

# Adaptation to CC for national roads in Poland

*Results of Stages I, II and beginning of Stage III*

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Utrecht, 20<sup>th</sup> November 2018

## Adaptation to CC for national roads in Poland

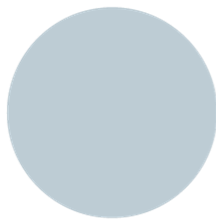
- **Who are we?**
- **The Project**
- **Stage I: Summary and main conclusions**
- **Stage II: Summary results**
- **Stage III: starting with workshops...**
- ***Suggestions***

# Who are we?

## JASPERS

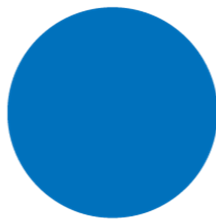
Joint Assistance to Support Projects in European Regions

- **Partnership between the European Commission (EC) and the European Investment Bank (EIB).**
- **Managed by the EIB on the basis of a Framework Partnership Agreement with the EC.**
- **JASPERS assists beneficiary countries in preparing high quality investment projects to be co-financed by the EU Funds (European Regional Development Fund, Cohesion Fund, Connecting Europe Facility and Instrument for Pre-Accession).**



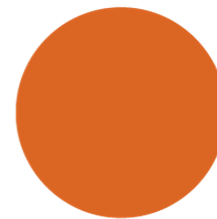
### Project preparation

Guidance in the preparation of projects, with upstream involvement



### Capacity building

Proximity to beneficiaries, knowledge sharing and dissemination of good practices



### Independent Quality Review

Assessment of soundness, quality and compliance of project applications with relevant regulations

# Who are we?



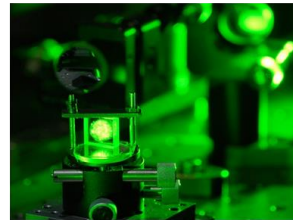
1. Energy and Solid Waste



2. Rail, Air and Maritime



3. Roads



4. Smart Development



5. Water and Wastewater

# JASPERS

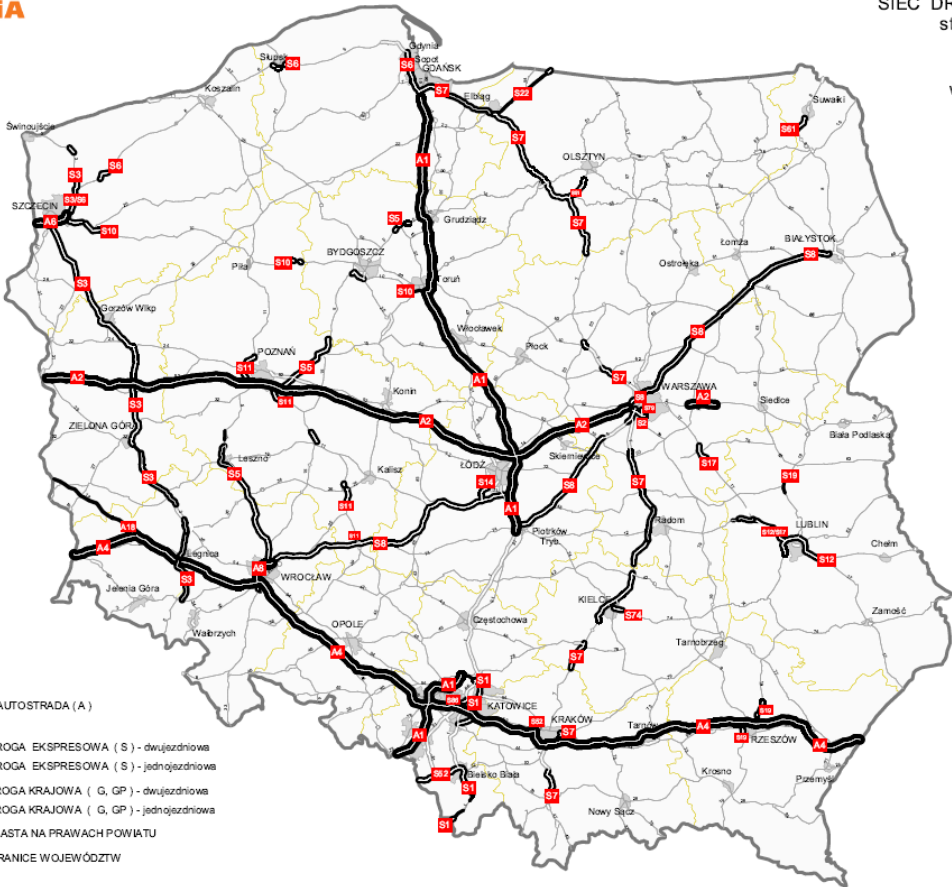
Joint Assistance to Support Projects in European Regions

## Sources of value added

- Contributions to sector strategy / planning
- Contributions to removal of barriers to realise projects
- Cost savings in projects (through optimal dimensioning and selection of rational options)
- Faster approval through improvement of project documents (\*)
- Better chance of realising expected project benefits after implementation through improvement of overall project quality
- Increased capacity of counterparts

# Who are we?

## GDDKiA



SIEĆ DRÓG KRAJOWYCH  
 stan istniejący

wg stanu na dzień  
 09. 11. 2018r








**17 650 km of National Roads**



1,627 km of motorways



1,809 km of expressways

- OZNACZENIA:
-  AUTOSTRADA (A)
  -  DRÓGA EKSPRESOWA (S) - dwujezdniowa
  -  DRÓGA EKSPRESOWA (S) - jednojezdniowa
  -  DRÓGA KRAJOWA (G, GP) - dwujezdniowa
  -  DRÓGA KRAJOWA (G, GP) - jednojezdniowa
  -  MIASTA NA PRAWACH POWIATU
  -  GRANICE WOJEWÓDZTW



