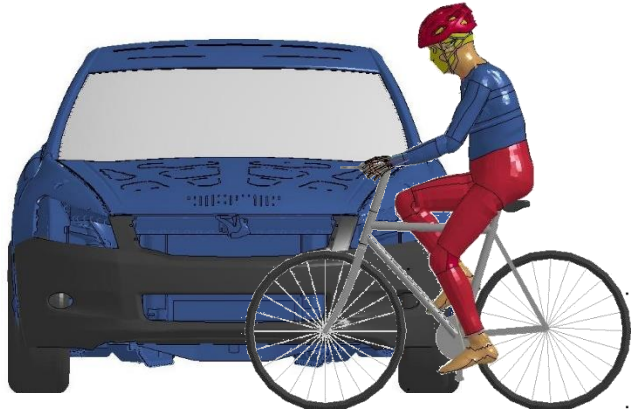
# Bicyclist to Vehicle Impact Simulations – SAFER HBM

Bengt Pipkorn & Johan Svärd

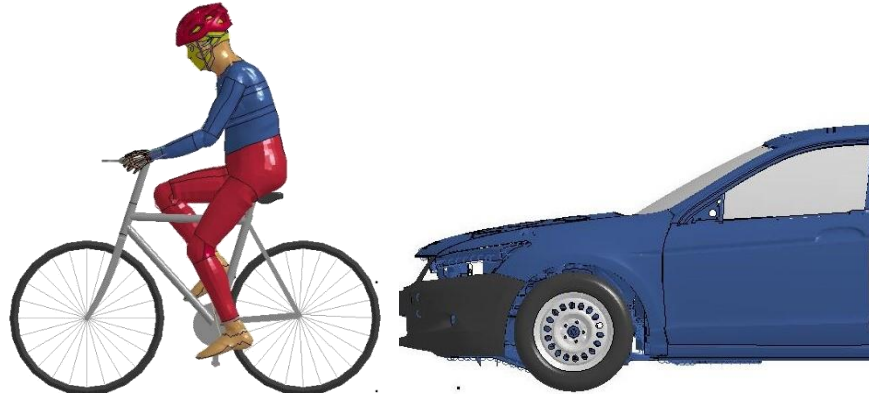
2022-09-13

# Test Matrix

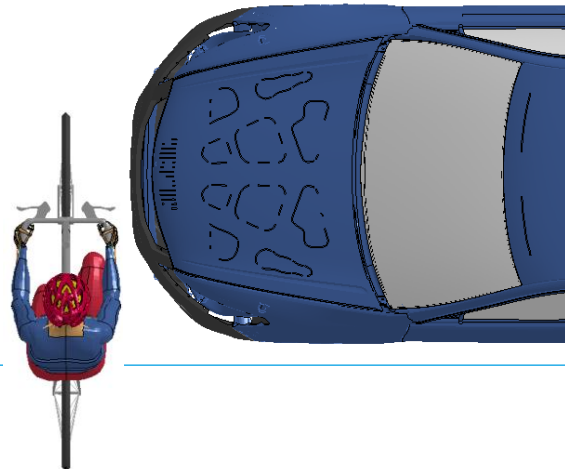
Perpendicular Corner Impact  
Windscreen impact (40km/h)



Corner Rear Impact  
A-Pillar impact (50km/h)



ES-2re

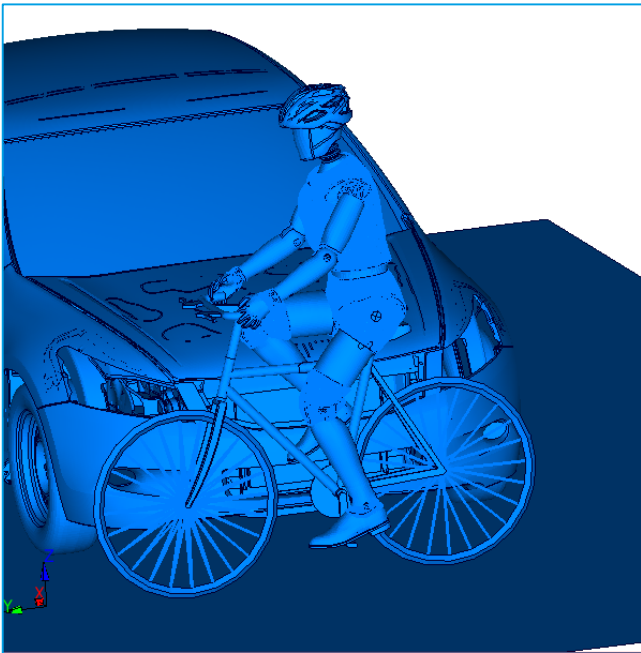




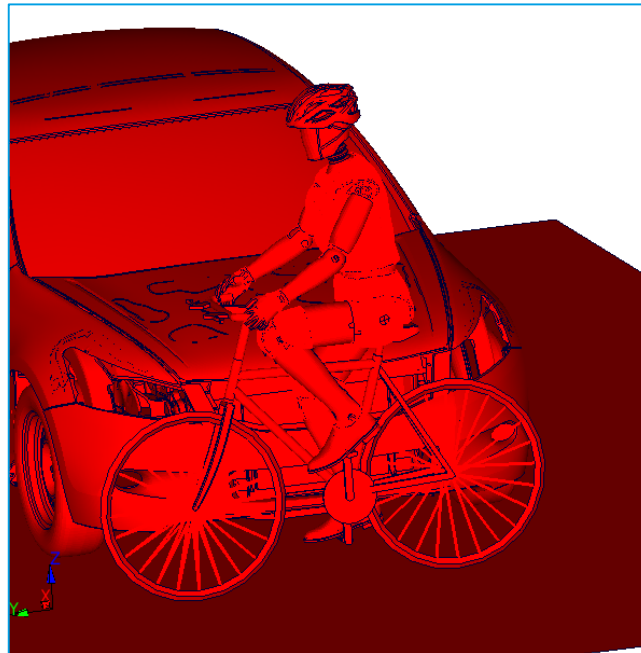
# Simulation Matrix

- Vehicle velocity 40km/h in side impact
- Bicyclist velocity 15km/h in side impact
- Bicyclist collision angle 0 deg
- Bicyclist centered & corner impact in side impact
- Honda Accord & Volvo V60
- SAFER HBM
- 3 pedal positions – impacted leg up, impacted leg down, impacted leg back
- Helmet

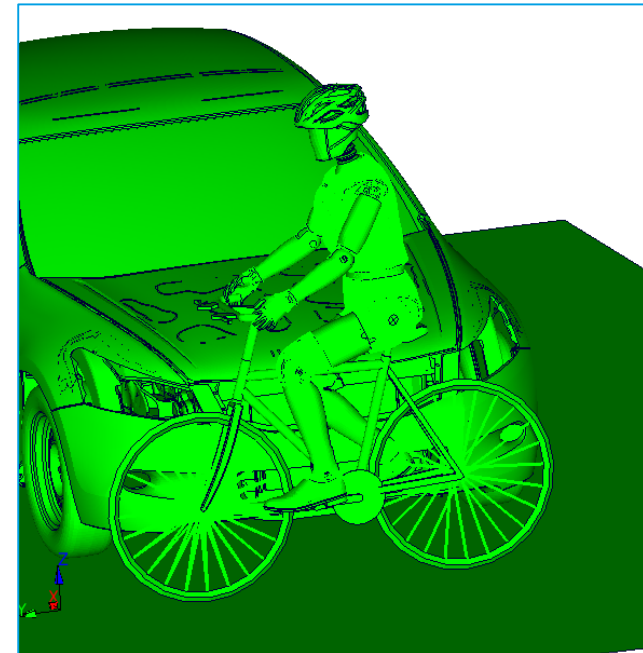
# Load-case A7 (c40b15a0mHPTWh) - Honda Accord - PTW



