HCT Duo Demo

Overtaking of cyclists

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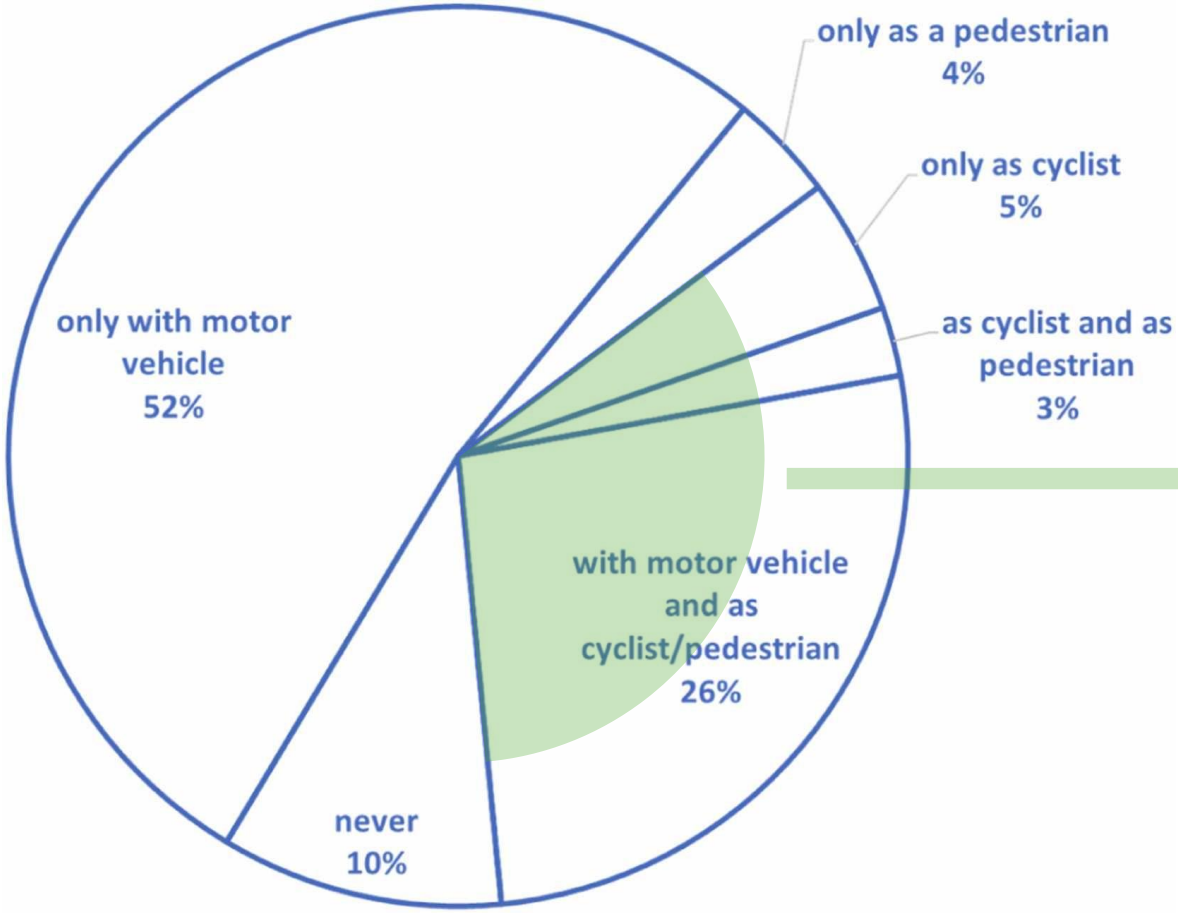
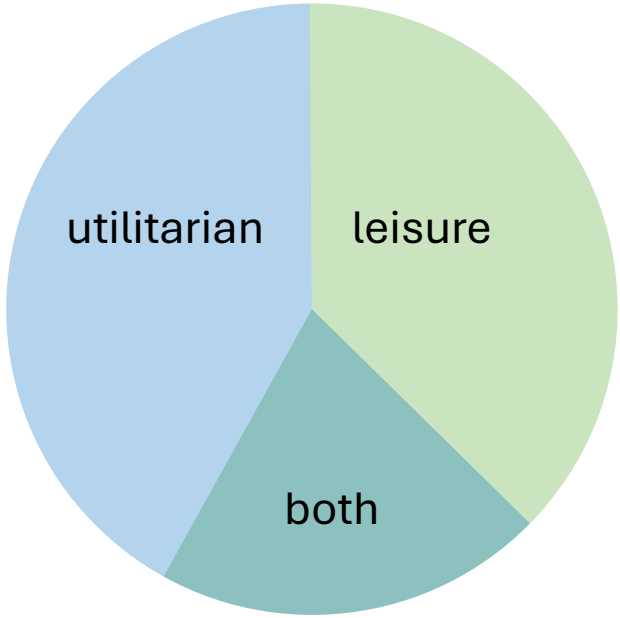
vti

Foto: CLOSER, Lindholmen Science Park

Cycling on rural roads





rural, EU

Fatalities: In a collision with...	Pedestrian	Cyclist	Moped	PTW	Car	LGVs + HGVs	Bus or Coach	Other	No other vehicle	Total
Pedestrians		3	1	16	573	178	8	33		812
Cyclists	2	26	2	17	425	149	14	25	154	814
Moped Occupants	0	0	3	3	121	25	1	5	67	225
PTW Occupants	5	5	3	52	792	242	4	55	702	1860
Car Occupants	4	4	2	13	1679	1371	70	182	2549	5874
LGVs + HGVs Occupants	1	1	1	0	118	215	7	30	229	602
Bus or Coach Occupants	0	0	0	0	0	15	1	3	1	20
Other	1	1	0	2	71	39	2	10	136	262
Total	13	40	12	103	3779	2234	107	343	3838	10469

149 : 1 = 149

425 : 4 = 106

Trucks overtaking cyclists

- real traffic
- 19 participants (experienced cyclists)
- 3 trucks (16.5 m, 24 m, 34.5 m)
- Fri – Sun, September 2024
- outside Karlstad (Vålberg)
- 70 km/h, 50 km/h

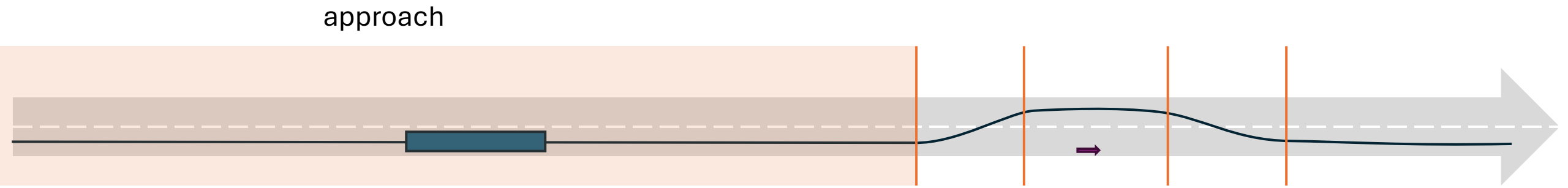
- 791 overtakes in total
- of which 178 by “our” trucks

The cyclist’s perspective

The cyclist’s perspective

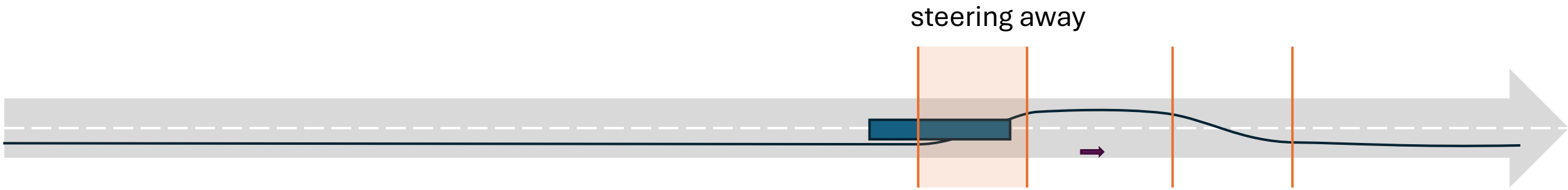
The cyclist’s perspective

Cyclist’s perspective of OT – approach



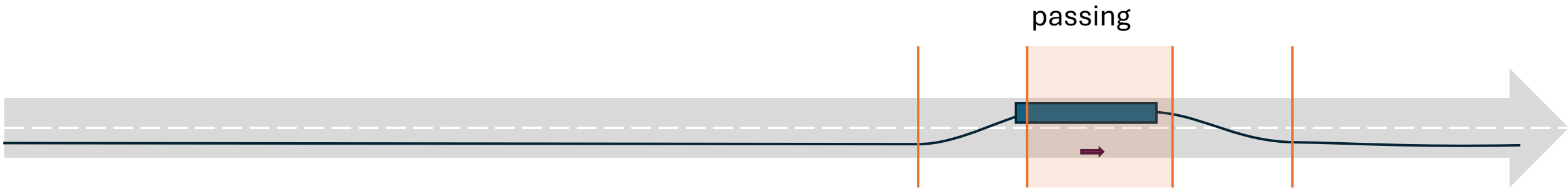
factors	**cyclist’s knowledge**	**cyclist’s possibility to act**
what (type of vehicle)	does not know	look over shoulder, mirror, listen
how (physical)	does not know	lateral position choice, other body movements
how (psychological)	does not know	
when (situation)	situation dependent	lateral position choice, other body movements
circumstances	situation dependent	keep track of oncoming traffic (and look behind)
how many	does not know	look over shoulder, radar