GDDKiA - Departament Studiów  
 Wykonalności i Analizy Ryzyka

# Who are we?

## GDDKiA

### Traffic intensity on national roads



Motorways



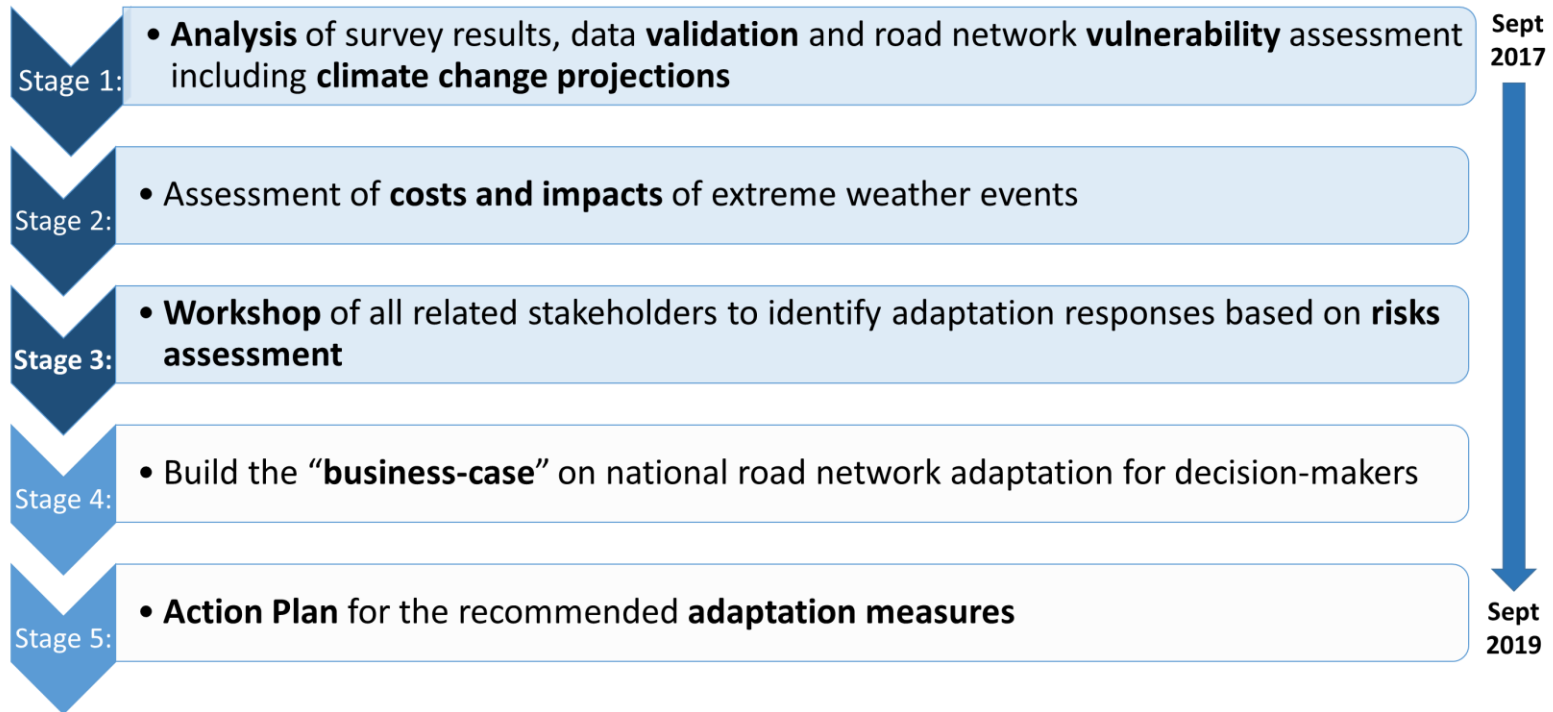
Expressways

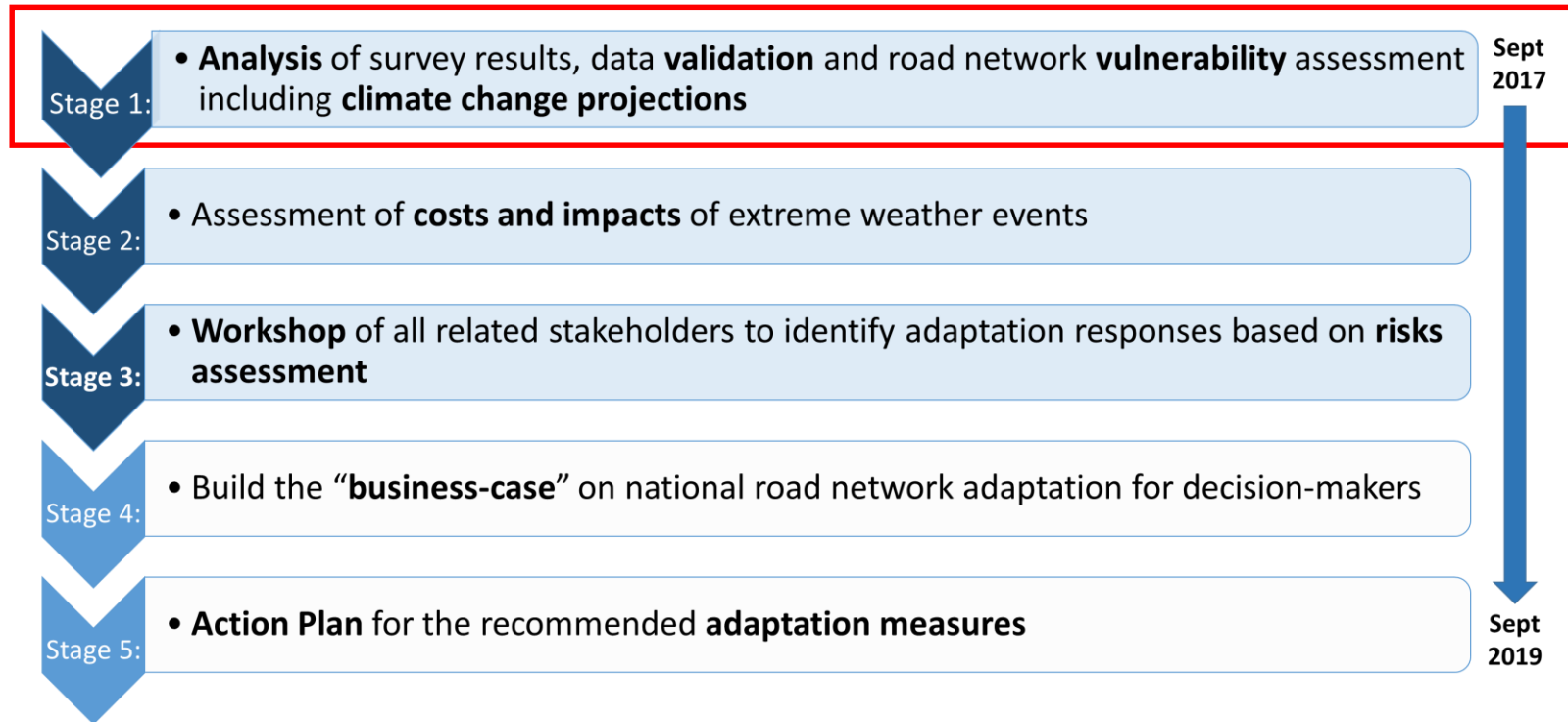


Main trunk roads and trunk roads

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
<b>TOTAL</b>	<b>17247</b>	<b>9888</b>	<b>18022</b>	<b>11178</b>

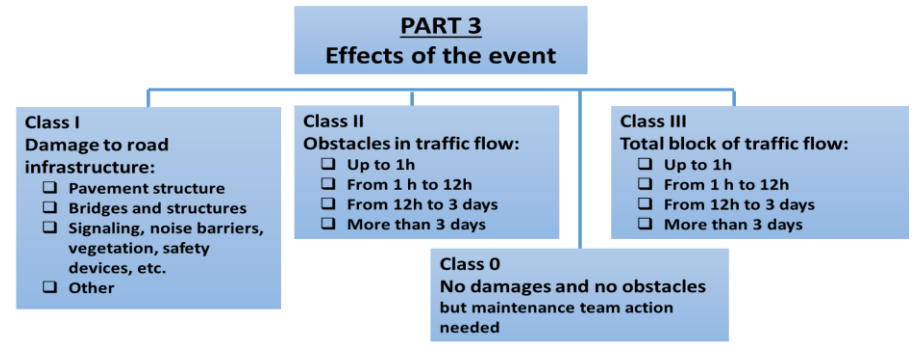
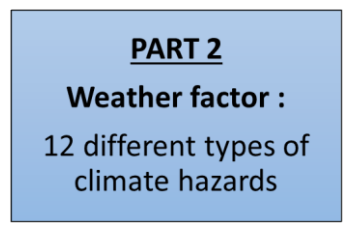
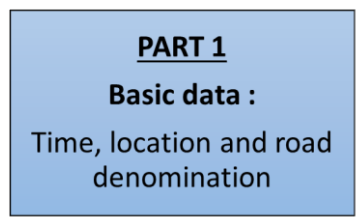
## Planned project steps





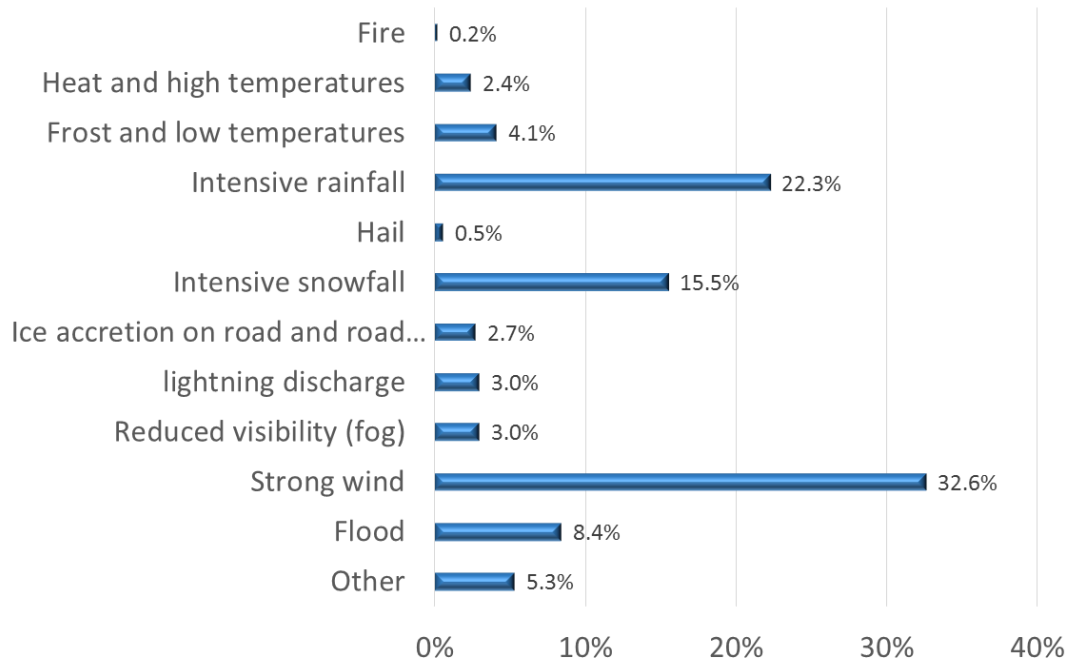
## Background

- Beyond the project level - Need to understand the overall network vulnerability to CC
- In 2016 GDDKiA conducted a survey on weather-related affections of national road network:
  - Period covered January 2004- April 2016
  - Send to all 16 regional offices
  - Data provided:
    - 3,300 extreme weather events required actions of road service teams

