

Establishment of Road Assessment Management System at Public Enterprise for State Roads- N.Macedonia

What is RAMS

- ▶ The RAMS is a planning tool that has a database, which stores and presents road data information, planning short and long-term road maintenance. The system is also used to create budgets and maximizes economic returns of the investments made for the road network.
- ▶ Road Asset Management provides decision makers with the necessary tools for efficient and sustainable management of roads. The process goes through the following steps:
 - Establish a complete inventory of all road network with all its elements
 - Provide a clear picture of the current condition/performance of the road network
 - Estimate the value of the asset
 - Predict future demand of traffic and service needs
 - Estimate maintenance needs and costs
 - Priorities objectives related to the desired quality and performance of the road network
 - Set up funding scenarios for the regular and timely maintenance and upgrade of the road asset
 - Define a strategy (RAM Plan)
 - Implement the RAM Plan

Road Asset Management is a permanent process!

RAMS Software Overview

- ▶ The RAMS software covers the next basic components:
 - Road Data Bank (RDB) database,
 - RDB application for data management,
 - integrated GIS for data management and data presentation,
 - integrated HDM-4 as data analyzing tool,
 - use of HDM-4 for programming purposes.

RAMS Software components

- ▶ **RDB database**

store all the roads data in standardized relational database according to road reference system (road section and chainage) and geometry (coordinates) simultaneously and care for data history,

RAMS Software components

▶ Data maintenance tools

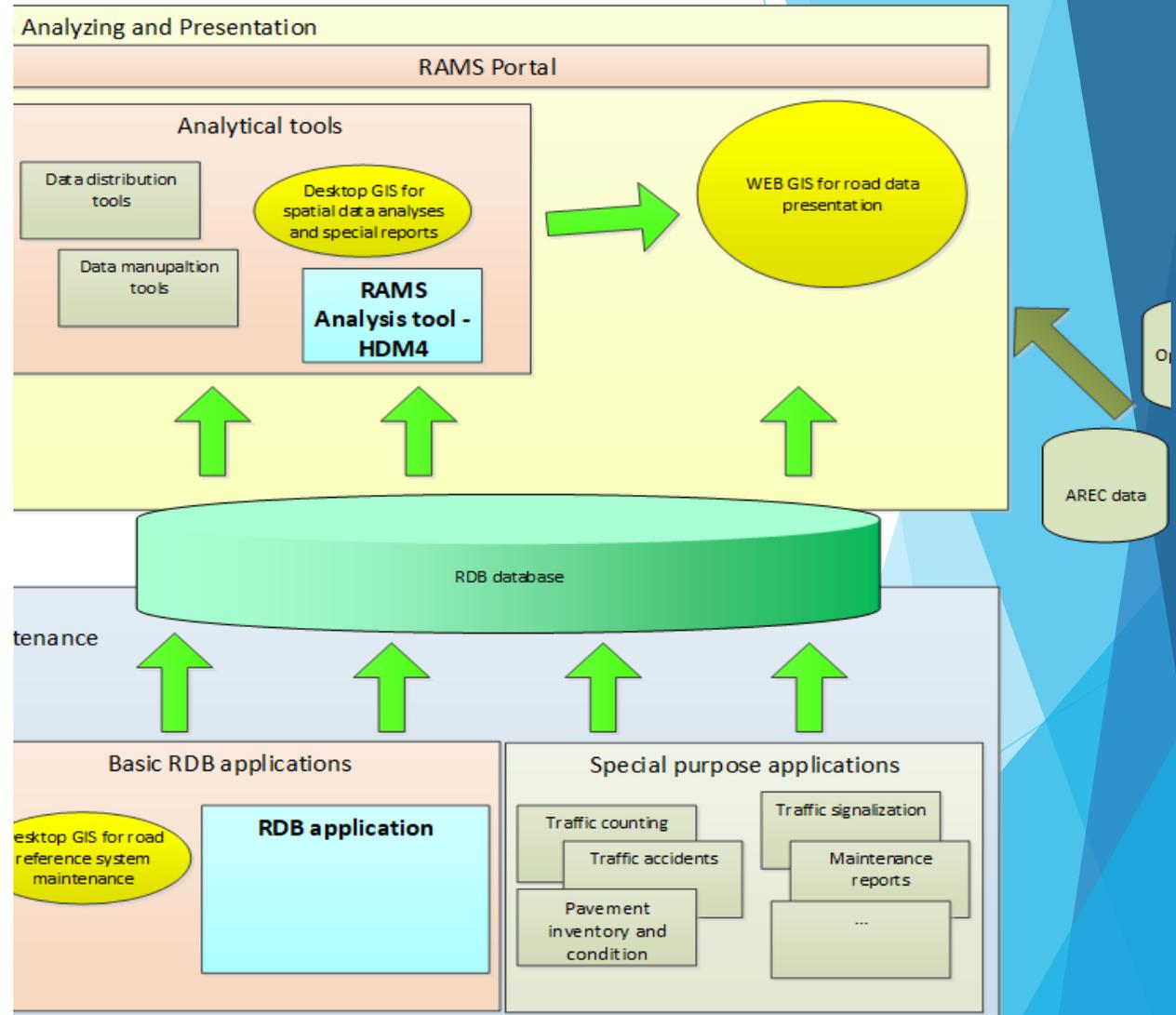
- RDB application for maintenance of the road data (import, input, edit, delete) is the core of the system; the RDB application is integrated with GIS and enables automatic transformation of data between the road reference system and geometry and must include utilities for data transformation when road reference system is changed;
- data preparation for HDM-4 is supported as part of RDB application; based on the collected and processed data different homogenous sections (links) for different HDM-4 analyses; appropriate software for defining a homogenous sections and importing to HDM4 software In addition, the average characteristics of a matrix of road classes should be computed and exported to HDM-4 to be able to perform an HDM-4 network strategic analysis
- The RDB is able to export the road network data per km, per homogenous road sections or for a matrix of road classes to Excel for further analysis.
- GIS Desktop tool for road reference system and other GIS data management

