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Tesla FSD (supervised) and active road users:

Study on system performance in contexts relevant for pedestrians and cyclists

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Johanna.be is a non-profit organization recognized by the Brussels-Capital Region as a mobility association for improving the urban environment and the living climate in the Brussels-Capital Region.

Executive summary

This report assesses the performance of Tesla's Full Self-Driving (Supervised) system (FSD) in traffic environments in Belgium that are particularly important for pedestrian and cyclist safety: 30 km/h zones, home zones (20 km/h areas), and cycle streets. The study was initiated after repeated observations that FSD continued to drive above posted 30 km/h speed limits, despite correctly detecting the speed limits, and with speed offset and contextual max speed disabled. Testing was conducted in July 2026 using a Tesla Model 3 equipped with FSD and documented through extensive video recordings.

The findings reveal a consistent pattern of non-compliance with critical low-speed traffic environments. In the Brussels Capital Region, 29 systematically selected 30 km/h segments were examined. FSD exceeded the legal speed limit in 16 segments (55%), with an average speed of 44 km/h. Among the clearly signposted 30 km/h zones tested under free-flow conditions, speeding occurred in 59% of cases, with average speeds of nearly 46 km/h. These speeds are substantially above the legal speed limit and significantly increase risk for pedestrians and cyclists.

A key finding is that the system frequently correctly recognized the speed limit but failed to adjust its driving behavior accordingly. In many cases, FSD correctly detected 30 km/h signage, as evidenced by the temporary "Observed Speed Limit" displayed on the screen. However, it continued to show a "Displayed Speed Limit" of 50 km/h to the supervising driver and often selected speeds consistent with that higher speed limit. Across the Brussels sample, the supervising driver was presented with incorrect speed-limit information in approximately 90% of tested 30 km/h segments. This behavior not only contributed to speeding by the system itself but also risked misleading the supervising driver about the applicable legal speed limit.

To verify whether the issue could be attributed to difficulty recognizing traffic signs, the study compared Tesla FSD's performance with a Citroën C3 equipped with a conventional traffic-sign recognition system. On seven 30 km/h segments, the Citroën correctly identified all relevant F4a zone signs, while the Tesla FSD correctly reflected the speed limit in only one of those segments. This suggests that the observed shortcomings are not primarily caused by road-sign visibility or infrastructure quality.

Performance in home zones was similarly concerning. Of the 12 tested home zones, FSD exceeded the 20 km/h legal limit in five cases (42%), averaging approximately 26 km/h. In two-thirds of the tested locations, the system incorrectly displayed a higher speed limit, typically 30 km/h or 50 km/h. Given that home zones are specifically designed as shared spaces where pedestrians, including children, may occupy the full width of the street, these findings raise significant safety concerns.

Further, results in cycle streets were particularly problematic. In none of the six tested cycle streets did FSD correctly indicate the applicable 30 km/h speed limit. The system attempted to overtake cyclists on multiple occasions, despite Belgian regulations

explicitly prohibiting overtaking cyclists in cycle streets. Several overtaking maneuvers had to be aborted by the supervising driver. This evidence suggests that FSD neither recognizes nor appropriately responds to the operational requirements of Belgian cycle streets.

The study also identified secondary concerns, including ineffective Intelligent Speed Assistance (ISA) operation, a user interface that makes reducing FSD-selected speeds unnecessarily difficult, and a disengagement behavior where braking can unexpectedly alter steering dynamics during driver takeover. These issues may increase workload and reduce safety margins for supervising drivers.

Importantly, the study also documented the strengths of the system. In general, FSD consistently behaved cautiously and courteously around pedestrians and cyclists, often yielding proactively and demonstrating careful interaction with active road users. These positive behaviors, however, do not offset the documented failures to comply with speed limits and cycle-street regulations.

Overall, the study concludes that Tesla FSD (Supervised), as tested, demonstrates serious safety deficiencies in low-speed urban environments, the very areas that are most critical for pedestrian and cyclist safety and comfort. The combination of frequent speeding, incorrectly presenting speed-limit information to the supervising driver, poor performance in home zones, and repeated attempts to illegally overtake cyclists on cycle streets raises significant concerns about the system’s suitability for public-road operation under its current approval conditions. The report therefore recommends that the current provisional approval be revoked and that operation of the system be suspended until the identified issues have been independently reviewed and verified as resolved.

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Speed Definitions

Legal Speed Limit	The maximum permitted legal driving speed for the lane travelled. (Also referred to as "applicable speed limit" in the ISA Regulation. Also called the "posted speed limit".)
Vehicle Speed (A)	The speed that the vehicle is currently traveling at, as shown on the display.
Observed Speed Limit (B)	The speed limit that the system identifies as posted on the traffic signs along the road or above the lane. It is displayed on the car status screen when approaching the sign and disappears after passing it.
Displayed Speed Limit (C)	The speed limit that the system displays to the supervising driver as being the legal speed limit applicable to the lane the vehicle is currently traveling on.
Maximum Speed (D)	The maximum speed up to which the (FSD) system will control the vehicle. ("Current maximum speed" in UN R171; Tesla's "Max speed").
Speed Offset	An FSD-specific function that allows the driver to set the maximum speed to a fixed percentage above the speed limit as detected by the system. The driver can either set it as a default (valid for all trips after setting) in a settings menu or while driving through a dedicated window. The speed offset can be set in 5% steps, up to 50%.
Contextual Max Speed	An FSD-specific function that allows the system to adjust the maximum speed setting dynamically based on visual cues in the driving scene.
Car status area	The area displaying visualizations of the road and the vehicle's surroundings, including road markings, traffic signs (vertical signage), stop lights, other road users and objects (such as rubbish bins and poles).
Segment Speed	The maximum speed driven by the FSD system through a segment of interest in this study (e.g. a 30 km/h zone, a home zone or a cycle street).

Belgian traffic signs referenced in this report

	F4a
	C43
	A23
	F12a
	F111

Introduction

This study was conducted in response to an observation during a ride with Tesla's Full Self Driving (Supervised) system ("FSD") on July 12, 2026 in Brussels, in which a concerning FSD speed behavior pattern was observed in many 30 km/h zones.

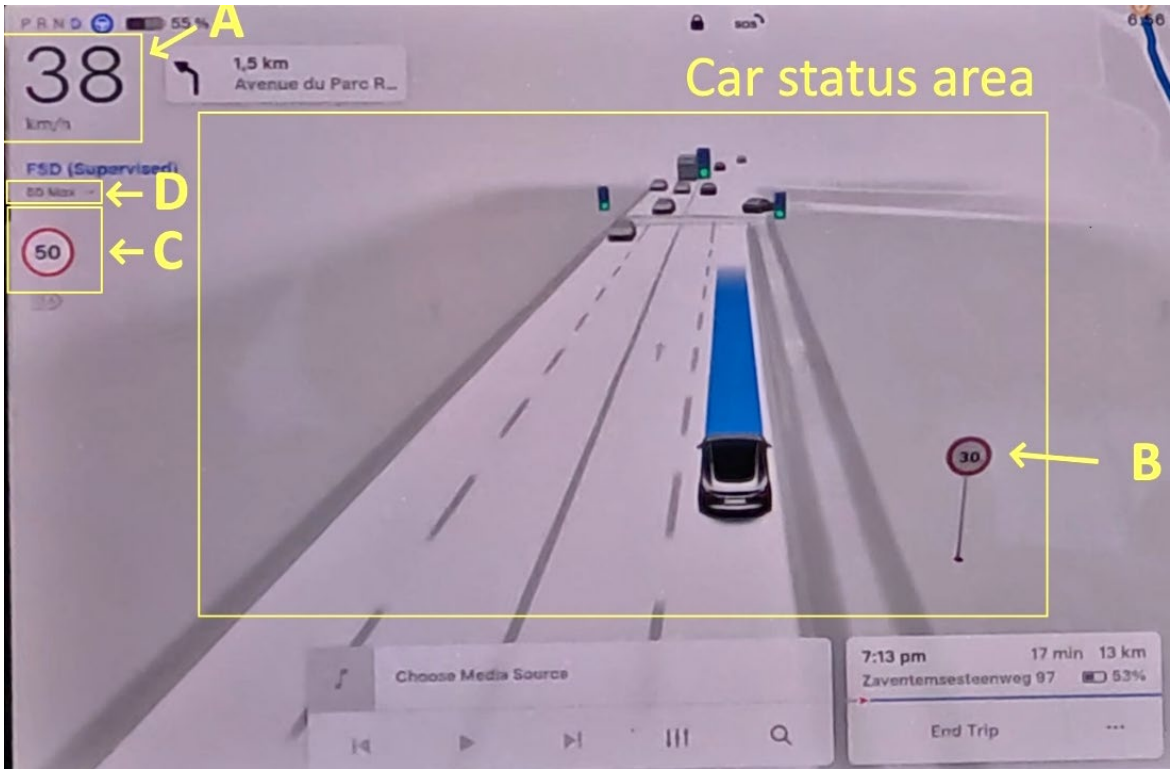


Figure 1: The different speeds displayed on the FSD screen. Vehicle speed (A), Observed speed limit (B), Displayed speed limit (C) and Maximum speed (D).

As illustrated in the above picture, the Vehicle Speed (A) selected by FSD (38 km/h in this example) was well above the Legal Speed Limit of 30 km/h, which was clearly recognized and correctly identified by the system (Observed Speed Limit, B). However, FSD controlled the vehicle with speeds up to 50 km/h (Maximum Speed, D) and simultaneously misinformed the supervising driver that the legal speed is 50 km/h (Displayed Speed Limit C). FSD speeding did not only occur at the beginning of the lower speed zone, but it typically continued throughout the full 30-zone. (This picture was chosen because the Observed speed limit (B) is still visible at the moment of the capture.)

Faced with this discrepancy, it was decided to investigate Tesla FSD's performance further in zone 30s using a more scientific approach. Two additional areas that are critical for pedestrian and cyclist safety and comfort were added to the study: Home zones (woonerf) and cycling streets. All other relevant behavior that was observed was noted and where appropriate ad-hoc further investigated.