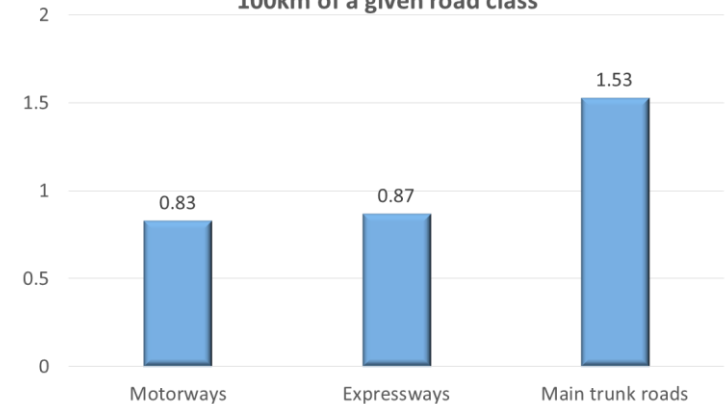


- In 2017 Jaspers Advisory and GDDKiA established horizontal project: “Adaptation to CC for national roads in Poland”

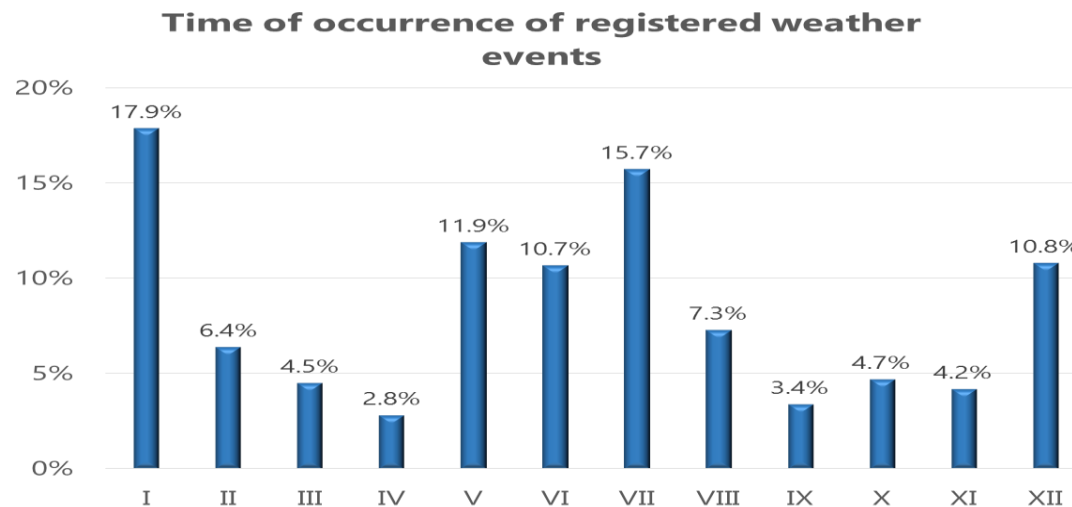
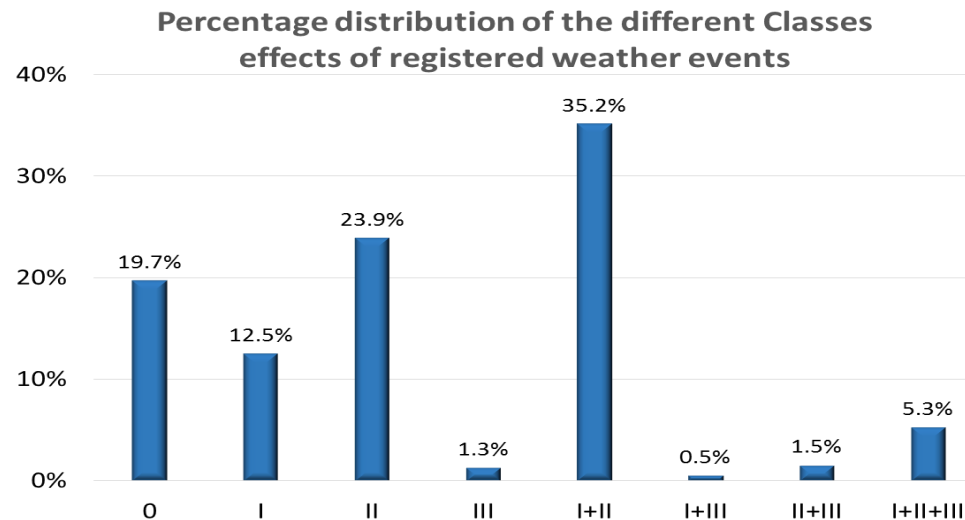
## Percentage distribution of weather causes of registered events



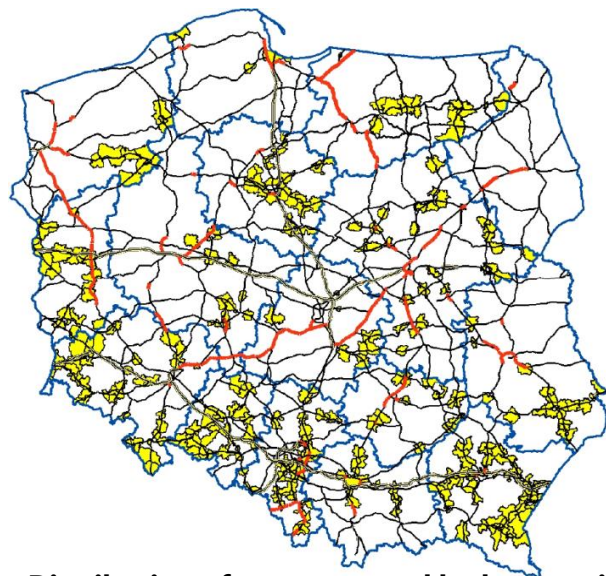
## Annual average number of registered events per 100km of a given road class