RAMS Software components

- ▶ **Data analyzing and presentation tools;**
 - HDM-4 is used as basic analyzing tool for preparation of plans for road construction, reconstruction, rehabilitation and maintenance.
 - The GIS Desktop application is used for spatial analyses and data preparation for further analyses in HDM-4 and preparation of specific reports on road maintenance plans calculated by HDM-4
 - The system produces standard reports and maps for monitoring the network and presenting the results of the HDM-4 evaluation.
 - WEB GIS system is the core system for all RDB data presentation to all PESR users.

RAMS SOFTWARE

- ▶ RAMS software:
 - RAMS Portal
 - RDB database and application
 - WEB GIS
 - HDM-4 Data handling model



RAMS SW - PORTAL

RAMS Portal served as single entry point:

- with all information for users
- links to all RAMS SW components
- Integrated with PESR Active Directory single sign on system
- user rights are managed by PESR IT team

In 2018 RAMS Portal is regular use

news regarding the RAMS - new and updated road data, new functionality, etc. - are regularly published,

user documentation and FAQ are published, forum for user questions is open

Public Enterprise for State Roads

The screenshot shows the RAMS Portal website interface. At the top, there is a navigation bar with the logo of the Republic of Macedonia and Public Enterprise for State Roads, along with user information: "Logged user: RAMS ADMIN" and "english". Below the navigation bar is a large banner image of a road with the text "RAMS portal" overlaid. The main content area is divided into several sections:

- Applications:** A grid of four application tiles: "ROAD DATA BANK" (with a red 'A' logo), "WEB GIS", "DOCUMENT MANAGEMENT" (with a laptop icon), and "METADATA CATALOGUE".
- News:** A section titled "Latest news" with two news items:
 - 26 Jun** Road measurements with Road Lab Pro
 - 7 Jun** HDM-4 analysis
- Frequently asked questions:** A section with a filter "Open All Closed My questions" and two questions:
 - Wim measurement** Answered RAMS ADMIN asked 6 months ago
 - Private: ENG question** Answered RAMS ADMIN asked 9 months ago

At the bottom right of the FAQ section, there is a button labeled "Ask Question".

RAMS SW - ROAD DATA BANK

- ▶ Goal: to enable storing and management of all road asset data in standard database
- ▶ RDB includes database and application for road data management
- ▶ RDB database is designed as integrated relational and GIS database that store all the roads data in standardized relational database MS SQL Server according to road reference system (road section and chainage) and geometry (coordinates) simultaneously
- ▶ RDB application for maintenance of the road data (import, input, edit, delete) is the core of the system and is implemented as WEB solution to enable use of the RDB as many users as possible but also as client/server solution with more advanced functionality for advanced users (RAMS team).
- ▶ Important functionality of RDB is customized Data handling module that is used for road data analyses and preparation, defining homogenous sections and exporting prepared data to HDM-4 software.

RAMS SW - ROAD DATA BANK

Client/server version (full)

The screenshot shows the RAMS SW - ROAD DATA BANK Client/Server version (full) interface. The main window displays a table of road sections with columns for Road_Class, Road_Code, Section_Code, Desc, Section_Length, Node_Code_From, Node_Code_To, Traffic_Type, Section_Type, Serial_Number, and Dat_Start. A navigation tree on the left shows the database structure. A detail panel on the right shows the selected record's data, including Reference System and System data.