Regulatory Situation

On April 10, 2026, the Dutch vehicle authority RDW granted provisional EU type-approval to Tesla's "FSD (Supervised)". The provisional approval in the Netherlands was issued under Article 39 of Regulation (EU) 2018/858, an exemption procedure for novel technologies not compatible with harmonized EU rules.

These rules for assisted driving systems as FSD, as currently applicable in the European Union, are set out in UN Regulation No. 171 on "driver control assistance systems", or "DCAS" for short. FSD has been approved against this Regulation, with Tesla having requested exemptions where it was incompatible.

Two provisions from the DCAS Regulation are particularly important in the context of this study. Firstly, paragraph 5.3.7.4.1. requires the system to aim to determine the permitted road speed limit relevant to the current lane of travel. Meaning that FSD should aim to determine the legal speed limit correctly.

Secondly, paragraph 5.3.7.4.7.3.3., which states that if the new system-determined road speed limit is lower than the current maximum speed, the current maximum speed shall automatically change to the new system-determined road speed limit. Meaning (in combination with other provisions) that if the FSD determines that a lower legal speed limit applies, the system should reduce the maximum speed of the vehicle to be at or below the new lower legal speed limit.

For the FSD system to be used across the EU, the Commission must adopt an implementing act authorizing the approval, requiring a vote in the Technical Committee – Motor Vehicles (TCMV). Under Article 40, an authorization then obliges the Commission to bring the underlying UN regulation, in this case UN Regulation No. 171 on Driver Control Assistance Systems (DCAS), into line with the new technological developments.

The provisional approval limits the territorial scope of where FSD can operate to the Netherlands. Pending this decision by the TCMV, European Member States may already accept the provisional approval, thereby authorizing the use of FSD in their territories. Lithuania, Estonia, Denmark and Belgium have so far accepted the provisional approval.

Background

According to the World Health Organization (WHO), the fatality risk for a pedestrian hit at 50 km/h is more than 8 times higher compared to being hit at 30 km/h[1].

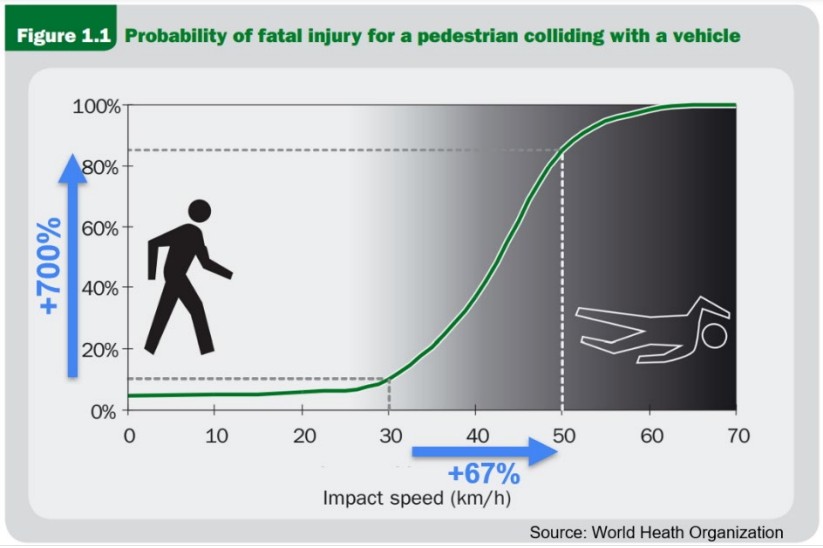


Figure 2: Fatality risk for pedestrians in a crash versus car speed

Speed km/h	relative risk
30	1.00
32	1.40
34	1.91
36	2.54
38	3.26
40	4.07
42	4.95
44	5.87
46	6.80
48	7.71
50	8.55

Table 1: relative risk vs speed

30 km/h zones

These safety considerations are the reason why many urban streets are designated as 30 km/h zones. Per Royal Decree of 26 April 2004, the local road authorities in Belgium are even obliged to provide 30 k/h zones around school entrances. The adherence to the 30 km/h limit, however, yields benefits that extend beyond reduced collision severity. Perceived safety is a strong factor influencing whether people choose to walk or bike for everyday journeys. When drivers and (semi-) autonomous systems consistently comply with the posted speed limit, streets become not only safer but also more attractive and accessible for active modes of transport.

Home zones (20 km/h areas)

Home zones (woonerf) are defined as areas in which the living function takes precedent over the motorized mobility. Per Belgium Road Traffic Code (Royal Decree of 1 December 1975), Article 22bis, in home zones, "*pedestrians are allowed to use the entire width of the public road: playing is also permitted*" and "*driving speed is limited to 20 km/h*". (In the Netherlands, the speed of motorized vehicles in home zones is evenlower, at 15 km/h).

[1] Speed management: a road safety manual for decision-makers and practitioners. Geneva, WHO / Global Road Safety Partnership, 2008. ISBN 978-2-940395-04-0

Cycle streets

Two important characteristics of cycle streets in Belgium are the speed limit of 30 km/h for motorized vehicles and the prohibition for motorized vehicles to overtake cyclists. (In the Netherlands, where FSD was extensively tested by the Dutch vehicle authority RDW, however, there is no default speed limit nor the restriction on overtaking cyclists as required in Belgian cycle streets.) As the Belgian permit to use FSD in public space was based on the Dutch permit, it is important for the safety and the comfort of cyclists to ensure that the differences in legal status of cycle streets in Belgium and The Netherlands are adequately acted upon by the FSD system.

Methods

A recent[2] Tesla Model 3 with software 2026.21.100 and FSD version v14.2.2.6 was configured in “standard mode”, with “speed offset” set at 0% and “contextual max speed” off. All testing was performed between Monday, July 20, 2026, at 17:00 and July 22 at 10:00 under dry weather conditions. July 21 is a bank holiday in Belgium.

A GoPro Hero 13 was mounted between the driver’s seat and the front passenger’s seat, so that it captured the full screen as well as the full windscreen view. Post processing included video segment generation of each relevant segments and extraction of data including the Legal Speed Limit , the Observed Speed Limit, the Displayed Speed Limit, the Maximum Speed up to which FSD will control the vehicle, the Segment Speed, the presence of horizontal and vertical signage, the presence of radar warning signs and/or informative speed radar, the presence of a school along the segments, overtaking intentions (cycle streets) and the general traffic condition (free flow or not).

All observations described in the result section of this study are clearly documented by video, except in one case (due to a technical issue) clearly mentioned in that section. Video documentation can be made available to authorities upon request.

30 km/h zones

The “city30” attribute of Mobigis, the cartographic viewer of Brussel Mobility (https://data.mobility.brussels/mobigis/), was used to identify locations in the Brussels Region where 50 km/h axis are interrupted by 30 km/h segments (see appendix). These are predominantly signposted 30 km/h zones around schools, but they also

[2] Date of first registration: June 11, 2026

include some segments where the default 30 km/h regimen applies simply through the absence of higher speed limit signs after an intersection (often combined with horizontal signage). An attempt was made to drive through each of those 30 km/h zones at least once. The default 30 km/h (city30) in residential networks in Brussels, as such, was not tested.

> *Note: Some of the segments in the Brussels Capital Region were driven multiple times (up to 5 times) to test reproducibility of FSD behavior. This resulted in 59 runs in 29 segments. All data presented in this report are reported per segment, not per run. However, a similar analysis on the basis of individual runs rather than lumped per segment yielded a very similar data distribution.*

Due to time constraints (the availability of the test vehicle), the 30 km/h zone testing only focused on this systematic testing within the Brussels Capital Region, but some more ad-hoc testing in the Flemish and the Walloon Regions was performed as well.

The original test plan prescribed that the supervising driver would manually reduce the vehicle's allowed maximum speed to the legal limit whenever the Displayed Speed Limit was higher than the Legal Speed Limit (signposted or implicit). However, during early testing, we observed that in some situations (albeit a minority of cases), FSD respected the Legal Speed Limit despite the Displayed Speed Limit being incorrectly well above the Legal Speed Limit. In other words, the Displayed Speed Limit proved not to be a correct indicator of the speed that the FSD intends to travel. As such, we were forced to rewrite the test plan to not interfere and allow the speeding by FSD. In these situations, however, the supervising driver was instructed to apply maximal vigilance.

Home zones

A convenience sampling scheme was used to investigate FSD behavior in home zones. A few known home zones were investigated, as well as a few "ad hoc" home zones that were encountered while testing.

Cycle streets

A convenience sampling scheme was also used to investigate FSD behavior on cycle streets. Given the danger and the intrusion on the comfort of the cyclists involved, the testing scheme stipulated that the supervising driver would have to abort overtaking the cyclist in case FSD would attempt to do so, before the vehicle was alongside the cyclist.

