

Results on Behaviour, Acceptance, and Usage

Adaptive Cruise Control and Forward Collision Warning

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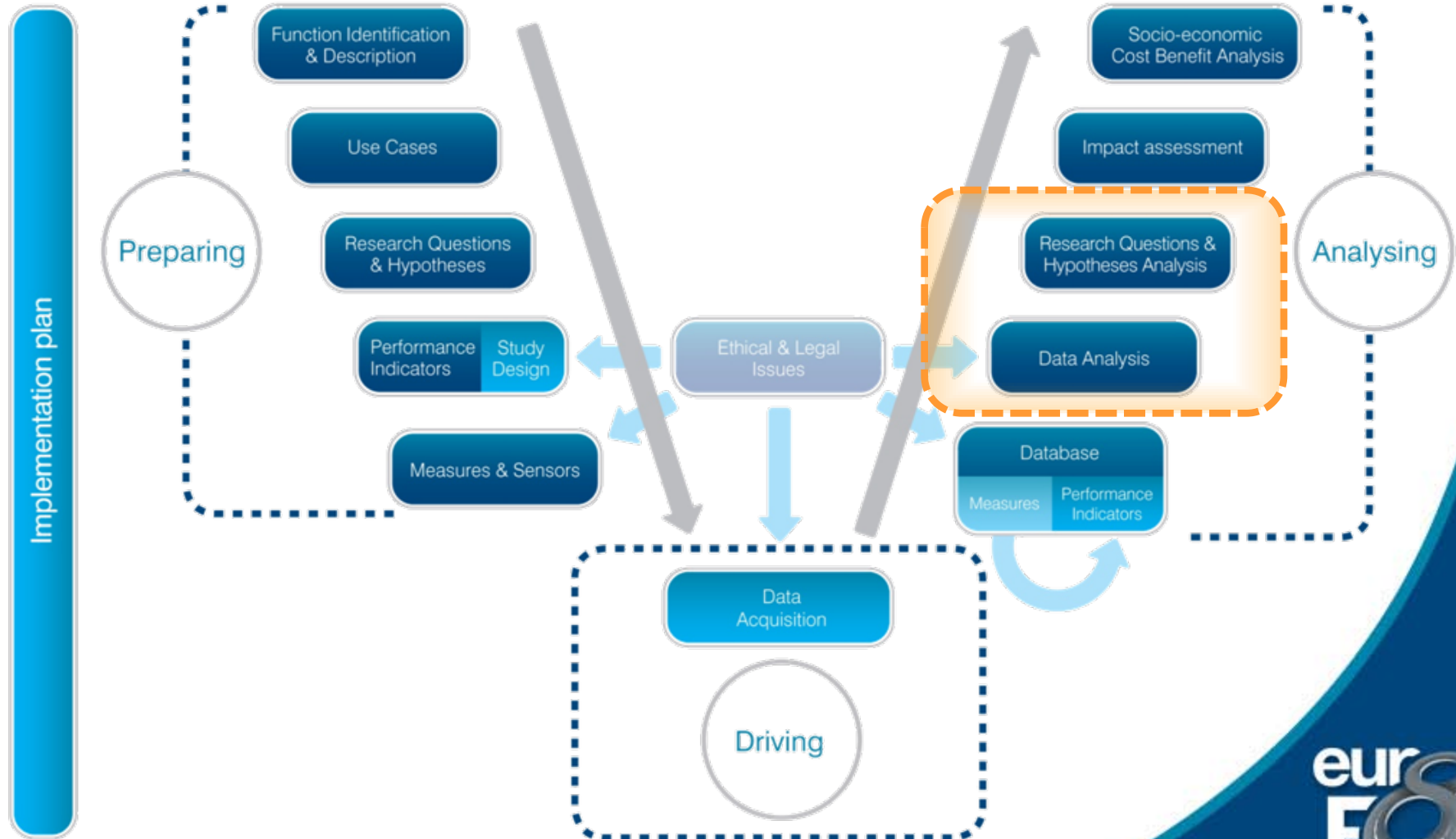


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FOT

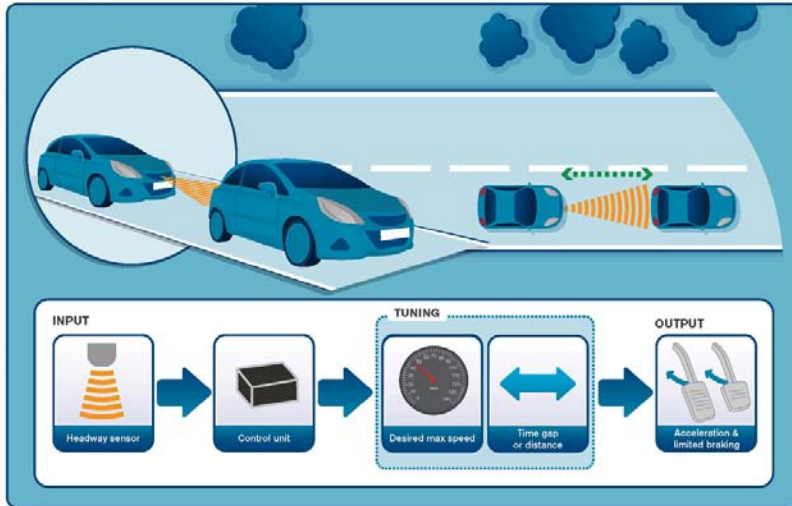
Bringing intelligent vehicles to the road

Approach – FESTA V

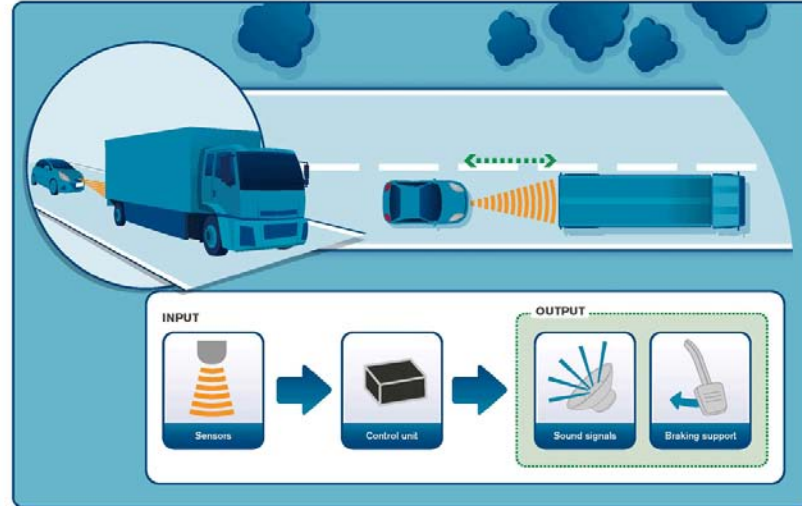


ACC and FCW

ACC Adaptive Cruise Control







FCW Forward Collision Warning



- ⌘ ACC and FCW are integrated in one system
- ⌘ Debundling of effects not always possible
- ⌘ Analysis as a bundle 'ACC and FCW'

Available data

		VOLVO		
✓	✓	✓	✓	✓

	Mileage	Number of drivers	
		N _{passenger cars}	N _{trucks}
Overall	1.350.729 km	174	53
Motorway	1.279.790 km	174	53
Rural	37.211 km	64	-
Urban	33.728 km	64	-

Tested Hypotheses

Subjective data

ACC increases driving perceived safety and comfort

Certain features of the systems, in terms of usability, influence acceptance

Certain features of the systems, in terms of usefulness, influence acceptance

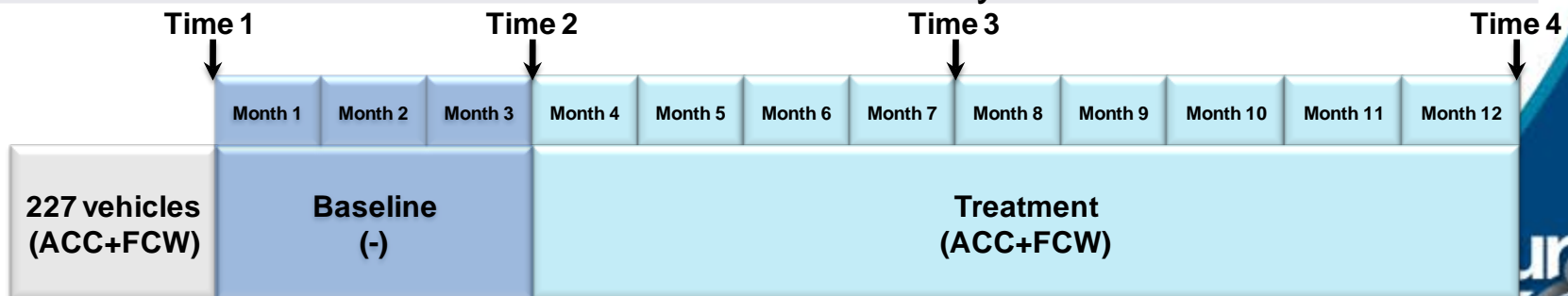
Trust in system changes over time with system use

