The Digital Future of Driving

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MINISTRY
OF HUMAN CAPACITIES

1. WHAT IS THE CHALLENGE?

Mobility Challenges

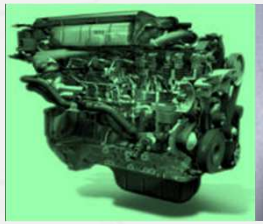
Inspirating factors for development

1	Zero Emission	▪ Fuel-consumption reduction ▪ Reducing emission
2	Demographic pressure	▪ Support of insecure leaders ▪ Increase the elderly mobility
3	Risk of accidents	▪ Avoidance of the accidents by reducing the effect of human mistakes
4	Increasing traffic density	▪ Management of transport process ▪ Comfortable, time-saving travel
5	Assistance systems	▪ Intelligent sensors for appropriate process ▪ Intelligent actuators (steering, brakes, etc.)

Source: VDA

Multi-level Approach

There is no one single good solution




Optimization of the components and
the whole conventional drive train system

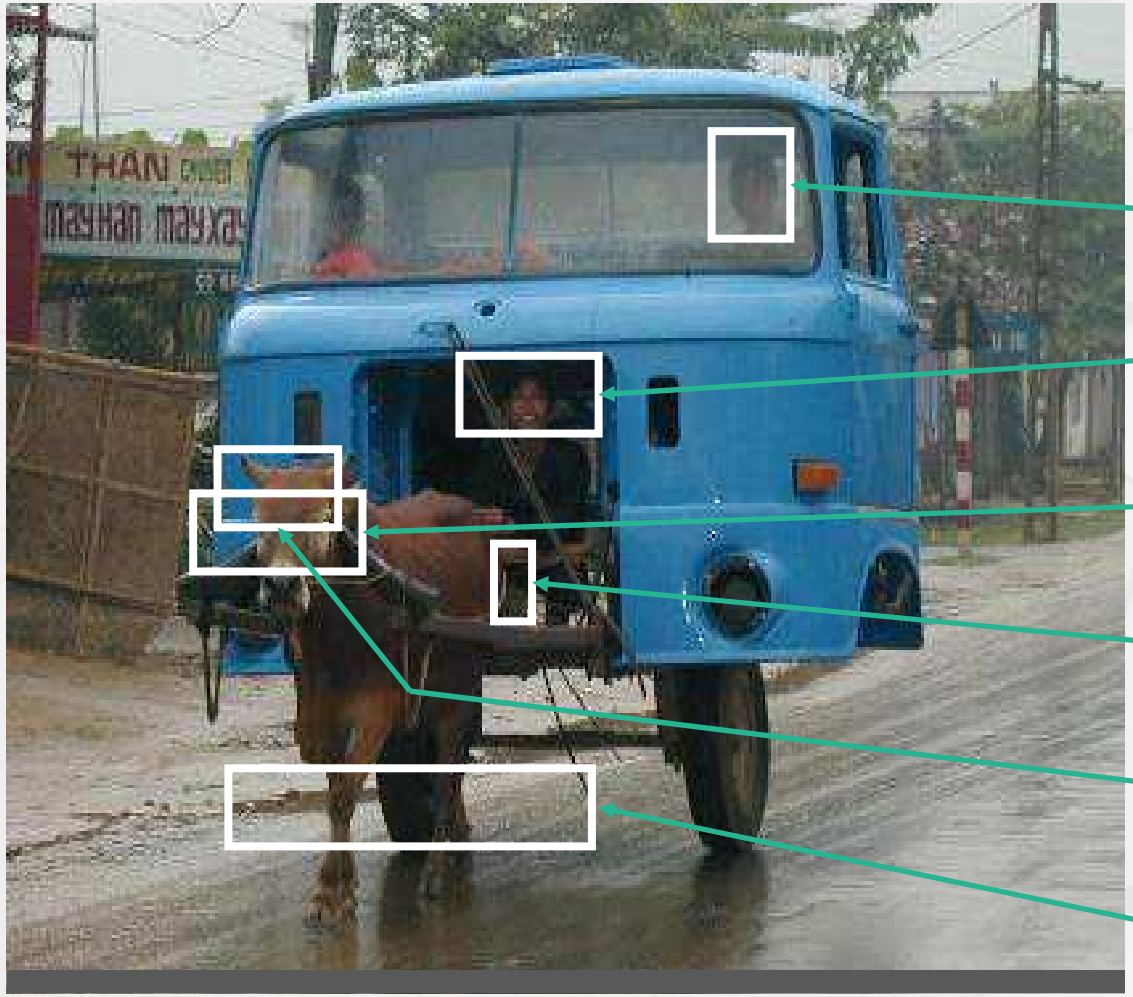


Introduction of new alternative fuels,
drive systems, enhance energy recuperation


