JASPERS Networking Platform Webinar on Data Management in Transport

Data and Road Network Management

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Background

► **Innovative transport**

> How innovative technologies influence transport infrastructure?

► **Advanced Driver Assistance Systems / Autonomous Vehicles**

> How to prepare for the emerging ADAS / AV technologies and make the infrastructure "futureproof"?
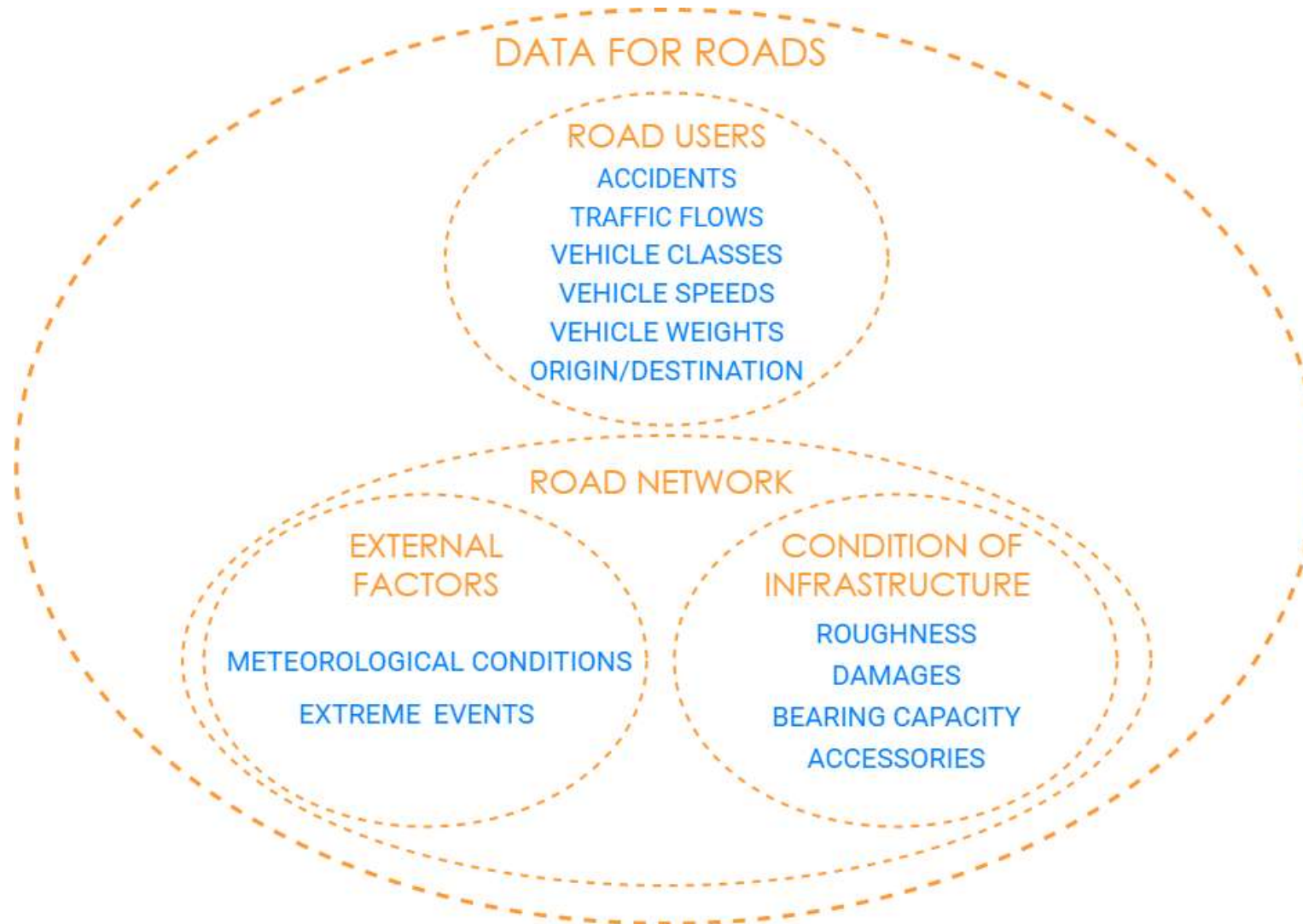
► **Data management**

> Develop the instruments to efficiently advise on the development of data management systems.

