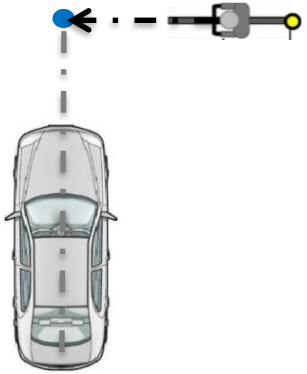
THE FUTURE OF TRANSPORT

General Safety Regulation 5: AEBS – Proportion of M1 vehicles likely to pass the vehicle to cyclist test of the proposed draft regulation

November 2019

Proposed AEB vehicle to cyclist tests



Crossing Scenario:

- Bicycle impacts centreline of the subject vehicle if it does not brake
- Bicycle speed – 15 km/h
- Test Speed - [20], 42 and 60 km/h
- Test at all vehicle load conditions

(ECE-TRANS-WP29-GRVA-2019-05e)

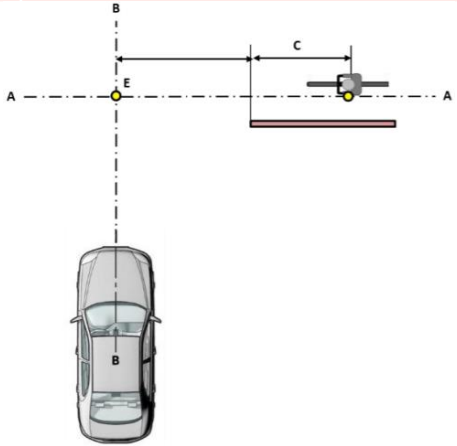
Longitudinal Scenario:

- Bicycle impacts centreline of the subject vehicle if it does not brake
- Bicycle speed - 20 km/h
- Test Speed - [50] km/h
- Test at all vehicle load conditions

(ECE-TRANS-WP29-GRVA-2019-05e)

3 Scenarios for AEB vehicle to cyclist test

	CBNA-50	CBLA-50	CBLA-25
Function	**AEB**	**AEB**	**FCW**
Vehicle Speed (km/h)	20-60	25-60	50-80
Bicycle Speed (km/h)	15	15	20
Impact overlap	50%	50%	25%