Control of vehicle groups on different levels:
traffic control, platoon control, fleet control

2. TECHNICAL AND LEGAL ANSWERS

Is this the future? In some sense: Yes



Optimal bio-intelligent system

- **Transfered goods and navigation system**
- **Primary environment observer**
- **Redundant observer**
- **Transfer of the motion demand**
- **Motion coordination**
- **Biomechanical motion realization**

Architecture in more technical way

Corresponds to the bio-intelligent system

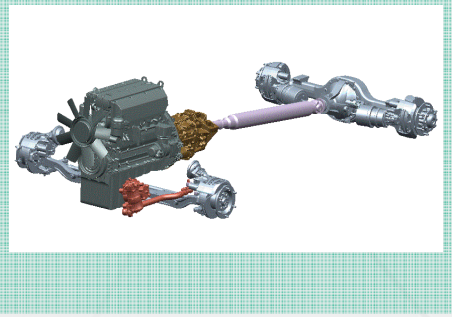
PHYSICAL SEPARATION

FUNCTIONAL SEPARATION

CABIN

Only Electrical Interface

speed vector

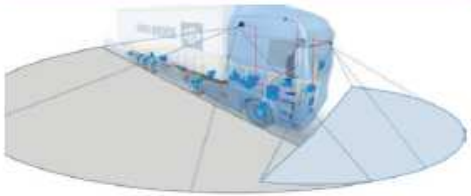


DRIVELINE

New operating philosophy: sidestick, ...	MMI (Man-Machine Interface)
ACC, lane follower, autonomous driving	Automation of inputs
Collision avoidance	Predictive input correction
Translation to powertrain component inputs	Powertrain co-ordination
ESP, ESP with steering	Reactive input correction
Mechatronic subsystems: steering, engine, transmission...	Execution

Impact of Driver's Responsibility Change

New architecture will be required

TODAY 2017	TOMORROW < 2020	FUTURE > 2020
		
Lane departure warning	Longitudinal control	Emergency brake system
	Active steering	Object detection in dead spot
	ACC + LKA	
		Automated driving: The driver can do other activities
		Autonomous driving: Low following distance, lower fuel consumption
DRIVER IS PART OF THE VEHICLE CONTROL „FAIL SAFE" SYSTEM		DRIVER IS INACTIVE „FAIL TOLERANT" SYSTEM

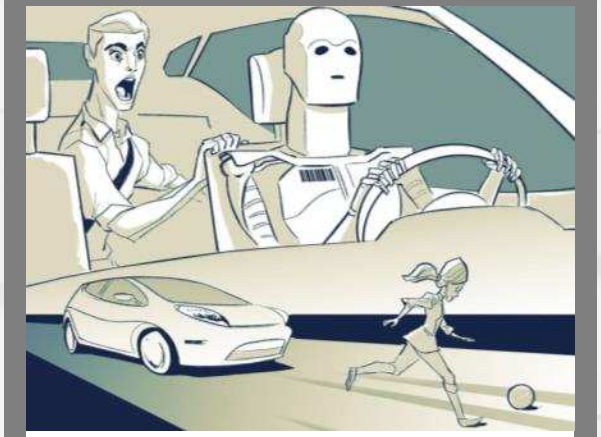
Source: Volvo, Knorr-Bremse

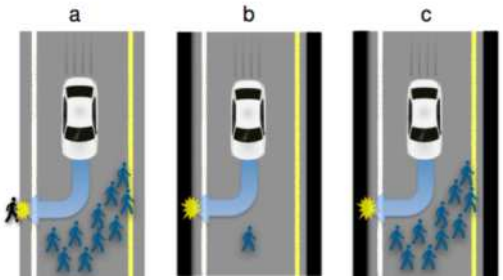
Legal, Moral, Safety issues…

Non-technical questions will also appear

- Can we take away the enjoyment of driving from the driver?
- As different to the other co-operatively drivable vehicles (plane, boat, rail) we must be ready to manage the vehicles to handle the dangerous situations while having human participants with unperfect and very different abilities?
- What is the base of decision if we must choose from two bad options?
- Liability and legal concerns remain open for a while…
- New business models/players will appear
- New concerns will rise: how can we guarantee, that autonomous vehicles will not be put in non-proper use, etc.

Number of test/use cases can exponentially increase





Source: Technologiereview, VDA

New Business Models will Appear – Partner Portfolio

Letter of Intent (LoI)

T · · Systems ·

Memorandum of Understanding (MoU)

Memorandum of Understanding (MoU) WG

KNORR-BREMSE, BOSCH, Continental, AVL, evopro, SMR, thyssenkrupp, ZF, TÜVRheinland, ELMŰ · ÉMÁSZ Energiakereskedő Kft.