Data and Road Network Management

Key topics

▶ Definition of the **data management model**

▶ Design recommendations for **data management system**

▶ Typical provisions to be included in the **technical specifications**
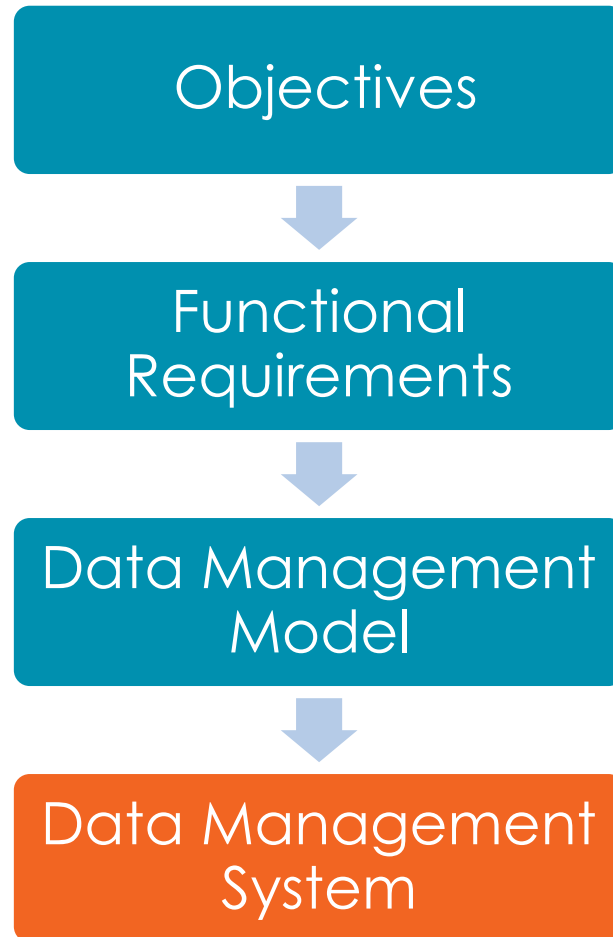
▶ **Examples** of the use of data for management of roads

Data and Road Network Management

⊙ **Introduction**

▶ **Principles for developing data management systems**

◯ Approach to specifying data management systems

◯ Example 1: Identification of blackspots

◯ Example 2: National Access Points for travel information

◯ Example 3: Collection of data for management of the road network

◯ Example 4: Transport Observatory Database / Information System

Principles for developing data management systems

Classification of data items

Principles for developing data management systems

Objectives ▶ What do we need to achieve?

Functional Requirements ▶ What functionality will ensure achieving the objectives?

Data Management Model ▶ Specification of data items, data management processes and procedures

Data Management System ▶ System design; specification of hardware and software components, human resources

Objectives and Functionality

Objectives of the road management activities

Operation:

▶ Ensuring the health and safety of the public

▶ Ensuring comfortable operating conditions

▶ Optimising operation in terms of time, costs, environmental impact

Maintenance:

▶ More efficient planning of short-term repairs, rehabilitation and reconstruction activities

▶ Optimising winter maintenance

Planning of new infrastructure:

▶ Maximising economic benefits of the new infrastructure

▶ Minimising environmental impacts

▶ Ensuring sustainability

Objectives and Functionality

Applications of the different classes of data

OPERATION

ACCIDENTS

VEHICLE WEIGHTS

VEHICLE SPEEDS

METEOROLOGICAL CONDITIONS

EXTREME EVENTS

MAINTENANCE

NUMBER OF VEHICLES

VEHICLE CLASSES

ROUGHNESS

DAMAGES

BEARING CAPACITY

ACCESSORIES

METEOROLOGICAL CONDITIONS

PLANNING OF NEW INFRASTRUCTURE

TRAFFIC FLOWS

VEHICLE CLASSES

ORIGIN/DESTINATION

VEHICLE SPEEDS

ACCIDENTS

METEOROLOGICAL CONDITIONS

EXTREME EVENTS

Data Management Model

Data Collection	Data Storing and Processing	Data Analysis	Use and Sharing of the Data

The data management model analyses the stages of:

▶ data collection

▶ storing and initial processing of the data

▶ data analysis

▶ data use and exchange (internally and with external parties)

Data Management Model
Contents of the model

The data management model specifies:

- the **set of data items** to be collected, stored, processed, analysed and shared

- **quantitative requirements** to the way the data is handled

- the **processes** to handle the data, and

- the implementing **procedures**

> (!) The data management model is independent from the technical implementation

Data Management Model

Defining the model

Answer to questions such as:

- ► How, by whom, when and how precisely must data be collected and kept up to date?