User practices will change over time during the FOT

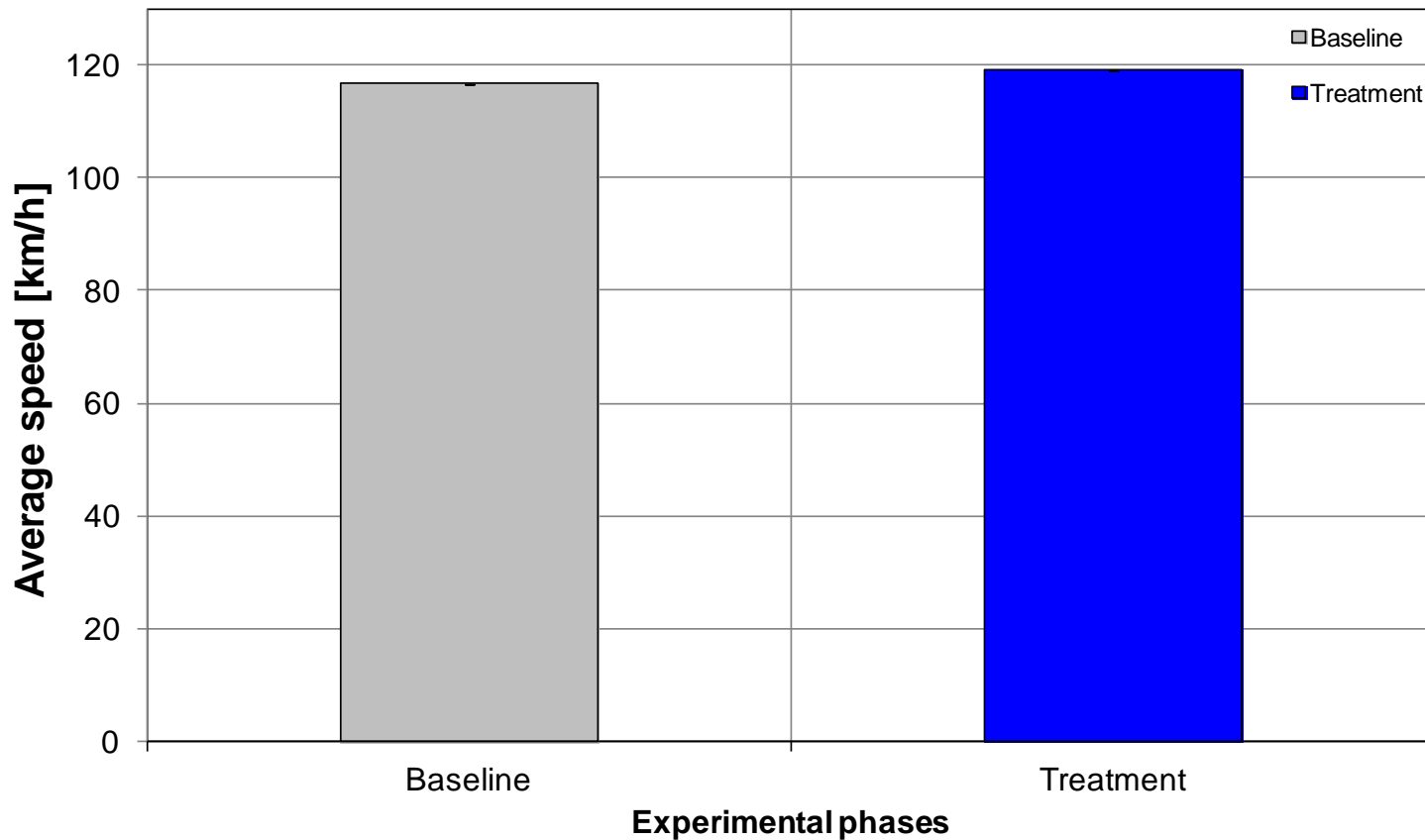
Acceptance changes over time with system use

Using ACC, focus and level of engagement on secondary tasks will increase

Driver workload decreases over time with the system

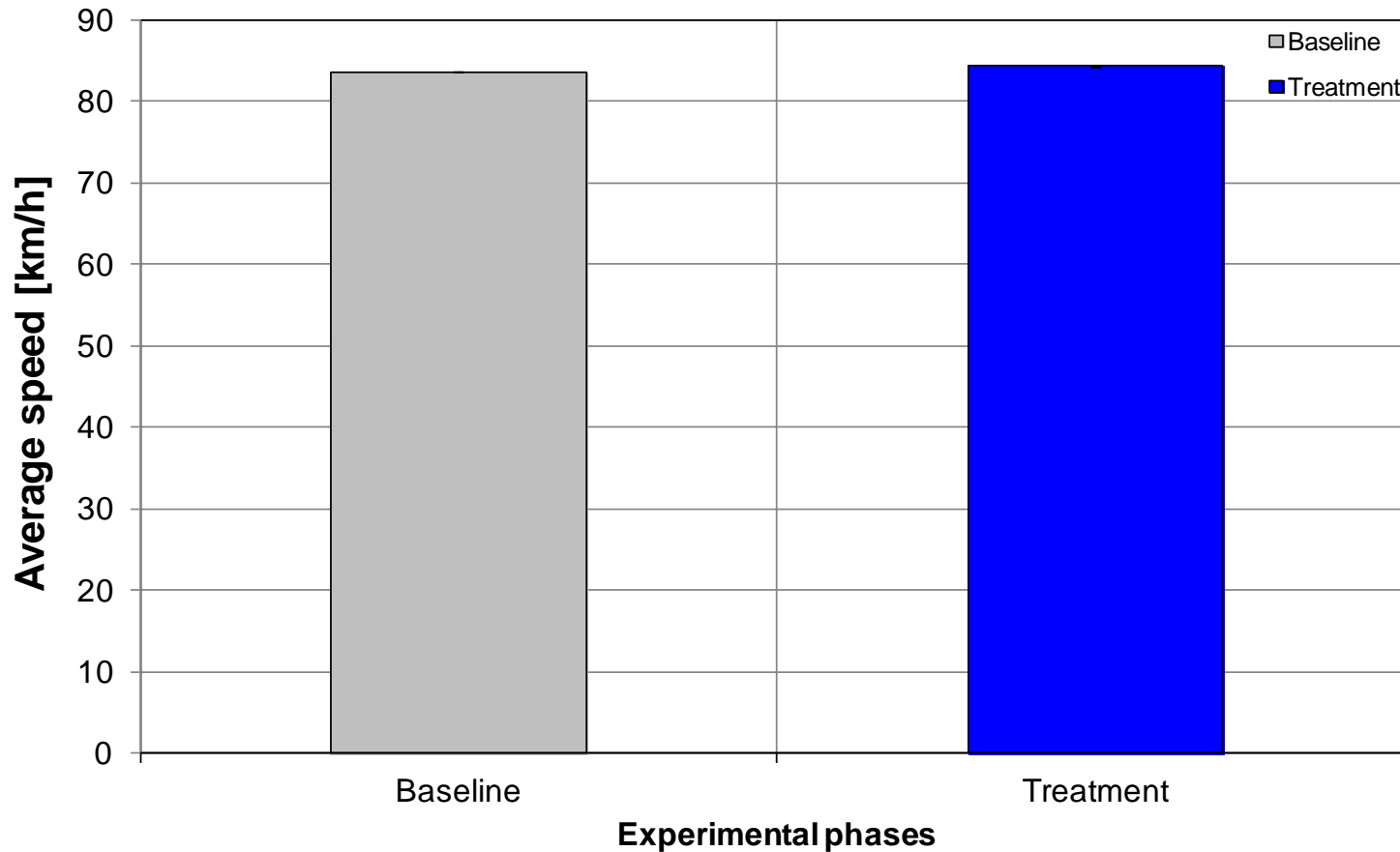


Average Speed - cars



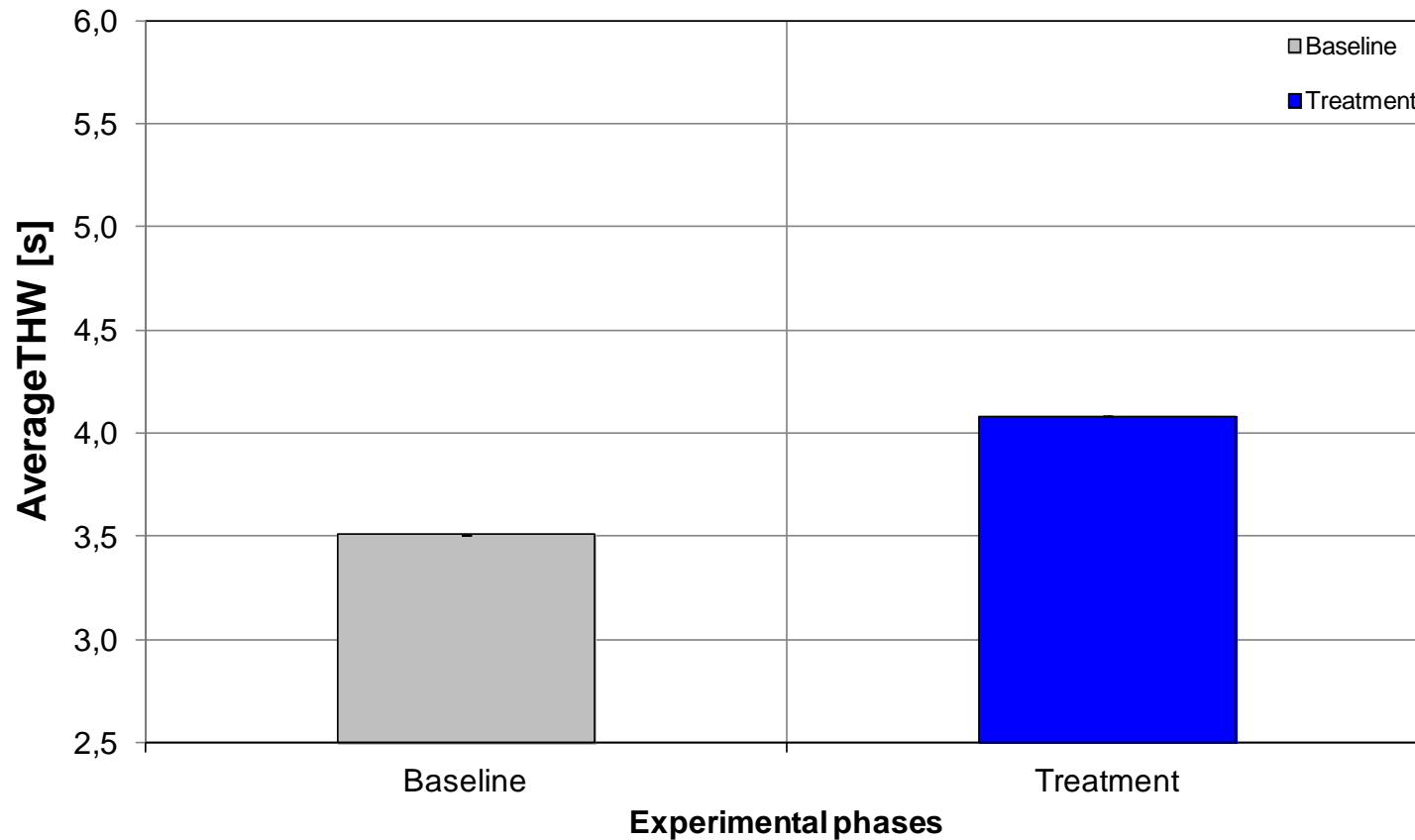
Conditions	Baseline	Treatment	% Increase/ Reduction	N	Mileage [km]
	Mean [km/h]	Mean [km/h]			
Motorway	116.7	119.0	2.0	174	709.607