Non-Disclosure Agreement (NDA)

Audi, MAGNA, ASTON MARTIN, ROBORACE, apollo, FEV, KREISEL, vodafone

Non-Disclosure Agreement (NDA) WG

AIMOTIVE, RWE, kapsch, commsignia, swarco, IBM, NOKIA, SIEMENS, ORACLE, NATIONAL INSTRUMENTS, HUAWEI

Indication of Interest…

EURO NCAP, Mercedes-Benz, DELPHI, MICHELIN, Mobileye, Autoliv, tass, ZTE, Post, Volvo Trucks, Volvo Cars, DENSO, Valeo, preh, MAGNA, Magna Electronics, Swiss Re, COMBITECH, flex, MERCK, Microsoft, SCANIA, Jebasto, EDAG, NXP, LEM, LINAMAR, Atos, BearingPoint, Infineon, MAHLE, IVECO, CNH INDUSTRIAL, ERICSSON

Need follow-up…

FCA, PSA GROUPE, WABCO, VINÇOTTE, QUALCOMM, BYD, TOYOTA, RENAULT, SUZUKI, DAF, SUBARU, CSI, RIMAC, MAN, SAMSUNG, HOLITECH EUROPE, VEDECOM, UTAC CERAM

3. HOW TO SECURE THESE SOLUTIONS? WHY HUNGARY?

Long term competency in electronic vehicle control

Participation in all relevant large scale EU FP projects

Cooperative Vehicle Infrastructure Systems

Powertrain Equipped with Intelligent Technologies

Secured Propulsion Using Advanced Redundant Control

Highly Adcanced Vehicle and Infrastructure

Truck Driver Assisting Systems

Budapest University of Technology and Economics

Magyar Tudományos Akadémia

University of Szeged

Széchenyi István University

University of Pannonia

Óbuda University

Supported Research – Comprehensive Program

Scientific Areas

Artificial Intelligence	Control Theory and Energy Management	Software and System Integration	Data Science and Communication Technologies	Safety, Security, Privacy
• Knowledge representation • Intelligent Data Analytics • Machine Learning and Conclusions • Human- Machine-Interaction	• Autonomous, Distributed, Hierarchic and Cooperative Modeling and Control • Human- Machine-Interaction • Energy Management	• Platforms and Standards • Design, Testing and Validation • Reliability • Virtualization	• Data Mining and Analytics • Cloud Technologies • Internet, IoT • Sensor Fusion • Mobile Technologies • Wired and Wireless Communication	• Functional Safety • Cyber Security • Data Ownership and Access Control • Privacy • Traffic Safety • Accident reconstruction

Research Directions

Vehicle
- Automated Vehicle Control (Level2-5)
- Drivetrain
- Human Factors
- Testing and Validation

Vehicle-Environment Connection
- Environment Sensing
- Cooperative Control
- V2X Communication

Environment
- Intelligent Transportation Systems
- Mobile Communication Systems
- Smart Infrastructure
- Electromobility