Cyclist’s perspective of OT – steering away



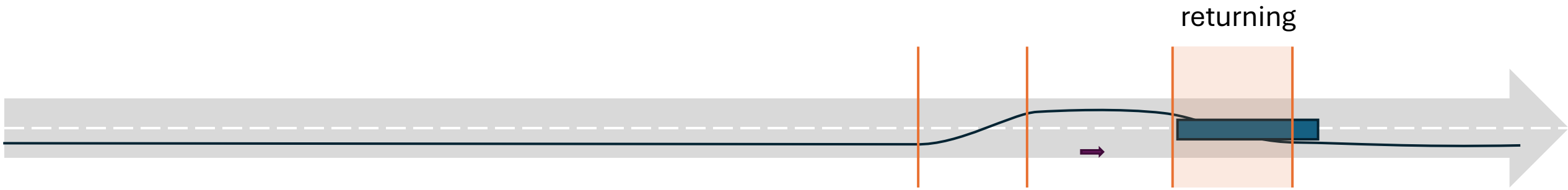
factors	**cyclist’s knowledge**	**cyclist’s possibility to act**
what (type of vehicle)	does not know	look over shoulder, mirror, listen
how (physical)	some indication	listen, look over shoulder, lateral position adjustment
how (psychological)	some indication	
when (situation)	now	lateral position choice
circumstances	knows some	
how many	does not know	look over shoulder, radar

Cyclist’s perspective of OT – passing



factors	**cyclist’s knowledge**	**cyclist’s possibility to act**
what (type of vehicle)	knows	peripheral vision or head turn
how (physical)	knows rather well	lateral position adjustment
how (psychological)	knows rather well	
when (situation)	now	
circumstances	as they are now	
how many	does not really know	look over shoulder, radar

Cyclist’s perspective of OT – returning

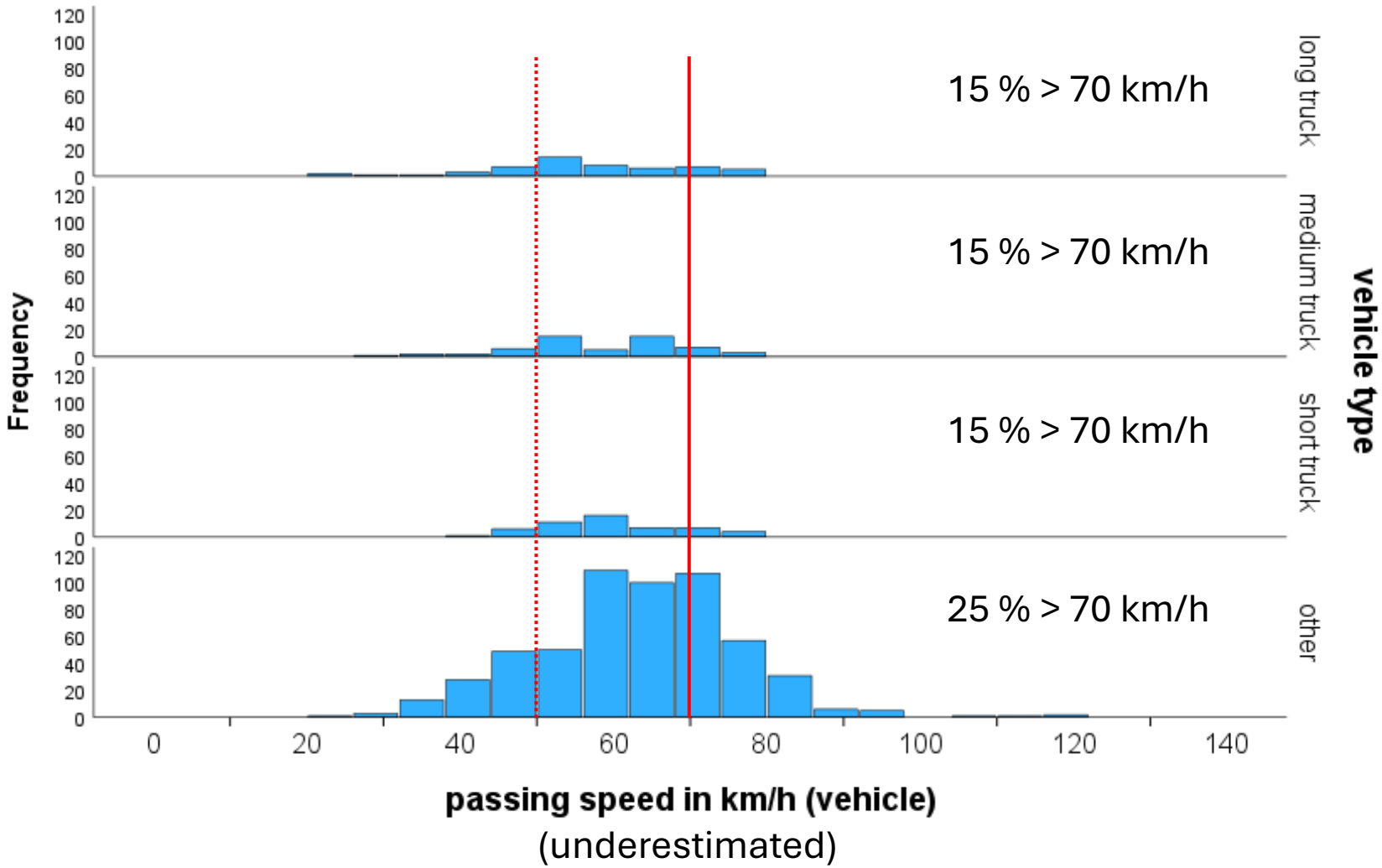


factors	**cyclist’s knowledge**	**cyclist’s possibility to act**
what (type of vehicle)	knows	sees vehicle in front
how (physical)	knows	
how (psychological)	knows	
when (situation)	knows	
circumstances	knows	
how many	does not really know	look over shoulder, radar

Foto: CLOSER, Lindholmen Science Park

Results

Passing speed



(underestimated)

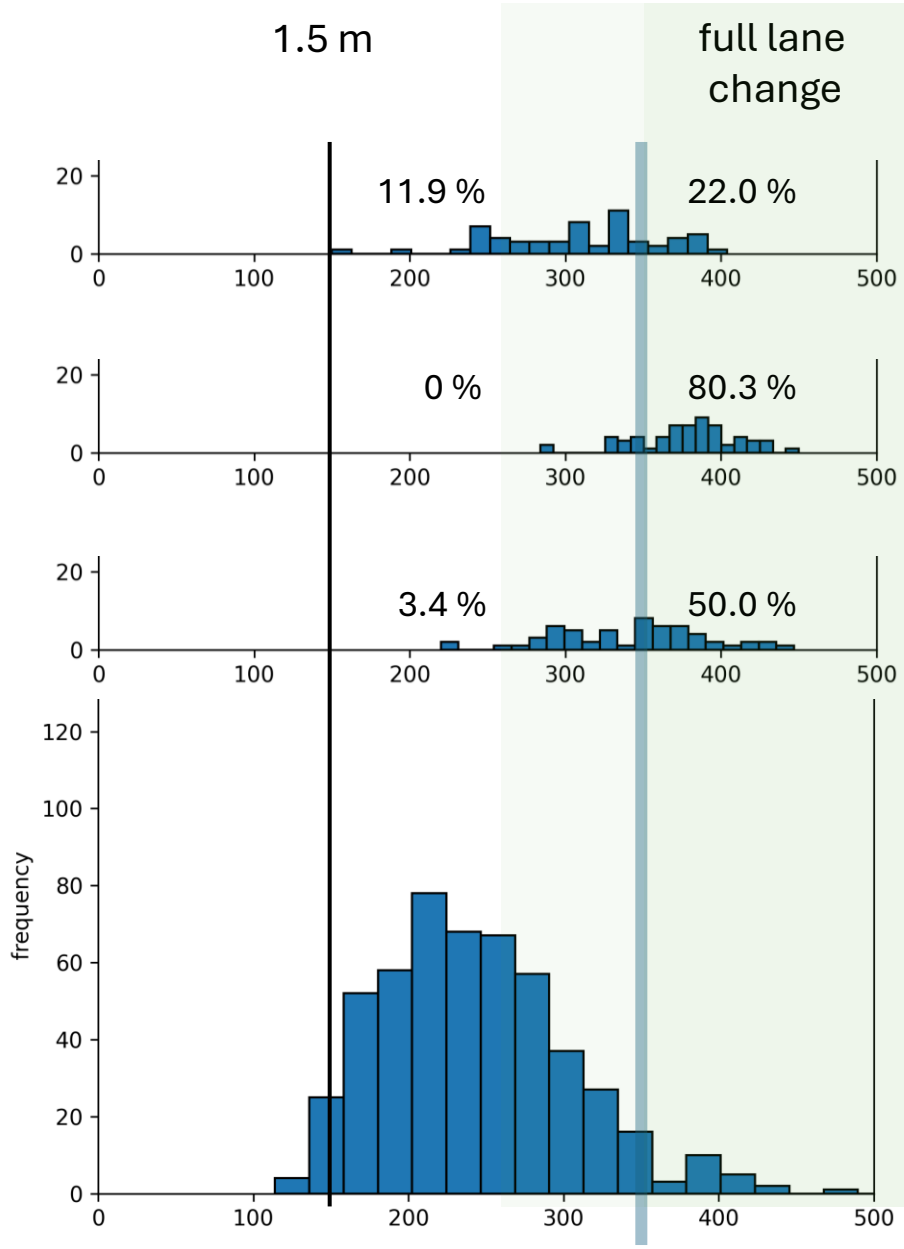
Passing phase

All overtakes (791)

< 100 cm	4	0.5 %
< 150 cm	95	12.0 %
< 250 cm	470	59.4 %
< 350 cm	679	85.8 %
> 350 cm	112	14.2 %

