



C-ROADS – DEPLOYMENT OF C-ITS SERVICES THROUGHOUT EUROPE

Tamás Attila, TOMASCHEK
Head of section for traffic management
Hungarian Public Road Non-profit PLC.



URBAN
NODES
FORUM

3-4
APRIL
2019
BUDAPEST



Co-financed by the European Union
Connecting Europe Facility

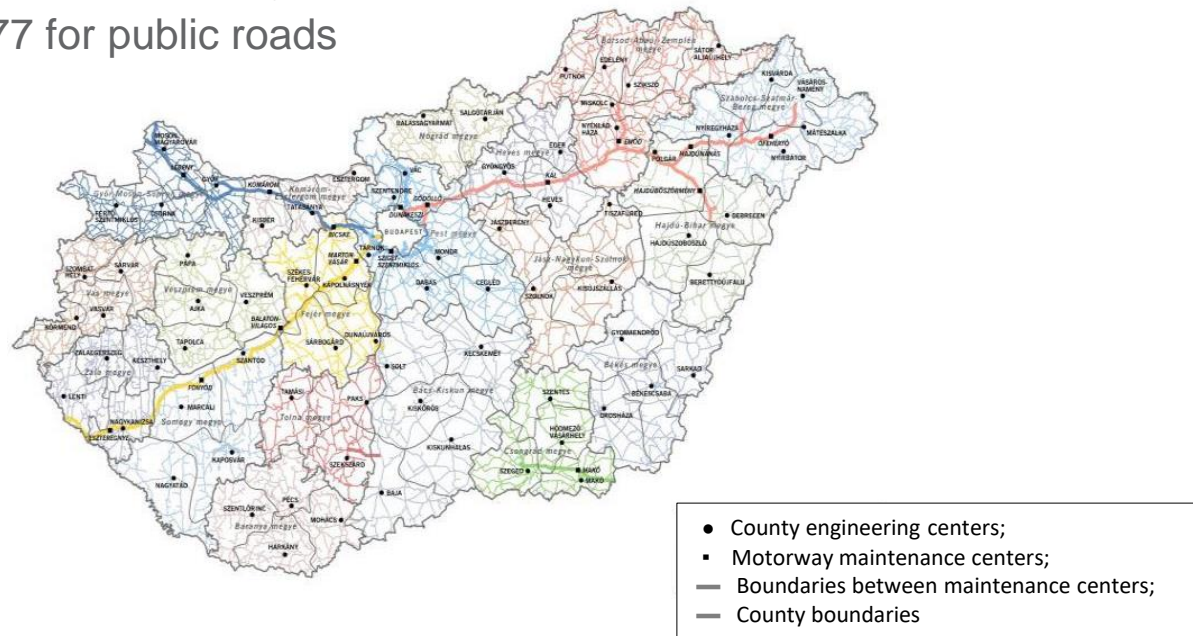
www.c-roads.eu

Road operator



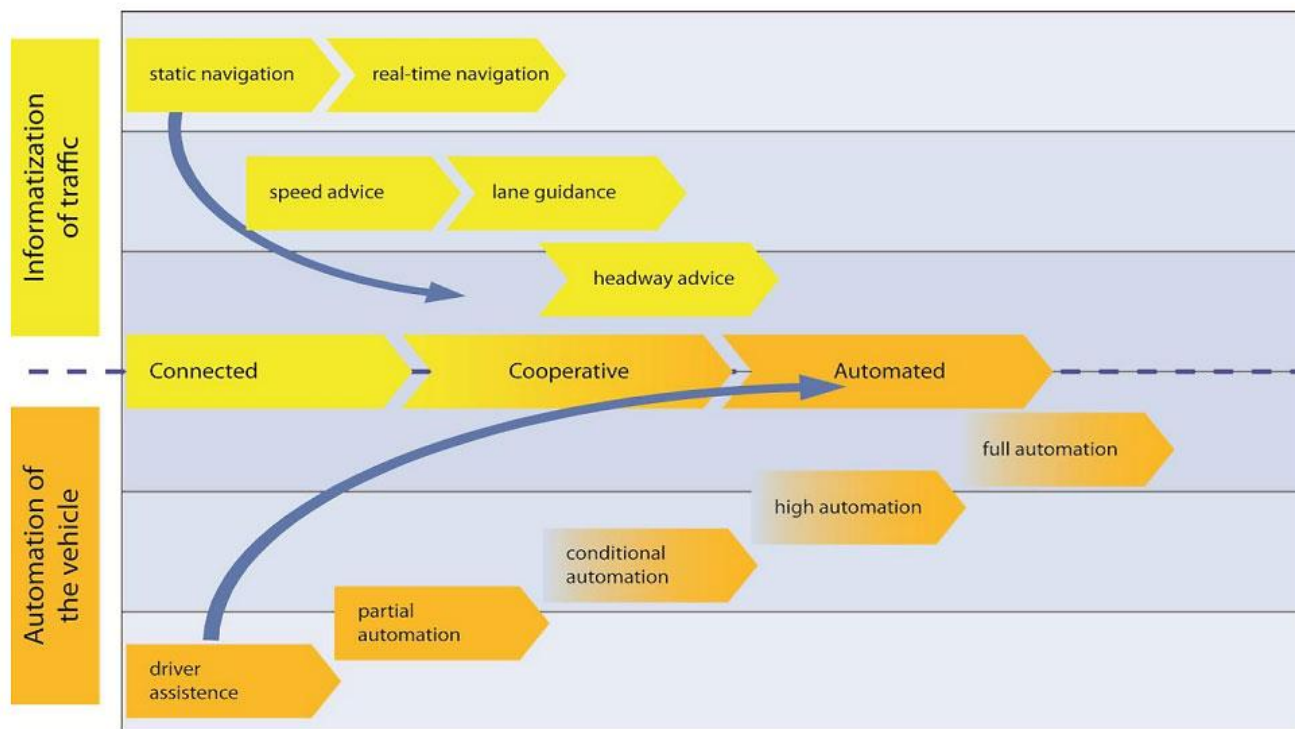
HUNGARIAN PUBLIC ROAD NONPROFIT PLC

- 19 County Directorates
- 93 Maintenance Centers
 - 16 for motorways
 - 77 for public roads



