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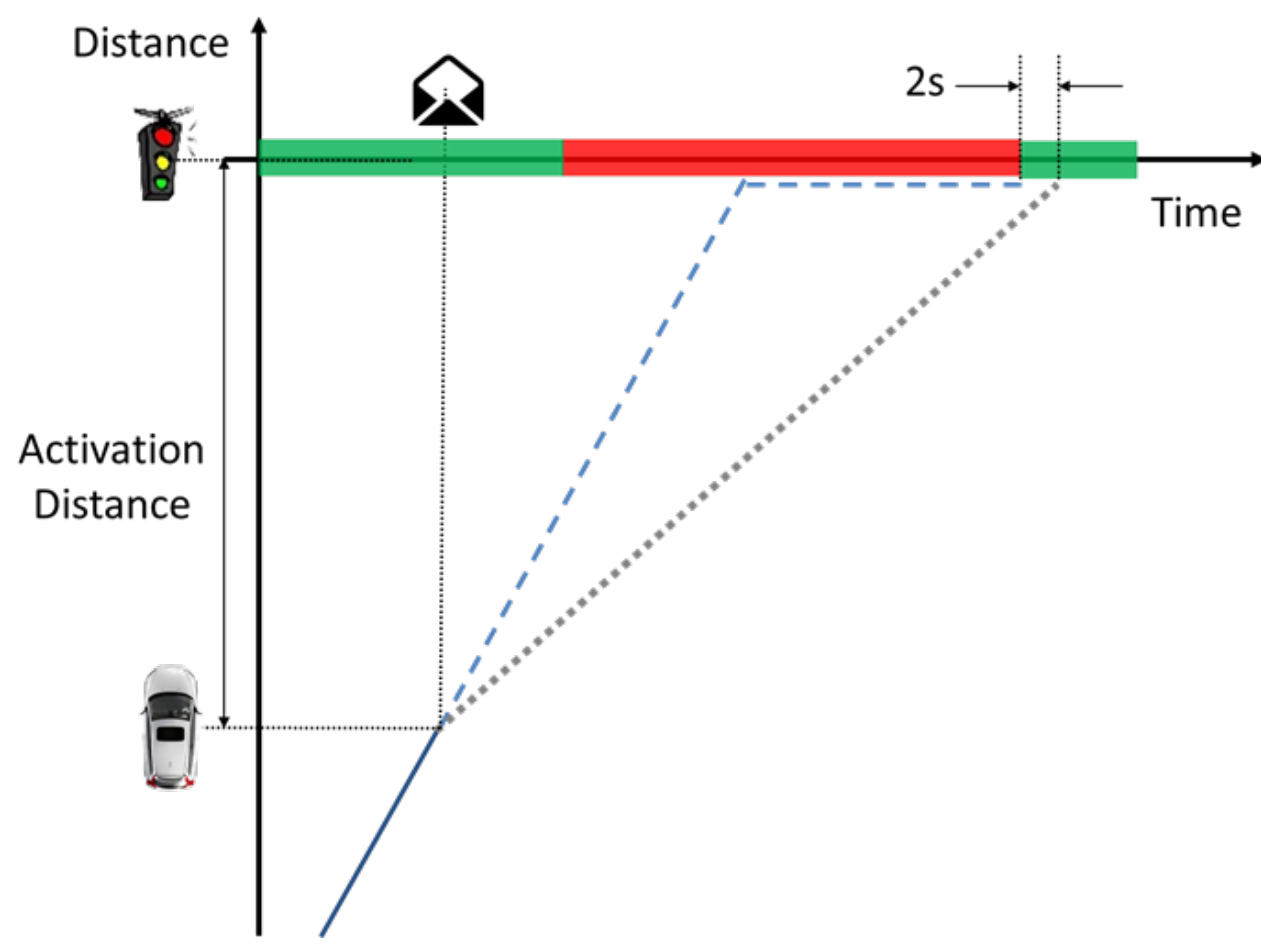
Field Operation Test Analysis of Connected Drivers' Response to GLOSA Messages and Impact on Traffic Efficiency

