Mapping of climate vulnerabilities on existing national road network in Poland

General Directorate for National Roads and Motorways (GDDKiA)

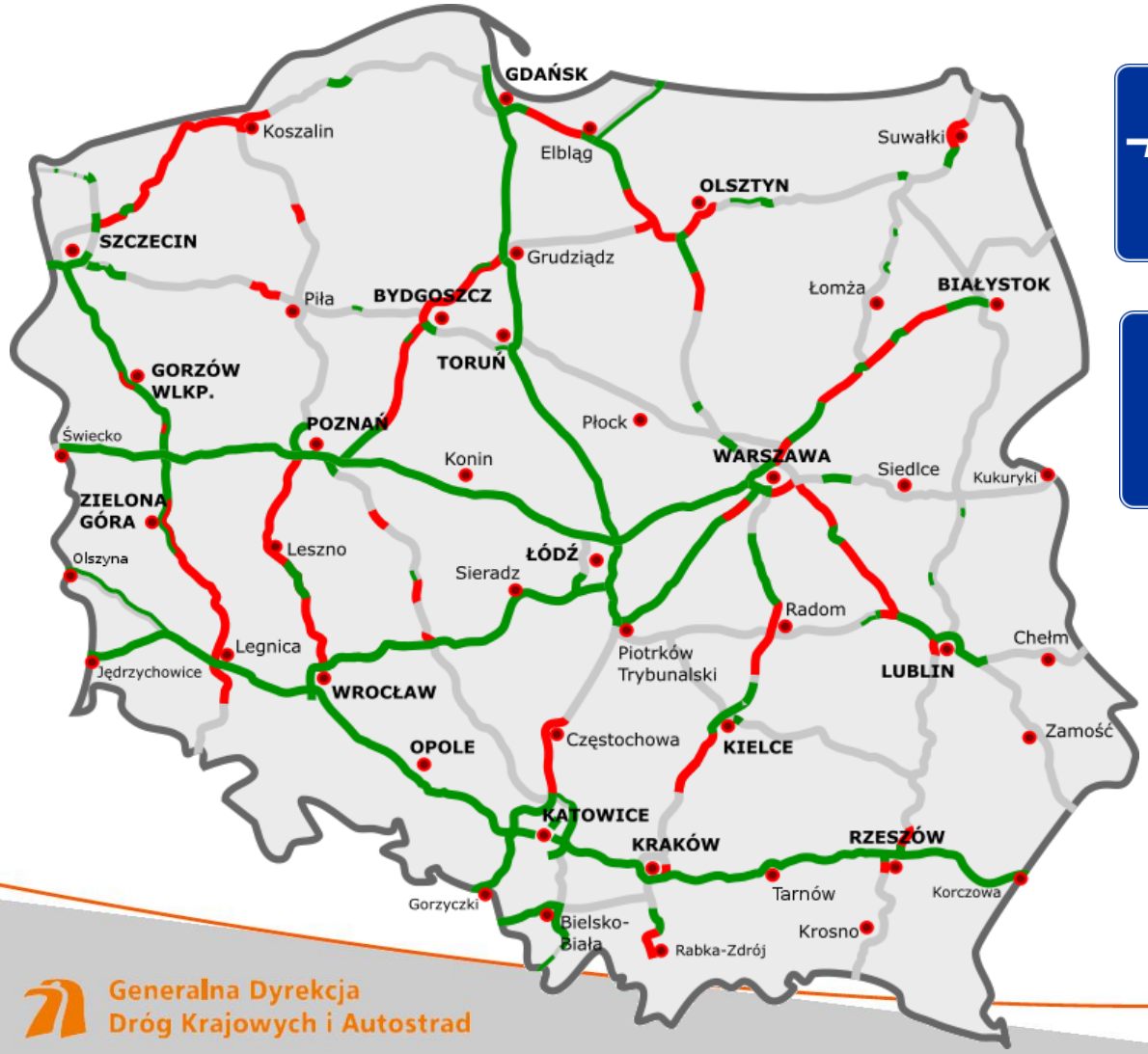
JASPERS Networking Platform Seminar - 6th of December 2017

Brussels

Contents of presentation:

1. Introduction – overview of the Polish national roads network.
2. Overview of EU funded projects.
3. Project of CC adaptation on national roads in Poland.
4. Conclusions.

Network of high-class roads (motorways and expressways) current network and development



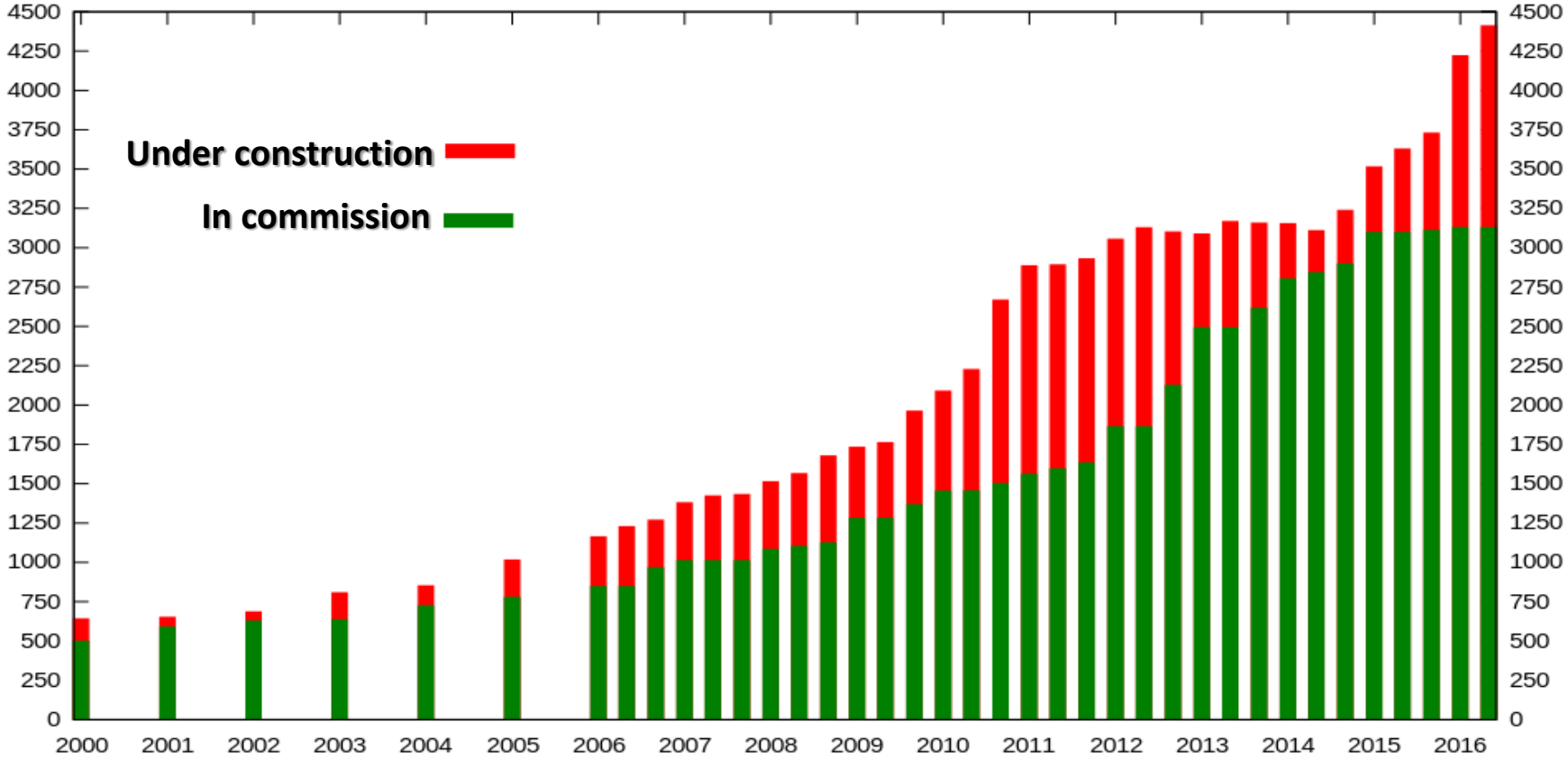
- 1660,55 out of 2027,15 km completed (81.9%)
- 56,8 km under construction
- 18,1 km in tender