**A7a:** Impacted leg up



**A7b:** Impacted leg down

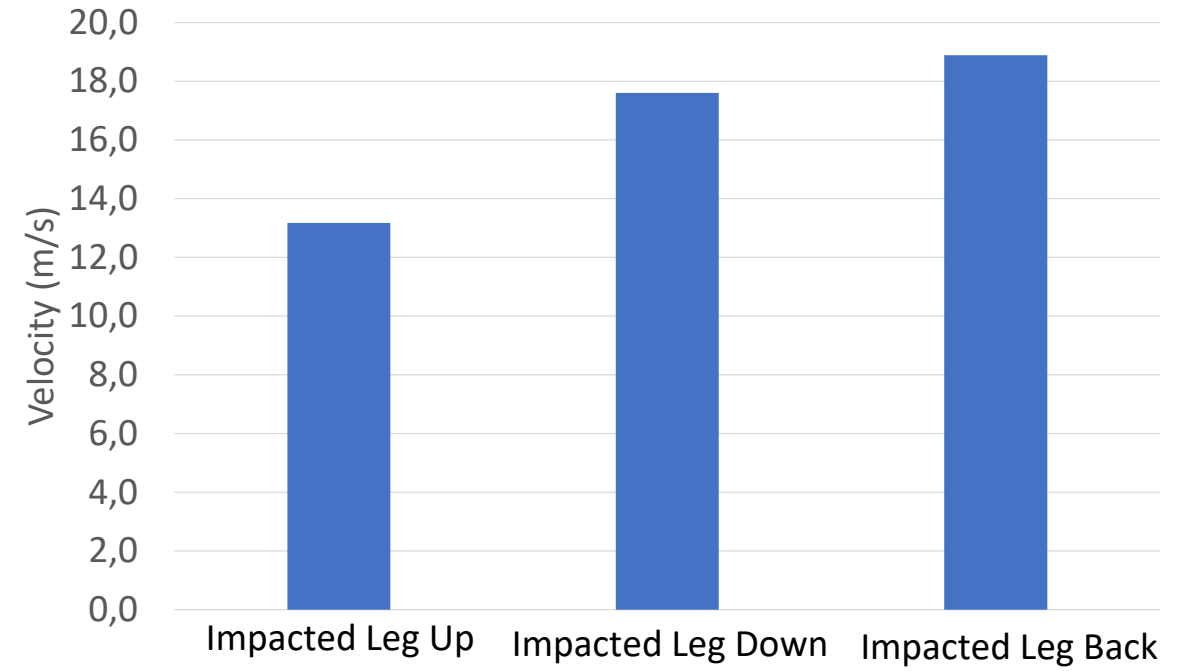


**A7c:** Pedals level. Impacted leg back.

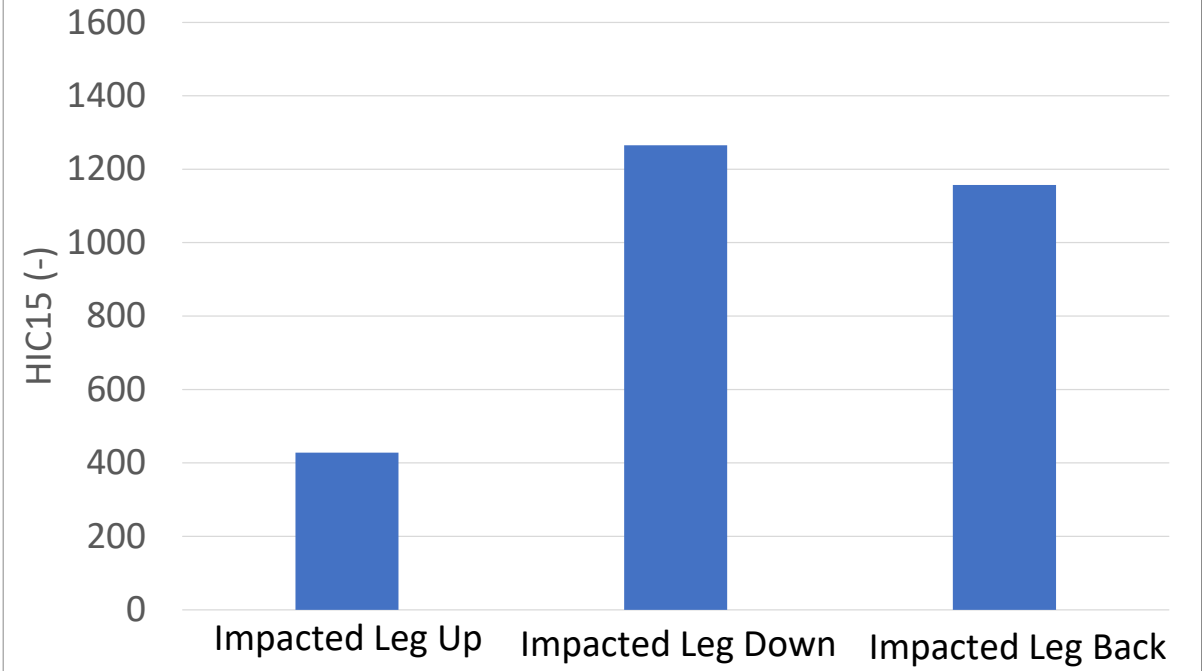
	Vehicle Speed km/h	Cyclist speed km/h	Impact Point	Impact Angle Deg
1	40	0	middle	0
2	30	0	middle	0
3	20	0	middle	0
4	40	0	corner	0
5	30	0	corner	0
6	20	0	corner	0
7	40	15	middle	0
8	30	15	middle	0
9	20	15	middle	0
10	40	15	corner	0
11	30	15	corner	0
12	20	15	corner	0

# Load-case A7 (c40b15a0mHPTWh) - Honda Accord - PTW

Head Impact Velocity



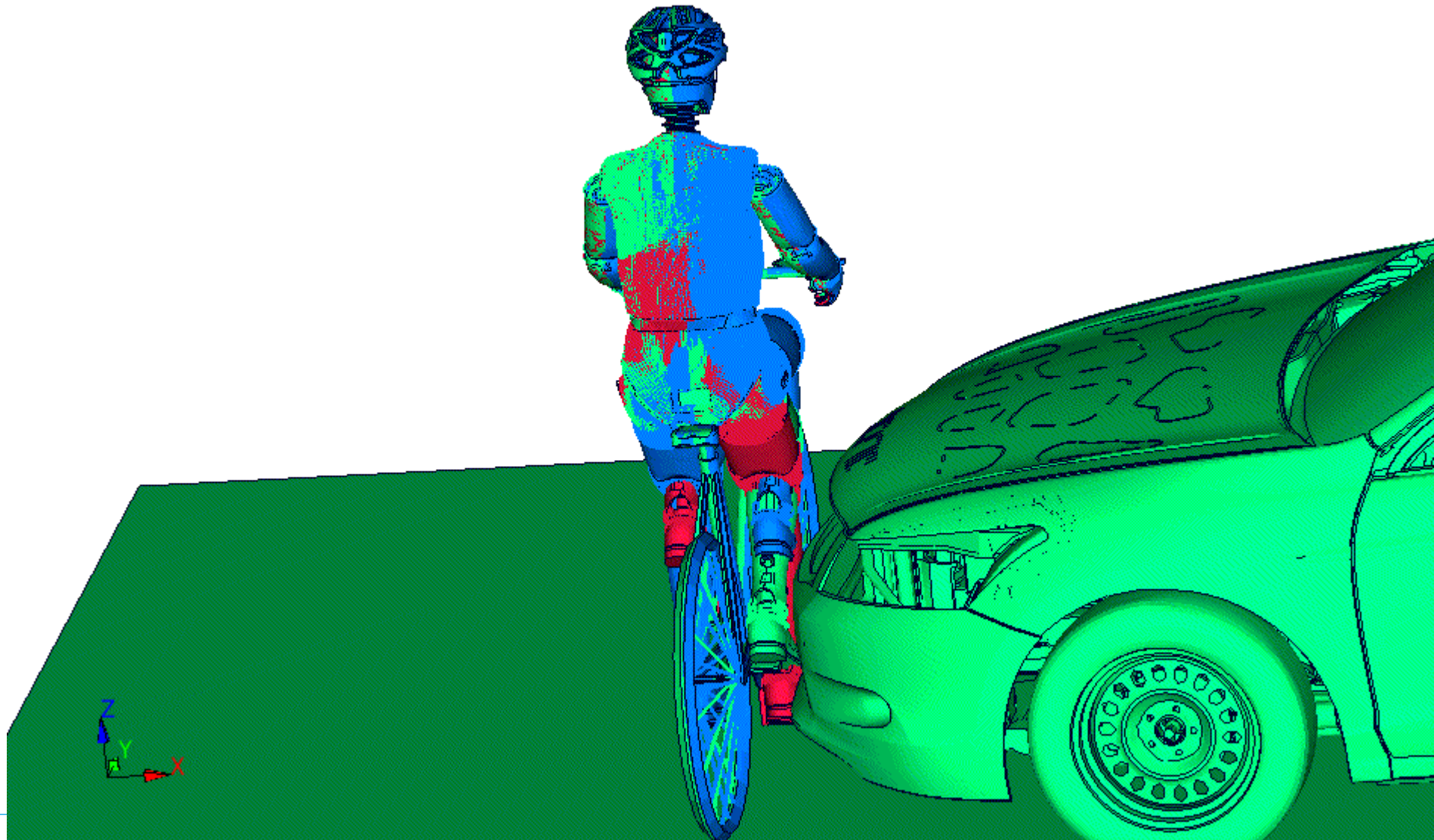
HIC15





# A7 - Animation

**Blue:** Impacted leg up  
**Red:** Impacted leg down  
**Green:** Pedals level. Impacted leg back.

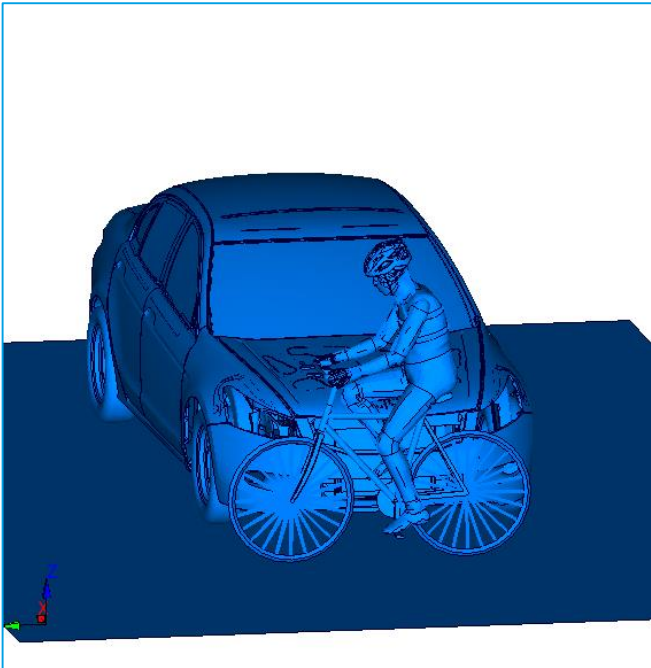


# A7 - Impact positions

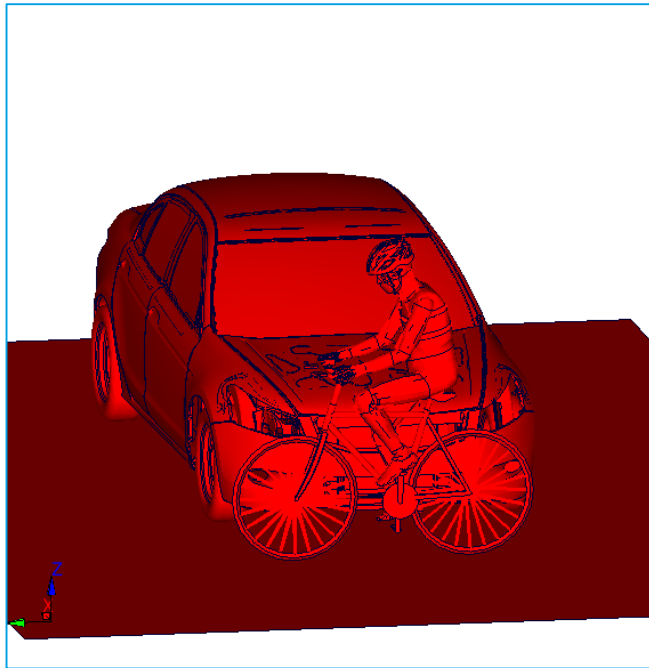
**Blue:** Impacted leg up  
**Red:** Impacted leg down  
**Green:** Pedals level. Impacted leg back.