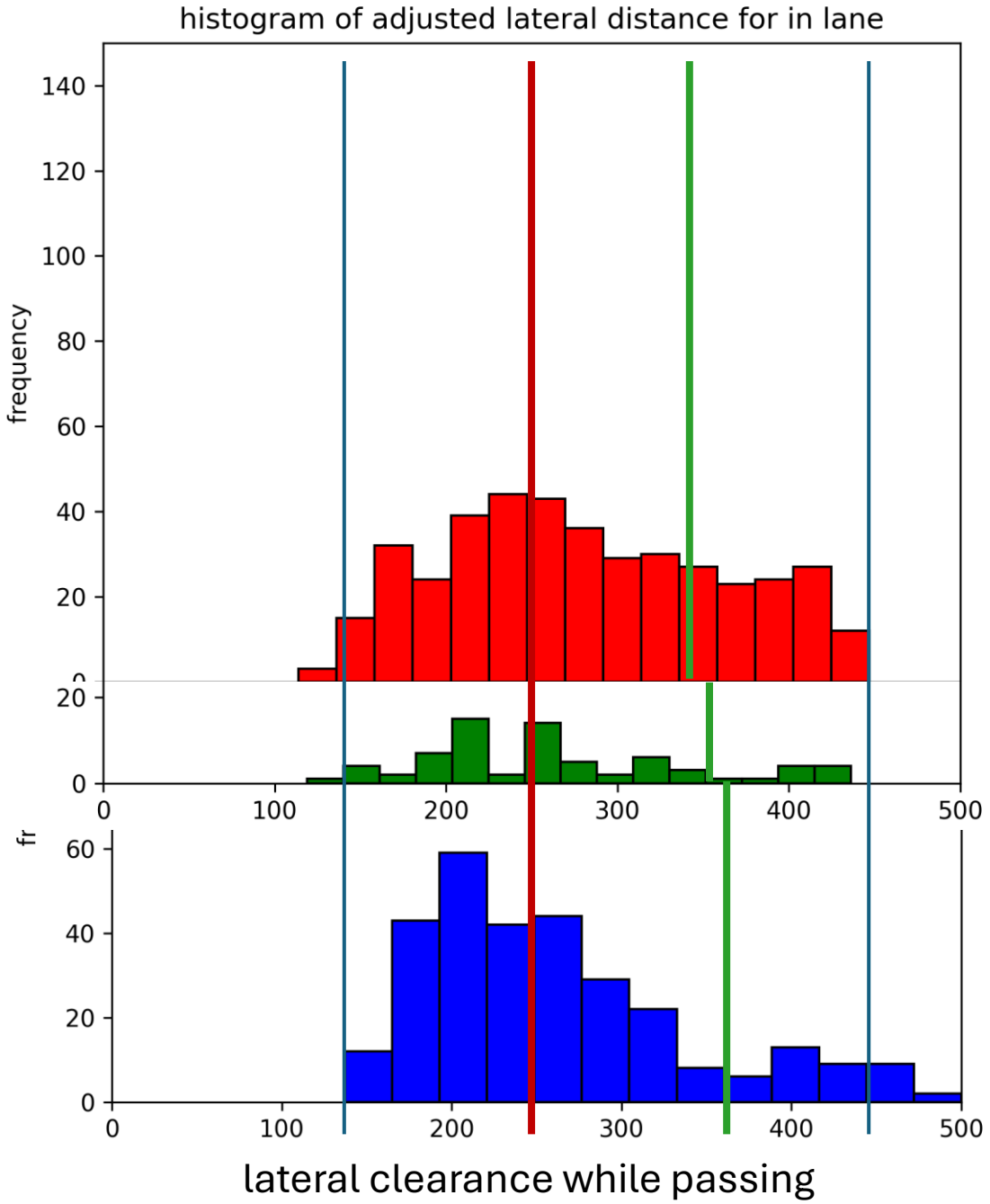
All passenger cars (511)

< 100 cm	3	0.6 %
< 150 cm	77	15.1 %
< 250 cm	384	75.1 %
< 350 cm	492	96.3 %
> 350 cm	19	3.7 %



lateral clearance while passing

Cyclist lateral position



in lane

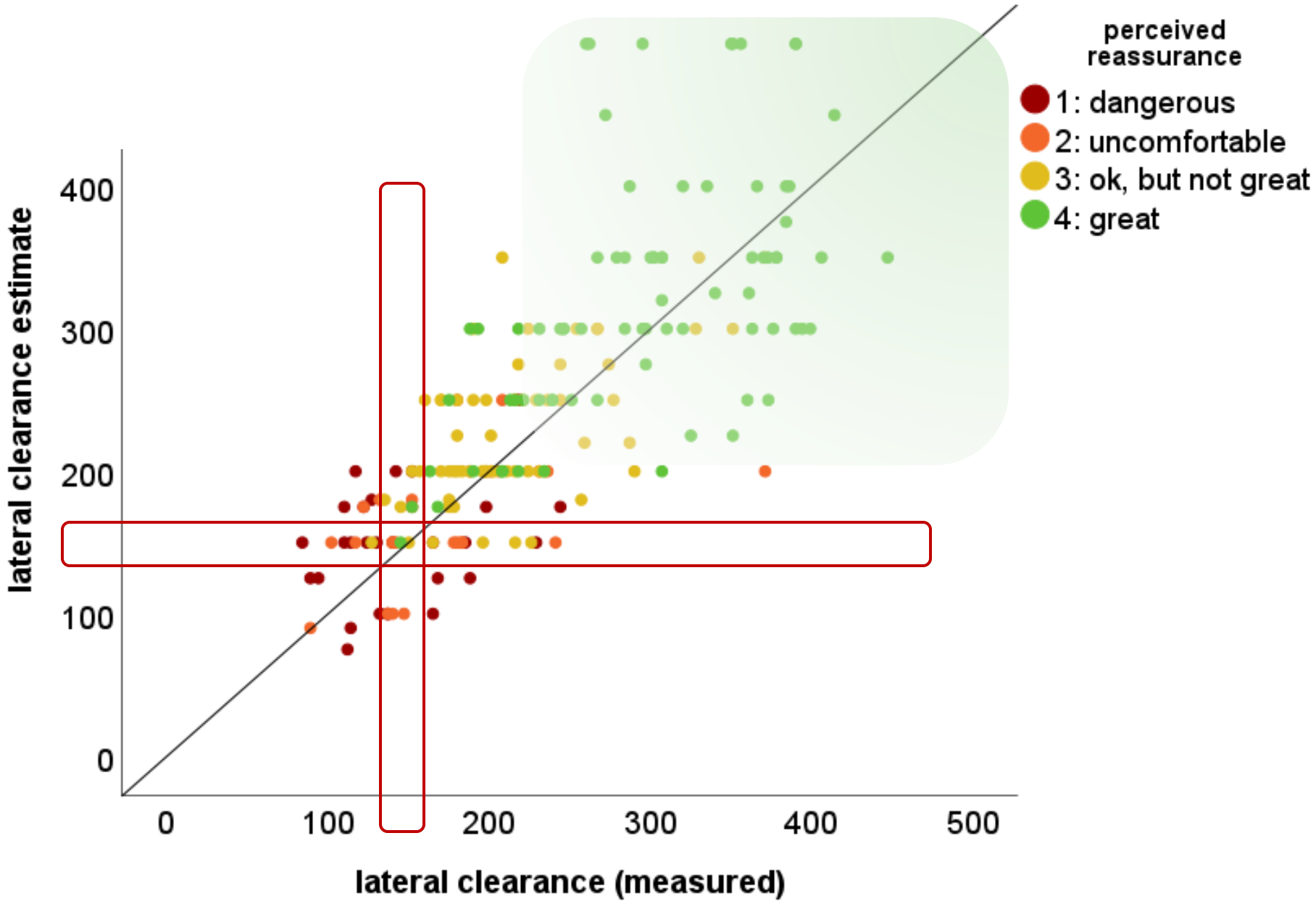
on edge line

on shoulder

	< 250 cm	full lane change
in lane	52.9 %	15.7 %
on shoulder	67.6 %	11.7 %

Significant difference in mean (t-test: t(705) = 3.14, p = .002 (two-sided))

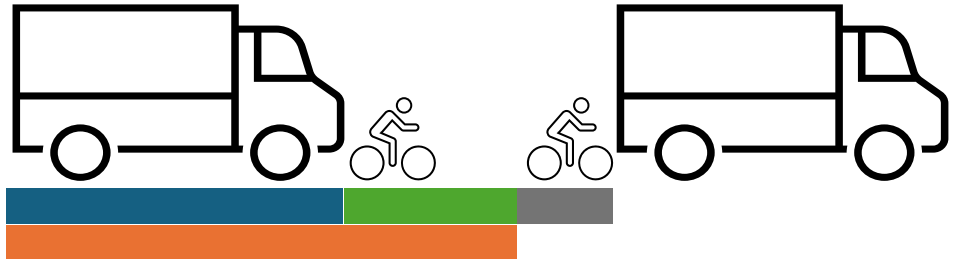
1.5 m?


perceived reassurance
1: dangerous
2: uncomfortable
3: ok, but not great
4: great
lateral clearance estimate
0
100
200
300
400
lateral clearance (measured)
0
100
200
300
400
500