- 1506,00 out of 5765,9 km completed (28.3%)
- 1091,6 km under construction
- 504,1 km in tender

High-class roads – overall numbers:
Total network length: 7793,05 km
Total length under operation: 3166,55 km
Total percentage of completion: 40,6%

under construction
in commission

Historical data for high-class road network (since 2000)



Traffic density on state roads

Motorways

Expressways

Main trunk roads and trunk roads

Road category	Length - 2010	AADT 2010	Length 2015	AADT 2015
Motorways	848	23285	1556	26509
Expressways	550	19567	1484	21232
Main trunk roads	11203	10434	10536	9995
Trunk roads	4646	4978	4446	5260
TOTAL	**17247**	**9888**	**18022**	**11178**

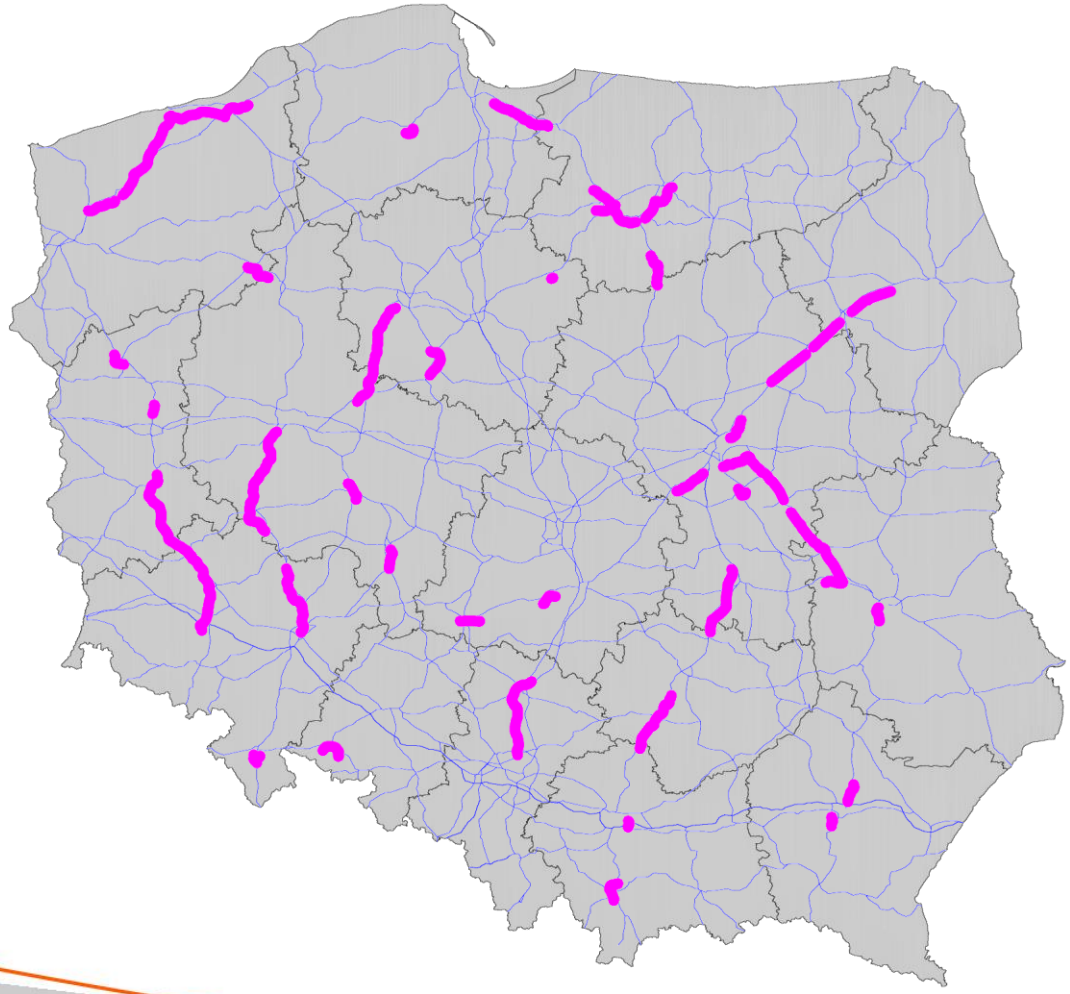
Operational Programme Infrastructure & Environment 2014-2020

Priority Axis III: Development of TEN-T road transport and multimodal transport
a) Measure 3.1 Development of TEN-T road transport and airline network

Priority Axis IV: The road infrastructure of cities
b) Measure 4.1 Increase in transport availability of the urban centres on TEN-T road network and relief for the cities from the extensive road traffic
c) Measure 4.2 Increase in transport availability of the urban centres outisde the TEN-T road network and relief for the cities from the extensive road traffic

Information on OPI&E at GDDKiA (data from: 29th of September 2017)
Project applications approved by European Commision: **27**
Applications for subsidy: **40**
Agreements for subsidy: **36**
Applications for payment: **234**, for the amount of: € **3,62 billion** worth of eligible expenditure

Location of the OPI&E 2014-20 projects



Climate change assessment is carried out for EU financed projects:

- Mitigation - quantification of GHG emissions and related external costs based on national values (Blue Book, 2015)
- Adaptation – vulnerability and risk assessment, performed at application stage considering results of KLIMADA project for the vulnerability analysis – the goal of current activities regarding adaptation at national roads level.

