FROM VISION TO REALITY: BLUEPRINT FOR THE ROAD ASSET MANAGEMENT SYSTEM IMPLEMENTATION

Online workshop

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2025 04 02

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01

PURPOSE OF ROAD ASSET MANAGEMENT SYSTEMS

ASSET MANAGEMENT

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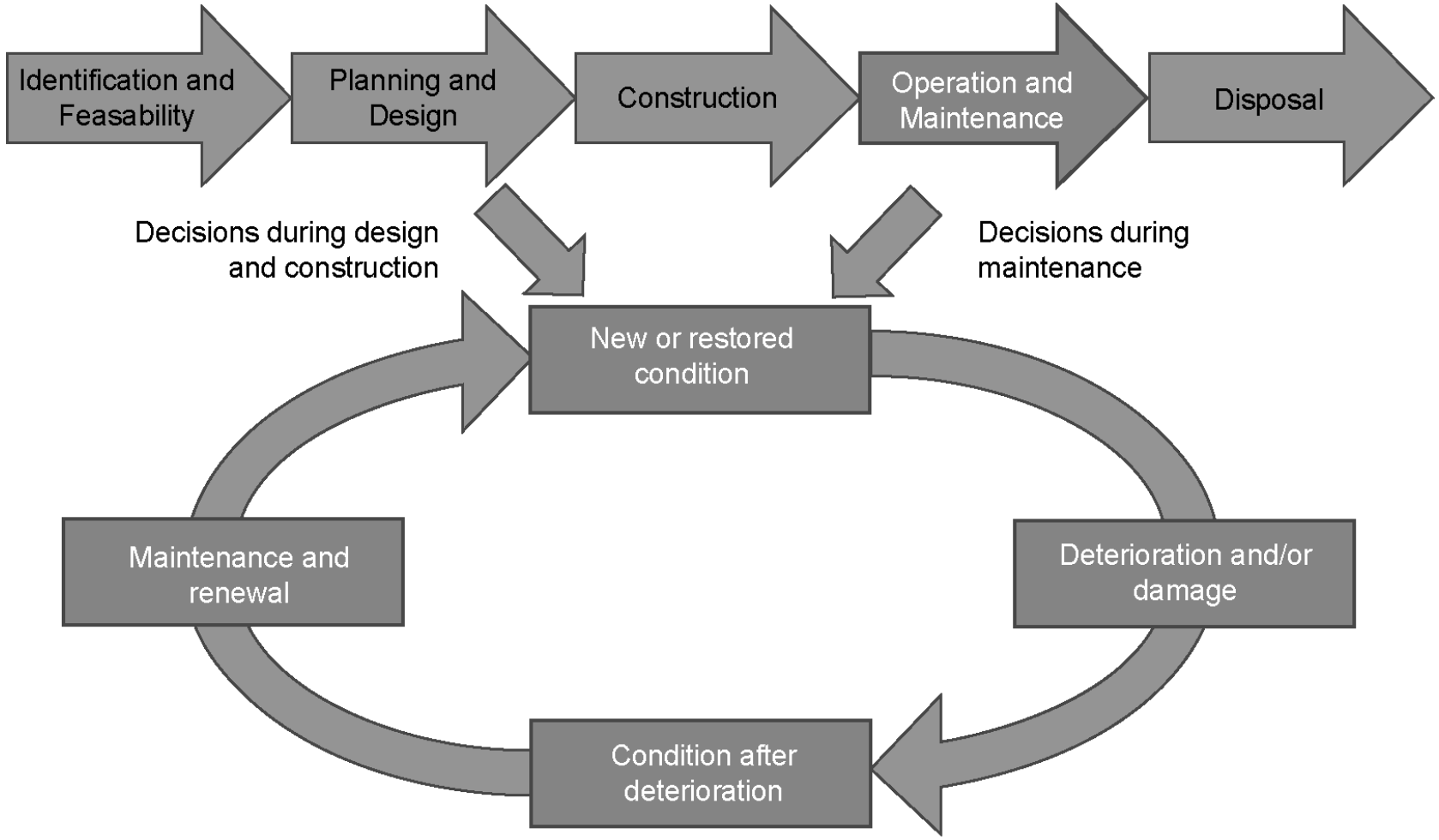
DEFINITION

Comprehensive and structured approach to the whole of life management of assets (such as roads, bridges, tunnels, buildings, plant and equipment, and human resources) as tools for the efficient and effective delivery of services.



TRENDS AND IMPACT ON THE INFRASTRUCTURE INVESTMENTS

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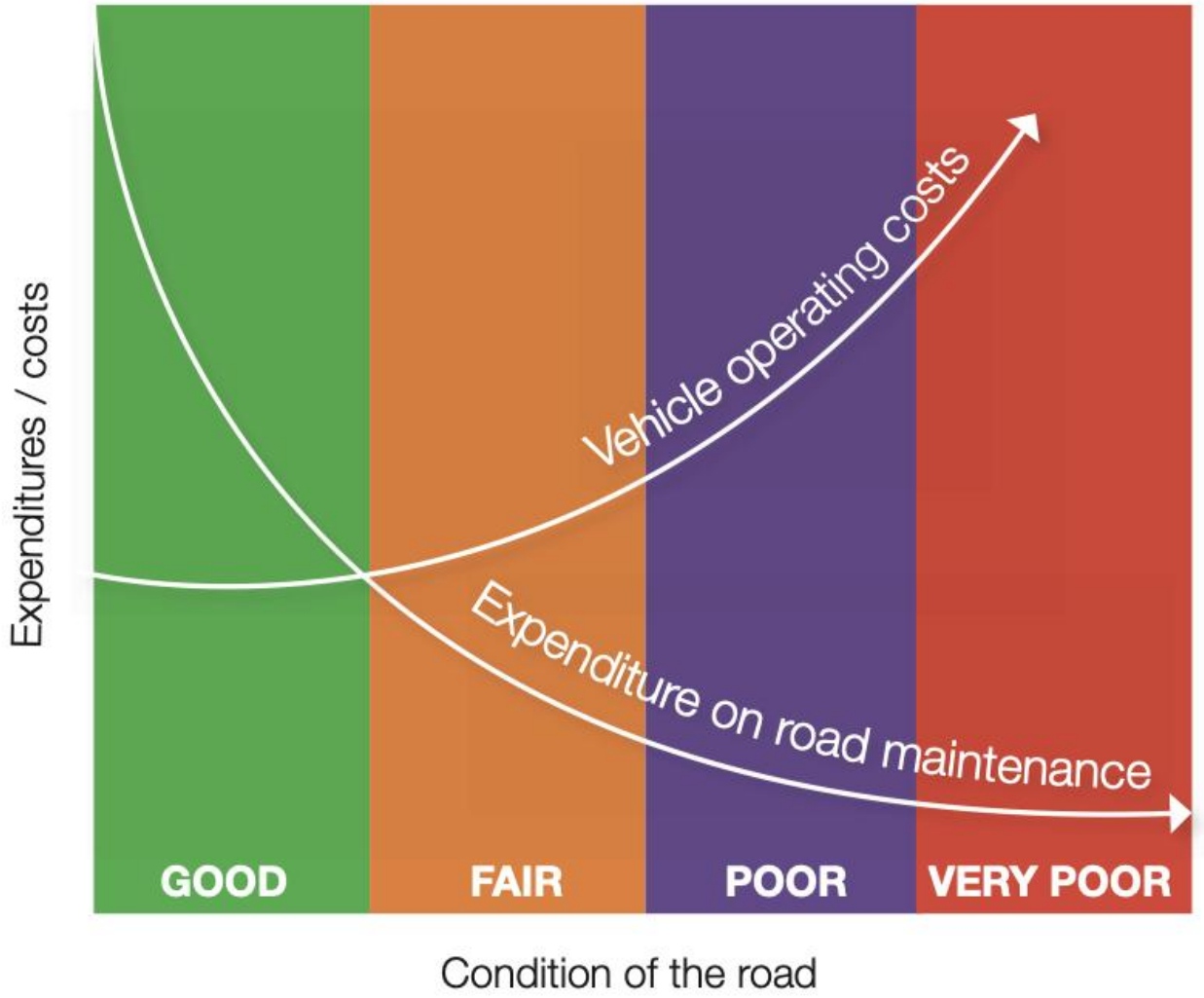
Like any physical asset, road infrastructure needs to be regularly taken care of, maintained, upgraded and renewed in order to keep on providing the citizens with the level of service they are entitled to expect and maintaining its value for society.

This requires investing regularly in the infrastructure.



ROAD NETWORK MANAGEMENT FRAMEWORK

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Road networks are managed in different ways:

- Most are under the **responsibility of authorities**, in charge of planning, construction, supervision, operation, maintenance and road safety.
- They are working with **annual budgets** generally decided by Parliaments.
- Just a few road authorities have the chance to **optimize spending on multi-annual basis**, although it would help to ensuring standards at significantly lower costs, and to establishing a transparent decision process enabling a close communication between road authorities, politicians and the citizens.

LEGAL FRAMEWORK OF ROAD ASSET MANAGEMENT

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20 year frame: National development strategy; National security strategy; National Comprehensive Plan (Territorial Spatial Plan)

10 year frame: National development plan

4-10 year frame: development programs, regional development programs

3 year frame: strategic action plan

1 year: annual activity plan

Strategic framework

Road law:

- Road Classification
- Development and Strategy
- Information Management
- Road Maintenance and Safety
- Responsibility and Liability
- Financing

Road maintenance and development program

Road maintenance rules

Road traffic rules

Legal framework for road transport

INSTITUTIONAL FRAMEWORK OF ROAD ASSET MANAGEMENT

Authority	Scope of responsibilities
The Office of the Government	General objectives and principles for government service digitalization
Ministry of the Economy and Innovation	Policy design, implementation coordination and control
Ministry of the Interior	Management and development of national public administration systems
State Digital Solutions Agency	Institutional support, monitoring of policy implementation, coordination support
State data agency	Maintenance and management of national data infrastructure
Other public entities	Policy implementation, data management

Government data management responsibilities

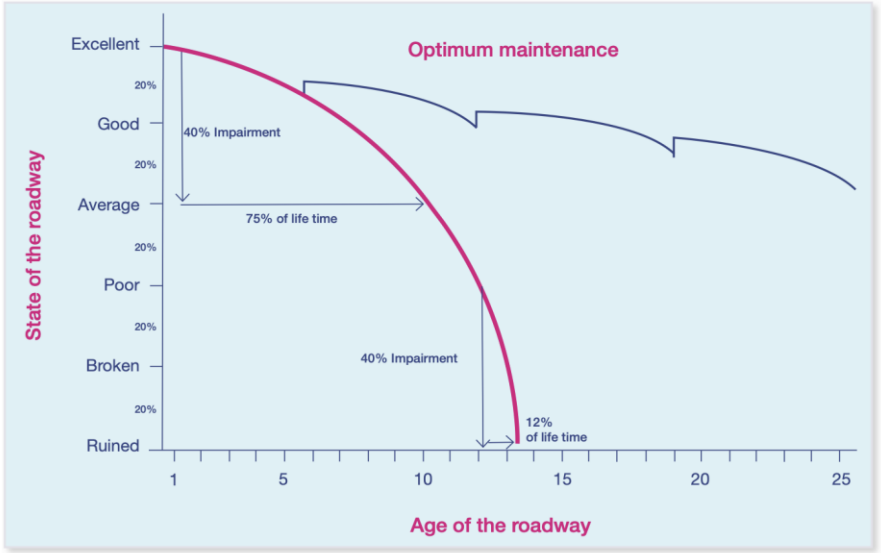
Authority	Scope of responsibilities
Via Lietuva	Management and maintenance of national road network
Ministry of Transport and Communications	National connectivity system policy development
Road safety administration	Management and maintenance of assigned transport information systems
Municipalities	Management and maintenance of municipal transport infrastructure and equipment

Transport data management responsibilities

THE TRADITIONAL BUDGETING APPROACH

Traditional budgeting focuses on annual spending, allowing politicians to adjust priorities yearly. However, this approach has limitations for efficient infrastructure management and maintenance, as investment consequences often take longer to become apparent than a typical legislative term. Other disadvantages:

- Money is not spent in infrastructure when the infrastructure needs it most, but when it is available.
- Maintenance and management costs of infrastructure are not optimised over the life-time of the roads.
- Due to the lack of reliable data on the condition of the roads and the absence of a data-based calculation on future mid- and long- term investment requirements, is difficult to make the decisions necessary to properly maintain the infrastructure.
- And it's even more challenging to integrate other political objectives like noise reduction and road safety.



THE STRATEGIC APPROACH: ROAD ASSET MANAGEMENT

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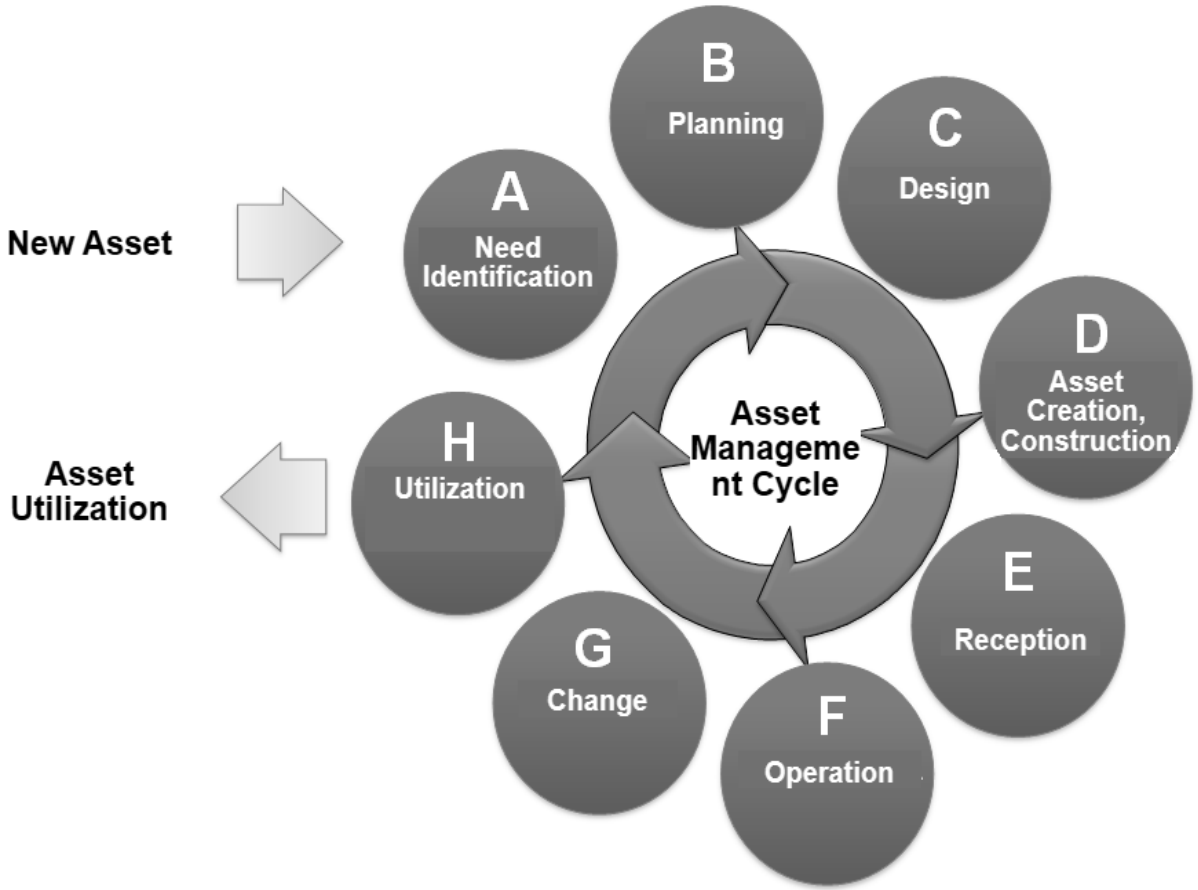
- Maintenance and modernisation are the key issues of Road Asset Management. It is a systematic and permanent process aiming at cost effective maintenance, upgrading and operation of physical assets.
- Asset Management combines engineering disciplines with solid business practices and financial theories.
- In this way, Road Asset Management can help achieve sustainable and effective management of a safe and efficient road network.
- **The primary goal of Road Asset Management is to think, plan and act on the basis of long-term decisions aiming at optimizing maintenance while keeping costs at a minimum and contributing to other political objectives while modernising the network.**