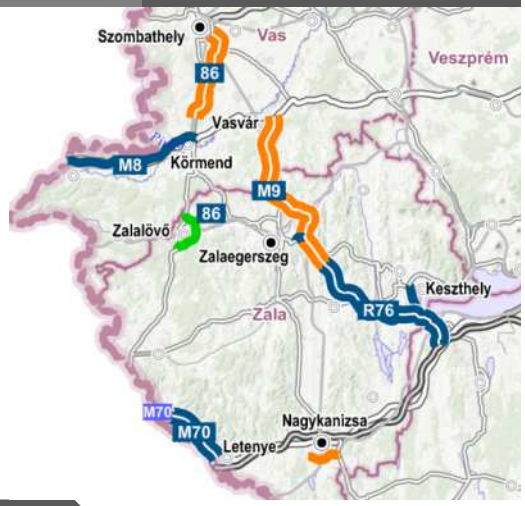
Knowledge, Competence and Applications

Scientific Publications and Know-how

BME KJK · BME Villamosmérnöki és Informatikai Kar · ik · MTA SZTAKI

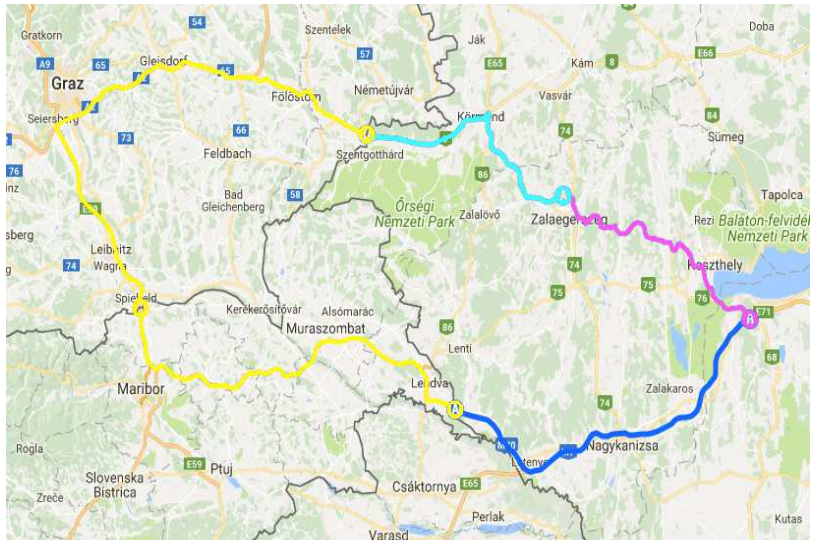
How to secure these solutions?

Public road tests are allowed in Hungary



Today

- Public road tests are allowed in Hungary since 12th of April, 2017
- 11/2017. (IV.12.) NFM decree (5/1990, 6/1990 KöHÉM)
- Anywhere in Hungary for automotive R&D companies after registration at Ministry



… and tomorrow

- Specific routes on public road with enhanced services for automated and connected vehicle tests
- Integration to Prove Ground in Zalaegerszeg
- Smart city zone in Zalaegerszeg
- Part of cross-border cooperation between Zalaegerszeg-Graz-Maribor
  - 2018 Q2: M7 highway
  - 2019: M70
  - 2020: Zalaegerszeg smart city
  - 2021-2022: R76 highway

Decision on a 140 Millions Euro Public Investment

Requirements are determined by the Industry

- Capacity constraints in Europe in area of vehicle dynamic testing
- Technology change in vehicle industry – single vehicle vs. co-operative vehicle control: different development environment is required
- Decision of Hungarian Government in 2016:
  „contribution to the success of the European automotive industry ”

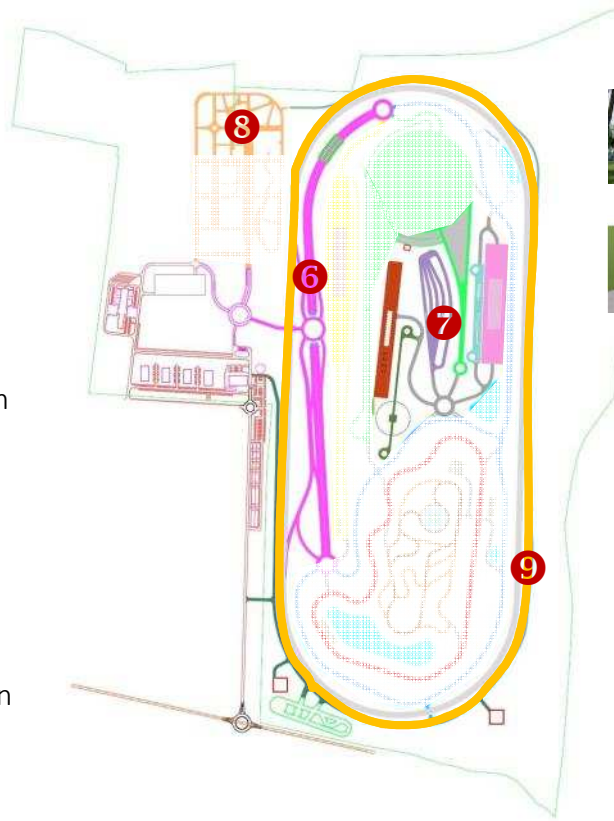
Test field for classic and automated and connected vehicles in Hungary

AMOTIVE
AVL
BOSCH
Continental
commsignia
evopro
KNORR-BREMSE
NATIONAL INSTRUMENTS
thyssenkrupp
TÜVRheinland
ZF

Project Phases

Phase 1: 2017-2018
(70MEUR)

1. Dynamic platform
2. Brake surface
3. Handling track
4. Smart city I.
5. Rural road
6. Motorway section
7. Diverse tracks
8. Smart city II.
9. High speed oval



Phase 2: 2018-2020
(70MEUR)

Proving Ground Modules - Example

Motorway

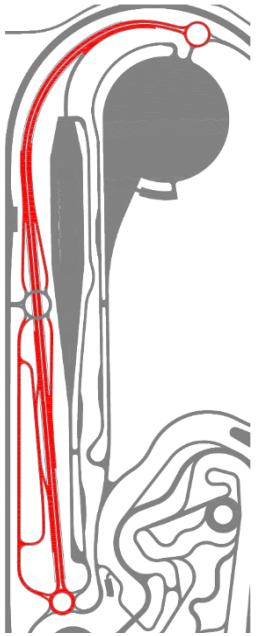
Parameters:

- 1500m 2 x 2+1 lane motorway
- 100m real tunnel
- Partly watered surface
- VMS, 5G test network
- V2X communication coverage
- GPS base station
- Public road like layout
  (junctions, road surface, geometry)

“Simulation”:

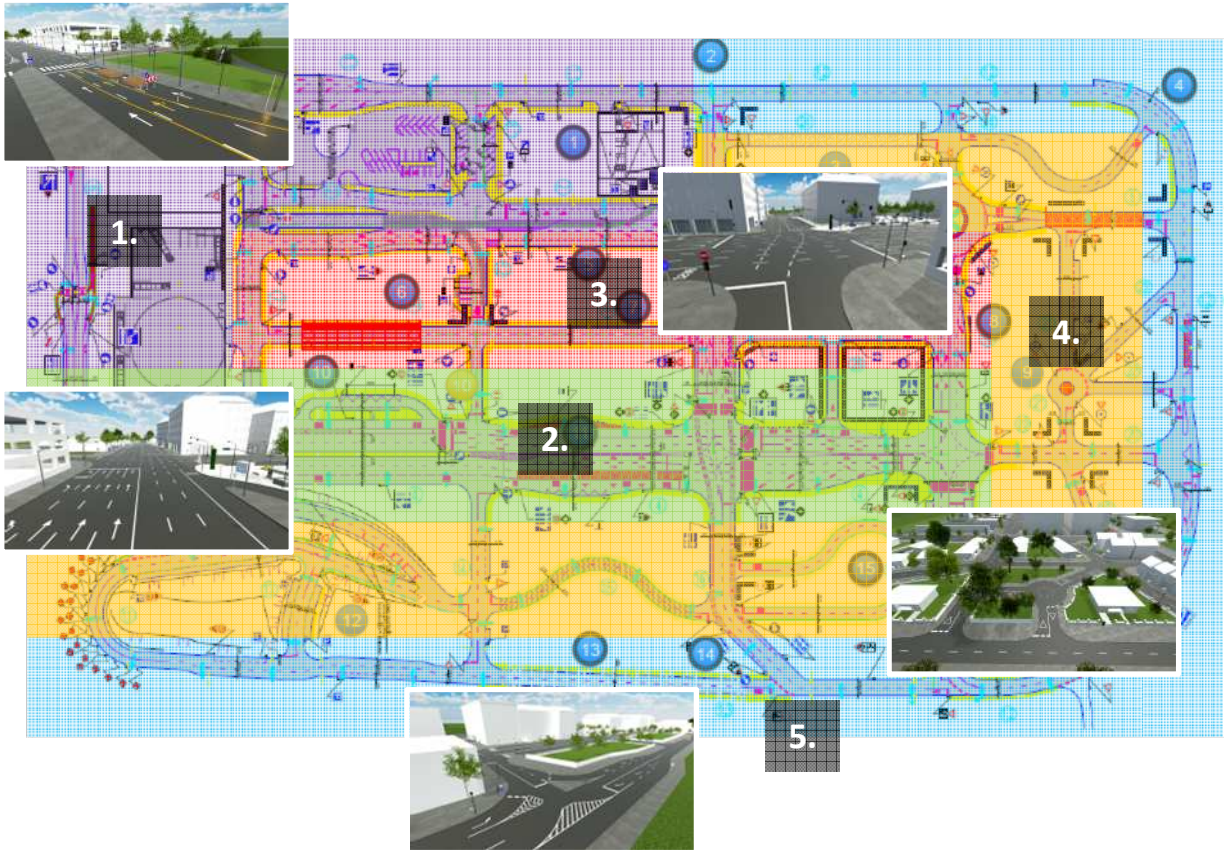
- Platooning on motorway at realistic conditions, exits and entrances
- Platooning and cooperative control with limited communication (tunnel)
- Moving and static obstacles
- Construction site situation
- Multi level junction

Project Phase I. (2017-2018)



Proving Ground Modules

SMART City Zone – Separated Function Zones



Project Phase I. (2017-2018)