Network of national roads

OPI&E Projects

CC adaptation project on national roads in Poland

- In February 2016 GDDKiA started preliminary works on the CC adaptation strategy
- *Climate change* is understood as increase in frequency and intensity of extreme weather events
- First step – sensitivity analysis regarding disturbances in traffic flow and damages caused by extreme weather events (based on DG CLIMA model):

sensitivity x exposure = vulnerability

…in accordance with „International Climate Change Adaptation Framework for Road Infrastructure" by PIARC)

- Questionnaire was sent to all 16 regional branch offices of GDDKiA, to units responsible for road maintenance.
- Acquisition of data from period between January 2004 and March 2016.
- Feedback: information about 3300 extreme weather events, which resulted in actions of road servicing teams.

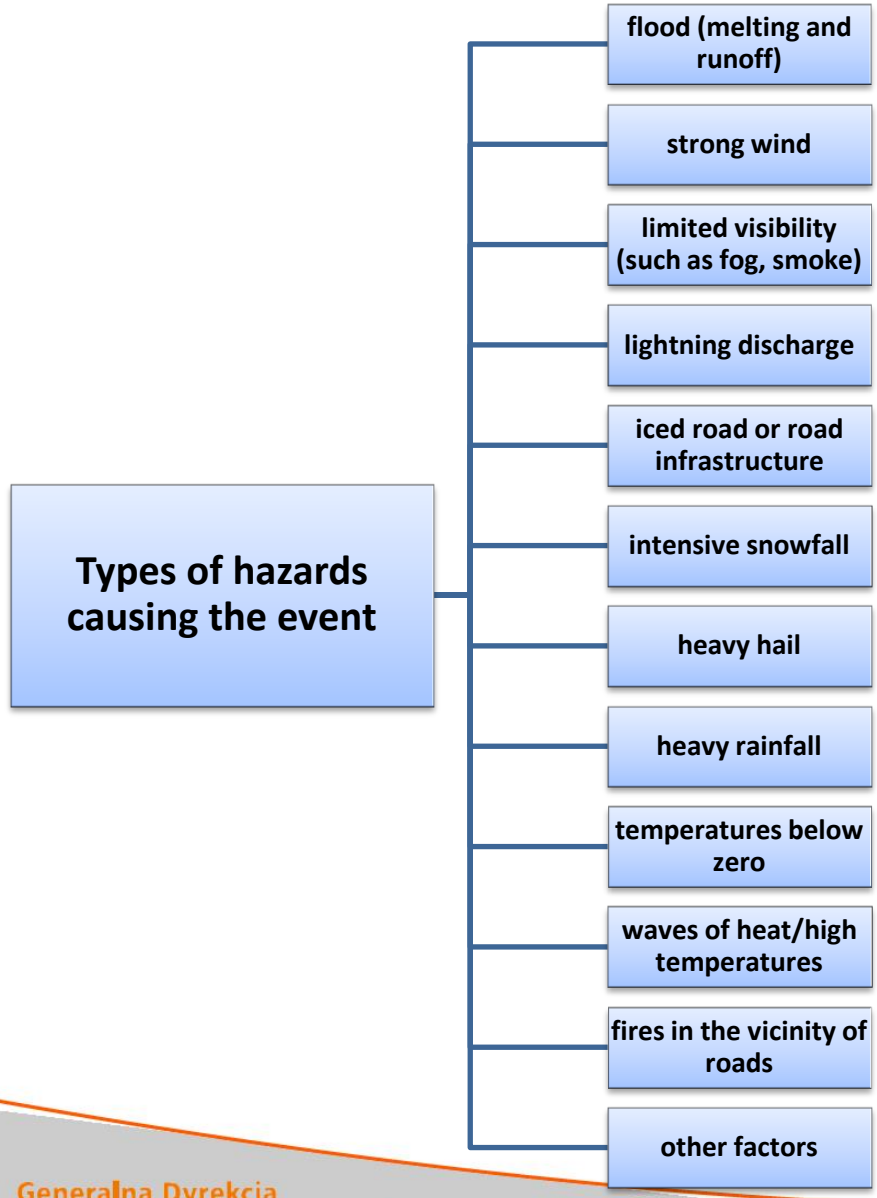
In 2017 cooperation with JASPERS was established to develop the CC adaptation project.

Questionnaire scheme:

Three main parts:

- PART 1 - Basic data on time and location and road section of every event
- PART 2 - Types of the event - 12 different types of events, such as intensive rainfall, lightning discharge, strong winds, flood etc.
- PART 3 - Effects of the event - 4 main classes:
  - Class I – damages and defects of road or road infrastructure (no obstacles in traffic flow)
  - Class II – obstacles in traffic flow (no damages and defects of road and road infrastructure)
  - Class III – total block of traffic flow (no damages and defects of road and road infrastructure)
  - Class 0 – no damages and no obstacles, but maintenance team action needed

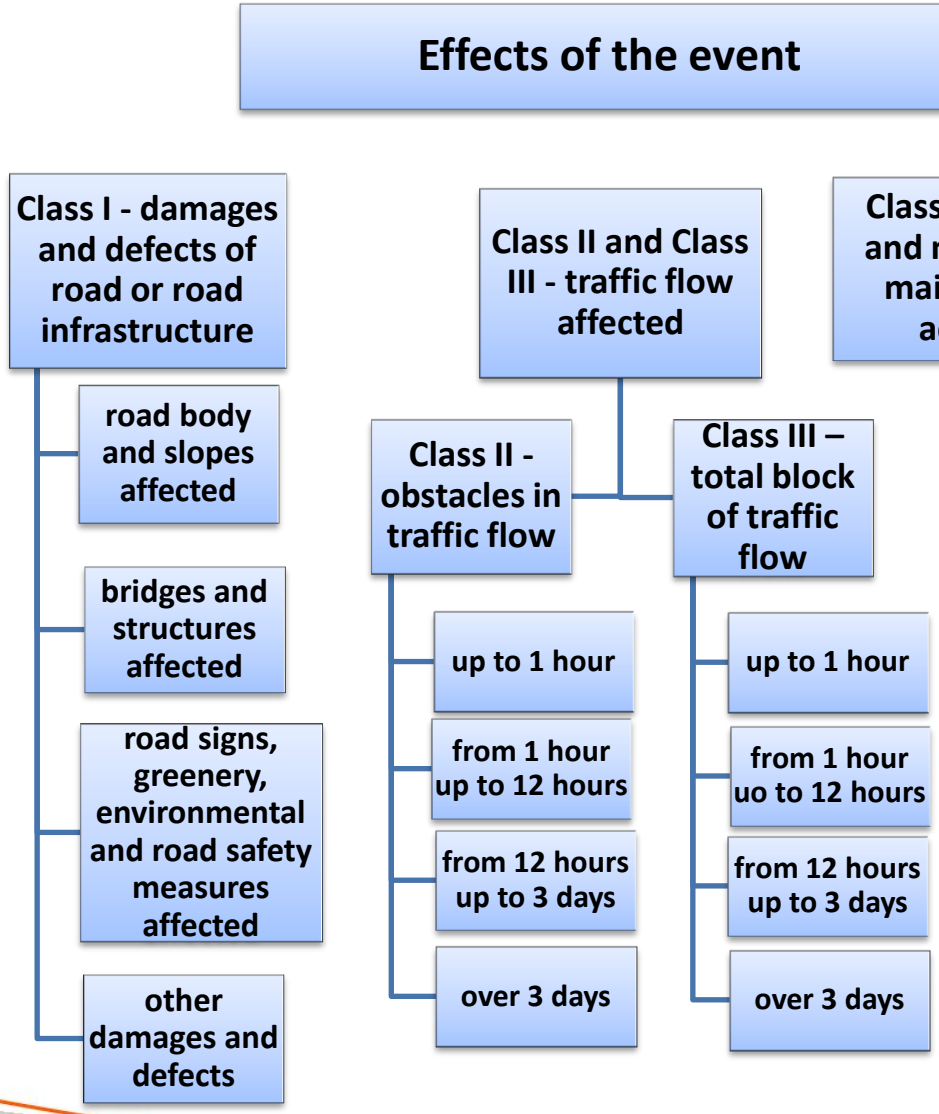
Acquired data adjusted for GIS analyses.