- ► Who and how must carry out initial data processing, so that raw data becomes fit for further analysis?

- ► What analyses are to be made with the data, how often and by whom?

- ► Who, when and how can access the data and results of the analyses (i.e. how are privacy and security ensured)?

- ► What decisions are to be taken based on the data and analyses?

- ► Who, when and how controls the quality of the whole process?

Data and Road Network Management

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○ Example 4: Transport Observatory Database / Information System

Design of the Data Management System
Identification of constraints

► **Time and budget**, available for implementation

► **Human resources** to work on implementing the system

► Limitations of the **technologies** on the market

► Financing, available for **operation and maintenance**

► Human resources to take care of system's operation and maintenance

Design of the Data Management System
Defining system's architecture

Data collection equipment
Roadside stations, specialised vehicles, etc.

Communication medium
Means for the data to reach the storage equipment

Data storage system
Own or hired servers, cloud solutions for backup

Data processing and analysis system
A database, GIS, statistical software, hardware to run the software components

Means to allow access to the data and analyses
Software and hardware equipment

Specification of the Data Management System

► **General provisions** – legal framework, stakeholders, fitness for purpose, general technical requirements, existing systems, licensing, third-party software, defects liability, insurances, etc.

► **System architecture** – definition of system's components and their functionality

► **System design tasks** – business analysis, prototyping, consultations with stakeholders

► **Documentation, manuals and training**

► **Testing** – quality assurance plan; tests before, on and after completion; test reports

► **Deployment and commissioning** – conditions for taking over, stages

► **Operation and Maintenance** – operational requirements to the system, management of user support requests, scope of maintenance activities

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▶ **Example 1: Identification of blackspots**

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Identification of blackspots

Legal basis

► Directive (EU) 2019/1936, amending Directive 2008/96/EC (*the Road Safety Directive*)

► Annex IV of the Directive specifies the **accident data** to be collected:

  ► **Accident** – location, pictures and/or diagrams, date and hour, road infrastructure at the site, accident severity

  ► **Accident classification** – collision type, vehicle and driver manoeuvre, etc.

  ► **Participants** – characteristics of the persons involved, data regarding the vehicles involved

Identification of blackspots

JASPERS assignment overview

Assignment	2019 139 BG TRA CAP
Client	Road Infrastructure Agency (Bulgaria)
Timing	Start – October 2019
	Planned completion – December 2022

Activities so far:

► Review of the **accident information systems** and recommendations for improvement

► Support to the agency in the efforts to update the **blackspot identification methodology**

Identification of blackspots

The accident data management model

	Data collection	Data storing and processing	Data analysis	Use and sharing of the data
📄	The traffic police registers accidents using tablets	Accident records are directly stored in the accident database	Annually, regional police directorates run analyses for blackspot identification	Aggregated accident data (blackspots) is sent to the roads agency, which does further analysis
❌	► Coordinates not always registered ► No data regarding road infrastructure ► No accident data from insurers and hospitals	► No control of the quality of accident records	► Process not fully automated ► Some quality control, but unreliable ► Inconsistent approach from one regional directorate to another ► Differences from one year to another	► Inconsistent approach to classifying accidents ► No access to individual accident records

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Why? Legal basis

► Directive 2010/40/EU (the *ITS Directive*), and

   ► Commission Delegated Regulation (EU) No 886/2013 for provision of **road safety-related traffic information**

   ► Commission Delegated Regulation (EU) 2015/962 for provision of EU-wide **real-time traffic information** services

   ► Commission Delegated Regulation (EU) No 885/2013 for provision of information services for **safe and secure parking** places for trucks and commercial vehicles

   ► Commission Delegated Regulation (EU) 2017/1926 for provision of EU-wide **multimodal travel information services**

National Access Points for Travel Information

What is a NAP for multimodal travel information?

End Users

Travel Service Providers

National Access Point

Data Publishers

| Transport Infrastructure Managers | Public Transport Operators | ... |

Web and mobile applications for multimodal route planning, booking of trips; input for navigation devices, etc.

Automated data sharing using Transmodel/NeTEx, INSPIRE application schemas, etc.

