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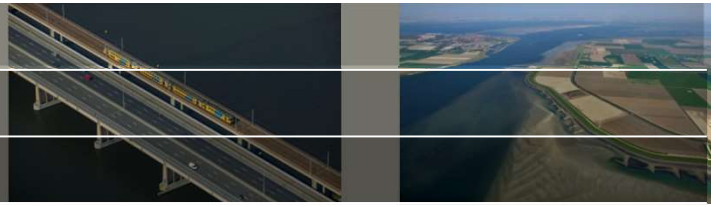
Enabling Delta Life

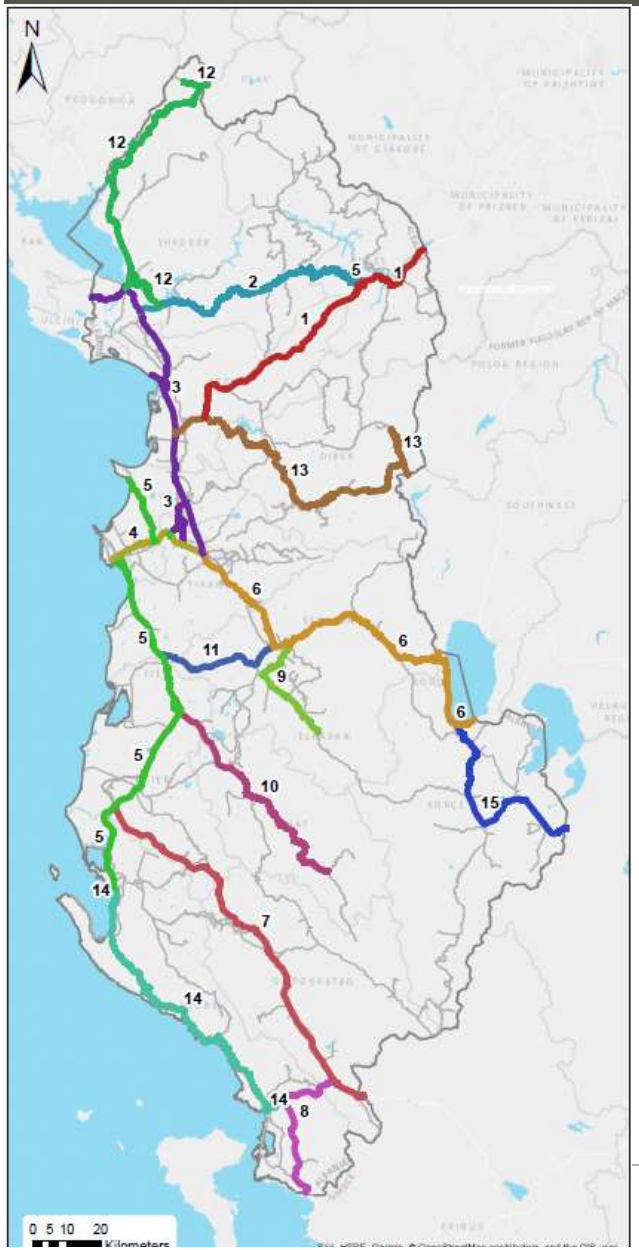
SEEDConsulting
Smart Environment
Engineering Design

Climate resilient road assets in Albania

30 november 2021

Goal & scope of project





Inform the prioritisation of future climate and seismic resilient investments in road assets (in Albania)

Hazards

- Earthquakes
- Landslides
- Floods
  - Coastal
  - Fluvial

Road network

- Primary roads + few extra parts (~1500km)
- Divided in corridors

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Approach – Risk analysis and action planning

Risk analysis per hazard

- Hazard mapping
- Risk analysis → Annual Expected Damages (AED)
  - Repair costs: Repairs to road assets
  - Economic losses: additional travel time and/or travel distance due to corridor disruption

Action planning per hazard

- Prioritization of locations
  - AED
  - Criticality
- Portfolio & selection of measures
  - Cost benefit analysis (B/C ratio)
    - Cost = Cost of measures
    - Benefit = Reduction of AED

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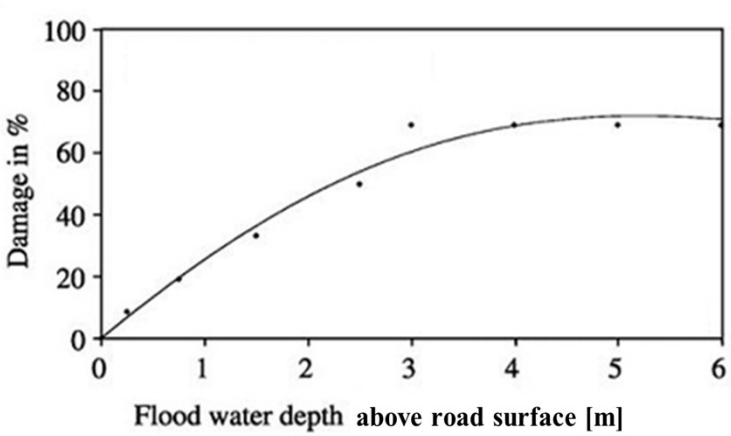
Approach – Repair costs (Operator costs)



Hazard maps

Damage functions

Value of assets

Damage to road
(repair costs → Road Authority)

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Risk analysis – approach per hazard

- Seismic → detailed seismic hazard mapping + damage functions for Greek bridges
- Landslide → European model (ELSUS)+ limited landslide database
- Coastal flooding → DEM + storm surge + sealevel rise
- Pluvial flooding → catchment run-off vs culvert capacity