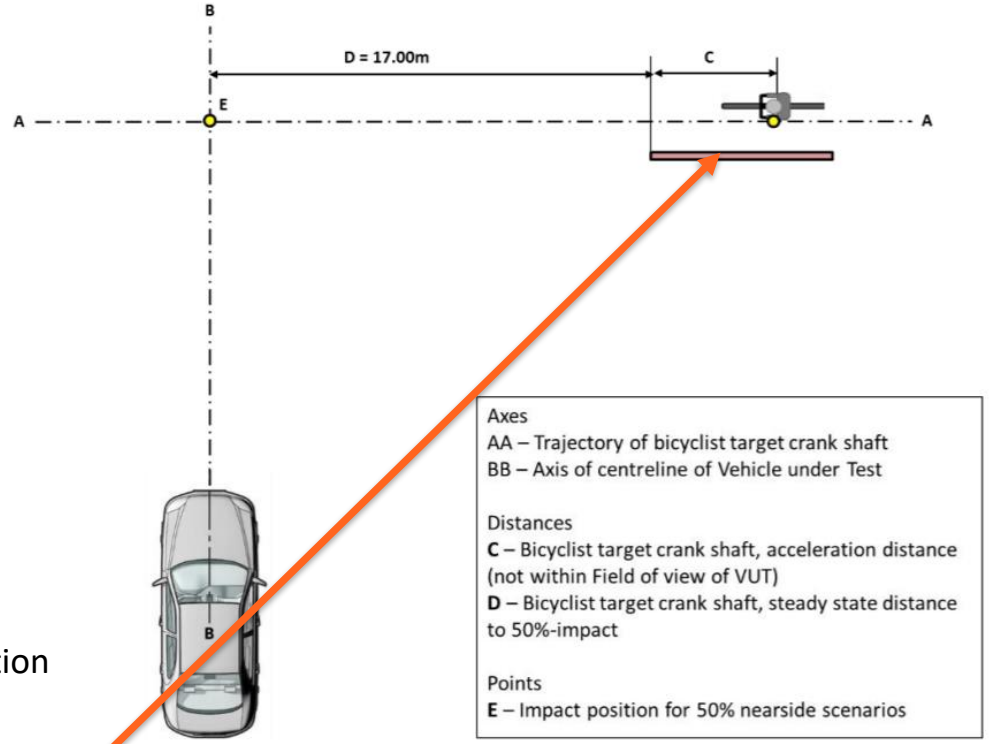


CBNA-50

CBNA-50 Specification:

- Impact point at **50%** (Centreline)
- Bicycle crossing at **15 km/h**
- **20-60 km/h** test speed (5 km/h increments)
- 200 kg ballast in car
- ≤ 40 km/h points awarded relative to speed reduction
- > 40 km/h points awarded on Pass/Fail basis

Obstruction for bicycle acceleration phase



CBNA scenario, Bicyclist from Nearside

CBLA-50

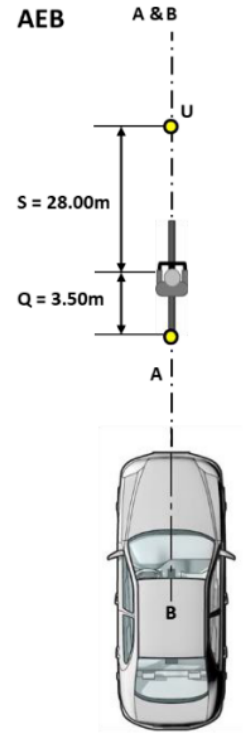
CBLA-50 Specification:

- Impact point at **50%** (Centreline)
- Bicycle speed at **15 km/h**
- **25-60 km/h** test speed (5 km/h increments)
- 200 kg ballast in car
- ≤ 40 km/h points awarded relative to speed reduction
- > 40 km/h points awarded on Pass/Fail basis

Axes
AA – Trajectory of bicyclist rear tire
BB – Axis of centreline of Vehicle under Test

Distances
Q – Bicyclist acceleration distance for AEB
S – Bicyclist steady state distance to impact (without intervention)
T – Impact point offset for 25%

Points
U – Impact position for 50% longitudinal scenarios



CBLA scenarios, Longitudinal Bicyclist

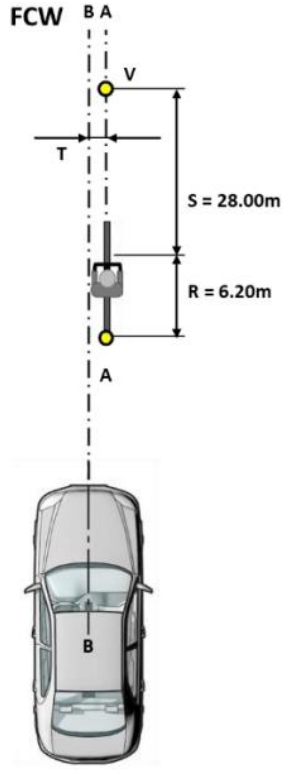
CBLA-25

CBLA-25 Specification:

- Impact point at **25%**
- Bicycle speed at **20 km/h**
- **50-80 km/h** test speed (5 km/h increments)
- 200 kg ballast in car

The available points per test speed are awarded when the warning is issued at a TTC ≥ 1.70s.