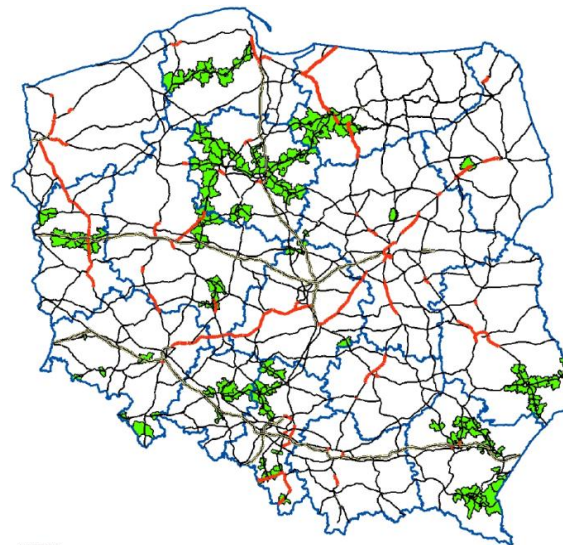
# Stage I: Survey results analysis



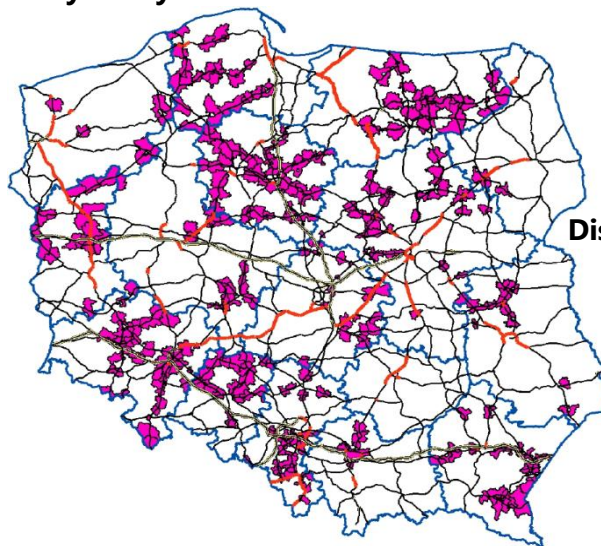
# Stage I: Survey results analysis



Distribution of events caused by heavy rainfall



Distribution of events caused by heavy snowfall



Distribution of events caused by strong wind

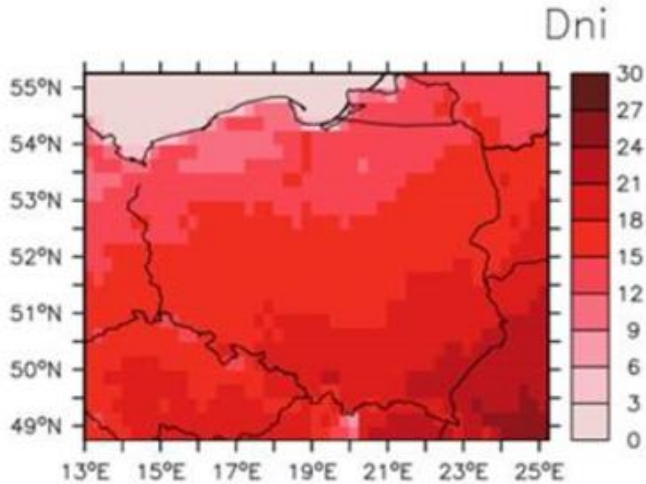
## Initial conclusions summary

- **Identified main climate hazards affecting national road network (intense rainfall, intense snowfall and strong winds – over 70% of all registered events). - Confirming initial KLIMADA assumptions. (Other hazards with longer-term effects e.g. heatwaves could not be captured by present study)**
- **Higher number of events occurred on national roads other than motorways and expressways (build based on higher design standards and operated under higher maintenance standards, other national roads often presenting poorer condition status).**
- **Most of events occurred in May-July and December-January.**
- **Data enabled GIS environment representation as key for further vulnerability analysis.**
- **About 10% of all recorded events resulted in complete blocking of the road (i.e. high impact on users and economy). Most commonly caused by heavy rain, heavy snow and flooding.**
- **A solid prelude to further work under the Jaspers supported project “Adaptation to climate change for the national roads in Poland”.**
- **A basis to state that adequate and well-planned adaptation measures can translate into direct benefits for GDDKiA, road users and the economy.**

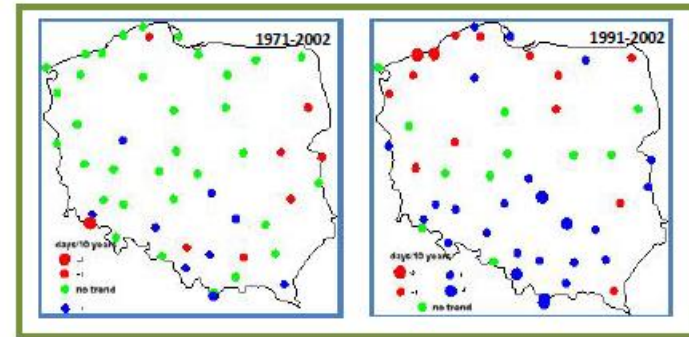
- **Observed trends:**
  - **Systematic temperature (T) increase since late nineteenth century (in particular since 1989).**
  - **Precipitation (P) changed but no unidirectional tendencies and high geographical variability.**
  - **Frequency increase of severe weather events.**
- **Few studies devoted to climate change forecasts in Poland.**
- **Lack of a platform with easy access to climate change scenarios and climate data:**
  - **[KLIMADA 2.0](#) project by IOŚ-PIB on-going**
- **Climate forecasts:**
  - **increase in annual average T (in particular, in winter) with increase of Ndays with  $T_{max} > 25^{\circ}C$  and decrease of Ndays with  $T_{min} < 0^{\circ}C$ ;**
  - **changes in P, differing forecasts, generally increase (winter P would increase while summer would decrease), increase in  $P_{max24h}$  and increase of Ndays with  $P > 10$  mm/day and  $P > 20$  mm/day;**
  - **decrease in Ndays with snow cover and reduction in maximum snow cover;**
  - **increased frequency and intensity of wind.**

# Stage I: Climate change forecasts

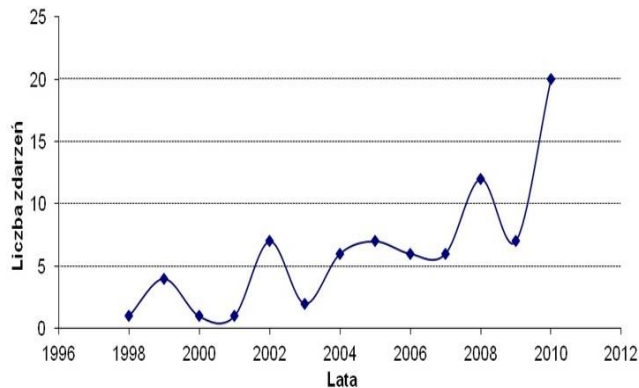
## Trends and forecasts: some graphs....



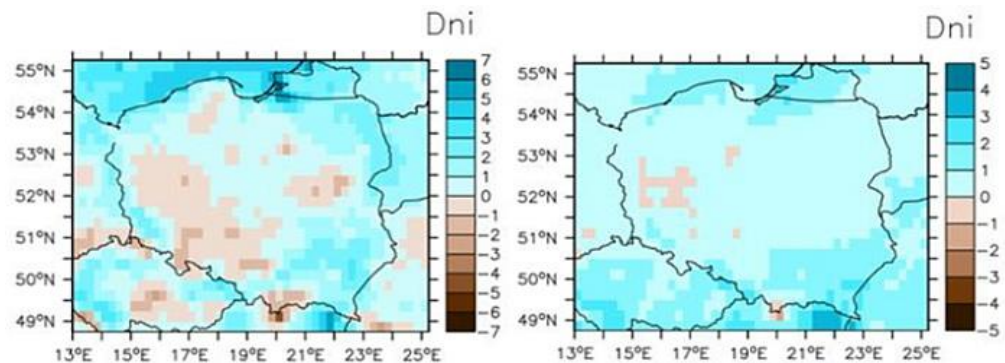
Difference in number of days with  $T_{max} > 25^{\circ}\text{C}$  between 1971-2000 and 2041-2070. Source: KLIMADA.



Trends of number of days with precipitation  $\geq 50$  mm. Source: KLIMADA.



Incidents (yearly number) of whirlwinds in Poland. Source: IMGW.