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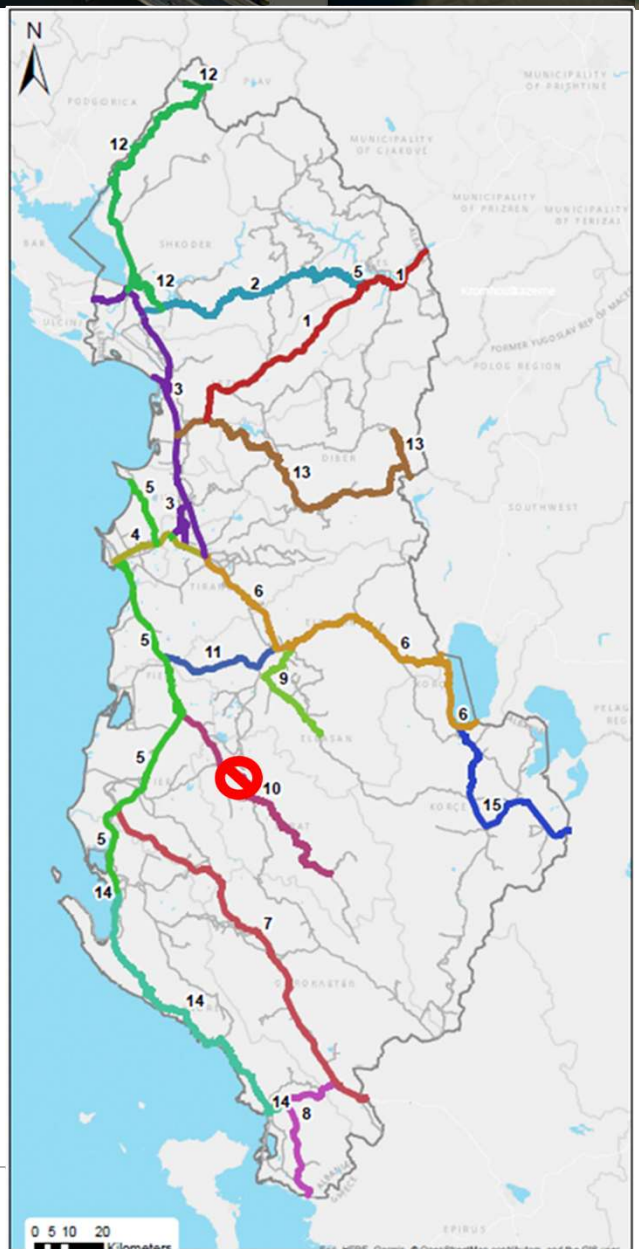
Approach – Losses for road users

Network is divided into corridors. Per corridor:

Origin

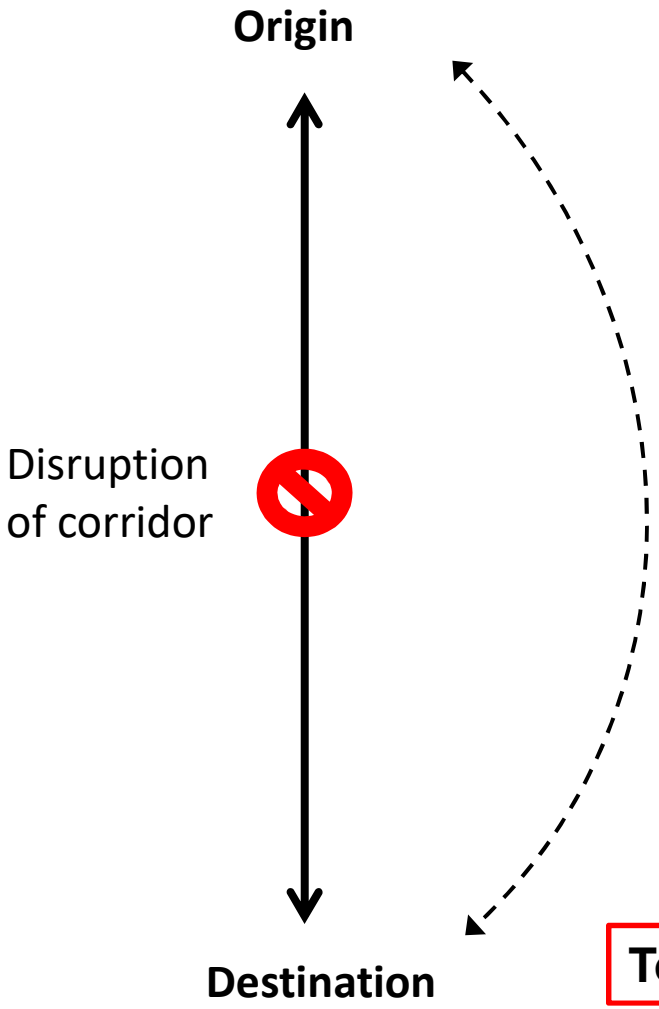
Disruption of corridor

Destination



Approach – Losses for road users

Network is divided into corridors. Per corridor:



Alternative route to reach destination

Cost of increased travel time

+

Cost of increased travel distance

X

Traffic density

X

Down time

Losses for user

Total costs = repair costs + economic losses

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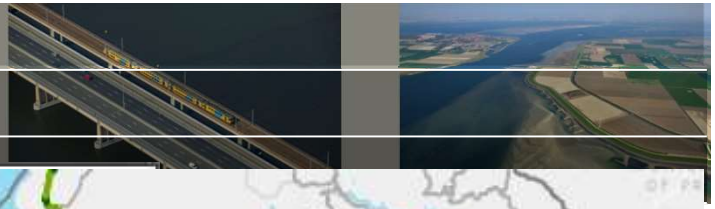
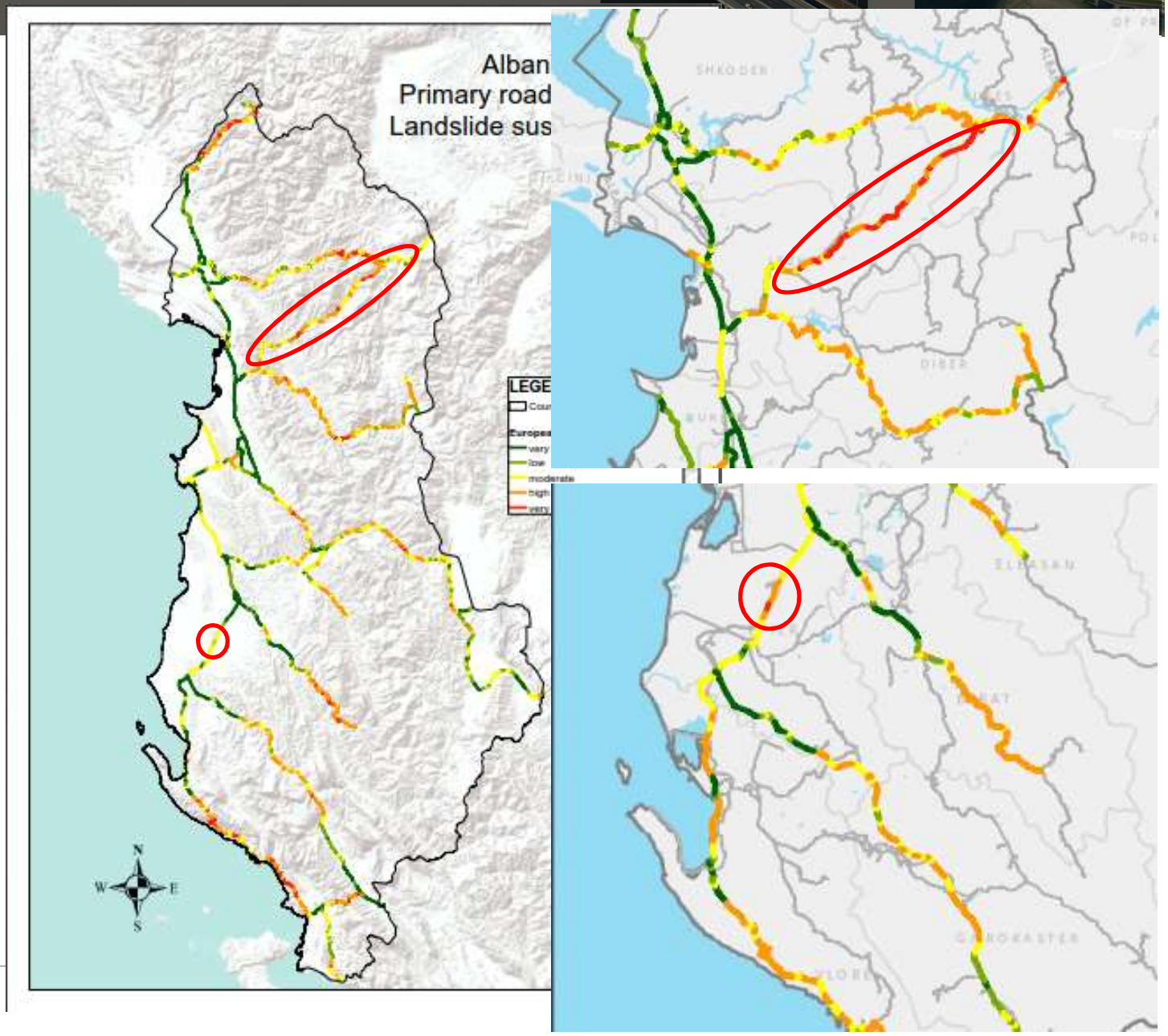
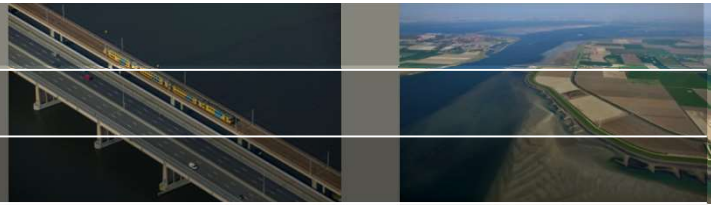
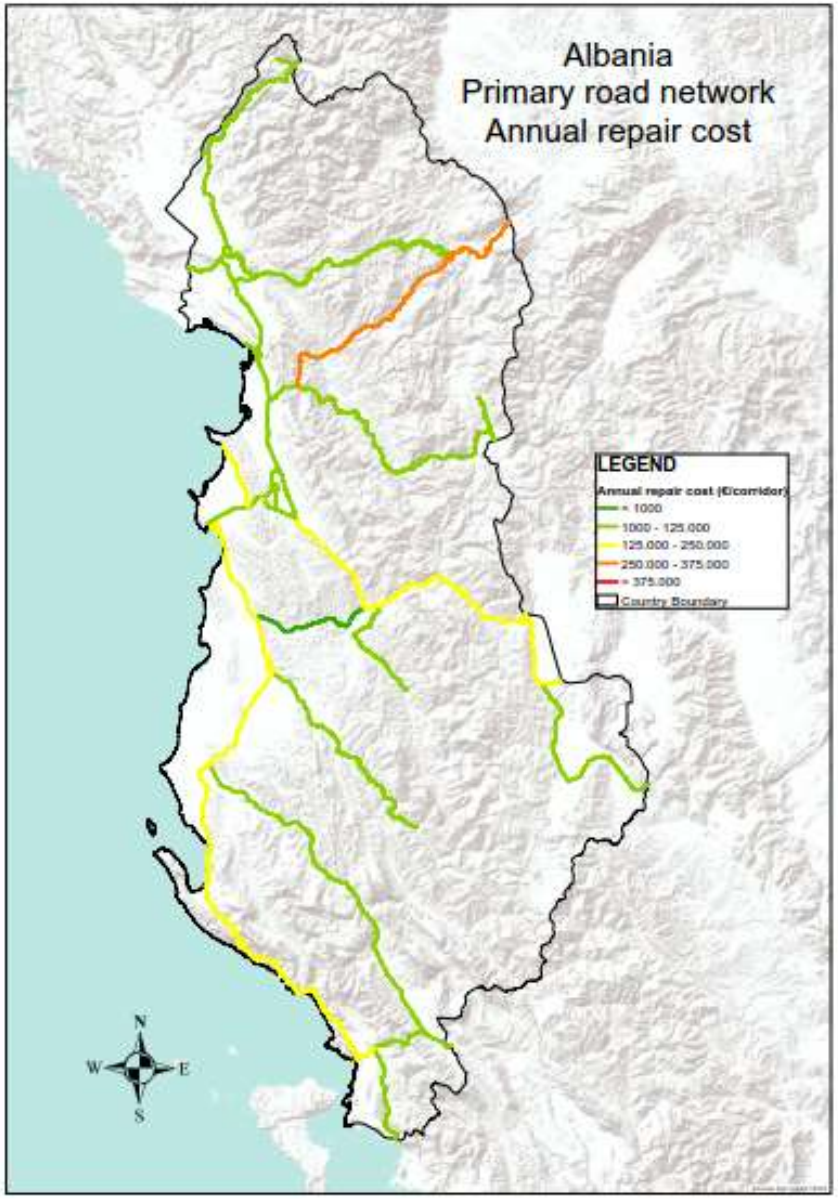
Exposure map