NB: TTC = Time to collision



Axes
AA – Trajectory of bicyclist rear tire
BB – Axis of centreline of Vehicle under Test

Distances
R – Bicyclist acceleration distance for FCW
S – Bicyclist steady state distance to impact (without intervention)
T – Impact point offset for 25%

Points
V – Impact position for 25% longitudinal scenarios

CBLA scenarios, Longitudinal Bicyclist

AEB with cyclist capability

- Euro NCAP assessment of 57 vehicles in 2018 and 2019
- AEB cyclist capability in 47 vehicles = 82%
- 47 with longitudinal capability & 36 with crossing capability

The AEB draft regulation does not define performance target for the cyclist test procedure – requirement for the Euro NCAP assessment data

Crossing Scenario

Subject vehicle speed (km/h)	Maximum mass	Mass in running order
[20]	[?]	[?]
42	[?]	[?]
60	[?]	[?]

Longitudinal Scenario

Subject vehicle speed (km/h)	Maximum mass	Mass in running order
[50]	[?]	[?]

Collision warning: “When a collision with a preceding bicycle is imminent the collision warning shall be provided at the latest at 1.7 seconds TTC.”

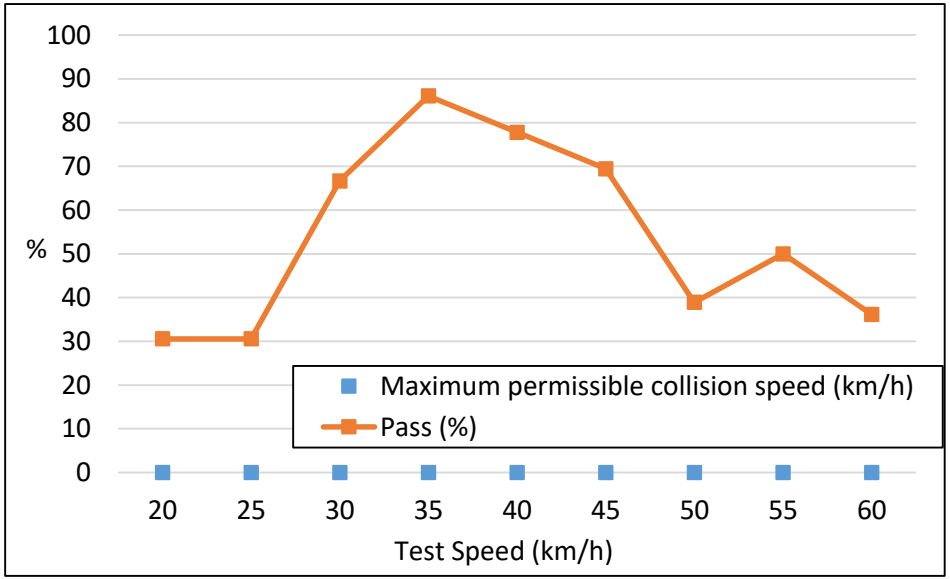
AEBS-08-07 Draft Suppl.1 to R AEBS M1N1

CBNA-50 (Crossing Scenario): Avoid impact at all test speeds

Test Type	Relative test speed (km/h)	Maximum Impact speed (km/h)[1]:	Proportion of Euro NCAP test vehicles meeting requirements
		M1 Unladen	CBNA-50 %
Bicycle crossing from nearside (CBNA-50)	**20**	**0**	**31**
	25	0	31
	30	0	67
	35	0	86
	40	**0**	**78**
	45	**0**	**69**
	50	0	39
	55	0	50
	60	**0**	**36**

Proportion of vehicles that pass the Euro NCAP AEB CBNA-50 test. (Data: Euro NCAP 2018-19)

Number of vehicles	Pass at 20 km/h	Pass at 42 km/h	Pass at 60 km/h	Pass at all test speeds	Fail at all test speeds
36	31 %	69 – 78 %	36 %	**6 %**	**8 %**

