

# Cooperative Corridor First experience

| TEM / HEEP Area V 2018 Annual Meeting

**Prague, 28 May 2018**



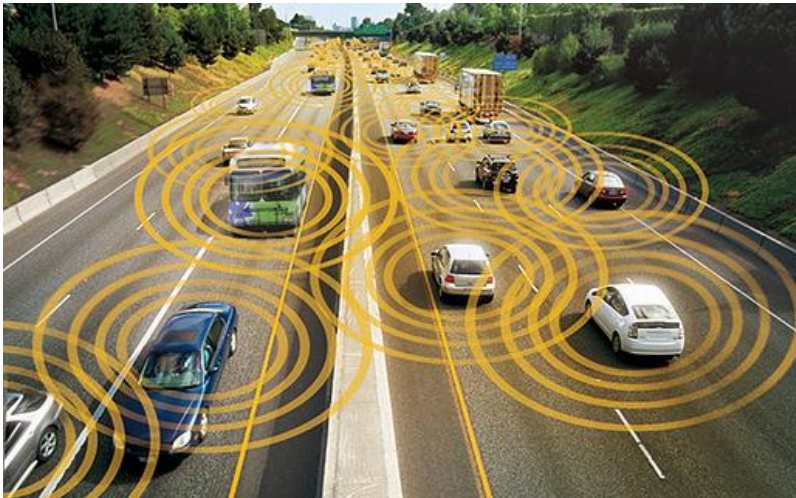
# C-ROADS Europe

- platform of harmonized C-ITS (Cooperative Intelligent Traffic System) in Europe
- Goal: cross country seamless traffic information system
- 8 cooperative countries (GB,F,B,NL,D,CZ,A,SLO)
- Feb. 2016 – Dec. 2020
- Allocated total budget: 98 M € (CEF funding 55 M €)



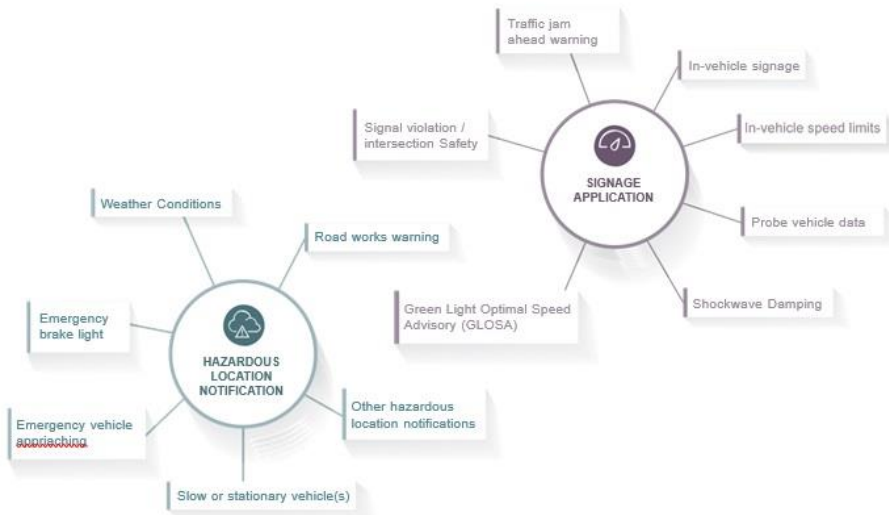
# C-ROADS Europe

- based on wireless communication (C-ITS G5, Mobile 3G/4G/LTE, Wi-Fi and Bluetooth technology)
- between vehicles (V2V), vehicles and infrastructure (V2X)
- traffic information is generated from drivers behaviour and from infrastructure dependent of driving area and direction
- most frequent scenarios expected during traffic are precisely specified within so called Use Cases



# C-ROADS Europe

- Use Cases are generated either automatically by sudden change of drivers behaviour or purposely from Traffic Centers along the motorways
- Use Cases are sorted by level of importance and urgency into Day 1 and Day 1,5 Services category
- Each Use case is gradually specified, tested and standardised for further implementation within other European member countries



# C-ROADS Czech Republic

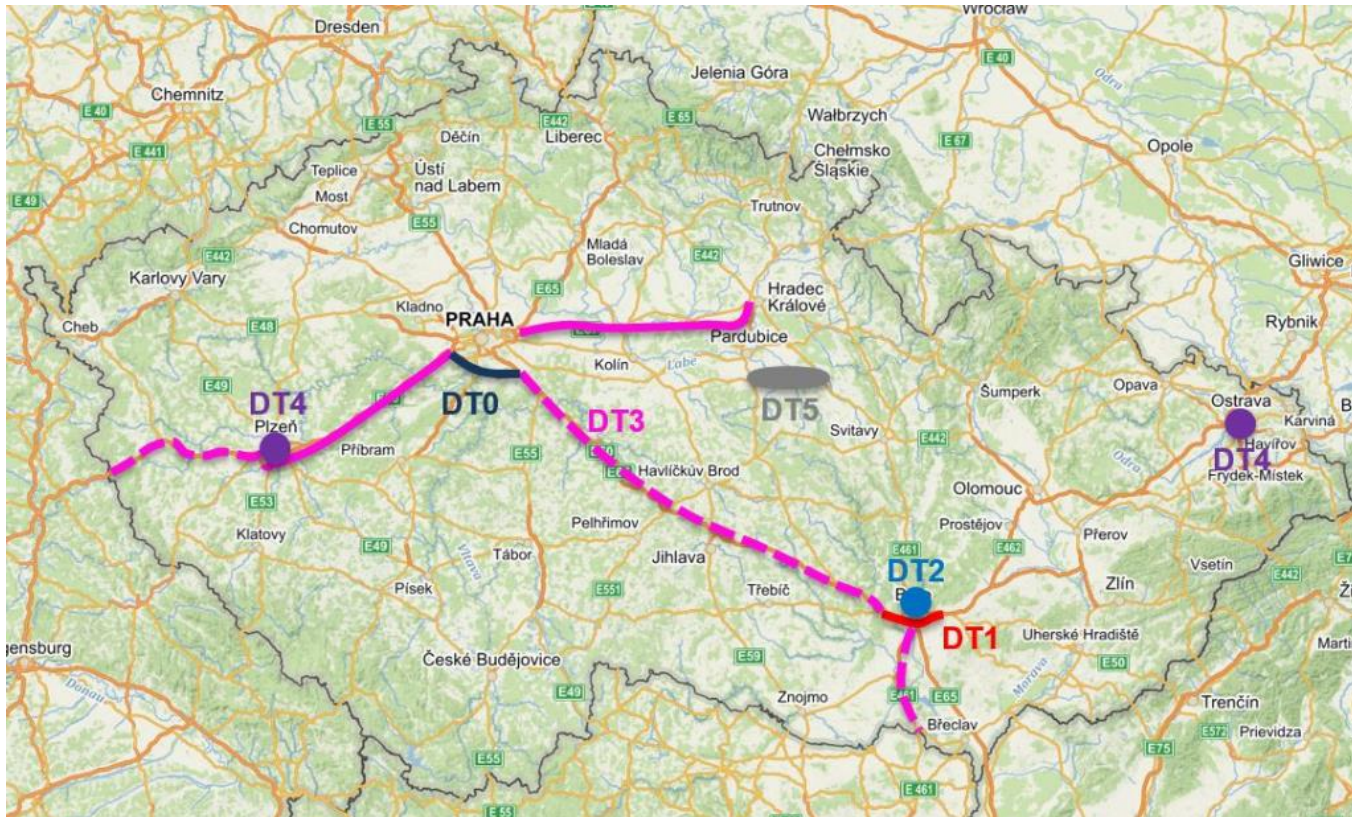
- Basic Stone - Grant Agreement signed in November 2016
- Ministry of Transportation - Coordination Body
- Road and Motorway Directorate – Realisation Body
- 7 basic and 4 associated partners
- Deadline – December 2020
- Allocated total budget: 19 M € (CEF funding 16 M €)