Average speed - trucks



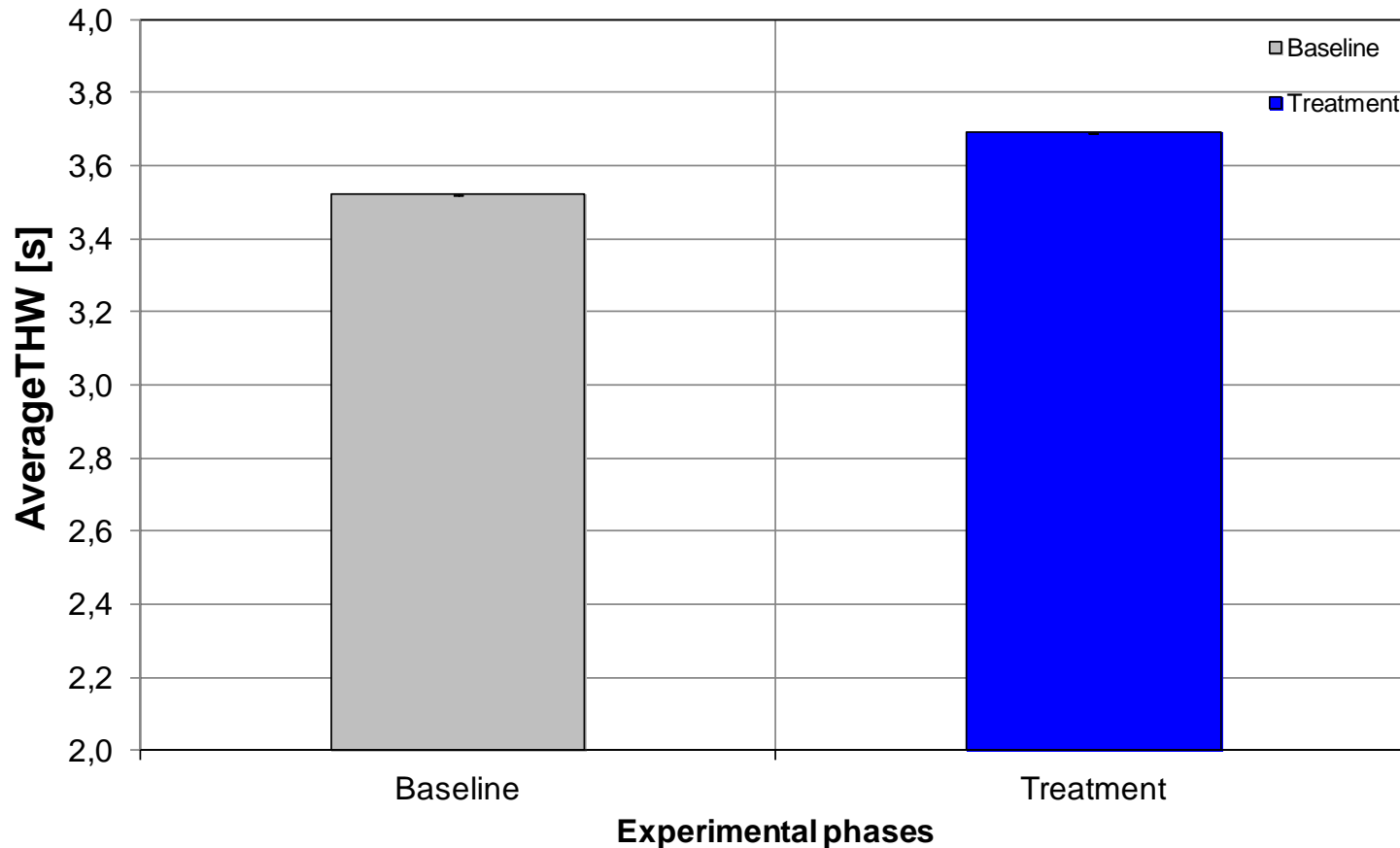
Conditions	Baseline	Treatment	% Increase/ Reduction	N	Mileage [km]
	Mean [km/h]	Mean [km/h]			
Motorway	83.6	84.3	0.9	53	570.183

Average THW - cars



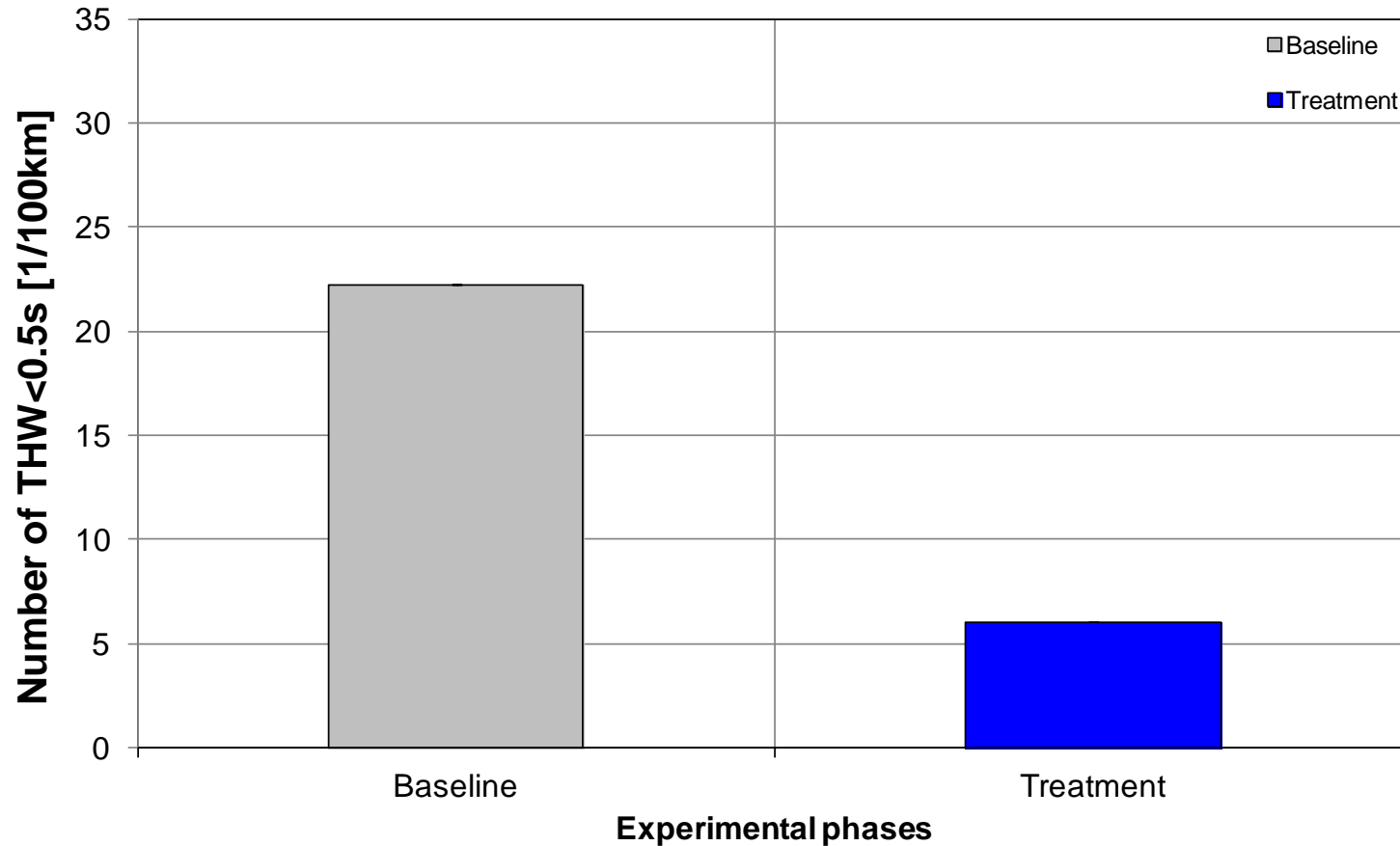
Conditions	Baseline	Treatment	% Increase/ Reduction	N	Mileage [km]
	Mean [s]	Mean [s]			
Motorway	3.51	4.08	16.2	173	709.607