Duration side by side

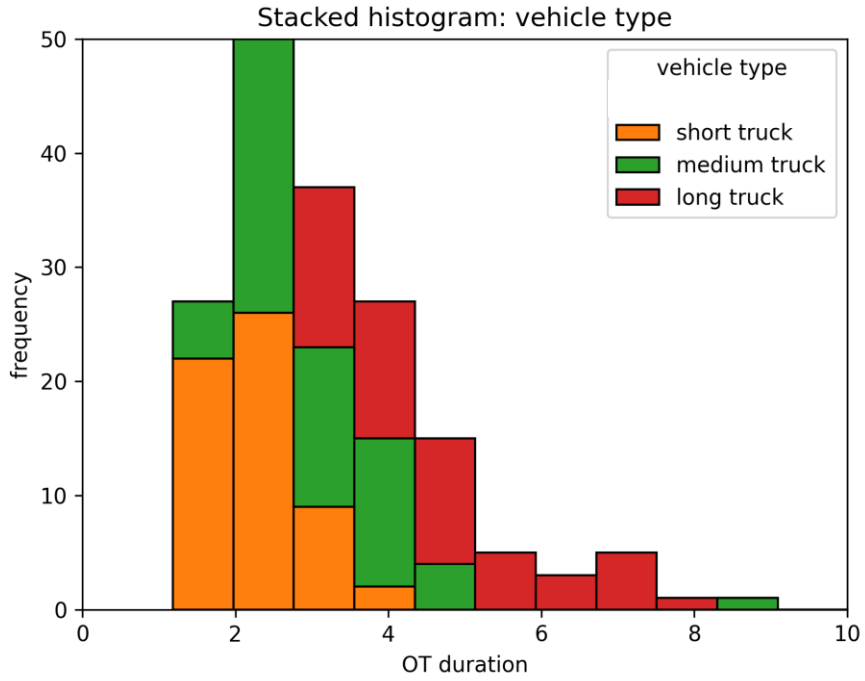
time needed for the truck to “pass itself”

total duration in parallel

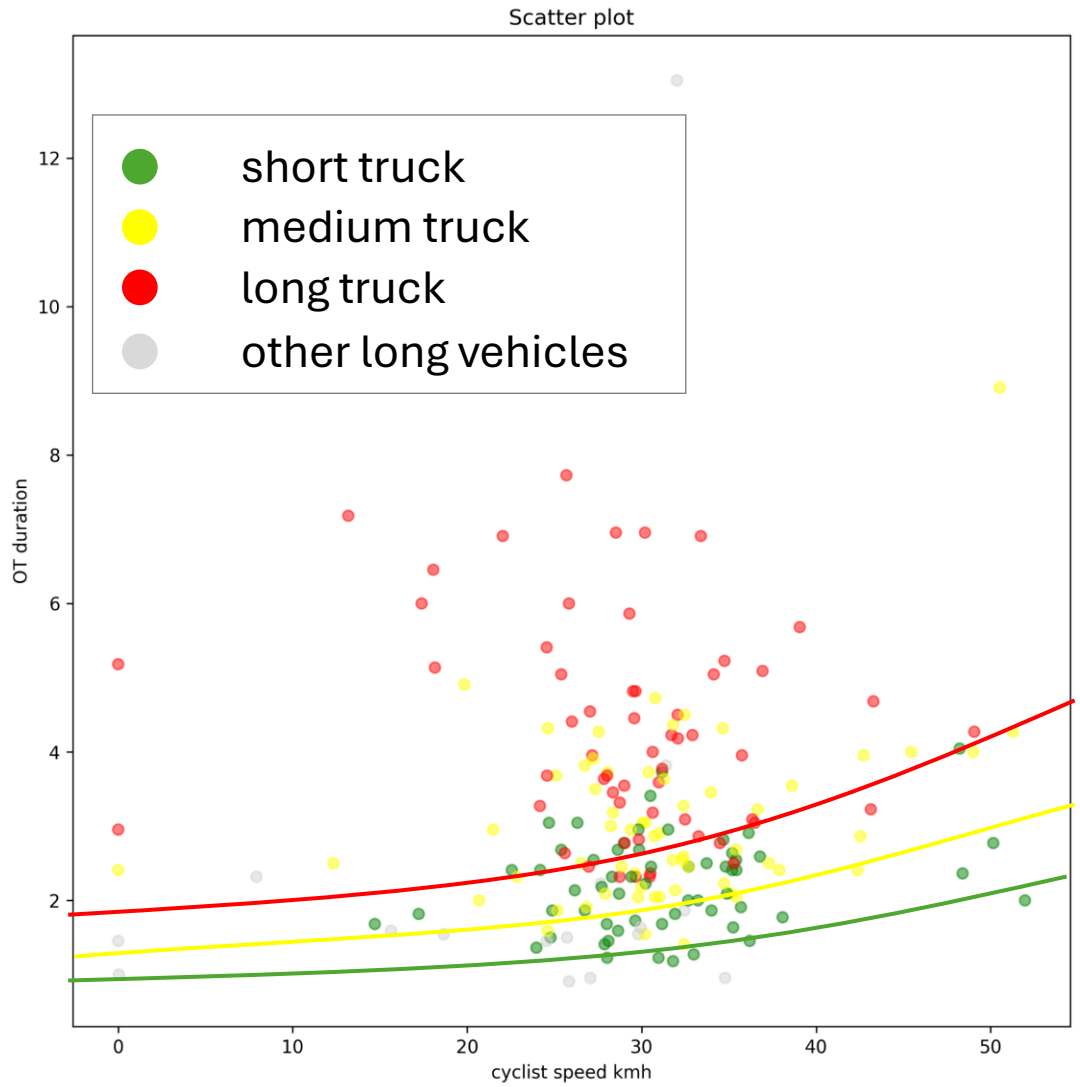


length	70 km/h	15 km/h	30 km/h
16.5	0.8 s	1.2 s	1.7 s
24	1.2 s	1.7 s	2.3 s
34.5	1.8 s	2.4 s	3.3 s

length	50 km/h	15 km/h	30 km/h
16.5	1.2 s	1.9 s	3.3 s
24	1.7 s	2.7 s	4.7 s
34.5	2.6 s	3.8 s	6.6 s



Duration



distance for long truck while parallel

	truck speed in km/h				
s parallel	40	50	60	70	80
2				39.1	44.6
3		42.1	50.4	58.6	66.9
4	45.2	56.1	67.1	78.2	89.2
5	56.5	70.2	83.9	97.7	111.6
6	67.7	84.2	100.7	117.3	133.9
7	79.0	98.2	117.5	136.8	156.2
8	90.3	112.3	134.3	156.4	178.5
9	101.6	126.3	151.1	175.9	200.8

ca. 80 km/h for truck

ca. 50 m parallel

Length: What do cyclists say?

length of truck is not the main issue …

IF a full lane change is made

- no wind gusts
- no debris flung around
- less noise

BUT:

- ”never-ending”, especially when cycling fast
- side wind can still be a problem
- long distance needed, effect on other traffic

Foto: CLOSER, Lindholmen Science Park

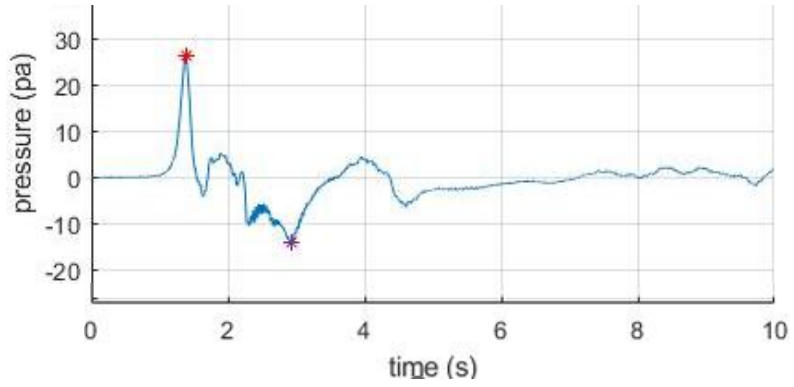
Wind: What do cyclists say?

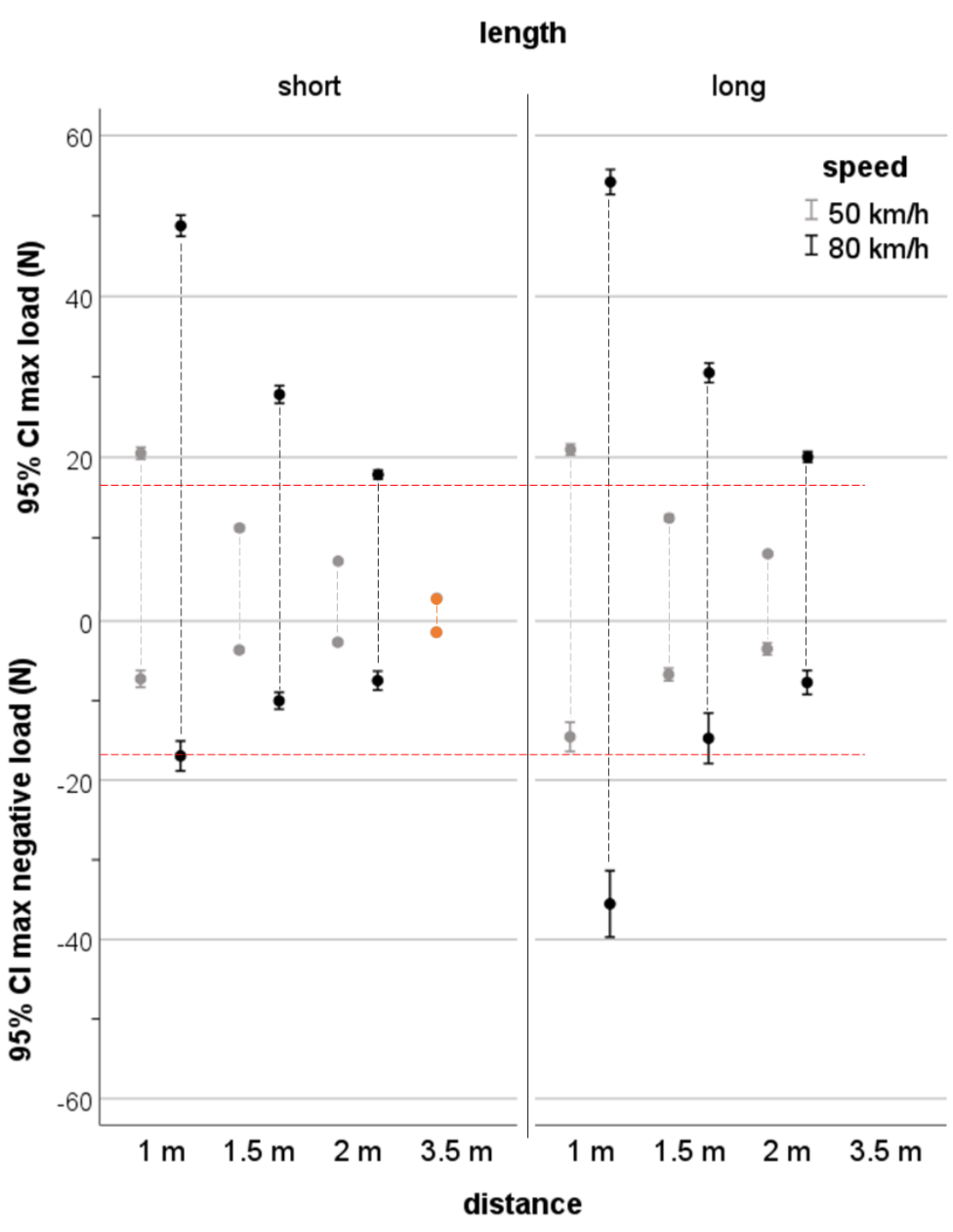
- Aerodynamic forces generated by truck
  - did not really feel anything
  - would have been scary with smaller clearance