Questionnaire - PART 2

In the case of a single extreme weather event more than one hazard could be selected

For all weather hazards, it was possible to select "Yes" (i.e. the hazard has occurred and caused certain negative effects) or „No" (i.e., the hazard did not occur)

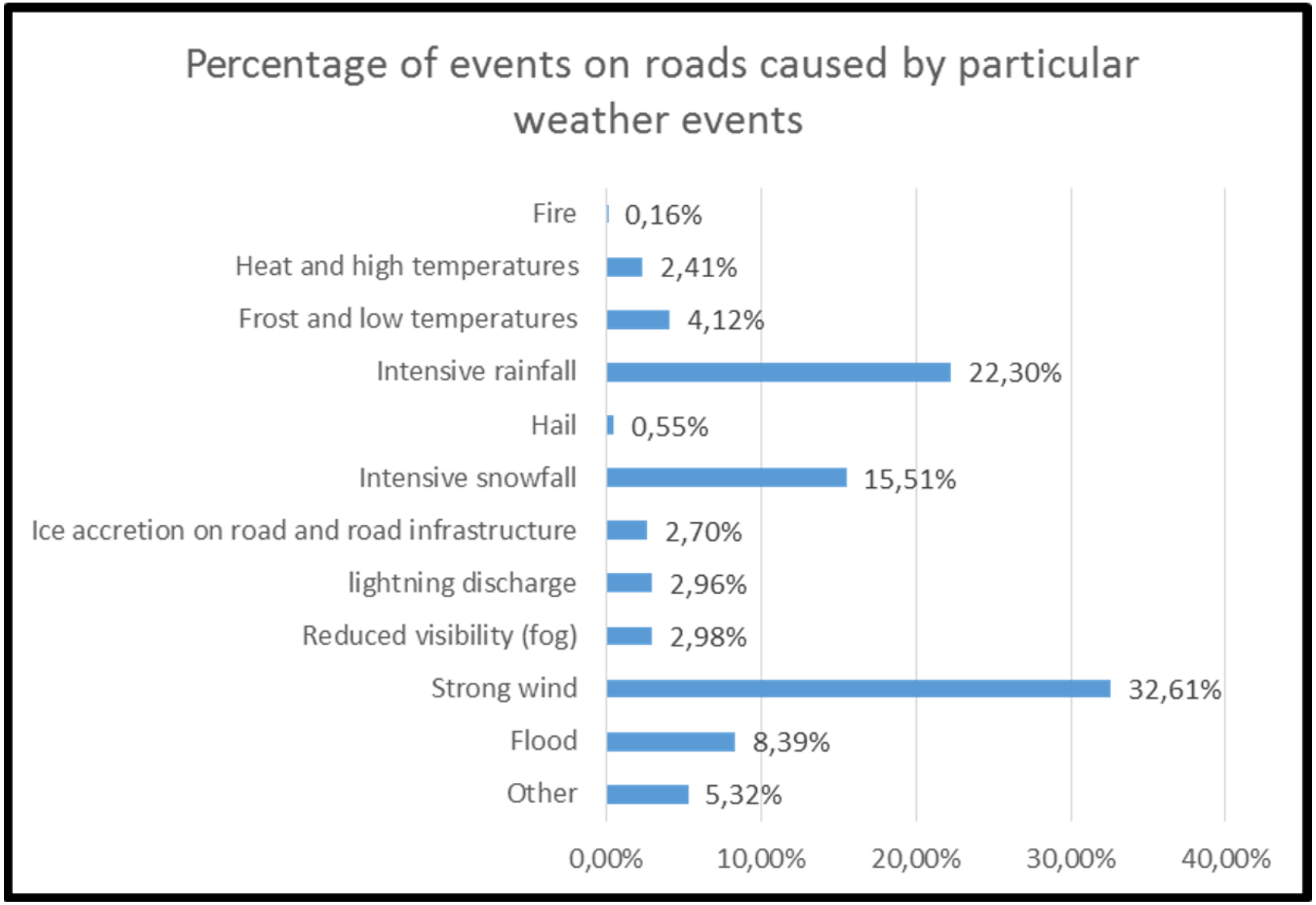


Questionnaire - PART 3

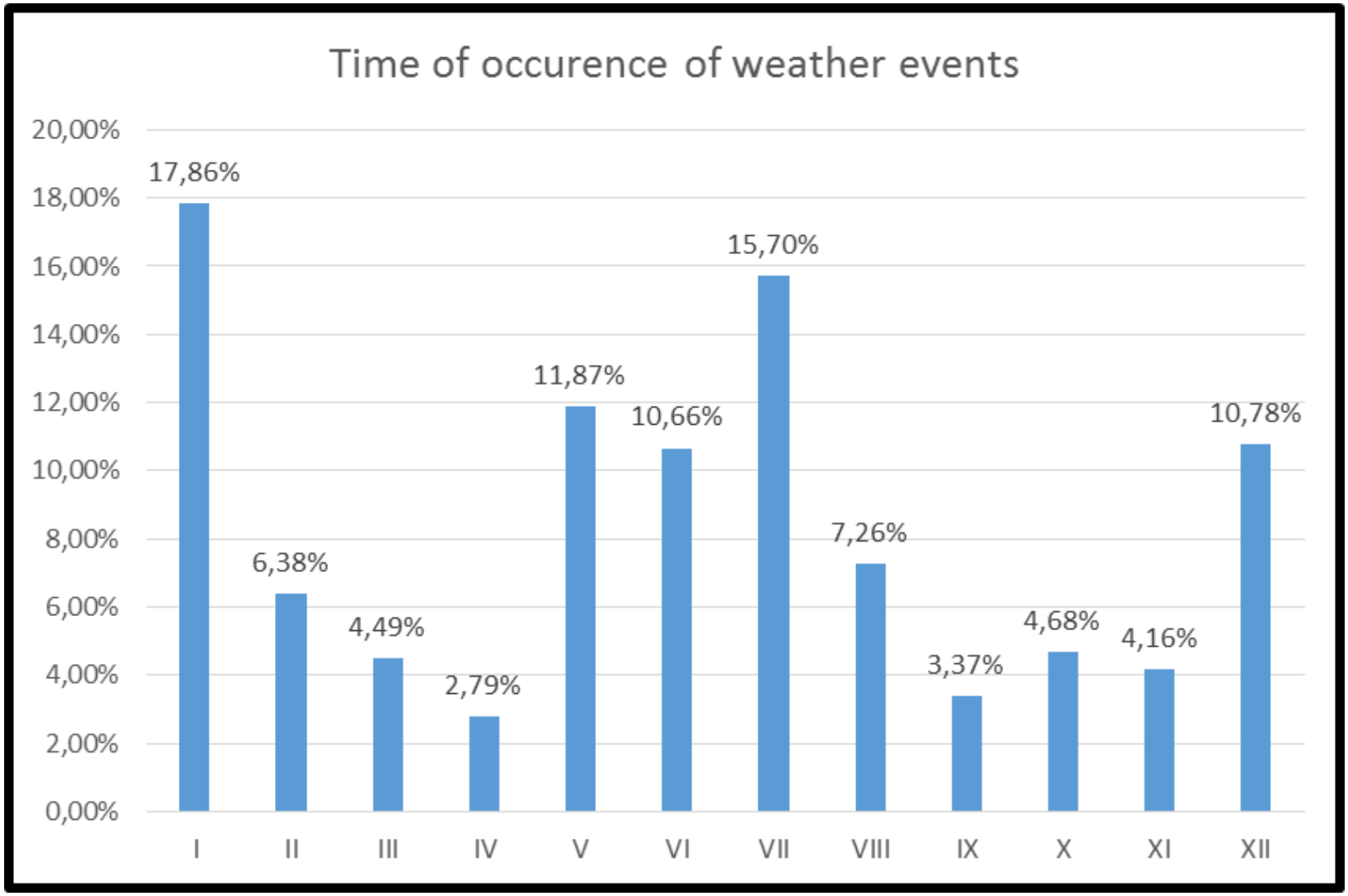