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Introduction

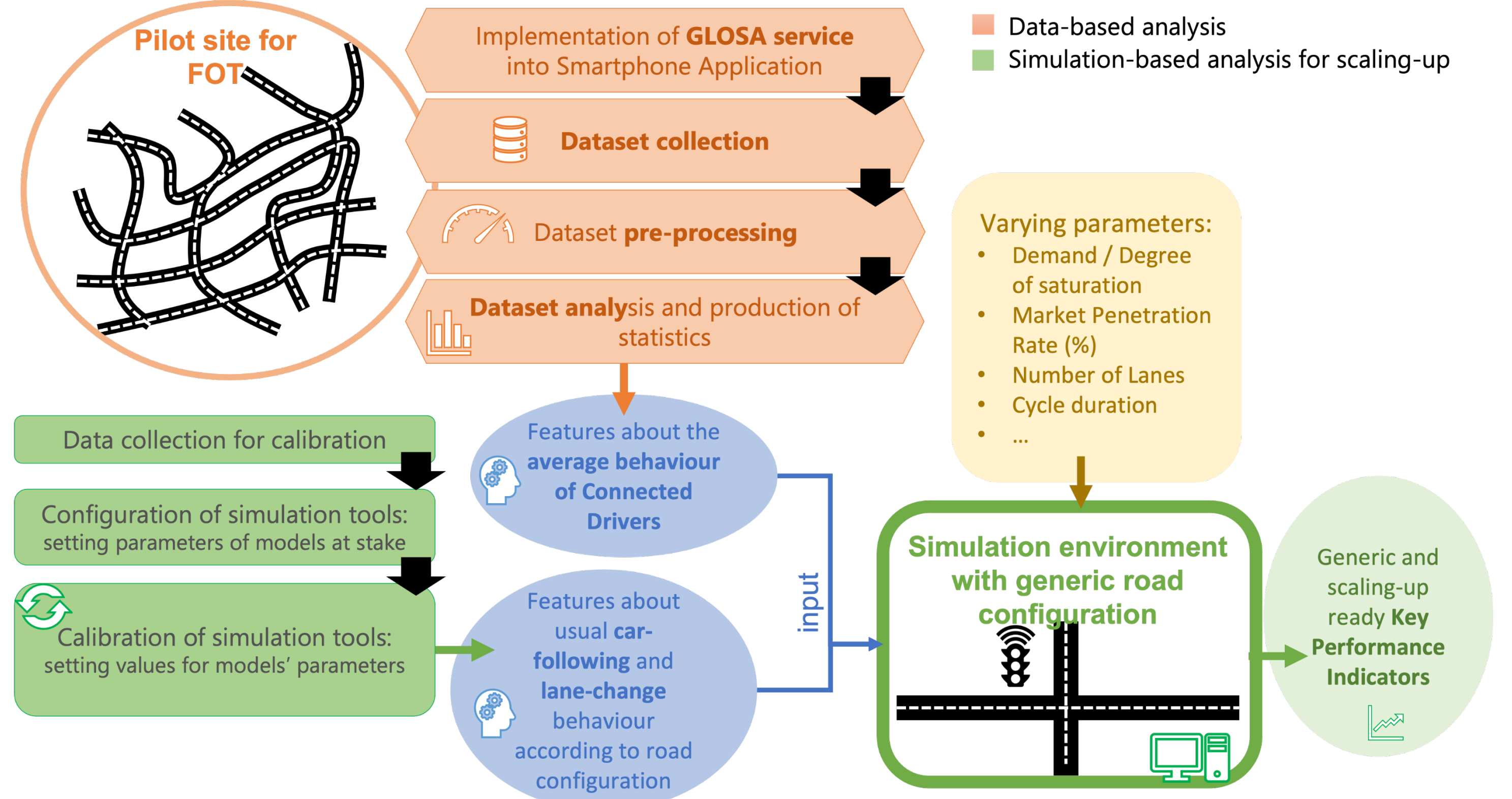
A widely-researched C-ITS service is the **Green Light Optimal Speed Advisory (GLOSA)** a.k.a. the **Eco-Cooperative Adaptive Cruise Control (Eco-CACC)**, provided to connected vehicles near signalized intersections



Two **primary objectives** were aimed in this study:

- Investigate the driver response behavior to GLOSA messages in a real-world naturalistic driving environment.
- Incorporate the driver response behavior in an integrated simulation environment to extend the results to generic situations and to scale up the assessed impacts.