- Own employees: 5 574
- Employees involved in the public works programme: 1 590

Future trends

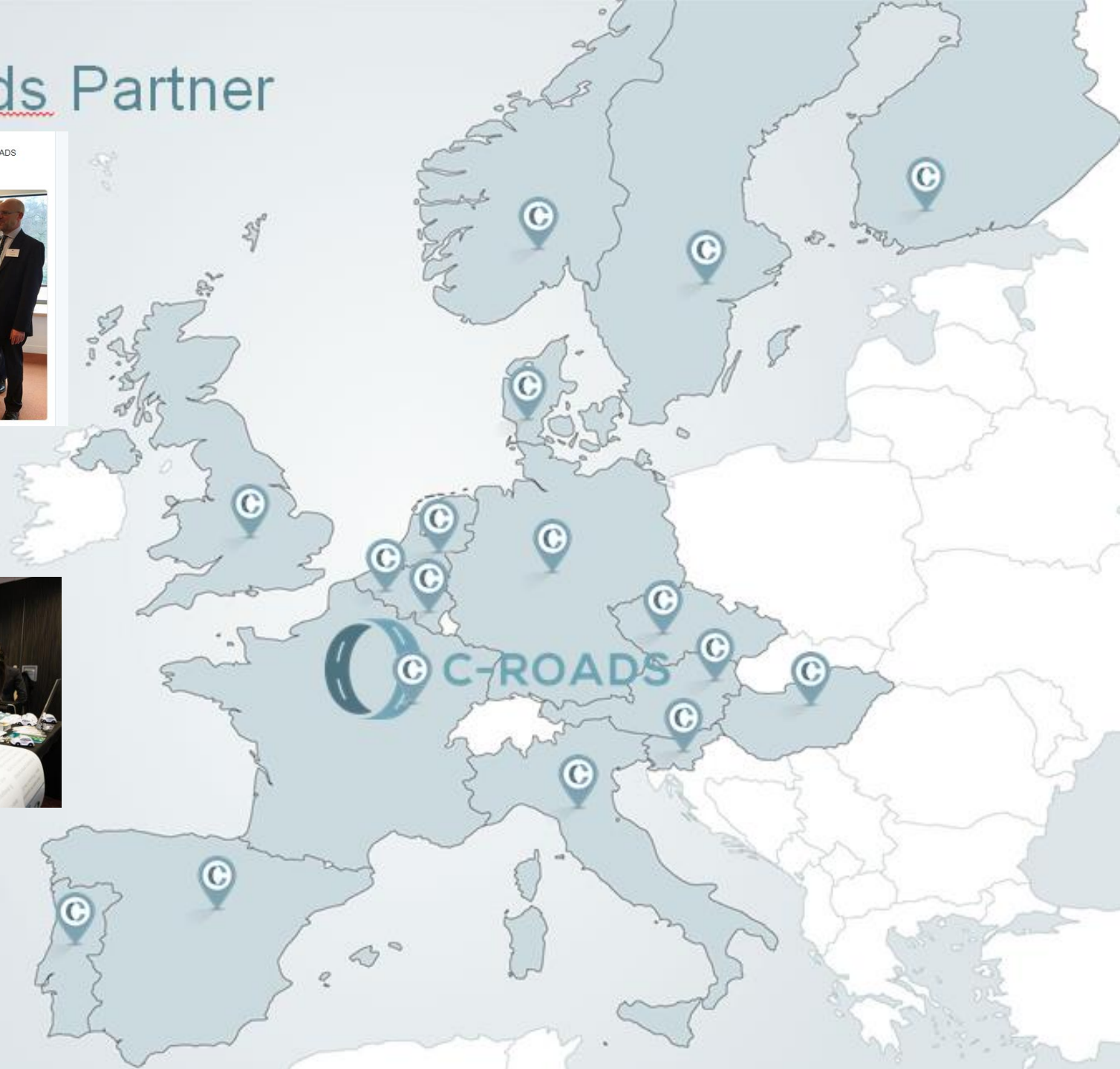


Connected, cooperative and automated driving developments should come together to harvest societal benefits.

C-Roads Partner



Violeta Bulc @Bulc_EU · 19h
I want to see cooperative vehicles on #EU roads in 2019. The C-ROADS platform will make it happen! #realITS
📍 EU Transport and INEA



C-Roads members

Core Members 2016

- Ⓒ Austria
- Ⓒ Belgium/Flanders
- Ⓒ Czech Republic
- Ⓒ France
- Ⓒ Germany
- Ⓒ Slovenia
- Ⓒ The Netherlands
- Ⓒ UK

Core Members 2017

- Ⓒ Belgium/Wallonia
- Ⓒ Denmark
- Ⓒ Finland
- Ⓒ Hungary
- Ⓒ Italy
- Ⓒ Norway
- Ⓒ Portugal
- Ⓒ Spain
- Ⓒ Sweden

Associated Members

- Ⓒ Croatia
- Ⓒ Greece
- Ⓒ Ireland
- Ⓒ Switzerland

- Ⓒ Australia
- Ⓒ Israel
- Ⓒ New Zealand
- Ⓒ Russia

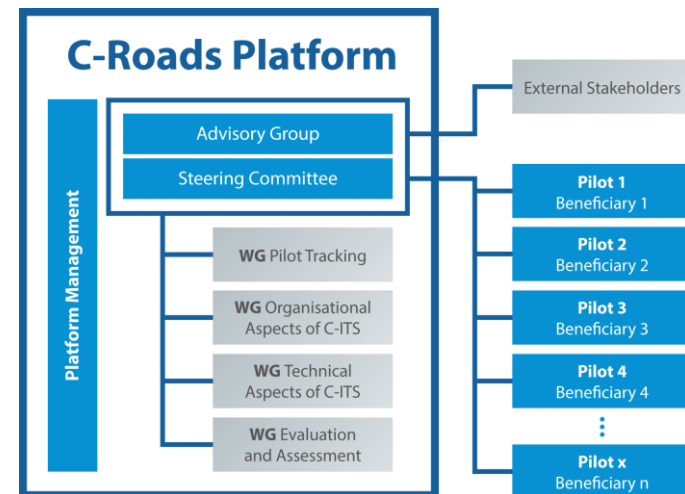


The aim of the C-Roads Platform

- Ⓒ linking all C-ITS deployments
 - Ⓒ develop, share and publish common technical specifications (including the common communication profiles),
 - Ⓒ planning intensive cross-testing to verify interoperability
 - Ⓒ develop system tests based on the common communication profiles by focusing on hybrid communication mix, which is a combination of ETSI ITS-G5 and operational cellular networks.
- ➔ And by doing so C-Roads paves the ground for making Cooperative, Connected and Automated Driving reality

Working together

- ☐ A Steering Committee, chaired by France
- ☐ WG1 : Organisational aspects, chaired by the Czech Republic
- ☐ WG2 : Technical aspects, chaired by France
 - ☐ TF1 : Security, chaired by Germany
 - ☐ TF2 : Functional specs, chaired by the Netherlands
 - ☐ TF3 : Technical specs, chaired by Austria
 - ☐ TF4 : Hybrid, chaired by Sweden
 - ☐ TF5 : Cross-site testing and validation, chaired by France
- ☐ WG3 : Evaluation, chaired by Italy



Doing cross-site testing

- Ⓒ Ex. InterCor TESTFEST in Reims (FR), April 2018
 - Ⓒ Testing secure exchange of messages cross-borders
 - Ⓒ 144 people from 11 countries
 - Ⓒ 22 OBUs, 12 RSUs
 - Ⓒ A 23 km loop with 9 events



Working on harmonised services

Day 1 C-ITS services list

Hazardous location notifications:

- Slow or stationary vehicle(s) & traffic ahead warning;
- Road works warning;
- Weather conditions;
- Emergency brake light;
- Emergency vehicle approaching;
- Other hazards.

Signage applications:

- In-vehicle signage;
- In-vehicle speed limits;
- Signal violation / intersection safety;
- Traffic signal priority request by designated vehicles;
- Green light optimal speed advisory;
- Probe vehicle data;
- Shockwave damping (falls under European Telecommunication Standards Institute (ETSI) category 'local hazard warning').

Day 1.5 C-ITS services list

- Information on fuelling & charging stations for alternative fuel vehicles;
- Vulnerable road user protection;
- On street parking management & information;
- Off street parking information;
- Park & ride information;
- Connected & cooperative navigation into and out of the city (first and last mile, parking, route advice, coordinated traffic lights);
- Traffic information & smart routing.