Average THW – trucks



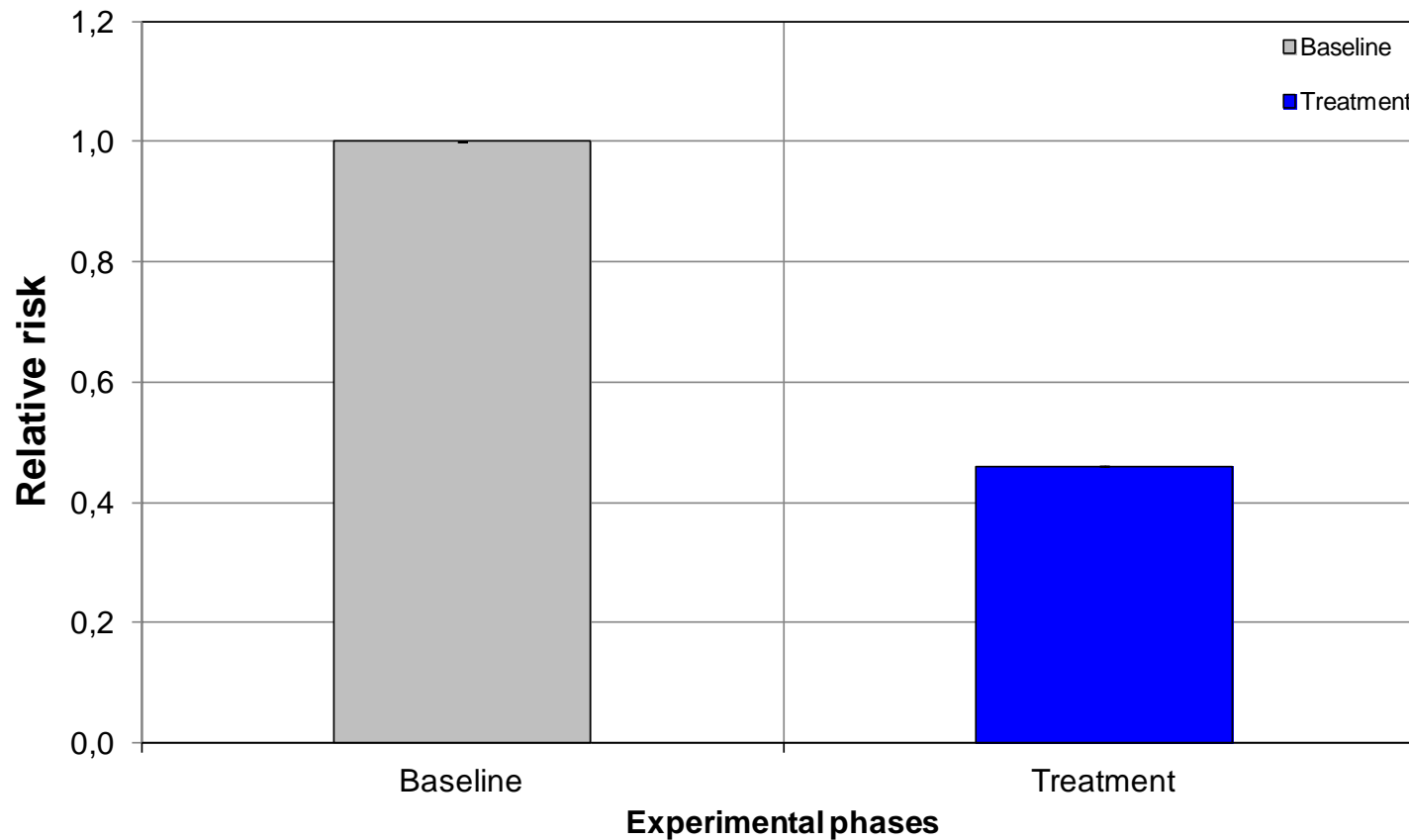
Conditions	Baseline	Treatment	% Increase/ Reduction	N	Mileage [km]
	Mean [s]	Mean [s]			
Motorway	3.52	3.69	4.8	53	570.183

Critical THW (< 0.5s) - cars



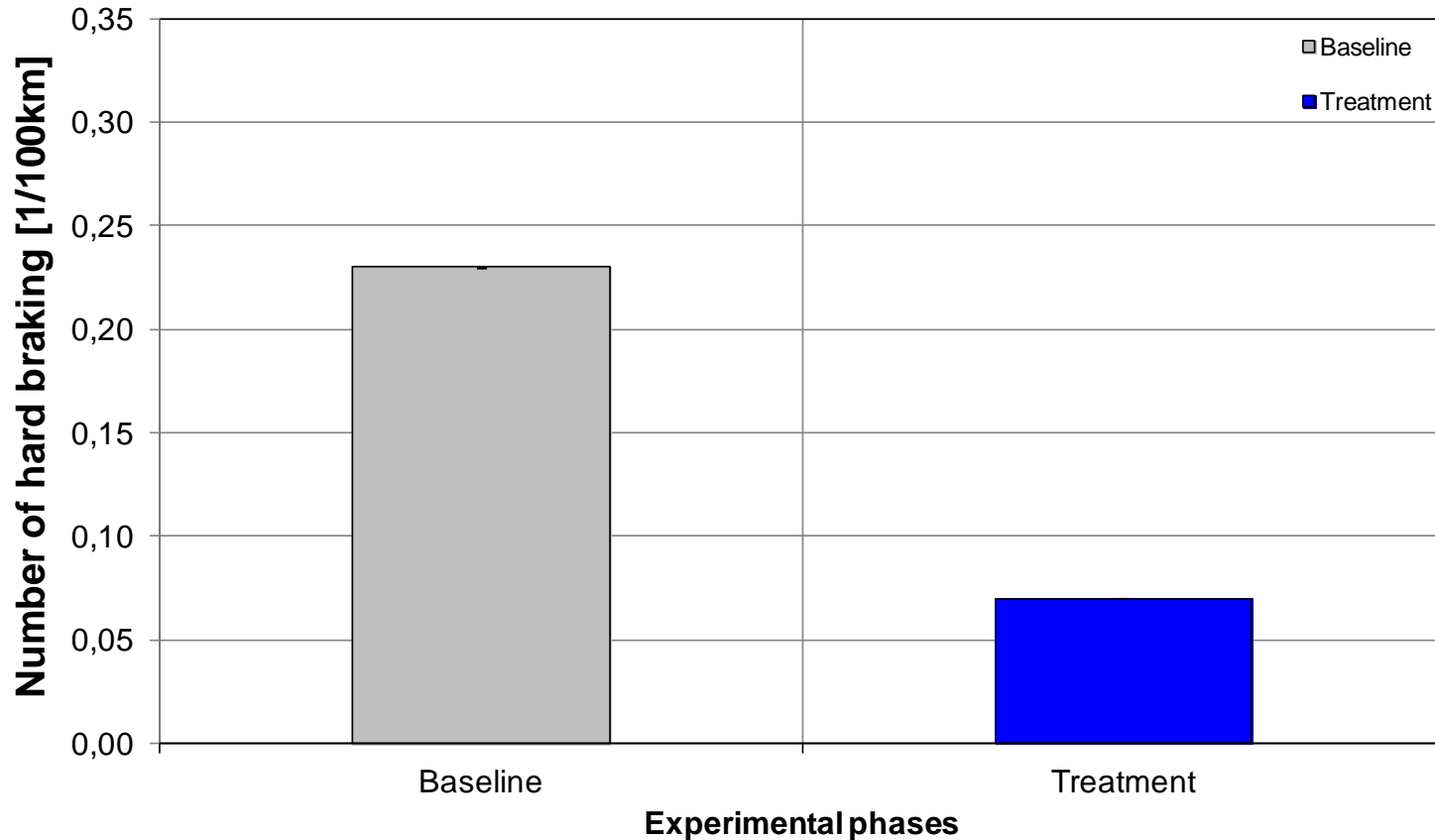
Conditions	Baseline	Treatment	% Increase/ Reduction	N	Mileage [km]
	Mean [1/100 km]	Mean [1/100 km]			
Motorway	22.22	6.02	-72.9	174	709.607

Critical THW (< 0.5s) - trucks



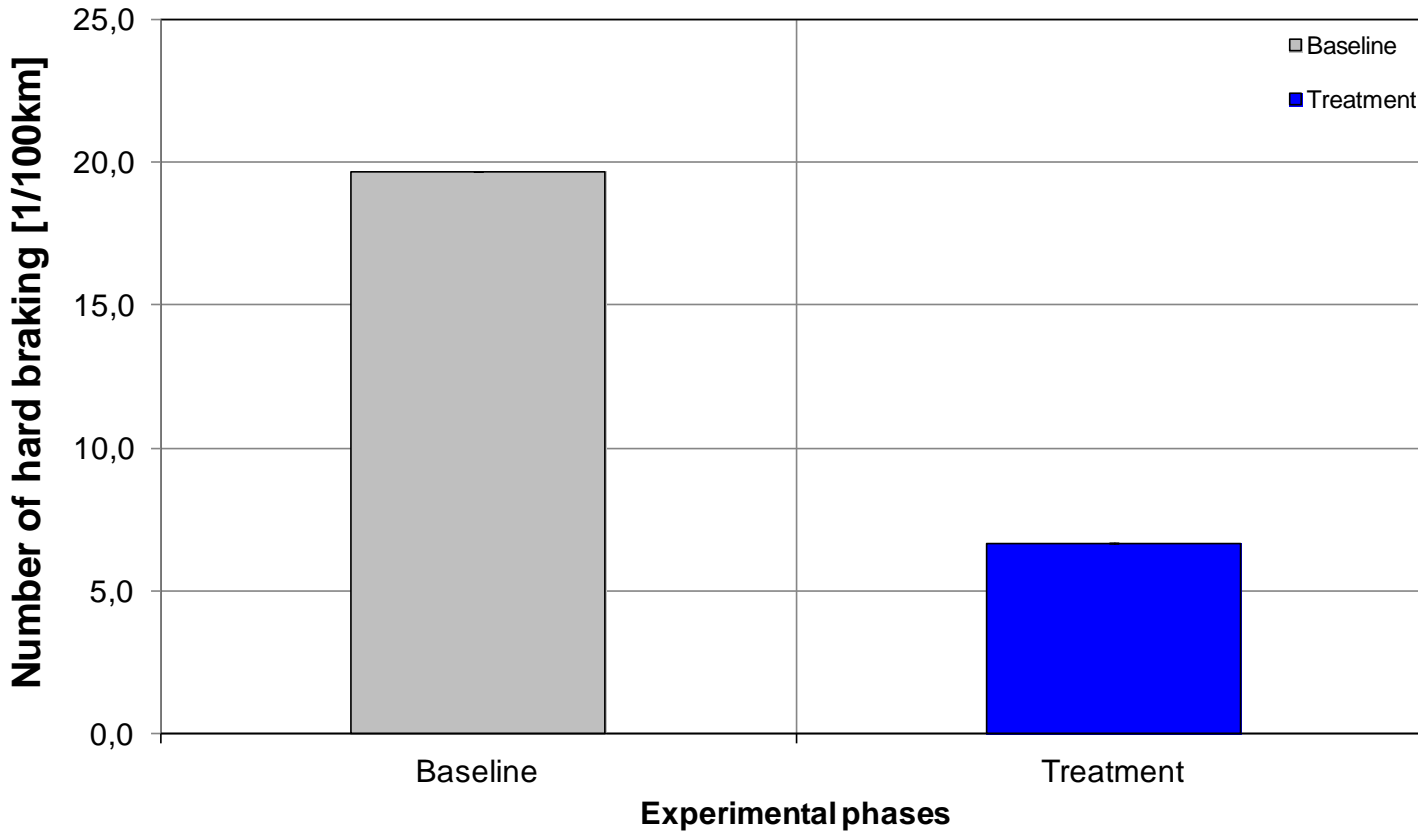
Conditions	Relative risk (risk treatment / risk baseline)	% Increase/ Reduction	N	Mileage [km]
Motorway	0.46	-54.0	36	501.069