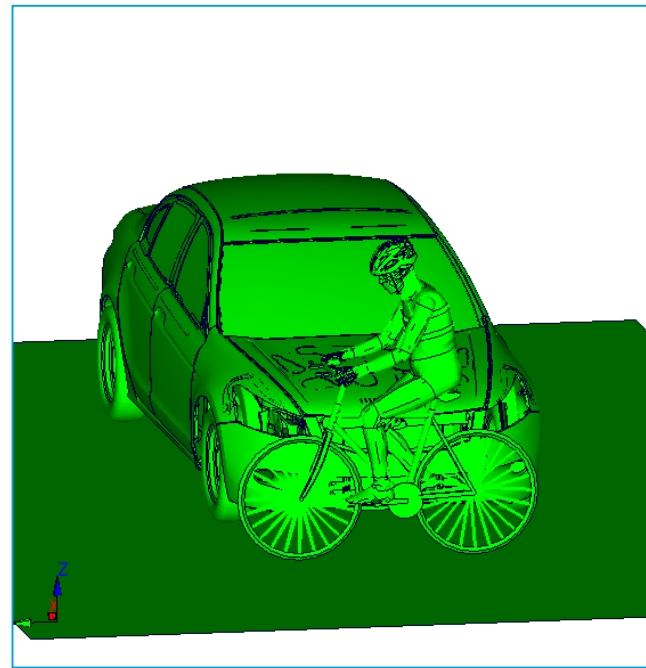
# Load-case B7 (c40b15a0mHHBMh) – Honda Accord- HBM



**B7a:** Impacted leg up



**B7b:** Impacted leg down



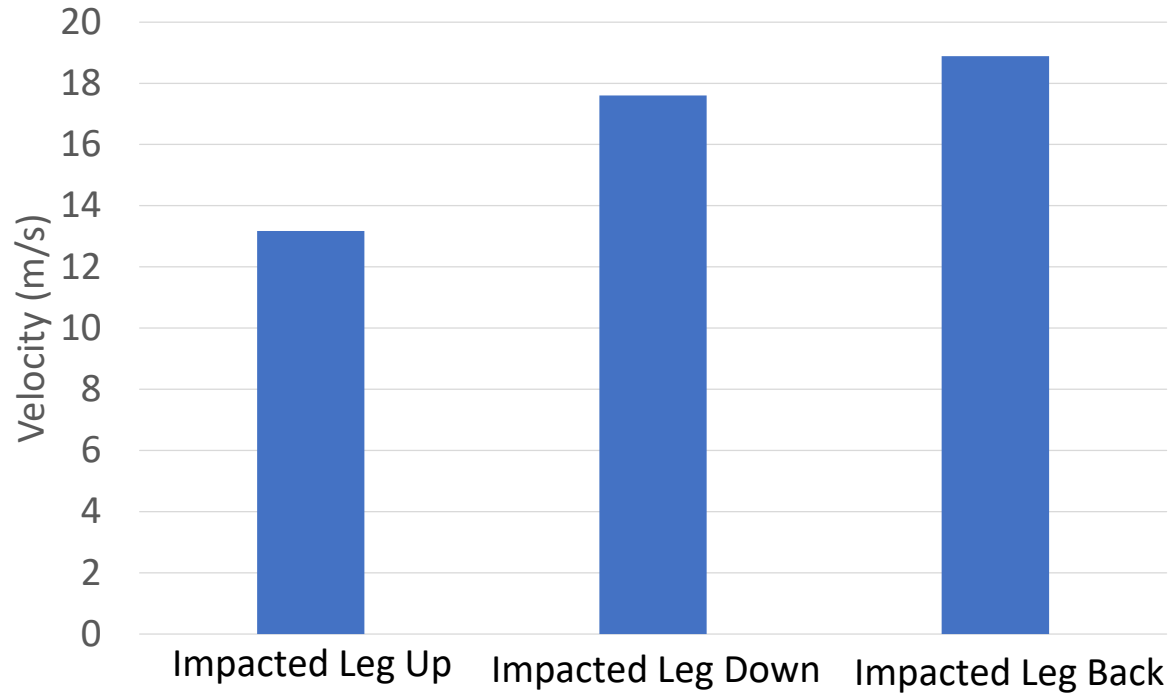
**B7c:** Pedals level. Impacted leg back.

	Vehicle Speed km/h	Cyclist speed km/h	Impact Point	Impact Angle Deg
1	40	0	middle	0
2	30	0	middle	0
3	20	0	middle	0
4	40	0	corner	0
5	30	0	corner	0
6	20	0	corner	0
7	40	15	middle	0
8	30	15	middle	0
9	20	15	middle	0
10	40	15	corner	0
11	30	15	corner	0
12	20	15	corner	0