Methodology



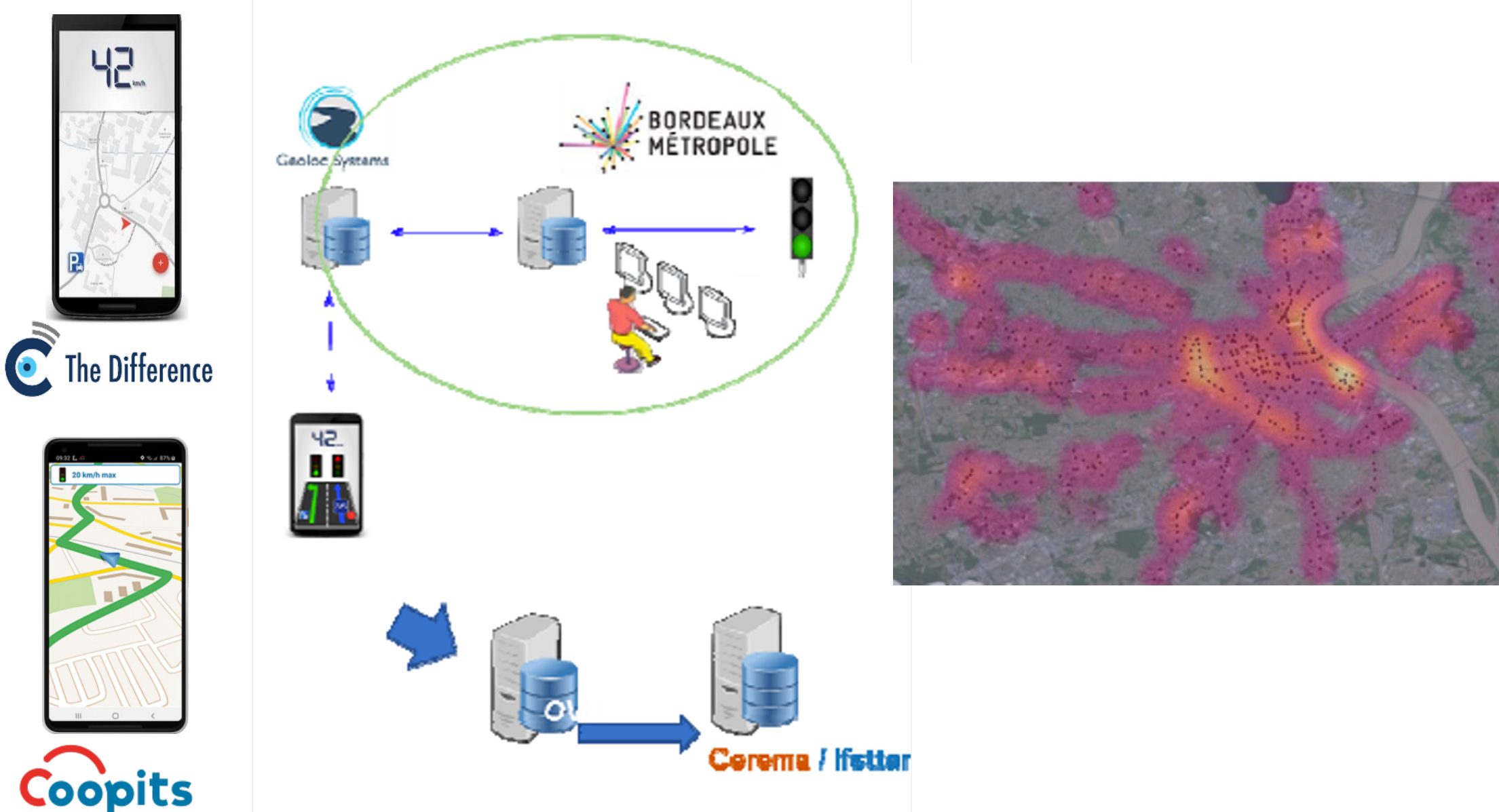
A 2-Phase Methodology

Results

Database Development

European projects **C-The-Difference** and **C-Roads**

- Bordeaux Métropole, France
- 600+ drivers



Response Rate

Average = 70%

Variable	Coefficient	S.E.	t	P> t	
Intercept	1.4566	0.409	3.565	0.000	
Rou_{CV}	LT	-0.2368	0.197	-1.201	0.230
N_b		-0.1357	0.125	-1.089	0.276
$Accel$		0.5612	0.145	3.862	0.000
D_{SL}	300m	-0.0966	0.396	-0.244	0.807
	250m	0.6634	0.399	1.663	0.096
	200m	0.8843	0.377	2.344	0.019
	150m	1.1664	0.377	3.095	0.002
	100m	0.8915	0.381	2.338	0.019
Sp_{diff}	25kmph	0.2559	0.247	1.036	0.300
	20kmph	0.3522	0.234	1.505	0.132
	15kmph	0.6298	0.216	2.910	0.004
	10kmph	0.5503	0.193	2.855	0.004
	5kmph	0.1818	0.175	1.040	0.299