Brussels, 30.11.2016
COM(2016) 766 final

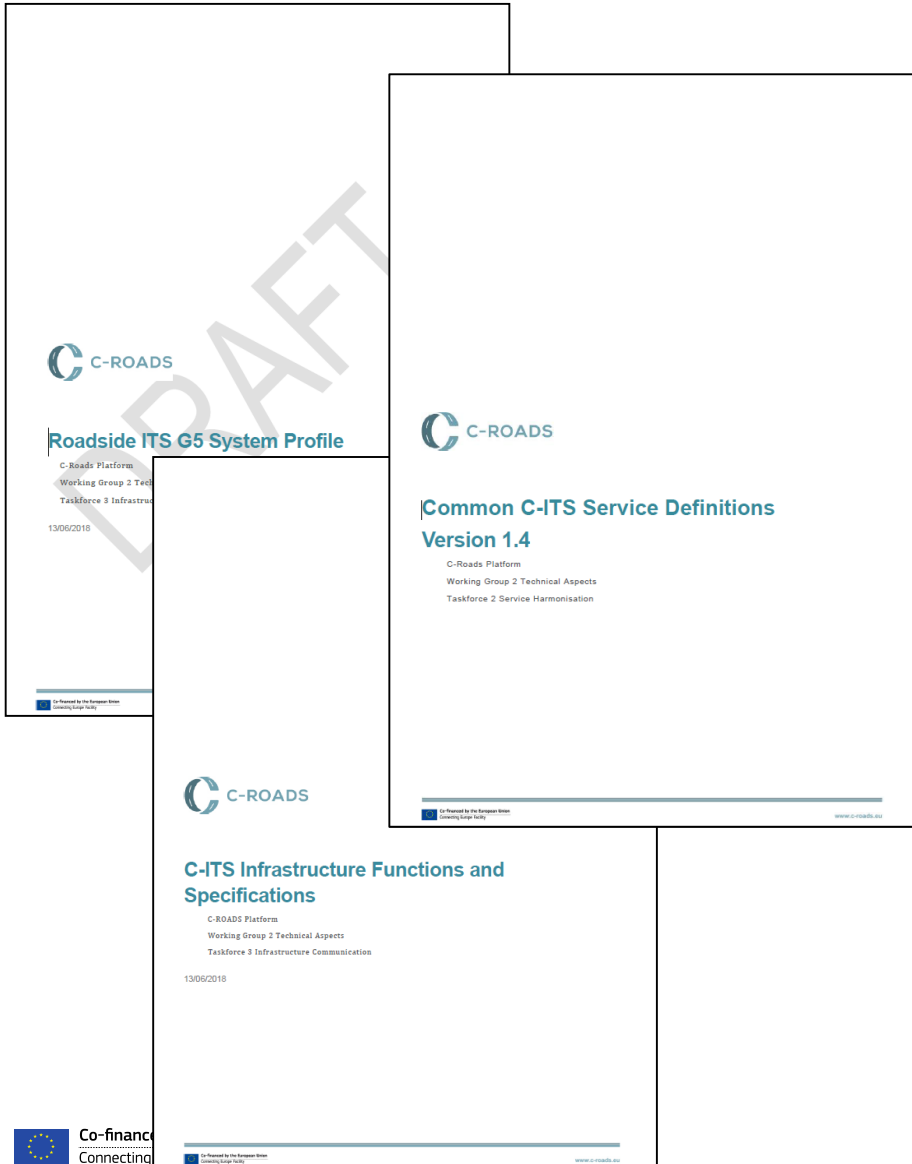
COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN
PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL
COMMITTEE AND THE COMMITTEE OF THE REGIONS

A European strategy on Cooperative Intelligent Transport Systems, a milestone towards
cooperative, connected and automated mobility