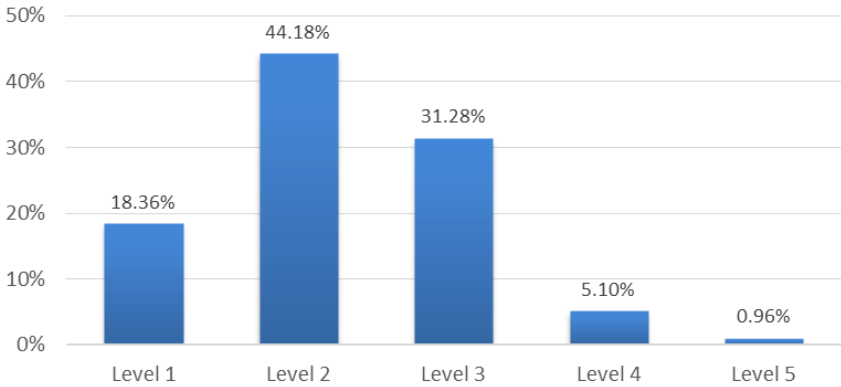
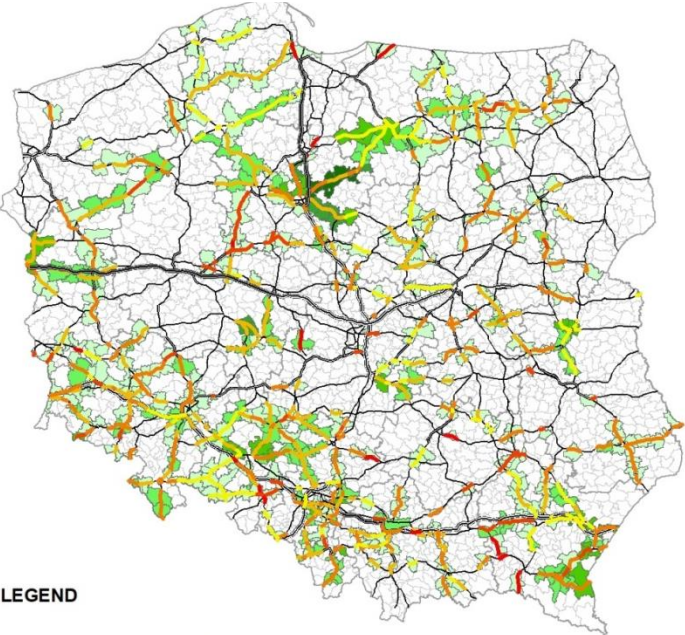
Difference in days with  $P > 10$  mm/day (left) and  $P > 20$  mm/day (right) between 1971-2000 and 2041-2070. Source: KLIMADA.

## Current vulnerability: initial conclusions

Vulnerability

= Sensitivity × Exposure

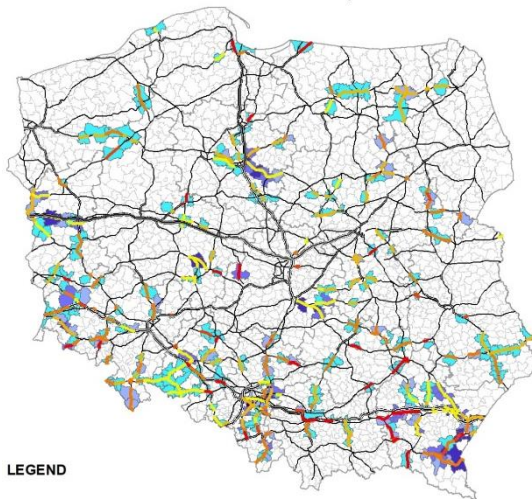
- **Sensitivity = Identifying the relevant climate hazards: *interventions of road maintenance service teams, infrastructure damage and/or traffic disruptions***
- **Exposure = Considering location: *number of registered events and climate data and projections considerations***



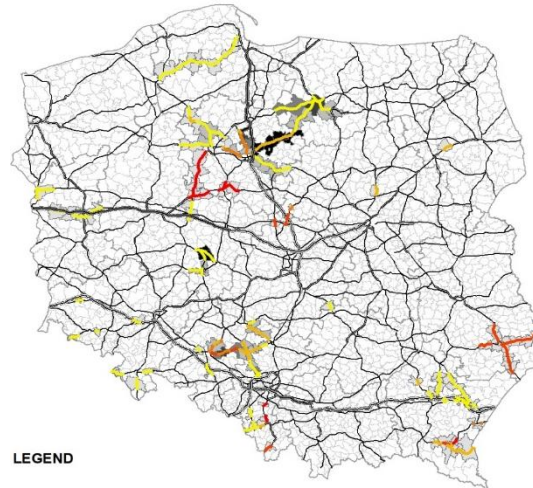
**Number of registered events and impact levels caused by all weather hazards.**