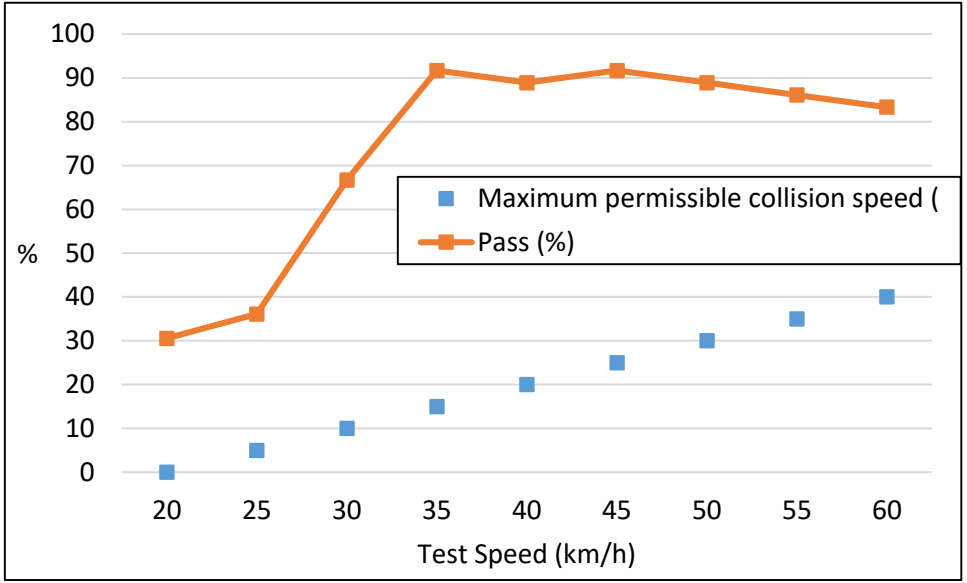


CBNA-50 (Crossing Scenario): Minimum speed reduction of 20 km/h

Test Type	Relative test speed (km/h)	Maximum Impact speed (km/h)[1]:	Proportion of Euro NCAP test vehicles meeting requirements
		M1 Unladen	CBNA-50 %
Bicycle crossing from nearside (CBNA-50)	**20**	**0**	**31**
	25	5	36
	30	10	67
	35	15	92
	40	**20**	**89**
	45	**25**	**92**
	50	30	89
	55	35	86
	60	**40**	**83**

Proportion of vehicles that pass the Euro NCAP AEB CBNA-50 test. (Data: Euro NCAP 2018-19)

Number of vehicles	Pass at 20 km/h	Pass at 42 km/h	Pass at 60 km/h	Pass at all test speeds	Fail at all test speeds
36	31 %	89 – 92 %	83 %	**86 %**	**6 %**