- Ambient wind
  - especially side wind from the left
  - oncoming trucks, too

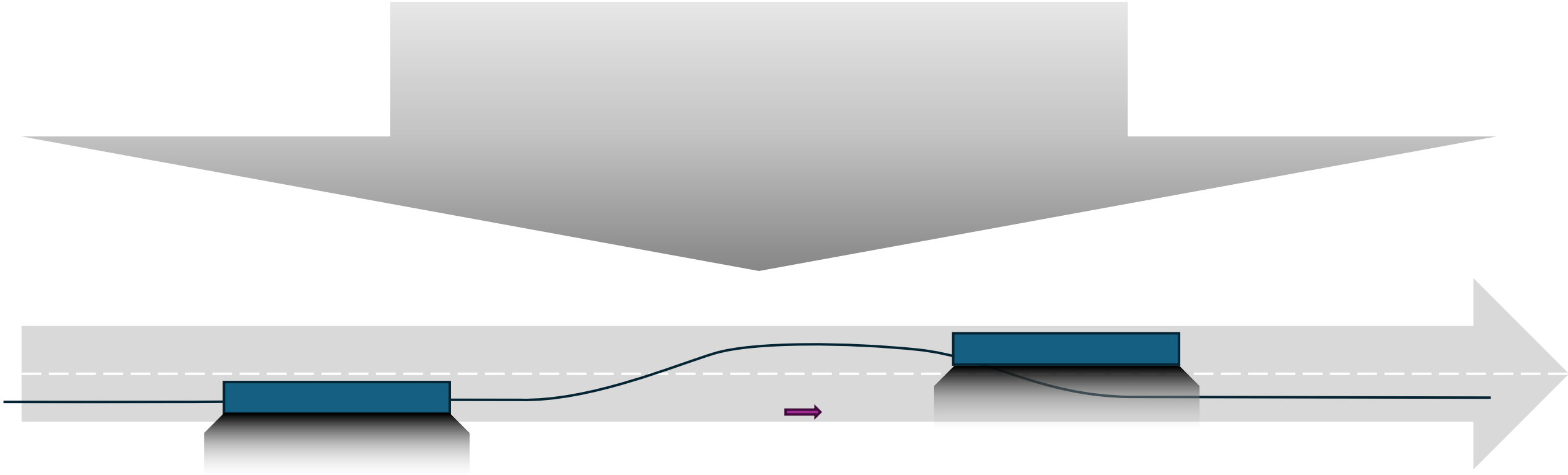
Foto: CLOSER, Lindholmen Science Park

Forces measured on test track





Ambient wind



Needs to be investigated.

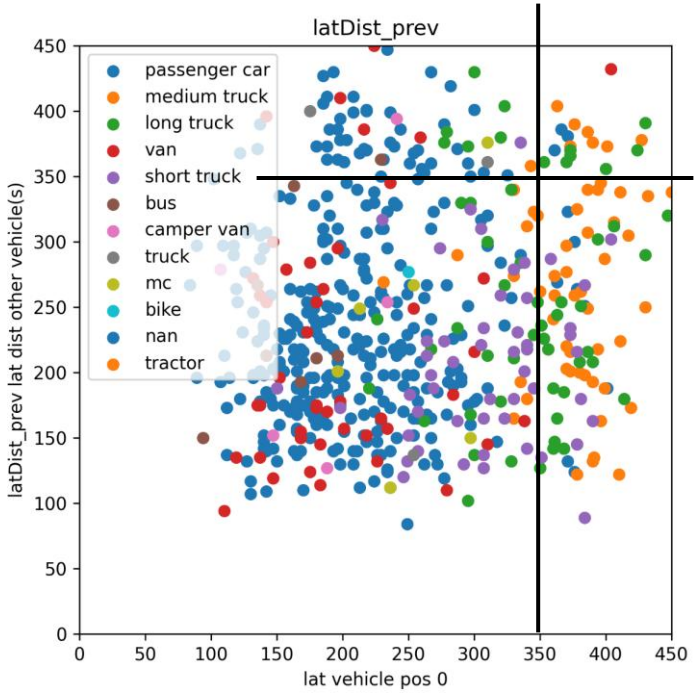
Others: What do cyclists say?

- Following vehicles
  - divided opinions, ”follow John” or not
  - nice that trucks serve as ”speed limiters”
- Oncoming vehicles
  - duration of overtake can lead to problems