EN

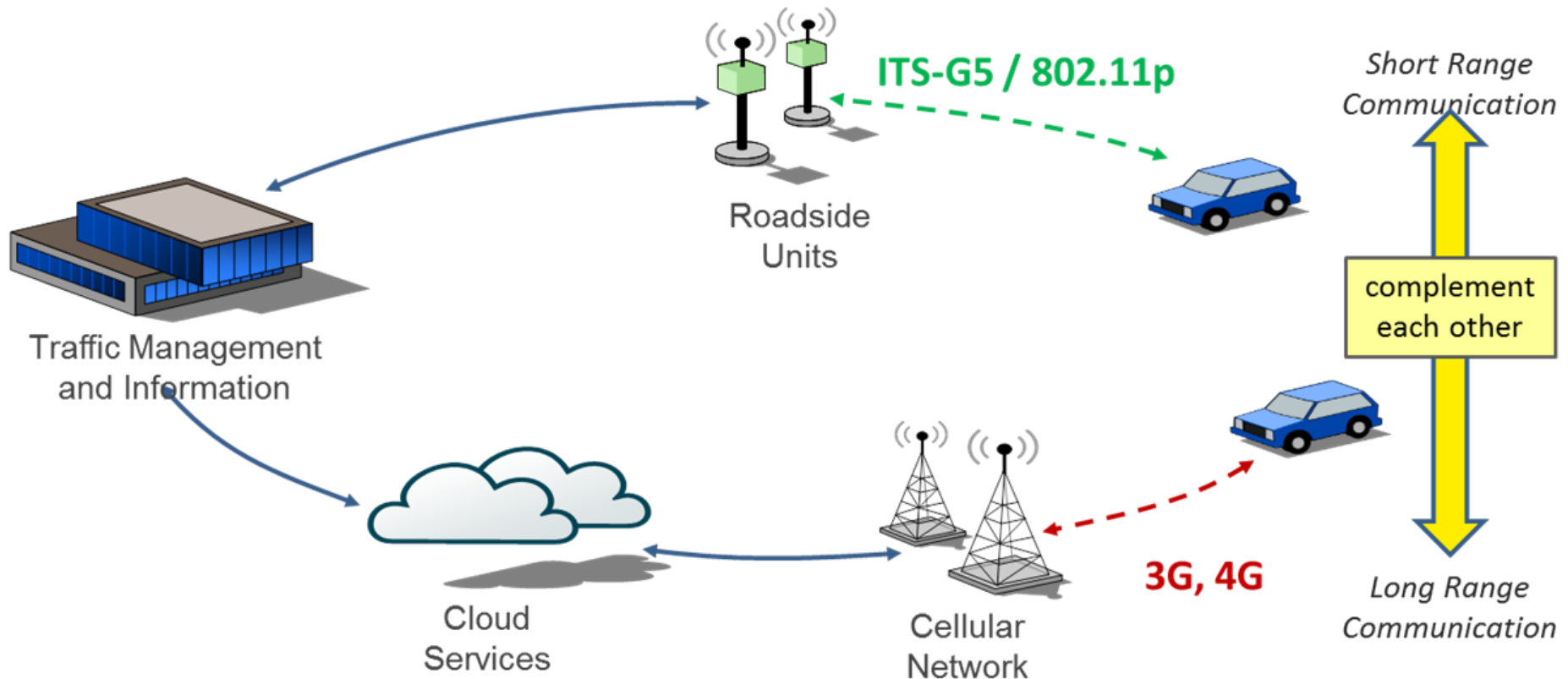
EN

Publication of the Communication Profile for ITS-G5

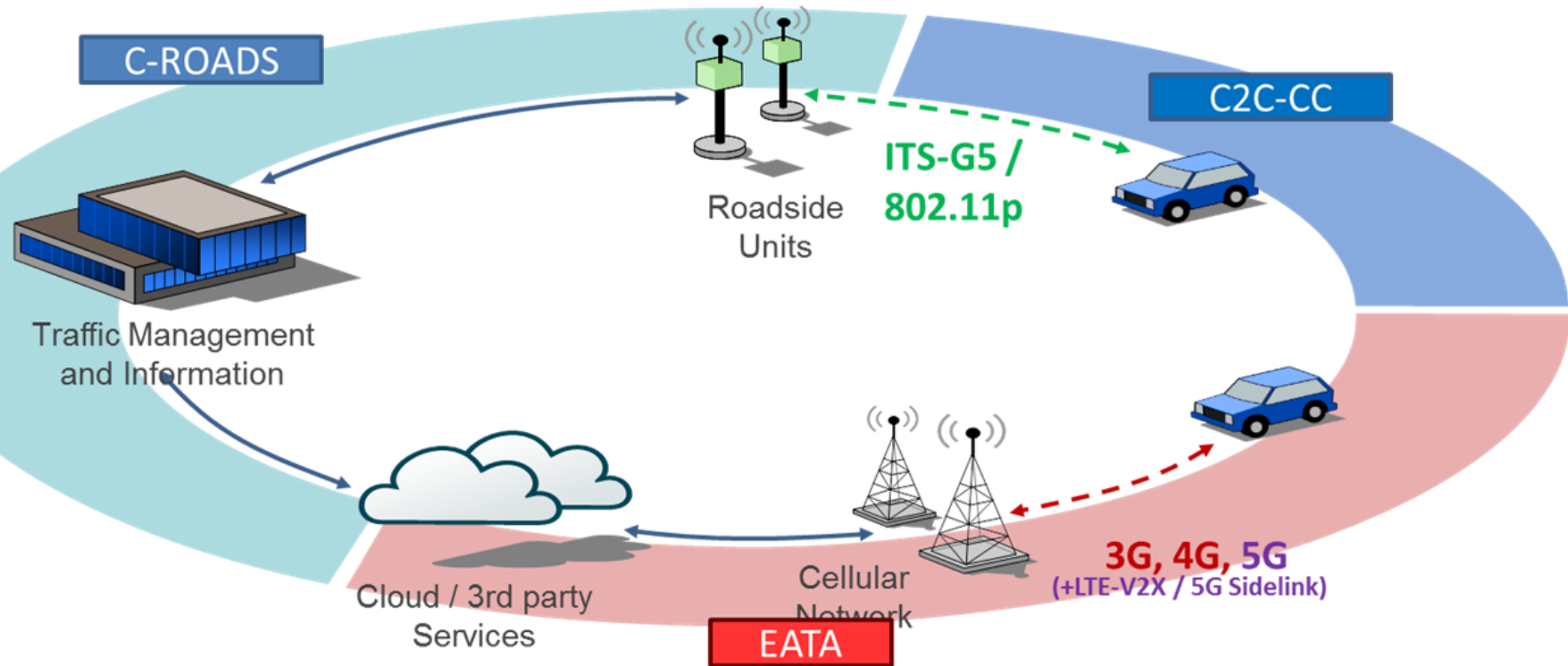


- C Rel. 1.0 published on 14th of September 2017
- C Rel. 1.1 published on 23rd of April 2018
- C Rel. 1.2 published on 9th of July 2018
- C Rel. 1.3 published on 23rd of October 2018
(harmonised with the Car 2 Car Communication Consortium)
- C Rel. 1.4 published on 31st of January 2019
- C Covering
 - C RWW – Road Works Warning
 - C IVS – In Vehicle Signage
 - C HLN – Hazardous Location Notifications
 - C SI – Signalized Intersections
- C Available via www.c-roads.eu

C-ITS based on hybrid communication mix

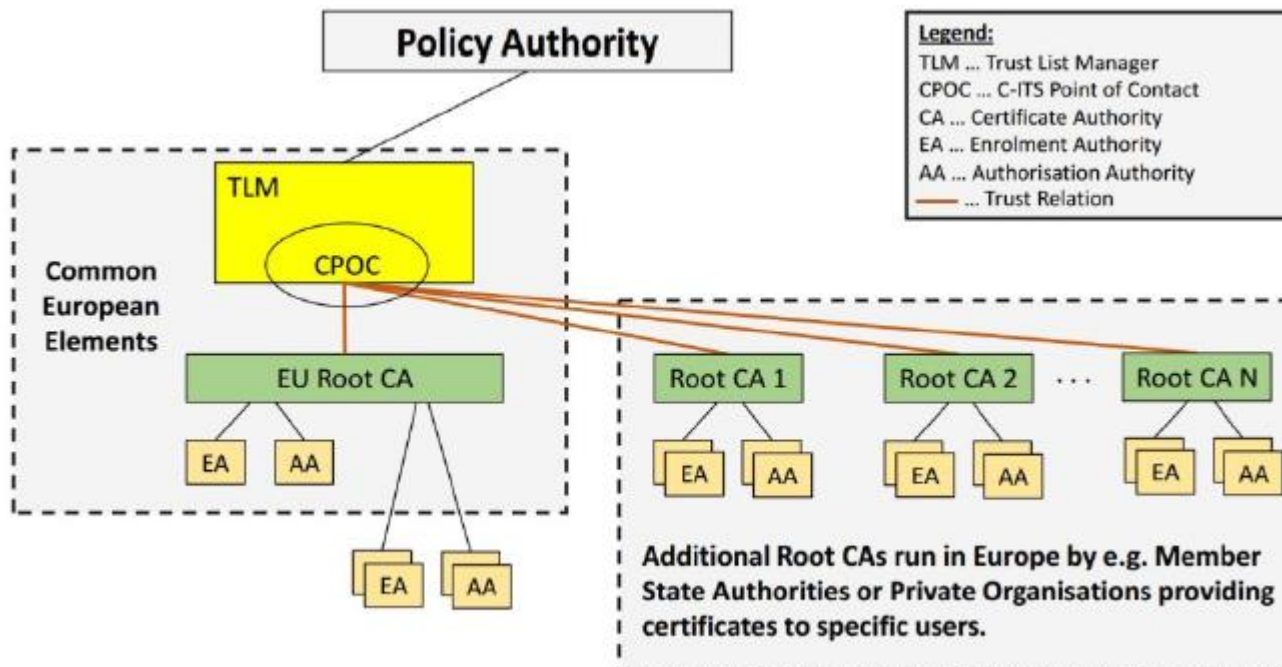


C-ITS based on hybrid communication mix



Implementing the European security mechanism

Based on two documents from the EU C-ITS Platform phase two: the Certificate Policy (CP) and its Security Policy (SP)