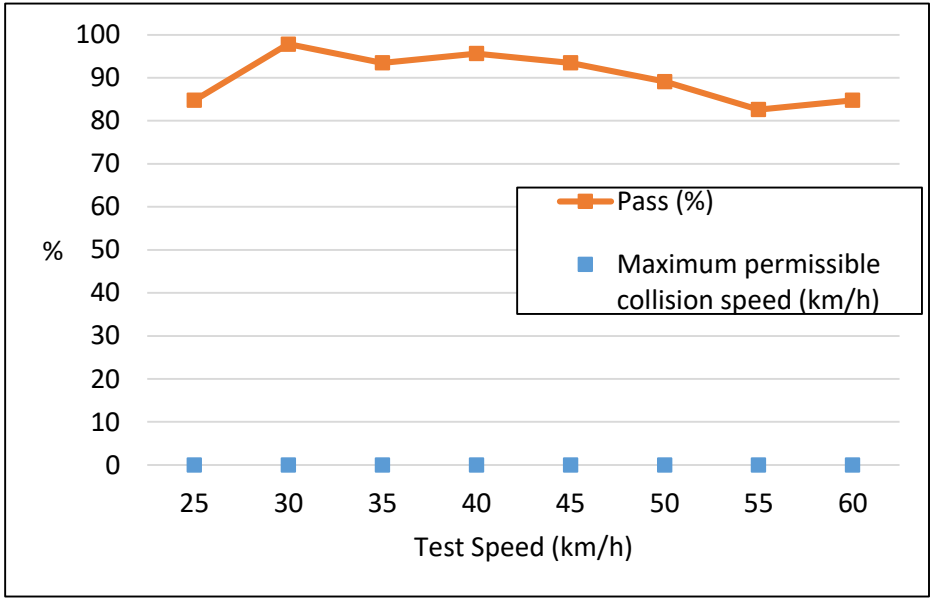


CBLA-50 (Longitudinal Scenario): Avoid collision at all speeds

Test Type	Relative test speed (km/h)	Maximum Impact speed (km/h)[1]:	Proportion of Euro NCAP test vehicles meeting requirements
		M1 Unladen	CBNA-50 %
Bicycle travelling forward (CBLA-50)	25	0	85
	30	0	98
	35	0	93
	40	0	96
	45	0	93
	50	**0**	**89**
	55	0	83
	60	0	85

Proportion of vehicles that pass the Euro NCAP AEB CBLA-50 test. (Data: Euro NCAP 2018-19)

Number of vehicles	Pass at 50 km/h	Pass at all test speeds	Fail at all test speeds
46	89 %	**70 %**	**0 %**

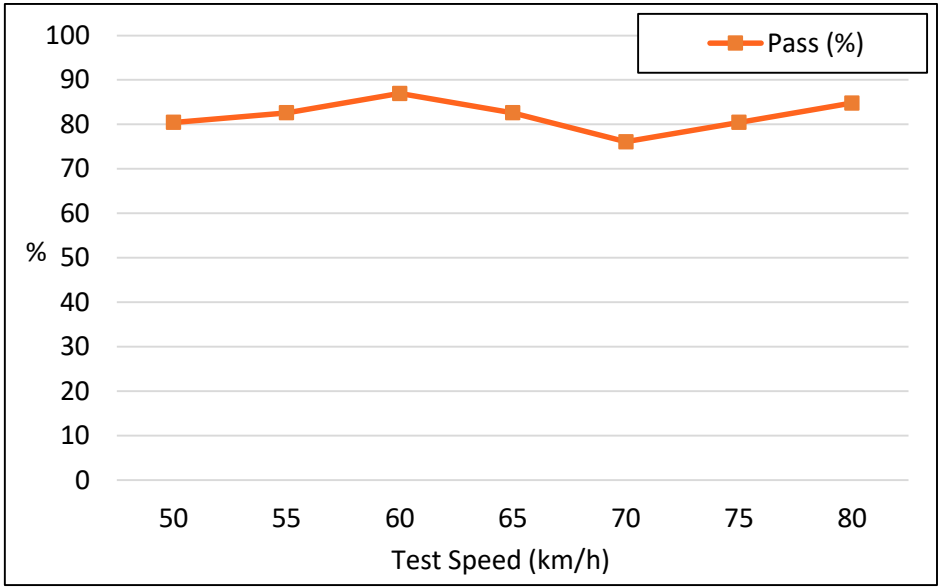


CBLA-25 (Longitudinal Scenario): FCW given at TTC ≥ 1.7 seconds

Test Type	Relative test speed (km/h)	TTC (sec):	Proportion of Euro NCAP test vehicles meeting requirements
		M1 Unladen	CBNA-50 %
Bicycle travelling forward (CBLA-25)	50	1.7	80
	55	1.7	83
	60	1.7	87
	65	1.7	83
	70	1.7	76
	75	1.7	80
	80	1.7	85