Foto: CLOSER, Lindholmen Science Park

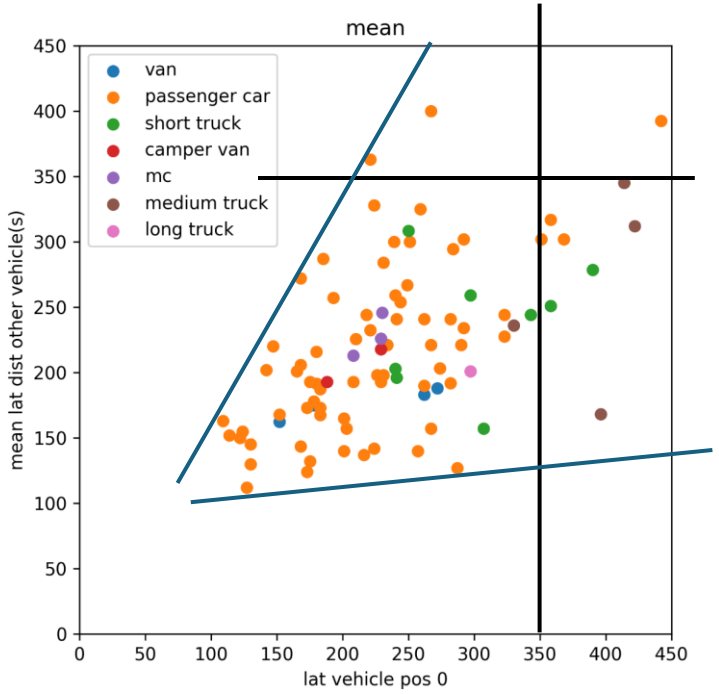
Following vehicles

“free” vehicles



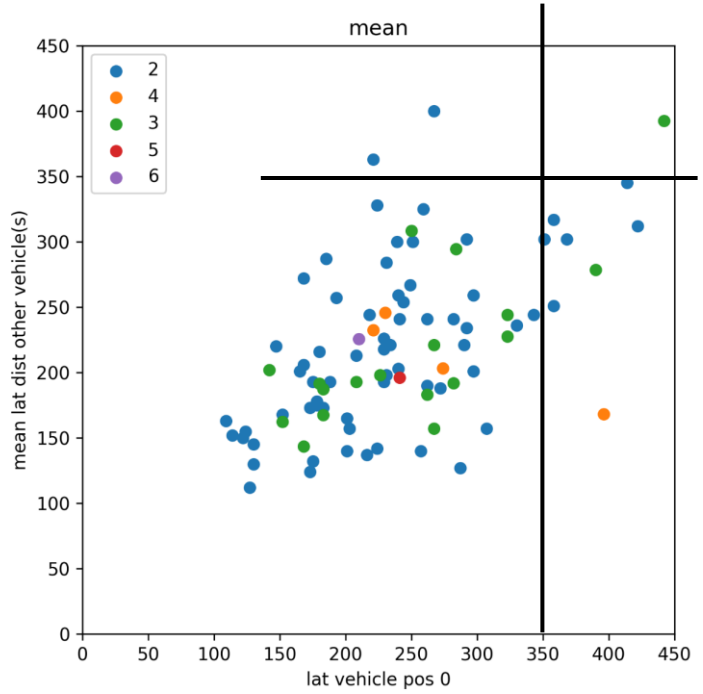
r = 0.14

groups by first vehicle type



r = 0.55

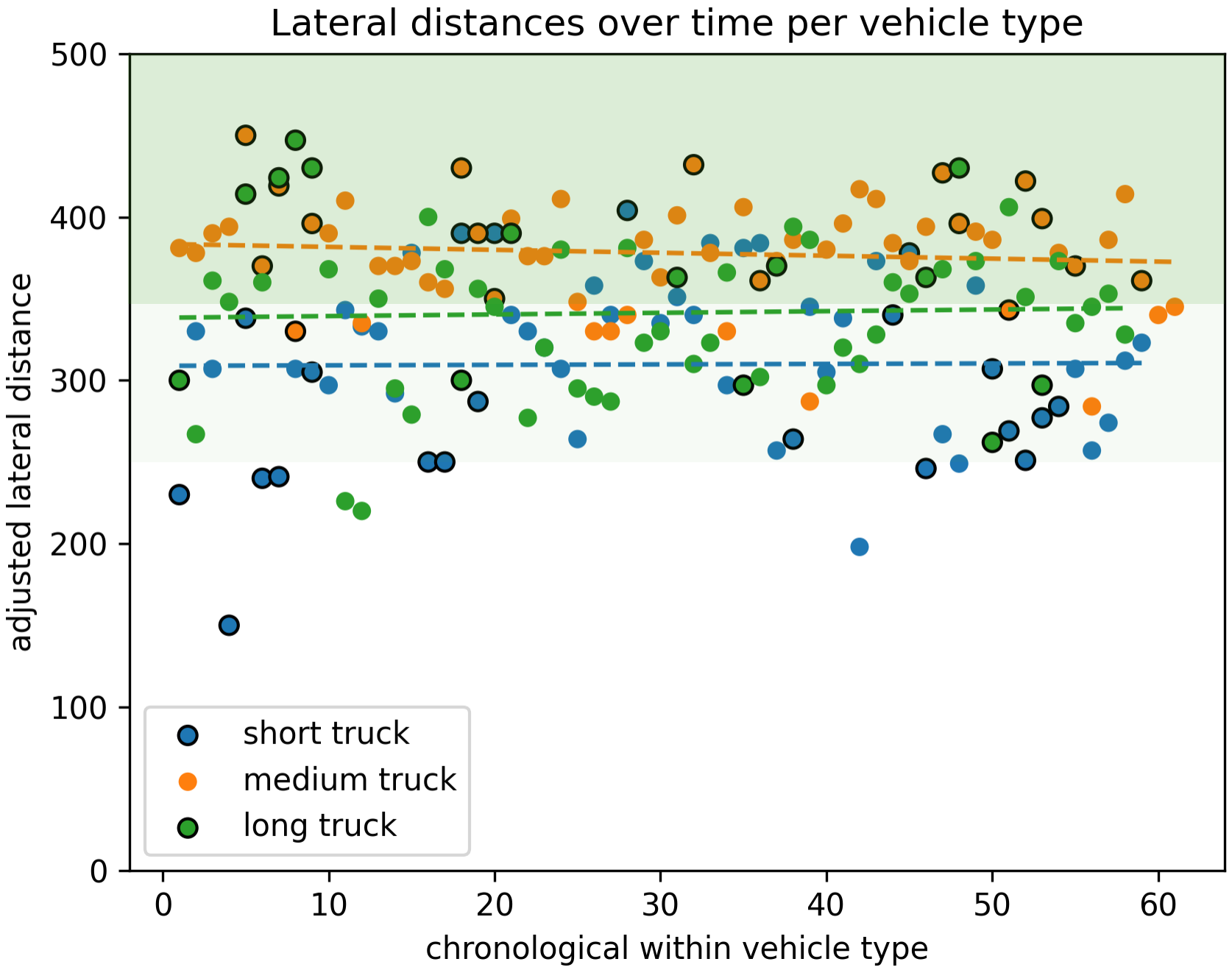
groups by count in group



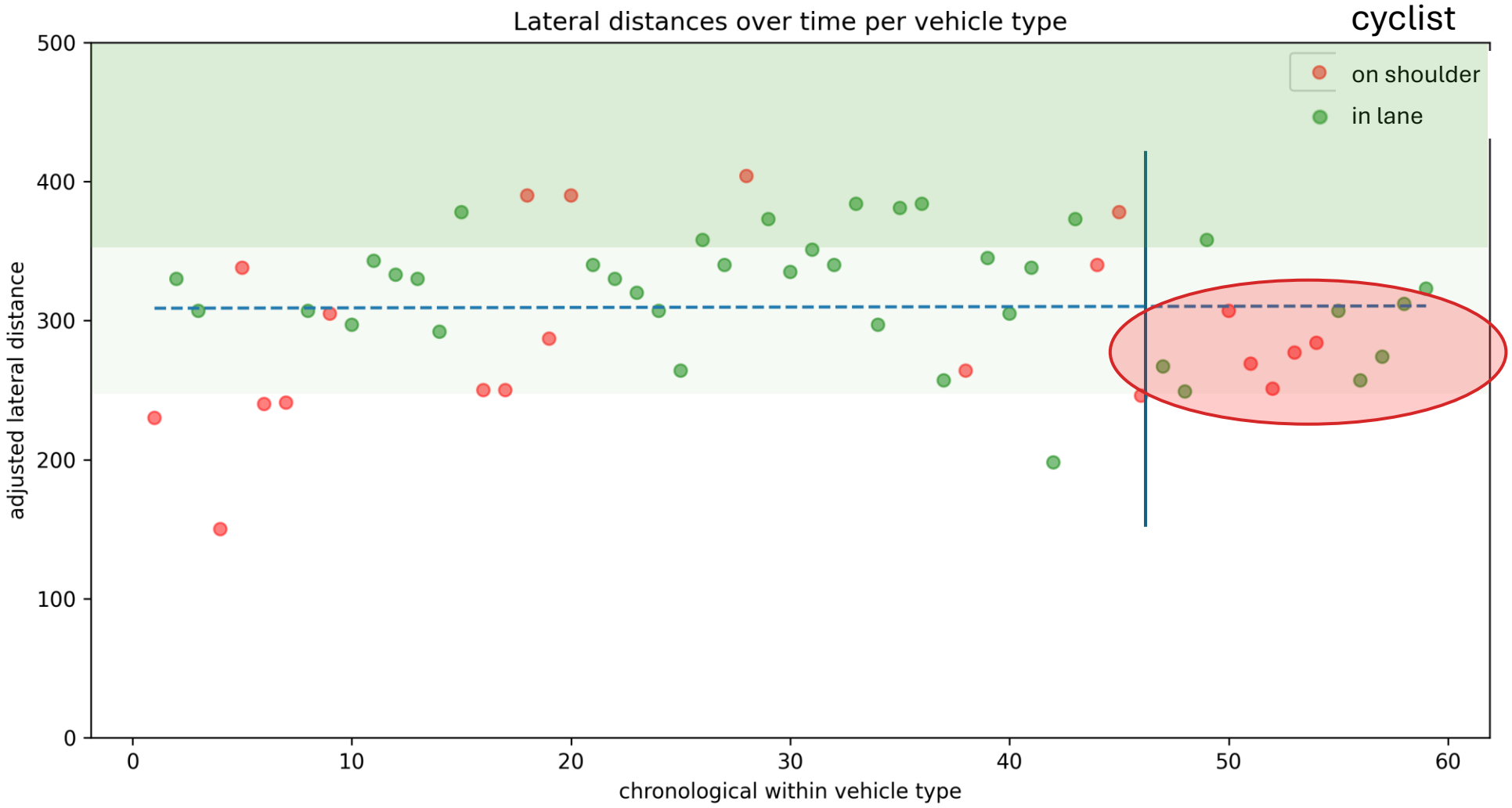

Can appropriate behaviour be guaranteed?

Stability over time

overtaking needs to be reliable, this study was sort of an accelerated testing under special conditions – drivers were not under time pressure, were paid volunteers and knew they'd be monitored