Annual damages to road





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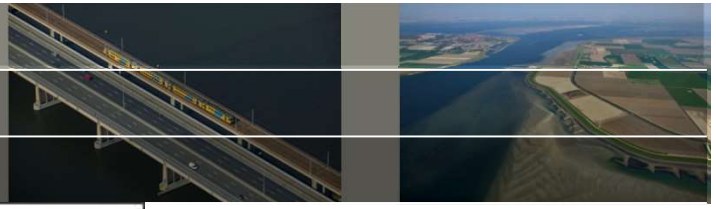
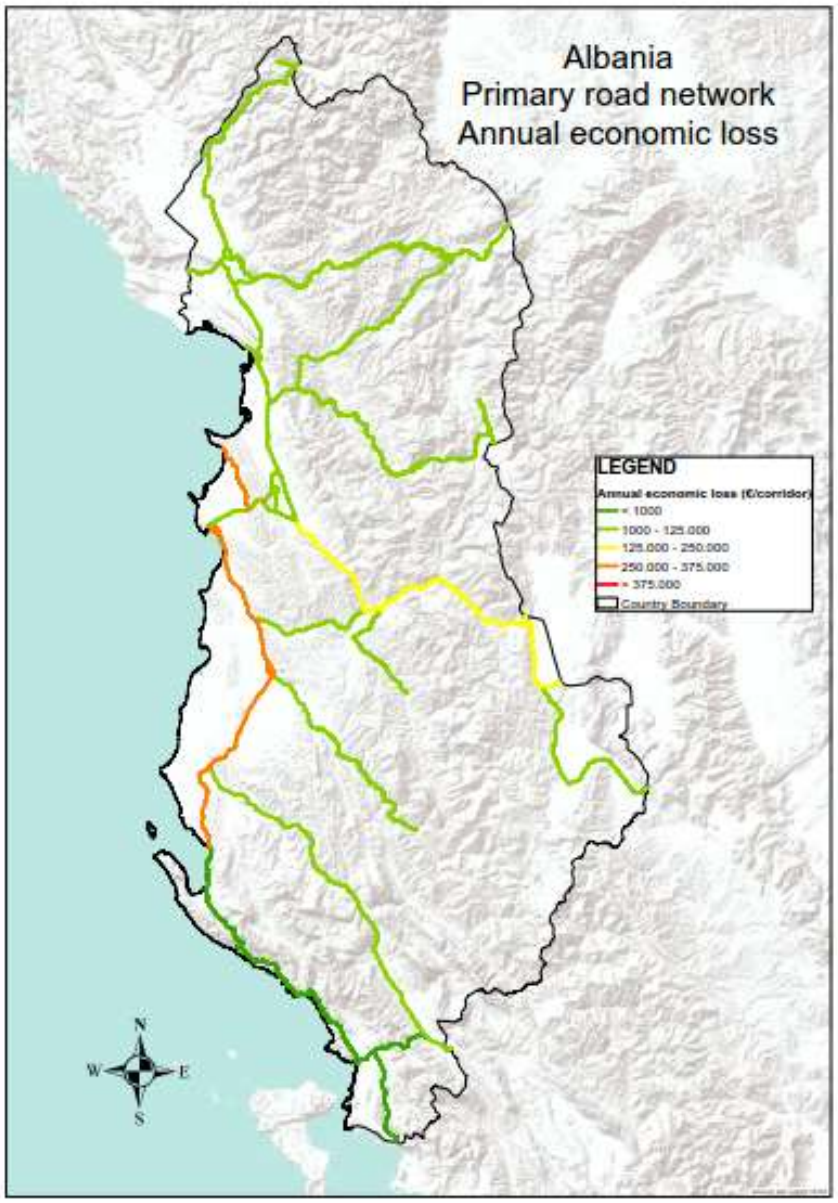
Annual Losses for road user





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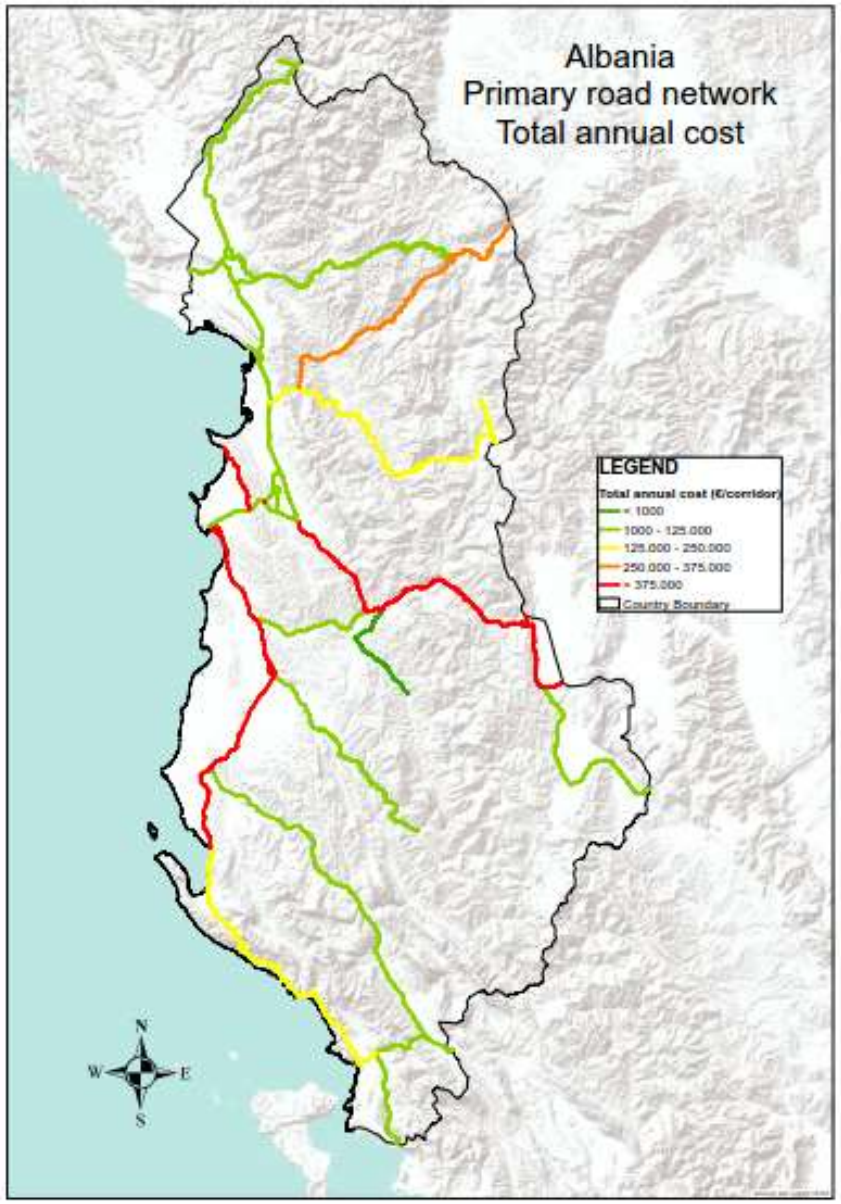
Total costs = damages + losses to user