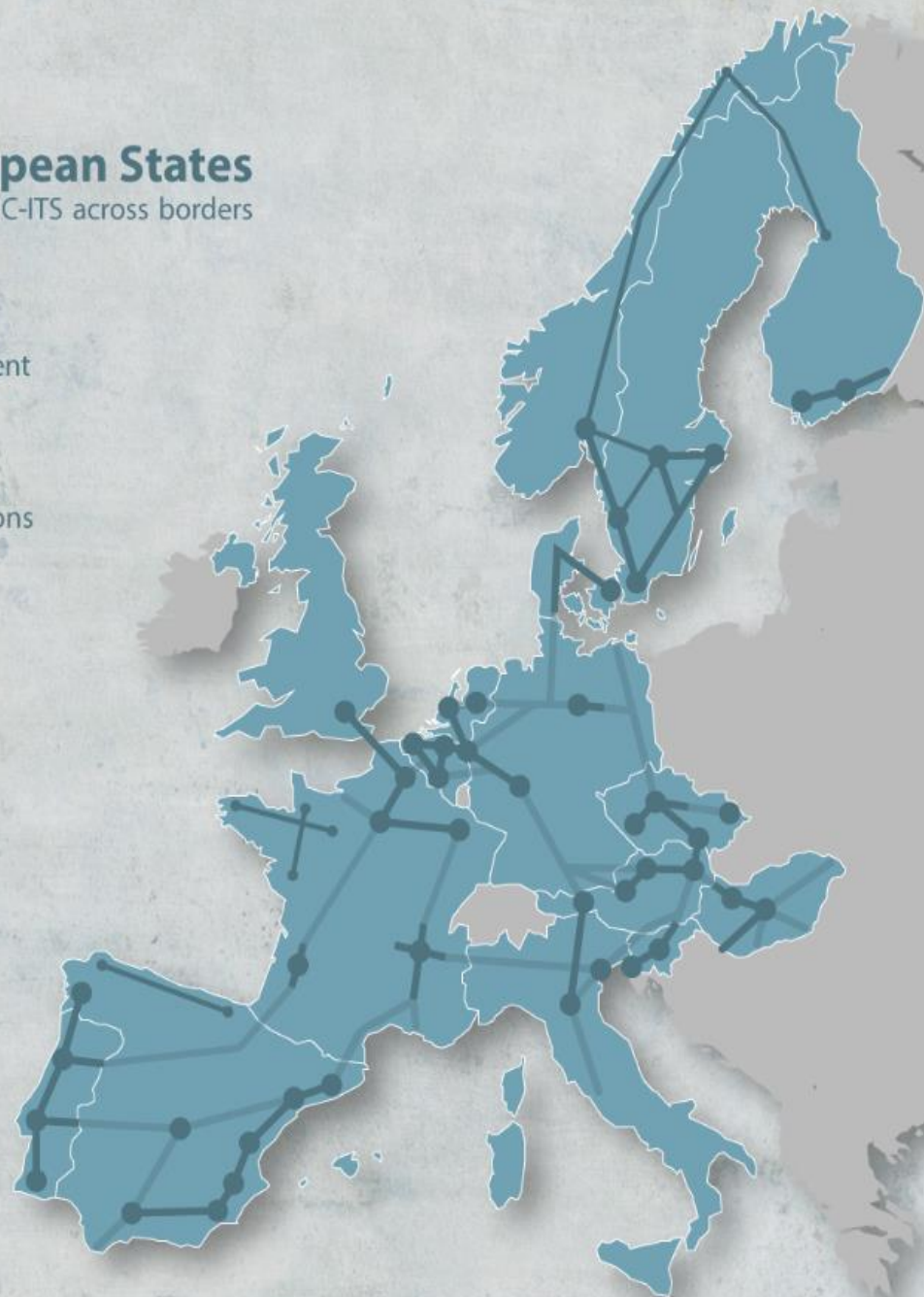
C-ROADS




By 2019
100,000 km of European roads in total will be covered by C-ITS services based on a hybrid communication mix

By 2019
6,000 km of safety-critical European road sections will be covered by short-range C-ITS services

15 cities
Starting with C-ITS deployment

16 European States
Harmonising C-ITS across borders



-  C-Roads core network pilot
-  C-Roads comprehensive network pilot
-  TEN-T core network (excerpt)

0 km 6,000 km 100,000 km

Outlook 2019

- Ⓒ Continuous procurement in 2019
- Ⓒ First C-ITS services operative by 2019
- Ⓒ Publication of the hybrid communication profile
- Ⓒ Inclusion of City Authorities
- Ⓒ Enlargement of the C-Roads Platform with new Member States
- Ⓒ Definition and Inclusion of future C-ITS services (Day 1.5 and later, including e.g. on-level railroad-crossings)

C-Roads Hungary



C Total Budget: € 1,995,431

CEF co-financing: € 1,696,116 (Co-financing rate 85%)

C Beneficiary:

Ministry for Innovation and Technology

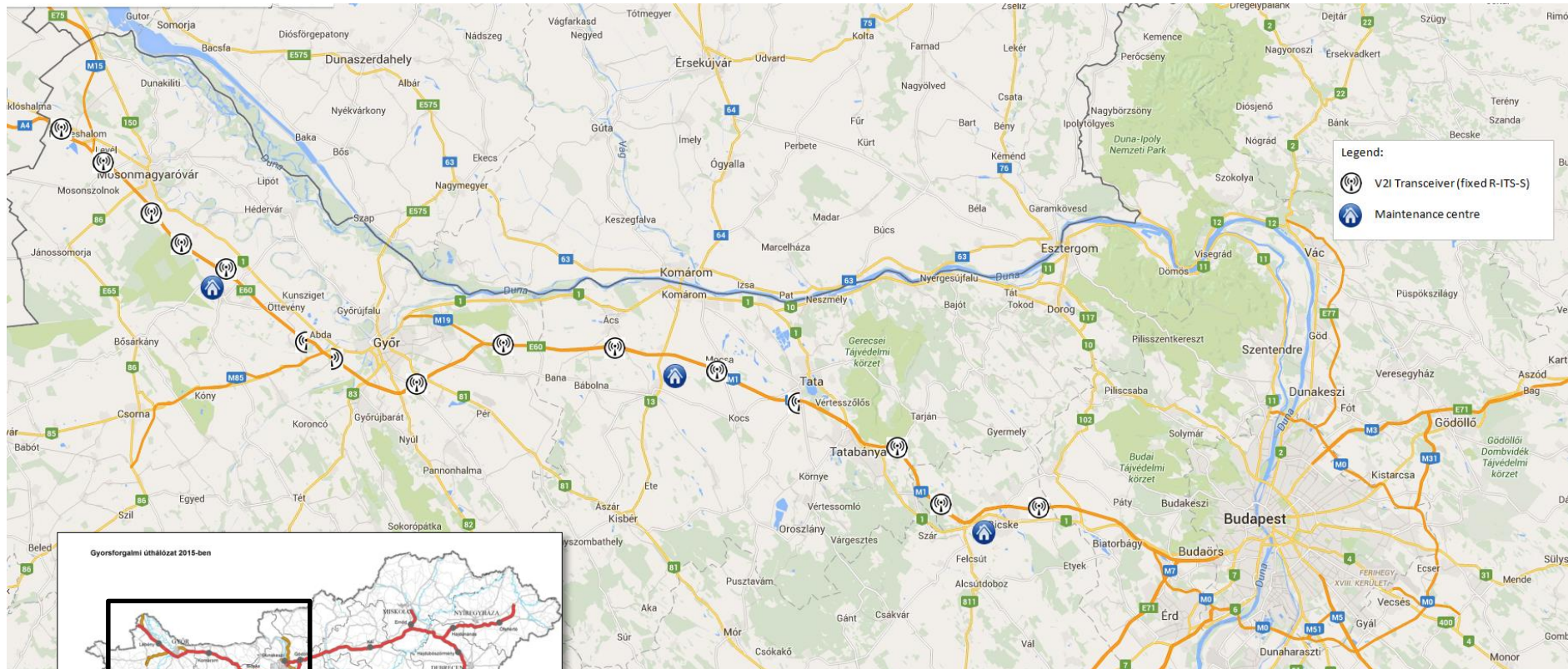


C Implementing body:

Hungarian Public Road Non-profit PLC.