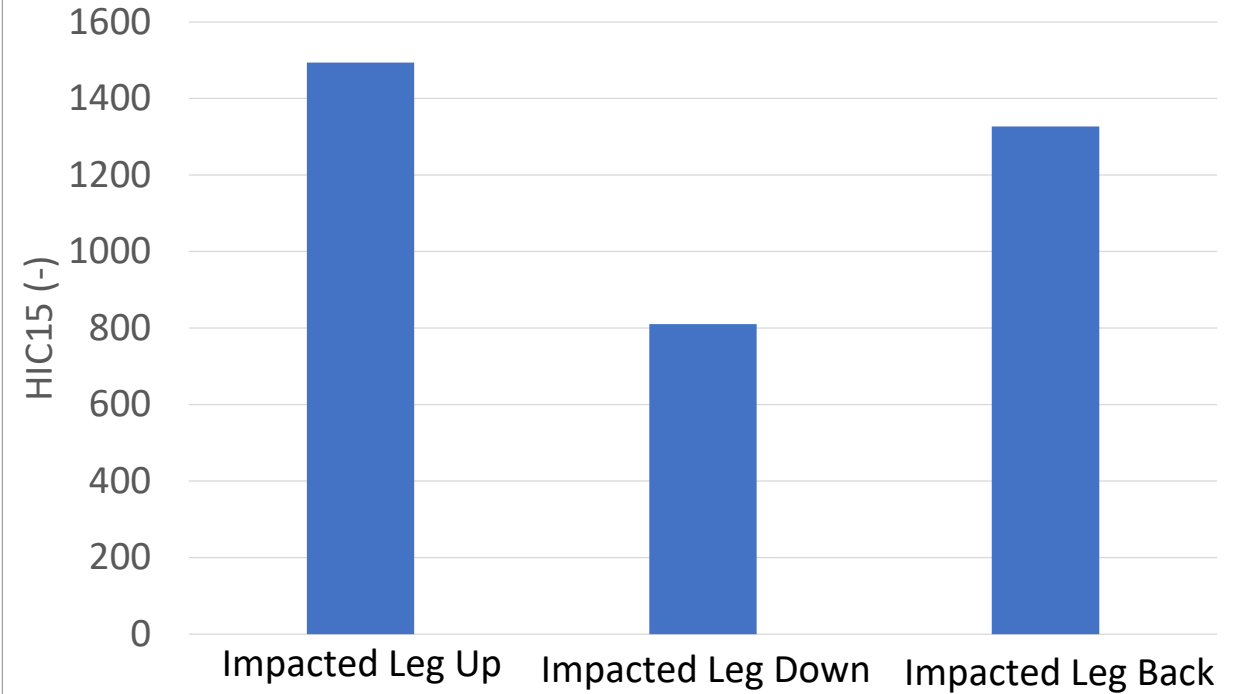


# Load-case B7 (c40b15a0mHHBMh) – Honda Accord- HBM

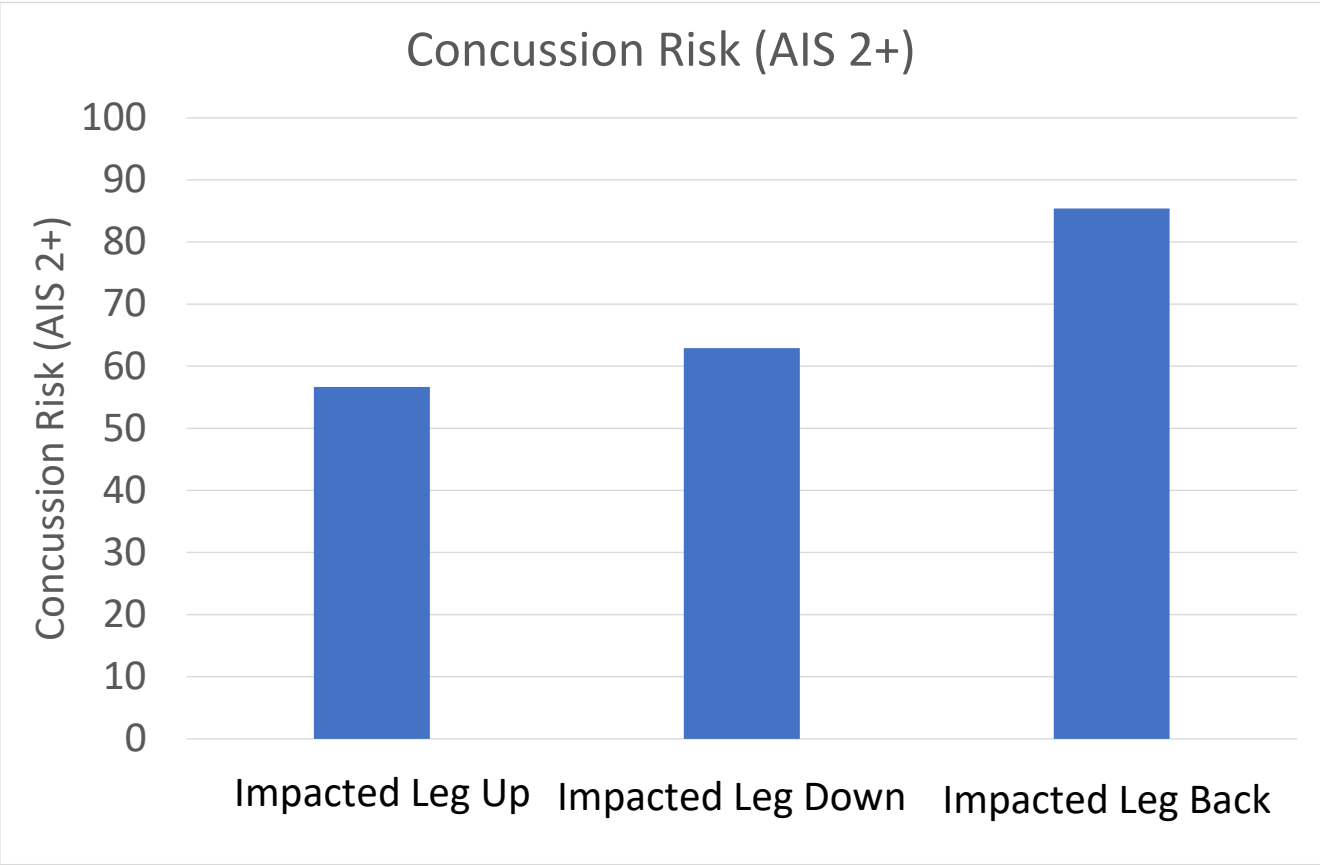
Head Impact Velocity



HIC15

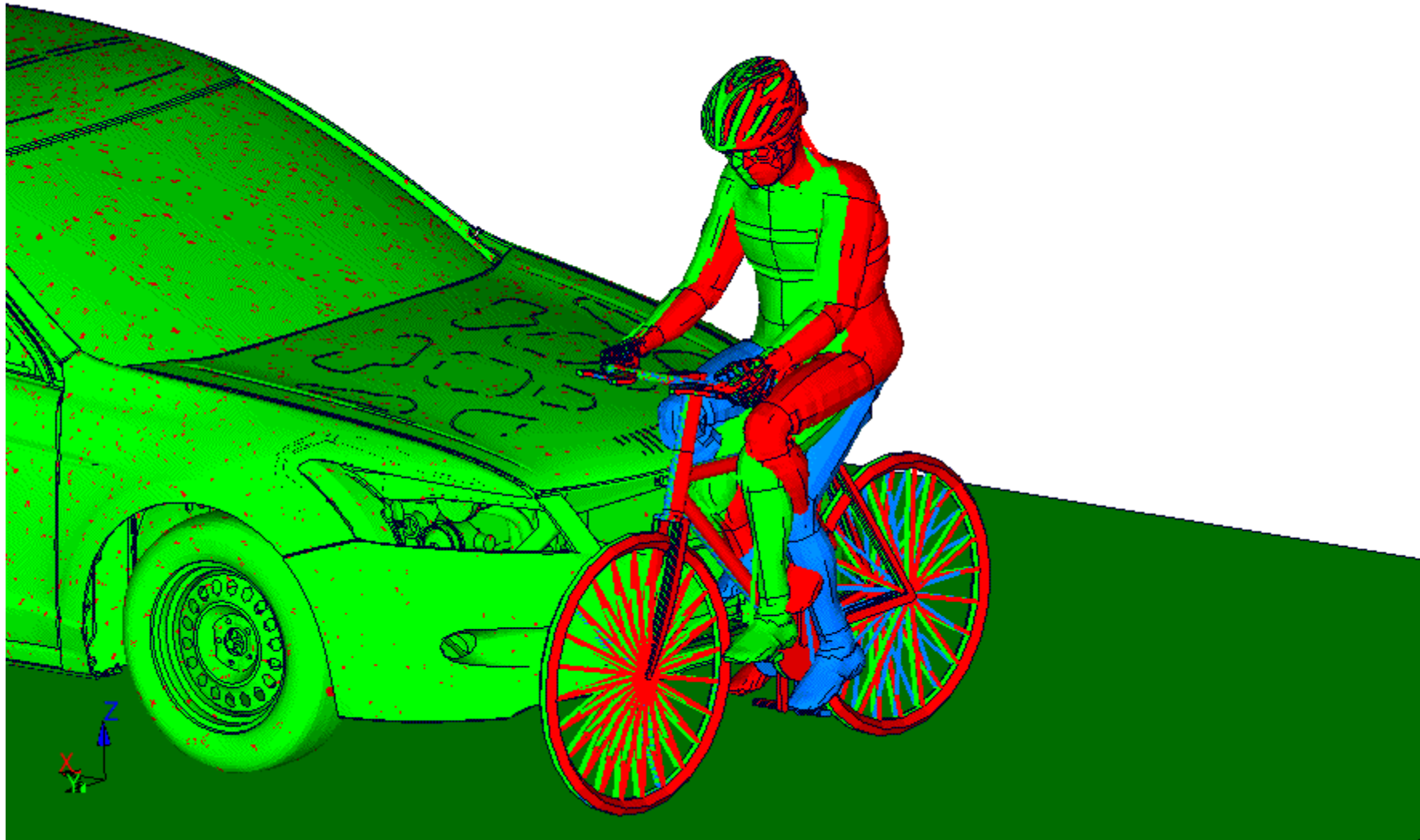


# Load-case B7 (c40b15a0mHHBMh) – Honda Accord- HBM



# B7 - Animation

**Blue:** Impacted leg up  
**Red:** Impacted leg down  
**Green:** Pedals level. Impacted leg back.



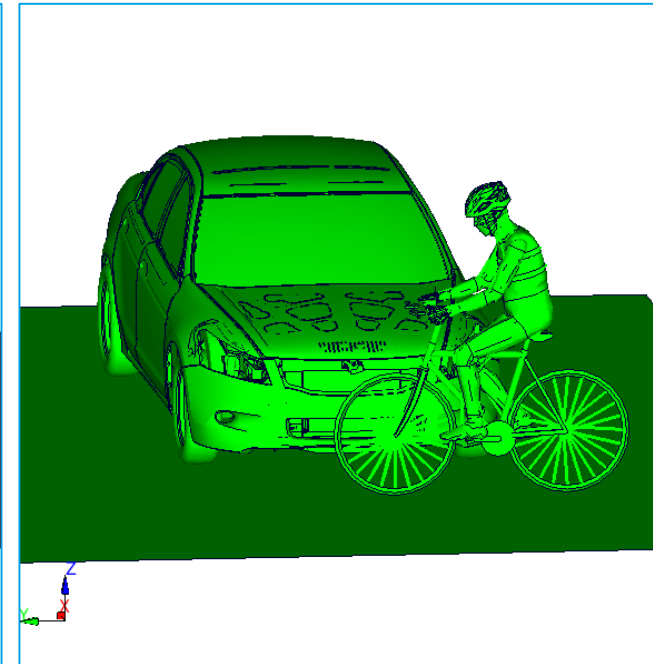
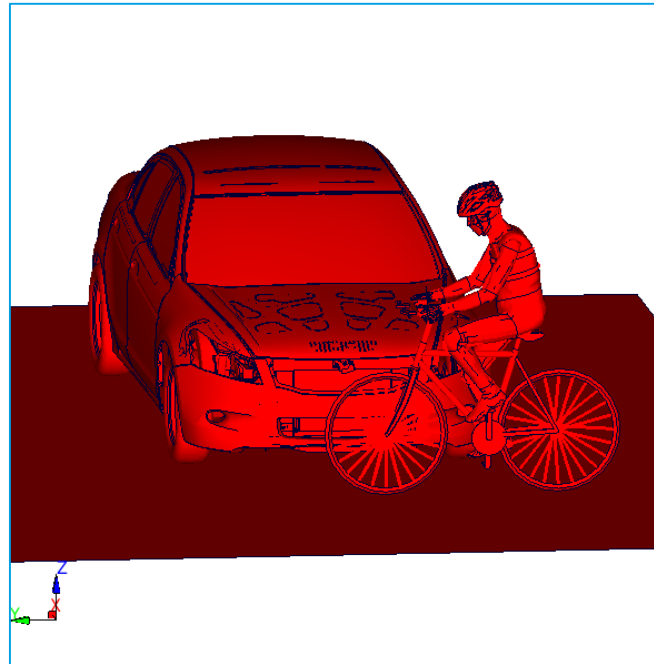
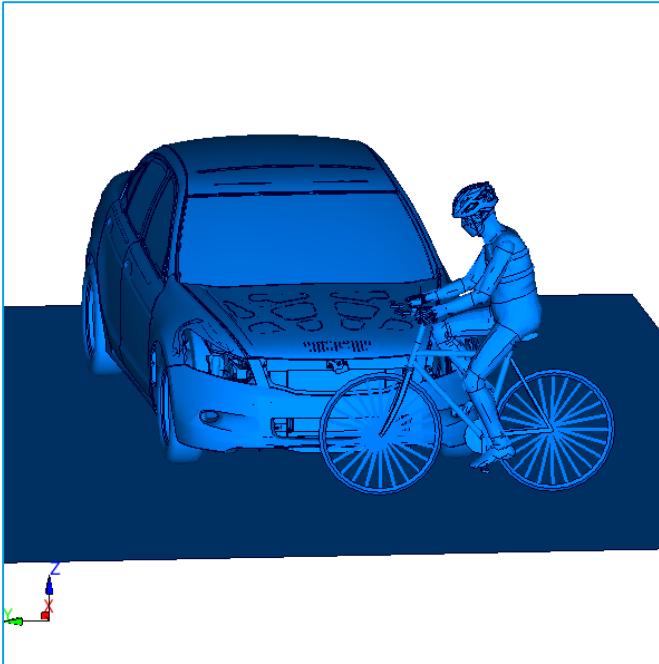


# B7 - Impact positions

**Blue:** Impacted leg up  
**Red:** Impacted leg down  
**Green:** Pedals level. Impacted leg back.



# Load-case B10 (c40b15a0cHHBMh) – Honda Accord- HBM



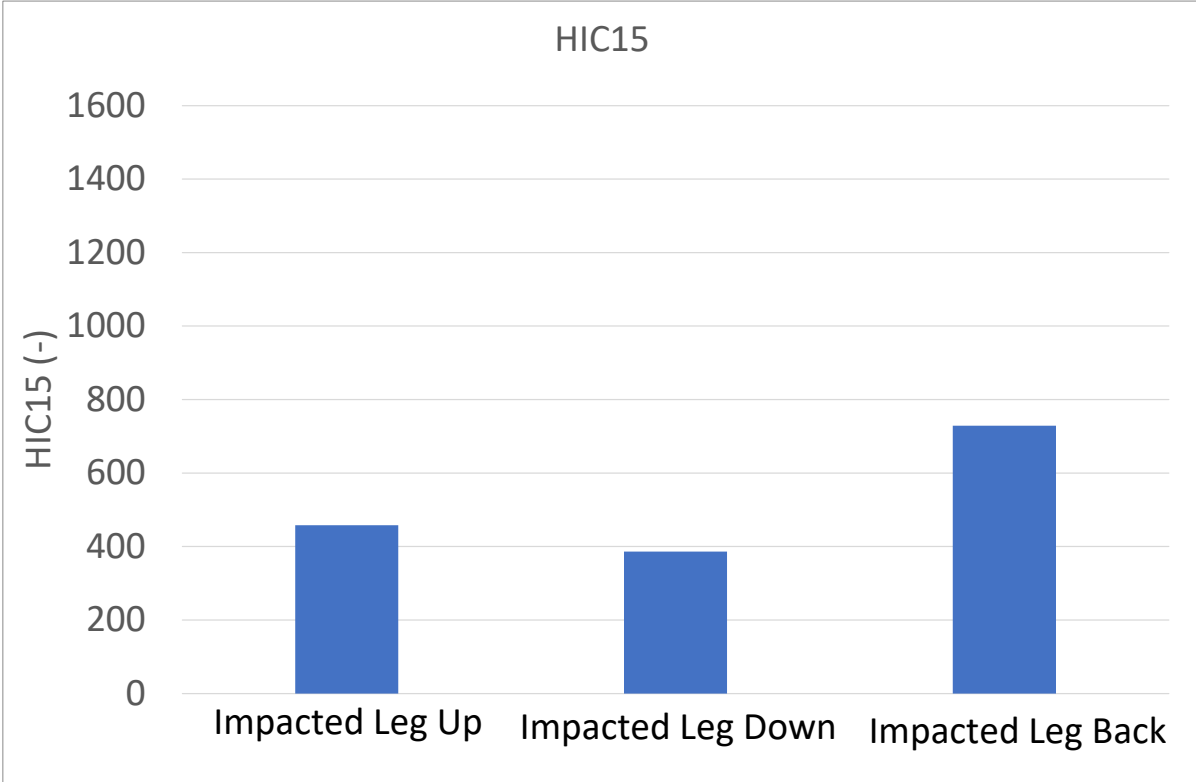
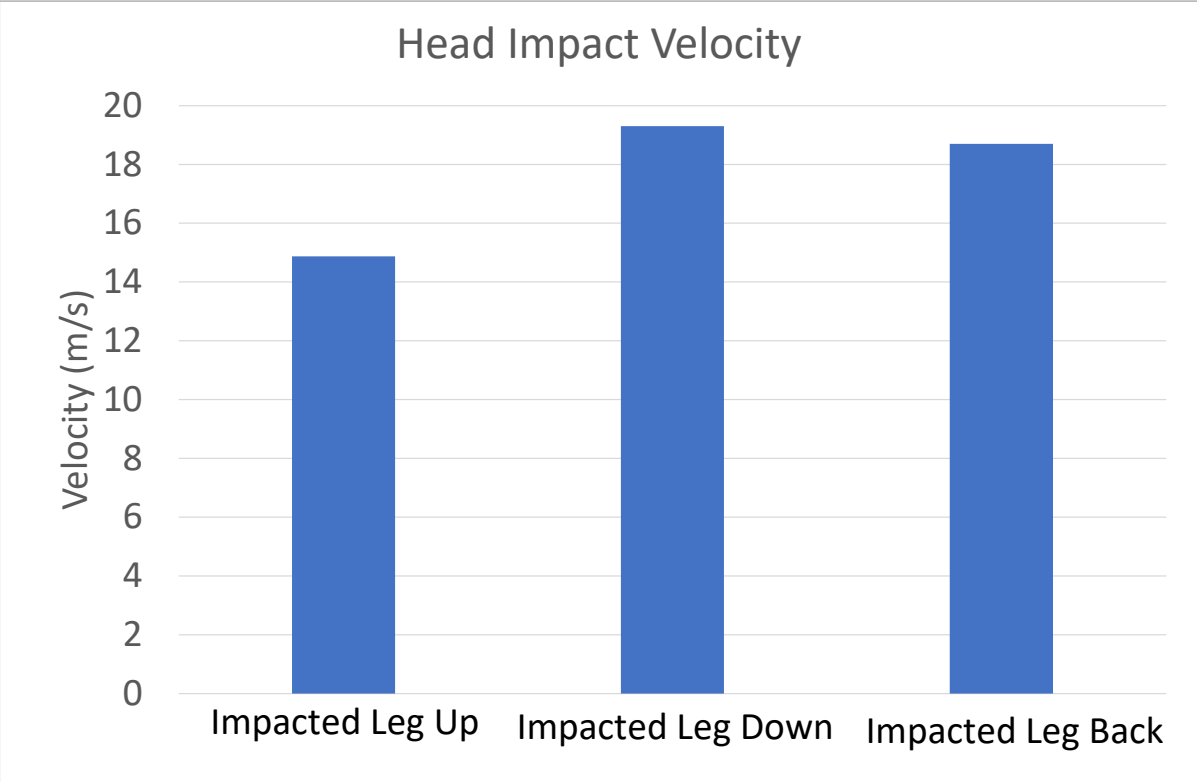
	Vehicle Speed km/h	Cyclist speed km/h	Impact Point	Impact Angle Deg
1	40	0	middle	0
2	30	0	middle	0
3	20	0	middle	0
4	40	0	corner	0
5	30	0	corner	0
6	20	0	corner	0
7	40	15	middle	0
8	30	15	middle	0
9	20	15	middle	0
10	40	15	corner	0
11	30	15	corner	0
12	20	15	corner	0