Hard braking - cars



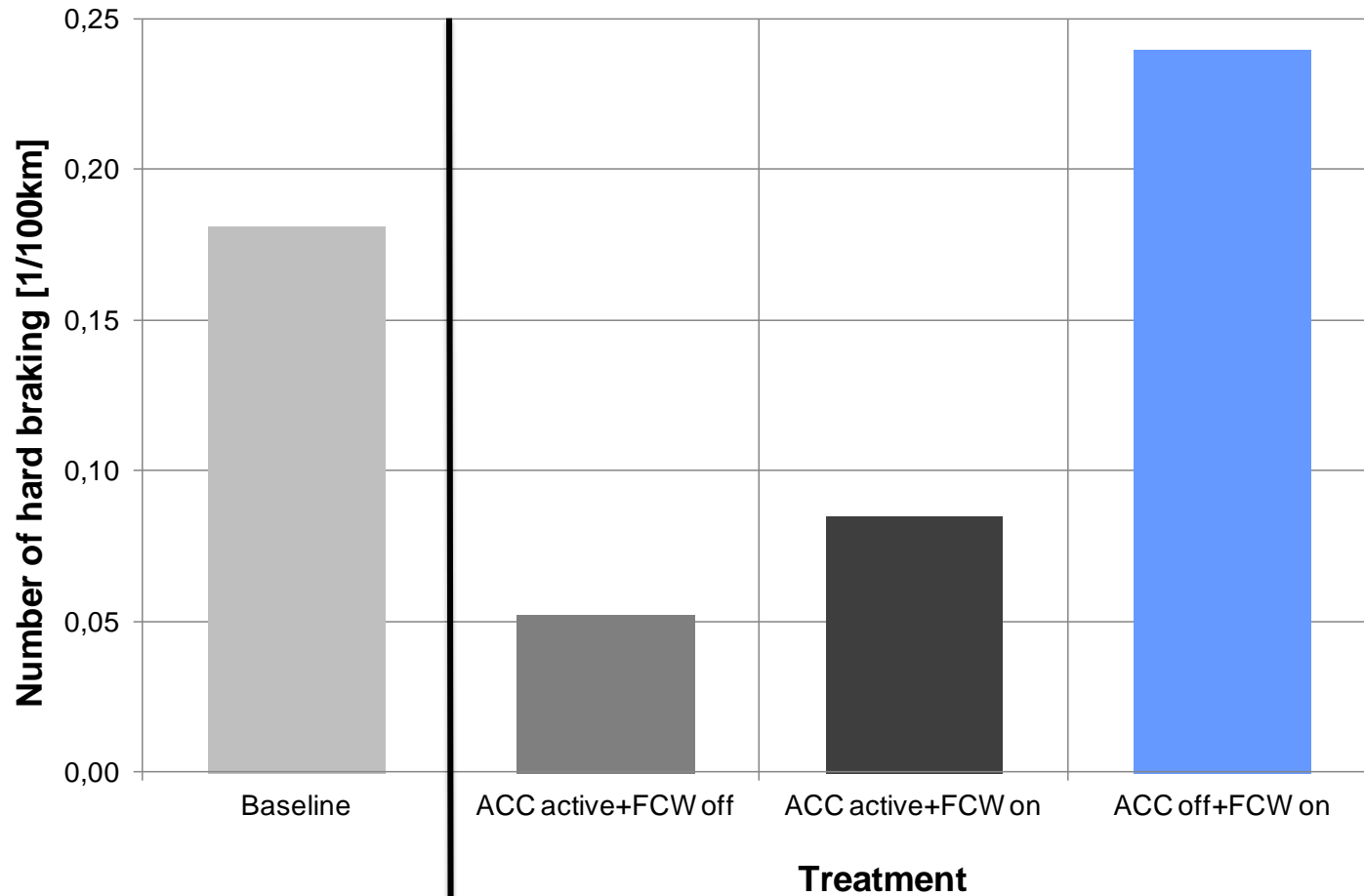
Conditions	Baseline	Treatment	% Increase/ Reduction	N	Mileage [km]
	Mean [1/100 km]	Mean [1/100 km]			
Motorway	0.23	0.07	-69.2	110	651.099

Hard braking - trucks



Conditions	Baseline	Treatment	% Increase/ Reduction	N	Mileage [km]
	Relative risk	Relative risk			
Motorway	1	0.59	-40.8	30	429.215

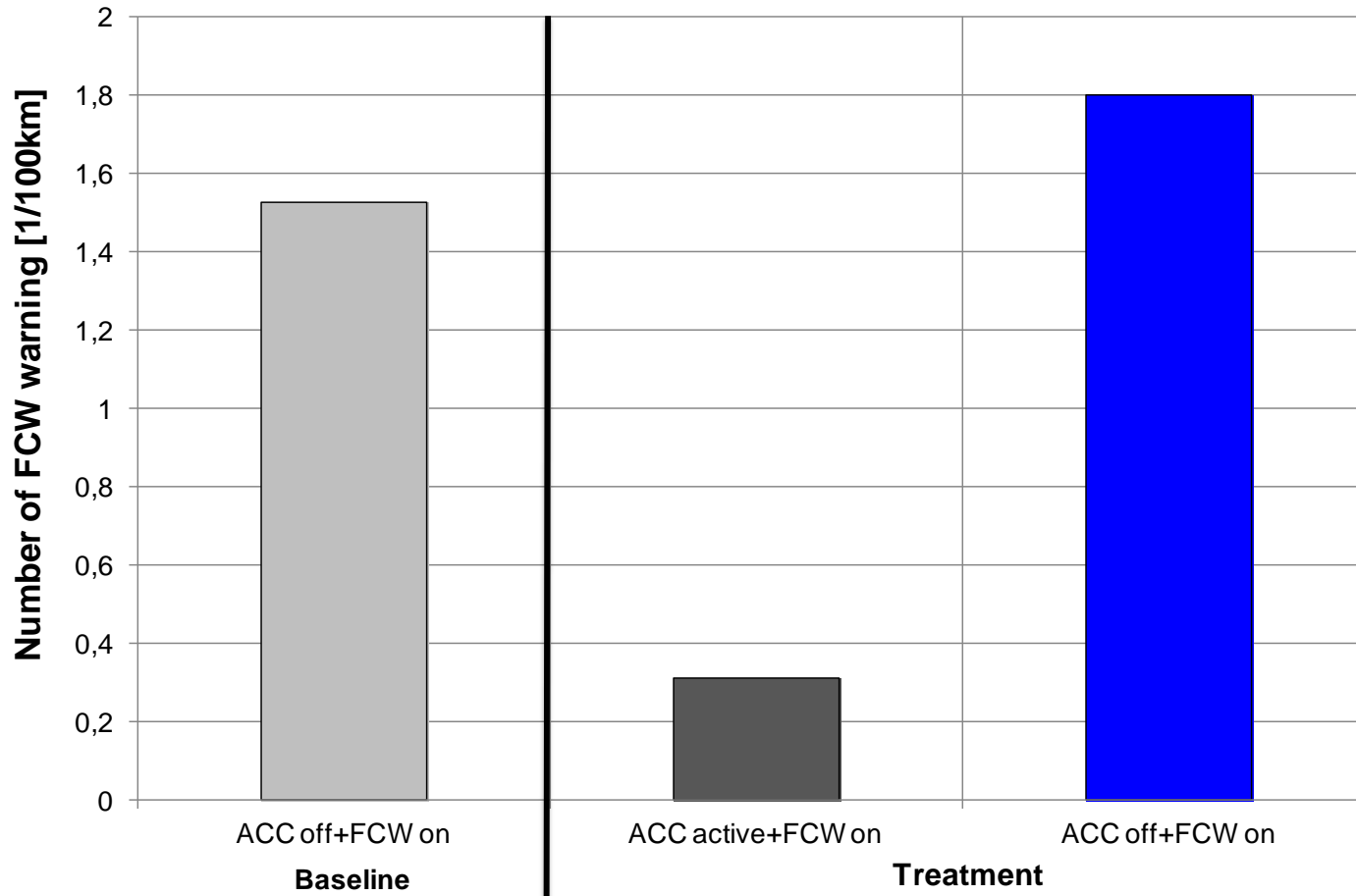
Comparison hard braking



High reduction in phases with ACC active on motorways:

- ♿ 75% reduction when ACC active and FCW off
- ♿ 53% reduction when ACC active and FCW on

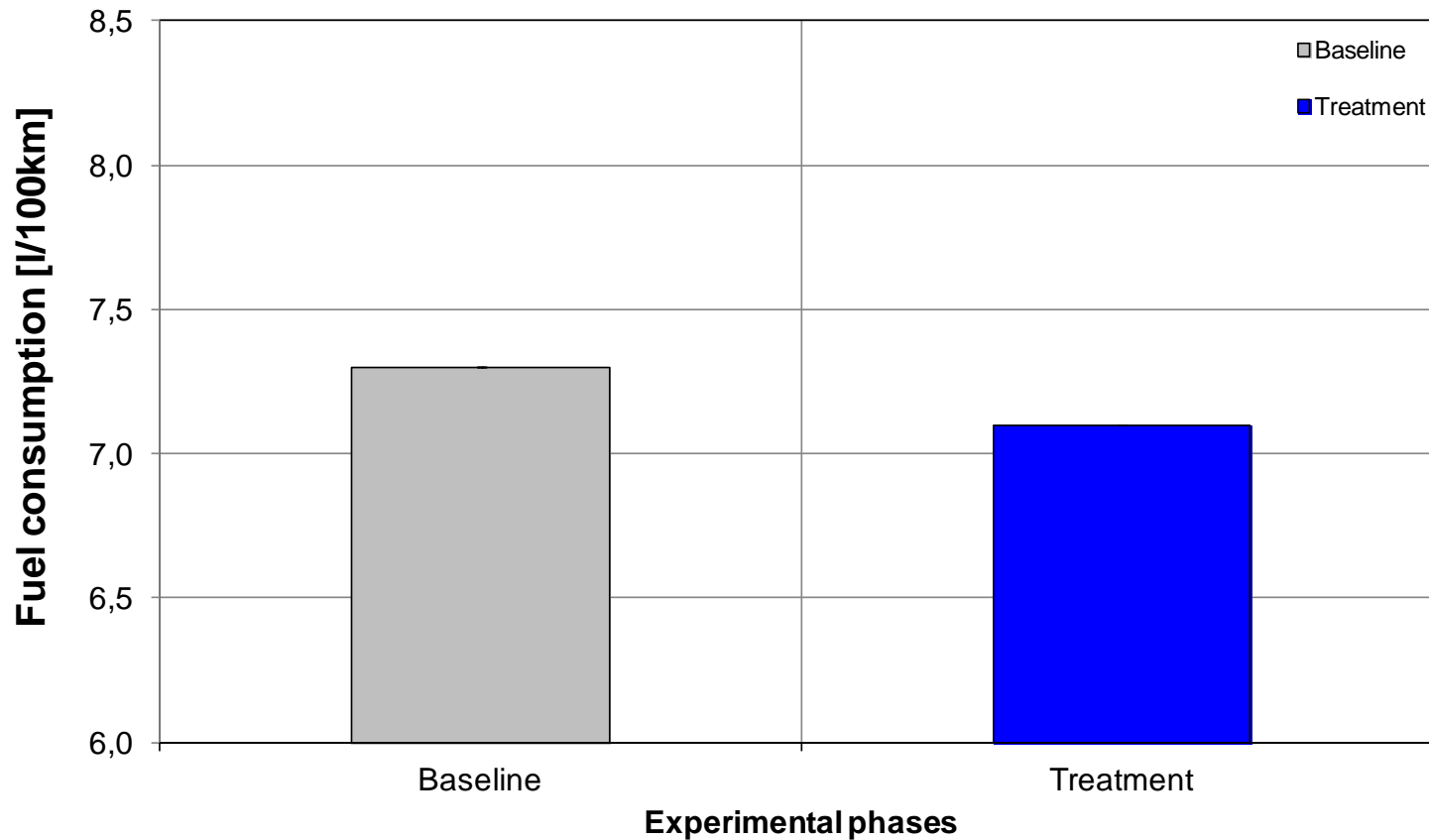
FCW warnings



High reduction of FCW warnings in phases with ACC active on motorways:

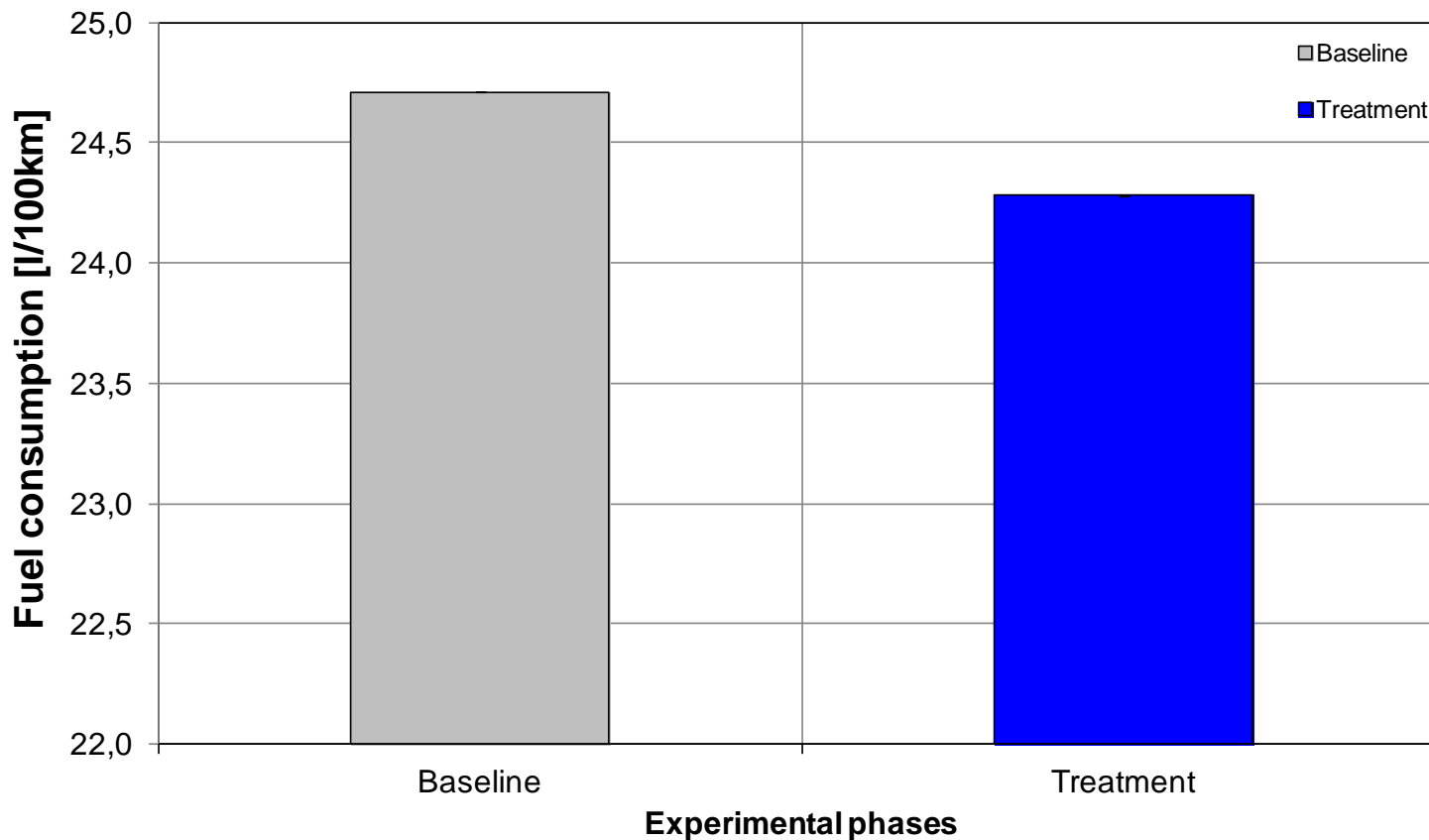
- 80% reduction when ACC active and FCW on

Fuel consumption - cars



Conditions	Baseline	Treatment	% Increase/ Reduction	N	Mileage [km]
	Mean [l/100 km]	Mean [l/100 km]			
Motorway	7.30	7.10	-2.8	163	698.695

