

Steps to action perspective

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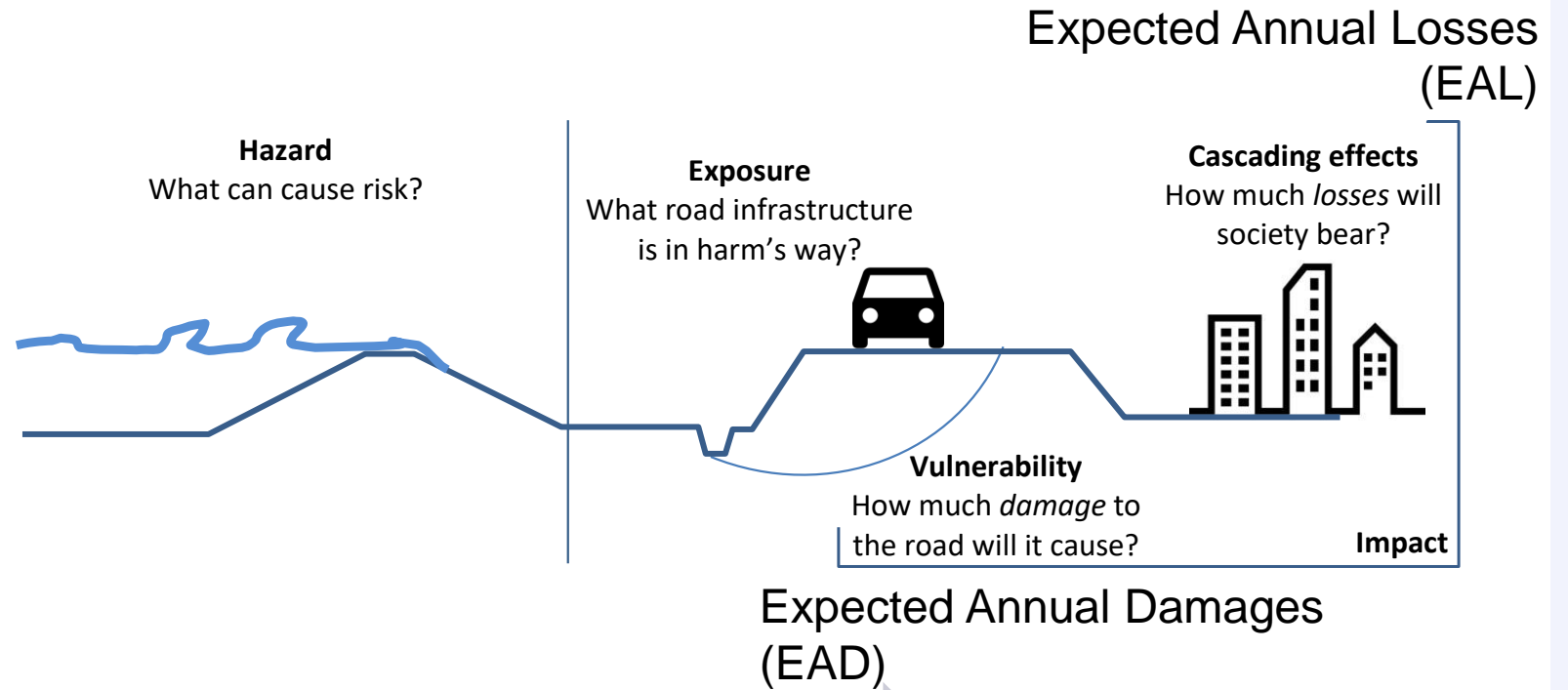
November 2021