ROAD ASSET MANAGEMENT SYSTEM (RAMS)

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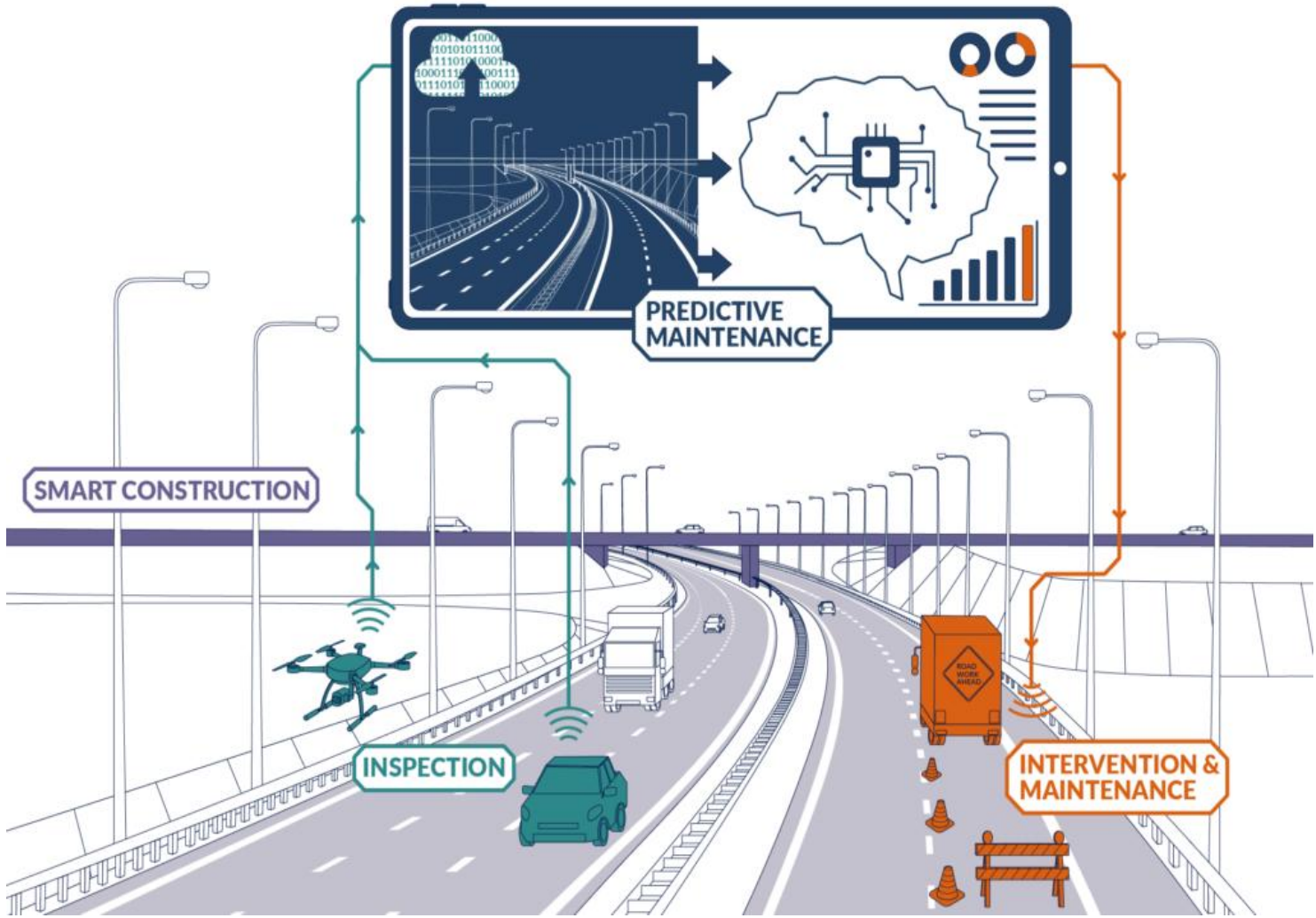
- ROAD ASSET MANAGEMENT is based on an analysis of road data related to inventory, condition, traffic, unit costs, and road deterioration models.
- RAMS: Any system that is used to collect, manage and analyse road data for road planning and programming purposes. The data is entered into RAMS allows the data to be analyzed, and optimal budget levels and allocations to be determined.
- Purpose of RAMS: Optimizing the level and the allocation of road funding in relation to medium- and long-term results regarding road conditions and road user costs.



RAMS FUNCTIONS

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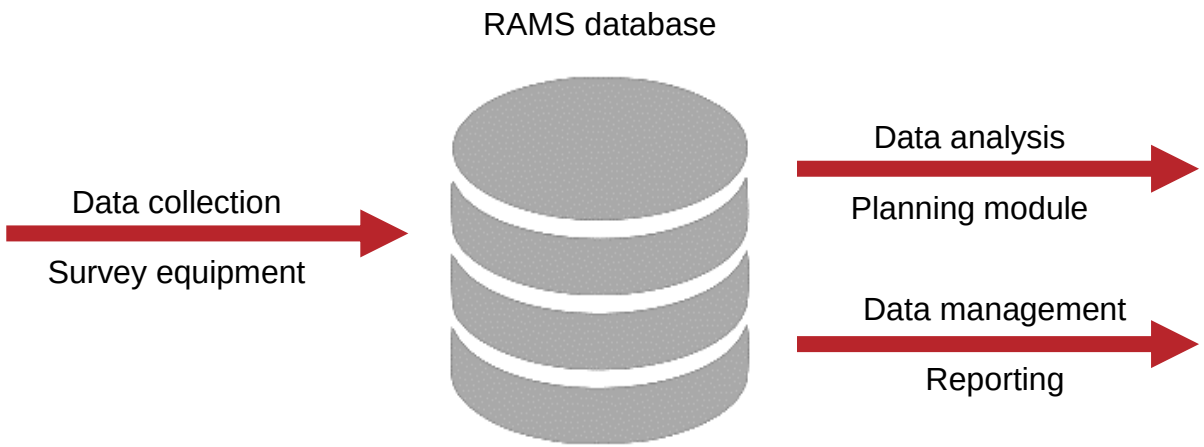
Data collection

- Road data (inventory, condition, traffic, other)
- Maintenance data (costs, performance, etc.)
- Missing / outdated data makes a RAMS useless



Data management (database)

- Combine different data sets
- Prepare reports - provide statistics for the network

Data analysis (planning tool)

- Identify required budget
- Criteria for prioritization + allocation of specific budget
- Algorithms for predicting future road deterioration and user costs

May incorporate other modules

- Bridge or tunnel management system
- Contract management system

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PLANNING AND DESIGNING RAMS

QUESTIONS TO START WITH

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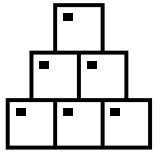
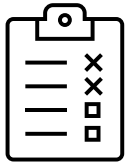


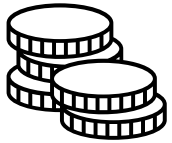
ASSET INVENTORY AND LOCATION

- What is the total number of assets owned by the organization?
- Where are the organization's assets geographically located?



ASSET CONDITION AND ISSUES

- What is the average age of the organization's assets?
- Are there any current issues or problems with the assets?
- If yes, where are these issues located?
- How many active issues are currently affecting the assets?



MAINTENANCE AND COSTS

- When was the most recent maintenance or work completed on a specific asset?
- What are the annual costs associated with maintaining the organization's assets?

FULL INVENTORY FOR ROAD ASSET

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Assets of a public (urban) road network		
Road	**Equipment**	**Structures**
Asphalt lanes	Drainage	Bridges
Walking paths	Signs	Tunnels
Parking areas	Markings	Ports
Bicycle roads	Street lighting	Playgrounds
Gravel roads	Crash barriers	Underpasses
Curbs	Urban furniture	Parks
Cobblestones	…	Galleries
Shoulders		Noise barriers
Ditches		…
Bus bays		
Verges		
Speed bumps		
..		

LITHUANIAN ROAD ASSET MANAGEMENT SYSTEM (LAKIS)

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DATA SETS		
Infrastructure dataset	**Road safety and environment protection data**	**Road reconstruction projects dataset**
Centerlines and parameters of roads and bridges, junctions, pavement layers, lay-bys, lighting, steel guard rails, traffic monitoring and management devices, horizontal marking, road and kilometer signs, crossings, culverts.	Information about accidents, black spots and dangerous sections, speed hums, pedestrian and bicycle ways, noise barriers, wildlife underpass, wildlife fence, greenery, road wastewater treatment plants.	Information about road projects, reconstruction, maintenance and other works

DATA PROVIDERS

- **Road maintenance (State) enterprises**
- **Contractors for road construction**
- **Map service providers**
- **Contractors for data collection**

ROAD ASSET DATA COLLECTION SOURCES

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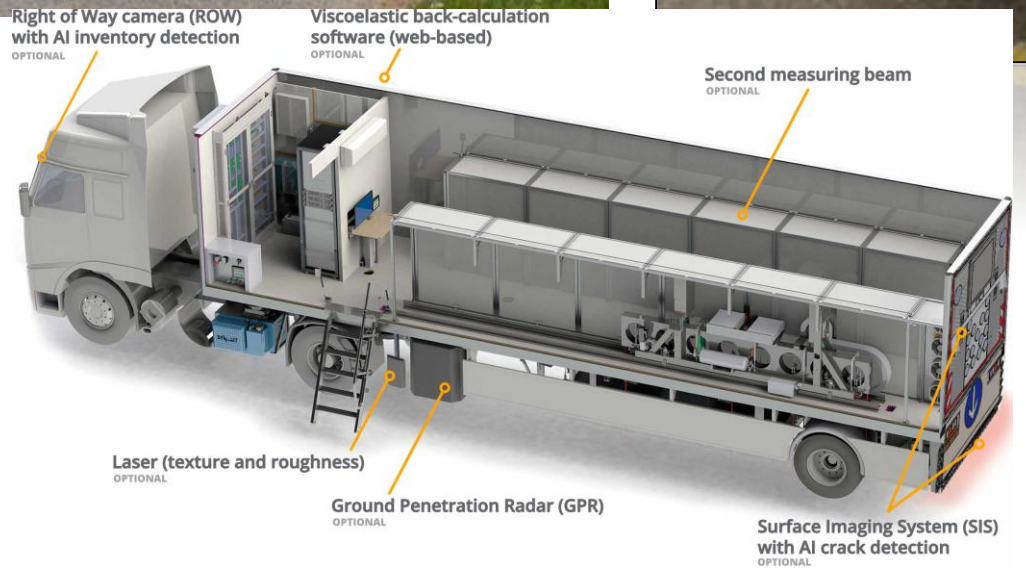

SENSORS FOR DATA COLLECTION

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HDR camera
mounted on Automated Survey Vehicle

Smart **phone**

Visual survey
by Tape, Odometer, Binoculars

Image processing

Network Referencing

Inventory, Geometry & Condition

DGPS

Hand-held **GPS**

Smart **phone**

Pavement Composition

Roughness

Pavement structural strength

Traffic Volume Count

Axle-Load

Bridge & Culvert Condition

History of Works

Manual method
(Excavating trial pits)

Laser Profiler
mounted on Automated survey vehicle

Subjective assessment

Benkelman Beam Deflection
(BBD)

Manual Counting

Portable Weighing Pads

Visual survey
(using Tape, GPS, Binoculars, etc.)