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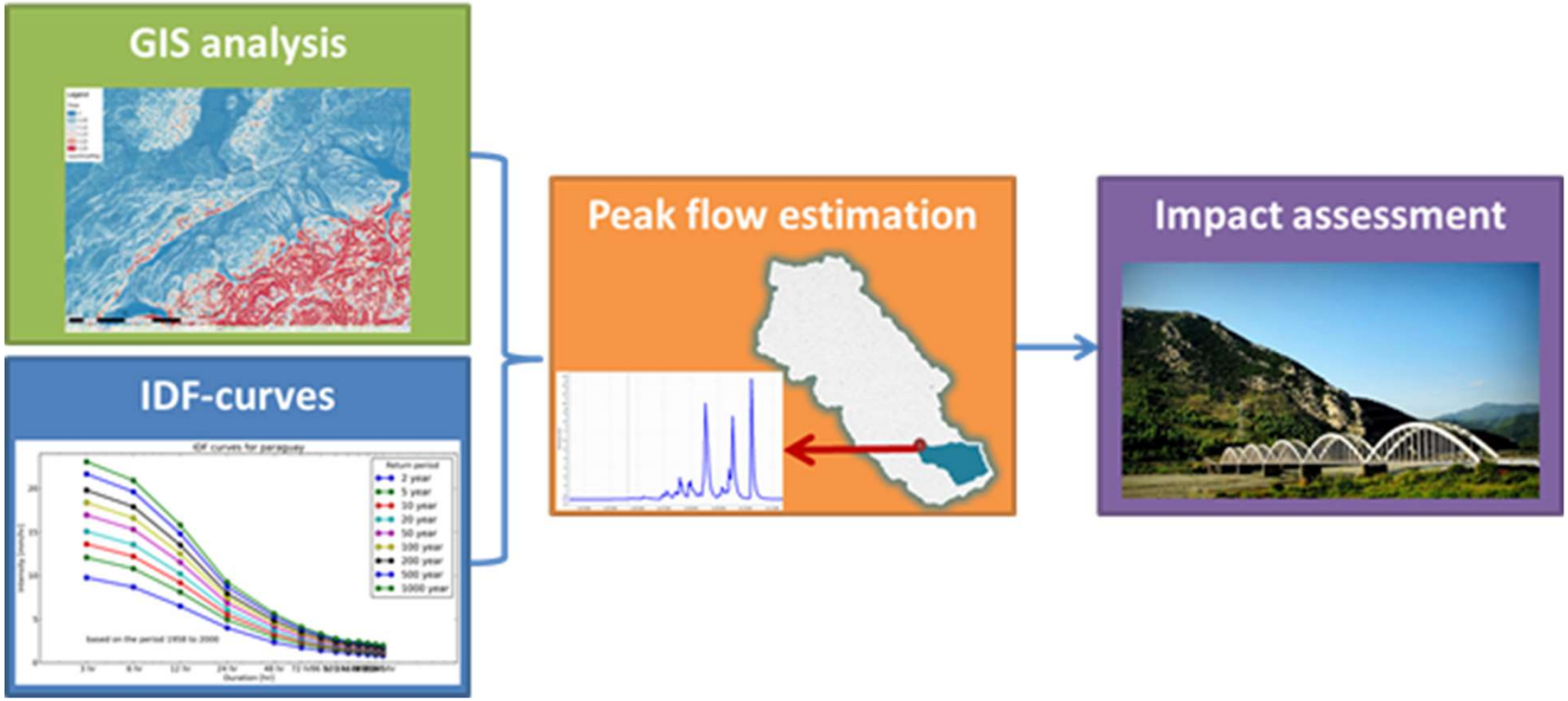
Steps for fluvial flooding assessment



- DEM quite coarse
- Bridges & culverts not precisely located → close to confluence of rivers: which river do they cross?
- IDF curves based on global data → need to downscale to regional scale
  - Calculated peak flows need to be validated