**B10a:** Impacted leg up

**B10b:** Impacted leg down

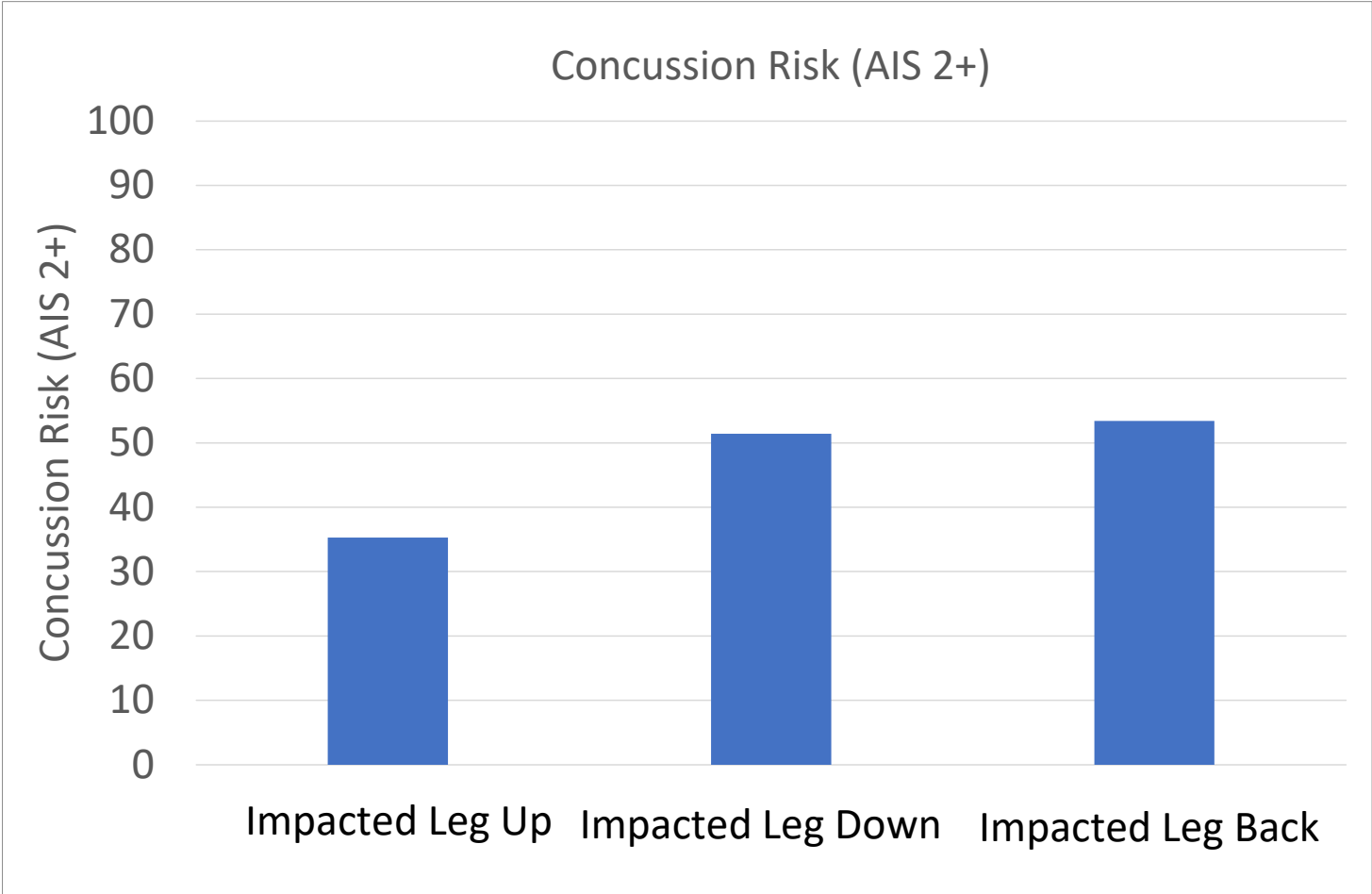
**B10c:** Pedals level. Impacted leg back.

# Load-case B10 (c40b15a0cHHBMh) – Honda Accord- HBM



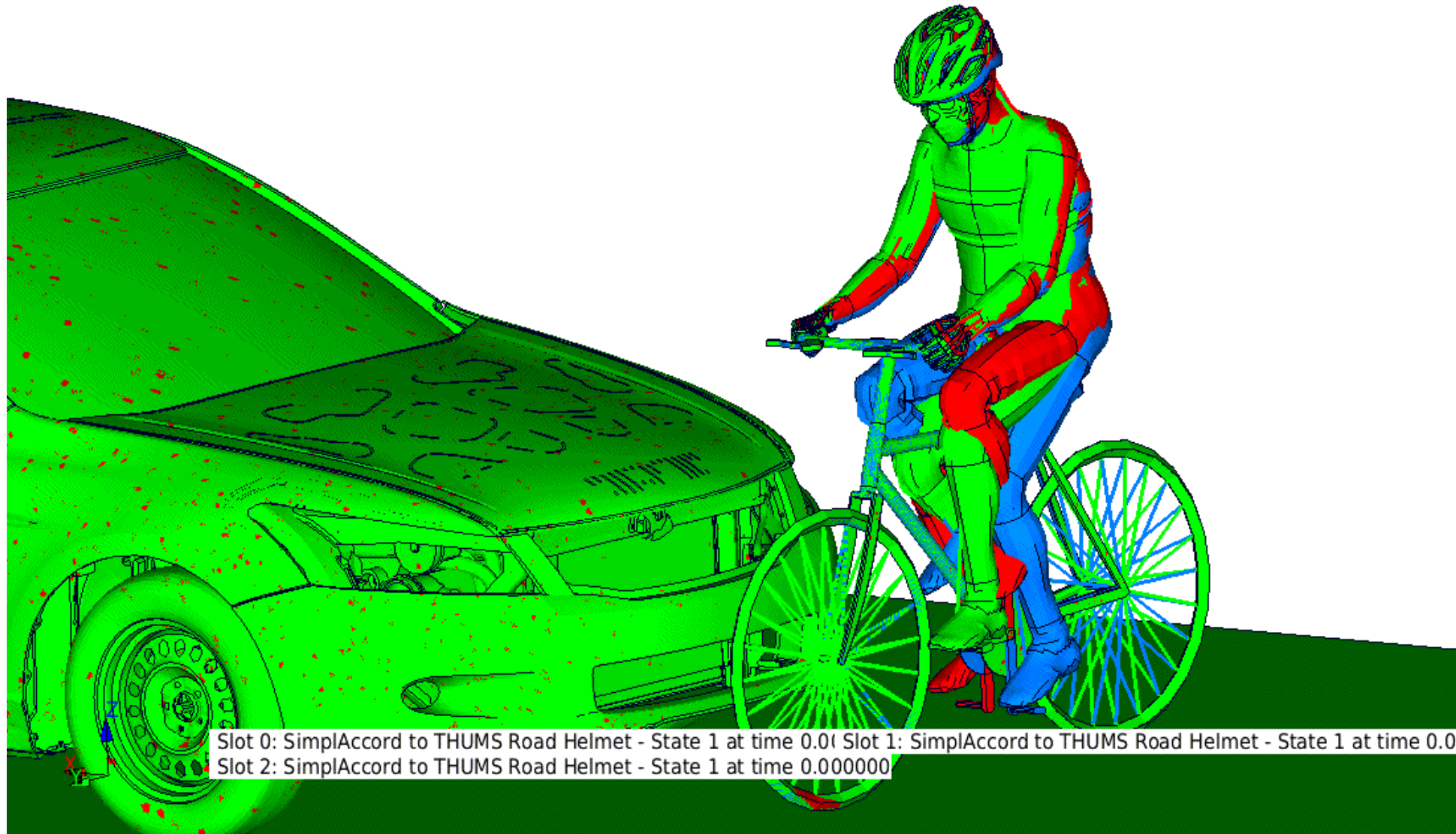


# Load-case B10 (c40b15a0cHHBMh) – Honda Accord- HBM



# B10 - Animation

**Blue:** Impacted leg up  
**Red:** Impacted leg down  
**Green:** Pedals level. Impacted leg back.



# B10 - Impact positions

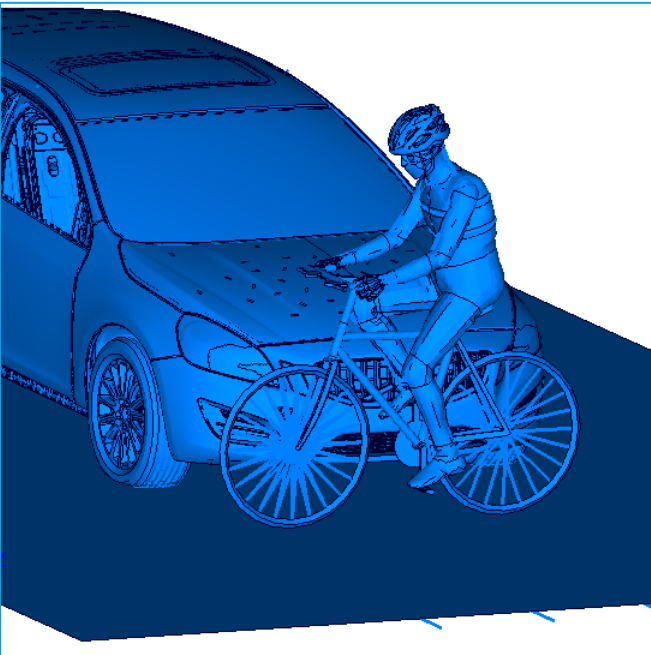
**Blue:** Impacted leg up  
**Red:** Impacted leg down  
**Green:** Pedals level. Impacted leg back.