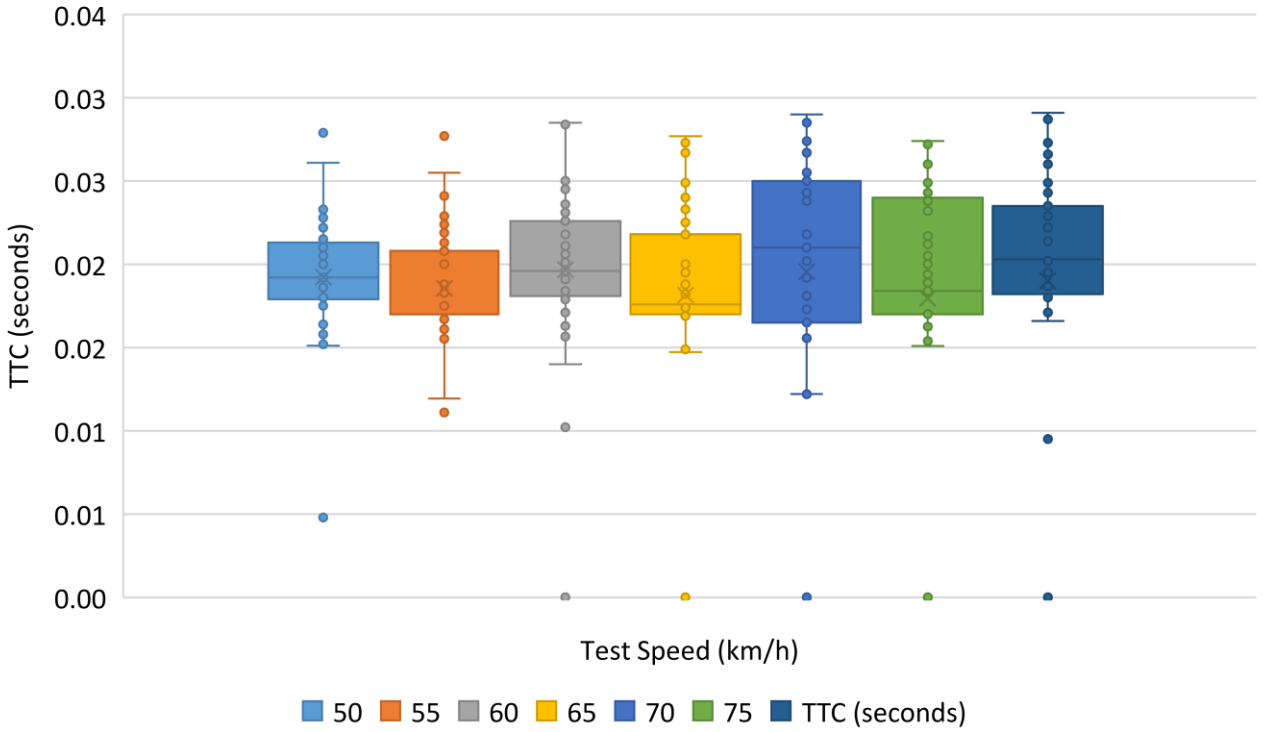
Proportion of vehicles that pass the Euro NCAP AEB CBLA-25 test. (Data: Euro NCAP 2018-19)

Number of vehicles	Pass at all test speeds	Fail at all test speeds
46	**64 %**	**4 %**