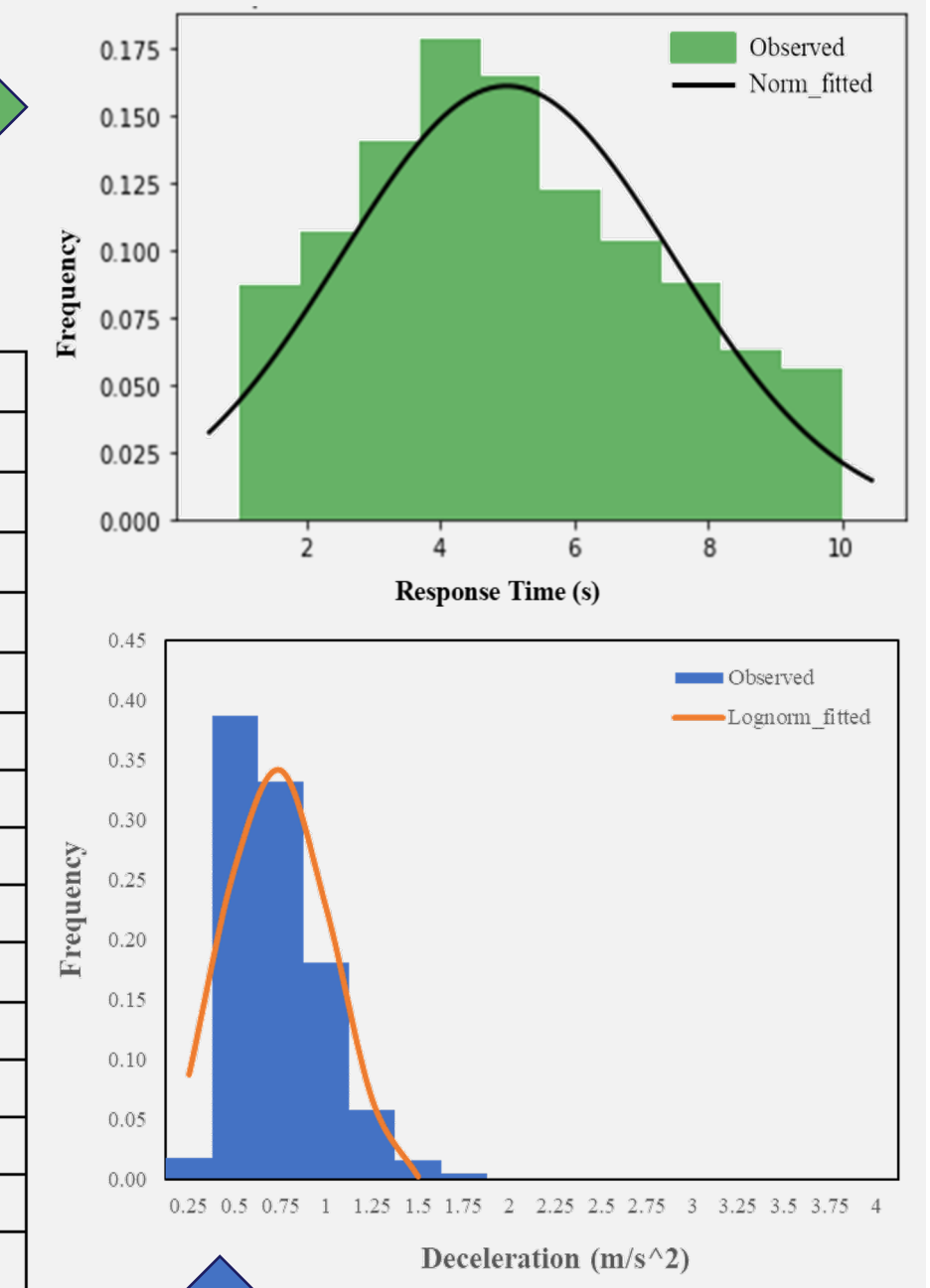
Log-likelihood = -770.21
McFadden Pseudo R-squared = 0.045

Response Time

Average = 5s, SD = 2.5s

Variable	Coefficient	S.E.	t	P> t	
Intercept	3.4995	0.608	5.76	0.000	
t_{peak}		-0.3374	0.288	-1.172	0.242
Rou_{CV}	LT	0.3666	0.264	1.387	0.166
$Accel$		0.9969	0.16	6.224	0.000
D_{SL}	300m	1.6071	0.654	2.458	0.014
	250m	1.4983	0.634	2.365	0.018
	200m	1.6094	0.609	2.644	0.008
	150m	1.1652	0.603	1.933	0.054
	100m	0.6429	0.61	1.053	0.292
Sp_{diff}	25kmph	-0.547	0.329	-1.664	0.096
	20kmph	-0.5396	0.299	-1.804	0.072
	15kmph	-0.2382	0.26	-0.917	0.36
	10kmph	-0.1461	0.239	-0.612	0.541
	5kmph	-0.2662	0.236	-1.128	0.26