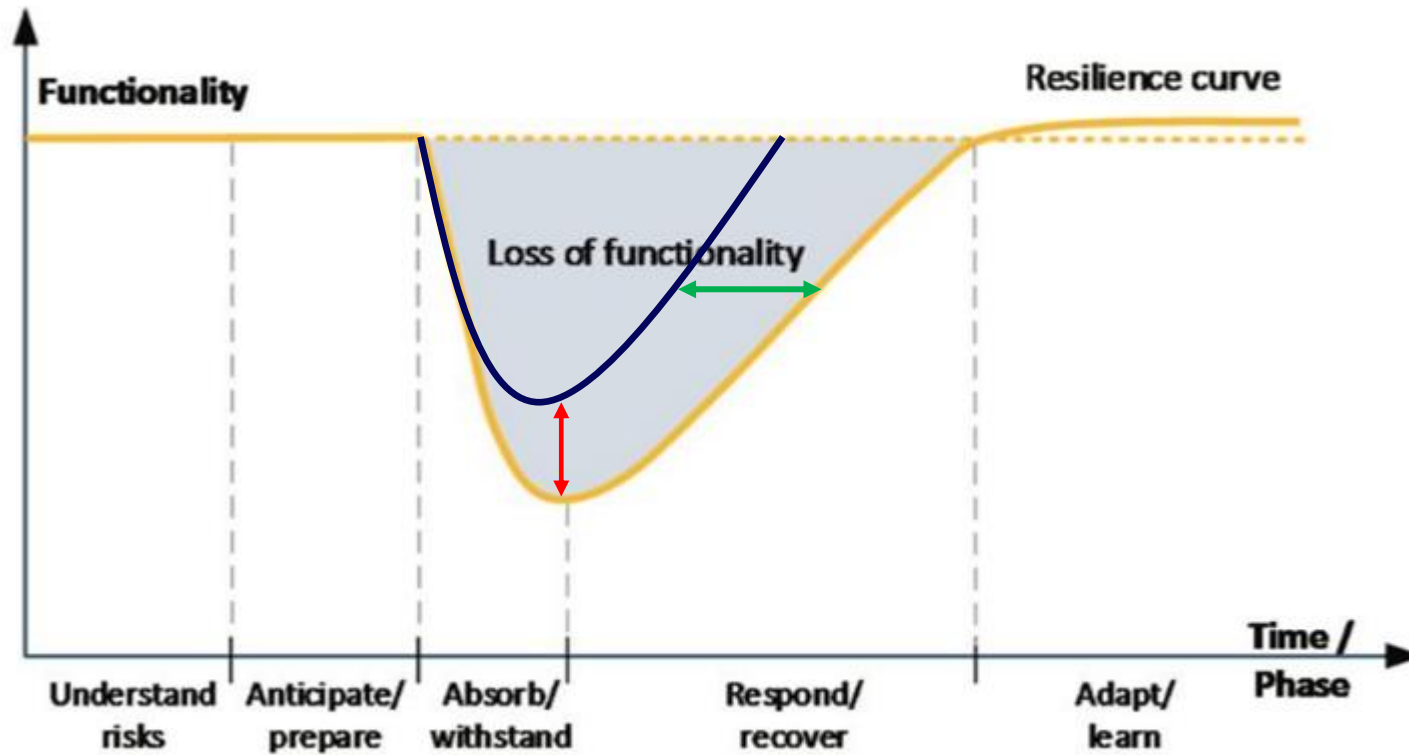
Overview

- Required input – what happened previously
- Why to take measures – what do we want to achieve?
- Prioritizing locations – where to start?
- Identification of measures – which solutions theoretically fit?
- Selecting suitable measures – which measures work for the given situation?
- Planning implementation - taking action in practice
- Questions

What happened previously...