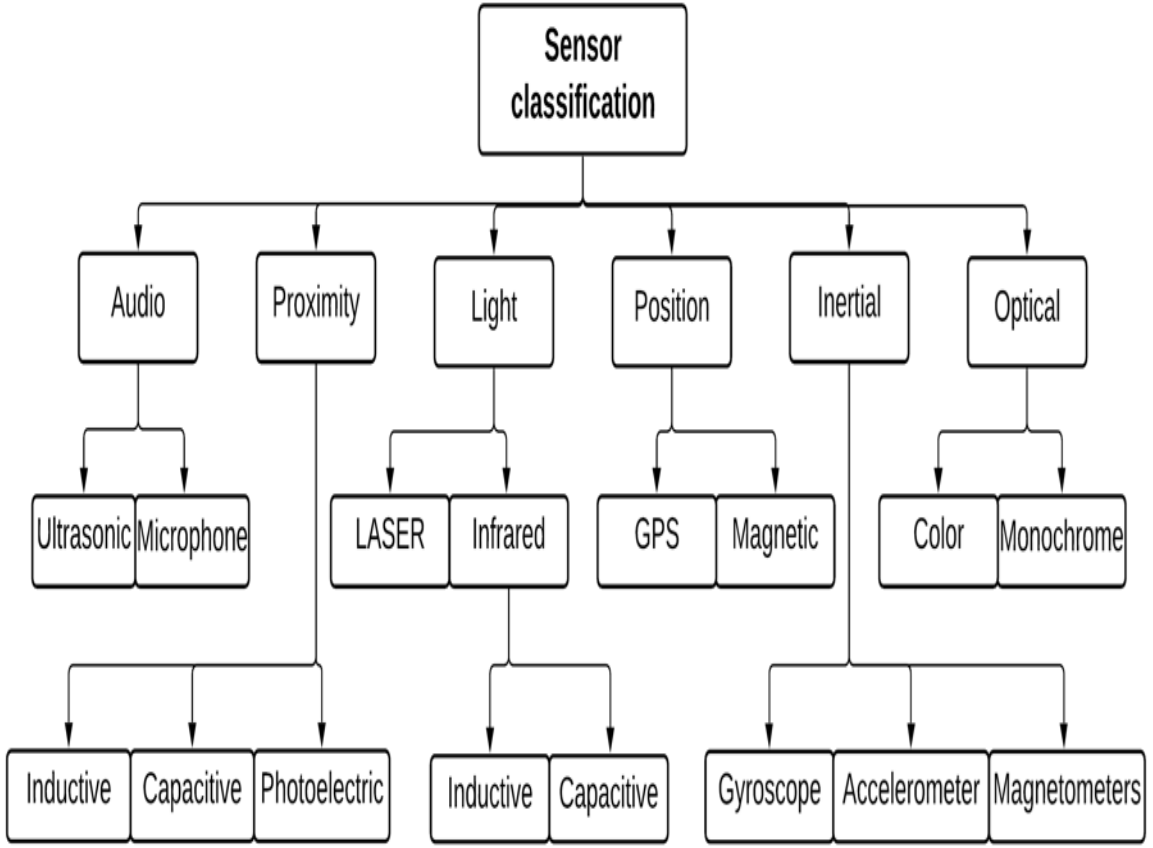
Division Offices

SENSORS FOR DATA COLLECTION

Cameras

RWIS

Traffic counters



ROAD ASSET COLLECTION USING AI

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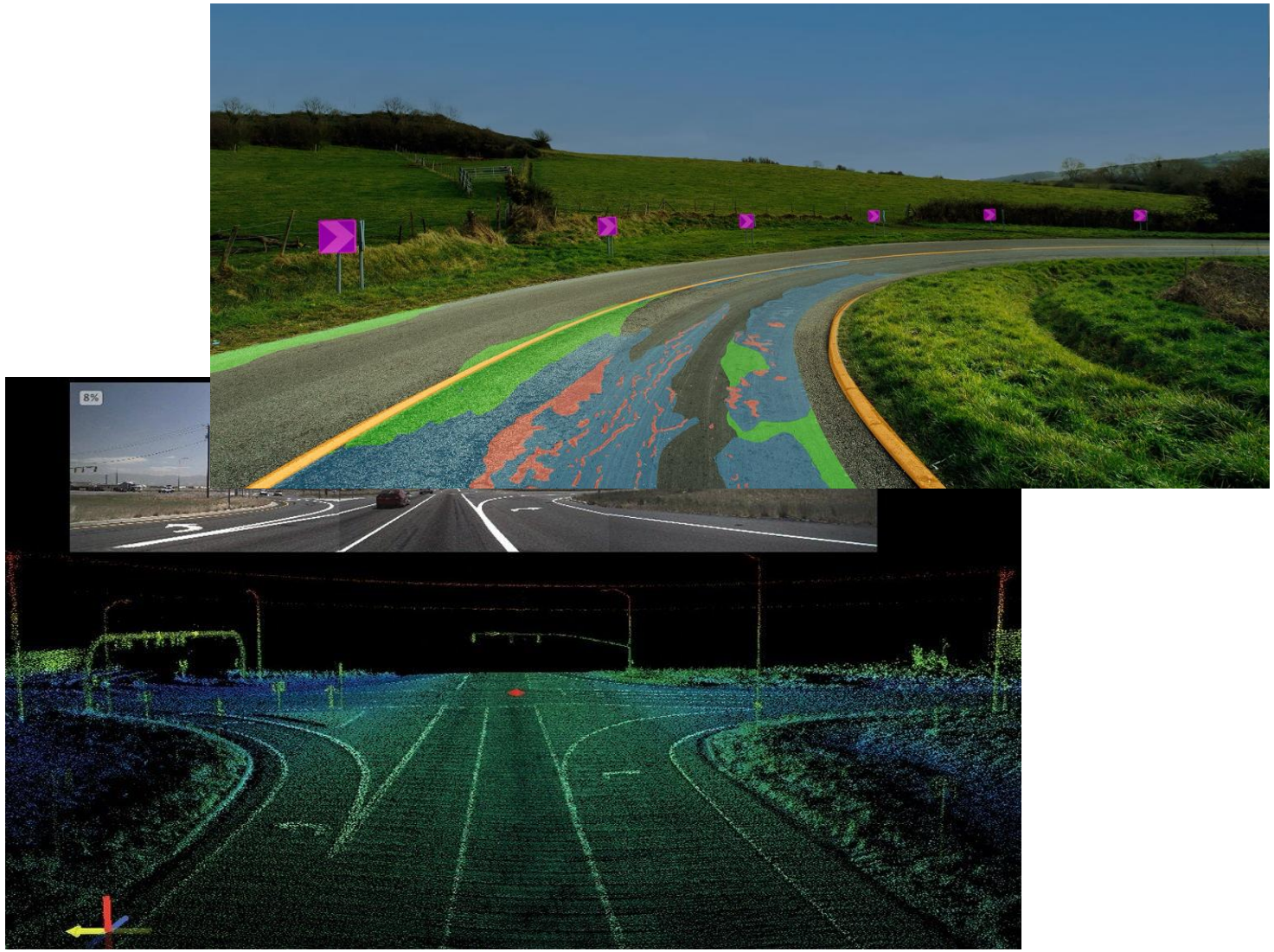

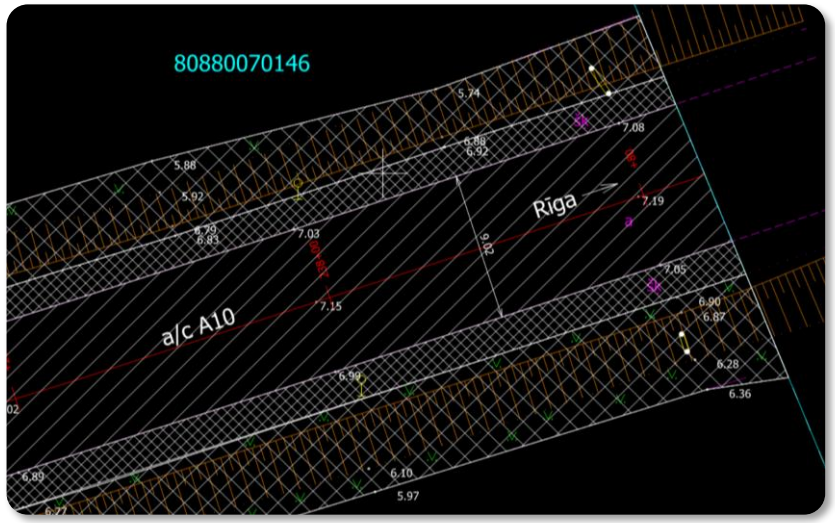

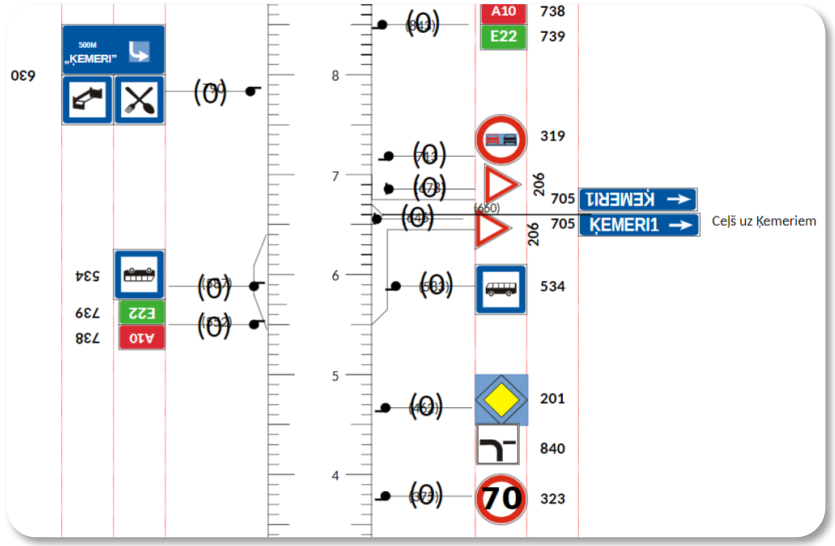


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ROAD ASSET MANAGEMENT SYSTEM. LITHUANIAN EXPERIENCE

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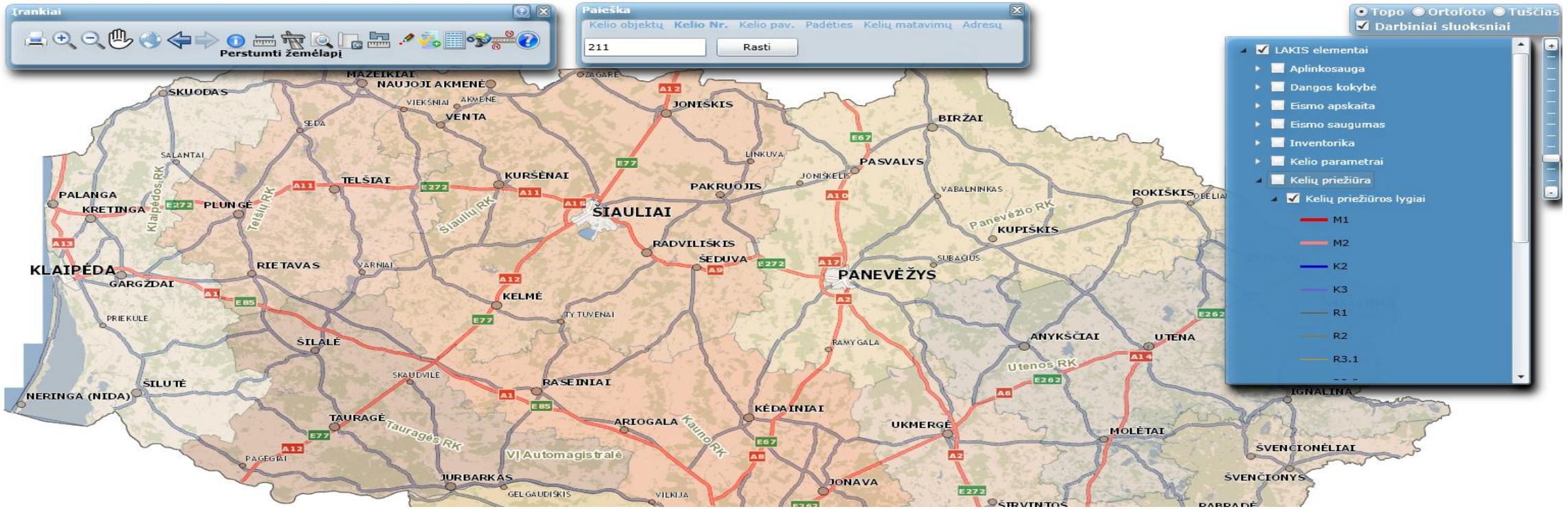

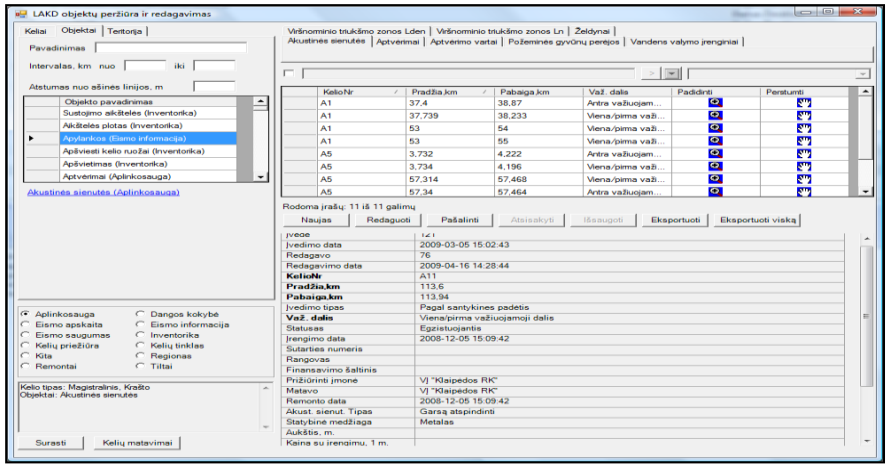

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RAMS ARCHITECTURE AND APPLICATION EXAMPLES

ENTERPRISE ASSET MANAGEMENT SOLUTIONS

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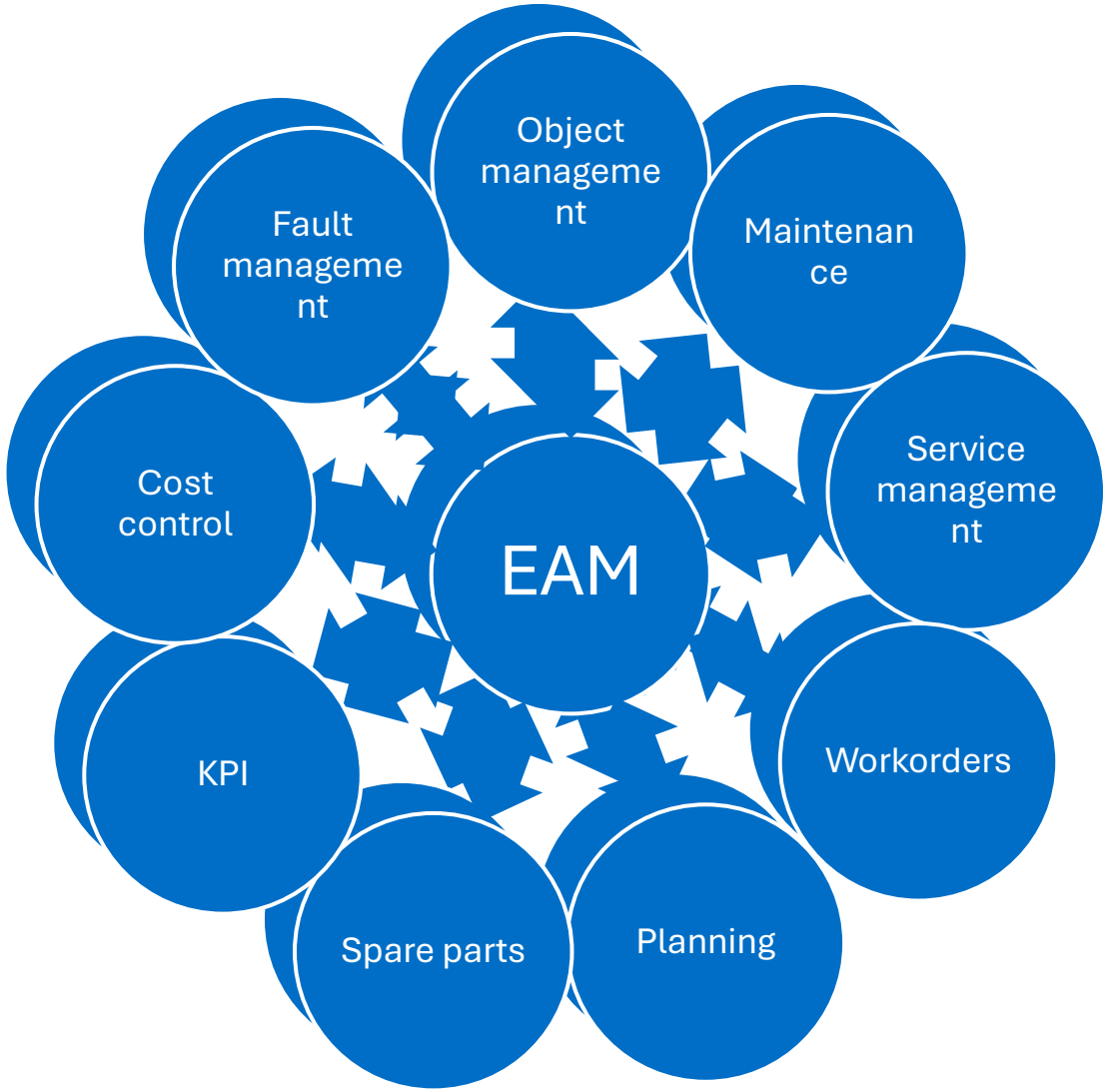
Definition: a software that helps organizations to plan, monitor, and optimize the maintenance and lifecycle of their physical assets such as road infrastructure, railway infrastructure, buildings, and other fixed assets.

Core application: to systematically monitor, control, and optimize the entire lifecycle of an organization's fixed assets. This includes planning and procurement, tracking asset details, managing maintenance schedules, assessing risks, and making informed decisions based on real-time data.

Outcome: efficient and strategic management of an organization's fixed assets throughout their lifecycle.