Results

30 km/h zones

a) Brussels Capital Region

A total of 29 segments were investigated (Table 2). Of these, 21 were clearly signposted as “zone 30” with one or two F4a signs; 6 more had horizontal C43 signage reminding drivers that they are driving in a (default) 30 area; and only 2 had neither vertical nor horizontal signage.

location	signage F4a	C43 Vertical	C43 horizontal	A23 school zone	default 30	school	radar warning sign	informative radar	# test runs	Legal Speed Limit	Observed Speed Limit	Displayed Speed Limit (max in segment)	Vehicle Speed (max in segment)
01a	Y	-	-	-		Y	-	Y	4	30	30	30	30
01b	Y	-	-	-		Y	-	-	5	30	30	50	45
02a	Y	Y	-	-		Y	-	-	2	30	30	50	50
02b	Y	-	-	Y		Y	-	-	2	30	30	50	35
03a	Y	-	Y	-		Y	-	Y	3	30	30	50	30
03b	-	-	Y	-	Y	Y	-	Y	2	30	-	50	45
04a	Y	-	-	-		Y	-	-	5	30	30	50	45
04b	Y	-	-	-		Y	-	-	4	30	30	50	49
05a	-	-	Y	-	Y	-	-	-	1	30	-	50	35
06a	Y	-	-	-		Y	-	-	1	30	30	50	*
07a	Y	-	-	-		Y	-	-	1	30	30	50	*
07b	Y	Y	-	Y		Y	-	-	1	30	30	50	*
08a	-	-	Y	-	Y	-	Y	-	1	30	-	50	*
08b	-	-	-	-	Y	-	Y	-	1	30	-	40	30
09a	Y	-	-	-		Y	Y	Y	1	30	30	30	30
10a	Y	-	-	-		?	-	-	1	30	30	50	45
11a	Y	-	-	Y		Y	-	-	5	30	-	50	49
11b	Y	-	-	Y		Y	-	Y	4	30	-	50	49
12a	-	-	Y	-	Y	-	-	-	2	30	-	50	46
12b	-	-	Y	-	Y	-	Y	-	2	30	-	50	32
13a	Y	-		Y		Y	-	-	1	30	-	50	*
14a	Y	-	-	Y	-	Y	-	-	2	30	30	30	30
14b	Y	-	-	Y	-	Y	-	-	1	30	-	50	30
15a	Y	-	Y	Y		Y	-	Y	1	30	-	50	47
15b	Y	-	Y	Y		Y	-	Y	1	30	30	50	45
16a	Y	-	-	Y		Y	-	Y	1	30	30	50	30
16b	Y	-	-	Y		Y	-	-	1	30	-	50	30
17a	-	-	Y	-	Y	N	-	-	2	30	-	50	43
18a	-	-	-	-	Y	N	-	-	1	30	-	50	46

Table 2: performance in 30-zones in the Brussels Capital Region, * = no free flow

Of the 29 segments tested with a 30 km/h limit, in only 3 (10%) both the Displayed Speed Limit was correctly set at 30 km/h and the actual Segment Speed was at or below 30 km/h. In an additional 10 segments (35%), the actual Segment Speed was at or below 30 km/h but the Displayed Speed Limit was incorrectly given as 50 km/h (40 km/h in one case). In 4 of those segments, traffic in front of the test vehicle did not allow FSD to go faster; in the other 6 segments, at least a significant portion of the test drive was in "free flow" conditions (there was neither a vehicle in front of the test vehicle nor a traffic light acting as a physical barrier to FSD's ability to freely determine its speed). **In 16 of the 29 segments (55%), FSD did not respect the 30 km/h Legal Speed Limit, driving at an average Segment Speed of 44 km/h.**

All 30km/h segments (n=29)				
		Displayed Speed Limit		
		30	>30	
FSD Segment Speed	≤30	10%	35%	45%
	>30		55%	55%
		10%	90%	
average Segment Speed when speeding:			*44 km/h*	

Table 3: Segment Speed and Displayed Speed Limit in all segments studied in the Brussels Capital Region.

In the subgroup of 8 segments without vertical signage, the default city30 speed limit applies (since they all started after an intersection). Only in 2 of those segments (25%) did FSD respect the 30 km/h Legal Speed Limit (and 1 of those 2 cases could be due to the speed of the vehicle in front of the test vehicle limiting the speed at which FSD could travel).

Default 30 segments (n=8)				
		Displayed Speed Limit		
		30	>30	
FSD Segment Speed	≤30	0%	25%	25%
	>30		75%	75%
		0%	100%	
average Segment Speed when speeding:			*41 km/h*	

Table 4: Segment Speed and Displayed Speed Limit in the default 30 segments studied in the Brussels Capital Region.

Of the 21 segments tested with F4a signage, 17 were tested under “free flow” conditions. In 10 of those 17 free flow segments (59%), FSD was speeding, with an average Segment Speed of 46 km/h).

F4a zone 30 segments free flow (n=17)				
		Displayed Speed Limit		
		30	>30	
FSD Segment Speed	≤30	18%	24%	42%
	>30		59%	59%
		18%	83%	
average Segment Speed when speeding:			*46 km/h*	

Table 5: Segment Speed and Displayed Speed Limit in the F4a-signed 30 segments studied under free flow conditions in the Brussels Capital Region.

Of the 21 segments with F4a signage, the system clearly identified the 30 km/h speed limit in 15 cases (71%) as evidenced by the correct Observed Speed Limit displayed on the car status screen when passing by the sign. However, only in 3 of those cases (20%), the Displayed Speed Limit was changed to this limit. In the remaining 12 cases (80%) the Displayed Speed Limit misinformed the supervising driver that the Legal Speed Limit was 50 km/h. In 5 of those 12 segments, the Segment Speed was 30 km/h or less (albeit in 3 segments that could have also been due to the slower leading vehicle making speeding virtually impossible). In 7 of the 9 “free flowing” cases, FSD decided to drive faster (with an average of 44.9 km/h) despite the correct Observed Speed Limit.

In a few cases, we observed the Displayed Speed Limit changing from 50 km/h to 30 km/h when passing the F4a sign, only to be reverted back to 50 km/h within a split second (see appendix B). Also, a few instances occurred in which the Displayed Speed Limit indicated 30 km/h for a portion of the segment, but not necessarily the initial portion.

b) Flanders

Six 30-zone segments were tested in Flanders, all clearly signposted with an F3a sign. Five of the 6 tested segments had additional horizontal signage reminding drivers of the 30 km/h speed limit (C43) and/or of the presence of a school (A23).

location	signage F4a	signage C43 Vertical	signage C43 horizontal	signage school zone	default 30	school	radar warning sign	informative radar	free flow	# test runs	Legal Speed Limit	Observed Speed Limit	Displayed Speed Limit (max in segment)	Vehicle Speed (max in segment)
F01	R	-	Y	Y		Y	-	Y		1	30	30	50	**30**
F02	R	-	-	Y		Y	-	Y		1	30	30	30	**30**
F03	R	-	Y							2	30	-	50	**30**
F04	R	-	Y	-	-	-	-	-		1	30	30	50	33
F05	R	-	Y	-	-	-	-	-		1	30	30	50	32
F06	R	-	-	-	-	-	-	-		1	30	30	50	34

Table 6: performance in 30-zones in Flanders

In only 1 of the 6 segments (17%) tested, were both the Displayed Speed Limit correctly set at 30 km/h and the actual Segment Speed at or below 30 km/h. In an additional 2 segments (33%), the actual Segment Speed was at or below 30 km/h but the Displayed Speed Limit was 50 km/h. In 3 of the 6 segments (50%), FSD did not respect the 30 km/h Legal Speed Limit, driving with an average of 33 km/h (under free flow conditions).

c) Wallonia

Four 30-zone segments were tested in Wallonia, all clearly signposted with an F3a sign. Three of the 4 tested segments had additional horizontal signage reminding drivers of the 30 km/h speed limit (C43) and of the presence of a school (A23).

location	signage F4a	signage C43 Vertical	signage C43 horizontal	signage school zone	default 30	school	radar warning sign	informative radar	free flow	# test runs	Legal Speed Limit	Observed Speed Limit	Displayed Speed Limit (max in segment)	Vehicle Speed (max in segment)
W01	R	-	Y	Y		Y	-	Y		3	30	30	50	**30**
W02	R	-	Y	Y		Y	-	Y		2	30	30	30	**30**
W03	R	-	Y	Y		Y	-	Y		1	30	-	50	**30**
W04	R	-	-	-		-	-	-		2	30	-	50	**29**

Table 7: performance in 30-zones in Wallonia

In only 1 of the 4 segments (25%) tested, were both the Displayed Speed Limit correctly set at 30 km/h and the actual Segment Speed at or below 30 km/h. In the

remaining 3 segments (75%), the actual Segment Speed was at or below 30 km/h (under free flow conditions) but the Displayed Speed Limit was 50 km/h.

d) F4a Displayed Speed Limit test with a vehicle of another brand

In order to dive deeper into the question of whether or not the F4a signs posed any unsurmountable issues for camera systems, we tested the performance of an alternative car on the first 8 segments tested in our main test above (1a, 1b, 2a, 2b, 3a, 3b, 4a and 4b), of which the FSD test vehicle only recognized 1 segment as being a 30-zone.

The alternative car was a Citroen C3 from the Cambio car sharing system, and the test was performed on August 17, 2026, 4 weeks after the FSD test. Only 7 of the 8 segments can be compared like-to-like, as segment 3b had no F4a sign during the FSD test but subsequently had one during the alternative vehicle test.

The Traffic Sign Recognition (TSR) system of that alternative car perfectly identified all 7 F4a signs as 30-signs and changed the Displayed Speed Limit to 30 km/h exactly at the right location[3]. The Intelligent Speed Assistance (ISA) system in that vehicle also warned the driver when attempts were made to go above that speed limit. (The ISA in the FSD vehicle did not warn the supervising driver in the 6 of those 8 segments in which the FSD was speeding with an average speed of 43 km/h.)

FSD-TSR versus alternative TSR testing	Tesla FSD	Citroen C3
Number of F4s segments tested	7	
30 km/h as value in TSR displayed	1	7
% correct readings	14%	100%

Table 8: FSD-TSR versus alternative TSR testing

Home zones

A total of 12 home zones were investigated, 8 in the Brussels Capital Region, 3 in Flanders and 1 in Wallonia. All of them were clearly signposted by an F12a sign.