Why to take measures



Build resilience by taking measures that lead to

- Less damages
- Quicker recovery

Prioritizing locations

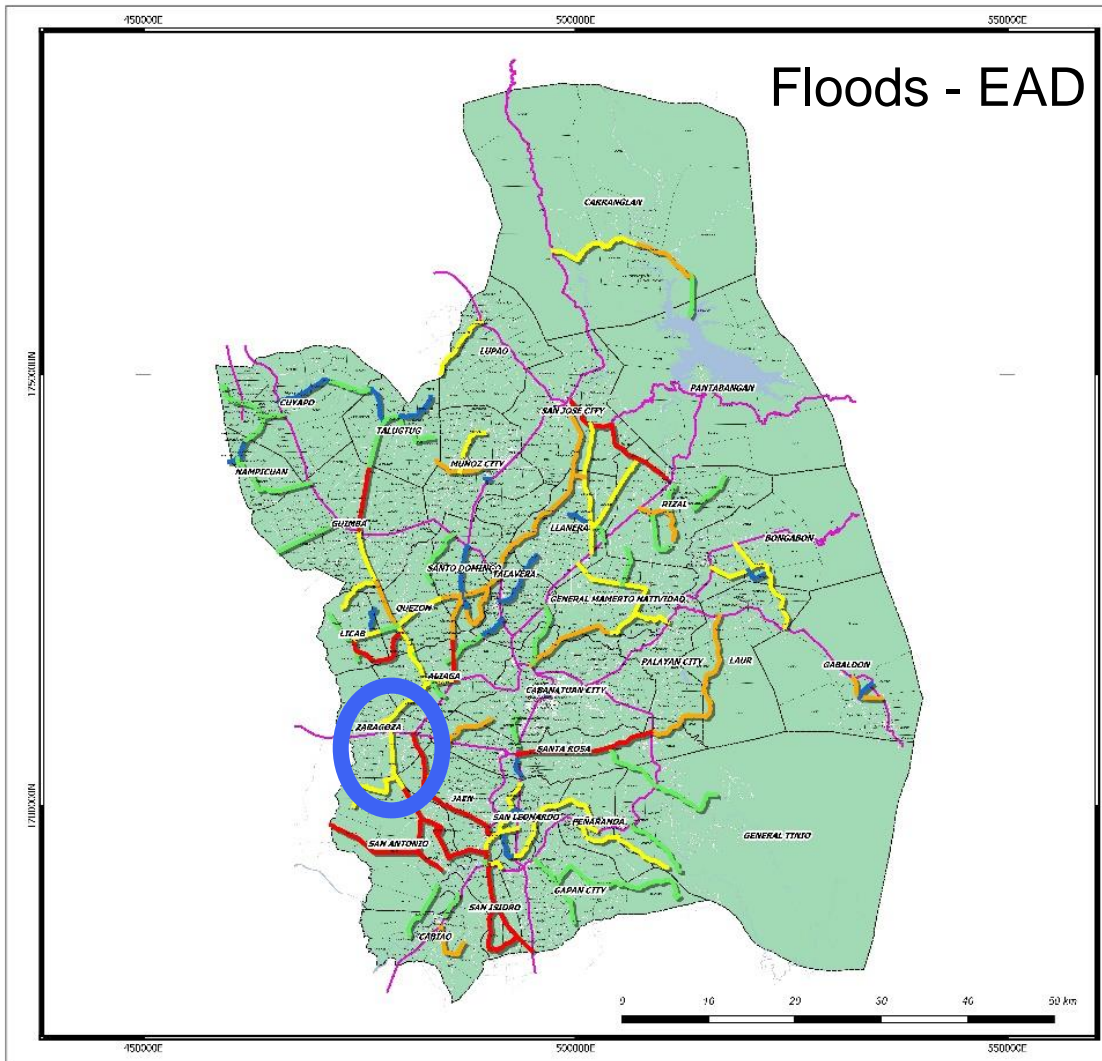
- Where is the situation unacceptable?
- Where does action need to be taken first?
 - Highest damages
 - Highest societal/ user impact
 - A combination of the two...