Data about the transport infrastructure and services (in formats, the data is readily available in, e.g. GTFS, GML, etc.)

National Access Points for Travel Information

What information must be provided?

As per Level of Service 3 from the MMTIS Regulation, NAP shall provide access at least to the following dataset categories:

(a) **Location search** – addresses, places, points of interest, public transport stations

(b) **Trip plans** – timetables, fares

(c) **Real-time traffic information** – disruptions, actual arrival times

(d) **Trip plan computation** – computation of optimum trips, based on various criteria

(e) **Information services** – mostly related to payment options

(f) **Fare query** – standard and special fares, passenger classes

(g) **Dynamic availability check** – for car-sharing, car-parking and charging stations

National Access Points for Travel Information

JASPERS assignment overview

Assignment	2020 102 BG TRA HOR
Client	Ministry of Transport, Information Technologies and Communication (Bulgaria)
Timing	Start – July 2020
	Completion – November 2021

Activities under the assignment:

► Preparation of draft **Technical Specification** for implementation, operation and maintenance of a National Access Point for multimodal travel information

► Support to the Ministry in **discussions with stakeholders**

National Access Points for Travel Information

NAP integration with other information systems

- ► NAP for (1) road safety-related minimum traffic information, (2) real-time traffic information services, and (3) safe and secure parking places (Road Infrastructure Agency)

- ► National electronic tolling system – to provide real-time information on the estimated arrival times of buses at stops (Road Infrastructure Agency)

- ► Urban public transport fleet management systems (public transport operators)

- ► Virtual parking boards to monitor the occupancy of paid car parks (parking operators)

- ► Train location monitoring system (National Railway Infrastructure Company)

- ► …

System architecture

▶ **Component A – National Access Point**

An application that serves through an API: data search, access, publication and modification requests; user management requests

▶ **Component B – Application for monitoring the NAP**

An application that sends regular dummy requests to the NAP, in order to verify system's operational parameters
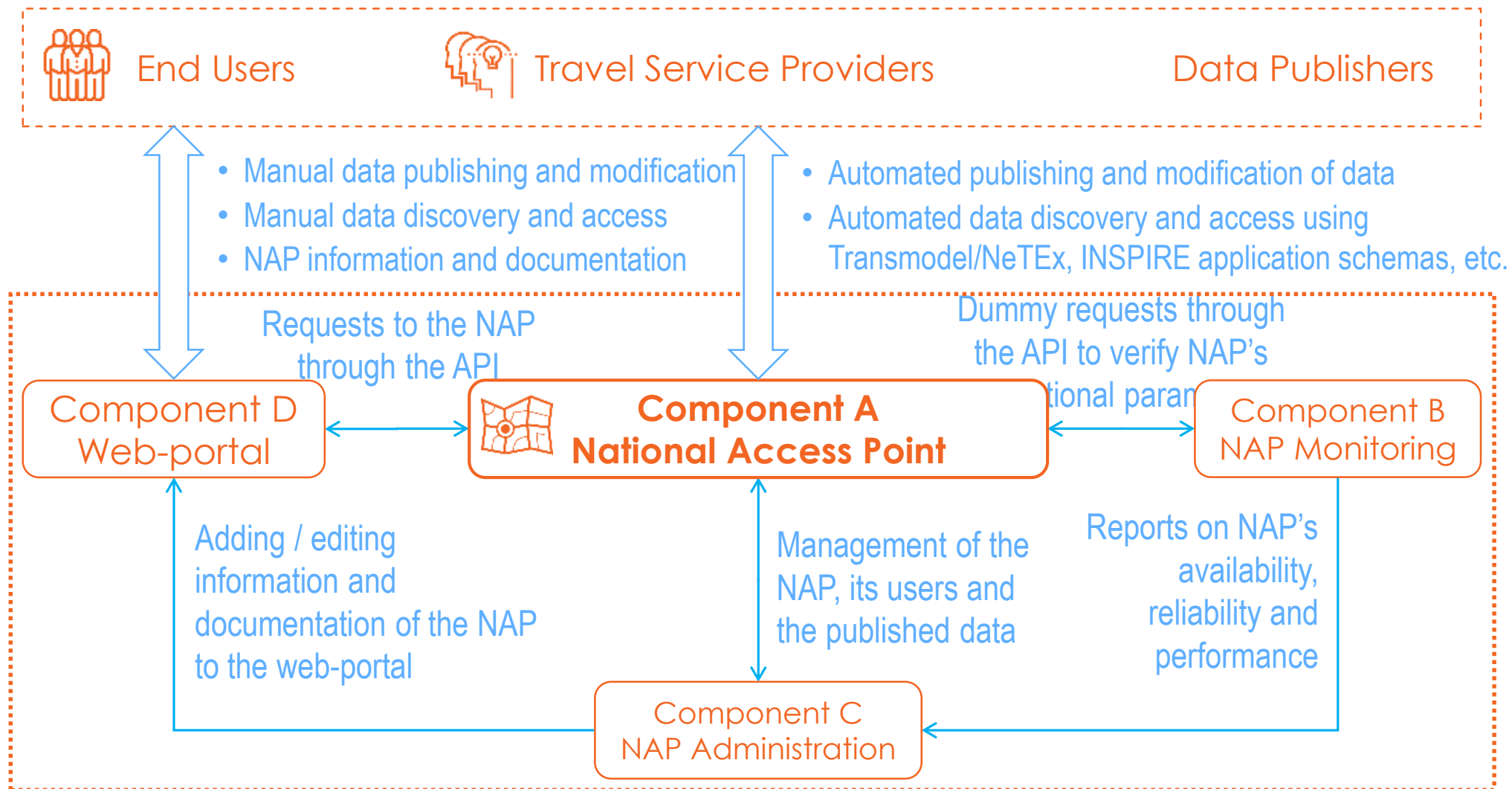
▶ **Component C – Application for NAP administration**