Fuel consumption - trucks



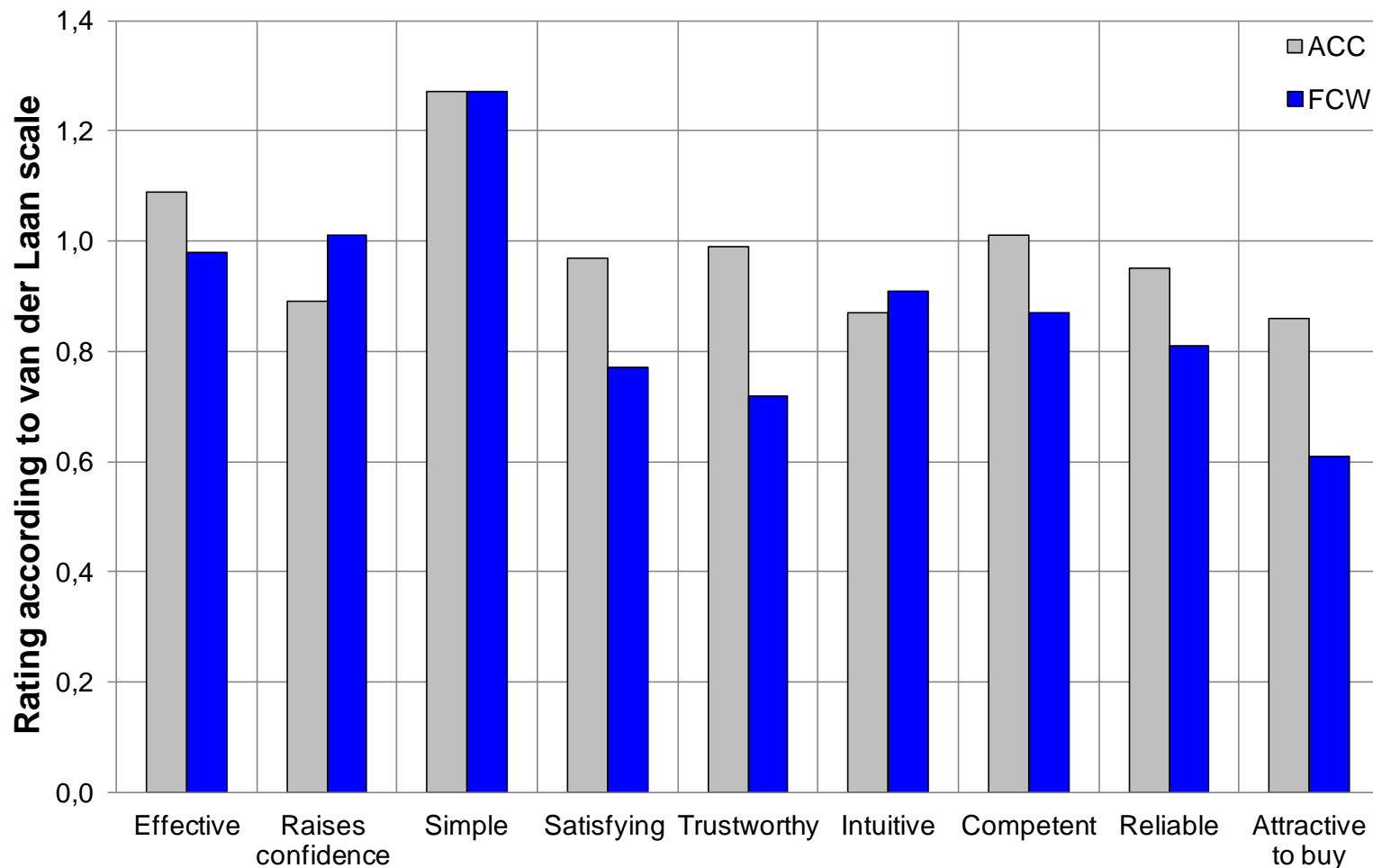
Conditions	Baseline	Treatment	% Increase/ Reduction	N	Mileage [km]
	Mean [l/100 km]	Mean [l/100 km]			
Motorway	24.71	24.28	-1.8	23	327.295

Usage ACC

Type of measure	Performance indicator	Results		Relative Increase / Decrease
		First month treatment	Last month treatment	
Objective	Percentage of travel time travelled with active ACC	19 %	25 %	+31 %
Objective	Number of ACC activations per hour travelled	1.1	1.6	+53 %
Objective	Number of overriding per hour travelled with active ACC	29.2	26.2	-10 %
Subjective (Questionnaire)	Change of user practices in using the ACC	-	63 % (no change)	-

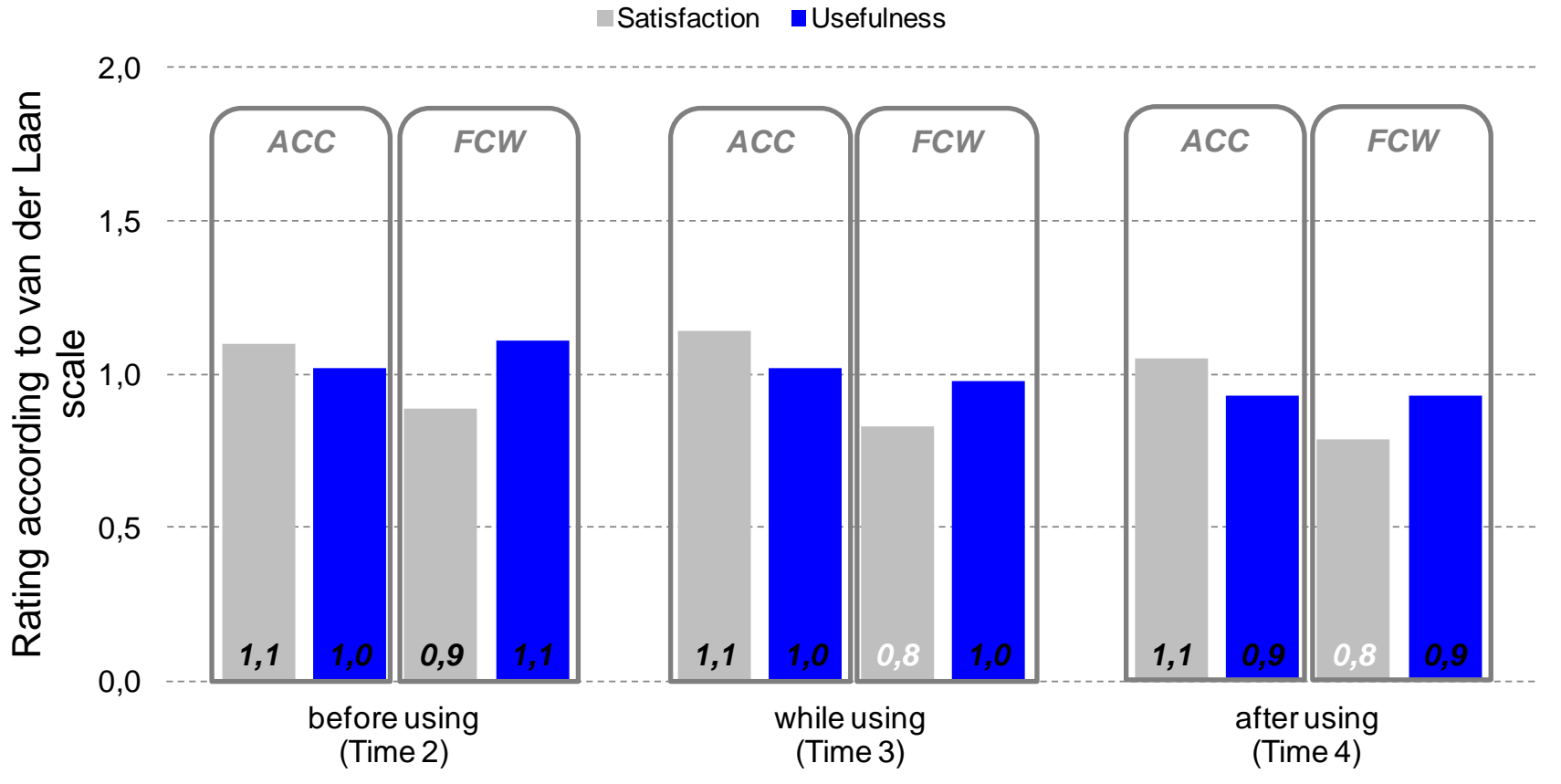
- ♂ Drivers use ACC more often and longer over time
- ♂ Slight decrease of overriding the ACC (not significant)
- ♂ Drivers report no change of ACC usage

Rating of acceptance indicators



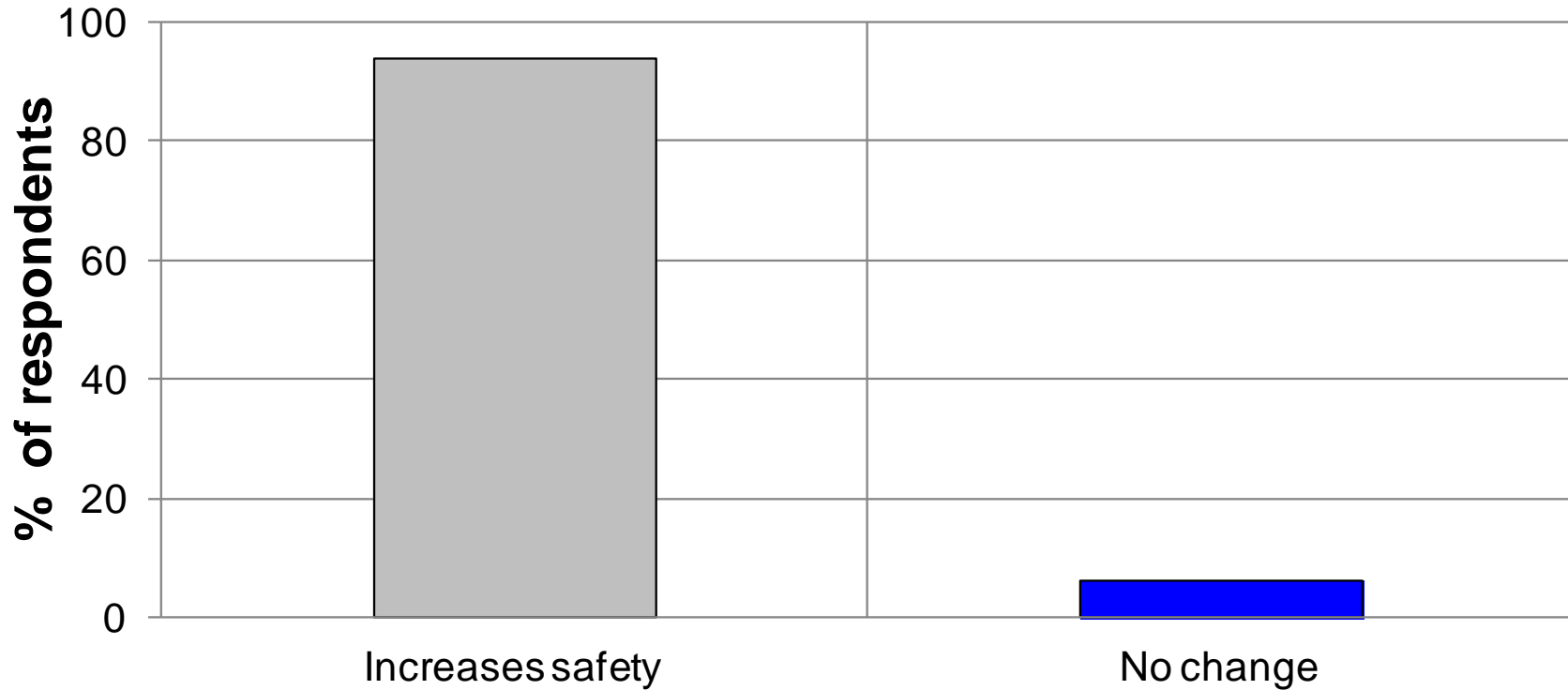
- ⌘ Acceptance rating positive for ACC and FCW
- ⌘ Van der Laan scale ranges from -2 to +2