# C-ROADS Czech Republic

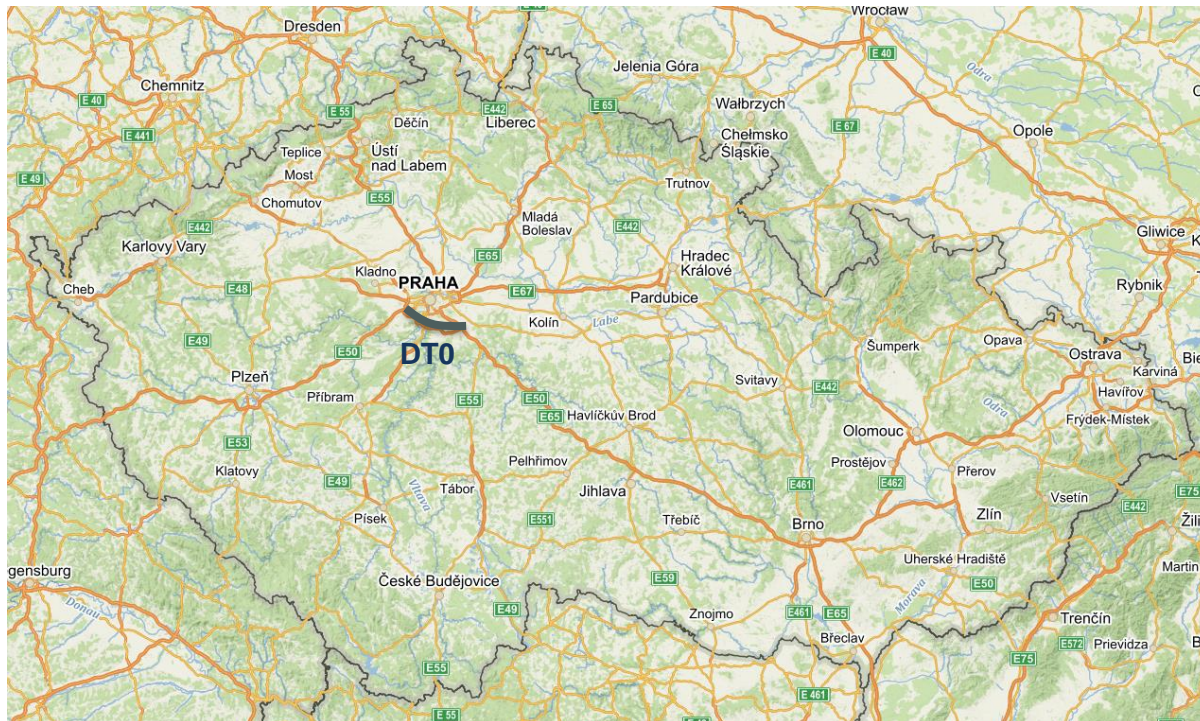
## Deployment & Field Testing (DT) – Pilot Projects defined by Grant Agreement



# C-ROADS Czech Republic

## Deployment & Field Testing – DT „Zero“

- Location: South Prague bypass (46 km length)
- Not involved in C-Roads project yet but will become a full-fledged part in C-ITS
- New Use Cases implementation: Road Works Warning, Probe Vehicle Data, In-Vehicle Information

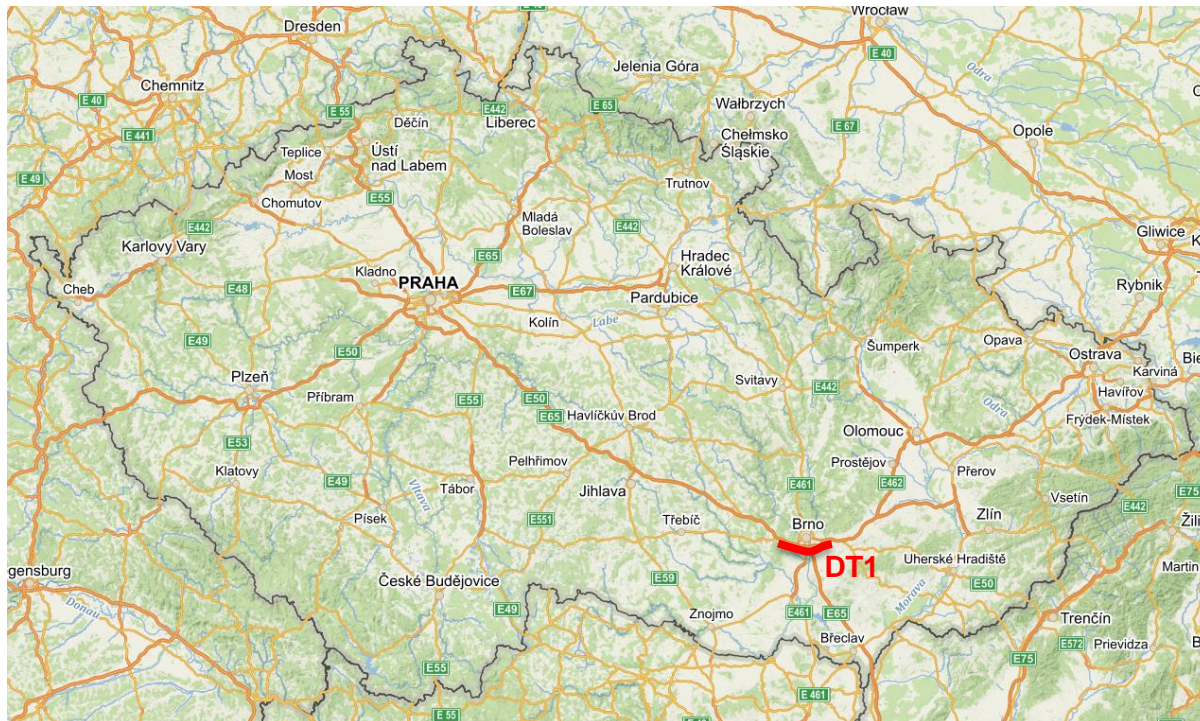




# C-ROADS Czech Republic

## Deployment & Field Testing – DT 1

- Location: Brno South D1 motorway part (23 km length)
- New Use Cases implementation: Slow and Stationary Vehicle, Emergency Vehicle Approaching