But also maybe also other factors:

- Which sectors does a failure impact
- Which parts of society (population)

Asset/ infrastructure owner

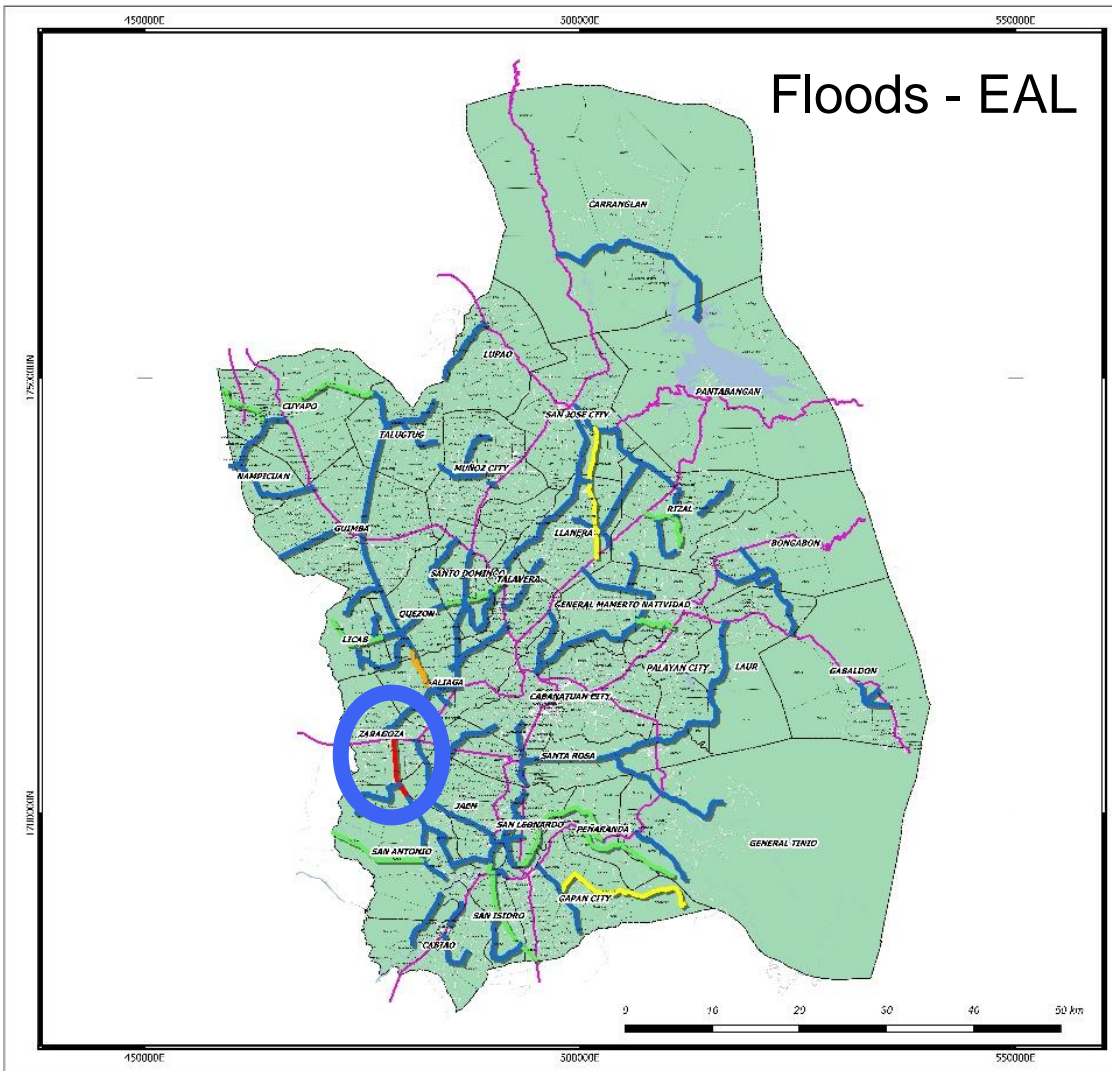
		Damage Category					
		C1	C2	C3	C4	C5	
Society	Losses Category	C1	1	1	2	2	3
	C2	2	2	3	3	4	
	C3	3	3	3	4	4	
	C4	3	4	4	5	5	
	C5	4	4	5	5	5	