In only 4 of the 12 home zones (33%) tested, were both the Displayed Speed Limit correctly set at 20 km/h and the actual Segment Speed at or below 20 km/h. In an additional 3 segments (25%), the actual Segment Speed was at or below 20 km/h but the Displayed Speed Limit was 30 km/h. All but one of the home zones were tested under “free flow conditions”. **In 5 of the 12 home zones (42%), FSD did not respect the 20 km/h Legal Speed Limit, driving with an average Segment Speed of 26 km/h.**

[3] It also correctly identified the 8th sign that was not present during the FSD testing

location	signage F12a	signage C43 Vertical	signage C43 horizontal	signage school zone (from 11)	radar warning sign	informative radar	Legal Speed Limit	Observed Speed Limit	Displayed Speed Limit (max in segment)	Vehicle Speed (max in segment)
weB01	Y	-	-	-	-	-	20	-	30	18
weB02	Y	-	-	-	-	-	20	-	30	19
weB03	Y	Y	-	-	-	Y	20	-	30	25
weB04	Y	Y	-	-	-	-	20	-	30	25
weB05	Y	-	-	-	-	-	20	-	20	17
weB06	Y	-	-	-	-	-	20	-	20	12
weB07	Y	-	Y	-	-	Y	20	-	20	18
weB08	Y	-	Y	-	-	-	20	-	30	16
weF01	Y	-	-	-	-	-	20	-	50	28
weF02	Y	-	Y	-	-	-	20	-	50	23
weF03	Y	-	Y	Y	-	-	20	-	30	29
weW01	Y	-	-	Y	-	-	20	-	20	13

Table 9: performance in home zones (woonerfs) in Belgium

FSD home zone (woonerf) testing	Brussels	Flanders	Wallonia	Belgium
Number of home zones tested	8	3	1	12
Number of speeding incidents by FSD	2	3	0	5
% speeding FSD	25%	100%	0%	42%
Average speed when speeding (km/h)				26
Number of incorrectly high Displayed Speed Limit	5	3	0	8
% of incorrectly high Displayed Speed Limit	63%	100%	0%	67%

Table 10: summary of home zones results

Cycle streets

A total of 6 cycle streets were tested: 1 in the Brussels Capital Region, 4 in Flanders and 1 in Wallonia. All of them were clearly signposted with an F111 sign. The F111 sign in Wallonia was positioned suboptimally (just behind a corner) but was reinforced with large horizontal signage.

In none of the 6 cycle streets was a correct Displayed Speed Limit provided to the supervising driver. In 5 of the 6 cycle streets, the Displayed Speed Limit was 50 km/h; in the sixth cycle street, it was 70 km/h.

In 4 of the cycle streets, the Segment Speed was at or below the Legal Speed Limit of 30 km/h, but external factors were likely the cause of that:

1) In Brussels, a cyclist riding in front of the test vehicle positioned himselve on the road in a manner that left no space for the test vehicle to pass, keeping the test vehicle speed below the legal limit.
2) In Zaventem (Flanders), the cycle street was also equipped with several speed bumps and chicanes (parking on alternating sides), making it very dissuasive to speed.
3) In the 2 cycle streets tested in Winksele (Flanders), the supervising driver interfered/disengaged the FSD several times as it was attempting to pass a cyclist (see further), thereby significantly lowering the test vehicle's driving speed each time.

In the 2 cycle streets where those external factors were not present, FSD was speeding at 38 and 42 km/h respectively.

FSD cycle street testing	Brussels	Flanders	Wallonia	Belgium
Number of cycle streets tested	1	4	1	6
Number of speeding FSD	0	1	1	2
% speeding FSD				33%
Average Segment Speed when speeding (km/h)				40

Table 11: FSD cycle street testing

Despite the prohibition on overtaking, FSD attempted to overtake a cyclist no less than 4 times in one test drive through a 600m long cycle street[4] (see appendix C). In another, rather narrow and winding cycle street[5], FSD also attempted to overtake 2 cyclists. Each of those attempts was aborted by the supervising driver before the test vehicle reached the cyclist.

Other observations

a) Interactions with pedestrians and cyclists

FSD yielded very well at zebra crossings. In some cases, it detected pedestrians earlier than a "normal" driver may have. FSD's yielding also extended beyond "legal" yielding. For example, FSD yielded to a cyclist arriving at a non-signalized crossing and yielded to a woman waiting to cross in the absence of a zebra. FSD also quietly stayed behind 2 joggers on the carriageway for some distance until they finally noticed the test vehicle and moved to the available sidewalk. FSD stopped for a cyclist seemingly about to pass through a red light (the test vehicle had the green) and even

[4] Warotstraat, Winksele, Flanders
[5] Klein Dalenstraat, Winksele, Flanders

slowed down from 30 km/h to 19 km/h for a cat that initially seemed to want to cross the street but subsequently sat down on the sidewalk.

In all observed interactions between FSD and pedestrians and cyclists, FSD behaved like a careful and courteous driver (apart from the above-mentioned speeding in 20- or 30 km/h zones and the overtaking of cyclists in cycle streets).

b) User interface differences for decreasing versus increasing driving speed

The driver can always overrule FSD to go faster by pressing the accelerator. When doing so, FSD does not disengage, and it resumes normal operation once the driver stops pressing the accelerator. Using the brake pedal to reduce the speed FSD is driving results in FSD disengaging.

The supervising driver also can also easily increase the speed by setting a Speed Offset[6]. Touching the blue “FSD Supervised” text opens a clear window allowing the supervising driver to increase the Maximum Speed (up to which the (FSD) system will control the vehicle) by up to 50% above the Displayed Speed Limit. Decreasing the Maximum Speed below the Displayed Speed Limit is not possible in this window.

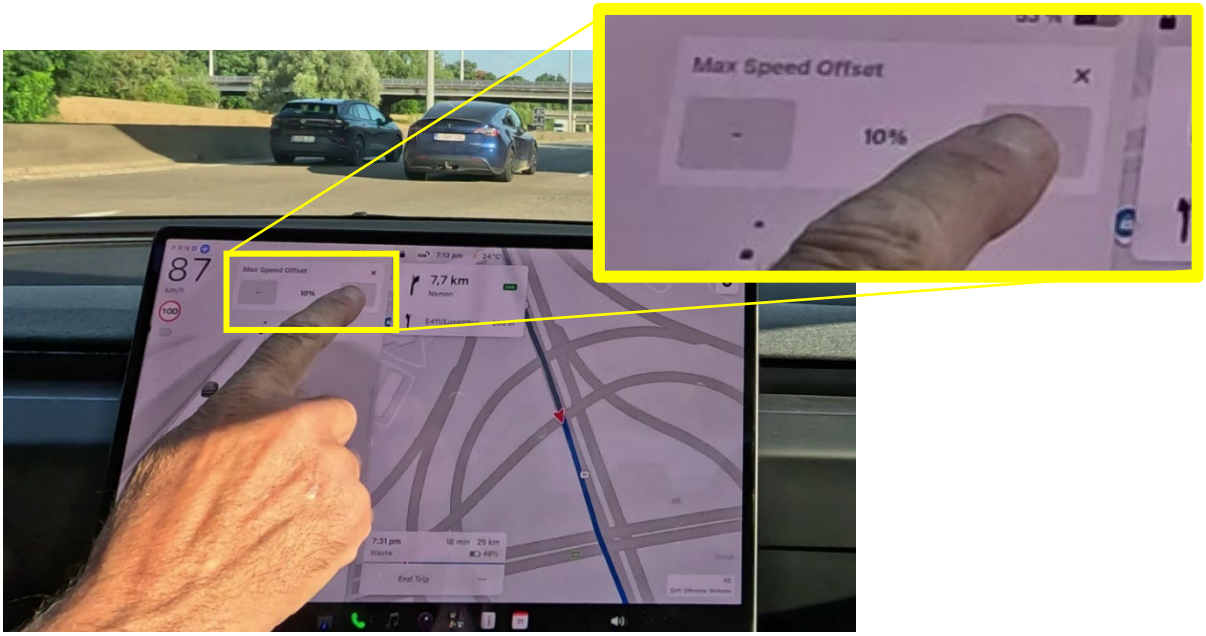


Figure 3: easy user interface to instruct FSD to speed

The only possibility for the supervising driver to lower the Vehicle Speed when FSD is speeding, without disengaging FSD, is to use the scrolling wheel which reduces the Maximum Speed. During the testing, it was observed that the user interface is designed such that adjusting the Maximum Speed is both visually difficult and distracting for the supervising driver. The below picture shows the screen after the supervising driver adjusted the Maximum Speed from 50 km/h to 35 km/h. The font

[6] This can either be done while driving or set as a default in the settings menu

size of the adjusted speed limit (middle left, under the blue “FSD Supervised” text) is not only ~25% smaller but also is considerably less readable (grey versus black) than less safety-crucial information being displayed, such as the time (upper right) or the distance to the destination (bottom right).



Figure 4: Comparison of the readability of the active speed limit set by the driver versus less safety-crucial information such as time and distance to destination

c) FSD disengagement by braking results in steering heading straight

When the supervising driver took over control by braking, this resulted in an unanticipated system behavior, creating additional risk rather than reducing it. When exiting a large roundabout to the right, the supervising driver pushed the brake pedal because a vehicle to the left, exiting the roundabout from the second lane, was cutting off the test vehicle, and the supervising driver felt unsure whether FSD would handle the situation adequately[7]. As this braking event disengaged FSD, the torsion that FSD exerted on the steering wheel also suddenly stopped. This resulted in the test vehicle unexpectedly driving straight ahead (towards the vehicle that was cutting off the test vehicle). The supervising driver was agile enough to correct this. In the meantime, however, the test vehicle came closer to the cutting off vehicle, instead of keeping a larger margin as was the intention of the supervising driver. A similar situation occurred at a smaller roundabout later in the testing as well[8].

[7] Unfortunately, due to a technical issue, there is no video coverage of this event.
[8] Video coverage is available

d) ISA disfunction during FSD driving

During the FSD test driving, the Intelligent Speed Assistance (ISA) system never issued an audible warning to the supervising driver, neither when the Vehicle Speed was above the Legal Speed Limit due to the Speed Offset nor when the speeding (in 30- or 20-zones) was accompanied by an incorrect Displayed Speed Limit.

The supervising driver never switched off ISA before or during the test drives. It may be possible that FSD switched off ISA, but the supervising driver was never made aware of this.

The picture below shows a C43 30 km/h reminder sign after the test vehicle had passed and correctly identified an F4a 30-zone sign as evidenced by the Observed Speed Limit that had appeared in the car status area, but the Displayed Speed Limit misinformed the driver (and presumably also the ISA) that the Legal Speed Limit was 50 km/h. FSD exceeded the Legal Speed Limit at 47 km/h throughout the entirety of this segment, yet ISA provided neither a visual nor an audible warning.