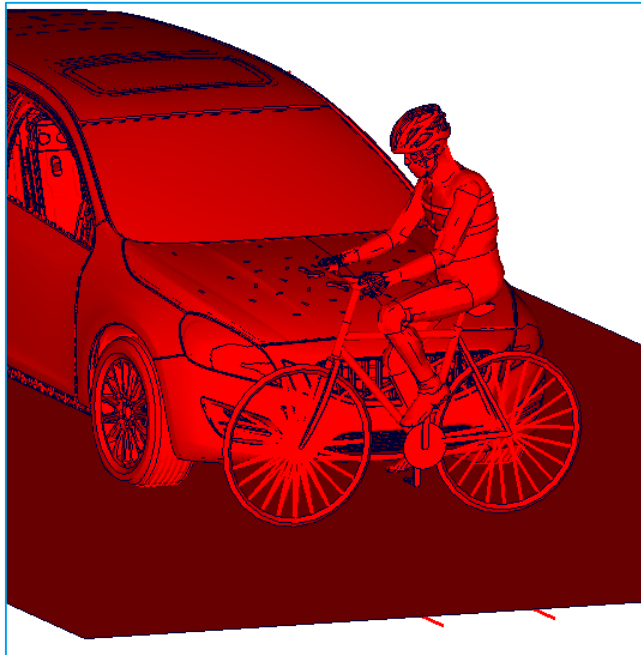


# Load-case D7 (c40b15a0mVHBMh) – Volvo V60 - HBM

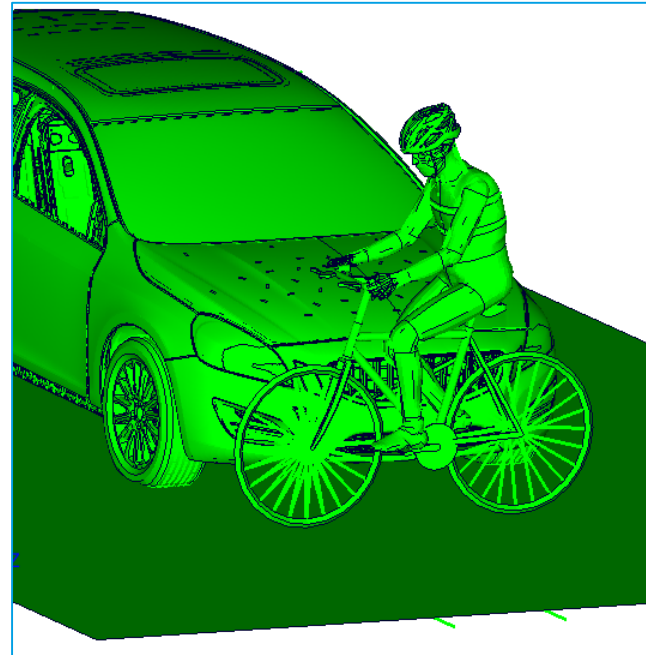
	Vehicle Speed km/h	Cyclist speed km/h	Impact Point	Impact Angle Deg
1	40	0	middle	0
2	30	0	middle	0
3	20	0	middle	0
4	40	0	corner	0
5	30	0	corner	0
6	20	0	corner	0
7	40	15	middle	0
8	30	15	middle	0
9	20	15	middle	0
10	40	15	corner	0
11	30	15	corner	0
12	20	15	corner	0



**D7a:** Impacted leg up



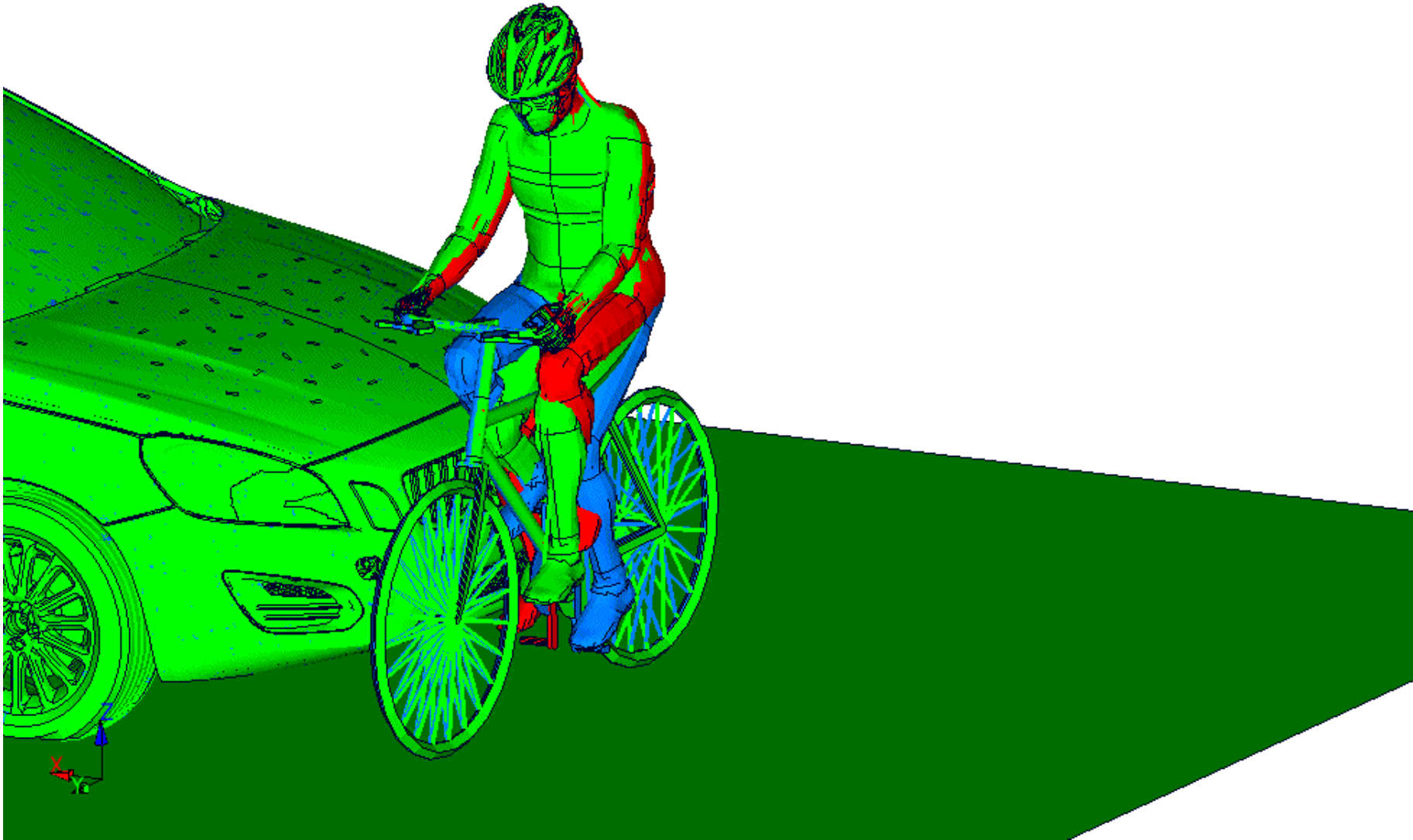
**D7b:** Impacted leg down



**D7c:** Pedals level. Impacted leg back.

# D7 - Animation

**Blue:** Impacted leg up  
**Red:** Impacted leg down  
**Green:** Pedals level. Impacted leg back.



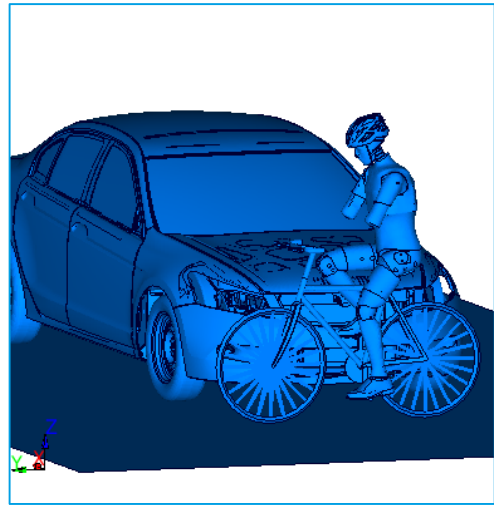
# D7 - Impact positions

**Blue:** Impacted leg up  
**Red:** Impacted leg down  
**Green:** Pedals level. Impacted leg back.

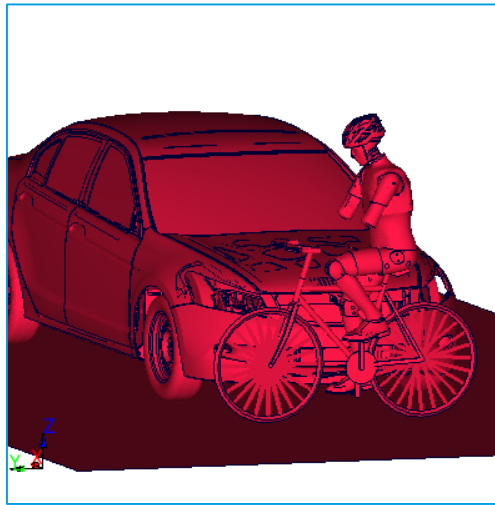




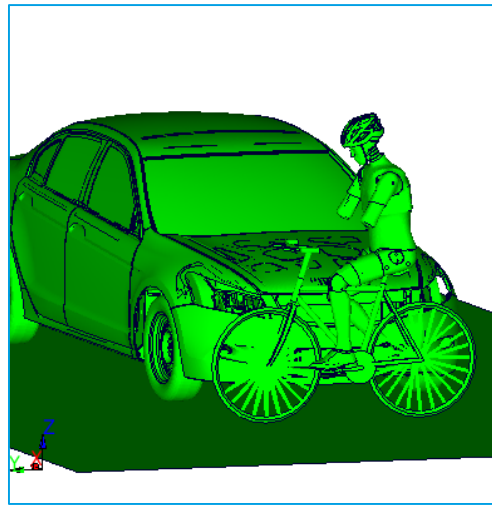
# Load-case E7 (c40b15a0mHES2h) – Honda Accord- ES2