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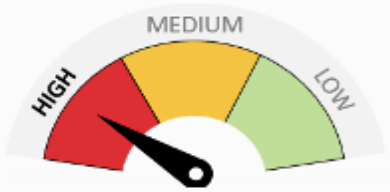
TECHNOLOGY REQUIREMENTS

MARKET

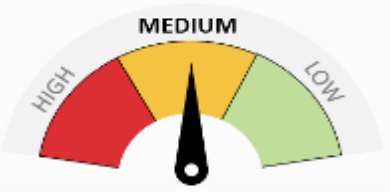


Available diversity of suppliers, ranging from niche offerings by a limited number of suppliers (high) to multiple suppliers (low)

SKILL

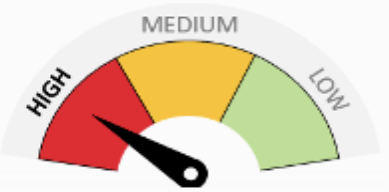
Technical proficiency needed to implement and maintain technology solution, ranging from advanced expertise (high) to basic skills (low)

INTEGRATION



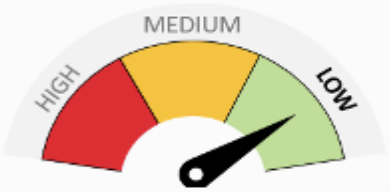
Integration need with external systems, ranging from highly demanded integration, strong system dependency (high) to standalone solutions with limited integration need (low)

COST



Amount of upfront and ongoing costs needed, ranging from extensive upfront costs and ongoing expenses (high) to low upfront investment and ongoing expenses (low)

DIGITAL ENVIRONMENT



The technology's dependencies within digital environment, ranging from advanced infrastructure needs (high) to minimal requirements and low dependencies (low)

ENTERPRISE ASSET MANAGEMENT PLACEMENT OPTIONS

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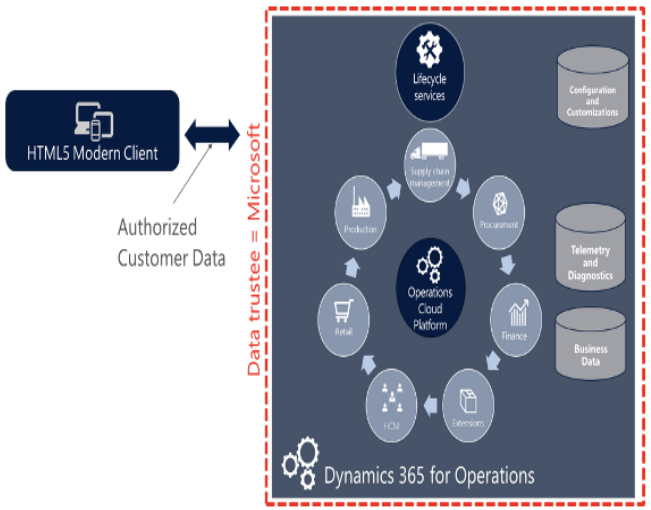
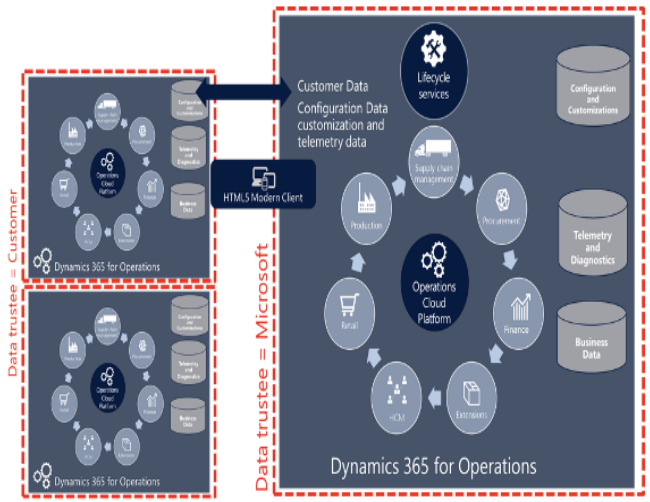
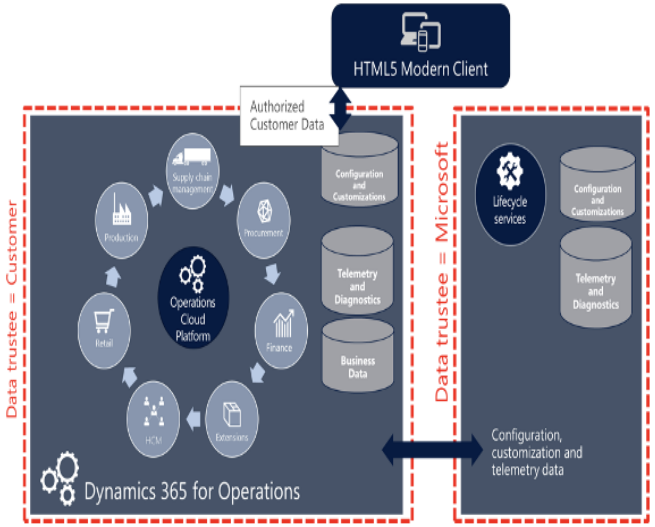
Cloud



Cloud and Edge Deployment



Local Business Data (On-Premises) Deployment



ENTERPRISE ASSET MANAGEMENT PLACEMENT OPTIONS

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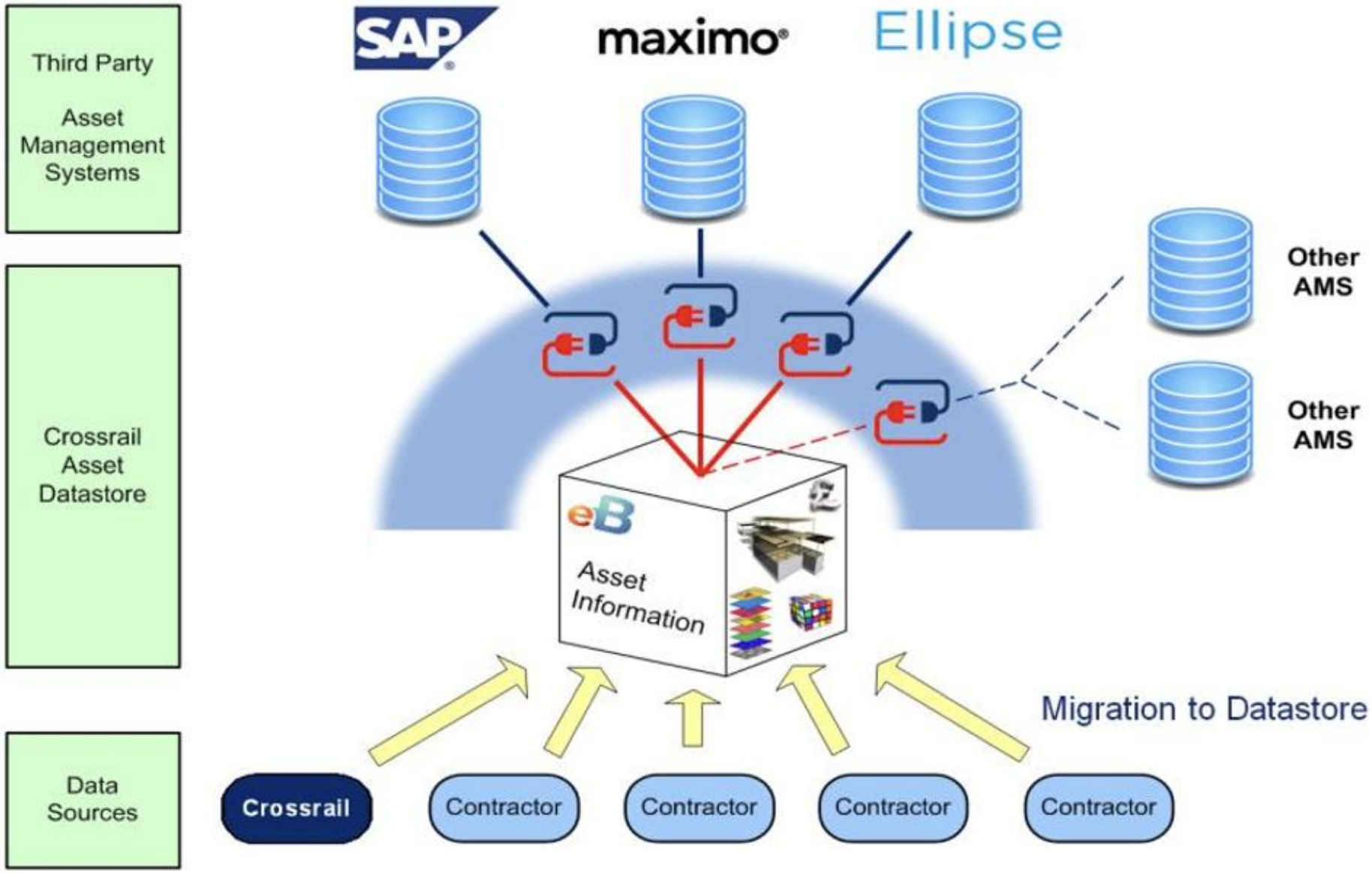

TYPICAL FLOW OF DATA INTO AND OUT OF A GENERIC ROAD ASSET MANAGEMENT SYSTEM

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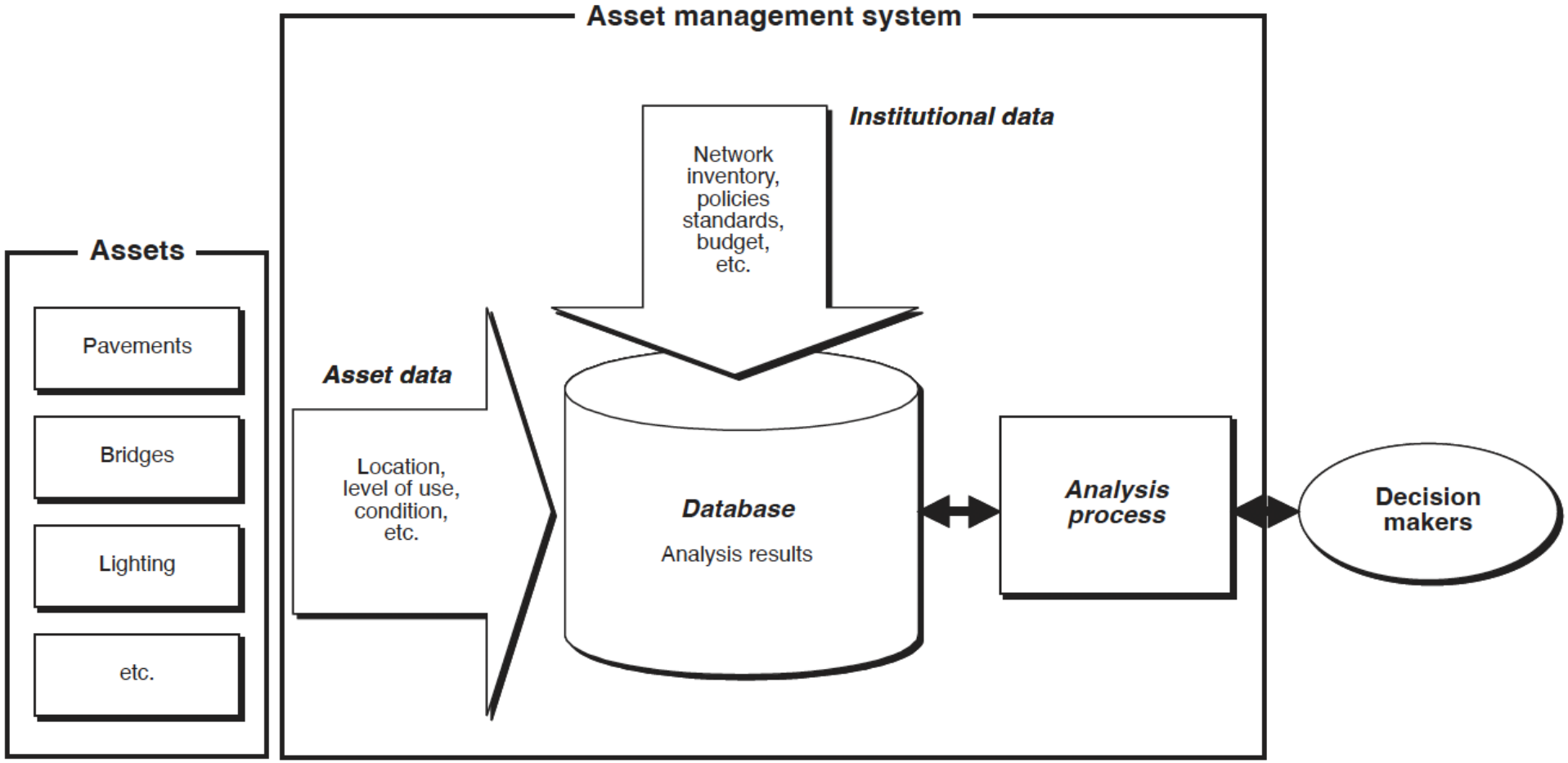

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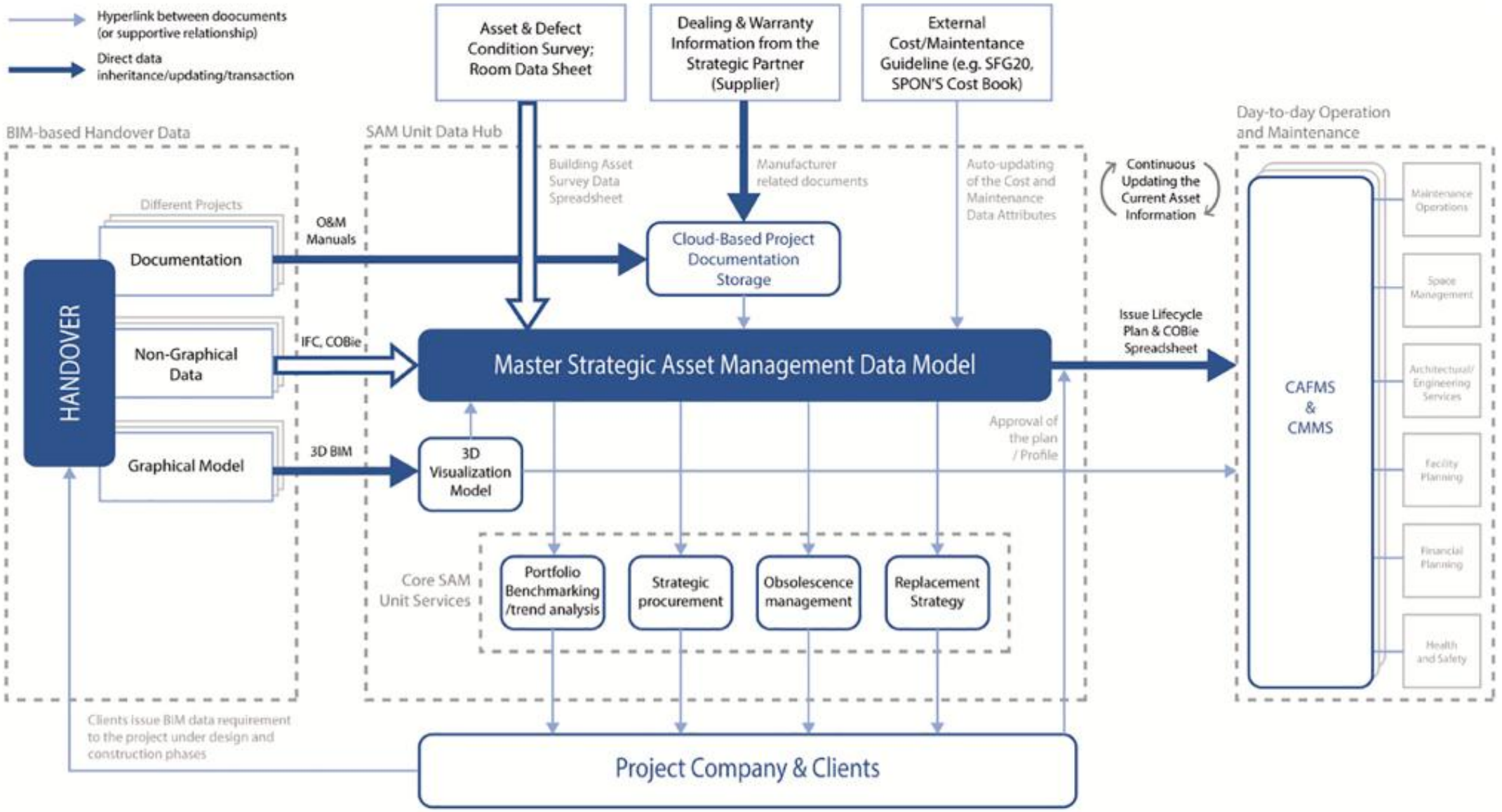