Road_Class	Road_Code	Section_Code	Desc	Section_Length	Node_Code_From	Node_Code_To	Traffic_Type	Section_Type	Serial_Number	Dat_Start
AA	A1	0001	Drzavna granica RS/MK (Tabanovce) - Redhica ...	5.664	158	547	M	A	1,000	1. 12.
AB	A2	0311	Drzavna granica MK/BG (Deve Bair) - Uzem	1.580	187	188	M	O	1,000	1. 12.
AB	A3	0351	Podmolje - Ohrid 1 (Sv. Erazmo)	5.171	460	461	M	O	1,000	1. 12.
AA	A1	0601	Kluchka Tabanovce	961	558	559	M	K	1,000	1. 12.
AB	A2	0651	Kluchka Kumanovo Sever	1.159	783	784	M	K	1,000	1. 12.
AB	A3	0701	Kluchka Ohrid-Sv. Erazmo	858	610	611	M	K	1,000	1. 12.
AA	A4	0752	Kluchka Idrizovo	887	629	630	M	K	1,000	1. 12.
R1	P1102	0781	Kluchka Gradsko sever	592	646	647	M	K	1,000	1. 12.
AM	A1	1001	Gradsko 2 (Negotno) - Gradsko 1 (avtopat)	687	234	235	M	O	1,000	1. 12.
R1	P1101	1201	Novo Lagovo 2 (Prilep) - Novo Lagovo 3 (Galichan)	801	264	74	M	O	1,000	1. 12.
R1	P1102	1214	Chento 2 (avtopat) - Chento 1 (avtopat)	4.273	304	277	M	O	1,000	1. 12.
AM	A4	1101	Drzavna granica MK/KOS (Blace) - Stenkovec (...)	13.443	553	551	M	O	1,000	1. 12.
R1	P1103	1236	Novo Selo (Shopur) - Leskovica	4.361	230	298	M	O	1,000	1. 12.
R1	P1104	1243	Chento 2 (avtopat) - Nikushtak	11.250	304	305	M	O	1,000	1. 12.
R1	P1105	1248	Davidovo - Udovo (avtopat)	1.085	309	310	M	O	1,000	1. 12.
R1	P1106	1255	Jurumleri - Drachevo 1 (Jurumleri)	5.023	315	316	M	O	1,000	1. 12.
R1	P1107	1263	Rosoman - Kavadarci 1 (Ribaro)	10.726	236	474	M	O	1,000	1. 12.
R1	P1202	1288	Novo Selo (Cerovo) - Bunec	5.444	203	343	M	O	1,000	1. 12.
R1	P1201	1281	Struga - Morishki Most	1.480	335	35	M	O	1,000	1. 12.
R1	P1203	1298	Tetovo 2 (Dehepshite) - Leshok	7.891	351	352	M	O	1,000	1. 12.
R1	P1204	1302	D. Konjare 2 (Karposh) - Dobroshane	4.615	355	356	M	O	1,000	1. 12.

The detail panel on the right shows the selected record's data, including Reference System and System data.

Reference System

- Road_Class: AA
- Road class description: Motorway
- Road_Code: A1
- Section_Code: 0001
- Desc: Drzavna granica RS/MK (Tabanovce) - Redhica
- Section_Length: 5.664
- Node_Code_From: 158
- Node_Code_To: 547
- Traffic_Type: M
- Traffic type description: Motorized vehicles
- Section_Type: A
- Section type description: Divided carriageways - primary (right) section
- Serial_Number: 1,000
- Dokument: \\10.10.10.18\vs\BRS_IMAGES\Sections\RAMS_report-S

System data

- Dat_Start: 1. 12. 2017
- Dat_End: 31. 12. 2070
- User_New:
- User_End:
- Id: 1
- IdBefore:

RAMS SW - ROAD DATA BANK WEB version (light)

RDB Sections

Navigation: RDB, Reference system, Roads, Sections, Nodes, Network Division, Road geometry, Cross-section profile, Pavement Structure, Road Condition Data, Traffic, WIM measurement data, Traffic accidents, Vehicle Fleet Calibration, Road works and road data collection, iRAP/EuroRAP