**All weather registered events sensitivity levels.**

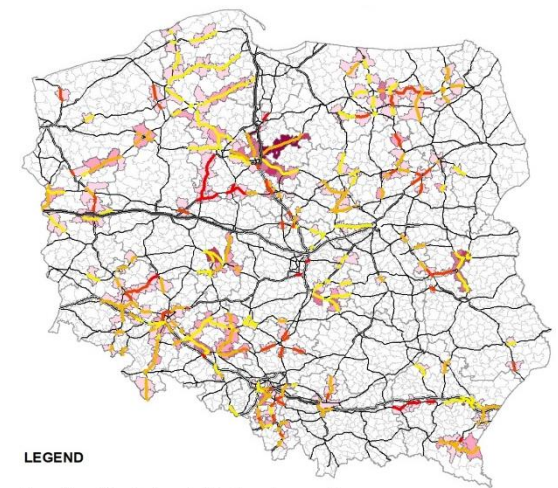
# Stage I: Vulnerability assessment



**LEGEND**



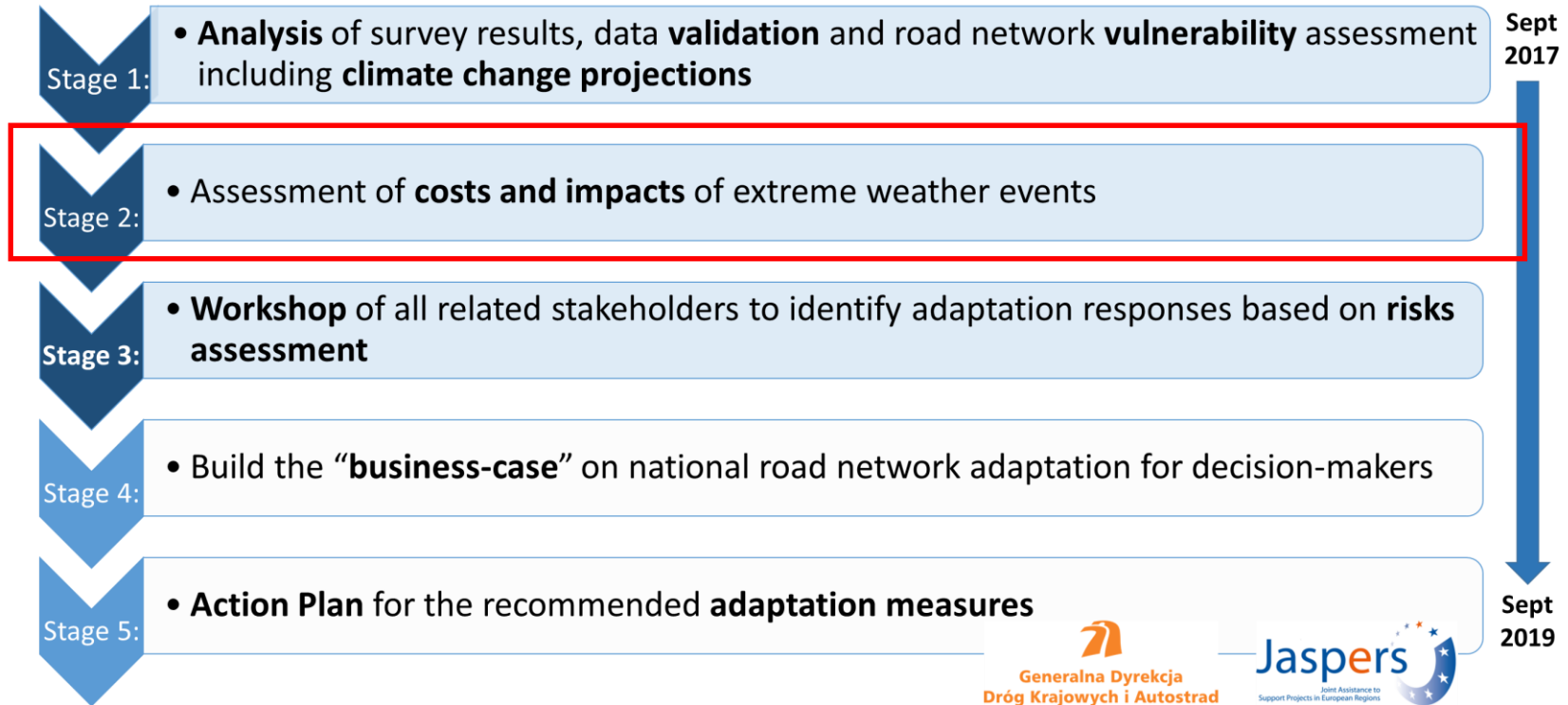
**LEGEND**



**LEGEND**

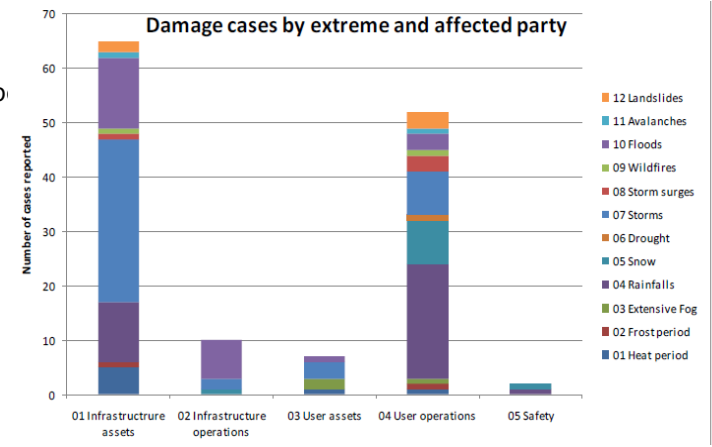
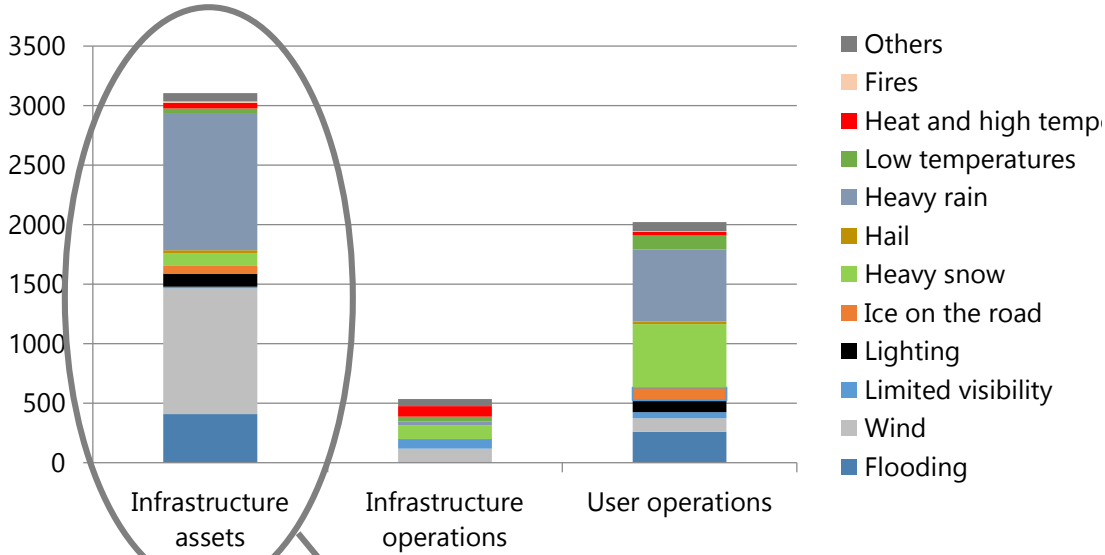


## Current Vulnerability Assessment: initial results – three main hazards

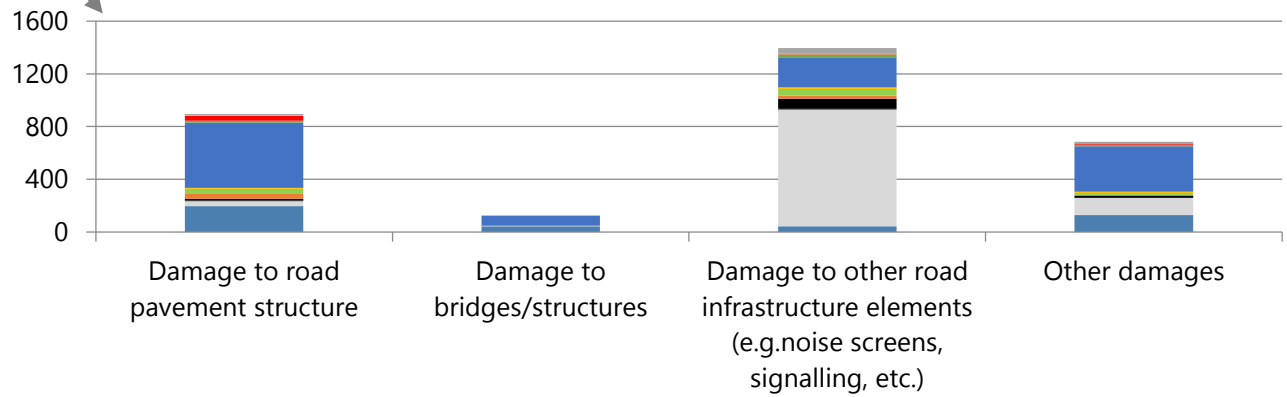


# Stage II: Costs and impacts assessment

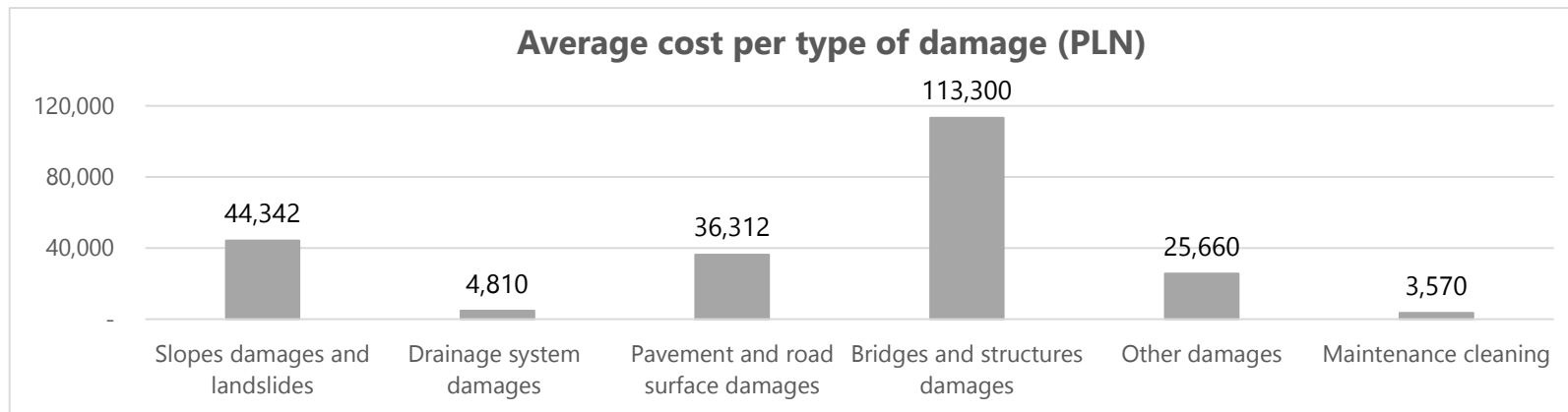
## Overview of impacts



Source: WEATHER project, Annex 3 Vulnerability Assessment for Road Transport, 2011.



## Impacts on road infrastructure



Based on a sample of 88 events from registers from Katowice, Krakow, Opole, Rzeszow, Warsaw and Wroclaw GDDKiA branch offices. (\*) 3 records needed to be excluded from average to avoid distortion.

Types of road infrastructure elements	Number of actions	% of all actions
Slopes damages and landslides	30	35.3%
Drainage system damages	7	8.2%
Pavement and road surface damages	9	10.6%
Bridges and structures damages	5	5.9%
Other damages	9	10.6%
Drainage & Pavements	2	2.4%
Slopes/landslides & Drainage	7	8.2%
Maintenance cleaning & Other damages	7	8.2%
....	...	...