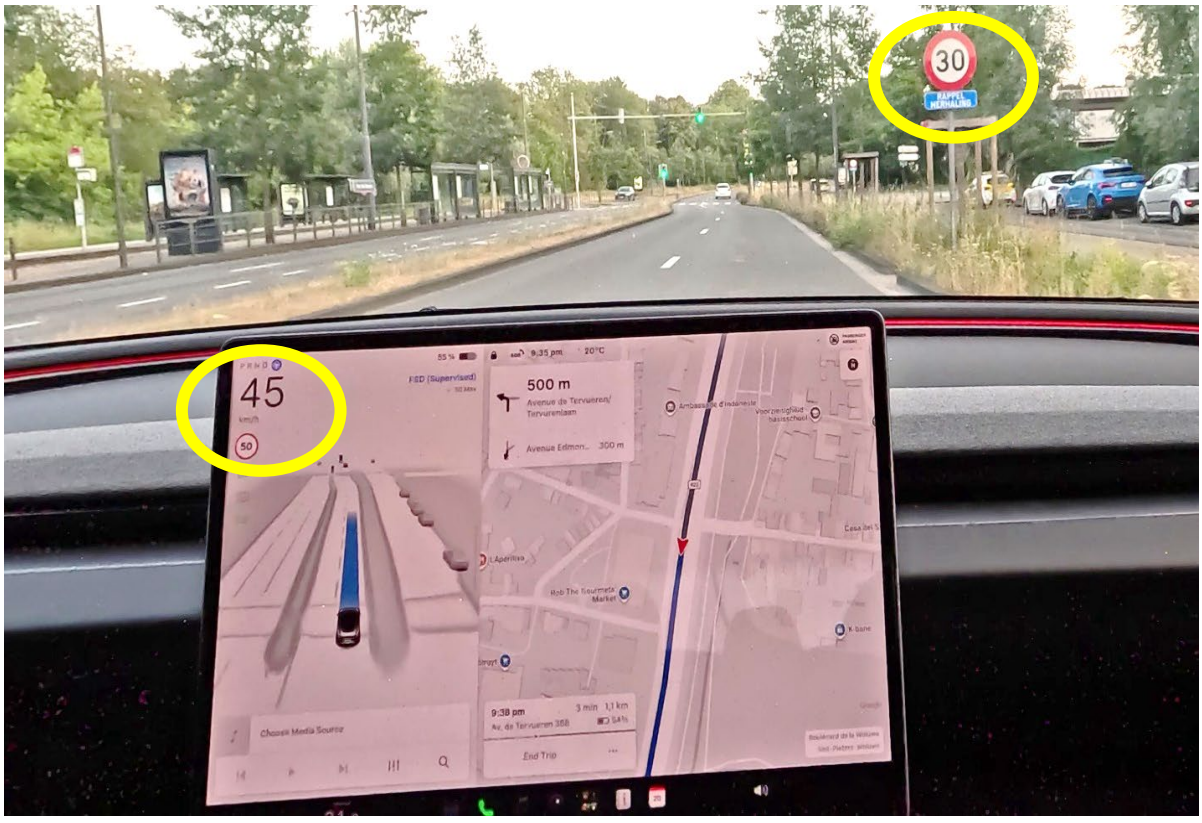


Figure 5: no ISA chime or visual warning in a 30-zone, linked to the overruling of the correctly identified 30 speed limit by the FSD system

In a separate test in which the driver had set a 15% margin above the legal limit, FSD has been speeding for several kilometers without any audible alarm. The ISA system

apparently detected the speeding as the Displayed Speed Limit was discretely blinking as a (weak) visual warning, but no audible alarm was provided.

e) ISA disfunction during non-FSD driving

During non-FSD driving, ISA frequently failed to issue speeding warnings. This failure was observed in the many instances where, similar to the FSD case illustrated above, the Displayed Speed Limit was higher than the Legal Speed Limit, despite the system correctly identifying the Legal Speed Limit as evidenced by the Observed Speed Limit appearing in the car status area. In the (less frequent) cases where the Displayed Speed Limit was correctly reflecting the Legal Speed Limit, ISA did correctly warn when the driver exceeded the Legal Speed Limit.

Discussion

30 km/h zones

This study revealed and documented a severe issue with the operations of FSD in 30 km/h zones: Under free flow conditions, FSD does not appropriately reduce its driving speed in the majority (10 of 17) of 30-zones clearly marked with F4a signs. The speeding level observed was far from insignificant, averaging 45.9 km/h in those 10 cases. The risk for a pedestrian to be killed when struck by a car at that speed is more than 6-fold the risk when struck at 30 km/h (see fig 2). As such, FSD generates an unacceptable risk to pedestrians (and cyclists). **This constitutes a major and critical shortcoming in the system's design and performance.**

The classic argument in TSR or FSD discussion that poor signage by the road authority is a major issue in the recognition of speed limit signage proved to be void, because:

a) In 7 of these 10 speeding cases (70%), the test vehicle was clearly able to correctly identify the F4a sign as a speed limit of 30 km/h (as evidenced by the Observed Speed Limit in the car status area). In the 3 other speeding cases, the F4a sign was clearly seen by the supervising driver and captured on the GoPro (hence in clear view through the windscreen and not somewhere hidden behind the corner in a sharp turn). This means that also in these 3 cases, poor signage by the road authority cannot be used as an excuse for speeding.
b) The additional test with an alternative vehicle (Citroen C3) on 7 of the like-for-like F4a segments revealed that this alternative vehicle correctly identified all 7 of them and informed the driver by means of the Displayed Speed Limit correctly that the vehicle was moving in a 30 km/h zone, whereas the FSD

vehicle misinformed the supervising driver that the vehicle was moving in a 50 km/h zone in 6 of these 7 segments (and FSD was speeding through 5 of them at an average speed of 44.8 km/h without ISA warnings).

During the testing, it seemed that the test vehicle handled F4a signs differently from C43 signs. C43 signs seemed to be taken much more at face value, as the Displayed Speed Limit was generally (but not always) correct and FSD reacted more often (but not always) in the legally appropriate manner after passing a C43 sign. F4a signs seemed to be treated more as end-of-speed-limit signs rather than as start-of-speed-limit-zone signs. This was anecdotally reinforced by clearly and repeatedly documented observations of Tesla's TSR system in a non-FSD Tesla Y in a specific setting in Flanders[9].

FSD (supervised) is allowed on our roads with the caveat that it is a supervised system for which the driver remains responsible for driving at all times. Our testing revealed that the system, however, actively misleads the supervising driver in the vast majority of 30 km/h segments (>=80%) by providing a falsely high Displayed Speed Limit on the screen, well above the actual Legal Speed Limit, and this even despite the fact that the system clearly identified the correct Legal Speed Limit as made evident through the Observed Speed Limit that passes by for a short while on the screen. **This also constitutes a major and critical shortcoming in the system's design and performance.**

To illustrate the severity of this misleading behavior, it is akin to a passenger constantly reassuring the driver that the speed limit is 50 km/h in nearly every 30-zone through which they pass. This could nudge the driver to speed through those zones, very much like FSD obviously does. If a collision were to occur with a pedestrian or cyclist while speeding, the question could arise whether the passenger should be considered at least partly co-responsible for the crash. As a minimum, we would ask the passenger to stop providing this false – and dangerous – information to the driver. Applied to FSD (supervised), it would be reasonable to require at least 90% accuracy in the Displayed Speed Limit specifically on 30-zones[10].

I**n conclusion, this study reveals that the FSD system tested largely neglects 30-zones and exhibits speeding at significant levels resulting in a severalfold increase in fatality risk for active road users in those zones.** This failure is clearly

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[9] The three roads leading to the Westvleteren abbey all start as default 70 km/h-roads and have their speed limit reduced in 2 steps. The C43 50 km/h sign of the first step is recognized by the TSR system and displayed as 50 km/h on the screen. The F4a sign is also correctly identified as a 30 km/h sign as evidenced by a C43 30 km/h sign passing by in the car status screen, but ignored or interpreted by the TSR system as an end-of-30-zone sign as the display in the TSR area changes to 70 km/h. This TSR system behavior was documented repeatedly and consistently for the 3 roads described.

[10] A general >90% accuracy requirement calculated on miles driven is very irrelevant for pedestrians and cyclist as this could be easily achieved by accurate highway speed regimen recognition (many miles) combined with the extremely poor <=20% accuracy in 30 zones as evidenced in this study.

not related to alleged poor signage by the road authority, as in many of the cases the system was able to correctly read and understand the signposted Legal Speed Limit, as they were presented as Observed Speed Limits in the car status area. On top of this, the system misleads the supervising driver very frequently by providing a far too high Displayed Speed Limit. **These clearly documented facts should be more than enough evidence to retract the current permit for FSD supervised to be operated on our roads, at least until an updated version has been independently tested and proven to mitigate all these issues.**

Home zones

The more limited study on home zones (n=12) revealed and documented the very poor performance of FSD with respect to home zones, fully in line with the severe issue documented for 30-zones clearly marked with F4a signs. The frequency of observed problematic FSD speeding behavior (42%) is unacceptably high, with speeding levels averaging 26 km/h. This is far from insignificant given the specific characteristics and goals of home zones in which, under the Belgium Road Traffic Code (Royal Decree of 1 December 1975) Article 22bis, "*playing is allowed over the whole width of the public space*" and "*drivers need to be double cautious with respect to children*". Speeding is not compatible with these legal requirements.

As was observed for the 30-zones, our testing revealed that the system here also actively misinforms the driver in 8 of the 12 home zones (67%) by stating a much higher speed limit on the screen than the actual Legal Speed Limit. In six home zones, the Displayed Speed Limit was 30 km/h instead of the legal 20 km/h, in two home zones, the Displayed Speed Limit was even as high as 50 km/h. This nudges the supervising driver not to interfere when FSD is speeding in a home zone, or might even result in the supervising driver wondering why the vehicle is driving so slowly and pressing the accelerator to move closer to the (incorrect) speed limit that the system states is applicable at that location. The system, marketed as an Advanced Driver Assistance System (ADAS), in practice generates driver confusion rather than the reliable assistance the term implies.