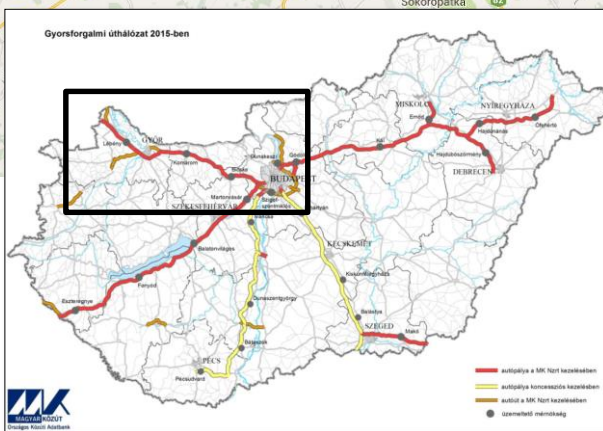


Pilot Motorway M1 (2015.)

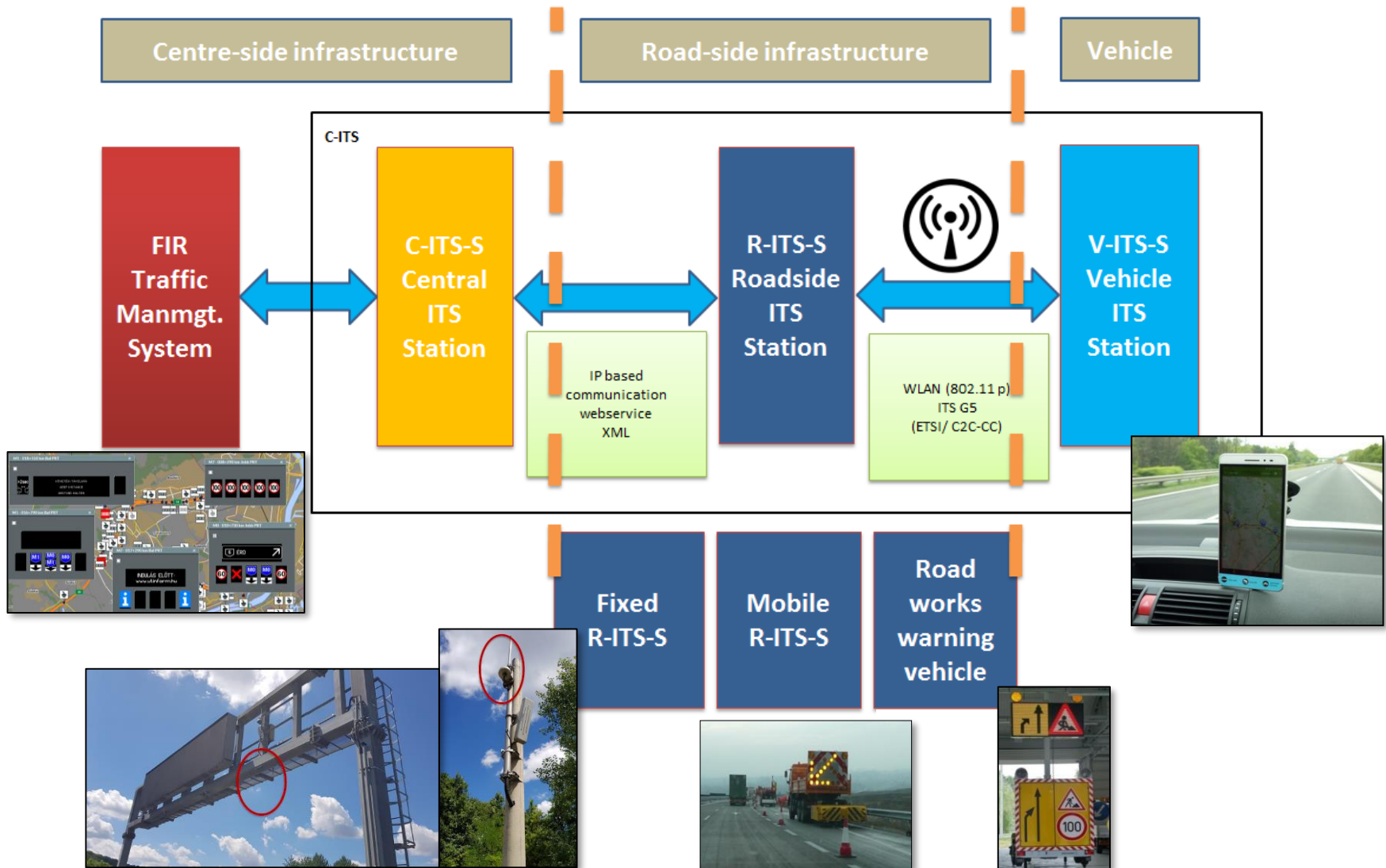


Technical details:

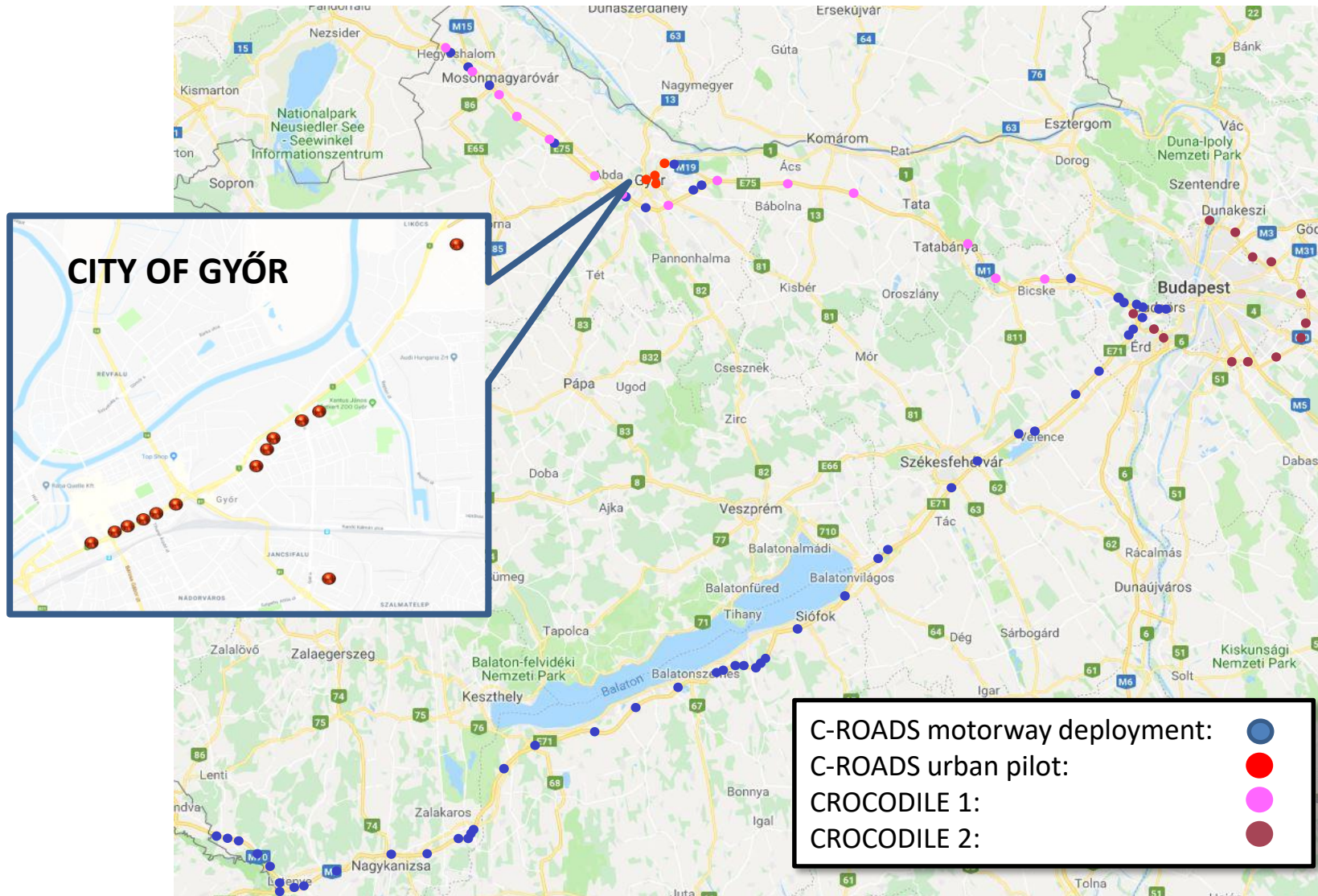
- 136 km-long-section
- 27 fixed/20 mobile RSUs – ITS-RS3-H (Commsignia)
- Communication channel: ETSI G5