Damages - EAD



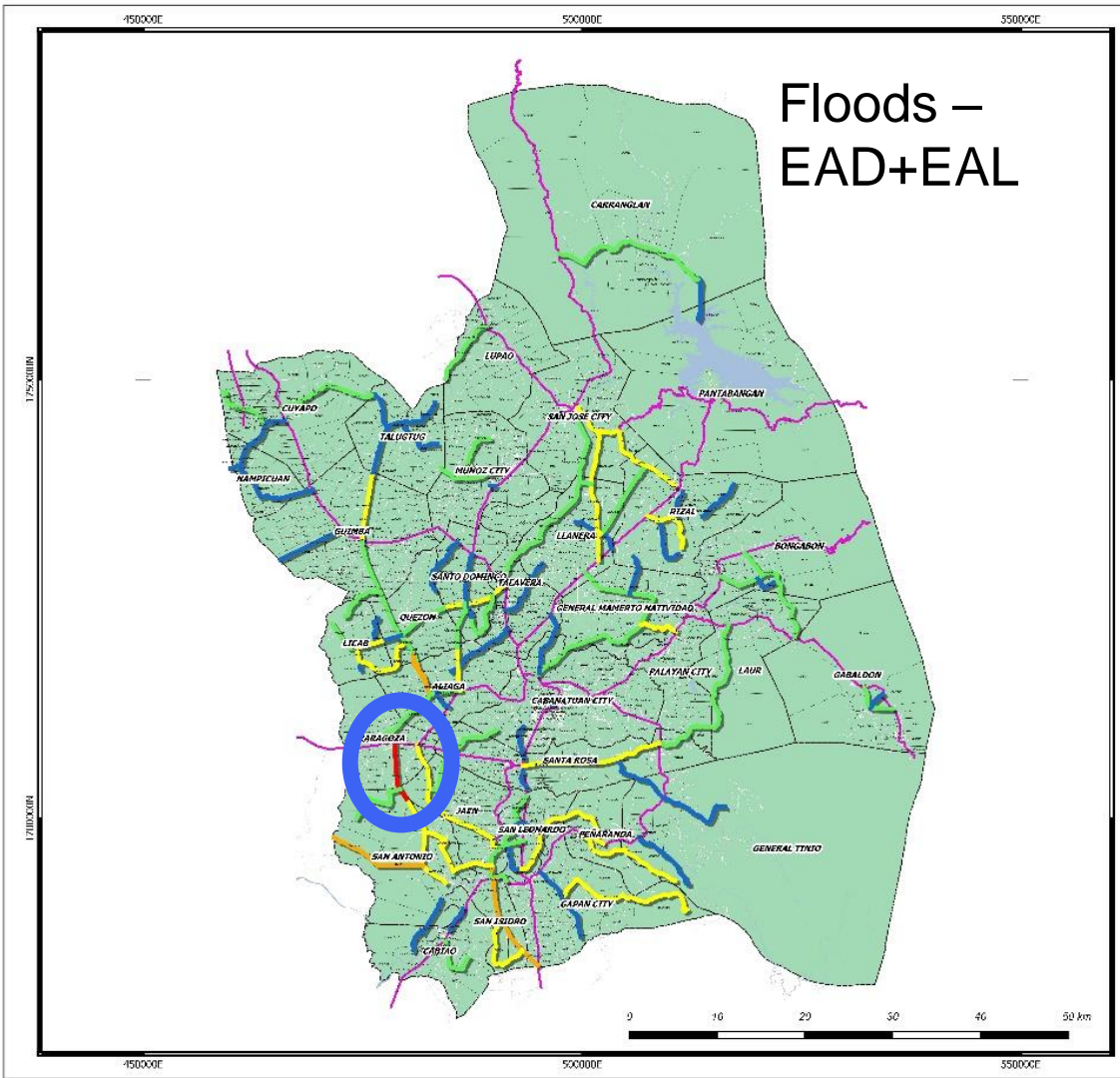
		Damage Category				
		C1	C2	C3	C4	C5
Losses Category	C1	1	1	2	2	3
	C2	2	2	3	3	4
	C3	3	3	3	4	4
	C4	3	4	4	5	5
	C5	4	4	5	5	5