Stability over time – short truck



Not only the overtake itself

longer vehicle ➔

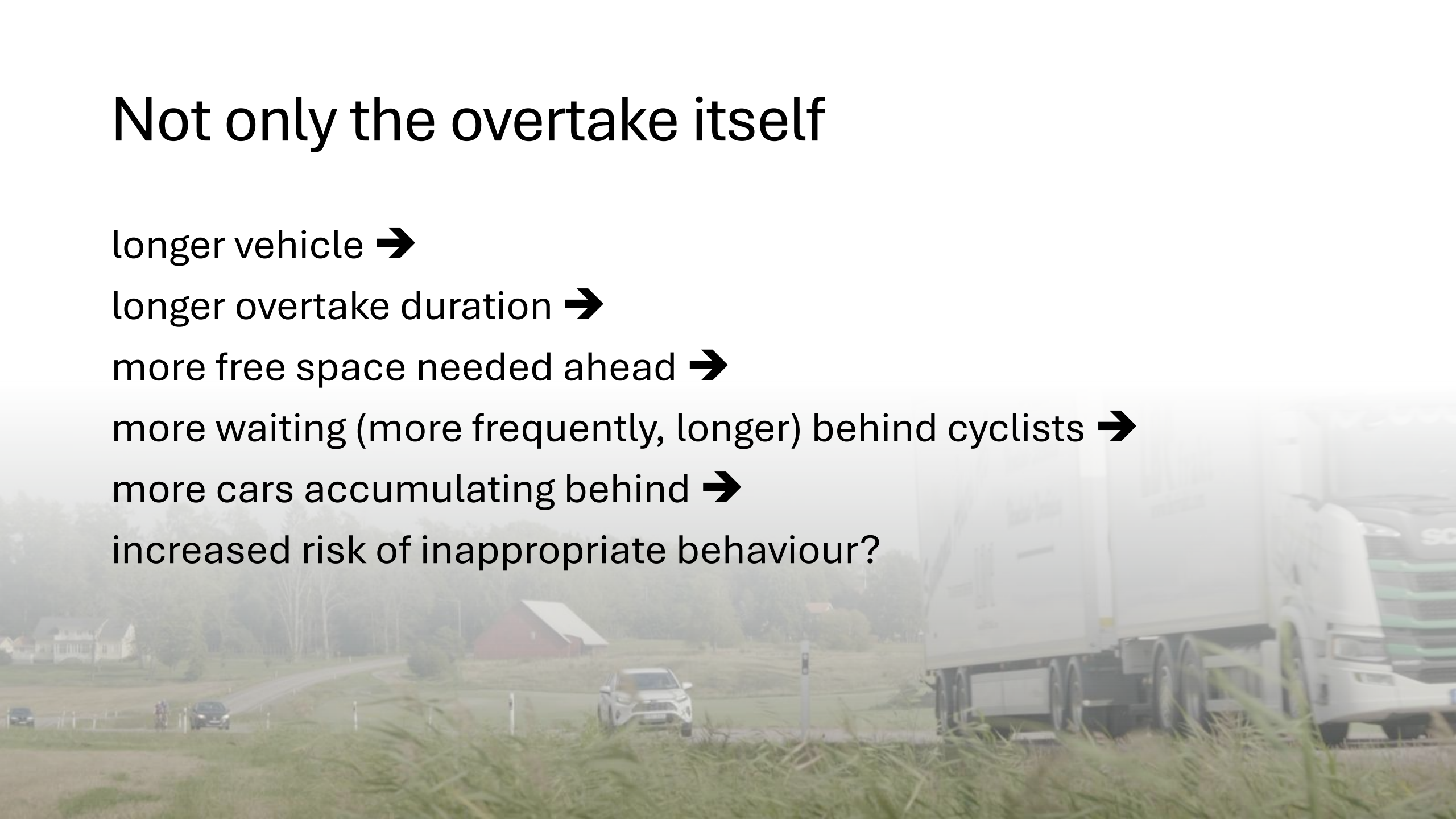
longer overtake duration ➔

more free space needed ahead ➔

more waiting (more frequently, longer) behind cyclists ➔

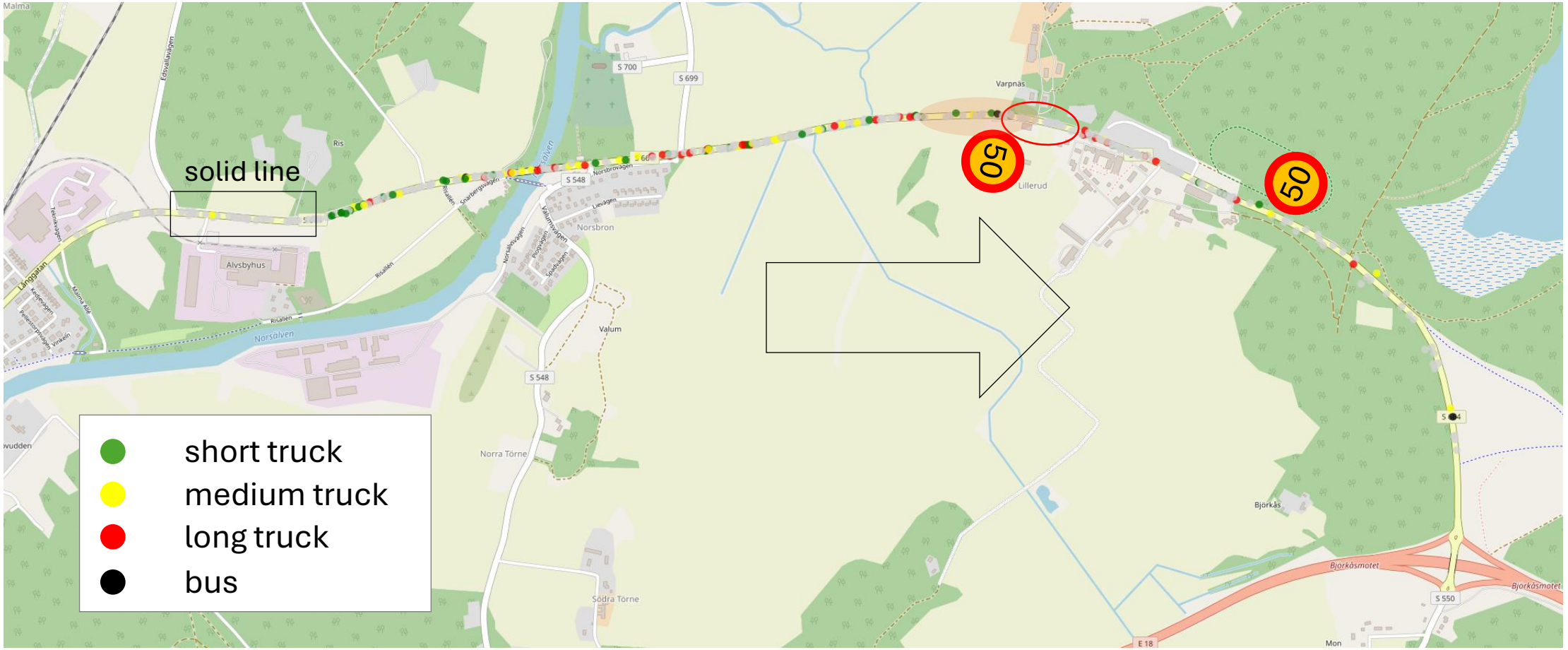
more cars accumulating behind ➔

increased risk of inappropriate behaviour?