Applied approach enabled to report also events, which caused effects compartmentalized to more than one Class.

Example: A particular event brought on by intensive rainfall might cause erosion of road body slopes (Class I) and as a result of that one lane of the road must be closed for 3 days to carry out repair works (Class II).

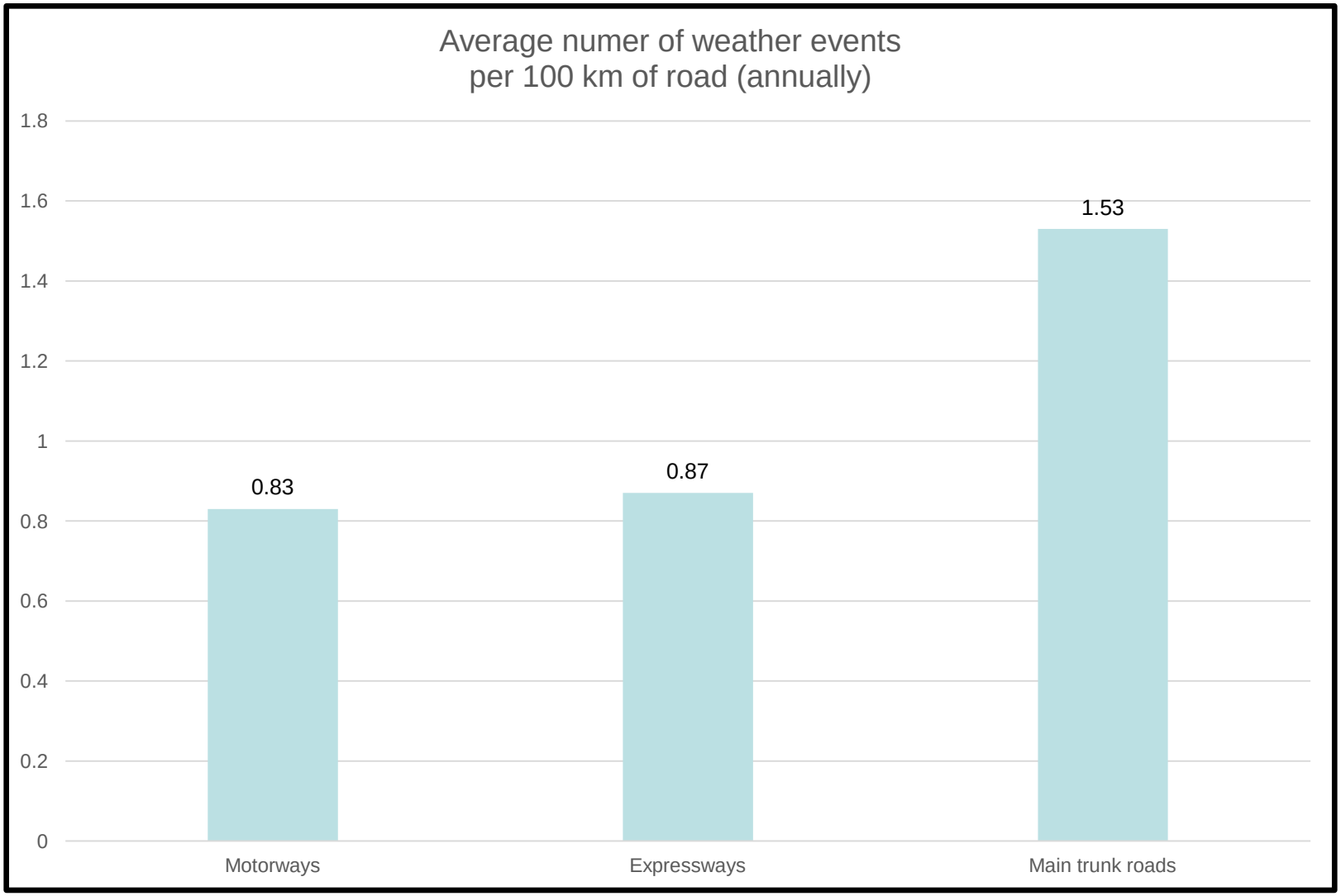
Preliminary results – percentage distribution of weather events