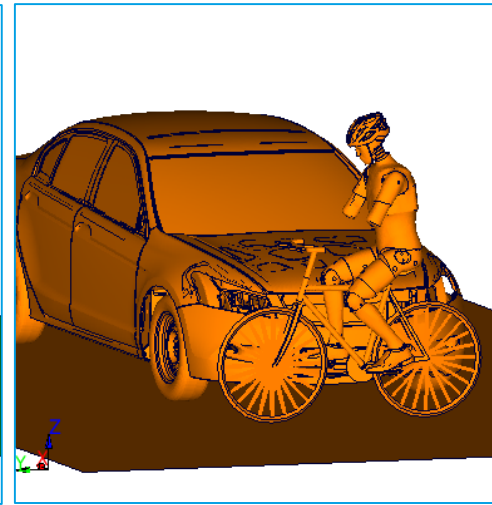
**E7a:** Impacted leg up



**E7b:** Impacted leg down



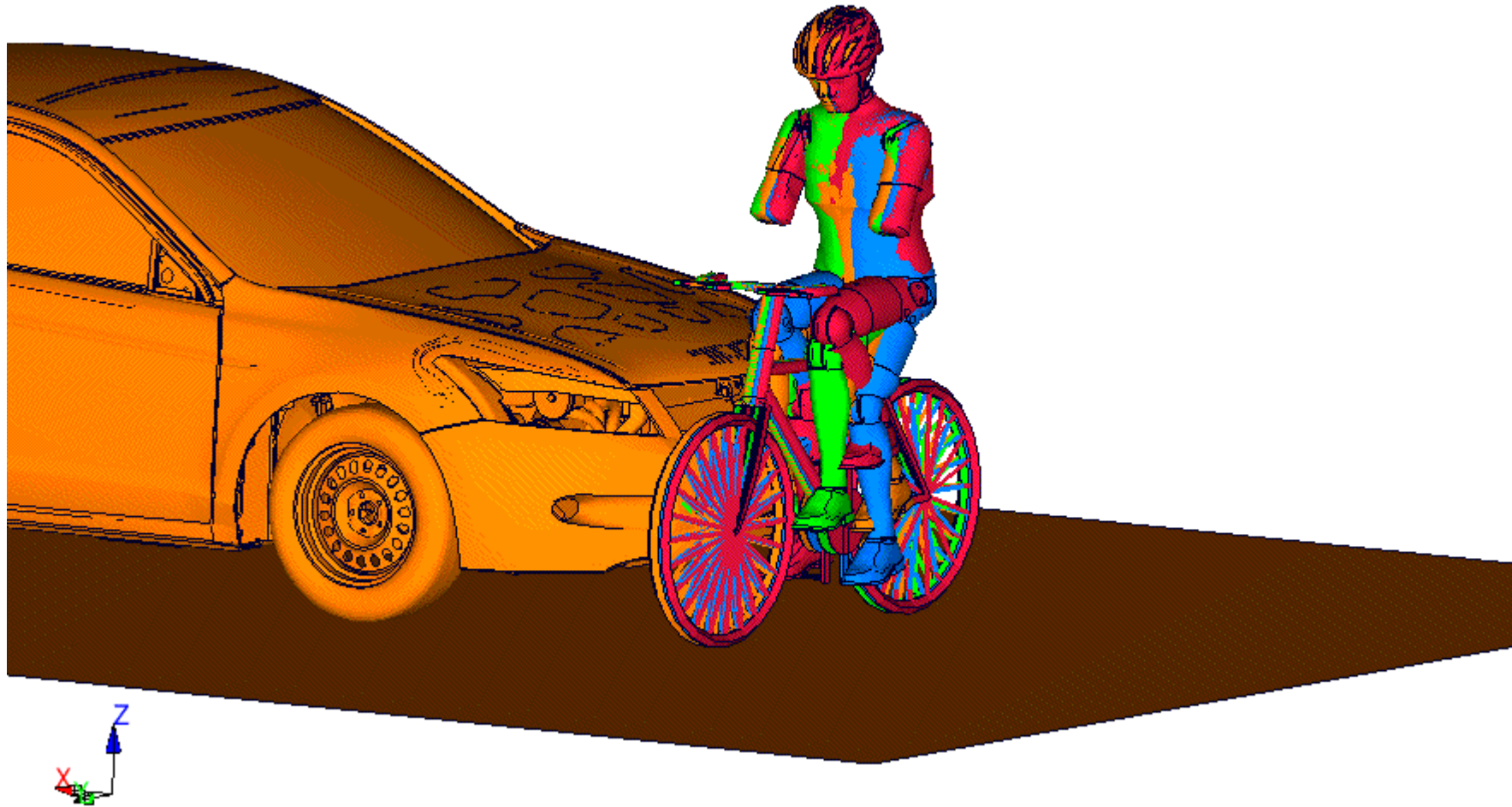
**E7c:** Pedals level.  
Impacted leg back.



**E7d:** Pedals level.  
Impacted leg front.

	Vehicle Speed km/h	Cyclist speed km/h	Impact Point	Impact Angle Deg
1	40	0	middle	0
2	30	0	middle	0
3	20	0	middle	0
4	40	0	corner	0
5	30	0	corner	0
6	20	0	corner	0
7	40	15	middle	0
8	30	15	middle	0
9	20	15	middle	0
10	40	15	corner	0
11	30	15	corner	0
12	20	15	corner	0

# E7 - Animation



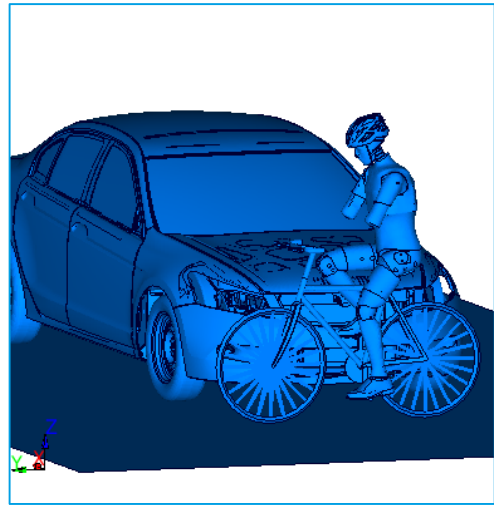
# E7 - Impact positions

**Blue:** Impacted leg up  
**Red:** Impacted leg down  
**Green:** Pedals level. Impacted leg back.  
**Orange:** Pedals level. Impacted leg front.

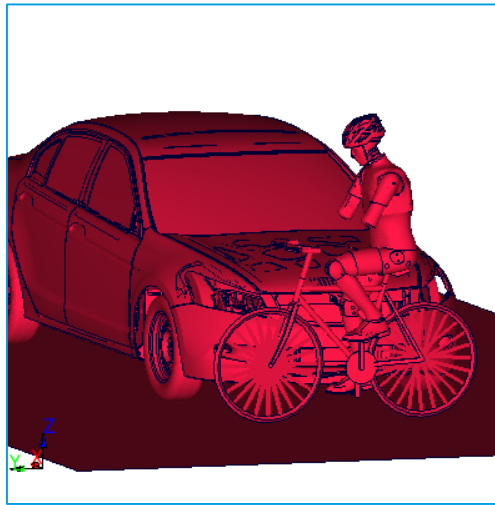




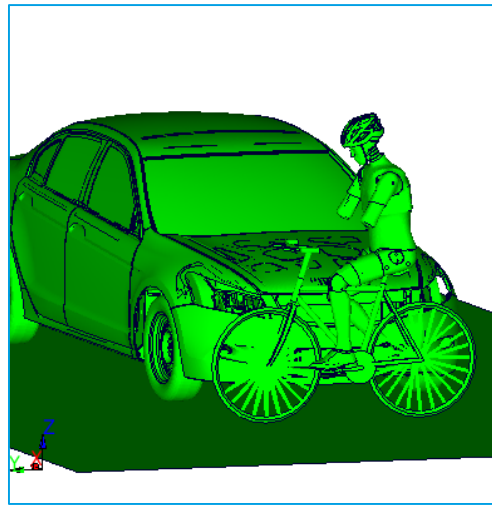
# Load-case G7 (c40b0a0mHES2h) – Honda Accord- ES2