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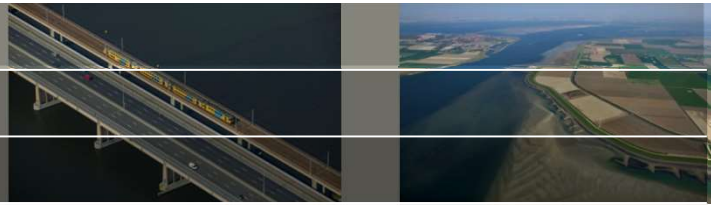
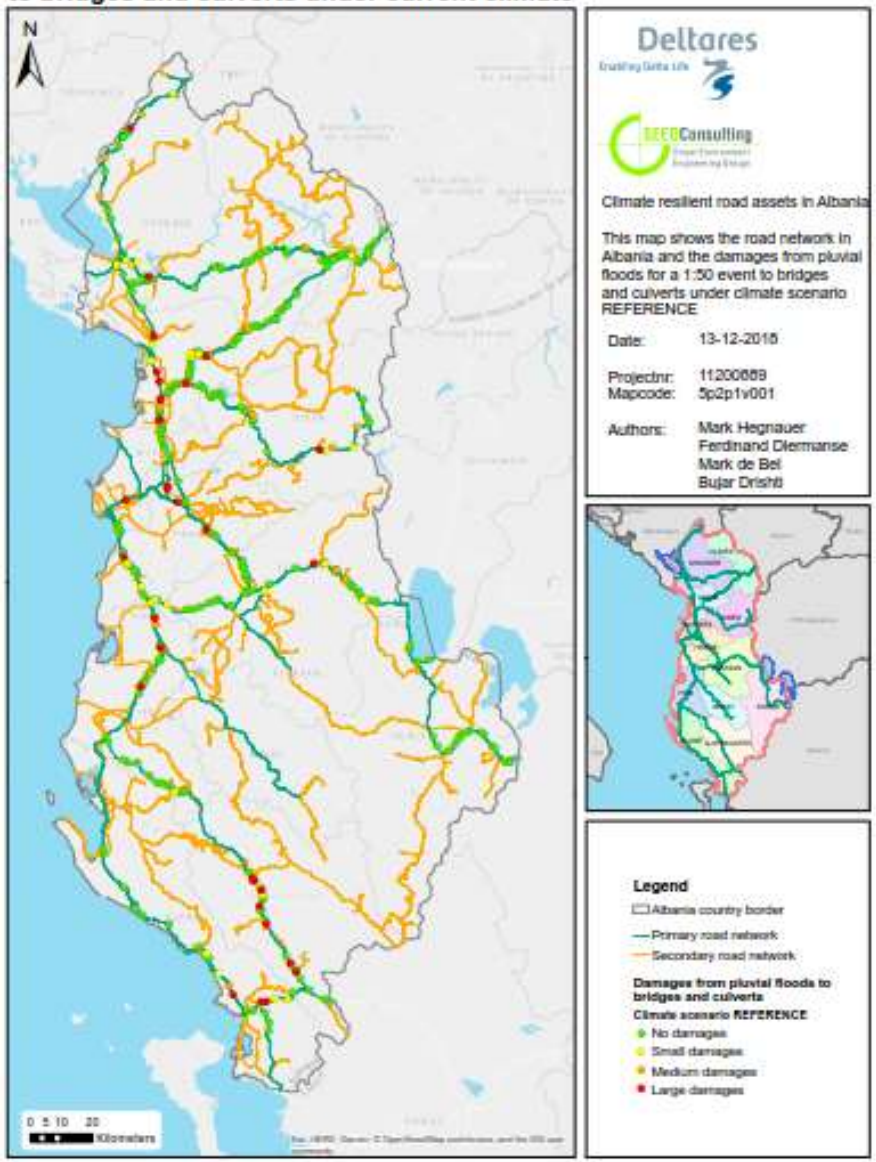
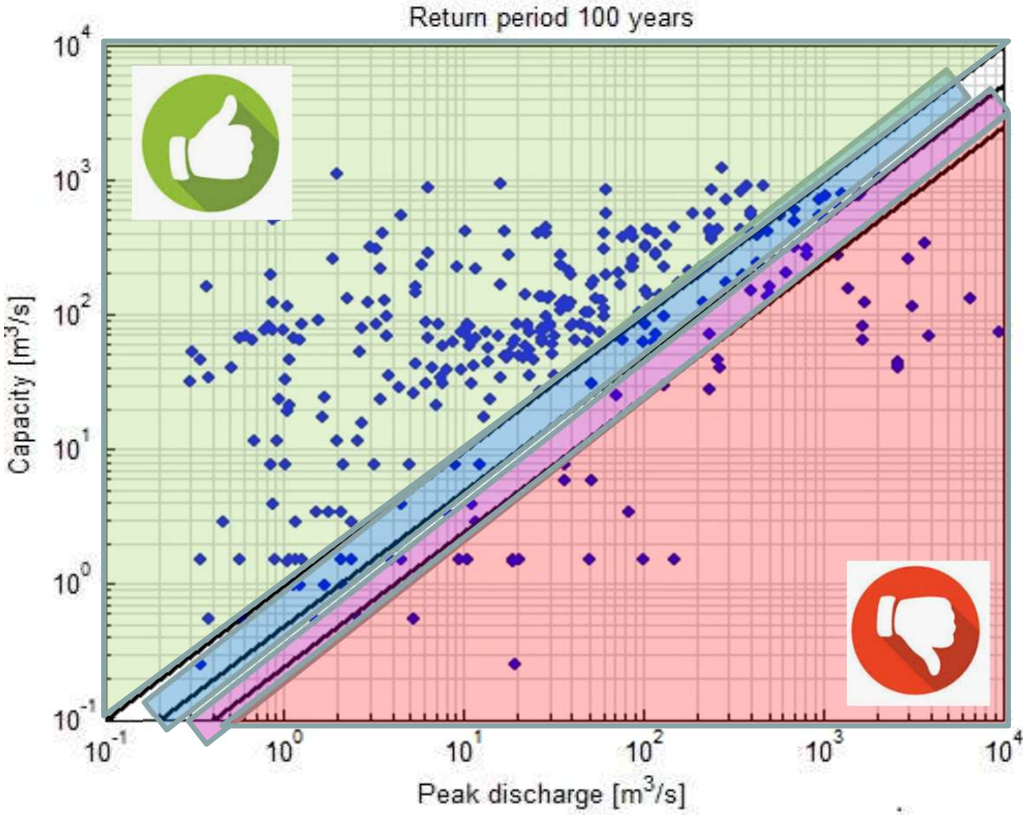
Pluvial flooding – hazard