Preliminary results - monthly distribution (percentage) of occurence

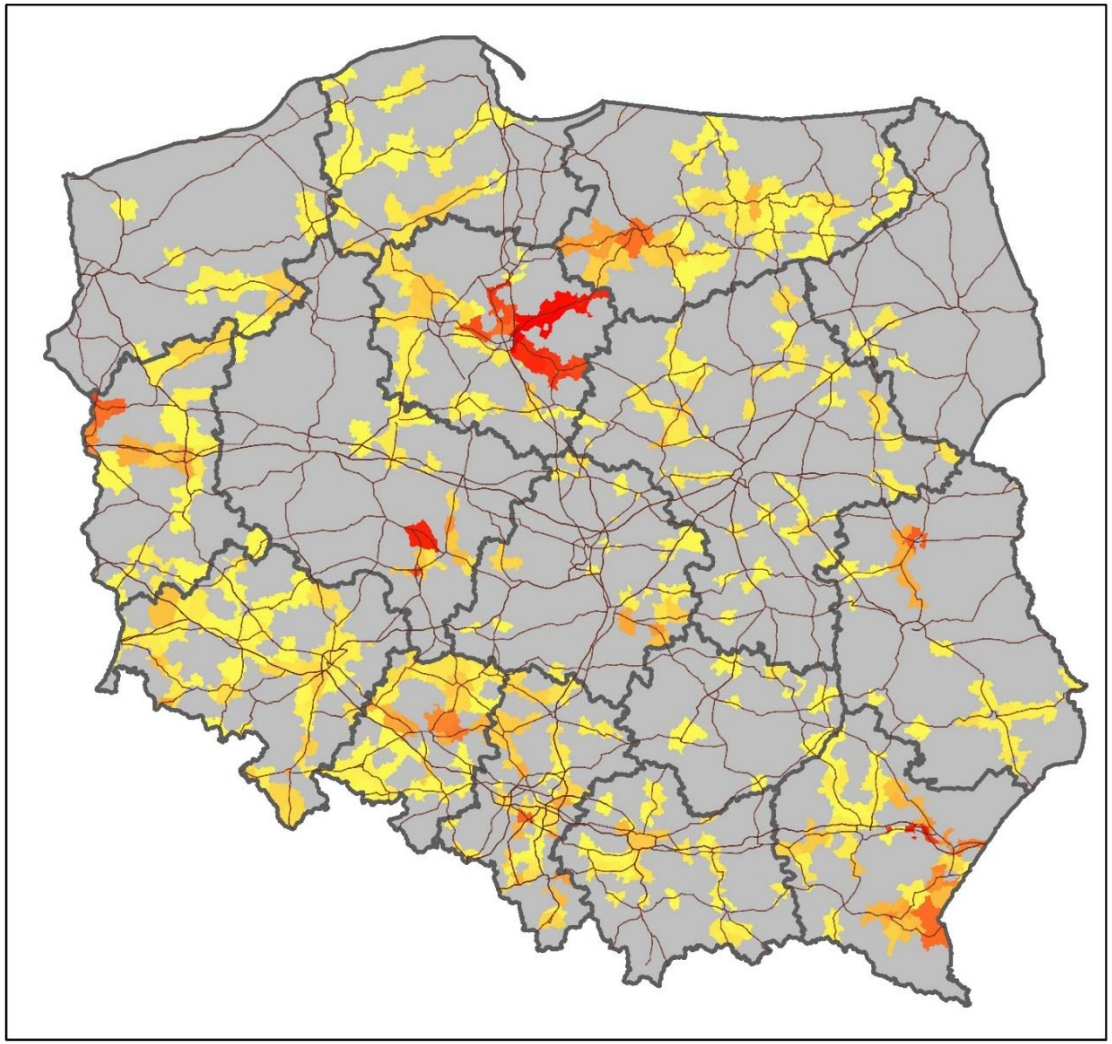


Preliminary results – occurence of events on different road classes



Preliminary results – identification of most risk sensitive areas

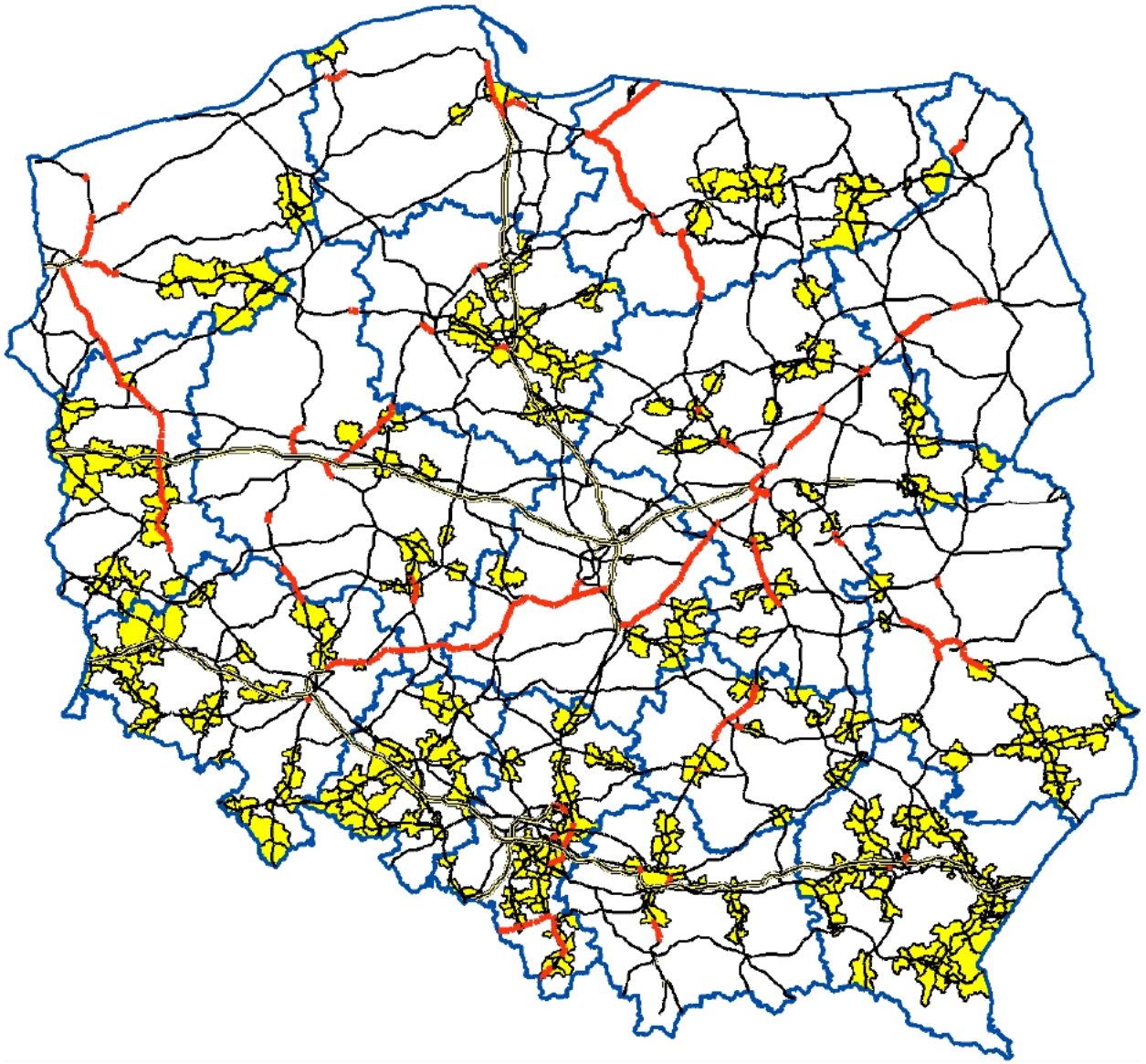
The colours' intensity represent the different frequency (absolute value) of total numer of extreme weather events registered between January 2004 and March 2016