In conclusion, our study reveals that the FSD system tested performs poorly in home zones when it comes to speed management and exhibits speeding at significant levels in those zones. As for the poor 30-zone performance, again, this failure is clearly not related to alleged poor signage by the road authority. This documented fact reinforces the evidence to retract the current permit for FSD (supervised) to be operated on our roads.

Cycle streets

Despite the rather limited sample size (6 cycle streets), the study clearly documented poor compliance of FSD (supervised) with Belgian traffic rules for cycle streets, exposing cyclists to unacceptable danger, reducing their comfort and undermining the inviting nature of cycle streets promoting a modal shift to active transport modi. It is hard to draw any other conclusion than that FSD has no knowledge of what a (Belgian) cycling street is, because:

a) None of the F111 signs (which were often repeated and placed both vertically and horizontally) resulted in the system correctly informing the supervising driver that the speed limit was 30 km/h (in one case, it even displayed 70 km/h as the speed limit). Speeding occurred in 2 of the 6 cycle streets and would likely have occurred in more, if not all of them, if the circumstances would have allowed it and/or the supervising driver would not have aborted the system's illegal overtaking attempts.
b) FSD made several attempts to overtake a cyclist, which per Belgium Road Traffic Code (Royal Decree of 1 December 1975), Article 22novies is strictly prohibited. In fact, the cases that FSD did not attempt to overtake a cyclist were those in which there was simply no reasonable possibility (width of the street, cyclist "taking his space", oncoming traffic in the other direction) to do so.

In conclusion, our study reveals that the FSD system tested ignores (and likely is not even aware of) cycle streets. Besides the speeding at significant levels resulting in a severalfold increase in fatality risk for active road users, the failure to respect the prohibition on overtaking cyclists represents another critical safety risk. **This clearly documented fact alone should be enough evidence to retract the current permit for FSD supervised to be operated, at least on Belgian roads.**

Is there any discrepancy with the FSD (Supervised) Dashboard?

On September 1, the FSD (Supervised) Dashboard[11] presenting "*comprehensive safety evidence for FSD (Supervised) across multiple domains*" was released. In that Dasboard, Tesla claims that a "*takeaway*" from "*Study 8: Max Speed Analysis*" would be that "*This data demonstrates that vision max speed corrects for incorrect speed limit determination without introducing excessive speeding behavior.*" It frames the speeding as a safety feature "*reducing the risk of driving significantly slower than surrounding vehicles due to an incorrect system-determined speed limit*"

The claim contrasts strongly with the conclusion of the current study, where the data show that FSD frequently introduces significant excessive speeding behavior, resulting in a severalfold increase in fatality risk for active road users.

[11] https://www.tesla.com/fsd-evidence-dashboard

Critical analysis of the sample selection criteria in study 8, as detailed in Appendix D, reveals that indeed some conclusions can be made from those data, but that they are very limited to the conditions selected through the inclusion criteria. A general claim that FSD would "*not introducing excessive speeding behaviour*" is neither supported by the data in Study 8 nor representative of the reality of FSD driving. As study 8 required that FSD was "knowingly" speeding, it implies the use of Contextual Max Speed and excludes all speeding issues reported in the current study, as they all occurred in the (very frequent) situations where the "*system-determined speed limit*" (the Displayed Speed Limit) was higher than the Legal Speed Limit (and often even higher than the Observed Speed Limit). Furthermore, Contextual Max Speed was not used in the current study.

Basically, study 8 is targeted at proving that Contextual Max Speed could have some value in case FSD erroneously determines the Speed Limit to be lower than the real Legal Speed Limit. The current study shows that there is, however, a much more concerning issue with FSD erroneously determining that the Speed Limit is higher than the real Legal Speed Limit, and acting on that erroneous information by speeding through areas where low speed is important for active road users.

Interactions with pedestrians and cyclists

One of FSD's strengths clearly documented in this study is its way of interacting with pedestrians. As mentioned, FSD consistently behaved as a careful and courteous driver in the presence of pedestrians. It would be very valuable if this courtesy was combined with full compliance with applicable speed limits (30-zones, 20-home-zones, and cycling streets).

Also for cyclists, FSD's way of interacting in a variety of conditions was respectful and courteous, apart from the glaring concern that FSD does not seem to recognize a cycle street at all and behaves all but respectful of cyclists there.

FSD disengagement by braking

The FSD's release of steering wheel torque after the supervising driver hits the brake pedal also deserves further consideration. This unexpected behavior was frightening for the supervising driver.

Is this something supervising drivers will get used to and adjust by first grabbing the steering wheel and applying the requested torque on it prior to hitting the brake pedal? Will this sudden direction change when braking in a curve be just a frightening experience for the supervising driver with no further harm or can it lead to collisions and or trigger secondary effects such as an overreaction of another driver involved causing more harm than good?

We would urge regulators to require an adaption of the system such that the torque on the steering wheel exerted by the FSD system is not released until the system detects that the driver takes over by exerting some torque on the steering wheel.

User interface

The supervising driver has several possibilities to control the vehicle's speed. However, while FSD readily accommodates supervising driver attempts to drive faster, it discourages the supervising driver from actions that would slow down the vehicle. This is concerning, given both the documented poor performance in respecting the Legal Speed Limit in areas that are crucial for pedestrian and cyclist safety (30-zones, 20-home-zones, cycle streets) and the crucial task of the supervising driver to interfere when FSD is showing dangerous or illegal behavior.

Lowering the speed below the Displayed Speed Limit without disengaging FSD can only be done by the scroll wheel on the steering wheel. The very poor readability of the adjusted speed limit makes it difficult to adjust, especially for people with farsightedness (presbyopia[12]), which affects 25% – 50% of the population. People with mild to moderate farsightedness typically do not need glasses to drive, as this condition does not affect their view of the road, provided that the information on the dashboard/screen is of sufficient size and contrast. However, specifically under time constraints and conditions requiring the supervising driver's attention elsewhere, such as FSD speeding through a 30-zone, the FSD user interface's very poor readability discourages supervising drivers to take the necessary action.

The same very small grey font is also used to display the current Speed Offset. As such, it is easy for the supervising driver to forget that a Speed Offset was set and continue to operate at a speed above the speed limit, a situation that occurred to the supervising driver during this testing.

[12] https://en.wikipedia.org/wiki/Presbyopia

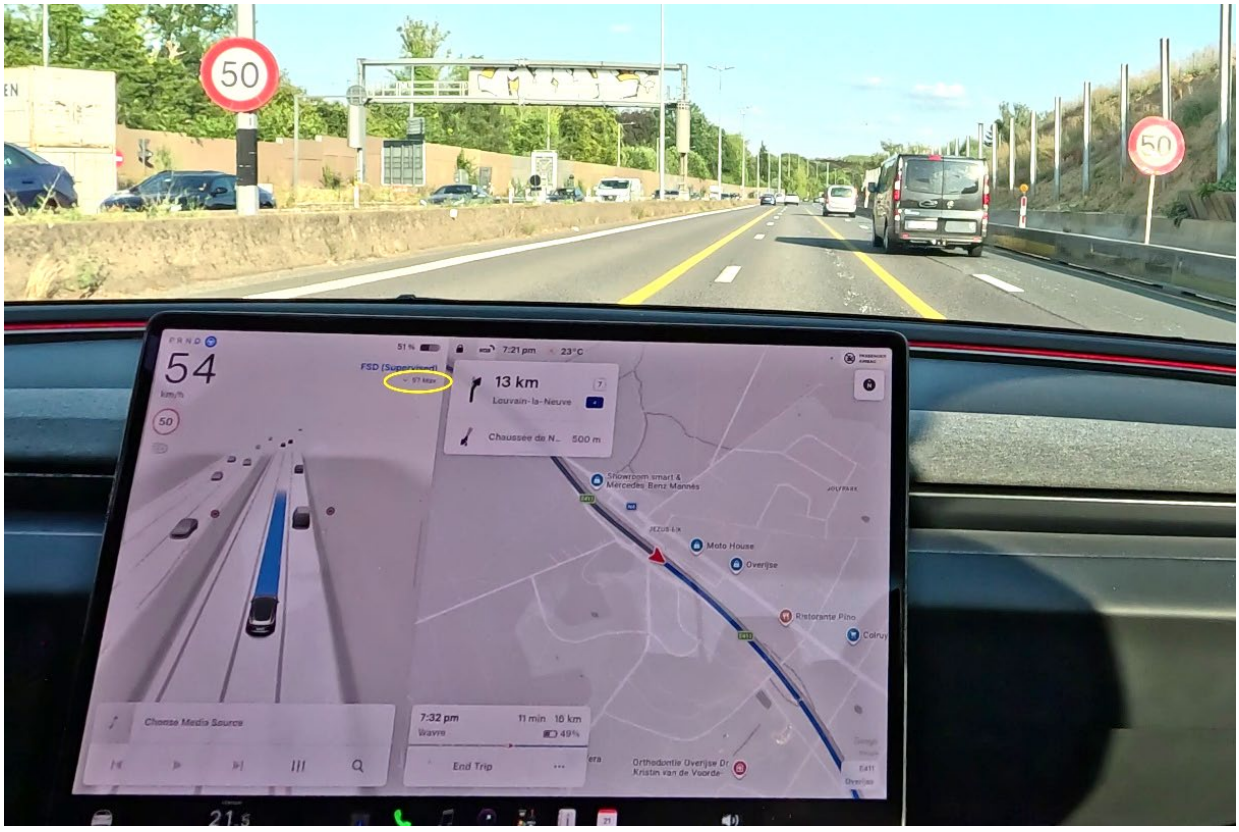


Figure 6: extreme poor visibility of the voluntary speeding margin

We urge regulators to require manufacturers to:

- Provide an easy interface for drivers to lower the vehicle speed (for example when the FSD is exceeding the legal speed limit) without affecting FSD behavior once beyond the current speed regimen
- Remove the possibility to set a **default** Speed Offset (both in the settings menu or during the driving). A possibility for the supervising driver to increase the Maximum Speed in a segment where FSD erroneously determined too low a Legal Speed Limit could make sense, but this increased Maximum Speed should only apply to that specific segment and should not be kept for subsequent speed segments.
- Provide good on-screen visibility of the exact Maximum Speed adjusted by the supervising driver, both during the process of adjusting itself as during the whole segment where this driver-changed value is active.