5.2.1 Damages from pluvial floods to bridges and culverts under current climate





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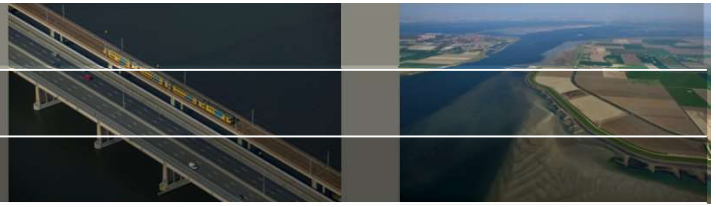
Results of Risk Analyses



- **Seismic events** do not pose a significant risk (based on EAD/ losses approach) to the primary road network due to large Return Periods
  - → no action planning
- **Landslides** lead to limited number of corridors with significant risk
  - Current data does not allow for correlation with climate change
- **Coastal flooding** does not pose a significant risk to the primary road network
  - Climate change does not increase the risk significantly
  - → no action planning
- **Pluvial flooding** leads to significant repair costs and damages
  - Climate change does not increase the risk significantly

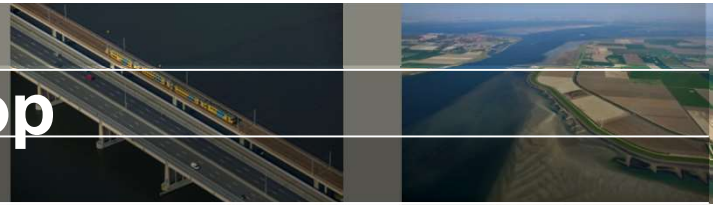
Criticality

Criticality determined during workshop with local stakeholders.

Take into account, importance for :

- International connections
- Industry
- Harbour
- Tourism
- Evacuation

Criticality – Result of workshop

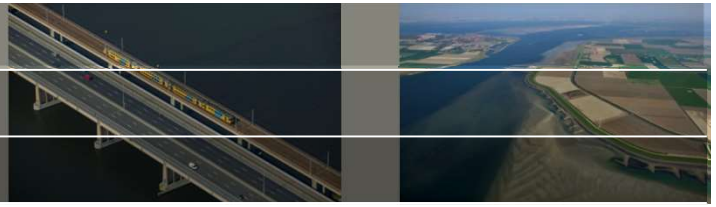


	Weight	Corridor														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
International	3.61	12.7	5.0	12.2	13.6	12.4	11.5	11.5	11.4	6.6	6.2	10.6	13.3	7.6	10.7	13.4
Industry	2.19	5.3	3.7	5.5	8.0	7.0	6.9	4.7	4.1	4.1	3.6	6.2	5.5	5.2	5.0	5.4
Harbour	3.10	8.2	4.0	6.7	11.8	10.4	7.4	5.7	7.4	4.2	3.8	7.3	6.6	5.1	10.0	5.2
Tourism	3.04	10.1	6.9	6.6	11.9	12.8	8.9	7.6	9.8	6.0	3.6	4.8	7.4	6.7	8.3	13.0
Agriculture	2.52	5.3	4.7	5.7	8.2	9.1	7.5	7.0	5.9	5.2	6.5	7.9	7.1	5.5	5.3	7.7
Evacuation*	3.33	12.5	10.0	8.0	10.5	14.0	16.0	14.0	13.1	12.5	11.1	11.1	12.2	11.0	11.3	14.1
Summation		41.6	24.2	36.7	53.4	51.7	42.2	36.5	38.5	26.1	23.6	36.7	40.0	30.1	39.2	44.8

Conclusions

- Corridors 4 and 5 are most critical → highest priority
- Corridors 2, 9 and 10 are least critical → lowest priority

Conclusions action plan



Corridor	Length (km)	Costs (k€/km)	Criticality
01 Milot - Morine New	104	3,3	42
02 Shkoder - Puke - Kolsh	126	1,0	24
03 Milot - Shkoder - Muriqan	127	12,8	37
04 Tirana - Durres	32	59,1	53
05 Durres - Vlore	152	69,0	52
06 Tirana - Elbasan - Pogradec	139	24,9	42
07 Fier - Gjirokaster - Kakavi	128	10,6	37
08 Gjirokaster - Sarande - Ksamil	58	1,4	39
09 Elbasan - Gramsh	41	0,7	26
10 Lushnje - Berat - Çorovode	86	4,1	24
11 Rrogozhine - Elbasan	40	0,9	37
12 Shkoder - Hani i Hotit - Vermos	125	2,3	40
13 Milot - Peshkopi	136	5,3	30
14 Vlore - Sarande	131	2,4	39
15 Pogradec - Korce - Kapshtice	69	1,0	45

= very high
= high
= low
= very low

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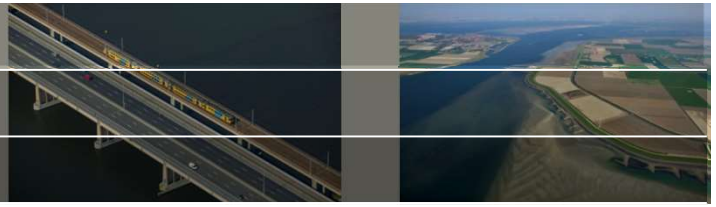
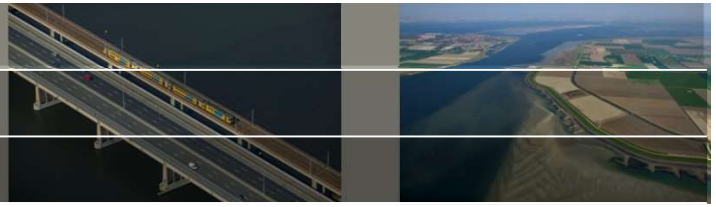
Lessons learned 1



- Desktop studies based on global/ regional input data with coarse traffic data (corridor level) can produce useful and objective (strategic) results at a network level
  - Results are a first scan at network level
  - View input and results in this context
  - Strategic assessment, not possible to downscale

Lessons learned 2



- Field validation is required for next steps (execution of action plan)
  - Are identified locations indeed vulnerable?
  - Does cost estimate of measure fit with location?
  - Update CBA if needed
- Difficult to find reliable input
  - Damage functions
  - Historical data (for validation)
  - Repair costs, downtimes, cost of measures per corridor
  - difference between ‘official input’ and ‘realistic input’