A web-application for managing the NAP and its users, and for monitoring NAP's operational parameters

▶ **Component D – Web-portal of the NAP**

A web-application to provide: NAP information and documentation; access to human users of the data discovery, access and publication functionality of the NAP; data visualization through GIS

National Access Points for Travel Information

NAP internal and external data flows

End Users Travel Service Providers Data Publishers

- Manual data publishing and modification
- Manual data discovery and access
- NAP information and documentation

- Automated publishing and modification of data
- Automated data discovery and access using Transmodel/NeTEx, INSPIRE application schemas, etc.

Requests to the NAP through the API

Dummy requests through the API to verify NAP's ... tional param...

Component D
Web-portal

**Component A
National Access Point**

Component B
NAP Monitoring

Adding / editing information and documentation of the NAP to the web-portal

Management of the NAP, its users and the published data

Reports on NAP's availability, reliability and performance

Component C
NAP Administration

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Data for Management of the Road Network

JASPERS assignment – overview

Assignment	2021 043 RO TRA HOR
Client	National Company for Administration of Road Infrastructure (NCARI), Romania
Timing	Start – March 2021
	Planned completion – July 2023

► Follow-up to assignment "Support to improve NCARI's National Road Transport Model" from 2018 – 2019

Data for Management of the Road Network

JASPERS assignment – scope

► Revision of **origin-destination survey questionnaires**

► Advice on the preparation of household surveys to establish **trip rates** per trip purpose, as well as **trip length distributions**

► Advice on how to acquire **travel time data**

► Support in updating the network of **automatic traffic counters**

► Review the existing **GIS portal** and propose improvements

► Identification of other studies that could improve the planning process (e.g. calibration of volume-delay functions).

► Support in the integration of the data collection framework within the overall ITS architecture of the country

Issues with the existing O-D survey form [1]

Objective – to directly build O-D matrices, hence:

- ► very large sample size and geographical coverage needed → very high costs

- ► inevitably many trip pairs remain unregistered

- ► concurrent classified counts must also be carried out to scale the survey sample → somewhat higher costs, but also scaling errors

Data for Management of the Road Network

Issues with the existing O-D survey form [2]

▶ Very limited set of trip purposes – tourism, commute, business, other (almost half of all trips classified as "other")

▶ No social or economic data being collected

▶ Questions about trip routes included – but not used in any analysis

▶ Very limited data regarding freight – a single type and vehicle occupancy

☑ **Result** – O-D data **not** being used in organization's transport model; classified counts utilized in a basic assignment model

Data for Management of the Road Network
Proposal for revisions of the O-D survey form

Objective – to collect information of sufficient volume and quality for the development of a four-stage model (➔ smaller sample size ➔ lower costs)

► Detailed questions regarding trip purpose

► Included questions regarding basic social and economic characteristics

► No questions regarding trip route

► Completely new and more detailed questionnaire for HGV

Proposed O-D survey form [1]