INTEGRATION WITH OTHER SYSTEMS. LITHUANIAN EXAMPLE

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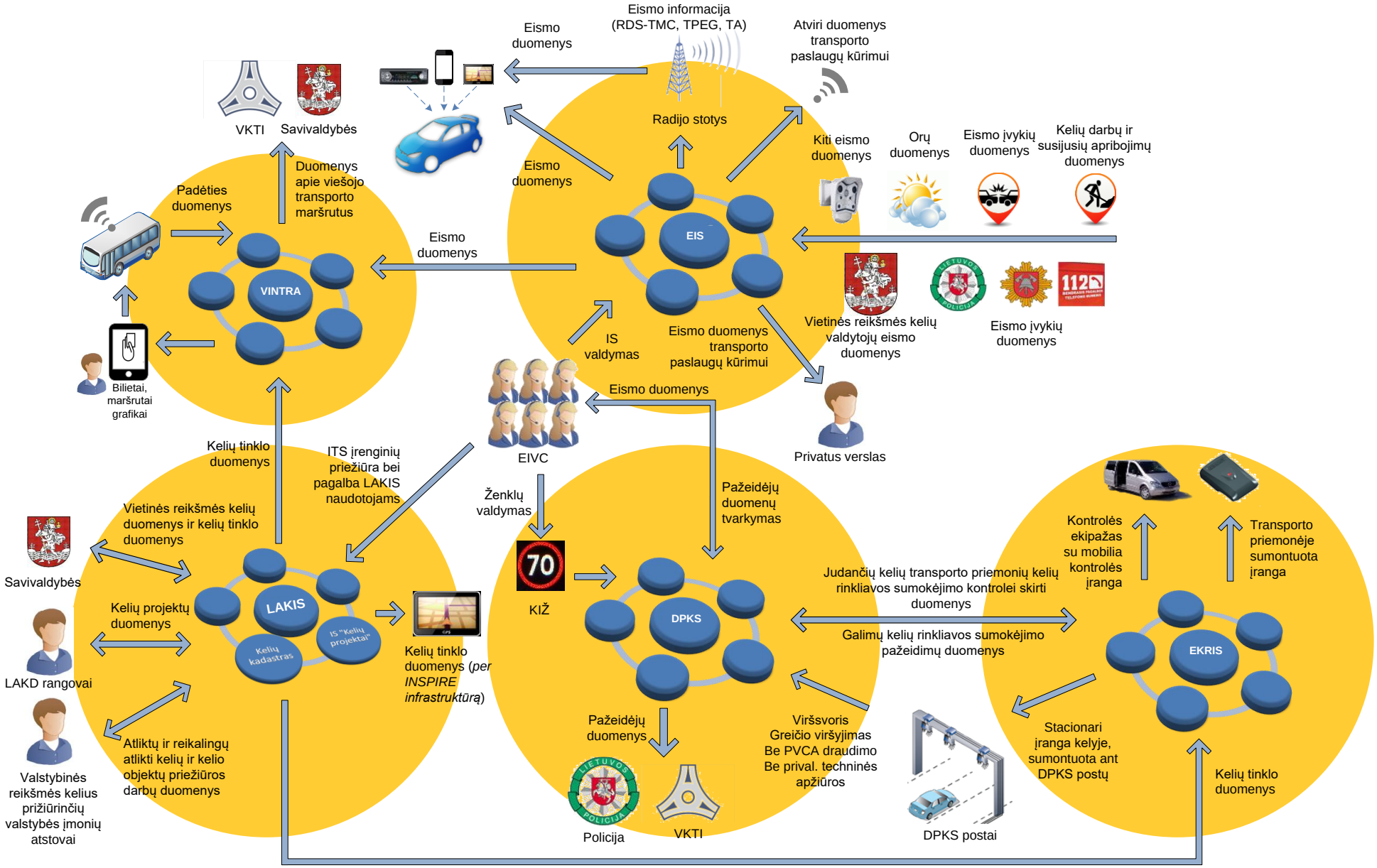

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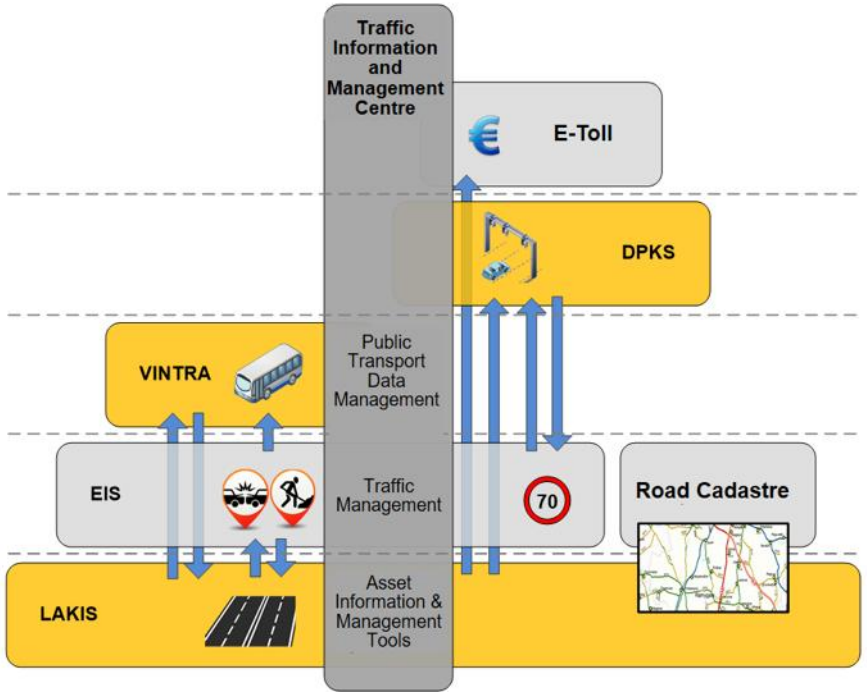

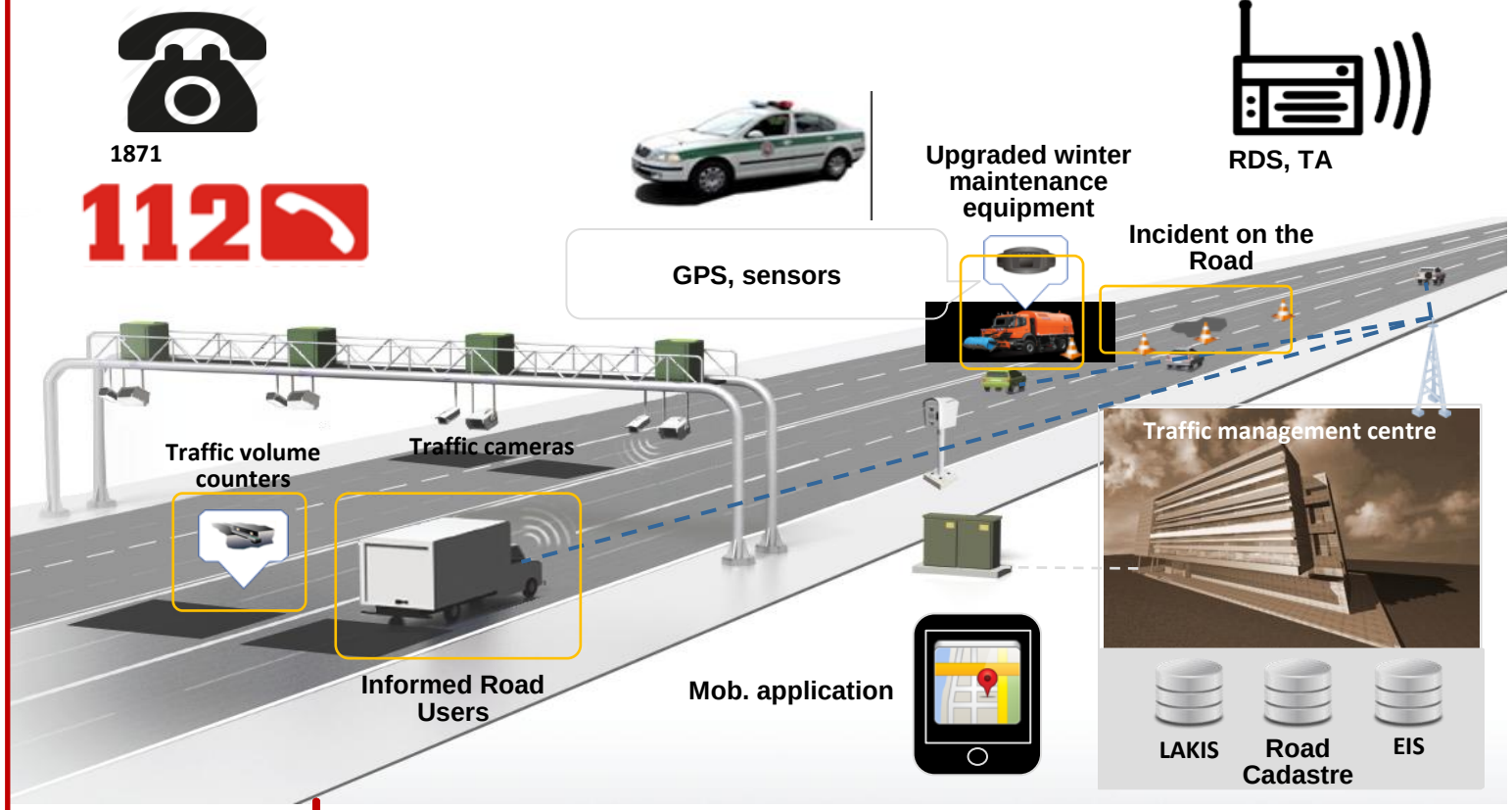

Register of suspects, accused and convicted persons	Register of tractors, self-propelled machines and trailers	Register of events recorded by the police	Road information system of national importance	Address register of the Republic of Lithuania	Register of preventive measures	Official register of wanted persons, unidentified corpses and unknown helpless persons	Information system of the service for determining disability and working capacity	Register of road vehicle drivers	Register of road vehicles	Register of wanted vehicles	Database of the Insurance Supervisory Commission of the Republic of Lithuania	Register of foreigners

RAMS USE FOR ROAD SAFETY INVESTIGATIONS

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DATA COLLECTION AND ANALYSIS

- Selection of dangerous points and stretches (experts, society)
- Network Safety Ranking procedure
- Road Safety Impact Assessment procedure
- Road Safety Audit procedure
- Black Spots determination and Investigation procedure
- Accidents Prediction procedure
- Investigation of every fatal accident
- Road Safety Inspection procedure
- Traffic police patrolling sections selection
- Providing information for society
- Improvement of the legislation

COST-BENEFIT ANALYSIS AND SELECTION OF MEASURES

- Installation of post-accident and preventive infrastructure
- Planning the traffic control activities and updating the legislation
- Society awareness raising and social campaigns planning

RAMS INTEGRATION WITH TRAFFIC ACCIDENT INFORMATION SYSTEM.

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INFORMATION SYSTEM ADMINISTRATIVE AND USER'S MANAGEMENT SUBSYSTEM

SERVERS AND MANAGEMENT

TRAFFIC ACCIDENTS INFORMATION SYSTEM SUBSYSTEMS

TRAFFIC ACCIDENT SUBSYSTEM
1. Data collection and storage 2. Data and documents formation

SPATIAL DATA SUBSYSTEM
Spatial data identification and mapping of traffic accident locations

REPORTING SUBSYSTEM
Traffic accident data processing, detalisation, systematization and formation of traffic accident statistical reports

ADMINISTRATION SUBSYSTEM
Administration of authorizations and rights of employees of EIlS manager and processors, management of classifiers, management of internal and external EIS data flows

DATA EXCHANGE SUBSYSTEM
Ensuring EIS data exchange with state registers, external and internal systems

INTEGRATIONS WITH OTHER PUBLIC SYSTEMS

- Register of suspects, accused and convicted persons
- Register of tractors, self-propelled machines and trailers
- Register of events recorded by the police
- Road information system of national importance
- Address register of the Republic of Lithuania
- Register of preventive measures
- Official register of wanted persons, unidentified corpses and unknown helpless persons
- Information system of the service for determining disability and working capacity
- Register of road vehicle drivers
- Register of road vehicles
- Register of wanted vehicles
- Database of the Insurance Supervisory Commissio n of the Republic of Lithuania
- Register of foreigners

USERS OF EXISTING TRAFFIC ACCIDENTS INFORMATION SYSTEM

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Traffic crash scene data collection

Transport and road information system

Hydrometeorology information system

112 center

Car register and drivers register

DATA SOURCES

TRAFFIC ACCIDENTS INFORMATION SYSTEM

DATA USERS

Police

Transport competency agency

Lithuanian road administration

Transport inspection companies

Lithuanian transport safety agency

Insurance companies

Municipalities administrations

Lithuanian open data agency

EC CARE database

112 center

State health Fund under the Ministry of Health

The State Board of the Social Insurance Fund under the Ministry of Social Security and Labour

RAMS FOR DIGITAL TWINS AND BIM

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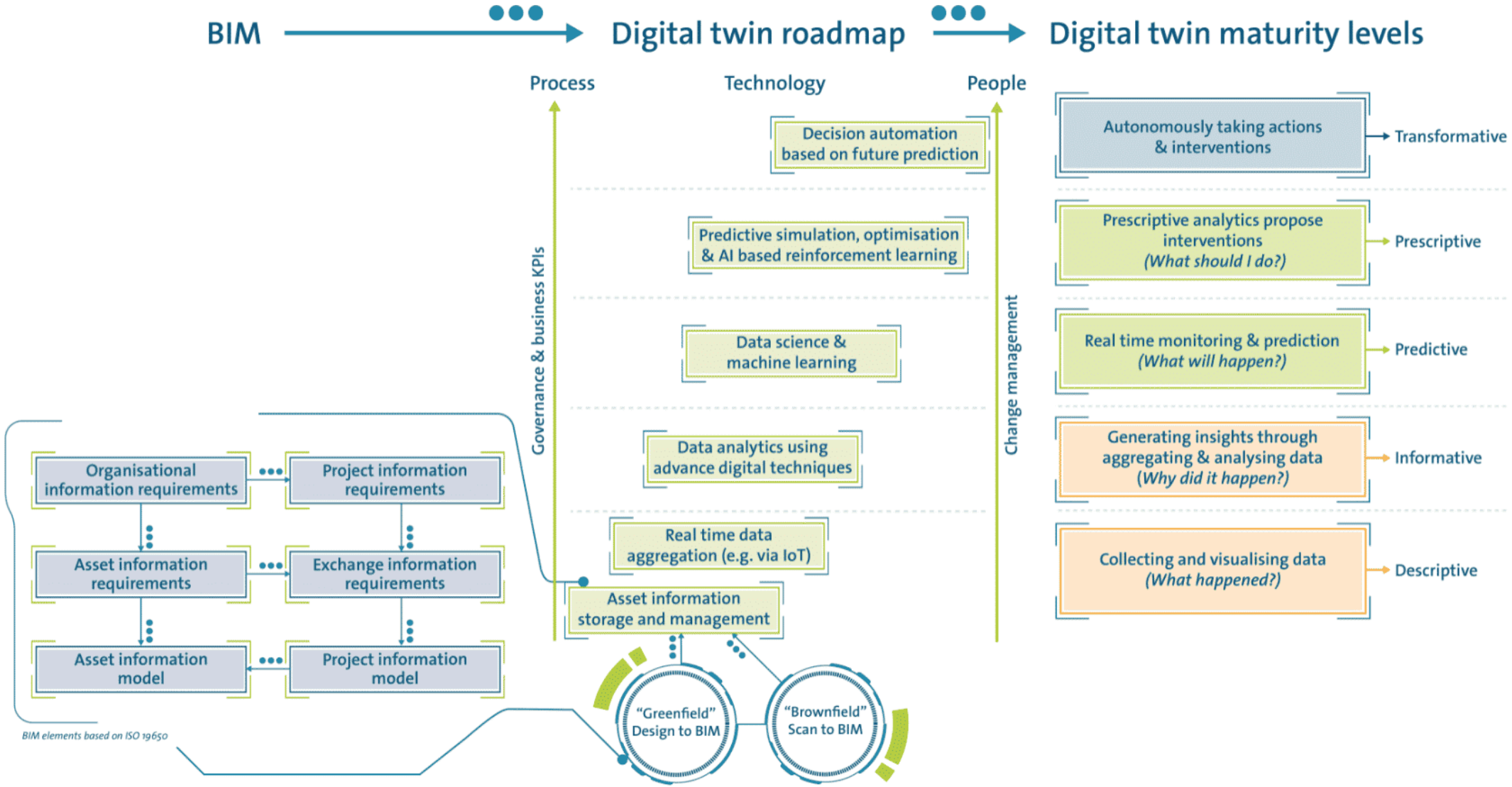