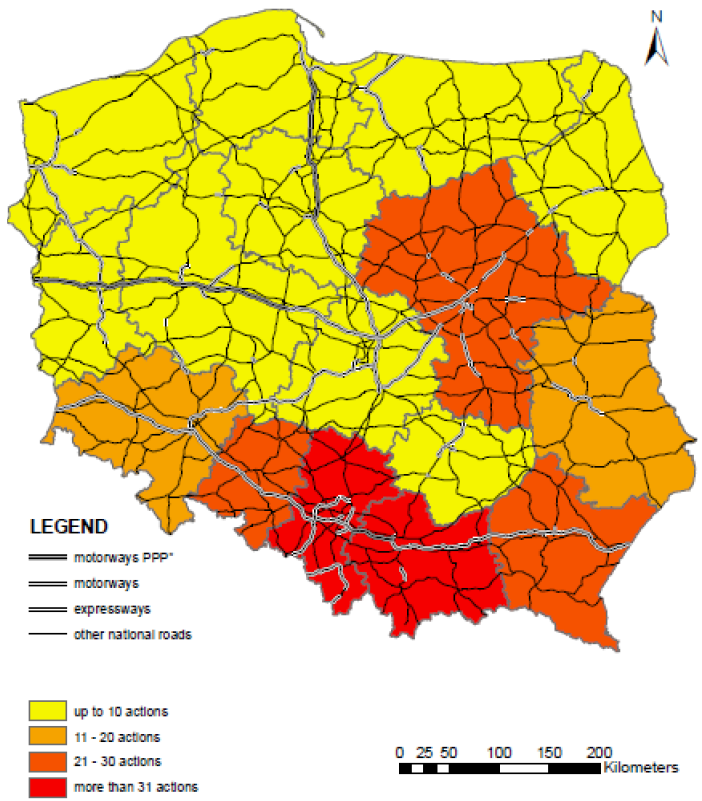
**General average cost of an event with registered damages (based on the sample):**

**92,000 PLN (\*)**  
**(aprox. 20,500 EUR)**

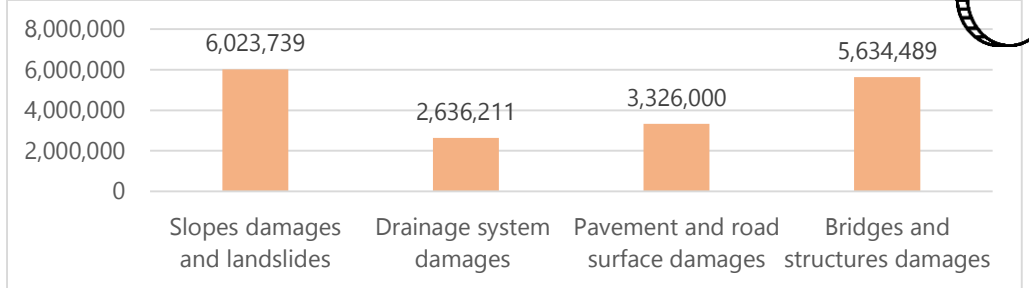


## The case of 2010 flooding

Number of actions undertaken to repair damages caused by flood in 2010



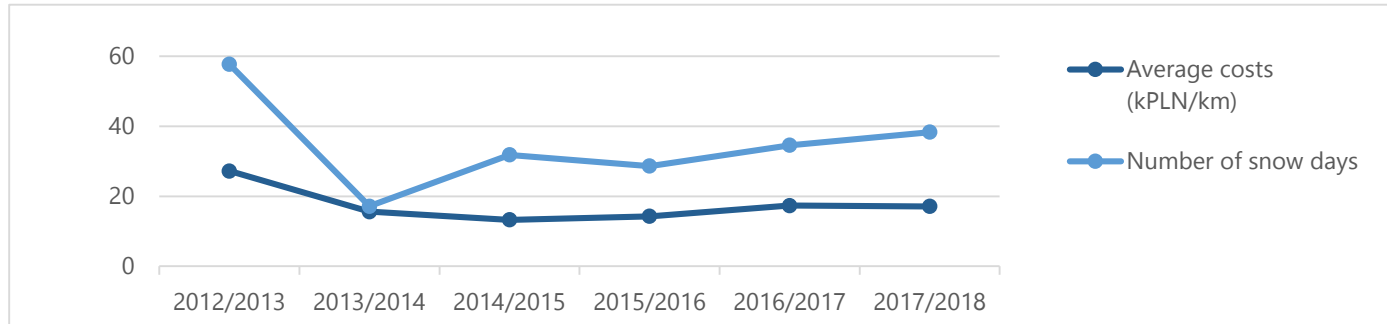
Average cost per type of damage (PLN)



Damage type	Number of actions	% of all actions
Slopes damages and landslides	11	5.1%
Drainage system damages	7	3.2%
Pavement and road surface damages	17	7.9%
Bridges and structures damages	31	14.4%
Slopes/landslides & Drainage & Pavements	9	4.2%
Drainage & Pavements	67	31.0%
Slopes/landslides & Drainage	12	5.6%
Slopes/landslides & Pavements	5	2.3%

# Stage II: Other impacts

## Impacts on road operations: the winter maintenance

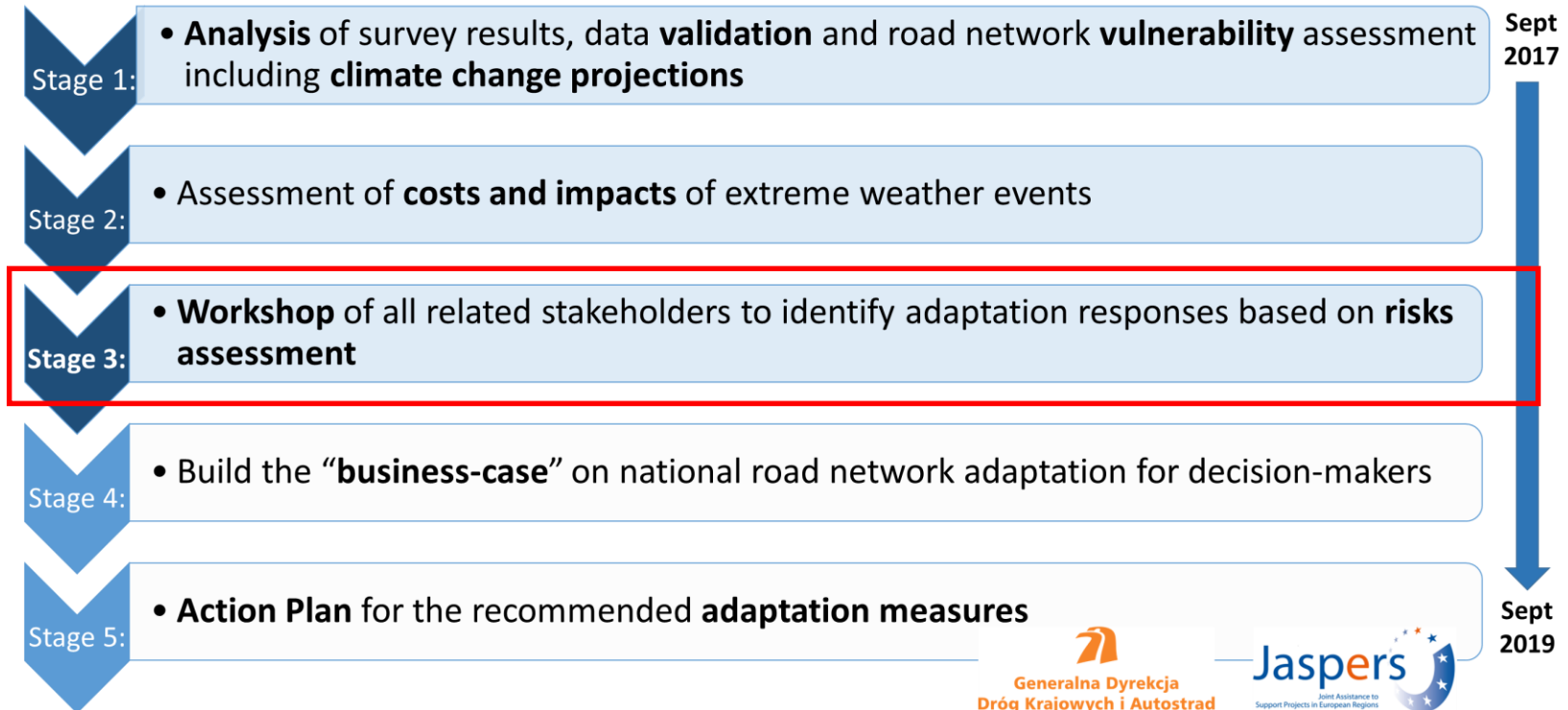


## Impacts on users and society

- 66% of all registered events incurred traffic disruptions and only 8.7% caused traffic blocking