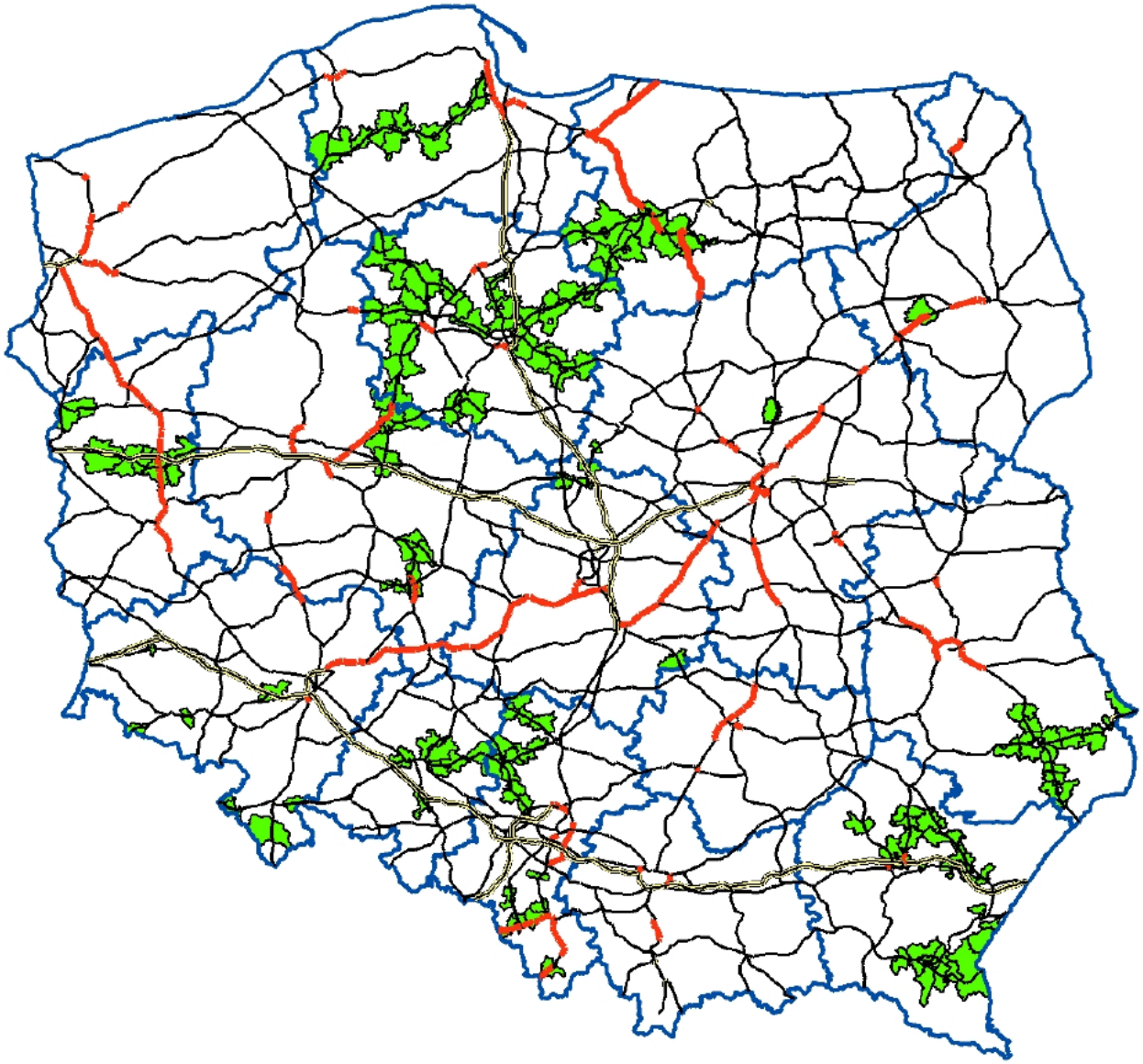
Preliminary results – Comments

- Data from questionnaire allowed for identification of main hazards to network of national roads – intense rainfall, intense snowfall and strong winds – responsible for more than 70% of all events caused by climate factors,
- Extreme weather events on roads in Poland are most frequent during periods from December to January and from May to July, as acquired from data collected between 2004 and 2016,
- Average number of weather related events is below one per one hundred kilometres for motorways and expressways per year, but is almost twice as high for other trunk roads,
- Data was sufficient to create a spatial representation of hazard sensitive areas using GIS analyses, limiting it to boundaries of municipalities, where weather related events occured on national roads,