Adjusted R-squared = 0.070



Speed Compliance

Average = 75%

Variable	Coefficient	S.E.	t	P> t	
Intercept	0.9448	0.075	12.552	0.000	
t_{peak}		0.0316	0.031	1.014	0.311
Rou_{CV}	RT	-0.067	0.028	-2.385	0.017
N_b		-0.0348	0.018	-1.964	0.05
$Accel$		-0.0842	0.018	-4.806	0.000
D_{SL}	300m	0.0538	0.072	0.743	0.458
	250m	0.0394	0.07	0.56	0.576
	200m	0.093	0.068	1.373	0.17
	150m	0.1141	0.067	1.698	0.09
	100m	0.1252	0.068	1.843	0.066
Sp_{diff}	25kmph	-0.3462	0.036	-9.722	0.000
	20kmph	-0.4063	0.033	-12.406	0.000
	15kmph	-0.2386	0.028	-8.403	0.000
	10kmph	-0.1687	0.026	-6.465	0.000
	5kmph	-0.0678	0.026	-2.625	0.009

Adjusted R-squared = 0.223

For best response

- Short Activation Distance (**b/w 150-200m**)
- Moderate Speed Difference (**b/w 10-20kmph**)

Deceleration

Average = 0.61m/s²

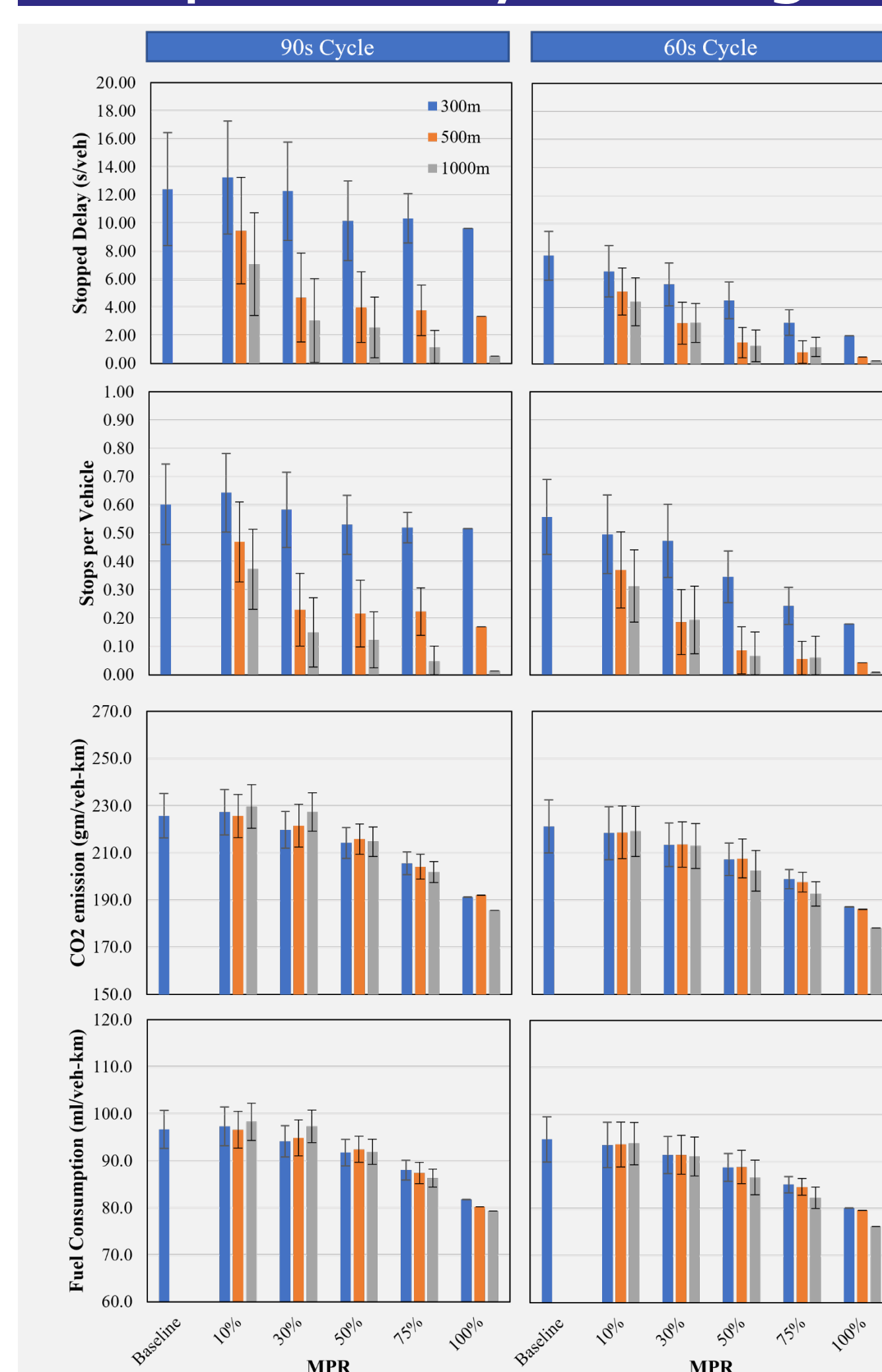
Variable	Coefficient	S.E.	t	P> t	
Intercept	0.4492	0.082	5.478	0.000	
t_{peak}		0.0506	0.032	1.586	0.113
Sp_{av}		0.0026	0.001	2.764	0.006
$Accel$		0.0424	0.018	2.365	0.018
D_{SL}	300m	-0.1832	0.074	-2.466	0.014
	250m	-0.1372	0.072	-1.9	0.058
	200m	-0.0462	0.069	-0.666	0.506
	150m	-0.0019	0.069	-0.027	0.978
	100m	0.0478	0.07	0.687	0.492
Sp_{diff}	25kmph	0.171	0.036	4.687	0.000
	20kmph	0.0186	0.034	0.554	0.58
	15kmph	0.0702	0.029	2.41	0.016
	10kmph	0.0541	0.027	2.023	0.043
	5kmph	0.0154	0.026	0.582	0.561