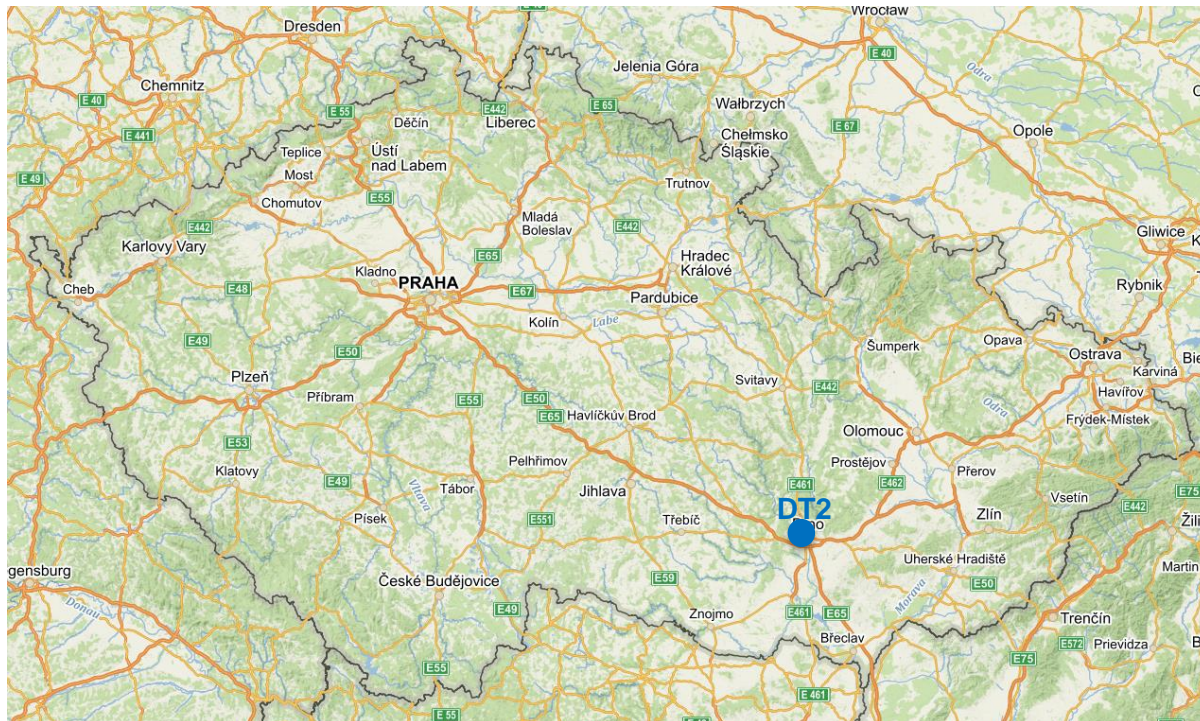




# C-ROADS Czech Republic

## Deployment & Field Testing – DT 2

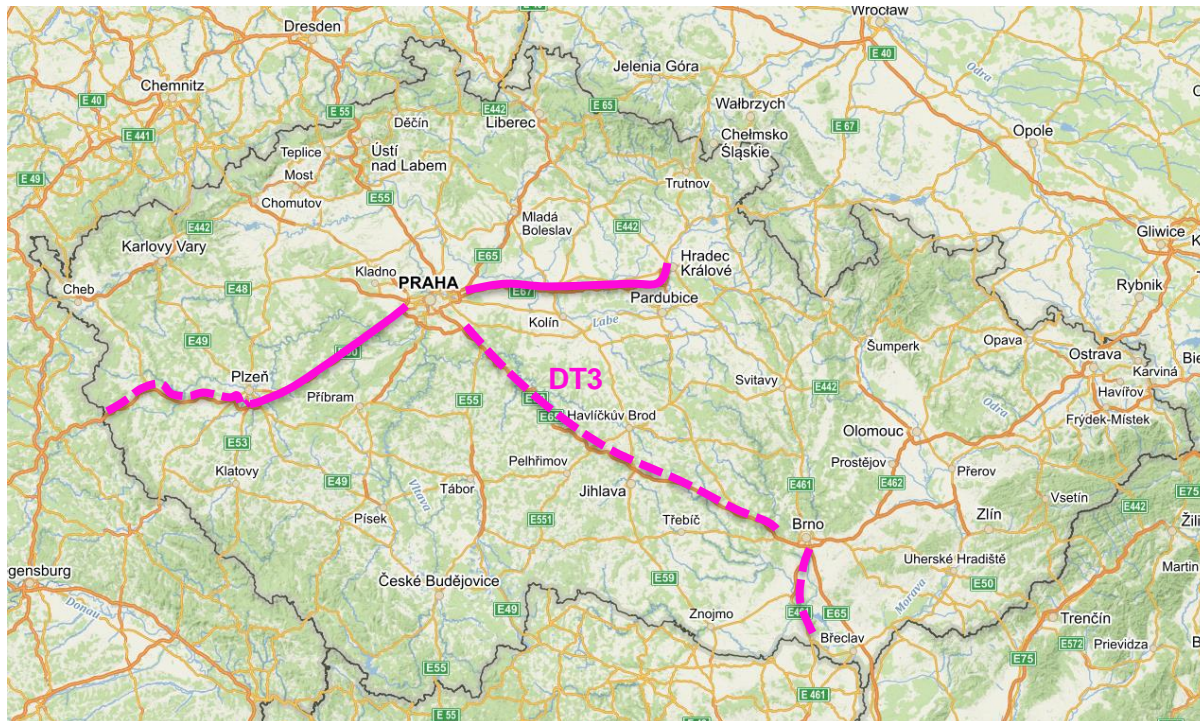
- Location: Brno city
- New Use Cases implementation: Signal Violation, Weather Conditions



# C-ROADS Czech Republic

## Deployment & Field Testing – DT 3

- Location: Motorways D5 Prague-Plzen and D11 Prague – Hradec Kralove
- New Use Cases implementation: Traffic Jam Ahead Warning, Emergency Brake Light

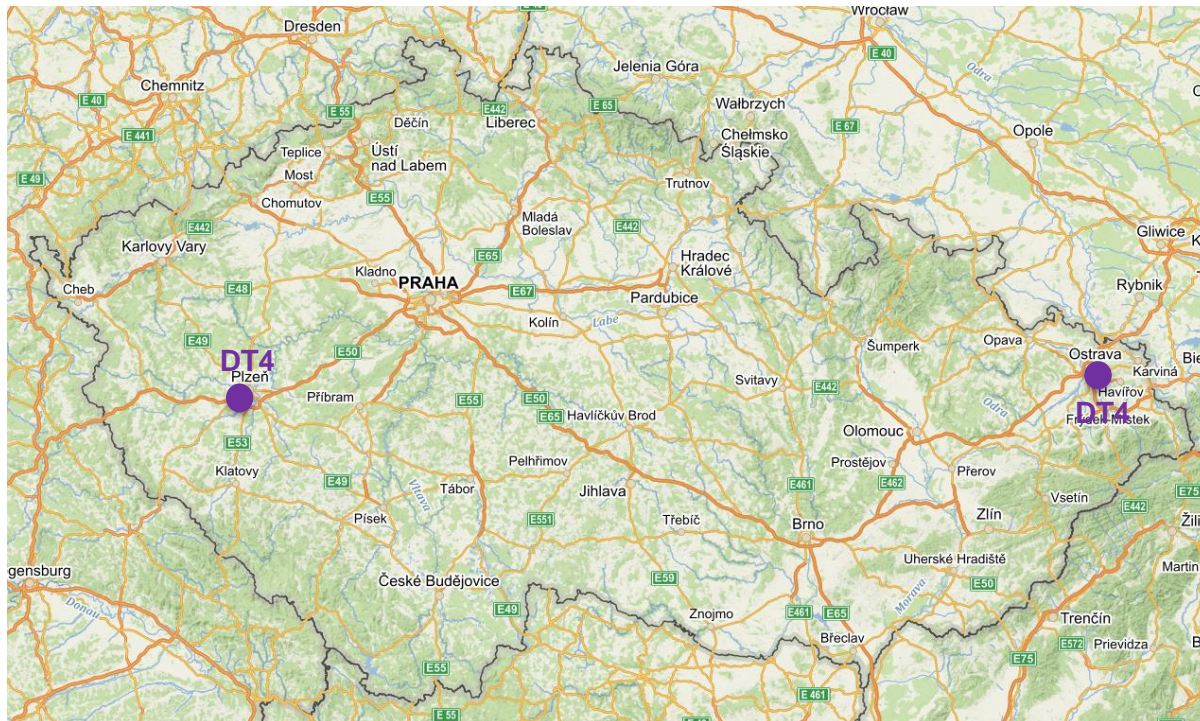




# C-ROADS Czech Republic

## Deployment & Field Testing – DT 4

- Location: Plzen and Ostrava
- New Use Cases implementation: Public Transport Preference, PT Safety, Hazardous Location Notification