System architecture








C-ITS deployment until 2020



Use cases / Communication profile (C-Roads Hungary)

-  Emergency electronic brake light
-  Emergency vehicle approaching
-  Slow or stationary vehicle
-  Traffic jam ahead warning
-  Hazardous location notification
-  Road works warning
-  Weather conditions
-  In-vehicle signage
-  Probe vehicle data
-  Shockwave damping

-  ETSI G5
-  Cellular communication (5G)
-  DAB
-  RDS
-  Wi-fi and Bluetooth

Use cases (1.)

- ❌ Emergency electronic brake light
- ❌ Emergency vehicle approaching
- ❌ Slow or stationary vehicle
- ✅ Traffic jam ahead warning
- ✅ Hazardous location notification
- ✅ Road works warning
- ✅ Weather conditions
- ✅ In-vehicle signage
- ✅ Probe vehicle data
- ❌ Shockwave damping

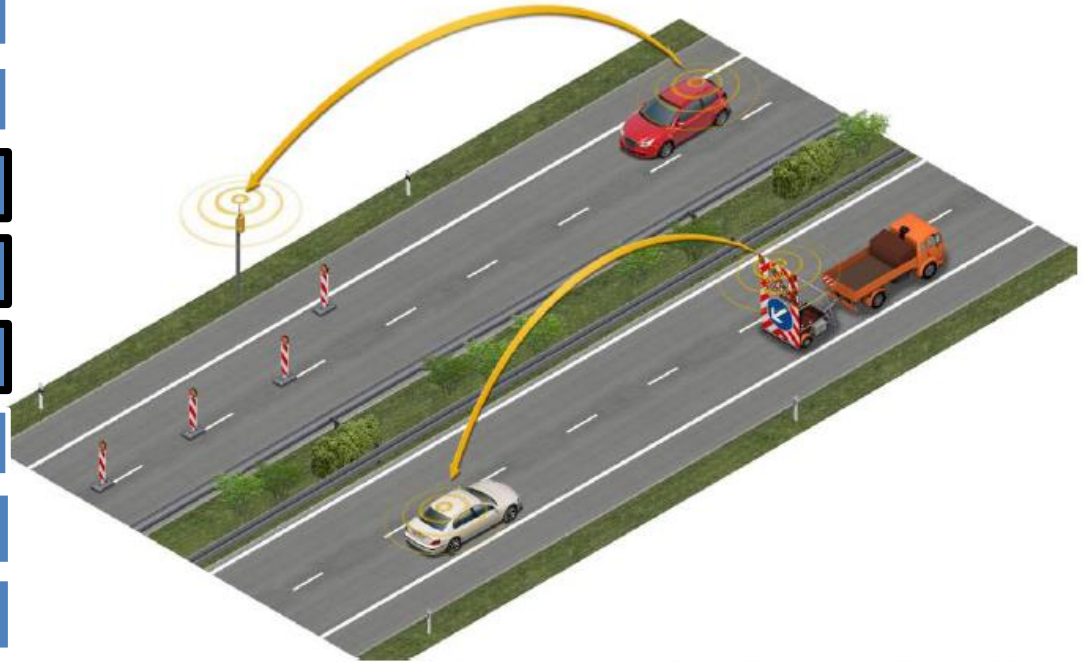


Figure: © CAR 2 CAR Communication Consortium

Use cases (2.)

- ❌ Emergency electronic brake light
- ❌ Emergency vehicle approaching
- ❌ Slow or stationary vehicle
- ✅ Traffic jam ahead warning
- ✅ Hazardous location notification
- ✅ Road works warning
- ✅ Weather conditions
- ✅ In-vehicle signage
- ✅ Probe vehicle data
- ❌ Shockwave damping

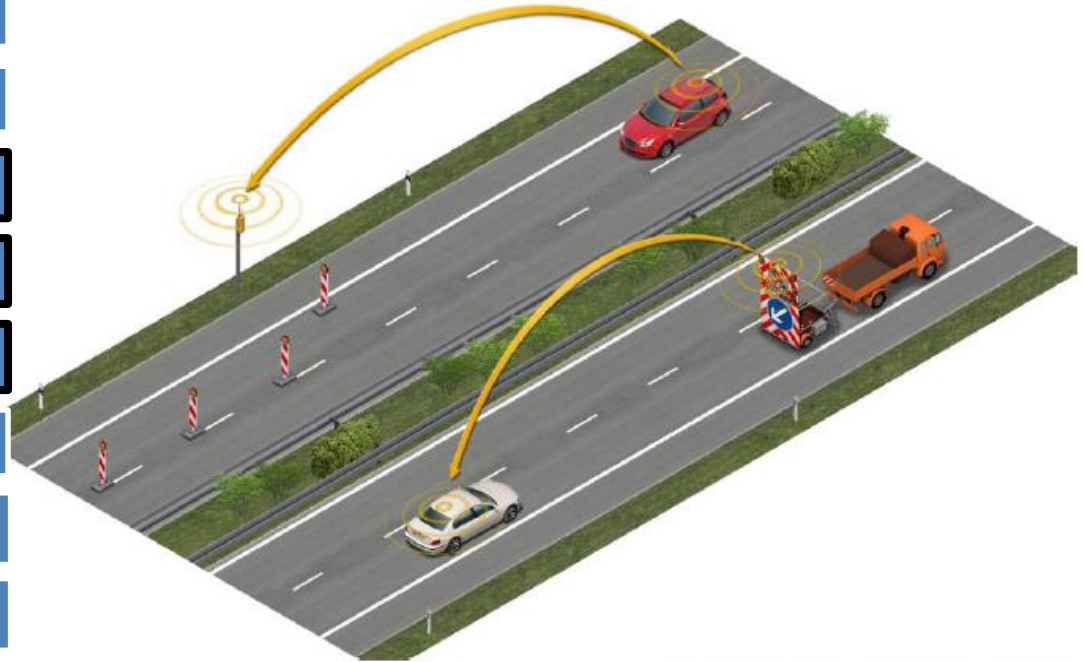


Figure: © CAR 2 CAR Communication Consortium

Urban use cases (1.)