Adjusted R-squared = 0.087

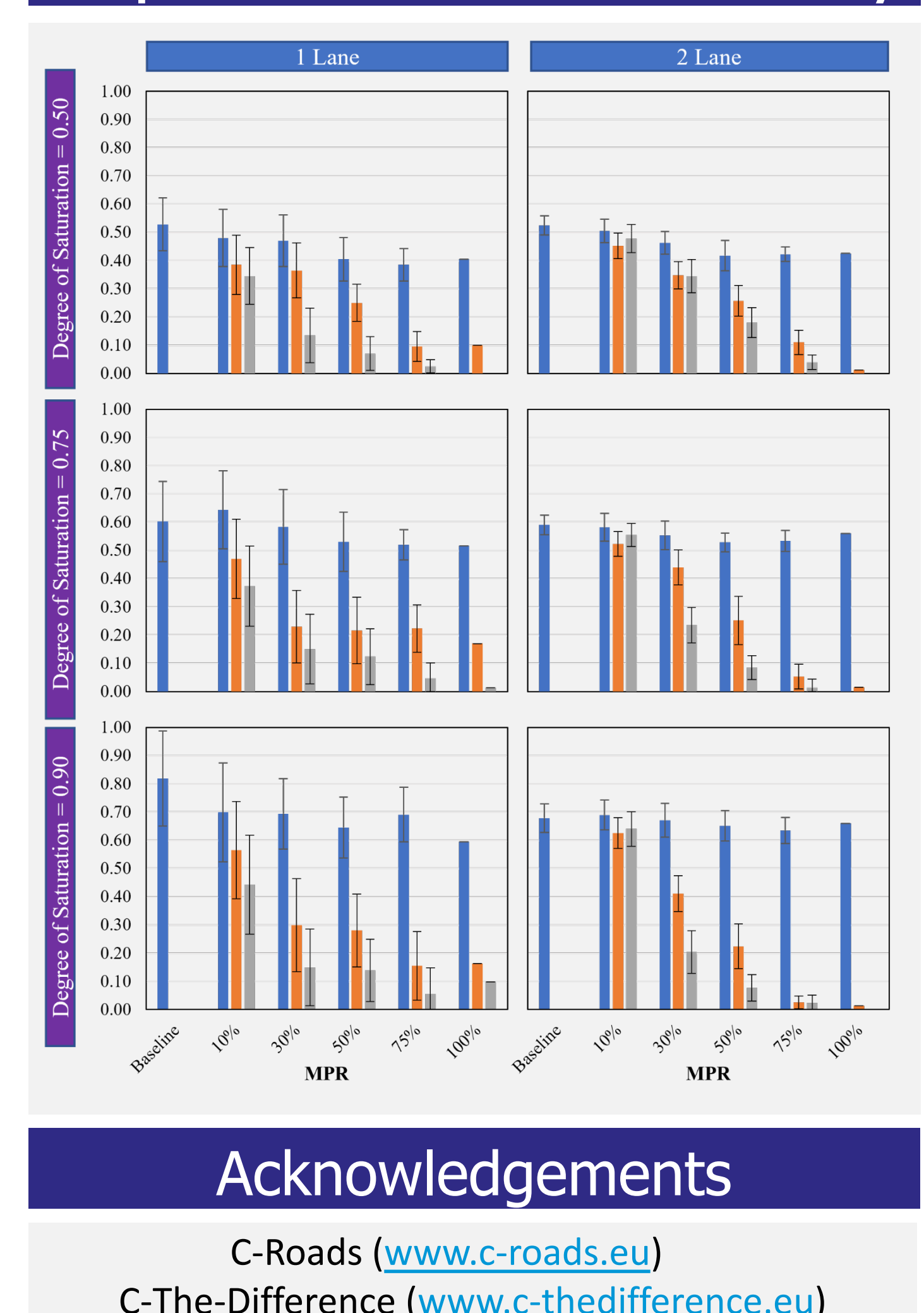
Data Pre-Processing

- GLOSA Advice = 'V' (with speed)
- Traj. Dur. >= 4s bef. first broadcast
- Traj. Dur. >= 10s b/w first & last broadcast
- Speed at first broadcast >= 20 kmph
- Upstream speed change < -3km/h
- Speed after slowdown operation >= 10 kmph