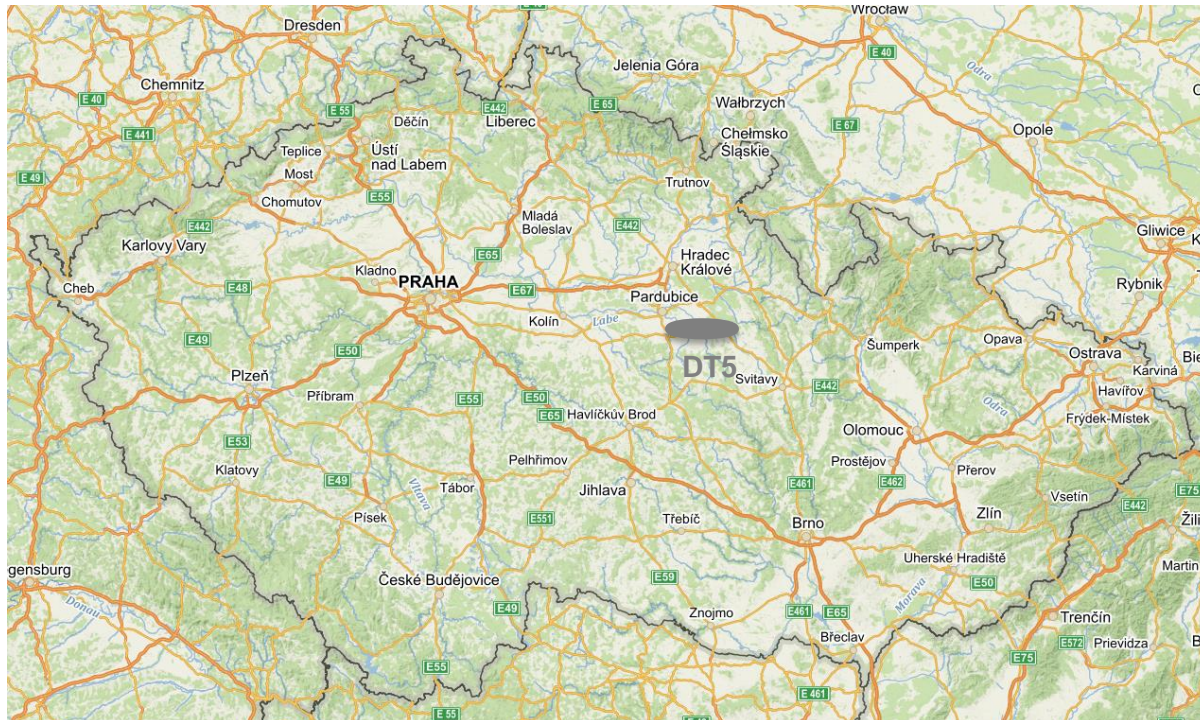




# C-ROADS Czech Republic

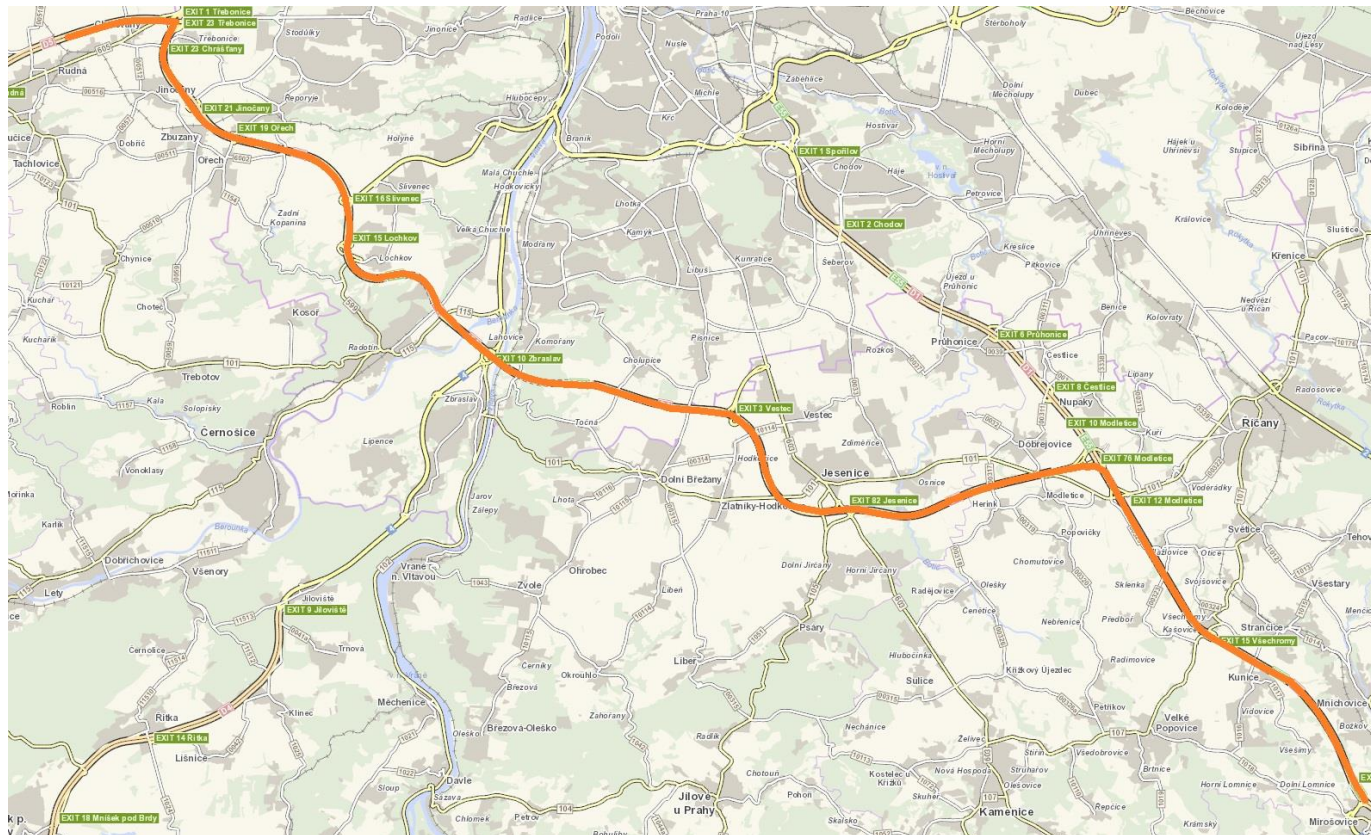
## Deployment & Field Testing – DT 5

- Location: 2 Railway Crossing (W and W/O barrier) in Pardubice region
- New Use Cases implementation: Railway Level Crossing



# Cooperative ITS Corridor Mirošovice – Rudná

- established in 2016 as an pilot cooperative system within Czech Republic
- 46 km stretch – D5 and D1 motorways parts and south Prague bypass D0 (R1)
- 2 tunnels (total of 3,6 km), 1 flyover (2,7 km)
- Busiest road in CZ