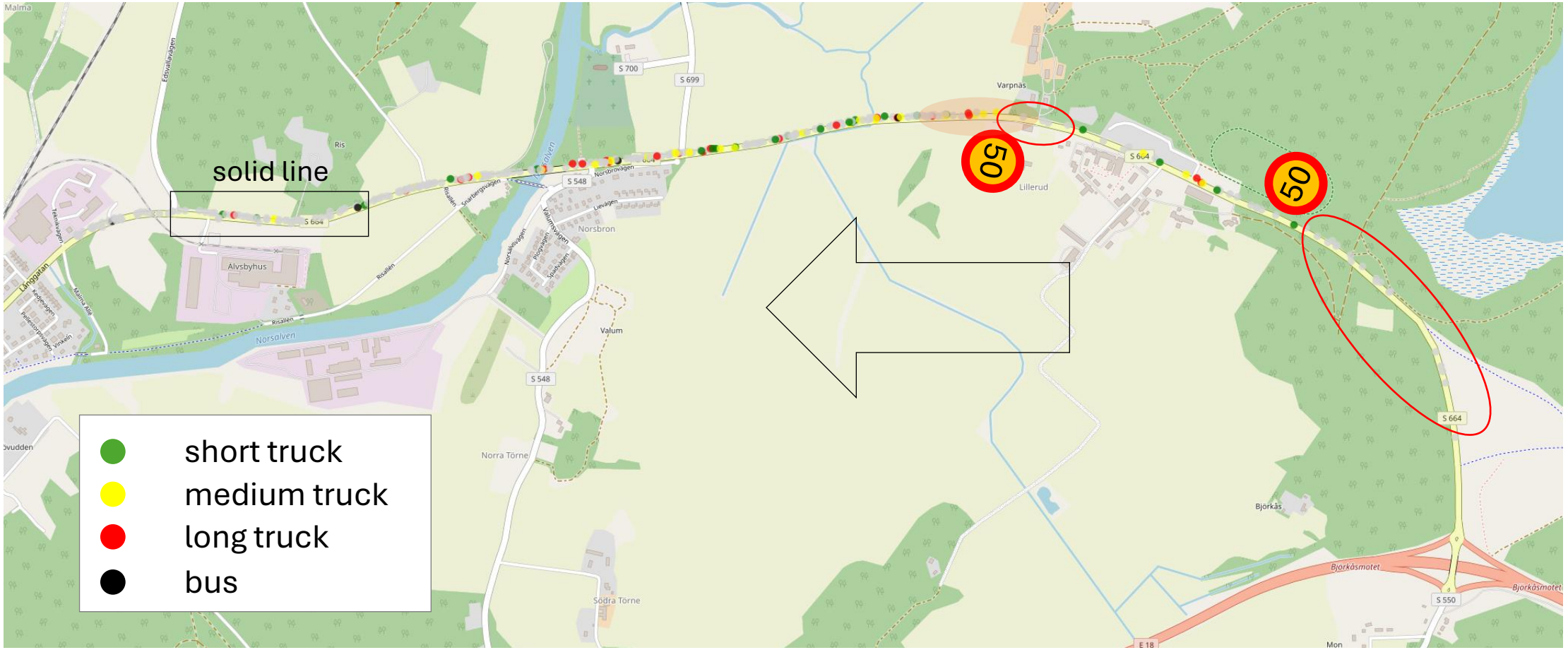
Eastbound – per vehicle type

no truck overtakes

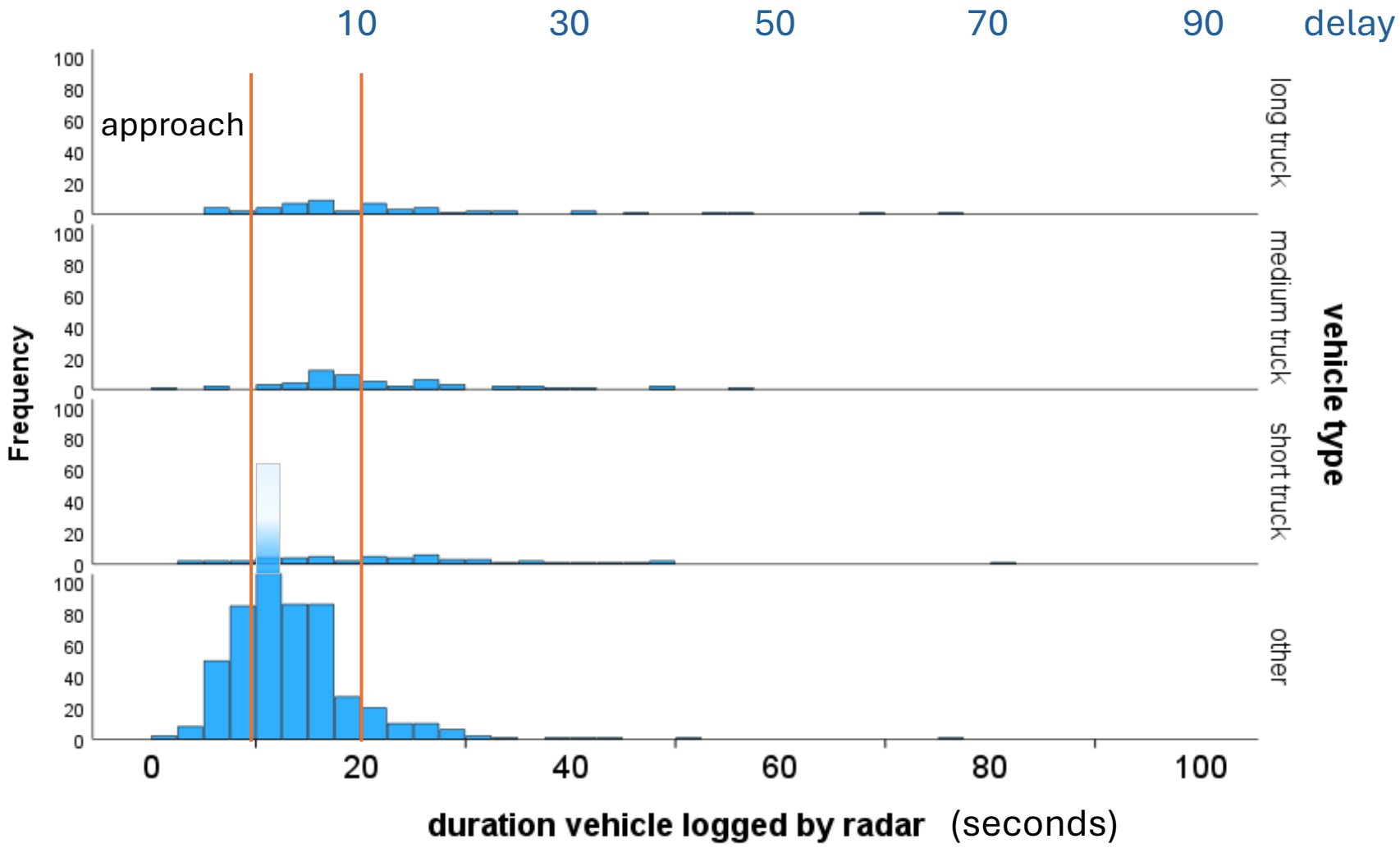


Westbound – per vehicle type

no truck overtakes



Duration behind cyclist



Waiting times and leverage points

- infrastructural preconditions
  - sight distance
  - number of lanes
- availability of gaps
  - number of oncoming vehicles
  - their possibility to overtake
  - speed

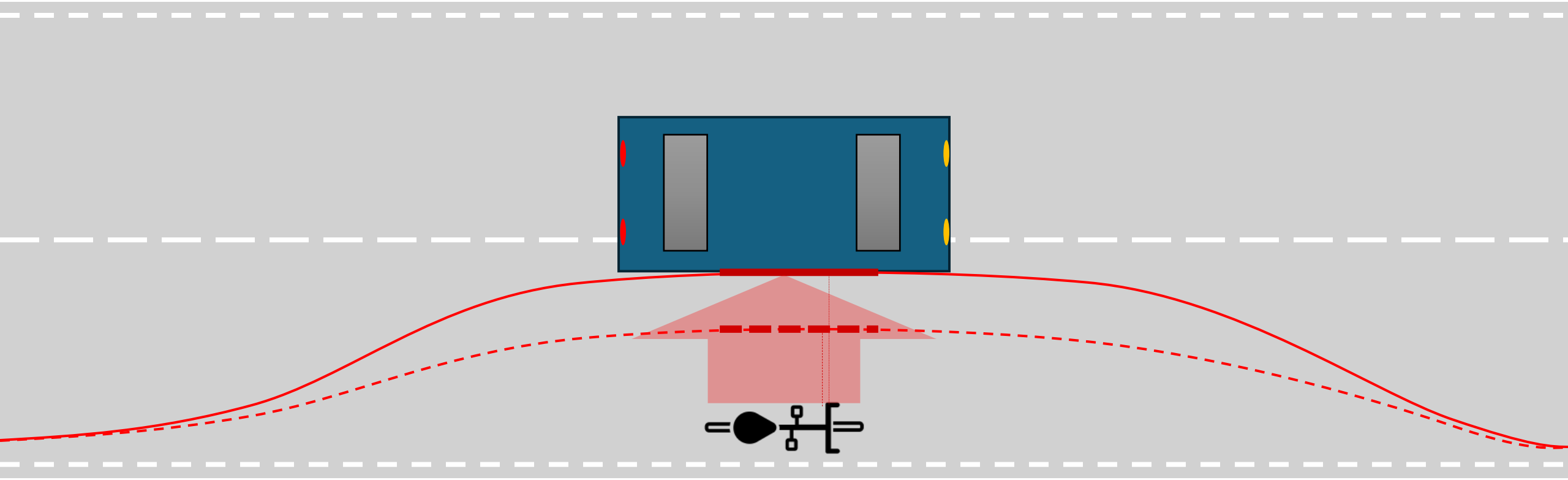
- reduce number of cars
- reduce speed

“Minimum” vs “maximum” approach

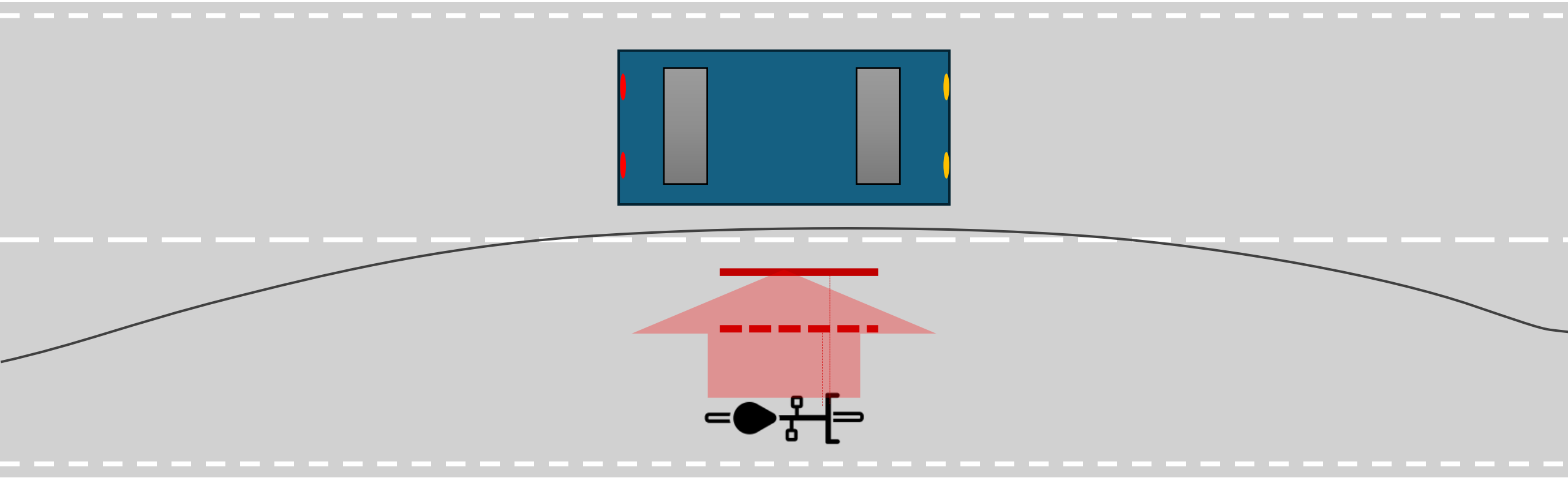
“1.5 m”

full lane change

Minimum envelope



Maximum envelope



Future research

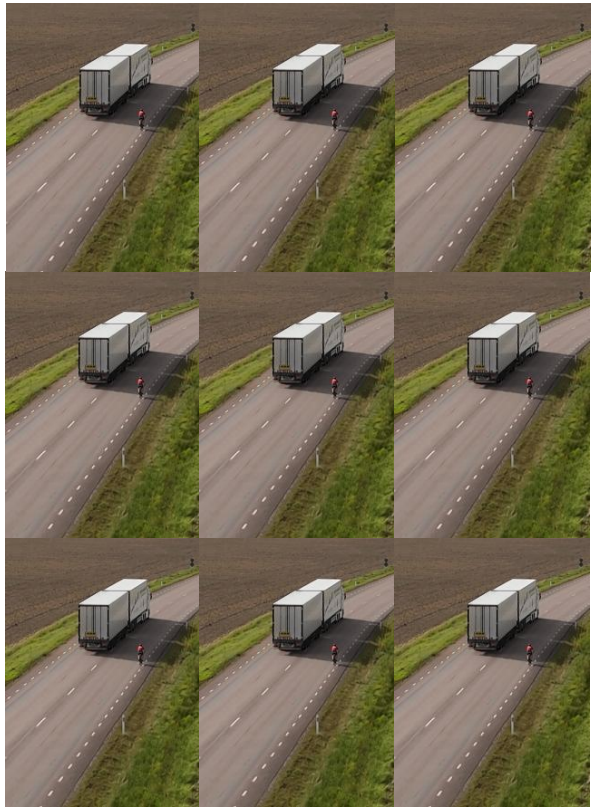
- Waiting time (different effects)
- Truck as good example for other drivers
- Truck as oncoming traffic (drivers overtaking truck)
- Aerodynamic forces
- Ambient wind

Conclusions

wait far enough behind

full lane change

work on consistency



Thank you!

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