▶ **Section A – interview information**

Survey station's identifier/location, interviewer, date, interview ID

▶ **Section B – vehicle**

Vehicle class, number of passengers

▶ **Section C – trip (private cars only)**

Trip's origin and destination, origin / destination location type
(9x9 trip pair options), frequency of similar trips

▶ **Section D – driver (private cars only)**

Age and occupation (+ income and possibly car ownership)
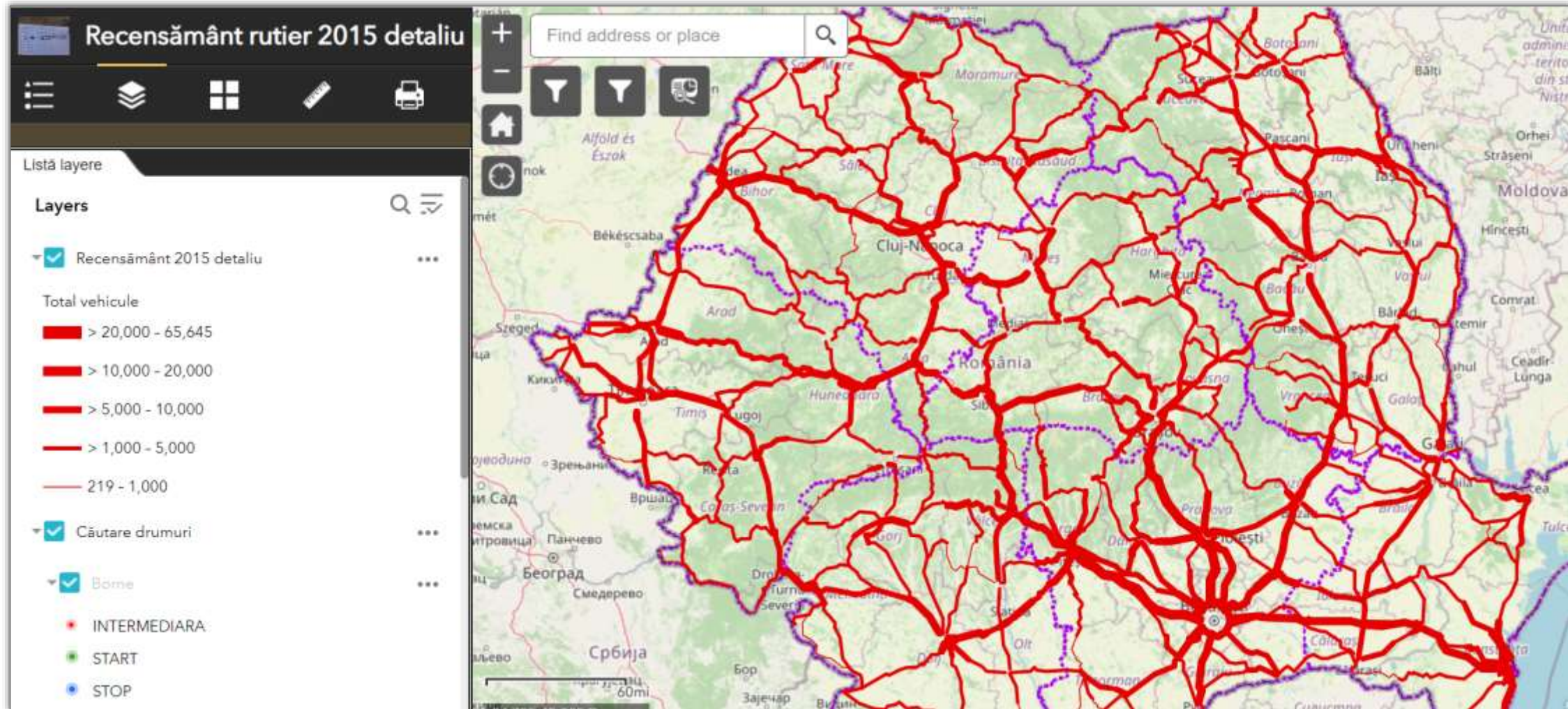
Proposed O-D survey form [2]

► **Section E – for goods vehicles only**

  ► **Trip** – origin and destination, origin / destination location type, frequency of similar trips