# Cooperative ITS Corridor Mirošovice – Rudná

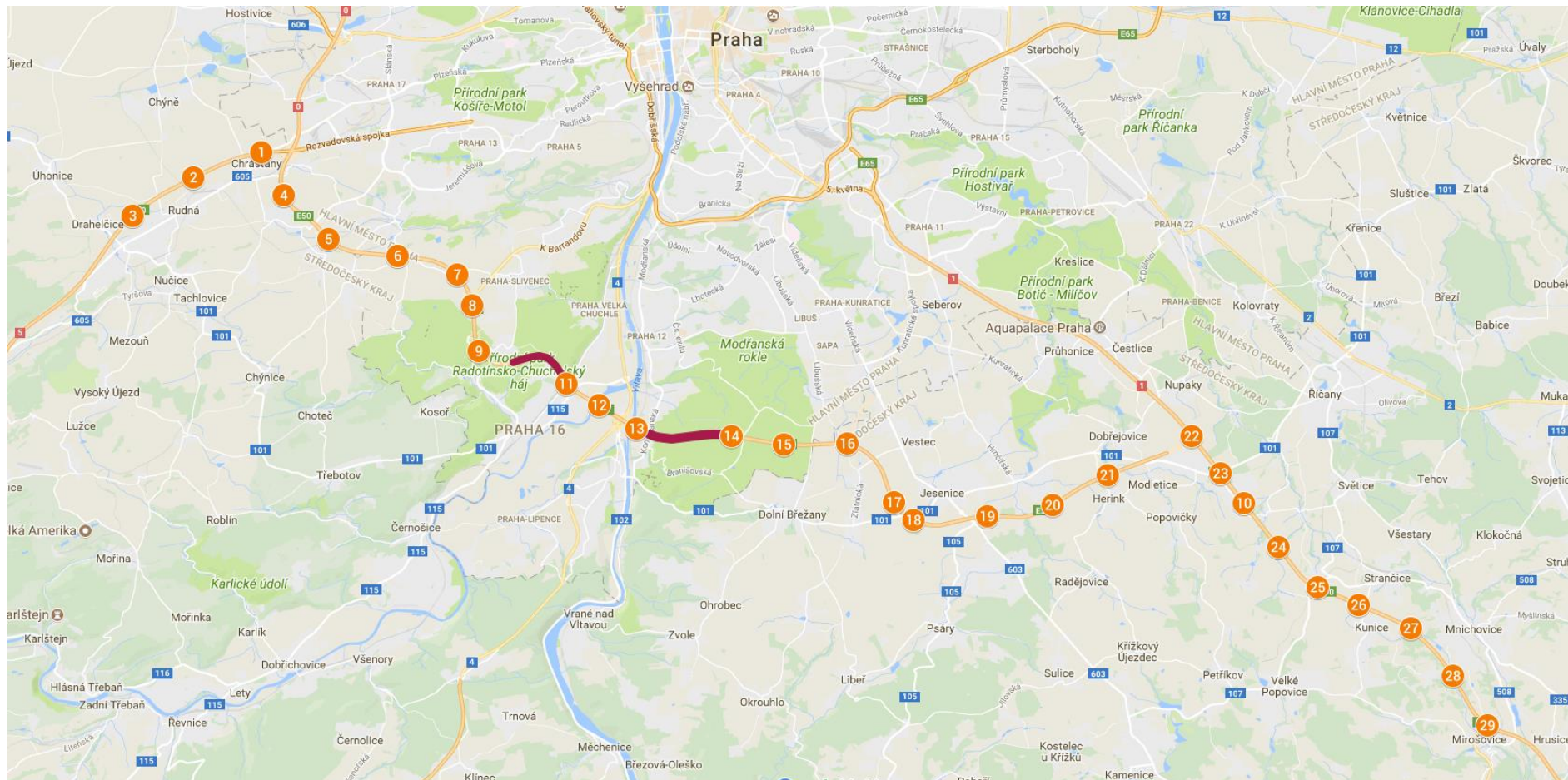
- Maintained by two highway maintenance centres – Mirošovice and Rudná
- Dedicated traffic management centre in Rudná (incl. management of tunnels)
- Dynamic Lane Management System
- Other ITS equipment (loops, CCTV cameras, tolling, height measurement...)
- total cost: 44 M CZK (1,8 M €)
- testing phase was finished in May 2018





# Cooperative ITS Corridor Mirošovice – Rudná

- 29 ITS G5 Roadside units including Bluetooth and Wi-Fi detection
- 5 On-board units (OBU) + 43 Road-vehicle units (RVU)
- Dedicated C-ITS back-office

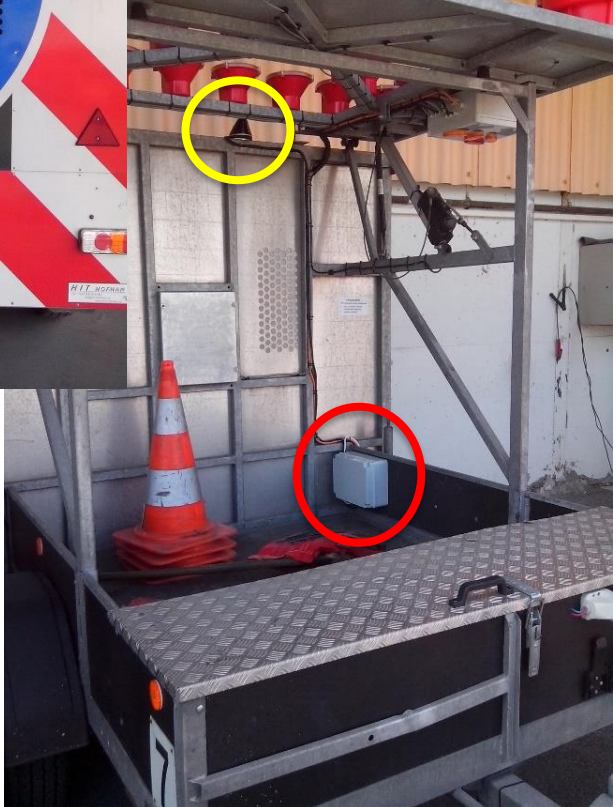
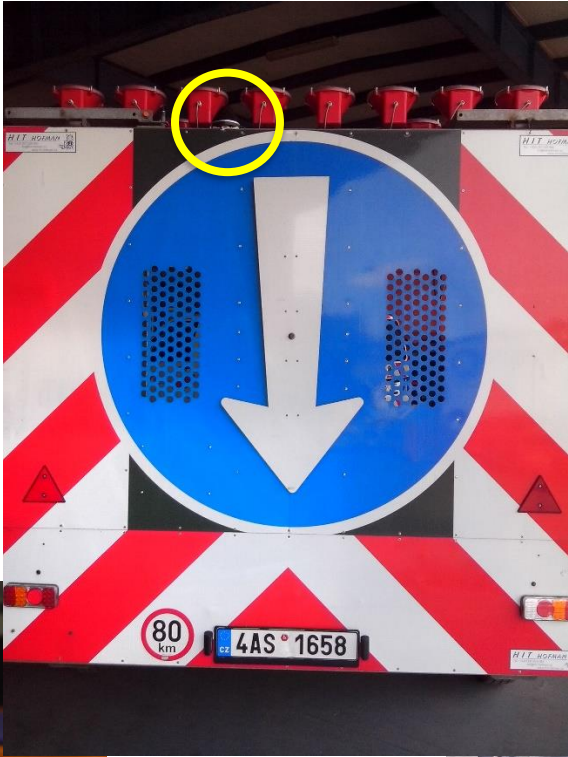