RAMS FOR DIGITAL TWINS AND BIM

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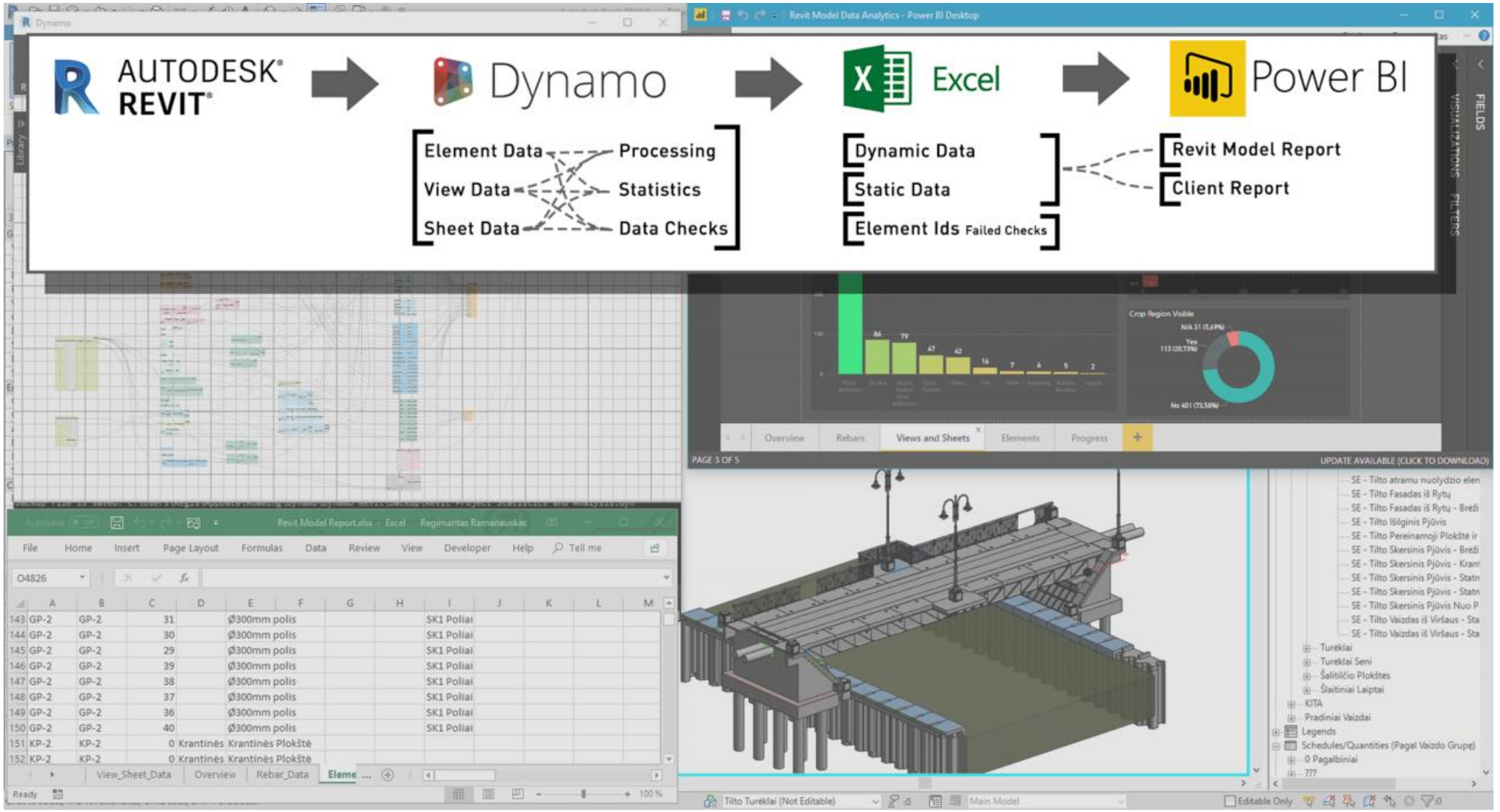

RAMS FOR DIGITAL TWINS AND BIM

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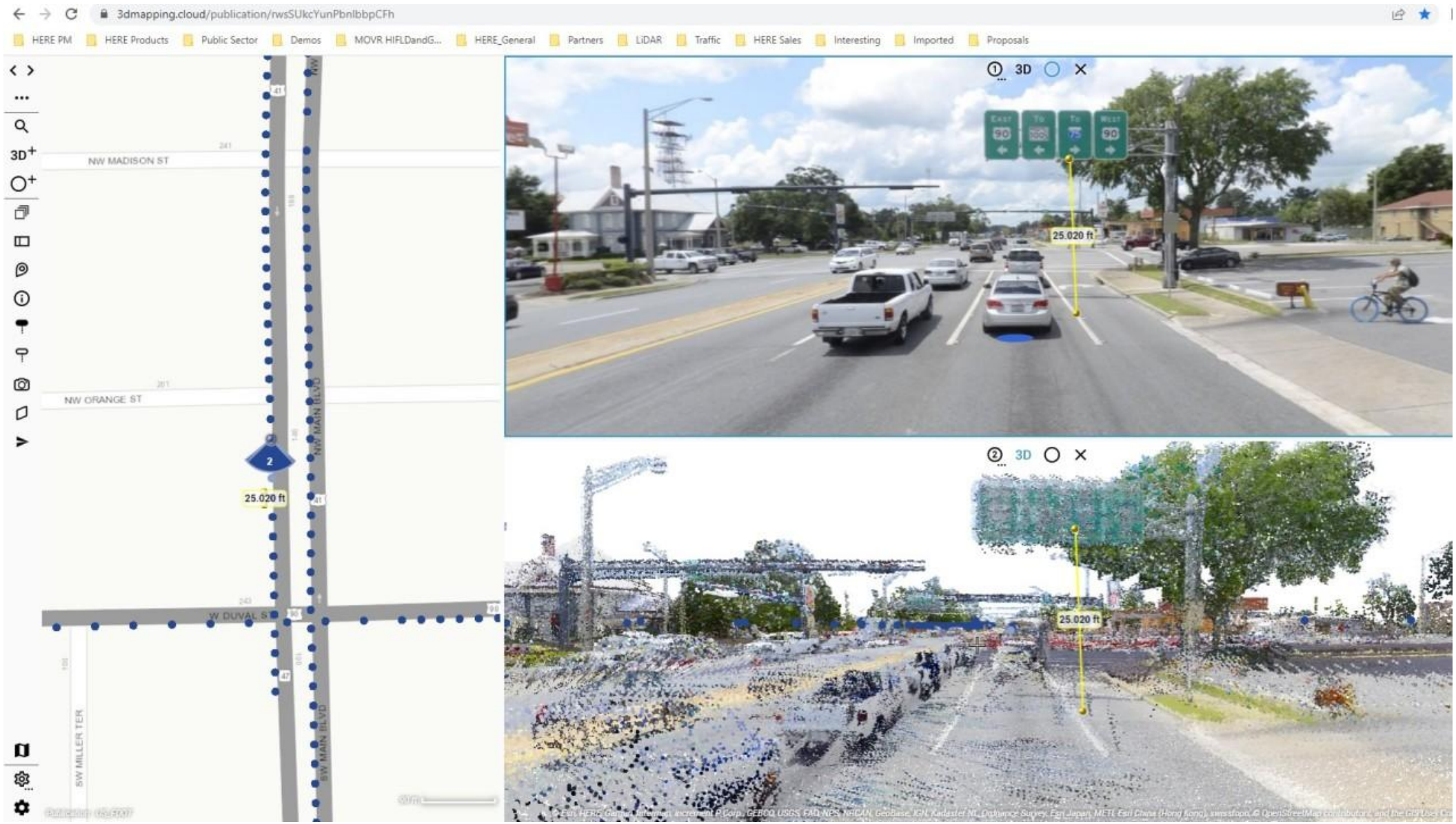
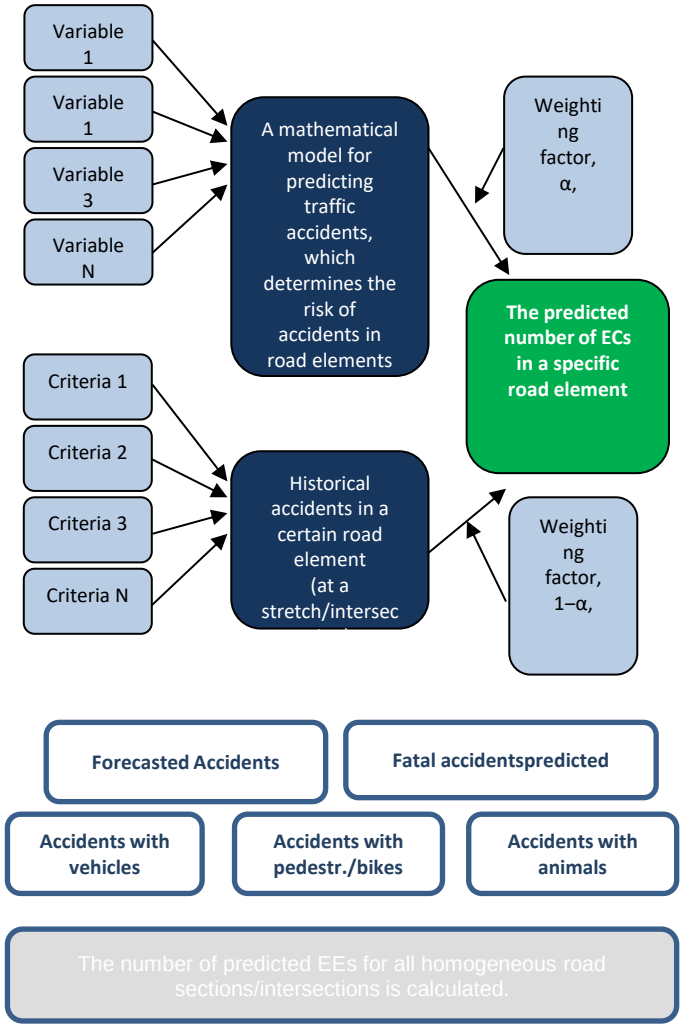
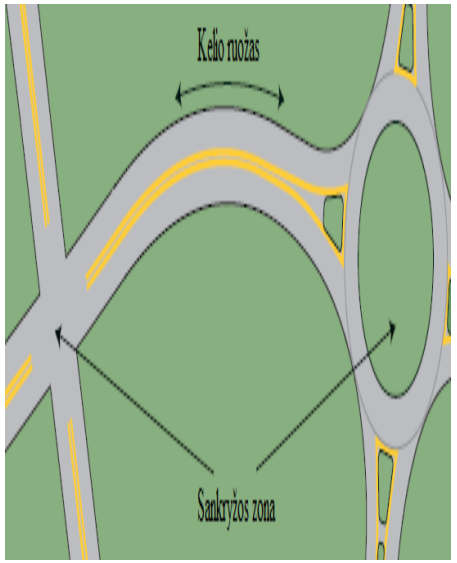
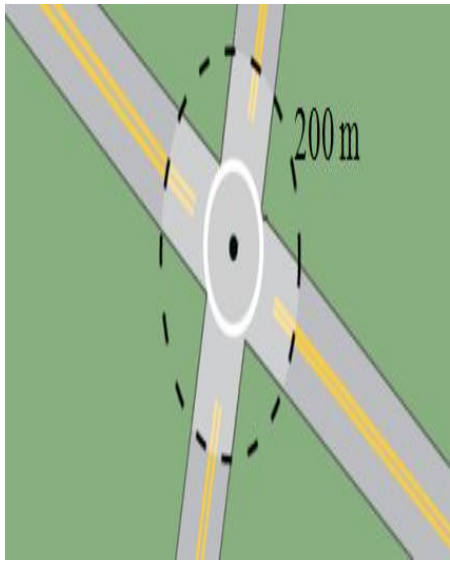


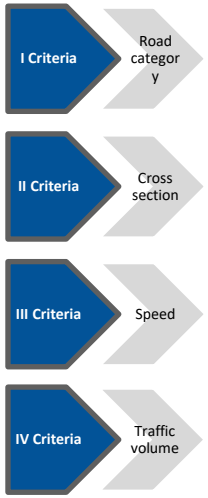
TARVA LT TOOL FOR EFFECTIVENESS CALCULATION OF ROAD SAFETY MEASURES (1)

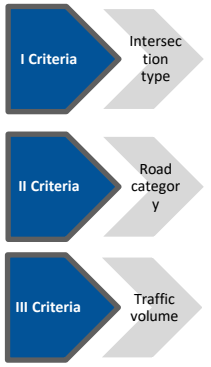
- Many researchers note that the empirical Bayesian method is well developed and widely used in the field of traffic safety
- This approach is based on the assumption that there is a similar risk of accidents in similar environments with similar traffic conditions
- Using an empirical Bayesian method, the predicted number of traffic accidents is determined by combining two sources of information: 1) historical traffic accidents data on a certain element of the road; and 2) a mathematical model for predicting traffic accidents, which determines the risk of traffic accidents in road elements similar in their environment











TARVA LT TOOL FOR EFFECTIVENESS CALCULATION OF ROAD SAFETY MEASURES (2)