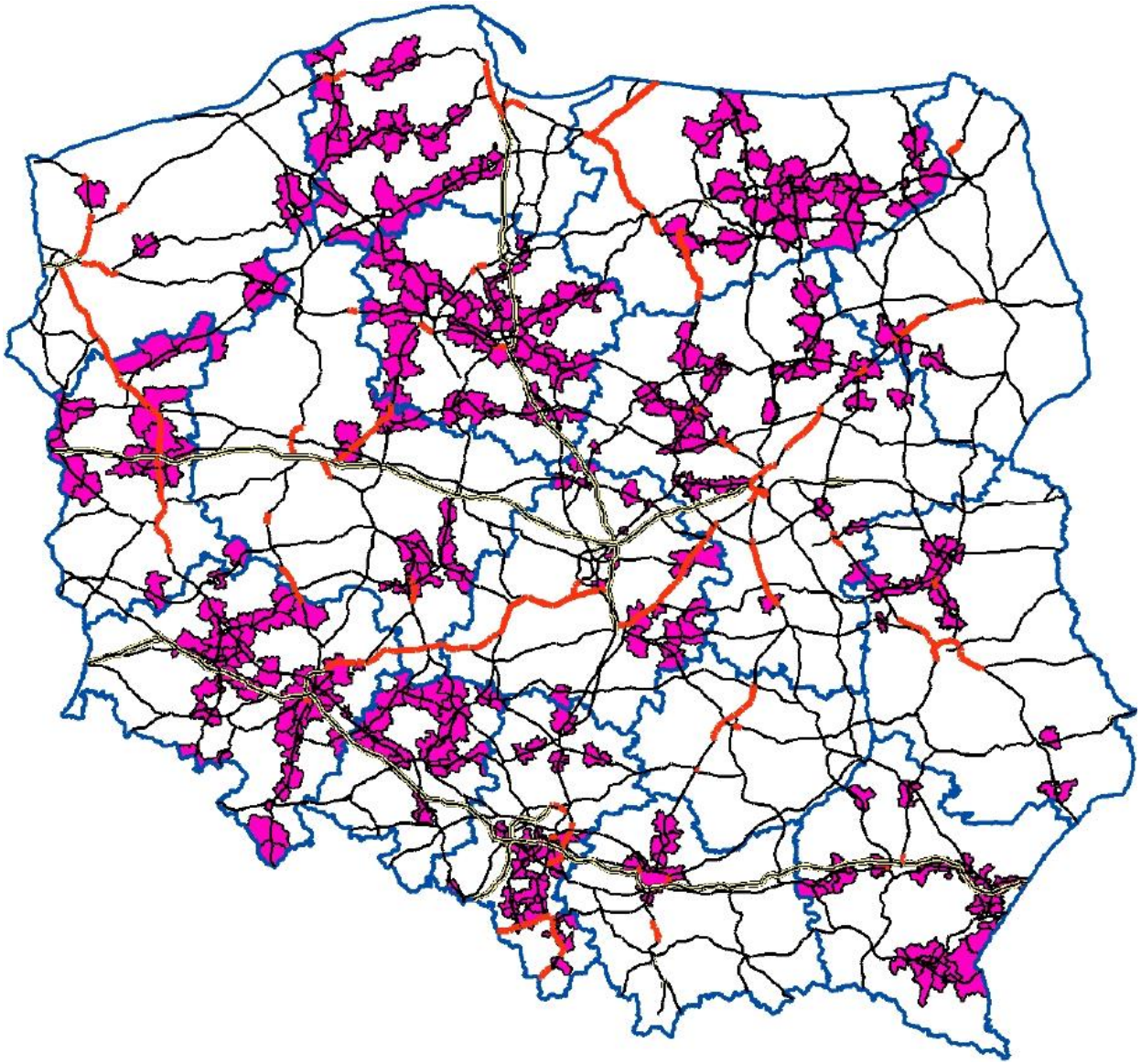
Preliminary results – distribution of events caused by intense rainfall



Preliminary results – distribution of events caused by intense snowfall



Preliminary results – distribution of events caused by strong winds



Preliminary results – table of effects of each hazard on roads

Weather Factor	Road Class	Damages and defects of road or road infrastructure				Obstacles in traffic flow				Total block of traffic flow			
		Damage to body and road surface	Damage to bridges	Damage to other parts of road infrastructure	Other	Up to 1 hour	1 - 12 hours	12 hours–3 days	Over 3 days	Up to 1 hour	1 - 12 hours	12 hours–3 days	Over 3 days
Strong wind	Mtwy	0	0	28	8	1	6	0	17	0	1	0	3
	Exwy	0	1	28	5	2	6	4	4	0	2	0	1
	Tkrd	38	3	826	123	263	549	134	54	34	38	15	7
Intense snowfall	Mtwy	0	0	0	0	0	1	0	0	0	0	0	0
	Exwy	0	0	3	0	3	4	3	2	2	0	0	0
	Tkrd	39	0	49	14	7	292	197	20	27	14	11	0
Intense rainfall	Mtwy	22	0	2	23	0	4	2	16	0	3	0	5
	Exwy	36	1	6	37	3	1	4	21	1	1	2	0
	Tkrd	439	72	220	287	47	162	104	281	37	29	13	67

Preliminary results – table of effects of each hazard on roads

		flood (melting and rainfall)	strong wind	limited visibility (e.g. fog smoke)	Lightning discharge	iced road or road infrastructure	Intensive snowfall	heavy hail	heavy rainfall	temperatures below zero	waves of heat/ high temperature	fires in the vicinity of roads	other factors
May - July	Up to 1 hour	7	13	1	10	0	0	4	21	0	0	0	0
	1 - 12 hours	13	15	1	1	0	0	0	16	0	0	3	4
	12 hours – 3 days	15	3	2	3	0	0	1	7	0	1	0	0
	Over 3 days	20	4	0	3	0	0	0	50	0	1	0	2
	Total per factor	55	35	4	17	0	0	5	94	0	2	3	6
December - January	Up to 1 hour	1	10	0	1	8	11	0	8	7	0	0	8
	1 - 12 hours	0	19	7	1	1	13	0	0	1	0	1	12
	12 hours – 3 days	0	8	3	0	3	8	0	0	3	0	0	0
	Over 3 days	1	6	0	0	0	0	0	1	5	0	0	0
	Total per factor	2	43	10	2	12	32	0	9	16	0	1	20

Further planned steps:

1. **Validation** of the available data and statistical treatment to be used e.g. in the vulnerability and risk assessment of projects as part of the EU co-financed project applications
2. **Desk review** of available past trends of climate in Poland, description of **climate projections** based on available forecasted scenarios and trends and definition of extreme events
3. **Cost assessment** of the maintenance and related intervention of the weather-related events
4. **Workshop** involving all relevant stakeholders necessary for analysis of all possible adaptation responses
5. **„Basic business case"** for taking action to adapt and build resilience as a tool to convince decision-makers
6. **Action plan** on the recommended adaptation responses (using workshop results) for the existing and planned Polish national road network including methodology for the continuous data collection on extreme weather events

Conclusions

- **Acquisition of increased knowledge** on the subject and **continuous learning process** – what started solely as EU requirements is being developed into a good project practice,
- **Awareness raising** shall be continued at different levels within GDDKiA and all relevant stakeholders,
- **Need of follow-up work** on adaptation analysis and necessary actions,
- **Dissemination and extension of project** on other road managers, also at regional and international levels.

Thank you for your attention!

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More Information

For info or further questions on this seminar and the activities of the JASPERS Networking Platform, please contact the JASPERS Networking and Competence Centre at the following email:

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