ISA related issues

This study identified 2 ISA (Intelligent Speed Assistance) related issues.

The first issue occurs both in FSD and non-FSD Tesla rides. Despite the system correctly identifying F4a traffic signs setting the Legal Speed Limit to 30 km/h, as

evidenced by displaying the correct Observed Speed Limit during the few seconds the test vehicle passes the sign, it frequently incorrectly set the Displayed Speed Limit to 50 km/h in those segments. As a result, the ISA system does not provide warning for as long as FSD (or in non-FSD rides, the driver) drives between 30 and 50 km/h and the (supervising) driver is misled by the incorrect Displayed Speed Limit that the speed the vehicle is driving at is fully within the Legal Speed Limit.

The second issue is purely FSD-related. Under the General Safety Regulation (GSR), drivers who wish to exceed the speed limit are required to disable the ISA each time a trip begins. In this study, the supervising driver never disabled the ISA system. However, when a Speed Offset was selected, ISA was disabled automatically by the FSD system without any warning or notice given to the supervising driver that this happened. No possibility to re-enable ISA during FSD driving was found.

By requiring that ISA remain active whenever an Advanced Driver Assistance System (ADAS), determines the vehicle's speed (such as with FSD), regulators could prevent or substantially reduce speeding by FSD, even when the speeding results from driver-selected configuration.

The clearly documented facts that the system misleads the supervising driver by frequently providing a Displayed Speed Limit well above the Observed Speed Limit determined by the system constitutes an additional reason to retract the current permit for FSD supervised to be operated on our roads, at least until an updated version has been independently tested and proven to mitigate all these issues.

Conclusions

This study confirms the concerning FSD speed behavior pattern that was observed in many 30 km/h zones during the initial test ride that prompted this study. Across the systematically selected 30km/h segments in the Brussels Capital Region, the study clearly documented a high speeding frequency. In 55% of the segments, FSD was speeding at an average speed of 44 km/h (46 km/h in F4a-signposted 30-zones under free flow conditions). **Given that a pedestrian struck at this speed faces a fatality risk more than six times higher than at 30 km/h, these findings raise serious road safety concerns. The magnitude and frequency of the observed speeding warrants an assessment of whether FSD's provisional EU type-approval should be revoked.**

In addition to documenting speeding in 55% of the 30 km/h zone segments, the study found in 90% of those 29 segments the system misinformed the supervising driver by providing an incorrect Displayed Speed Limit that heavily exceeded the correctly Observed Speed Limit or the implicit Legal Speed Limit. The limited testing that could be performed in Flanders and Wallonia (due to the limited availability of the test vehicle) revealed a similar pattern to that observed in the Brussels Capital region.

The results of the current study shed a different light on the claimed takeaway[13] from study 8 in the recently published FSD Dashboard that "*vision max speed corrects for incorrect speed limit determination without introducing excessive speeding behaviour*". Study 8 had very specific inclusion criteria and the data hence cover only very specific situations. **The current study clearly documented that FSD in its tested version introduced significant excessive speeding behavior resulting in severalfold increase of fatality risk for active road users.**

The study also identified important shortcomings of the FSD systems in 2 other areas that are important for pedestrians and cyclists, as well as for overall urban livability:

- In 5 of the 12 home zones tested (42%), FSD exceeded the speed limit, travelling at an average speed of 26 km/h. Although this might appear to be a relatively small exceedance of the legal speed limit (+30%), it has significant implications on livability and safety in these public spaces, on which the Belgian Road Code allows children to use the whole width of the street for play.
- A frightening observation was that FSD repeatedly attempted to overtake cyclist on cycle streets, despite overtaking being prohibited in Belgian traffic regulations. In none of the 6 cycle streets did FSD correctly recognize that the Legal Speed Limit was 30 km/h. The system was speeding in 2 cases and would likely have done so in all of them had the supervising driver not intervened to abort the overtaking attempts on 2 cycle streets, or had the road

[13] allegedly supporting Exemption Request 5

geometry and the presence of other road users not prevented speeding on 2 other cycle streets.

The misleading information provided to the supervising driver, the speeding in home zones and on cycle streets, and the FSD's repeated attempts to illegally overtake cyclists on cycle streets constitute additional reasons to pose the question whether the currently granted provisional EU type-approval should be revoked.

Although the careful and courteous interactions with pedestrians and cyclists are certainly appreciated and could likely result in a reduction in road danger generated by the vehicle compared to non-autonomous driving, they do not constitute a reason to accept the speeding, the misleading information to the supervising driver, or the illegal overtaking of cyclists as documented in this study.

Finally, the study revealed additional safety concerns, including the unexpected and possibly dangerous consequences of the supervising driver's braking action, an interface that is difficult and distracting when attempting to lower the Maximum Speed to correct for FSD speeding, and unwanted ISA inactivation/disengagement mechanisms.

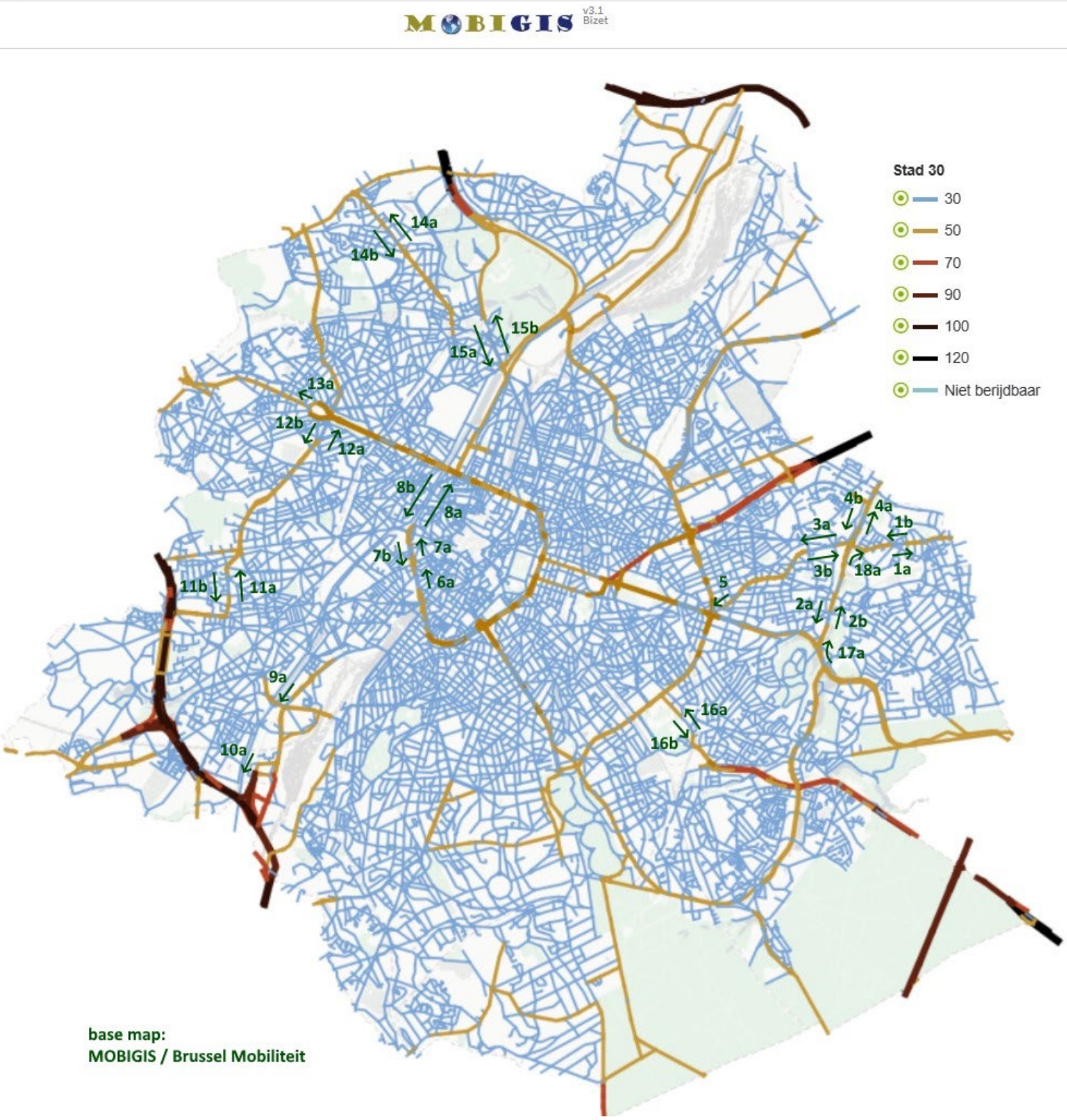
In summary, the competent authorities are urged to revoke the currently granted provisional EU type-approval for the Tesla FSD (supervised) system. This should remain in effect at least until an updated version has been independently tested and demonstrated to have effectively addressed all issues identified in this study.