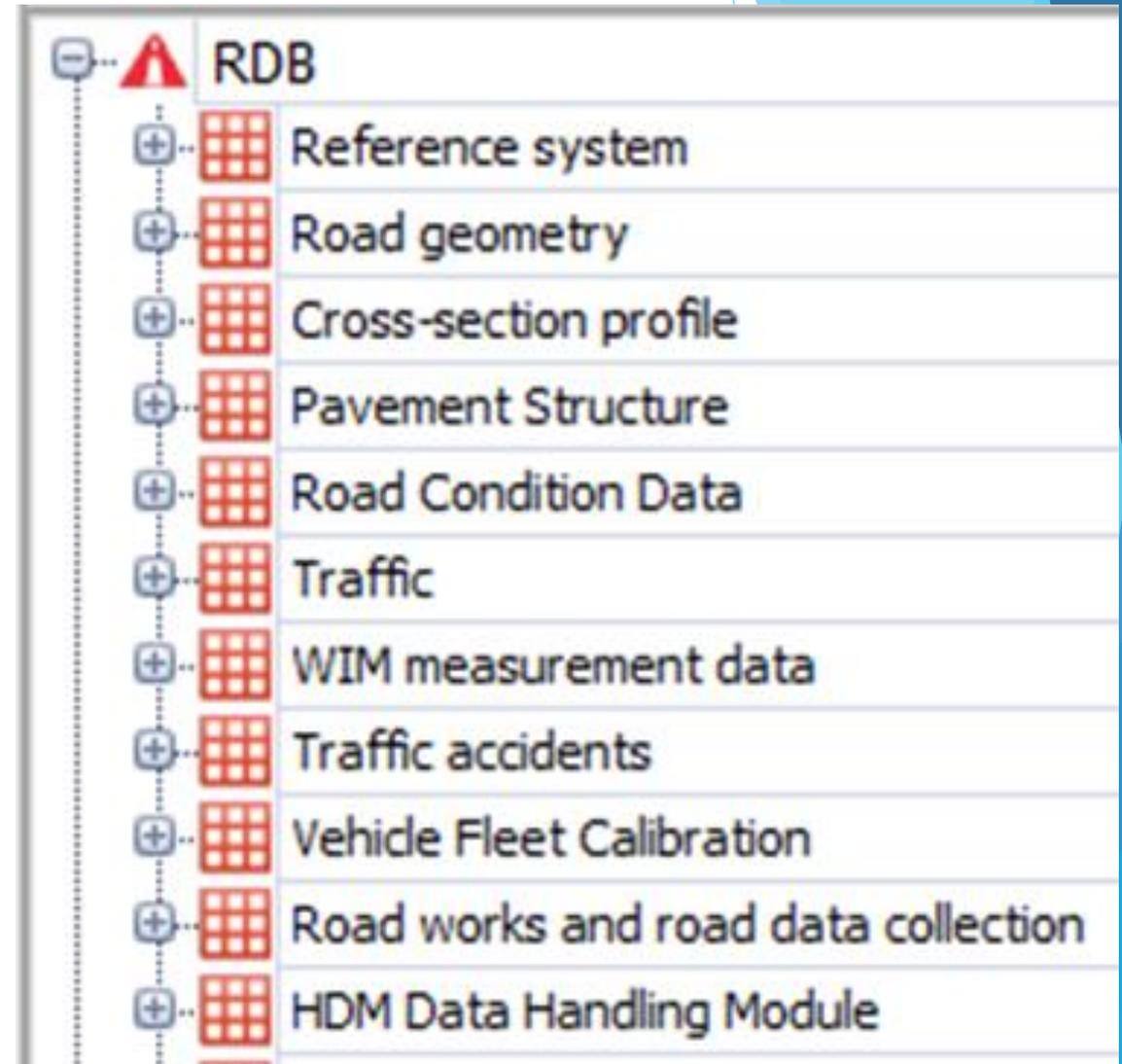
Page 1 of 31 (609 records)

Documents

#	DocType	Serial_Nu	Desc	NoPage	Document
>	DocType: Pict; Picture				
>	DocType: Doc; Document				

RAMS SW - ROAD DATA BANK

- ▶ Database data structure/data model consists of
- ▶ reference system data tables,
- ▶ road geometric/design elements data tables,
- ▶ road cross-section profile data tables,
- ▶ pavement structure data tables,
- ▶ road condition data tables,
- ▶ traffic data tables,
- ▶ traffic accidents data tables,
- ▶ HDM Data handling support data tables,
- ▶ road works management data tables (road works, road data collection works),
- ▶ WIM (weight in motion) data tables,
- ▶ iRAP data tables
- ▶ Data tables are organized and grouped into data groups of same topics, to ease access and to have data organized in the user application for better data access.