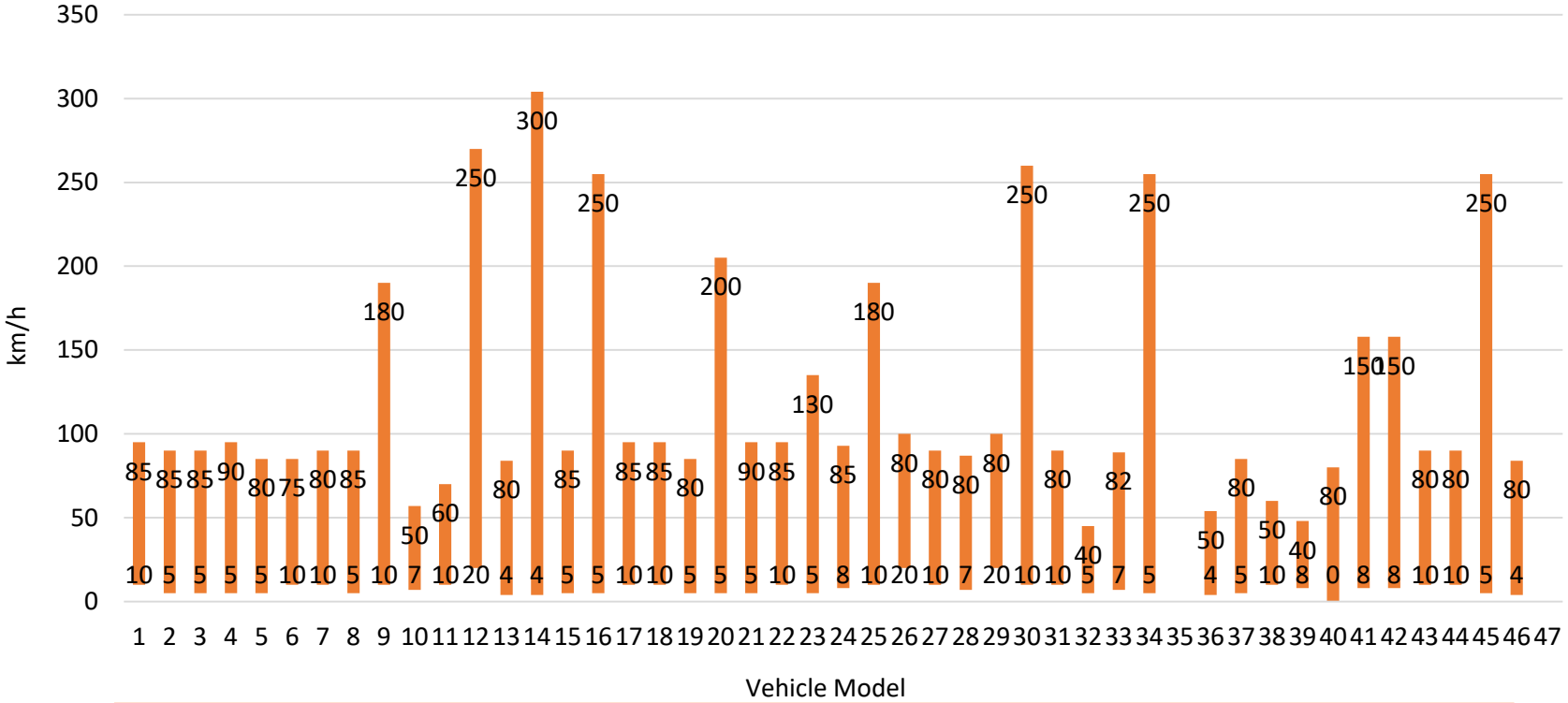


CBLA-25 (Longitudinal Scenario): TTC distribution 50 – 80 km/h

- Large proportion of FCW issued at TTC 2 seconds
- Five cars issued FCW at TTC 0 seconds (vehicle collides with bicycle)
  - 1 from 60 km/h +
  - 2 from 65 km/h +
  - 1 from 70 km/h +
  - 1 at 80 km/h