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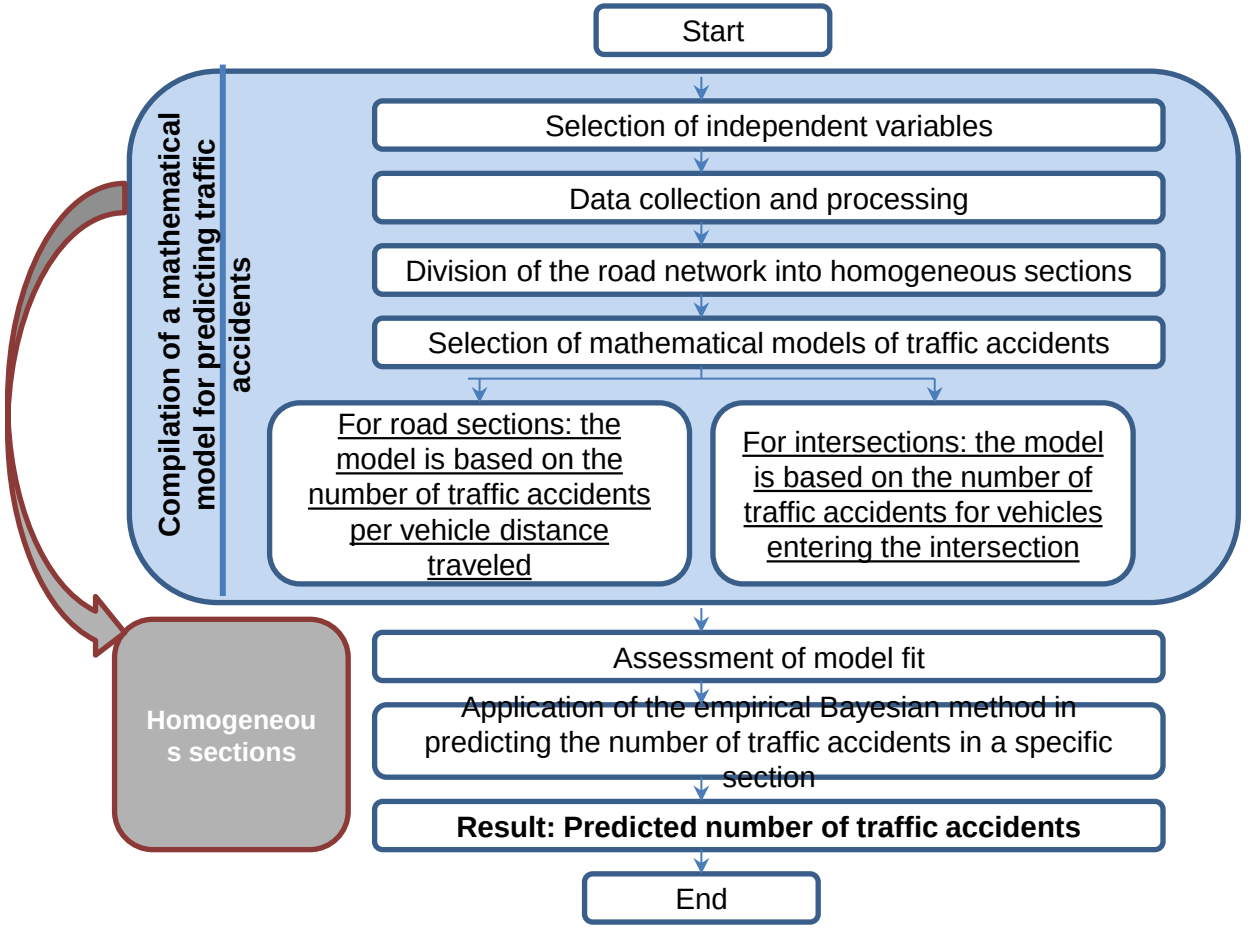
- It should be noted that the frequency of traffic accidents is influenced by many variables, which are usually related to traffic flow, section length, geometric parameters of the road infrastructure, condition of the road surface, lighting, weather conditions, driver behavior, etc.
- When driving on different sections of the road, the probability of getting into a traffic accident is different due to different geometric parameters of the road, different traffic conditions, different road environment, etc.
- Taking this into account, the functional purpose of the road, the transverse profile of the road, traffic volume, the environment surrounding the road, and the permissible driving speed are selected as the main variables.
- Different mathematical models for predicting traffic accidents are created for different types of roadbed elements.
- For road sections: the model is based on the number of traffic accidents for the distance traveled by vehicles, and for intersections - the number of traffic accidents for the number of vehicles entering the intersection.



TARVA LT TOOL FOR EFFECTIVENESS CALCULATION OF ROAD SAFETY MEASURES (3)

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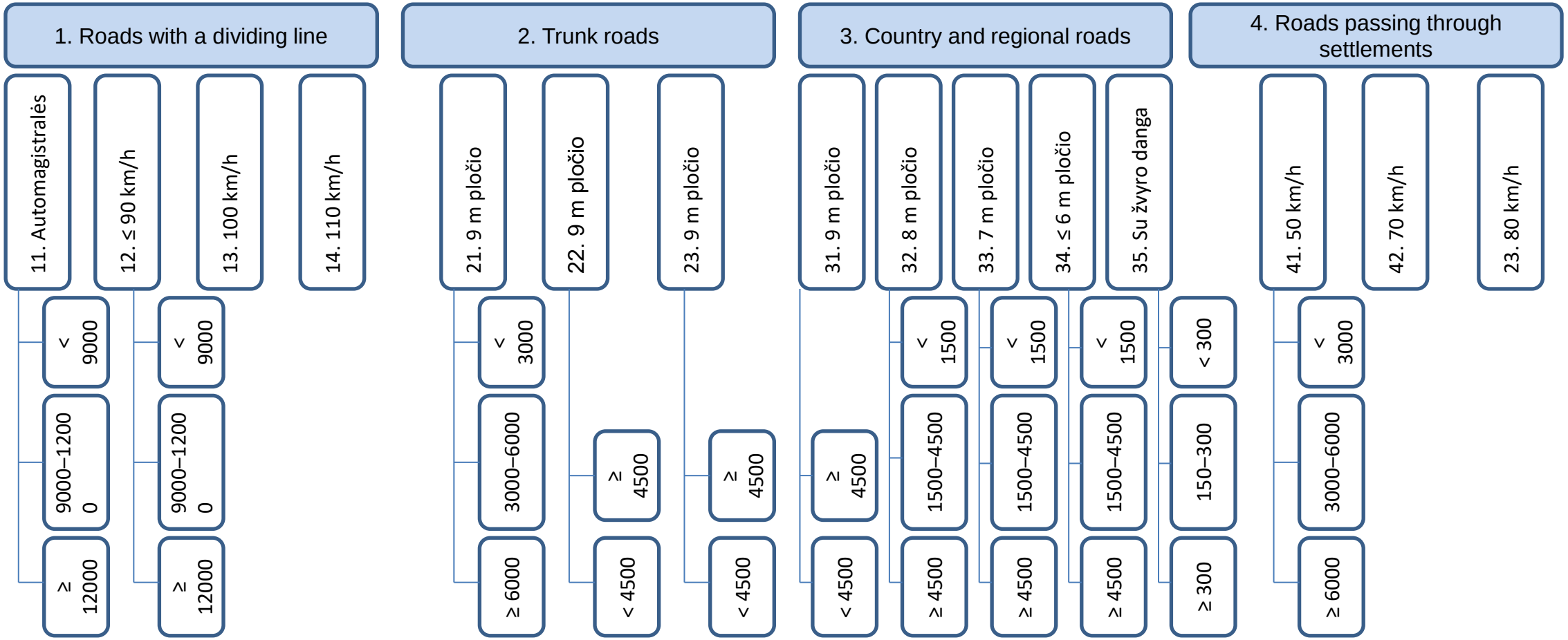

TARVA LT TOOL FOR EFFECTIVENESS CALCULATION OF ROAD SAFETY MEASURES (4)

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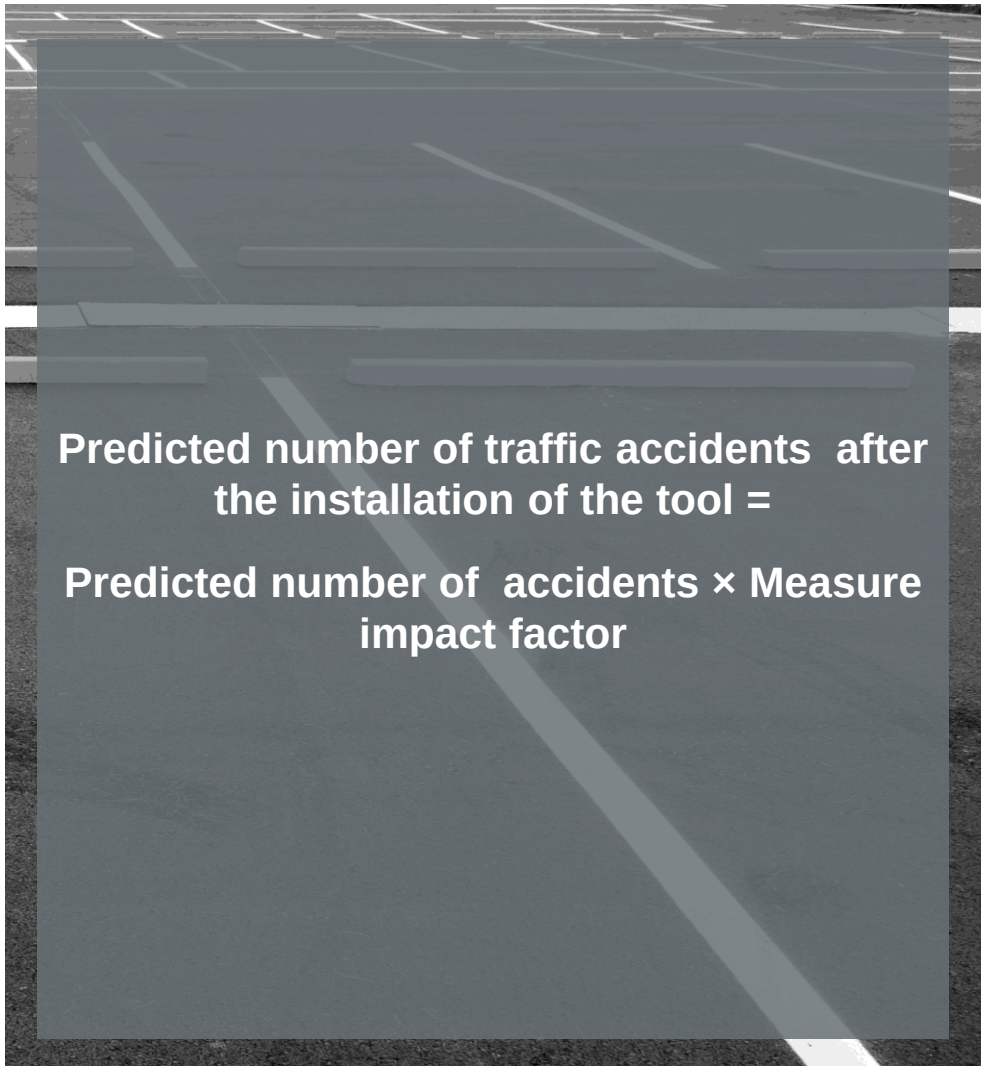
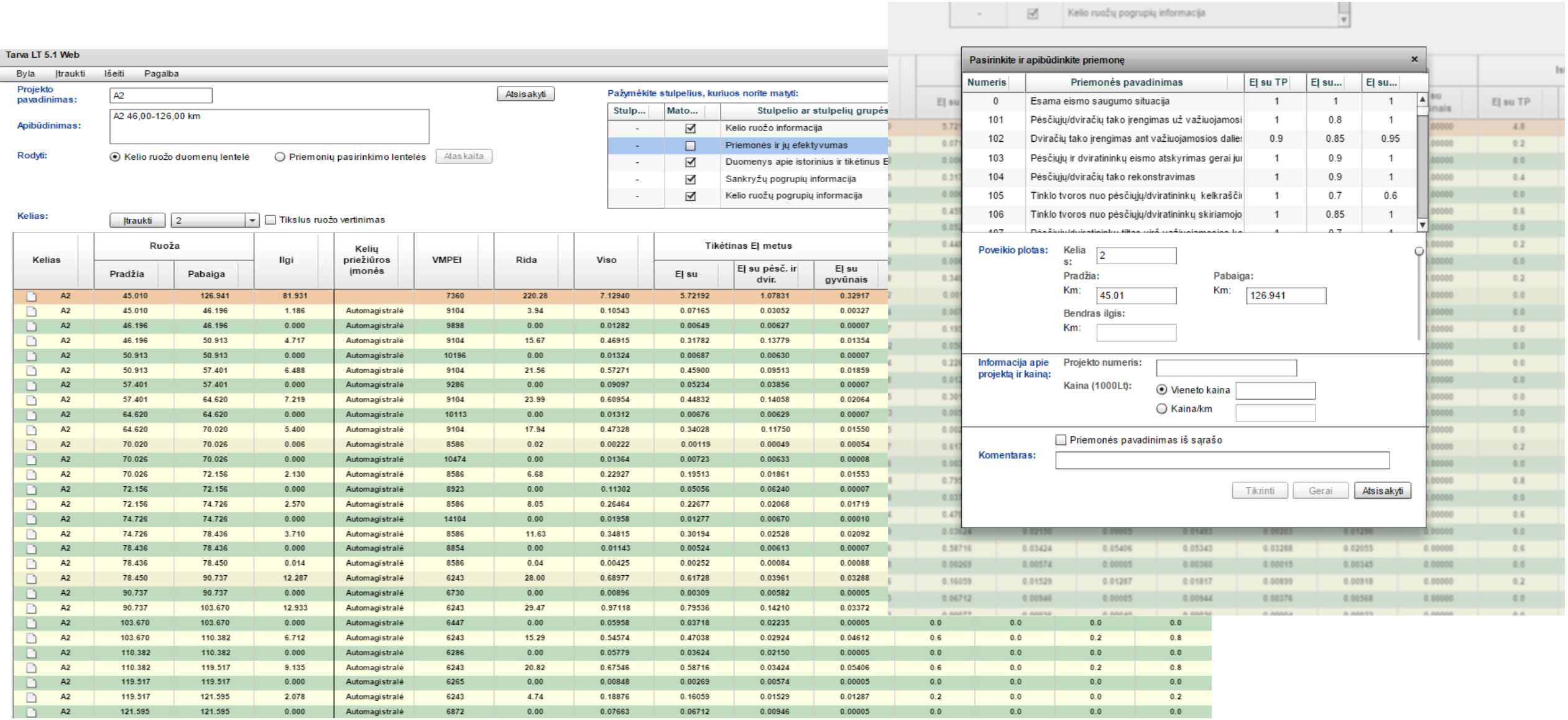
- Tarva LT, a computer program for assessing the safety of the road network, was created for roads of Lithuanian state importance.
- The program was created in cooperation with the specialists of the Public Road and Transport Research Institute, the Finnish Technical Research Center VTT and the computer equipment company Simsoft Oy.
- Tarva LT allows the user to perform simple actions, without entering additional information, to predict the expected number of traffic accidents on a certain road or road section, and to assess the impact of road safety-improving measures on accidents.



TARVA LT TOOL FOR EFFECTIVENESS CALCULATION OF ROAD SAFETY MEASURES (5)

Mobility Consultants



TARVA LT TOOL FOR EFFECTIVENESS CALCULATION OF ROAD SAFETY MEASURES (6)

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Object data		
Title	Meaning	
1	2	
Road no.	A2	
Road name	Vilnius - Panevėžys	
Beginning of the section, km	46.00	
End of section, km	126.00	
Length of the section, km	80.00	
VMPEI, TP/day	7159	
Emergency during the period (from–to)	2010–2014	
Historical traffic events/year	6.6	
Forecasted traffic incidents/year	7,129	
Measures to improve traffic safety are proposed		
	Traffic accidents decrease/year	
	Option 1	Option 2
Installation of road lighting on flexible supports	0.258	0.258
Installation of a long mesh fence against animals (≥ 5 km)	0.091	
Installation of steel fences on roadsides	0.090	
Installation of a net fence from people on the roadsides	0.131	
Implementation of an automated speed control system		1,242
Total:	0.570	1,500
Investments required to prevent the 1st traffic accident, thousand. EUR	142,534	42,466

OPEN PLATFORM FOR SOCIETY

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Map information

EN

General | Detail

- Traffic restrictions (temporary)
- Traffic restrictions
- Cameras
- Variable information signs
- Speed cameras
- Average speed control sections
- Electric vehicle charging stations
- Levels of road maintenance
- Road surface course
- Toll roads
- Vignette selling points
- Accident-prone road sections
- Places to visit (source lietuvon.lt)
- Rest areas
- Annual average daily traffic
- Traffic control equipment
- Frost zones
- Asphalt surface temperature zones