  ► **Freight** – vehicle occupancy, goods types (as per a classifier based on EUROSTAT's CPA)

  ► **Vehicle** – maximum admissible weight of freight, vehicle unloaded weight

Other recommendations

▶ **Interview locations** – to be updated to proportionally represent the number of trips made on different classes of roads (or weight the results accordingly); not too close to populated areas

▶ **Sample sizes** – decide on sample sizes based on the final survey form and constraints

▶ **Trial survey** – to test whether interviewees (and interviewers) understand the questions; adjust answer margins; determine average interview duration

▶ **Web-based form** – instead a paper form, develop a web-based form to directly register the data from interviews

Data for Management of the Road Network

GIS of the National Company for Administration of Road Infrastructure

Data and Road Network Management

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Transport Observatory Database / Information System

JASPERS assignment – overview

Assignment	2021 137 99 SCH HOR
Client	The six members of the Transport Community on the Western Balkans and TCPS
Timing	Start – October 2021
	Planned completion – December 2025

► The **objective** of the assignment is to support the beneficiaries and the Transport Community Permanent Secretariat (TCPS) in the preparation of tools for monitoring of TEN-T on the Western Balkans

► More information at https://www.transport-community.org/

Transport Observatory Database / Information System

JASPERS assignment – scope

Support in:

► The preparation and initial operation of the **Transport Observatory Database / Information System**

► The preparation of the Transport Observatory **multimodal transport model** for the region of the Western Balkans

► Ad-hoc advice to the beneficiaries and TCPS

Activities so far:

► Review of the ToR for the Transport Observatory Database / Information System

► Review of ToR for studies related to ITS and electric charging

Transport Observatory Database / Information System
System objectives and functional requirements

Objectives:

► Monitor the **performance of TEN-T** on the Western Balkans

► Support the **planning of improving TEN-T** on the Western Balkans

Functionality:

► Store and keep up to date a **large set of data** regarding the transport networks of all modes

► Allow multiple types of **analyses of the data**

► Provide access to the data and analytical tools to **the regional partners**

► Provide access to the data and results of analyses to **the public**

Transport Observatory Database / Information System

Data management model

▶ The ToR features a detailed specification of the data items to be collected for all modes, including: type, source, validation criteria, etc.

	A	B	C	D	E	
1						
2		**Demand Model**				
3						
4	**Project Name**	Technical Assistance for the Development of the Transport Community Information System				
5						
6	**Category**	**Mode**	**Data**	**Type of data**	**Resolution**	**Specific Breakdown**
7	Demand/		Average Daily Traffic (weekday/weekly)	Cross sectional	TEN-T network/national/strategic roads by road section	by vehilce type (car, b
8	Supply		Average Daily Traffic (weekday/weekly)	longitudinal	TEN-T network/national/strategic roads by road section	by vehilce type (car, b
9			Average Daily Persons (weekday/weekly)	Cross sectional	TEN-T network/national/strategic roads by road section	by vehilce type (car a
10			Average Daily Persons (weekday/weekly)	longitudinal	TEN-T network/national/strategic roads by road section	by vehilce type (car a
11			Average Daily Tonnes (weekday/weekly)	Cross sectional	TEN-T network/national/strategic roads by road section	by truck type/commod
12			Average Daily Tonnes (weekday/weekly)	longitudinal	TEN-T network/national/strategic roads by road	by truck type/commod
13		Road	Road network	Cross sectional	TEN-T network/national/strategic roads by road section	by category (regional and capacity etc)
14			Road Capacity	Cross sectional	TEN-T network/national/strategic roads by road	
15			Speed limits on network	Cross sectional	TEN-T network/national/strategic roads by road	by vehilce type (car, b
16			Maximum Gradient	Cross sectional	TEN-T network/national/strategic roads by road	by vehilce type (car, b
17			Accidents per km	Cross sectional	TEN-T network/national/strategic ro	by fatal/serious/slight

Transport Observatory Database / Information System

System architecture

Separate components for:

▶ **Data storage** – database, data import and entry facilities, data validation tools

▶ **Data analysis** – tools to allow statistical and spatial analysis of the data, export of the results in a multitude of formats

▶ **Data sharing** – web-application allowing data view and export

▶ **System management** – web-based facilities for system and user management, management of support requests

"It's not serious yet, but your data is enlarged."

Thank you!

More Information

For info or further questions on this webinar please contact the JASPERS Networking Platform team:

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