Weather Factor	Traffic flow disturbance					Total blocking of traffic flow				
	Up to 1 h	1-12 h	From 12 h to 3 days	More than 3 days	Total	Up to 1 h	1-12 h	From 12 h to 3 days	More than 3 days	Total
<b>Strong Wind</b>	18.8%	39.6%	9.7%	5.3%	73.3%	2.4%	2.9%	1.1%	0.8%	7.1%
<b>Heavy Snow</b>	1.5%	43.9%	29.5%	3.2%	78.1%	4.3%	2.1%	1.6%	0.0%	8.0%
<b>Heavy Rain</b>	5.1%	17.1%	11.3%	32.6%	66.2%	3.9%	3.6%	1.5%	7.4%	16.4%

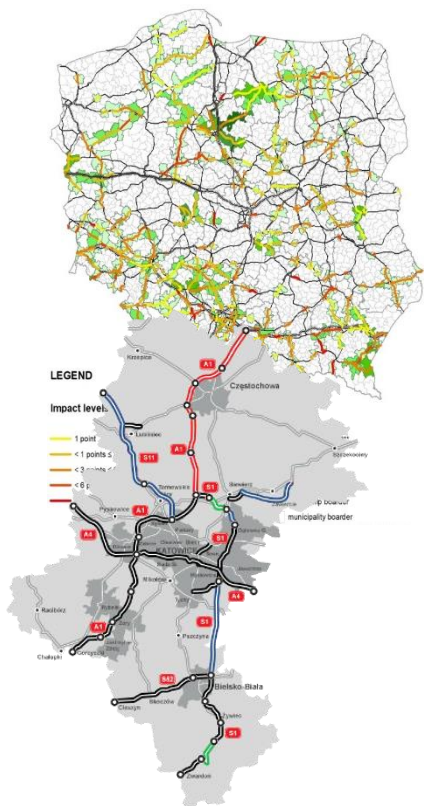
- Statistics: number of accidents is higher under most favourable weather conditions



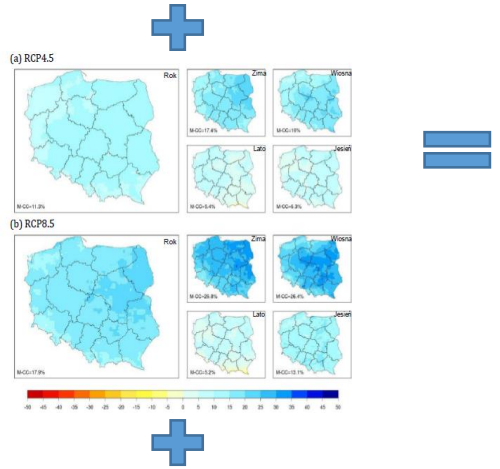
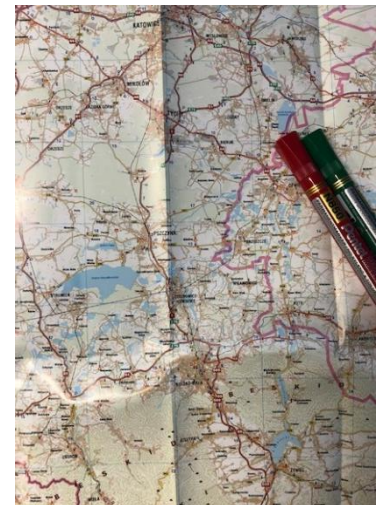
## Katowice GDDKiA Branch – 15/11/18



# Stage III: Workshops...



- List oddziaływań na drogi krajowe**
- Oddziaływania związane z wydłużonym/intensywnymi opadami deszczu:**
- uszkodzenia dróg (nawierzchni, el. ziemnych i inf. towarzyszącej) oraz systemów odwodnienia;
  - zwiększony odpływ z przylegających terenów powodujący powodzie;
  - powodzie;
  - zwiększona niestabilność nachyleń i osuwiska;
  - zwiększone podmywanie dróg, mostów i fundamentów obiektów;
  - pogarszanie się stabilności podłoża z powodu podwyższonej wilgotności;
  - redukcja ograniczenie;
  - Częstsza utrata przyczepności nawierzchni (śliskość) - zaburzenia płynności ruchu
- Oddziaływania związane z opadami śniegu:**
- zwiększone/zmniejszone zapotrzebowanie na odśnieżanie i utrzymanie zimowe;
  - zwiększona ilość topniejącego śniegu prowadzące do powodzi;
  - zwiększona ilość zaburzeń płynności ruchu.
- Oddziaływania związane z wiatrem i burzami:**
- różne zagrożenia: połamane drzewa, zniszczenia infrastruktury, latające i spadające przedmioty;
  - uszkodzenia znaków drogowych, ekranów akustycznych itd.;
  - ograniczenia ruchu w odsłoniętym terenie (np. wysokie pojazdy itd.)
  - zwiększona liczba dachowań wywołana wiatrem i burzami;
  - zaburzenia płynności ruchu.



Oddział	Klasa drogi (A, S, DK)	nr drogi (gminy)	Kod gmin	Nazwa gmin	Hazard	Assessment of future impacts	Comments
odział	kat_dr	nr_dro g	kod_g m	nazwa_gm			
Katowice	DK	52 2402072		Kozy	Heavy rain	4	Road under bad condition and presenting several incidents related to heavy precipitation
Katowice	DK	52 2402082		Porąbka		...	...

Nieistniejący/ograniczony wpływ na ruch i/lub infrastrukturę.	Średni wpływ na ruch i/lub infrastrukturę.	Znaczący wpływ na ruch i/lub infrastrukturę.
Pozioms 1 - 2	Pozioms 3 - 4	Poziom 5

# Stage III: Workshops....

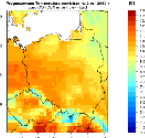
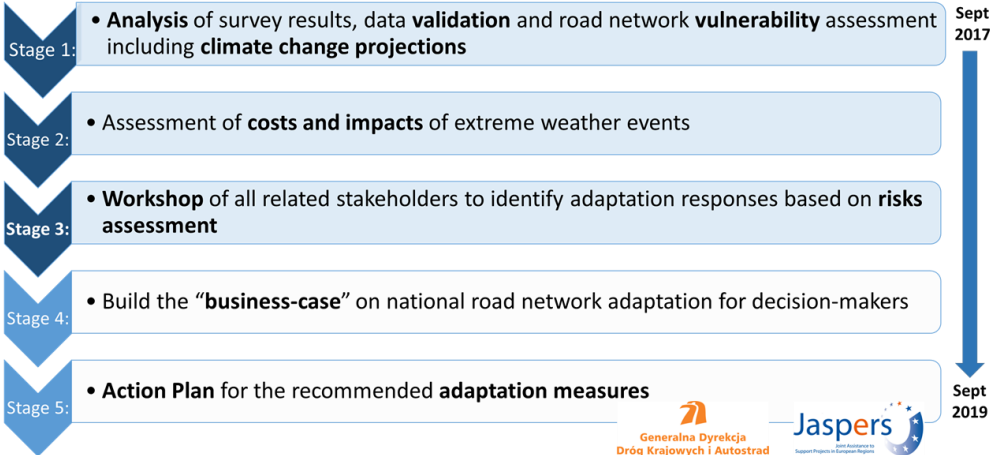
## Brainstorm on climate vulnerabilities, issues and potential adaptation responses



- Legislation not precise for Road management and Nature conservation to share responsibilities
- Different administrations responsible for adjacent land to road network with different maintenance levels
  - “A1 motorway accused to cause flooding to adjacent land”
- Current procurement practice (contract award on lowest-price) leading to low-quality designs and low-cost effectiveness solutions....
- .....

- Review legislation
- Joint action of different managers/ operators/ administration levels
- Review embankment designs materials
- Need of specific funding: not only under routine maintenance
- .....

# Another main project pillar



**-----Raising awareness -----Knowledge Sharing-----International cooperation-----**



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# Thank you!

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