Acceptance - change over time



- ⌘ No significant changes over time for ACC and FCW
- ⌘ Acceptance rating of ACC and FCW is very positive

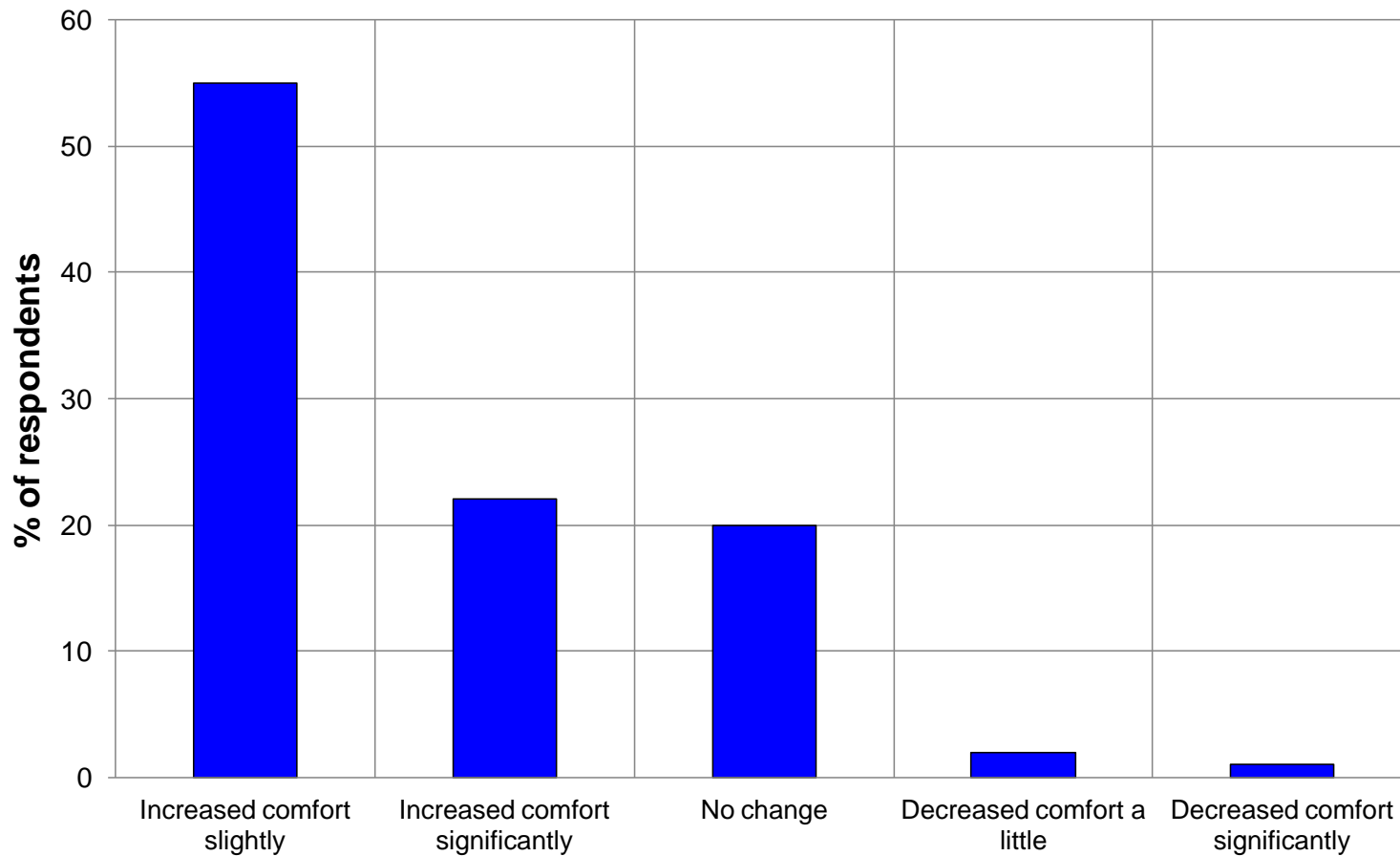
Perceived driving safety



ACC leads to an increase of perceived driving safety:

8 94% of drivers feel that ACC increases safety

Perceived driving comfort



ACC leads to an increase of perceived driving comfort:

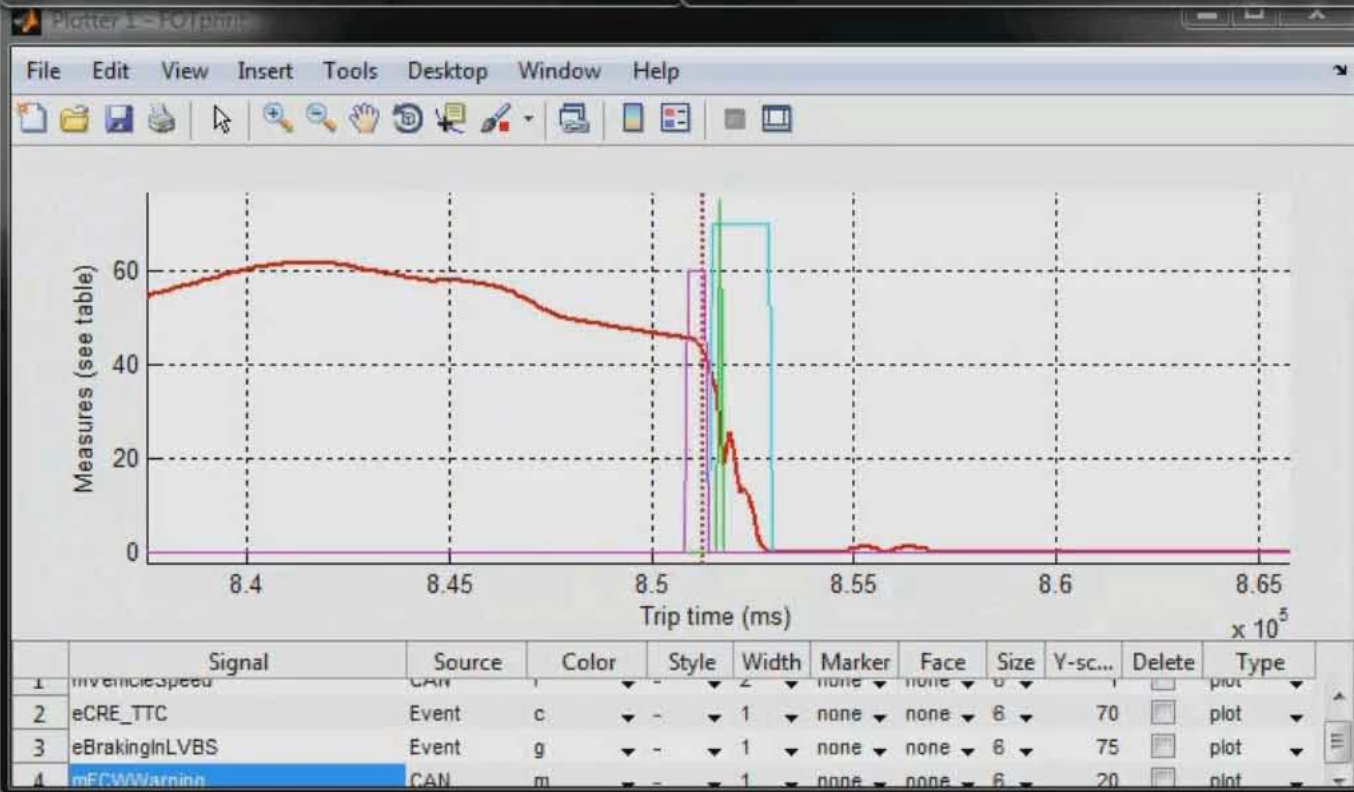
8 77% of drivers feel that ACC increases comfort

Conclusion ACC

- ♂ Acceptance in terms of perceived usefulness and satisfaction is high (stable over time)
- ♂ Driver expectations were fulfilled
- ♂ More than 75% of the driver feel that driving comfort and safety increases
- ♂ ACC perceived to be most useful on motorways
- ♂ ACC has a positive influence on driver behaviour (increased THW), which leads to increased safety
- ♂ Fuel consumption is reduced when driving with ACC

Conclusion FCW

- ♂ Almost 70% of drivers feel that FCW increases safety
- ♂ High expectations of drivers are mostly fulfilled
- ♂ Acceptance (usefulness, satisfaction) is high and stable over time
- ♂ FCW is perceived to be most useful on motorways
- ♂ Drivers were not all positive to the audio-visual warning



8 Functionalities, 28 Partners, 1000 Vehicles

1 Field Operational Test, 8 Functionalities

28 Partners, 1000 Vehicles, 1 Field Operational Test

8 Functionalities, 28 Partners, 1000 Vehicles

1 Field Operational Test, 8 Functionalities

28 Partners, 1000 Vehicles, 1 Field Operational Test

8 Functionalities, 28 Partners, 1000 Vehicles

1 Field Operational Test