RAMS SW - ROAD DATA BANK

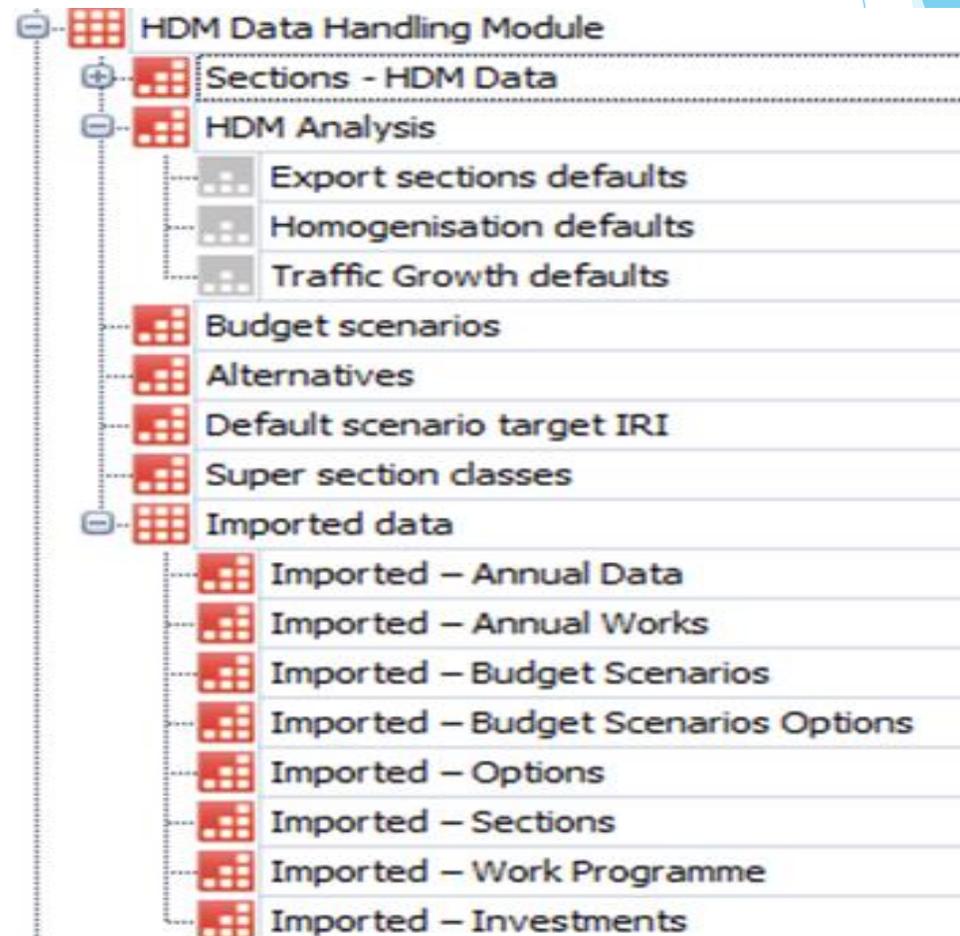
- ▶ RDB is designed for road data management, data collection, data analysis
- ▶
- ▶ RDB application (client-server version or web version) enables user to:
- ▶ access data,
- ▶ view, enter, search, filter, group data,
- ▶ conditional search record/advanced filter of data,
- ▶ edit (enter, change, delete data),
- ▶ view and change code-tables,
- ▶ design reports,
- ▶ view related documentation (images, documents, files).

RAMS SW - ROAD DATA BANK

▶ Data handling module:

- ▶ Customized module that is used for road data analyses and defining homogenous sections and importing prepared data to HDM-4 software
- ▶ Based on the collected and processed data different homogenous sections (links) for different HDM-4 analyses can be provided
- ▶ The average characteristics of a matrix of road classes can be computed and exported to HDM-4 to be able to perform an HDM-4 network strategic analysis
- ▶ Data can be exported the road network data per km, per homogenous road sections or for a matrix of road classes to Excel for further analysis

▶ TrueView Data Handling Module:



RAMS SW - ROAD DATA BANK

Conclusions:

- A comprehensive system was designed, which, with appropriate usage of trained professional users, enables PESR to have efficient data management of public roads under PESR jurisdiction.
- System requires regular data update, both in regard to reference system changes, road maintenance works and in regard to regular (scheduled annually, bi-annually or other interval) or on-request (after road works, requested by inspectorate, Police, PESR, ...) field measurements.
- Appropriate system of data flow and organizational procedures must be established in order to have road asset management system up-date regularly
- Open system to add other road inventory/road asset elements