# System technology





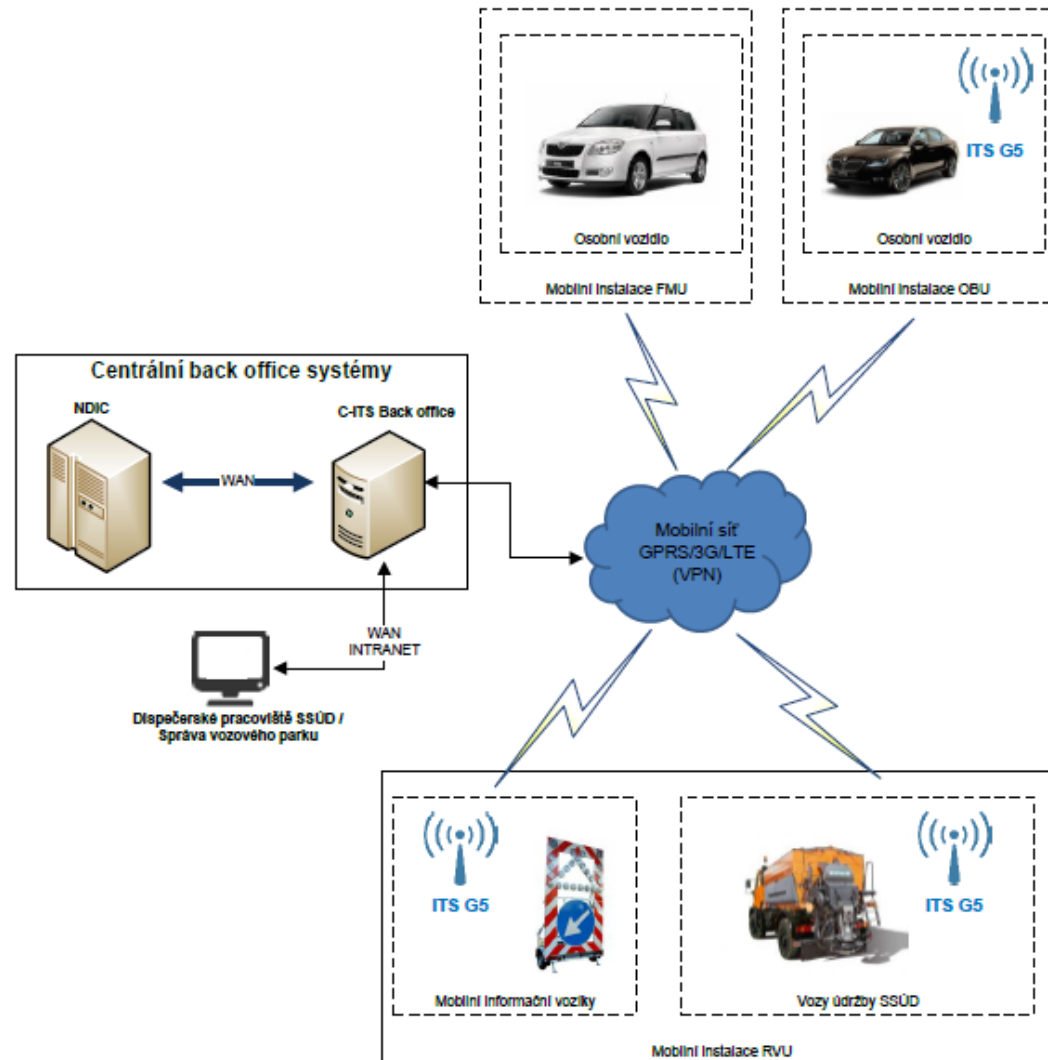
# System technology





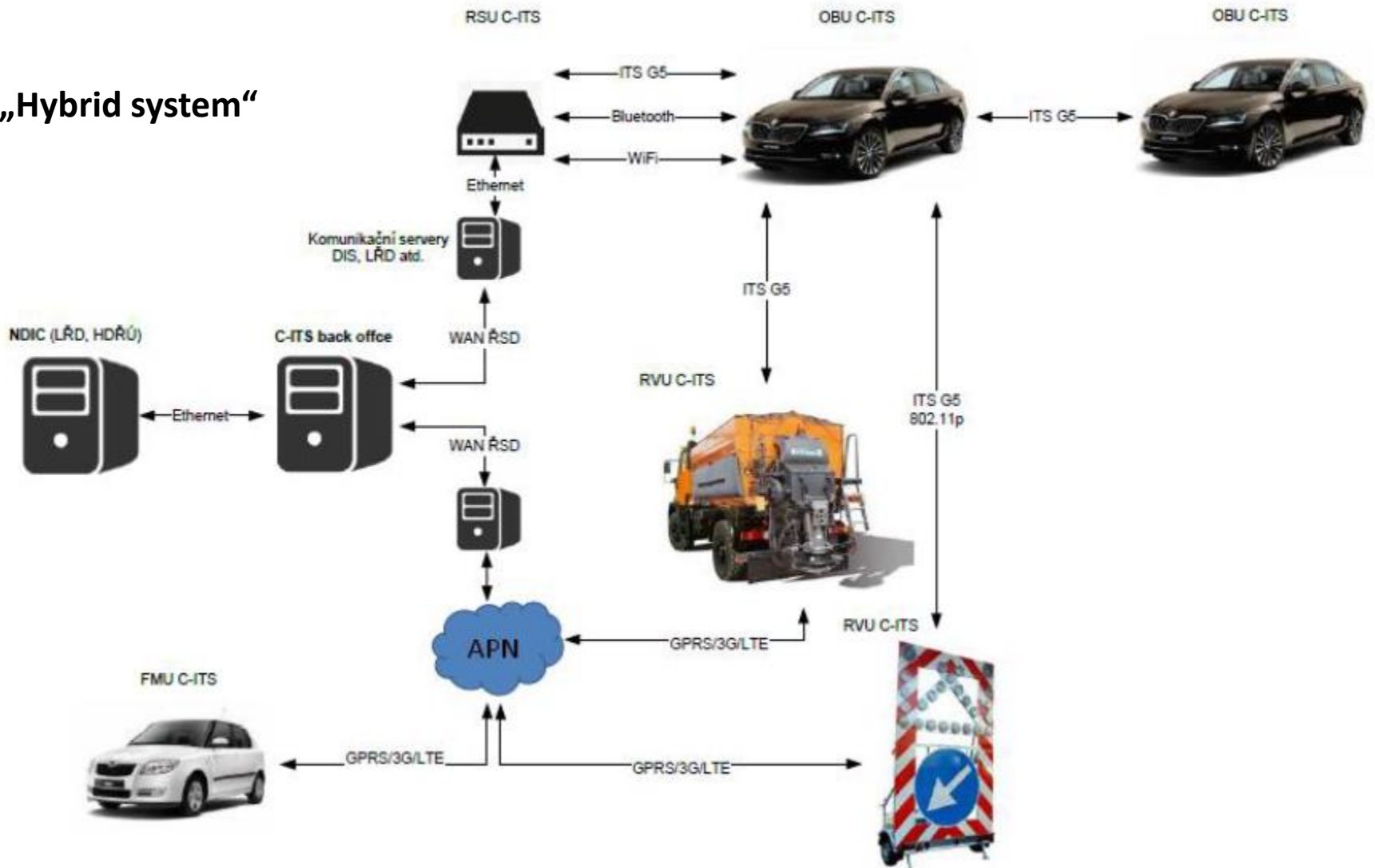
# Basic Principle

## V2X Communication



# System architecture

„Hybrid system“





# Deployed services

**Road Works Warning** – Message in advance with situation scheme as well as destination indication

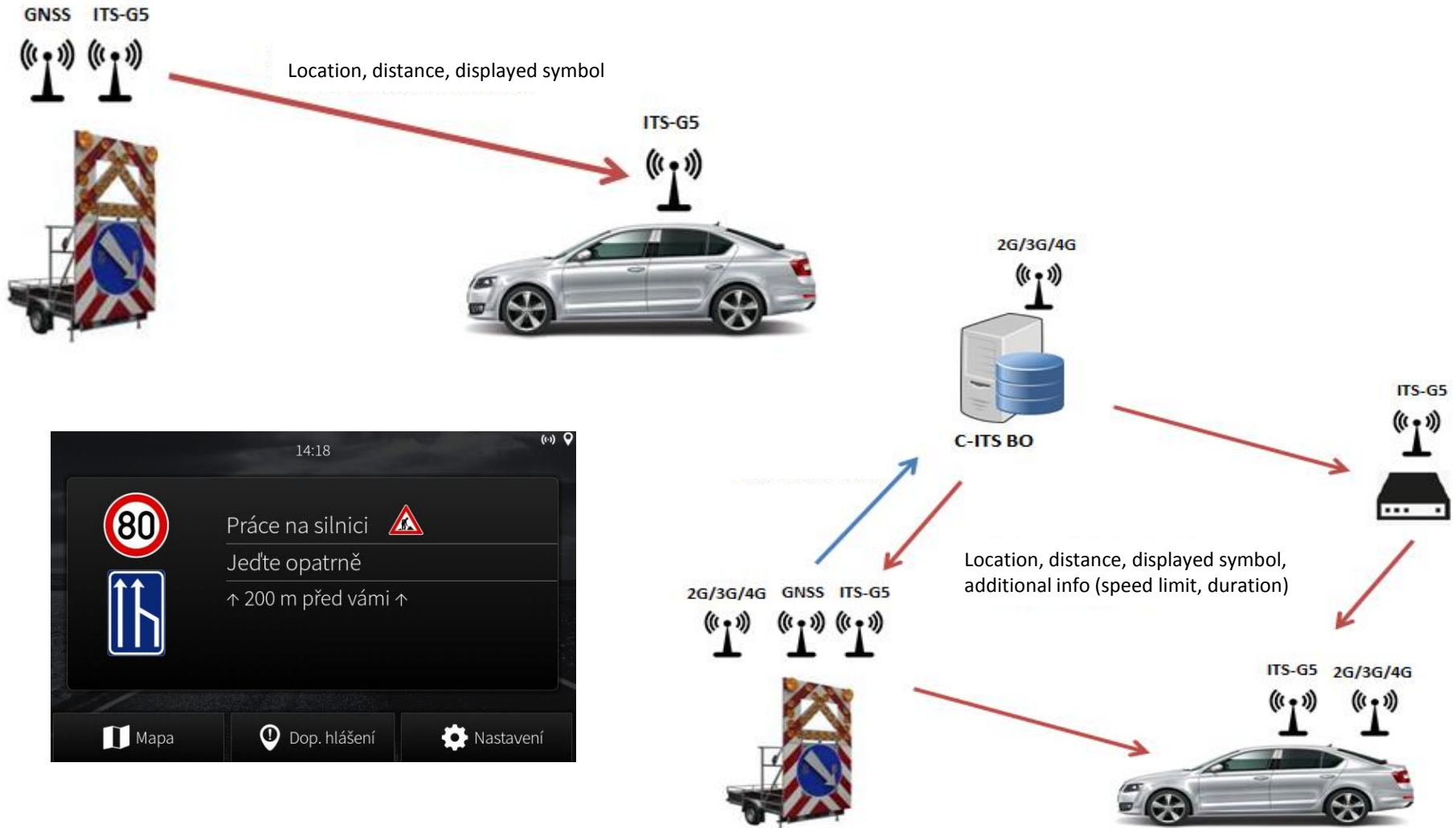
**In-Vehicle Signage** – All selected traffic information from infrastructure to driver are proper sequenced and indicated in advance and displayed within appropriate area