Green Light Optimal
Speed Advisory
(GLOSA)/
Time To Green (TTG)

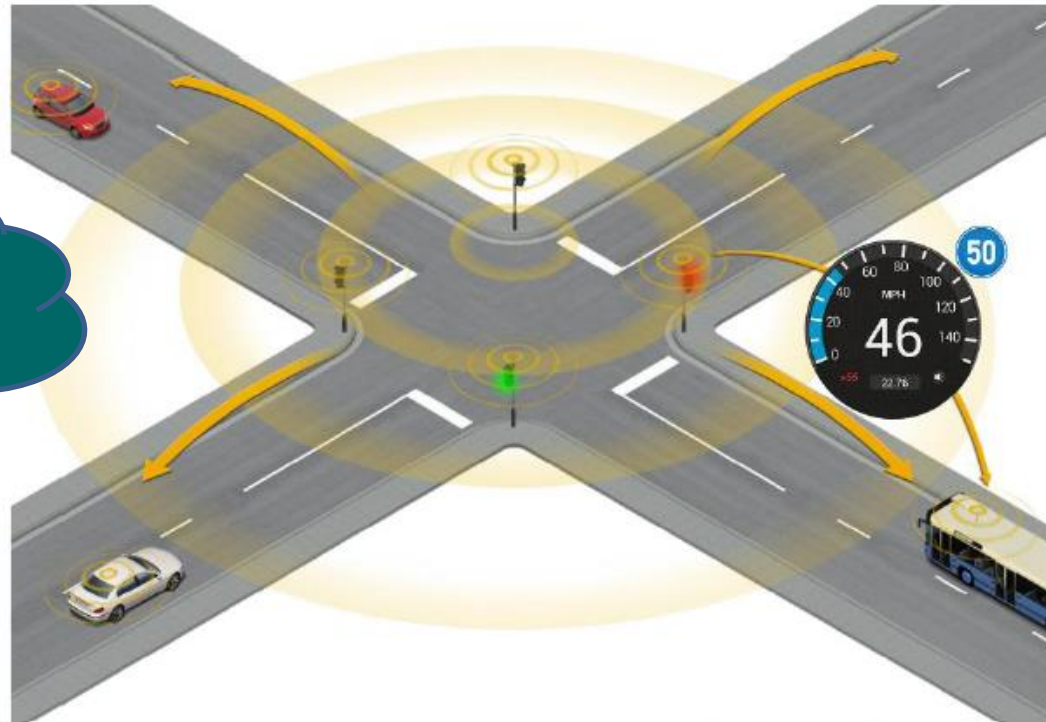


Figure: © CAR 2 CAR Communication Consortium

Urban use cases (2.)

Signal violation/
Intersection safety

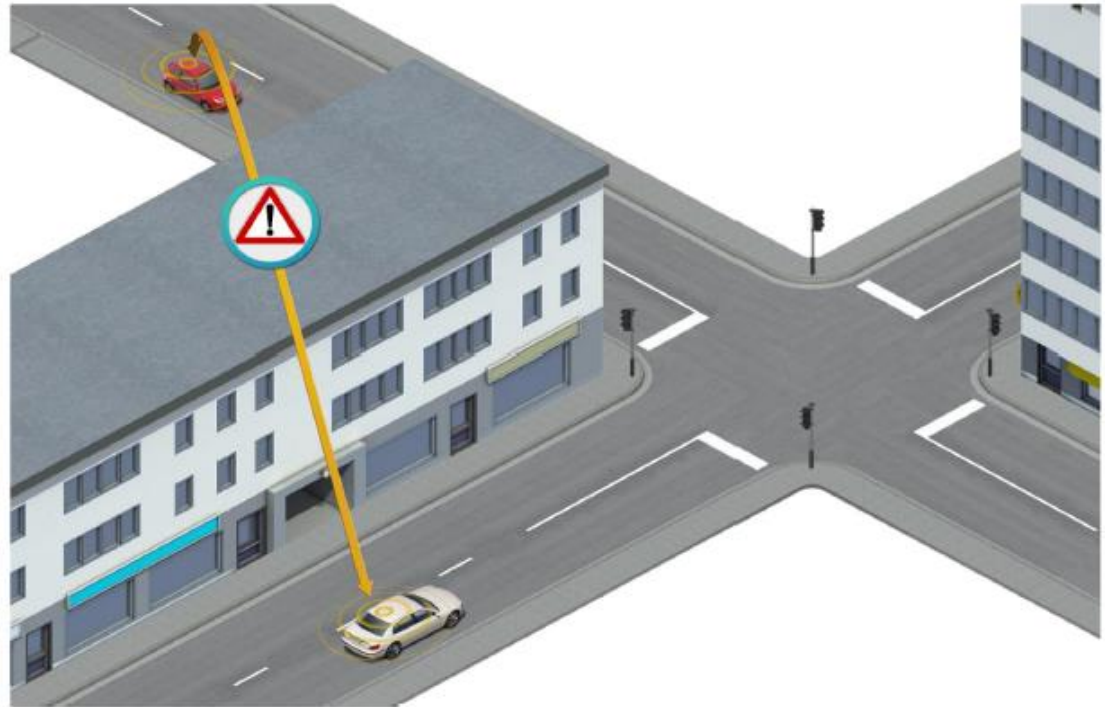


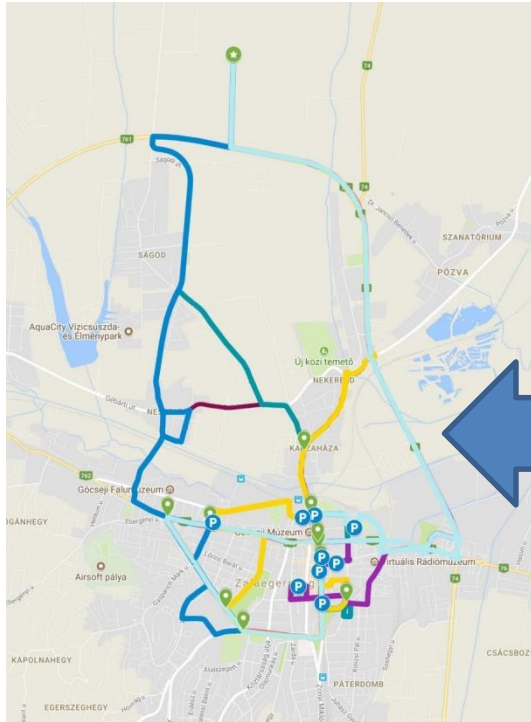
Figure: © CAR 2 CAR Communication Consortium

Impacts

Traffic jam ahead warning	Fuel consumption and CO ₂	Fuel consumption drop	-0,770%
Hazardous location notification	Traffic efficiency	Time saved	-1,067%
Road works warning	Emission	CO	-0,200%
Weather conditions		NOx	-0,174%
In-vehicle signage		PM	-0,137%
In-vehicle speed limits	Safety	Fatality	-3,320%
Probe vehicle data		Personal injury	-3,100%
Green Light Optimal Speed Advisory (GLOSA)/Time To Green (TTG)	Fuel consumption and CO ₂	Üzemanyagfogyasztás	-0,100%
	Emission	CO	-0,300%
		NOx	-0,100%
Signal violation/Intersection safety	Safety	PM	0,100%
		Fatality	-1,950%
		Personal injury	-3,650%

Source: C-ITS Platform

C-Roads Hungary phase 2



THANK YOU!

Tamás Attila, Tomaschek
Head of section for traffic management
Hungarian Public Road Non-profit PLC
cef@kozut.hu