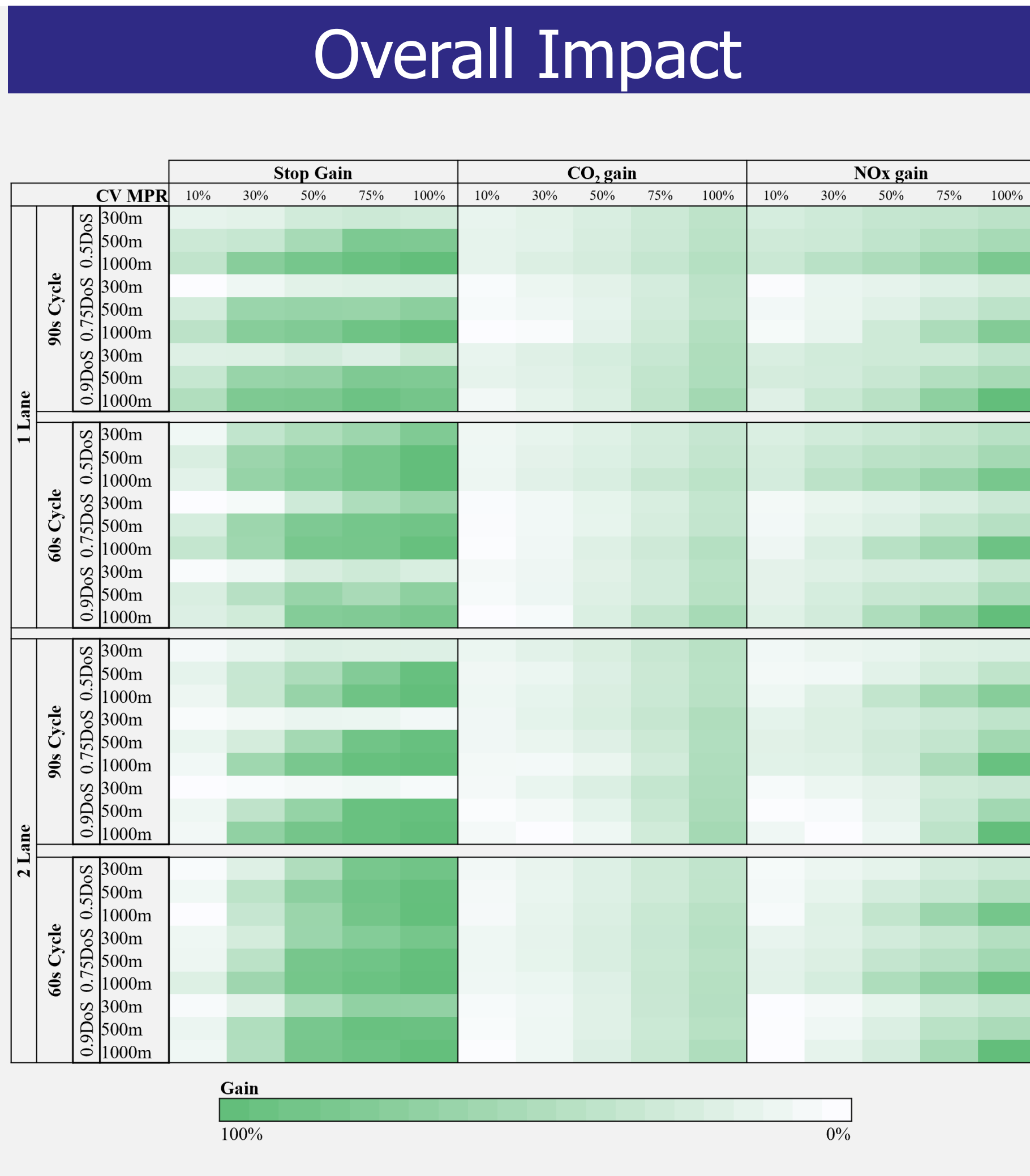
Impact of Cycle Length



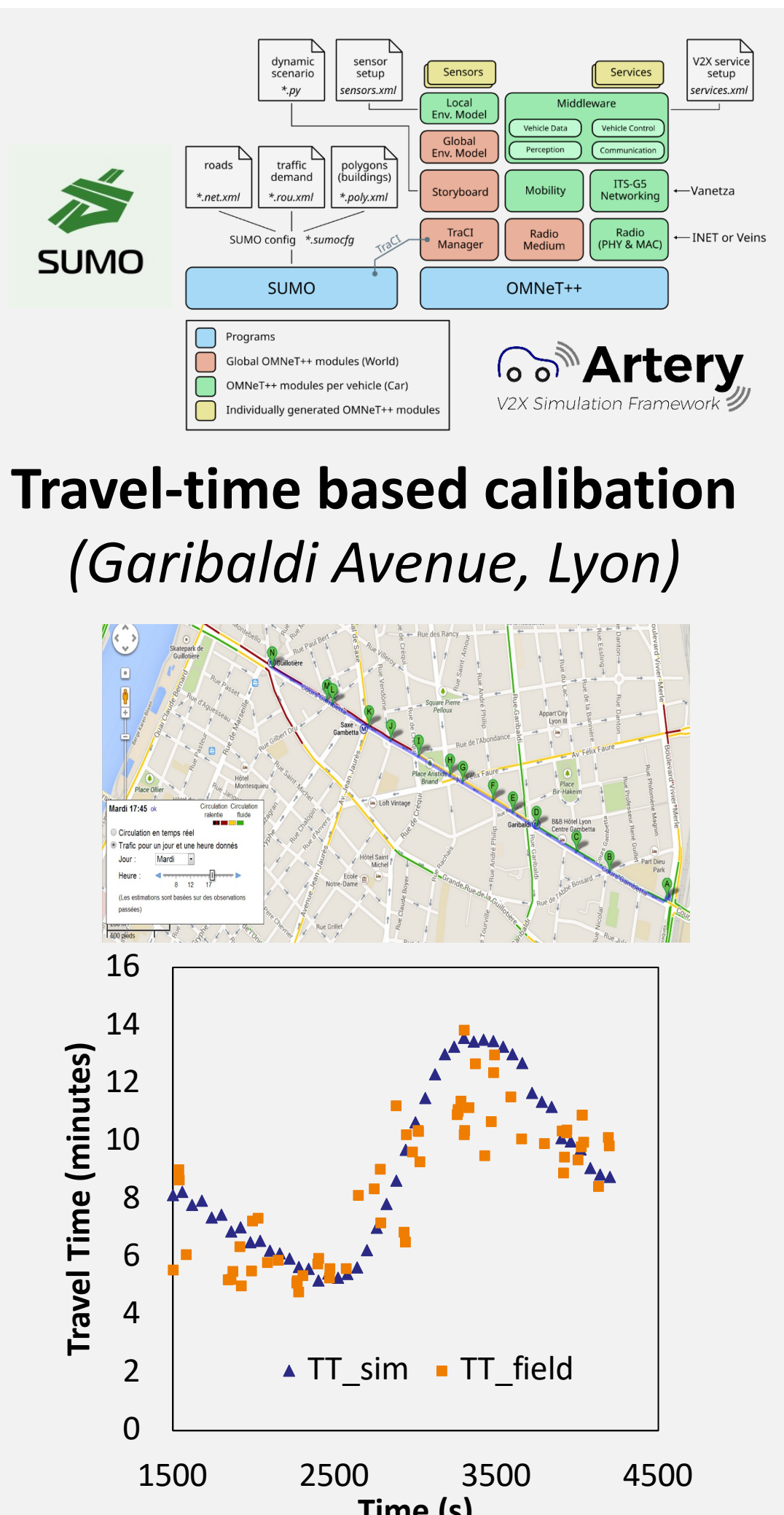
Impact of Lane Availability



Overall Impact



ScalingUp



Acknowledgements

C-Roads (www.c-roads.eu)
 C-The-Difference (www.c-the-difference.eu)