1. Low-speed, parking area
2. Multi-lane high speed area
3. Downtown area
4. Suburban area
5. T-junction area

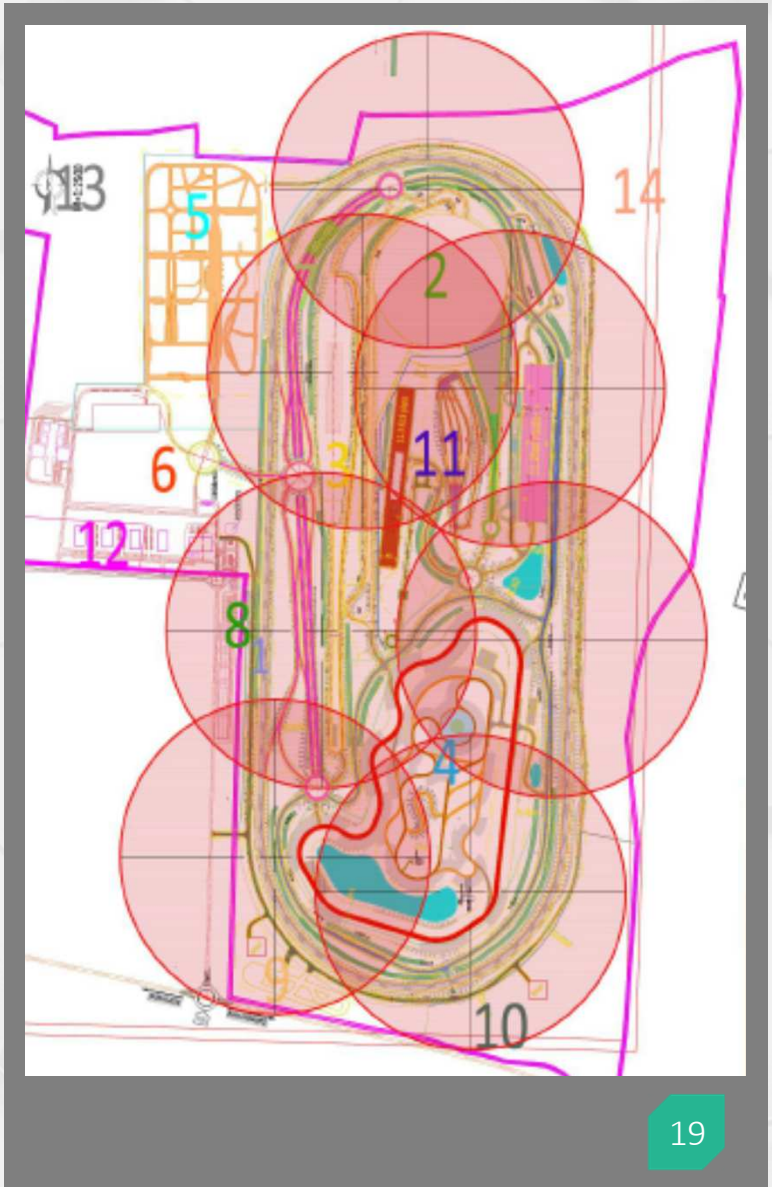
Proving Ground Modules

Communication network

3 level approach:

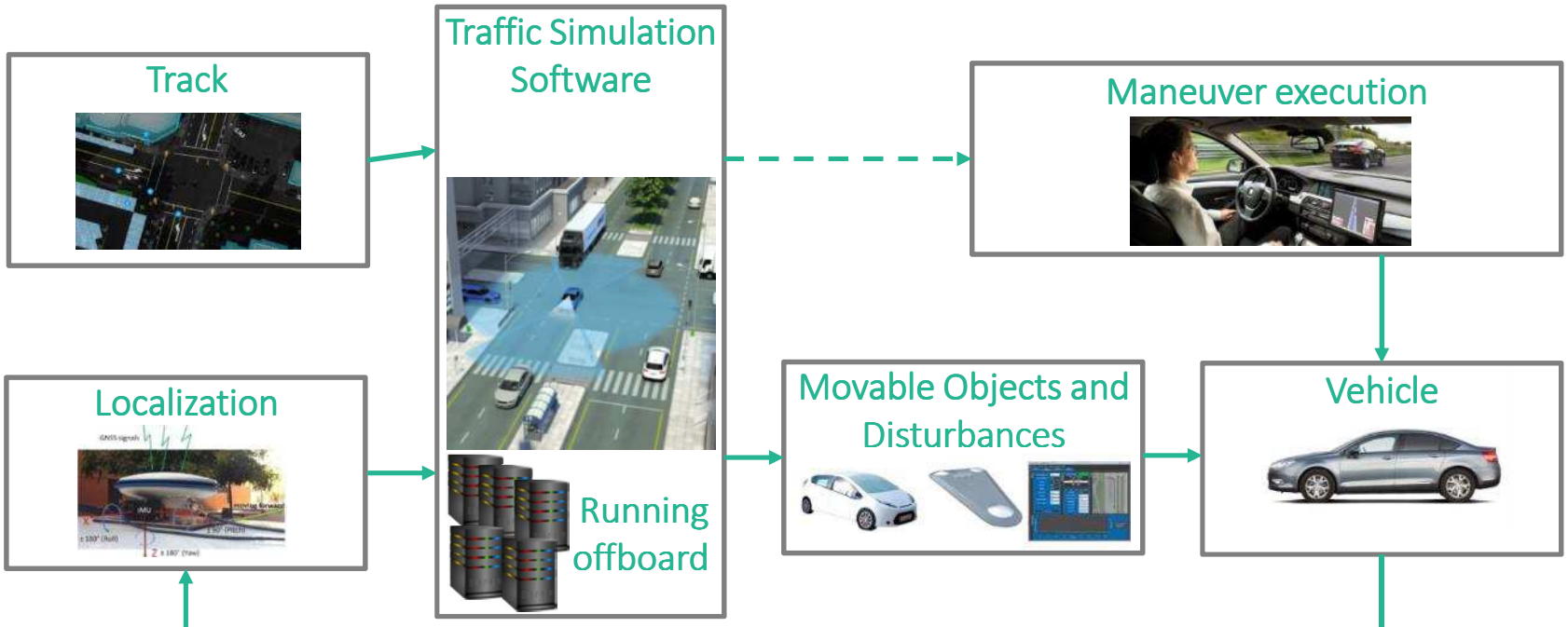
- 1st level:
  ITS G5 basic V2X test enviroment
- 2nd level:
  V2X developer enviroment: freely configurable, open interface for application developers, full data logging infrstructure
- 3rd level:
  fully customer defined test environment