**Probe Vehicle Data** – Automatic Vehicle to Infrastructure (V2X) data collection using WiFi and BT technology to evaluate precise Commuting Times



# Deployed services

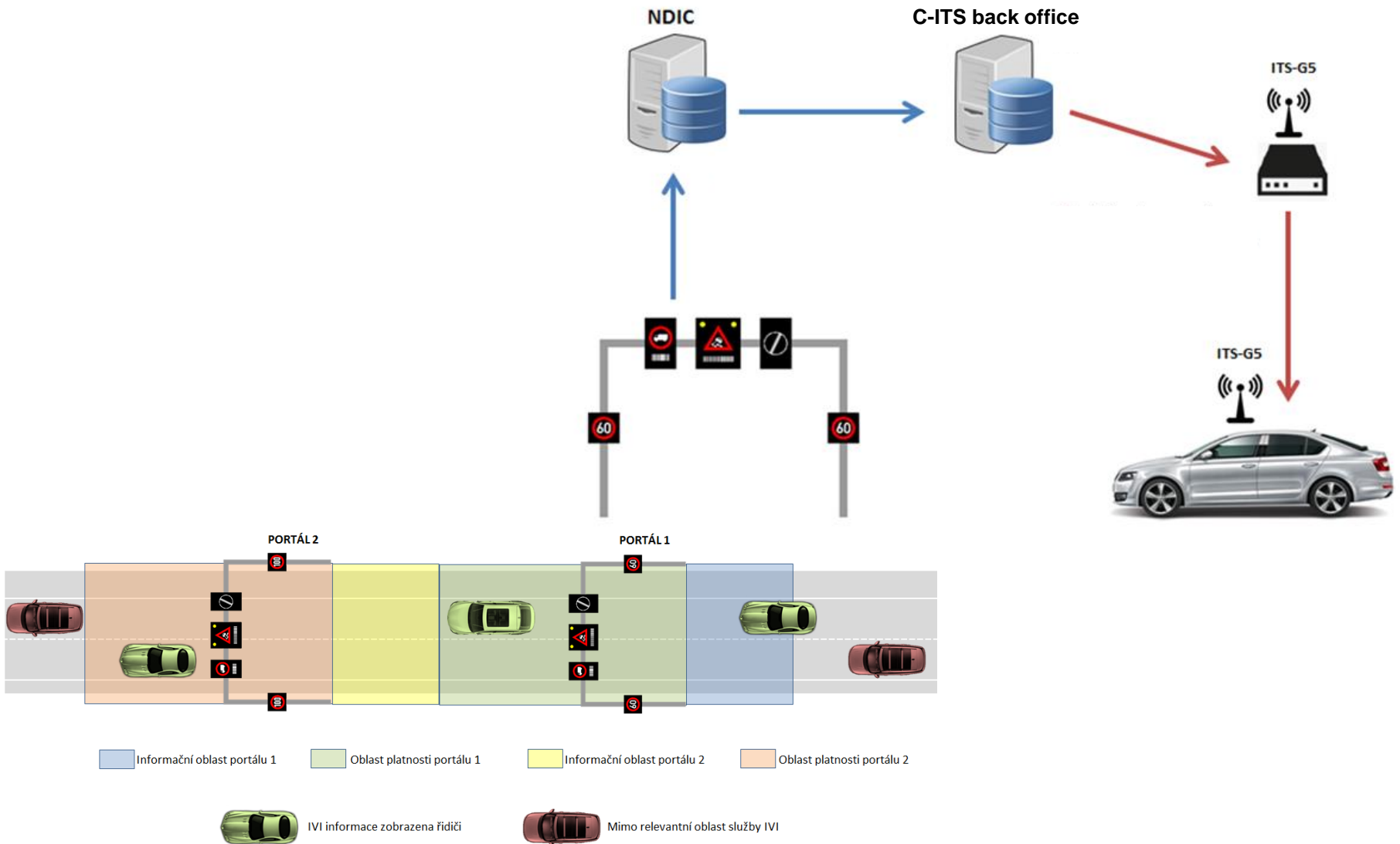
## Road Works Warning in „Standalone“ and „Connected“ mode