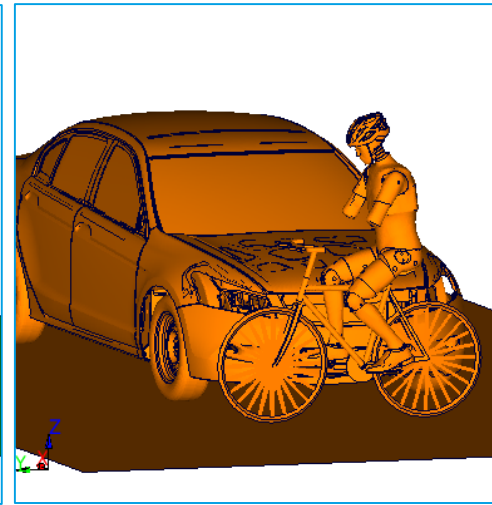
**G7a:** Impacted leg up



**G7b:** Impacted leg down



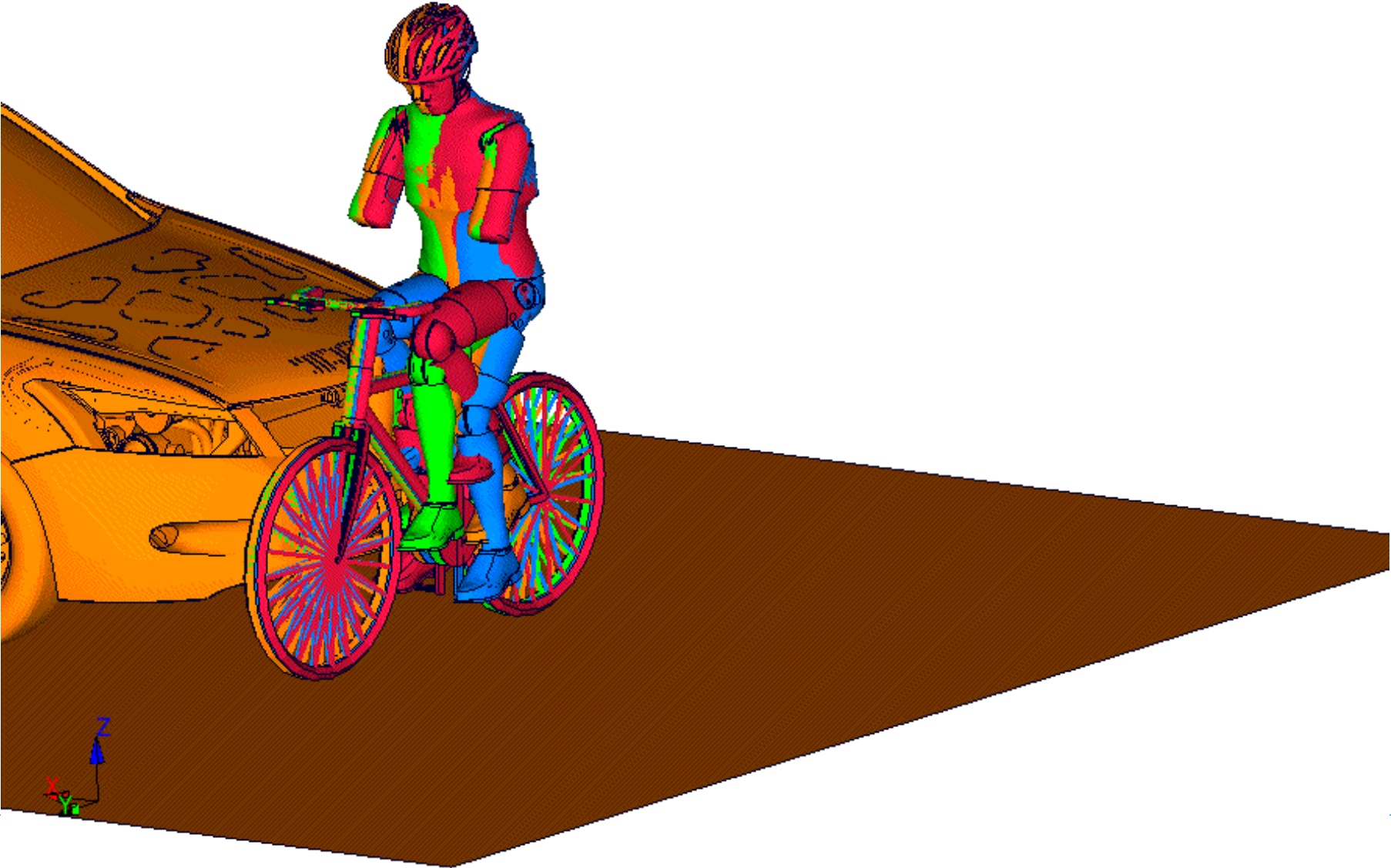
**G7c:** Pedals level.  
Impacted leg back.



**G7d:** Pedals level.  
Impacted leg front.

	Vehicle Speed km/h	Cyclist speed km/h	Impact Point	Impact Angle Deg
1	40	0	middle	0
2	30	0	middle	0
3	20	0	middle	0
4	40	0	corner	0
5	30	0	corner	0
6	20	0	corner	0
7	40	15	middle	0
8	30	15	middle	0
9	20	15	middle	0
10	40	15	corner	0
11	30	15	corner	0
12	20	15	corner	0

# G7 - Animation



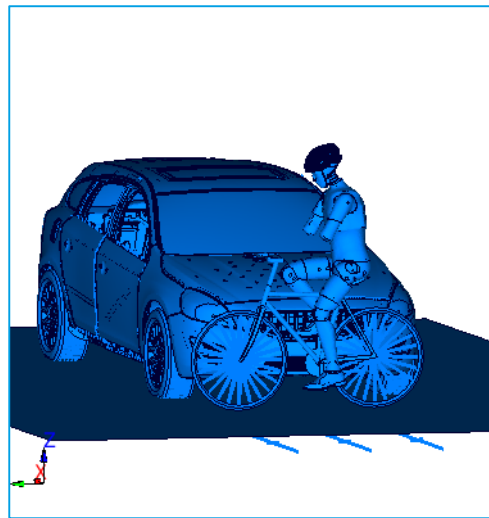
# G7 - Impact positions

**Blue:** Impacted leg up  
**Red:** Impacted leg down  
**Green:** Pedals level. Impacted leg back.  
**Orange:** Pedals level. Impacted leg front.

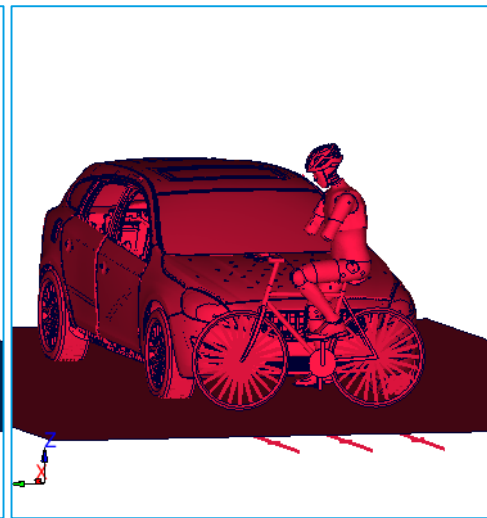




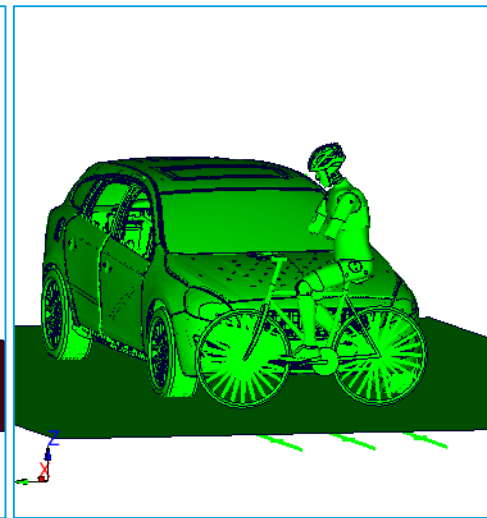
# Load-case H7 (c40b0a0mVES2h) – Volvo V60 - ES2



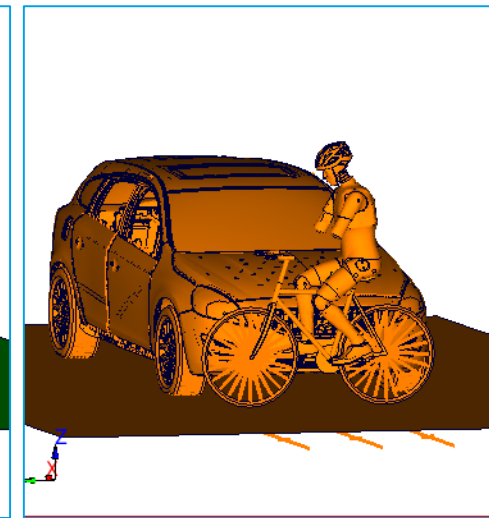
**H7a:** Impacted leg up



**H7b:** Impacted leg down



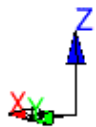
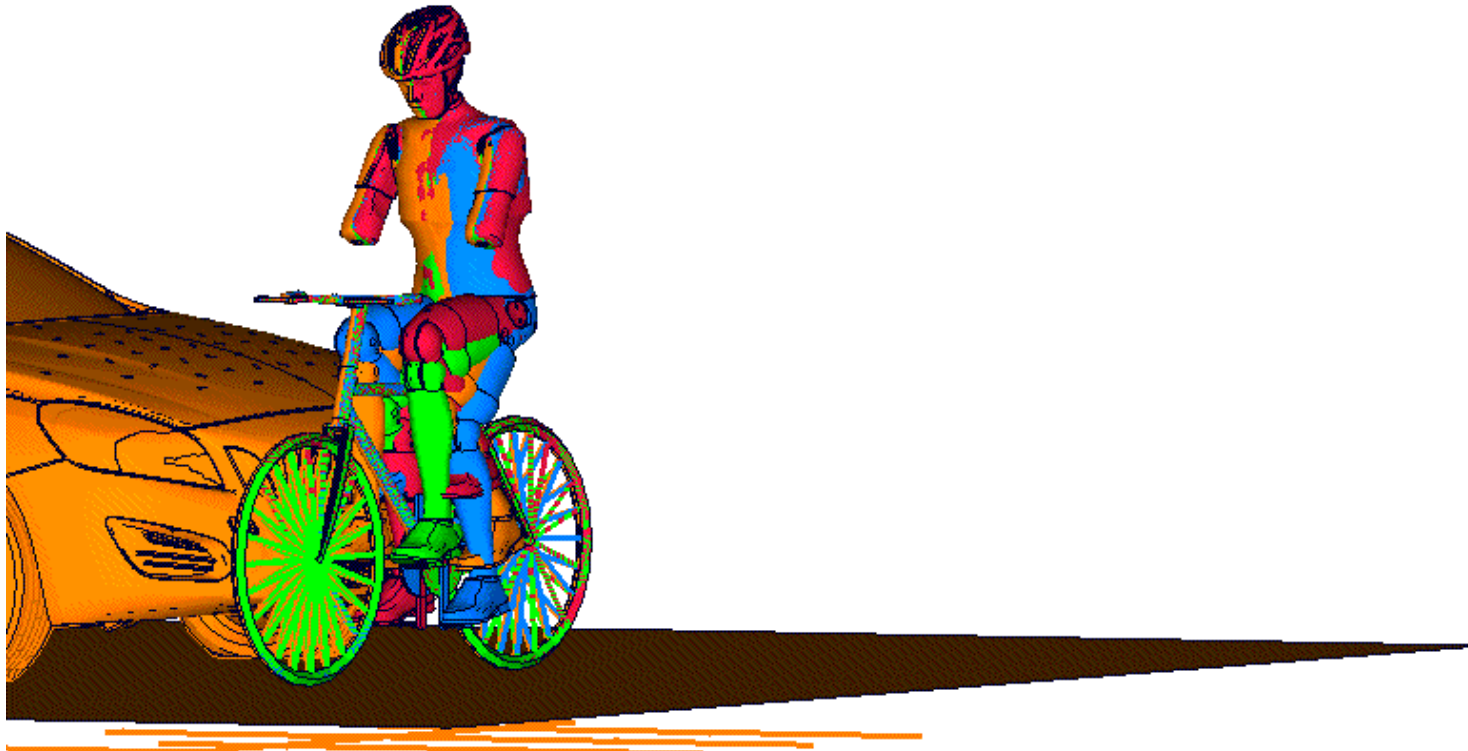
**H7c:** Pedals level.  
Impacted leg back.



**H7d:** Pedals level.  
Impacted leg front.

	Vehicle Speed km/h	Cyclist speed km/h	Impact Point	Impact Angle Deg
1	40	0	middle	0
2	30	0	middle	0
3	20	0	middle	0
4	40	0	corner	0
5	30	0	corner	0
6	20	0	corner	0
7	40	15	middle	0
8	30	15	middle	0
9	20	15	middle	0
10	40	15	corner	0
11	30	15	corner	0
12	20	15	corner	0

# H7 - Animation



# H7 - Impact positions

**Blue:** Impacted leg up  
**Red:** Impacted leg down  
**Green:** Pedals level. Impacted leg back.  
**Orange:** Pedals level. Impacted leg front.



# Slutsatser av simuleringarna

- Mer verklighetsnära dynamisk respons hos dockan.
- Fortsatt höga mätvärden i huvudet, vilket ger risk för bestående men.
- Hjälms med bättre stötupptagning...