- 5G cellular test network
  for future ITS applications
- Redundant layout
  for paralell customer networks



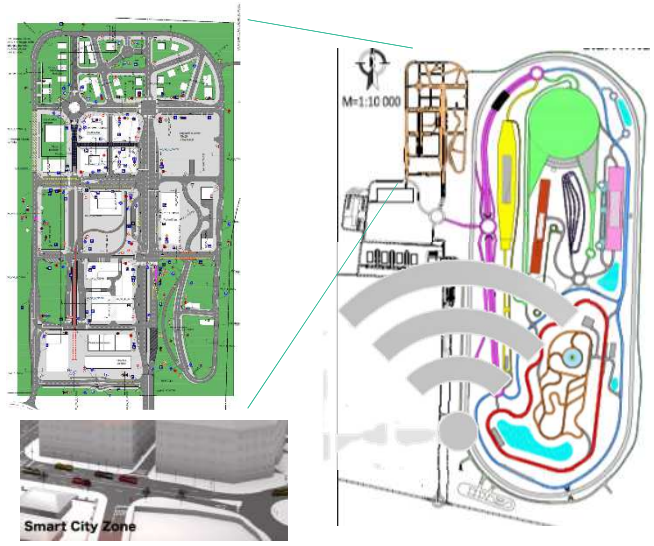
Fully Automatized Complex Test Scenarios

Scenario-in-the-Loop (SciL) Simulation



Leaving the Closed Testing Environment …

Zalaegerszeg as Smart/Digitalized City environment for Testing



Test track modules and scenarios for controlled and repeatable tests in a safe environment

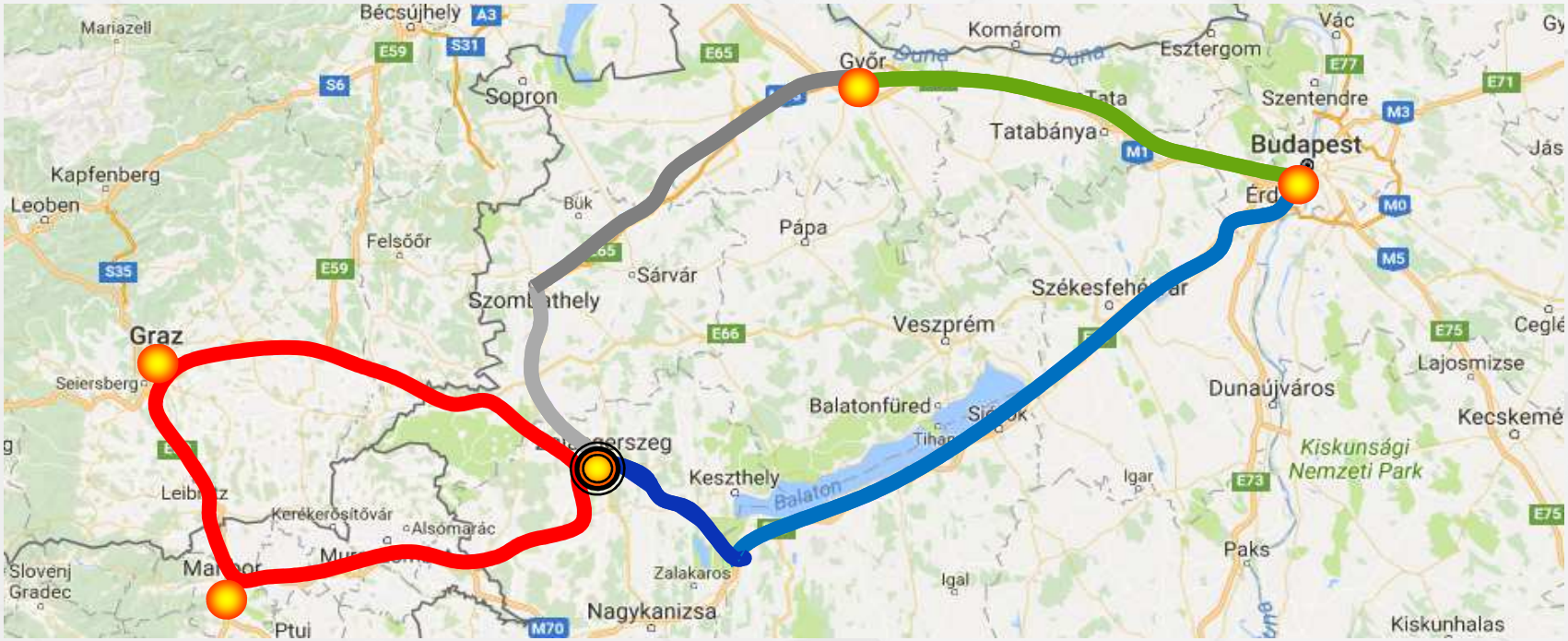
City environment for random real-life testing