    → data collection, open availability

    → project schedule

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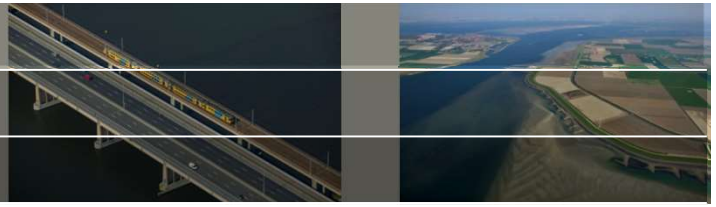
Lessons learned 3



- Local input very important
  - Local partners are vital (network, experience and 1st validation)
  - Interaction with local stakeholders (e.g. workshops)
    - *Q: How to get the right people to attend?*

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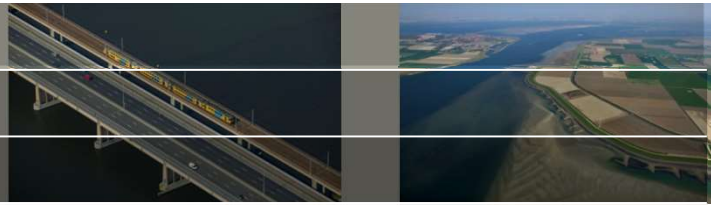
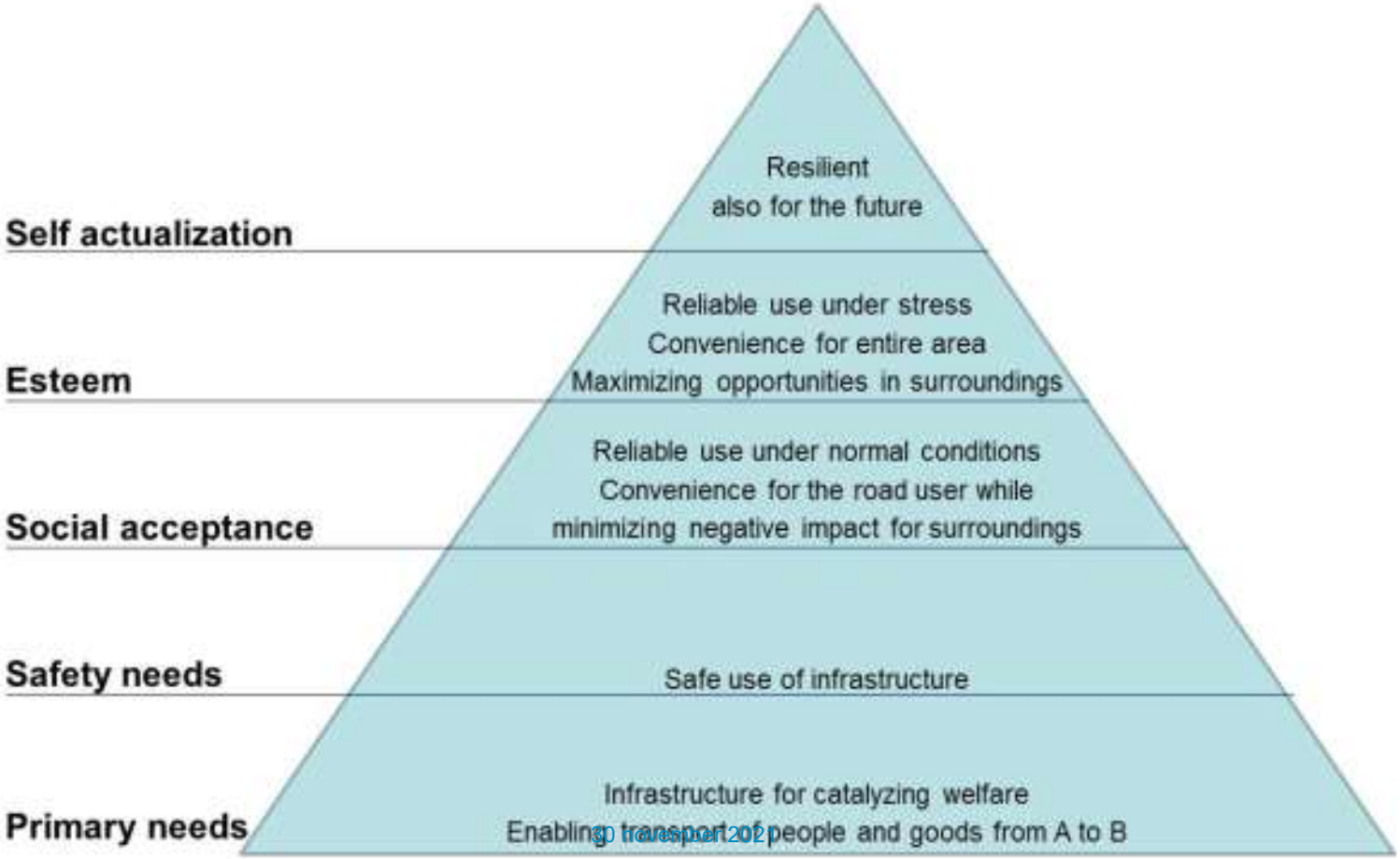
Lessons learned 4



- Implementation of results requires ‘local fit’
  - maturity level of local organization
  - create bottom up/ local support (e.g. via Emergency Management)
  - champions: requires capacity building



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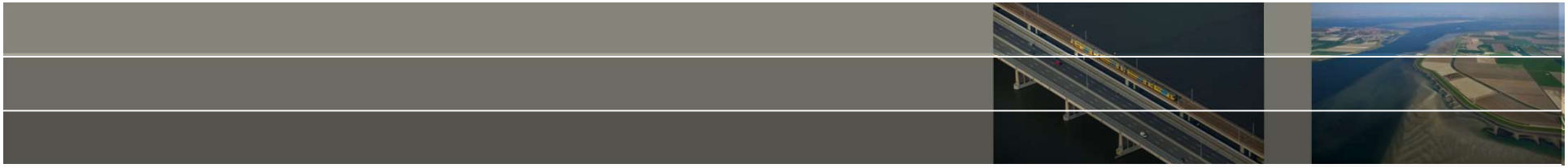

Thank you!

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