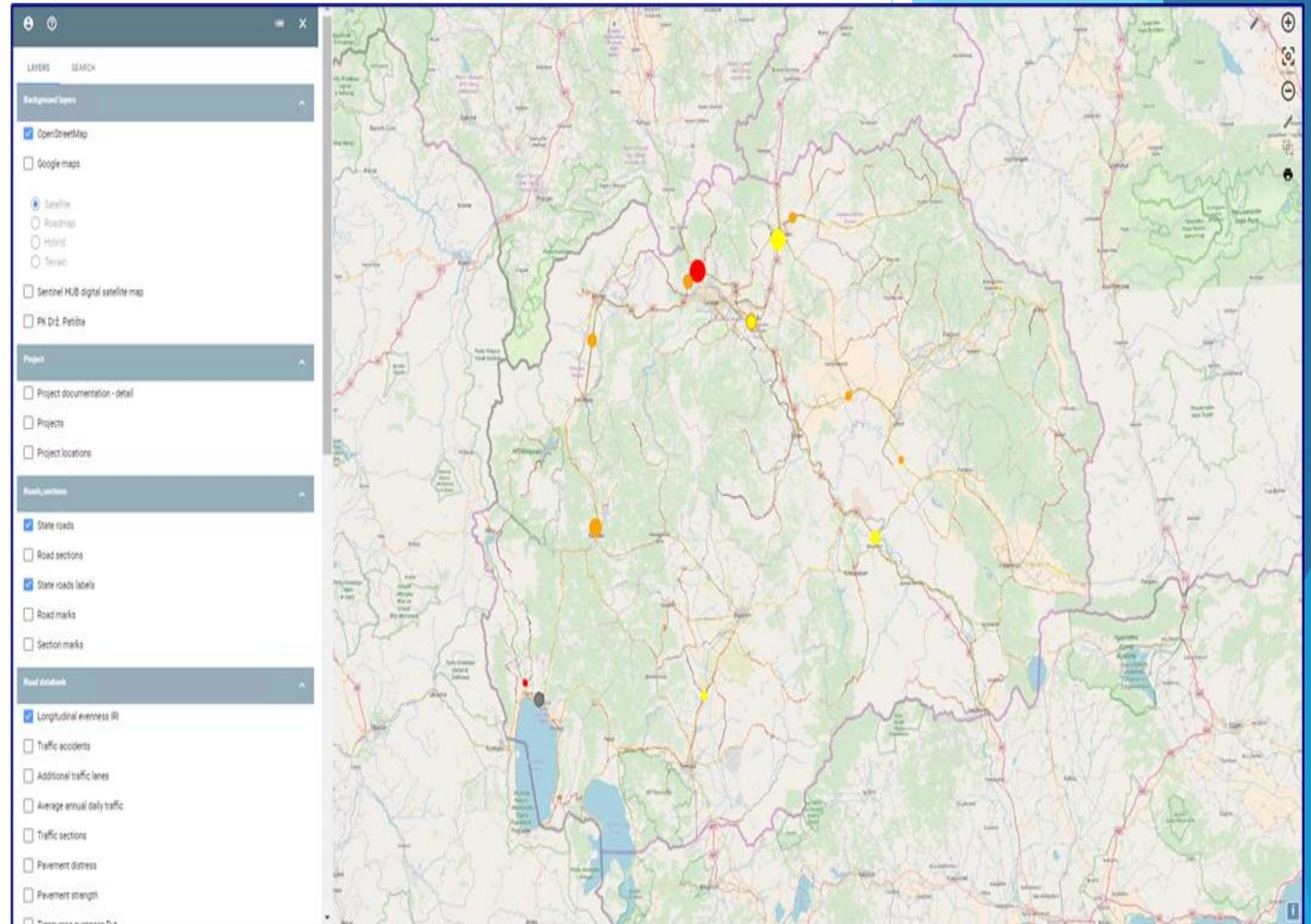
RAMS SW - WEB GIS

GOALS

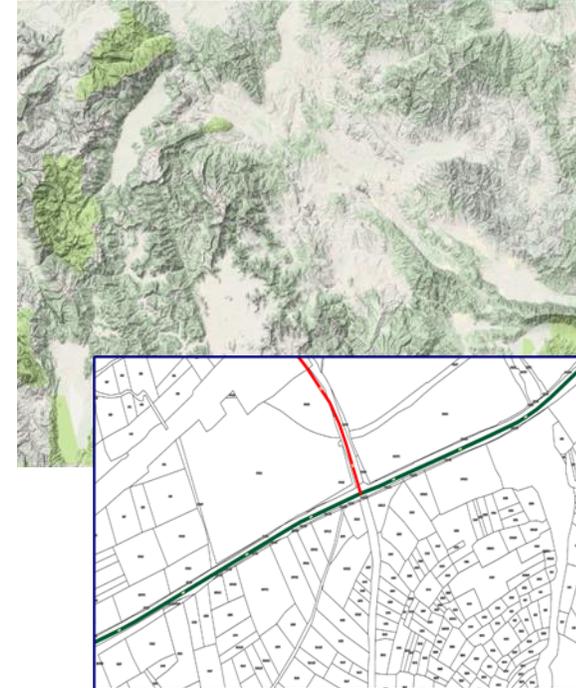
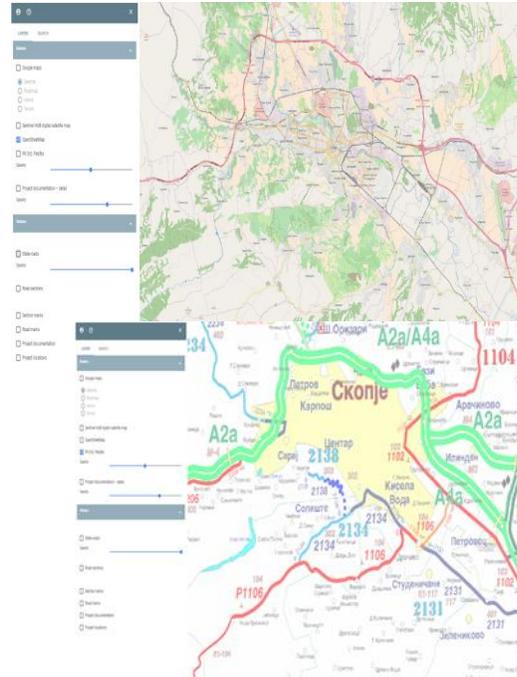
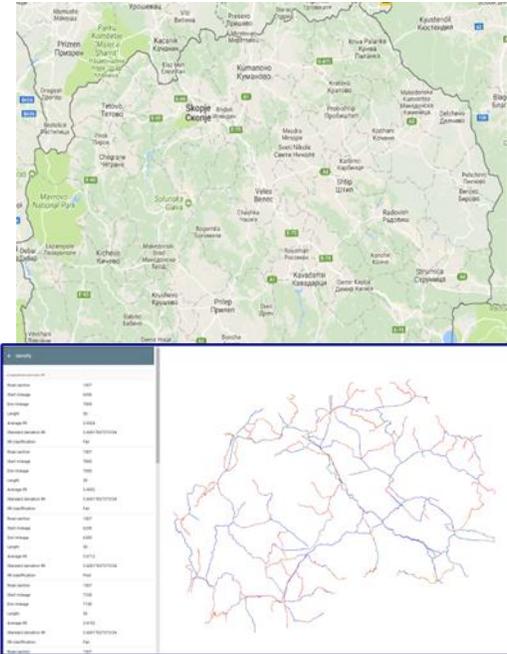
- ▶ Main goal was to deliver WEB GIS system that is the central point and basic tool for each PESR employee, where she/he can find all data about road, not only data regarding RAMS
- ▶ Huge amount of road data collected in RDB can be effectively presented only through the visualization of this data on road network
- ▶ Presentation of results of data analyses made by RDB data handling module and with HDM-4 prepared programs of road maintenance works
- ▶ GIS is also entering point for access to other road documentation, pictures, etc.

RAMS SW - WEB GIS

- PESR gets efficient WEB GIS solution tailored to PESR needs
- modern 3 level WEB architecture
- data are stored in MS SQL Server Spatial Database
- application server implemented on open GIS standard GeoServer environment with WMS and WFS services, developed in compliance with OpenGIS® and OGC standards
- light user interface supported by any standard WEB browsers



RAMS SW - WEB GIS



Presentation of RDB data:

- New RRS
- Existing road data
- GPR and WIM measurement data
- IRAP data
- Data handling module and HDM analysis

Other integrated data:

- Some data from AREC - as WMS
- Open source data - Google Maps, Open Street Map
- HUB Sentinel Satellite data
- Old map of state roads

Functionalities:

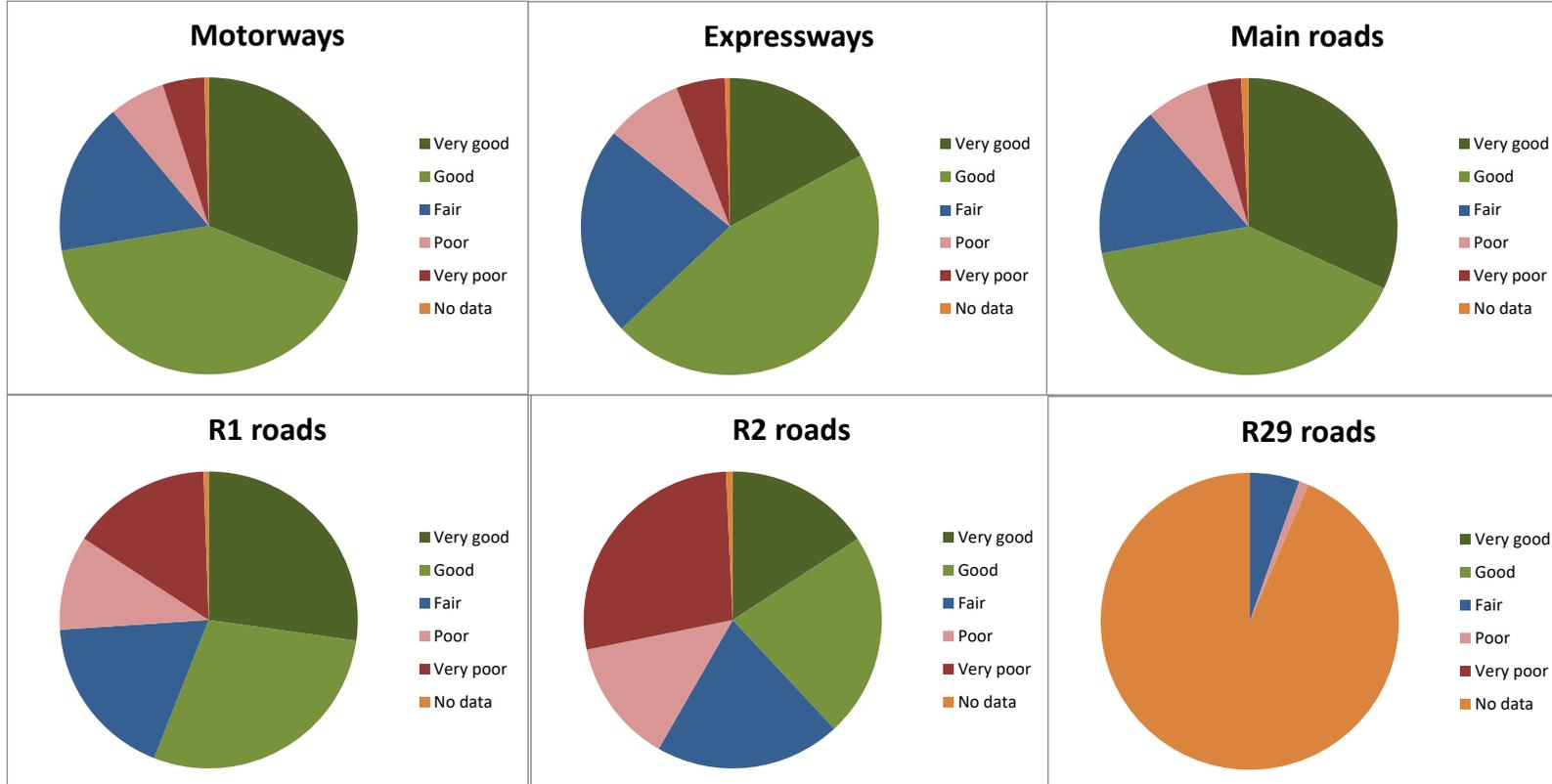
- Layer groups and layers setting
- Media integration
- Searching and filtering
- Measuring
- Printing
- Simple analyzing and exporting data

RAMS SW - WEB GIS

▶ CONCLUSIONS

- ▶ WEB GIS is independent but integrated with other RAMS software and can be used as PESR central GIS system not limited only to RAMS content and users
- ▶ In future in WEB GIS can be added new data when available and new functionalities and processes can be supported

HDM-4 ROAD NETWORK EVALUATION



Distribution of road network functional classes and IRI categories

DATA COLLECTION

Data was collected by roads survey with special vehicle to determine pavement structures (material type and thickness of pavement structure layers) of state roads in Macedonia for planning and programming of maintenance treatments in RAMS.



CONCLUSIONS

RAMS establishment is successful project and give expected results for all segments :

- RRS
- GPR and WIM measurements
- RAMS SW including RDB, WEB GIS and Portal
- Populating system with existing data
- Road network evaluation with the HDM-4
- Difficulties:
 - RAMS system is on place but is not used on daily base while PESR RAMS team are not established completely
 - PESR posses special vehicles for road survey and for time-to-time PESR RAMS TEAM is preforming roads survey and prepare reports.

THANK YOU FOR YOUR ATTENTION