AEB VRU operating speeds across the 2018 & 2019 fleet



Operational speed of the AEB VRU systems range from 40 – 300 km/h

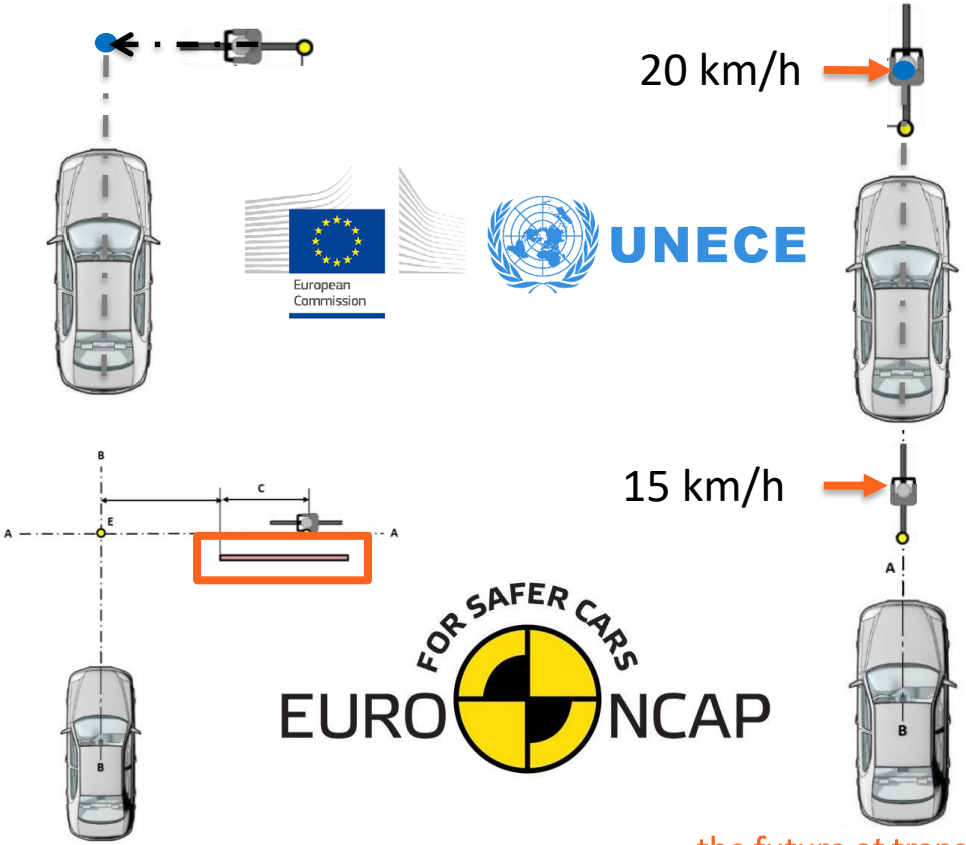
Observations

Euro NCAP assessment is subtlety different from proposed regulatory test:

- Obstruction for acceleration phase of the bicycle included in crossing scenario
- Bicycle speed is 15 km/h in longitudinal scenario as opposed to 20 km/h

Euro NCAP assessment of 57 vehicles in 2018 and 2019:

- AEB cyclist capability in 47 vehicles = 82%
  - 47 with **longitudinal** scenario capability (AEB & FCW)
  - 36 with **crossing** scenario capability



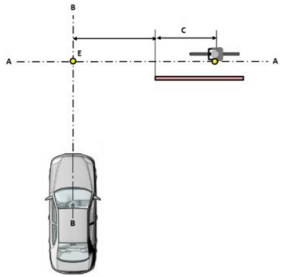
Conclusions

Vehicles with AEB Cyclist function:

Greatest compliance in the longitudinal scenarios (CBLA-50 & CBLA-25)

Lowest compliance in the crossing scenario (CBNA-50)

- Peak compliance from 30 – 45 km/h test speeds at approximately 70 %
- At lower speeds systems tend to either prevent collision completely or they do not activate
- At higher speeds systems either prevent the collision completely or mitigate the collision speed



	CBNA-50				CBLA-50		CBLA-25
Relative test speed (km/h)	20	42	60	All	50	All	All
Avoid Collision	31 %	69 – 78 %	36 %	6 %	89 %	70 %	64 %
Min. speed reduction of 20 km/h	31 %	89 – 92 %	83 %	86 %			

Proportion of NCAP tested vehicles that pass at all proposed vehicle test speeds. (Data: EuroNCAP 2018-19)