Acknowledgements

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- Charlotte Hauri and Mario Alves, International Federation of Pedestrians
- Ceri Woolsgrove, European Cyclists' Federation
- Frank Mütze and Dudley Curtis, European Transport Safety Council

Appendix: map of tested 30-segments in the Brussels Capital Region

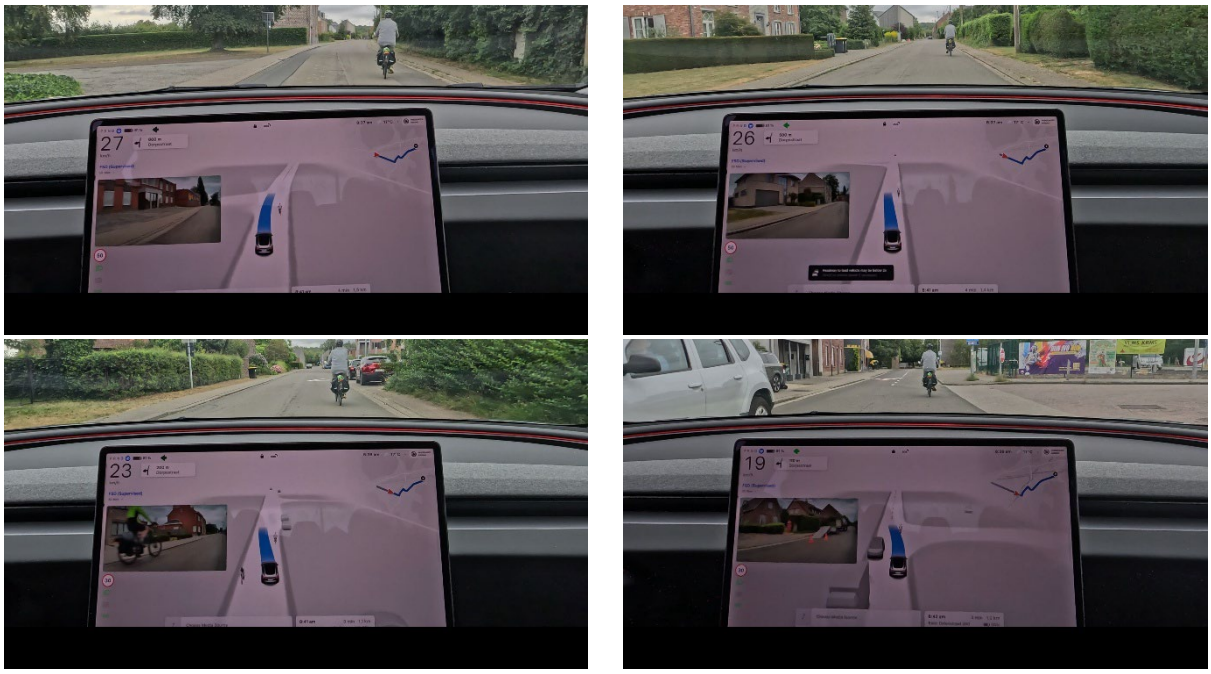


Appendix B: sequence of incorrect Displayed Speed Limit reset

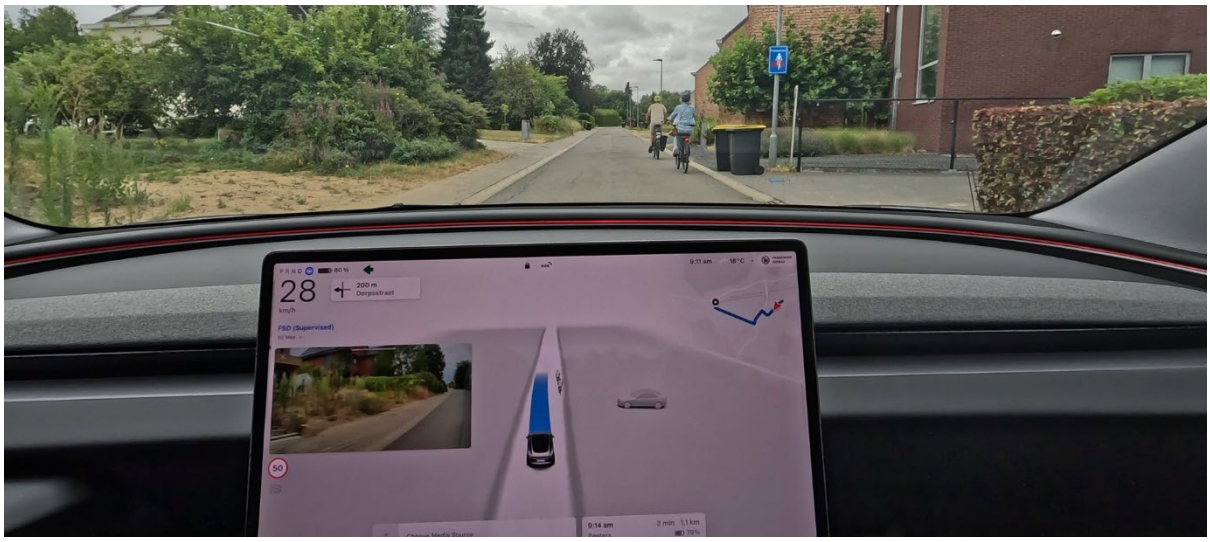


In the **first frame**, both F4a signs are visible. The Displayed Speed Limit is 50 km/h. In the **second frame**, the left F4a signs is visible. The Displayed Speed Limit is 50 km/h. The **third frame** (taken just after passing both F4a signs) shows that the Displayed Speed Limit has correctly been changed to 30 km/h. The **fourth fram**e shows the Displayed Speed Limit incorrectly reset to 50 km/h. ***The total time that 30 km/h has been displayed correctly at 30 km/h is 0.33 seconds***.

Appendix C: 5 attempts to overtake a cyclist in a cycle street



Four attempts by FSD to overtake the same cyclist in the same street. The blue line in front shows the trajectory planned by the FSD system. The camera picture on the left appears when the left indicator is active, confirming FSD's intention to overtake the cyclist. Every attempt was aborted by the supervising driver.



Another attempt by FSD to overtake cyclists in a cycle street. The F111 vertical sign is clearly visible (and several horizontal and vertical F111 signs had already been passed just before). The attempt was aborted by the supervising driver. The incorrect Displayed Speed Limit of 50 km/h is visible in the left corner of the screen.

Appendix D: Considerations about Study 8 of the recently released FSD (Supervised) Dashboard

On September 1, Tesla released its FSD (Supervised) Dashboard[14] presenting "*comprehensive safety evidence for FSD (Supervised) across multiple domains*". Its "study 8" covers data supporting an exemption request that "*In certain cases, FSD (Supervised) will adjust the maximum speed to allow the system to drive the appropriate speed for the surrounding traffic conditions, even when this exceeds the detected speed limit.*" and concludes that the data demonstrate "*that FSD (Supervised) adjusts speed appropriately to match traffic flow rather than exceeding it*".

According to the dashboard, study 8 takeaways include

- In 98% of high-speed cases, FSD (Supervised) travels at or below the median speed of surrounding traffic, even when the current maximum speed is set above the system-determined speed limit by vision max speed.
- This data demonstrates that vision max speed corrects for incorrect speed limit determination without introducing excessive speeding behaviour. The vehicle speed remains consistent with the surrounding traffic flow, reducing the risk of driving significantly slower than surrounding vehicles due to an incorrect system-determined speed limit.

Critical analysis of the sample selection criteria in study 8 reveals, however, that the claim about the FSD "*not introducing excessive speeding behaviour*" as a general statement is not supported by Tesla's own data. The current study shows, on the contrary, that FSD, even without Speed Offset and/or Contextual Max Speed does introduce excessive speeding behavior.

Study 8 does not cover speeding frequency, as all samples in that study are from situations where FSD is "knowingly" speeding[15], given that one of the inclusion criteria is that "*The vehicle speed exceeds the system-determined speed limit*".

Study 8 only selected driving samples in Europe on "*controlled access roads or city streets*". Despite the dashboard having a road classification section, it does nowhere define what a controlled access road or a city street could be. Study 8 does not have any criteria on the number of lanes in the driving direction. In the absence of any clarification in the study, it seems reasonable to assume that part - if not the majority - of the selected driving samples on "*controlled access roads or city streets*" are driven on streets with only one driving lane in the driving direction (especially in European

[14] https://www.tesla.com/fsd-evidence-dashboard

[15] As far as we understand, this implies that a speed offset was set and/or contextual max speed was enabled, which was not te case in the current study. The speeding issue in study 8 would hence be over and above the speeding issue / erroneous Displayed Speed Limit issue documented in this study.

cities from which the sample is taken). Combined with the requirement that "*At least one other vehicle is detected ahead of or behind the ego vehicle, travelling in the same direction*", this means that the sampling in study 8 (strongly) favored non-free-flow situations where exceeding the "median"[16] speed of the other vehicles was severely hampered:

- by either requiring to have another vehicle ahead of the ego vehicle, which implies that the ego vehicle has no possibility to drive faster than the "surrounding vehicle" without bumping into that vehicle, in single driving lane in driving direction situations or in multilane denser traffic not inviting for lane change.
- or by requiring to have another vehicle behind the ego vehicle, which implies that at least another vehicle is driving nearly as fast as the ego vehicle, and as such excludes many situations where FSD would be speeding. For example, the average speed attained by FSD in the current study in the 55% of 30 km/h segment it has been speeding through (Table 1) was 44 km/h. This is 14 km/h or 3.9 m/s faster than a vehicle driving at the Legal Speed Limit of 30 km/h. The distance between the ego vehicle and that trailing vehicle would increase by close to 20m every 5 seconds, resulting in a fast "disappearing" of the trailing vehicle. The dashboard does not define what "ahead or behind" means in terms of distance, but this ambiguity caters well for a sample selection where slower trailing vehicles result in exclusion of the FSD speeding from the random sample.
- Furthermore, for unclear reasons, study 8 excluded "*Low-speed scenarios*", defined as "*below 25 km/h for either the ego vehicle or the median surrounding traffic*".

Tesla frames the speeding as a safety feature "reducing the risk of driving significantly slower than surrounding vehicles due to an incorrect system-determined speed limit." While one could argue that driving "significantly slower" on a high speed road could indeed induce some danger, this cannot be claimed under the specific conditions stipulated in the inclusion criteria of study 8, being drives on "*controlled access roads or city streets*". Definitely on city streets, the documented significantly increased risk for pedestrians of higher vehicle speeds (see fig 2) heavily outweighs whatever risk could be incurred by driving slower than the surrounding traffic.

[16] Even the use of median speed is somewhat misleading in single-lane situations, since the camera would typically only see the speed of the car in front (or several cars limited in speed by the first vehicle) and behind (if keeping the same speed as the ego vehicle)..