TRAFFIC ACCIDENTS' PREDICTION MAP AND MEASURES PLANNING PLATFORMS

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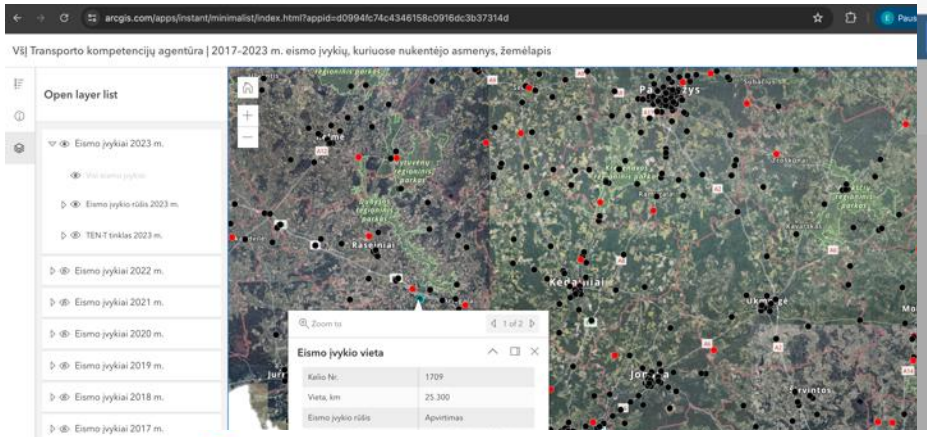
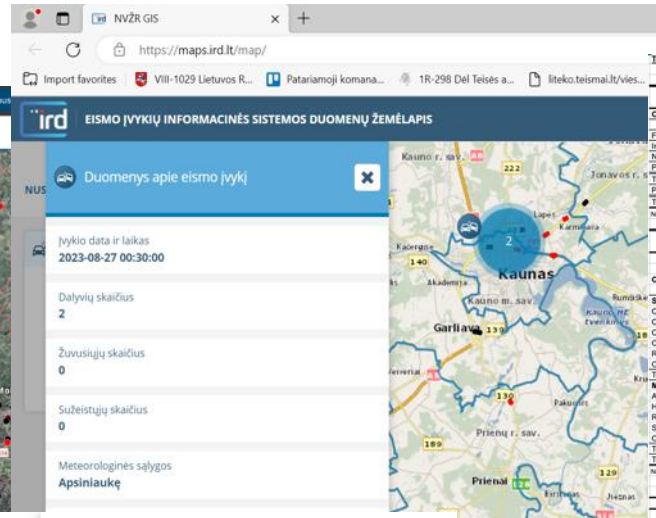




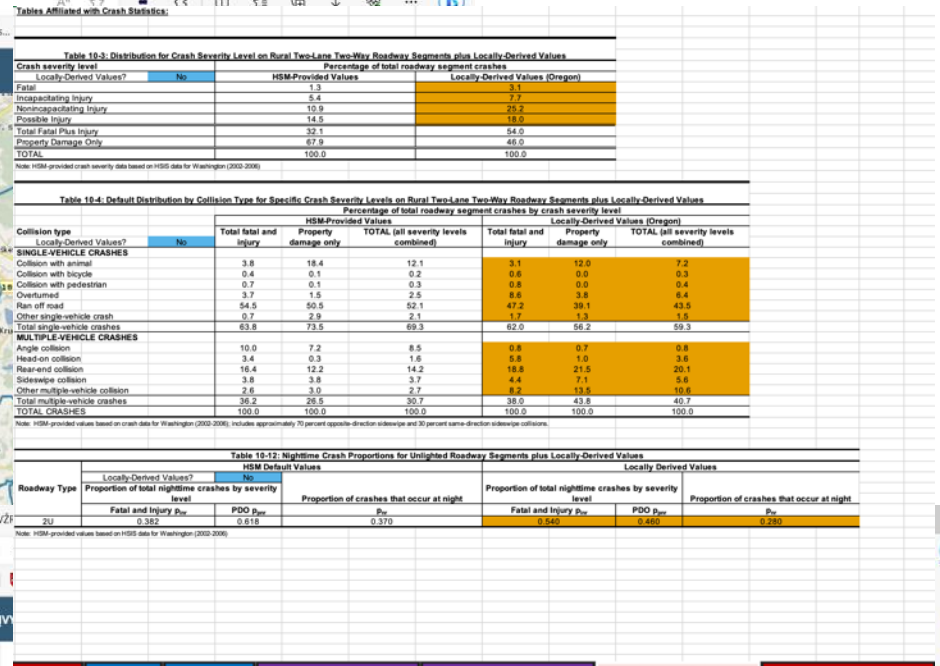


Table 10-3: Distribution for Crash Severity Level on Rural Two-Lane Two-Way Roadway Segments plus Locally-Derived Values

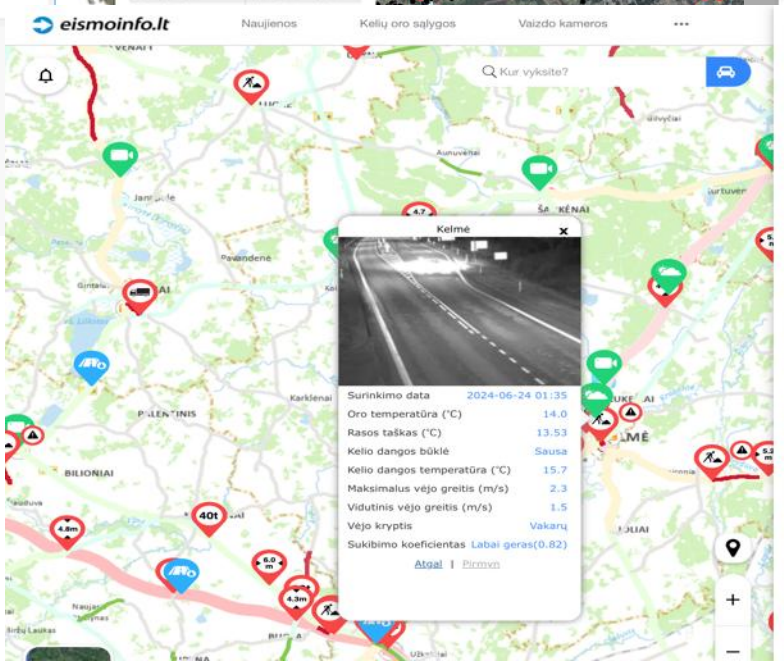
Crash severity level	Percentage of total roadway segment crashes	
Locally-Derived Values? No	HSM-Provided Values	Locally-Derived Values (Oregon)
Fatal	1.3	3.1
Incapacitating Injury	5.4	7.7
Nonincapacitating Injury	10.9	25.2
Possible Injury	14.5	18.0
Total Fatal Plus Injury	32.1	54.0
Property Damage Only	67.9	46.0
TOTAL	100.0	100.0

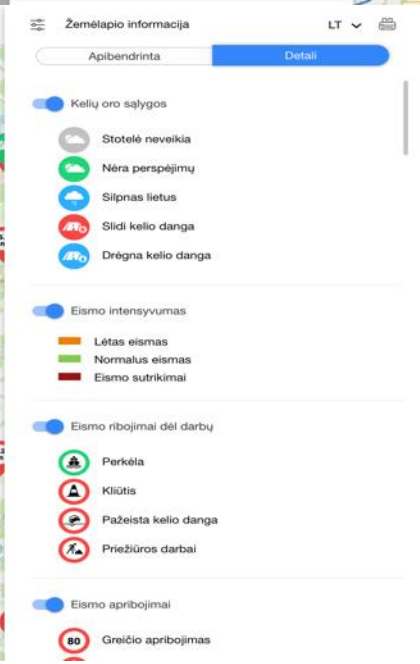
Table 10-4: Default Distribution by Collision Type for Specific Crash Severity Levels on Rural Two-Lane Two-Way Roadway Segments plus Locally-Derived Values

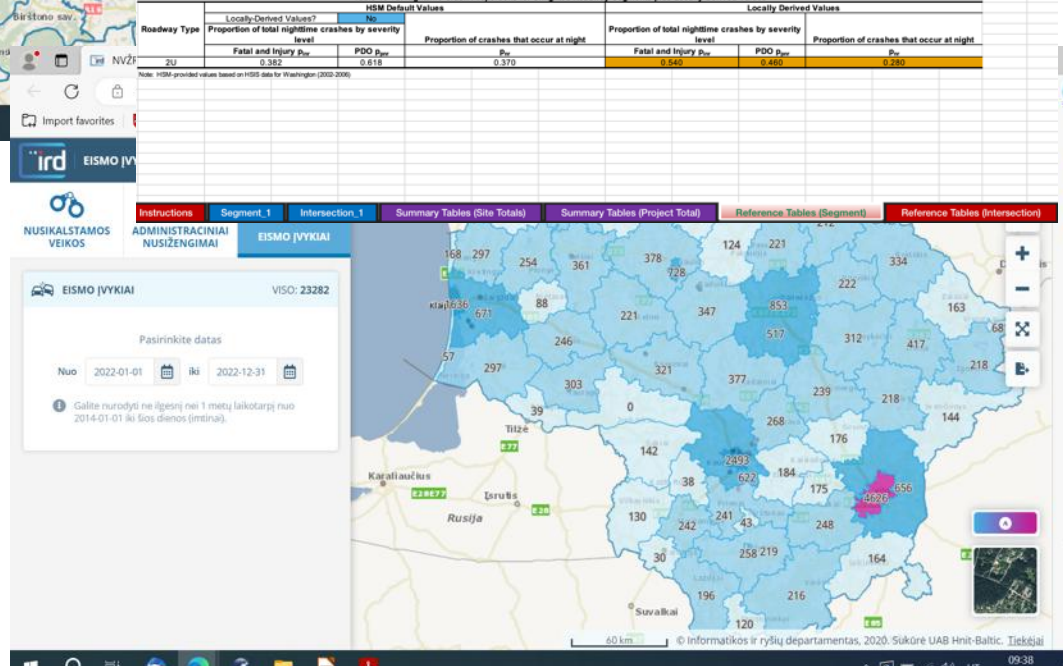
Collision type	Percentage of total roadway segment crashes by crash severity level					
	HSM-Provided Values			Locally-Derived Values (Oregon)		
Locally-Derived Values? No	Total fatal and injury	Property damage only	TOTAL (all severity levels combined)	Total fatal and injury	Property damage only	TOTAL (all severity levels combined)
SINGLE-VEHICLE CRASHES						
Collision with animal	3.8	18.4	12.1	3.1	12.0	7.2
Collision with bicycle	0.4	0.1	0.2	0.6	0.0	0.3
Collision with pedestrian	0.7	0.1	0.3	0.8	0.0	0.4
Overturned	3.7	1.5	2.5	8.6	3.8	6.4
Ran off road	54.5	50.5	52.1	47.2	39.1	43.5
Other single-vehicle crash	0.7	2.9	2.1	1.7	1.3	1.5
Total single-vehicle crashes	63.8	73.5	69.3	62.0	56.2	59.3
MULTIPLE-VEHICLE CRASHES						
Angle collision	10.0	7.2	8.5	0.8	0.7	0.8
Head-on collision	3.4	0.3	1.6	5.8	1.0	3.6
Rear-end collision	16.4	12.2	14.2	18.8	21.5	20.1
Sideswipe collision	3.8	3.8	3.7	4.4	7.1	5.6
Other multiple-vehicle collision	2.6	3.0	2.7	8.2	13.5	10.6
Total multiple-vehicle crashes	36.2	26.5	30.7	38.0	43.8	40.7
TOTAL CRASHES	100.0	100.0	100.0	100.0	100.0	100.0

Table 10-12: Nighttime Crash Proportions for Unlighted Roadway Segments plus Locally-Derived Values

Roadway Type	HSM Default Values			Locally Derived Values		
	Locally-Derived Values? No					
	Proportion of total nighttime crashes by severity level		Proportion of crashes that occur at night	Proportion of total nighttime crashes by severity level		Proportion of crashes that occur at night
	Fatal and Injury p_{nr}	PDO p_{nr}	p_{nr}	Fatal and Injury p_{nr}	PDO p_{nr}	p_{nr}
2U	0.382	0.618	0.370	0.540	0.460	0.280







NEAREST FUTURE – TRANSPORT SECTOR DATA LAKE

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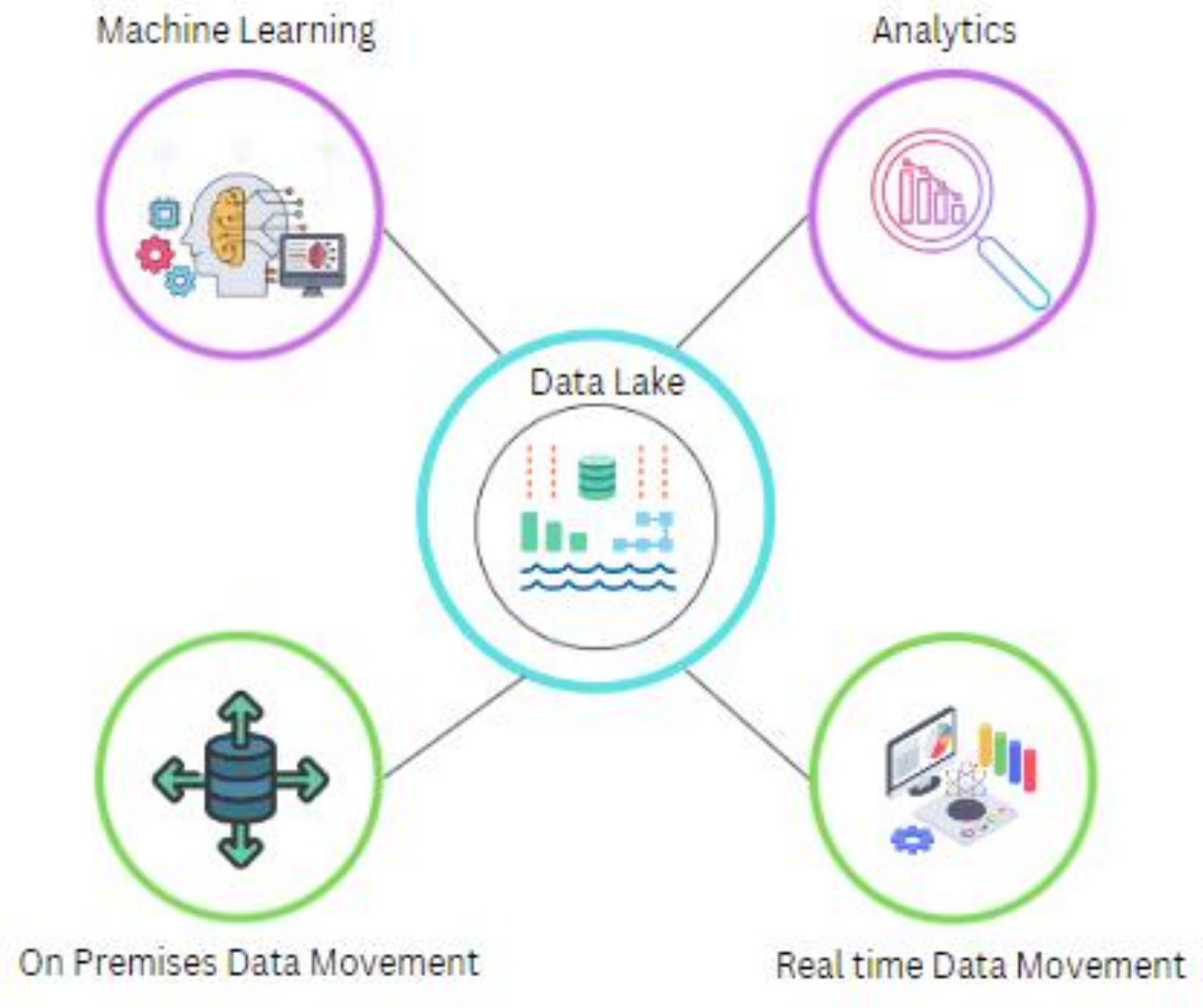

ROAD ASSET MANAGEMENT SYSTEMS (RAMS) SERVE MULTIPLE CRITICAL PURPOSES

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01 OPTIMIZATION OF MAINTENANCE AND RESOURCE ALLOCATION

02 DATA COLLECTION AND MANAGEMENT

03 IMPROVED DECISION-MAKING

04 ECONOMIC EFFICIENCY AND COST SAVINGS

05 ENHANCED SAFETY AND USER EXPERIENCE

06 COMPLIANCE AND REPORTING

07 SUSTAINABILITY AND ENVIRONMENTAL CONSIDERATIONS