Public Road Test in 3 Countries

Extended testing zone – test field to city to public roads

- Loop_1 Local roads (City Zalaegerszeg – being turned into “smart city”)
- Loop_2 Hungarian roads (Zalaegerszeg-Gyor-Budapest) – Actually designed R76 for automated driving, M7 with modified communication
- Loop_3 International roads (Graz-Zalaegerszeg-Maribor zone)

Test road (R76) **plan**
High level communication technologies for test (M7) **plan**
Highway with RSUs (M1)
Normal highway (M85-86)
Normal road (86/76)



4. STATUS OF THE PROJECT

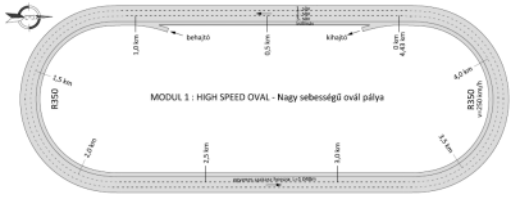
Project milestones and basic data

DYNAMIC PLATFORM

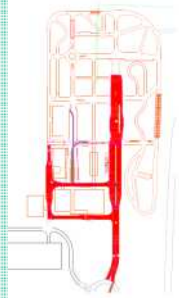
End of Phase I.
Jun,2018

HIGH-SPEED OVAL

Preparation PART I. Oct, 2018



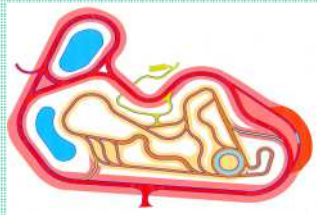
May-Dec, 2017 | **Aug, 2017 – Jun, 2018** | **Oct, 2018**



SMART CITY ZONE I.

completition

BRAKING PLATFORM



HANDLING COURSE

INTERNAL ROADS AS TEST ROADS

rural roads,
highway (lane 1)

BUILDINGS

main entrance, technical building, control center

Project milestones and basic data

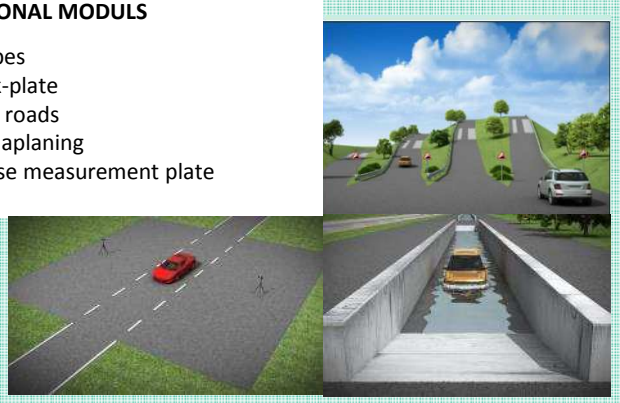
SMART CITY ZONE II.

HIGH-SPEED OVAL COMPLETITION

2019-2020

ADDITIONAL MODULS

- Slopes
- Kick-plate
- Bad roads
- Aquaplaning
- Noise measurement plate



ADDITIONAL BUILDINGS

- University Research Center
- Related buildings

Thank you
for your attention and check the website

www.zalazone.hu

MINISTRY
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