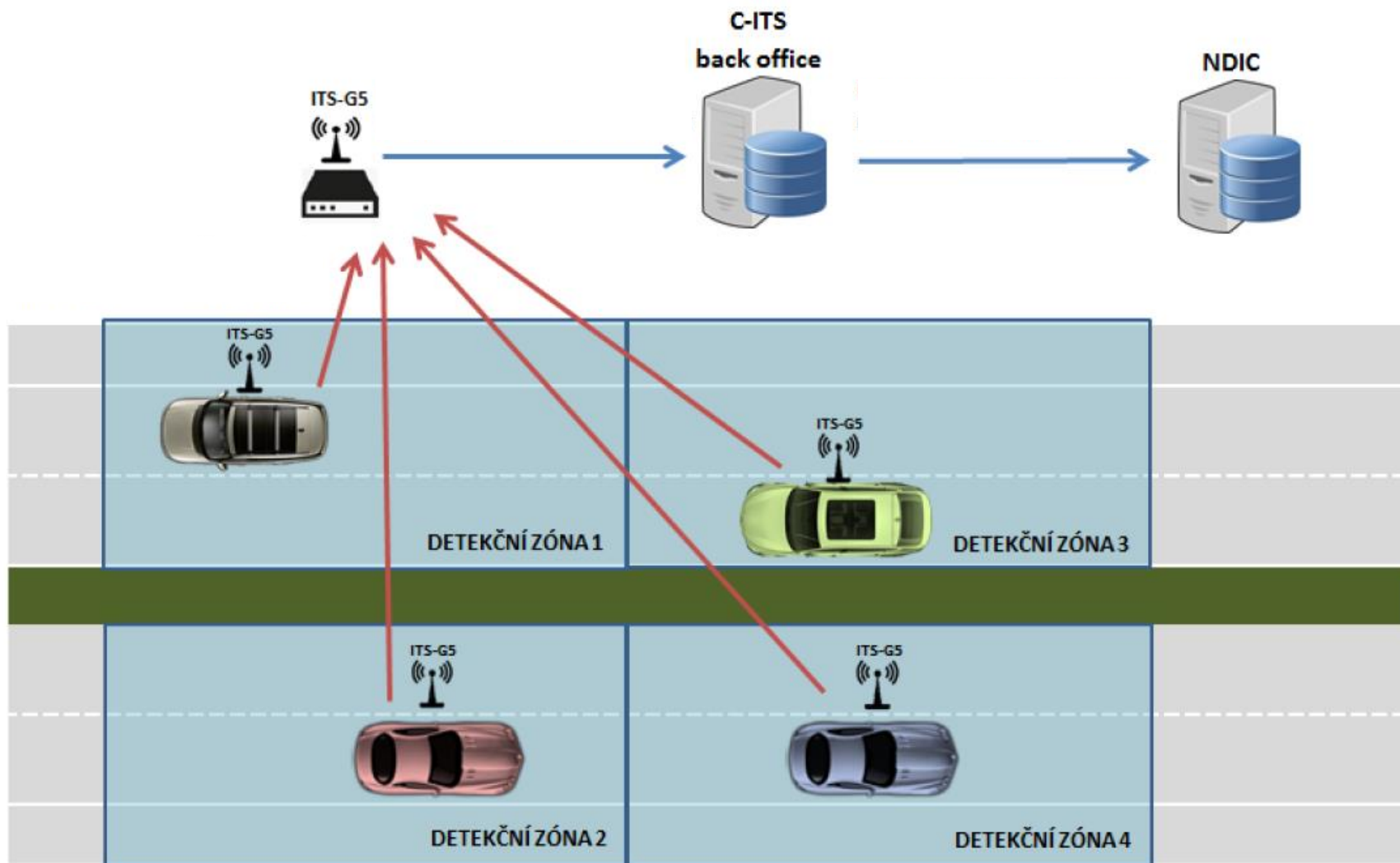
# Deployed services

## In-vehicle Signange



# Deployed services

## Probe Vehicle Data





# Administration

## C2X Application – System Supervision

The screenshot displays the C2X System Supervision application interface. At the top, there is a navigation bar with the text "C2X" on the left and "Čeština", "Nápověda", and the "ŘSD ČR" logo on the right. Below the navigation bar, there are three main menu items: "Seznam RSU" (with a signal icon), "Seznam vozidel" (with a car icon), and "Seznam událostí" (with a person icon and a count of 14). A warning triangle icon with the number "14" is also present. The main area is a map of the Prague region, showing various locations and infrastructure. The map is overlaid with numerous markers, including blue circles with numbers (e.g., 2, 3, 4, 5, 6, 7, 12, 26) and green icons representing RSU (Road Side Unit) and vehicle status. The map also shows major roads, rivers, and city boundaries. On the left side of the map, there is a vertical list of status indicators, each with a label and a corresponding icon: "Práce na silnici" (Road work), "Dopravní stav" (Traffic status), "Nehoda" (Accident), and "Stacionární vozidlo" (Stationary vehicle). The bottom left corner of the map shows a scale bar and a north arrow.

# Administration

## C2X Application – Road Works Management

The screenshot displays the C2X application interface for road works management. The top navigation bar includes the text 'C2X', a warning sign icon with the number '14', and menu items: 'Mapa', 'Role', 'Uživatelé', and 'Zařízení'. On the right side of the top bar, there are links for 'Čeština', 'Nápověda', an email icon, and the logo for 'ŘSD ČR' (Road Safety Research and Development Center of the Czech Republic).

The left sidebar contains a list of menu items: 'Seznam RSU', 'Seznam vozidel', and 'Seznam událostí' (with a sub-count of 14). Below these are several buttons labeled 'Práce na silnici' (Road Work) and 'Dopravní stav' (Traffic Status).

The main area shows a map of a road construction site. A yellow highlighted road is labeled 'okruh'. A specific vehicle is highlighted with a green icon and labeled '2AK 8659 Práce na silnici'. A detailed popup window titled 'Podrobnosti: 2AK 8659' is open, displaying the following data:

Podrobnosti: 2AK 8659	
SSÚD	Rudná
SPZ	2AK 8659
Odklopení rampy	Zapnuto
Stav výstražných světel/šípky	Šípka vpravo
Režim šípky	Šípka vpravo
Poslední komunikace s FMU	23. 5. 2018 10:46:53
Fleet jednotka připojena	Ano
Časová známka FMU	23. 5. 2018 10:47:13
Chyba RVU	Ne
ITS jednotka spuštěna	Ano
Síť připojena	Ano
Čas posledního spojení	23. 5. 2018 10:47:27
Časová známka RVU	23. 5. 2018 10:47:40
Zapnutý maják	Vypnuto
Stav zapalování	Zapnuto
Počet satelitů	10
Kvalita signálu [%]	100 %
Rychlost	0 km/h

The popup window has an 'OK' button at the bottom. The map includes a scale bar for 10m and a vertical stack of icons on the right side for navigation and settings.

# Administration

## C2X Application - Fleet Management

The screenshot displays the C2X Fleet Management application interface. The top navigation bar includes the text "C2X", a warning sign icon with the number "2", and menu items for "Map", "Role", "Users", and "Devices". On the right side of the navigation bar, there are links for "English", "Help", an email icon, and the logo for "ŘSD ČR" (Road Safety Research and Development Institute of the Czech Republic).

On the left side, there is a "List of vehicles" panel containing a scrollable list of vehicle identifiers, each with a corresponding icon (a green bus icon or a purple car icon). The list includes:

- 1AA 1834
- 1AA 4517
- 1AB 1604
- 1AC 4529
- 1AD 4857
- 1AN 3971
- 1AN 4651
- 1AN 4835
- 1AP 5309
- 1AP 5705
- 1AP 5827
- 1AR 1712
- 1AS 0451
- 1AS 1577
- 1AS 8437
- 1AS 8458
- 1AU 7325
- 1AU 7515

The main area of the interface is a map showing the locations of several vehicles, marked with green bus icons and labeled with their identifiers: AS 1655, 4AZ 9266, 2AX 8106, AKA 9192, 3A8 9615, 9A6 3300, and 9A9 9168. A scale bar at the bottom left indicates 10m. The bottom right corner features a vertical stack of utility icons (compass, location, zoom) and a copyright notice: "© OpenMapTiles © OpenStreetMap contributors".



# Motorway Maintenance Centers - SSÚD

## 23 MMC locations and scope of their activities

### Rozmístění a působnost SSÚD a SSÚRS

Rozmístění a působnost středisek správy a údržby dálnice (SSÚD),  
respektive rychlostní silnice (SSÚRS)

Stav k 1. 1. 2011



# C-ITS Benefits

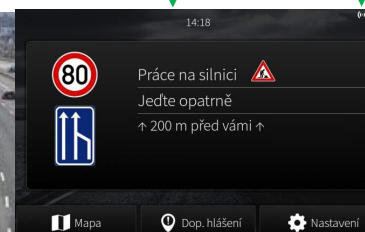
Centers / Road Workers / Drivers

DIS Network C-ITS Fleet Management Communication

Traffic MGMT & Traffic Police Center







Road Maintenance Operational Department



In Vehicle Information

# C-ITS Benefits

## Centers / Road Workers / Drivers

Actor	Advantage	Benefit
Traffic Management C. Traffic Police Center 	On line and enhanced C-ITS information Immediate response	Operative and effective management
Road Maintenance Operational Department 	On line information	Operative management
Road Workers 	„Visibility“	Life and health protection
Drivers 	Traffic information in advance	Accident prevention Continuous traffic Better route planning



# Next steps

- Implementation of new Use Cases
- Testing field for external partners (ŠKODA AUTO)
- Further development of the system (back-office) to harmonize services with other C-ROADS member countries and cross – border testing
- Explore possibilities of using ITS G5 in tunnels – safety critical locations
- Deployment of next project phases – extending coverage
- New security standards and recommendations implementation





Thank you for your attention