Societal losses - EAL

		Damage Category				
		C1	C2	C3	C4	C5
Losses Category	C1	1	1	2	2	3
	C2	2	2	3	3	4
	C3	3	3	3	4	4
	C4	3	4	4	5	5
	C5	4	4	5	5	5





Combination



		Damage Category				
		C1	C2	C3	C4	C5
Losses Category	C1	1	1	2	2	3
	C2	2	2	3	3	4
	C3	3	3	3	4	4
	C4	3	4	4	5	5
	C5	4	4	5	5	5

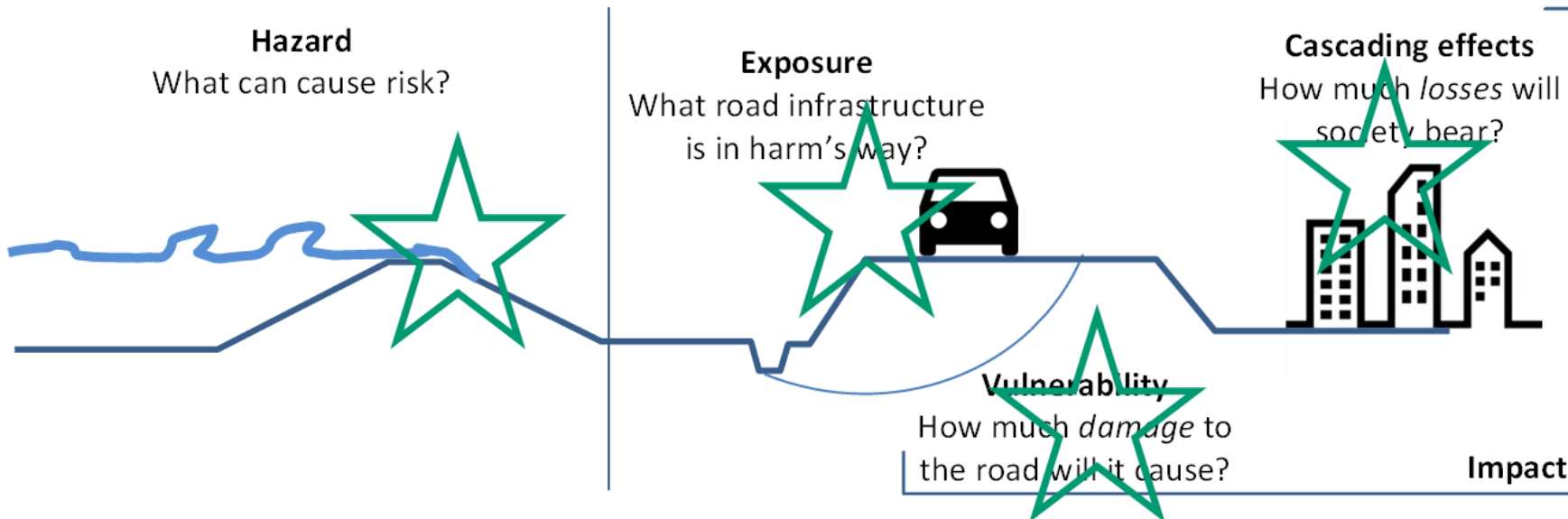


→ Priority = very high!

Note that how this matrix is filled can be adapted to user perspective.

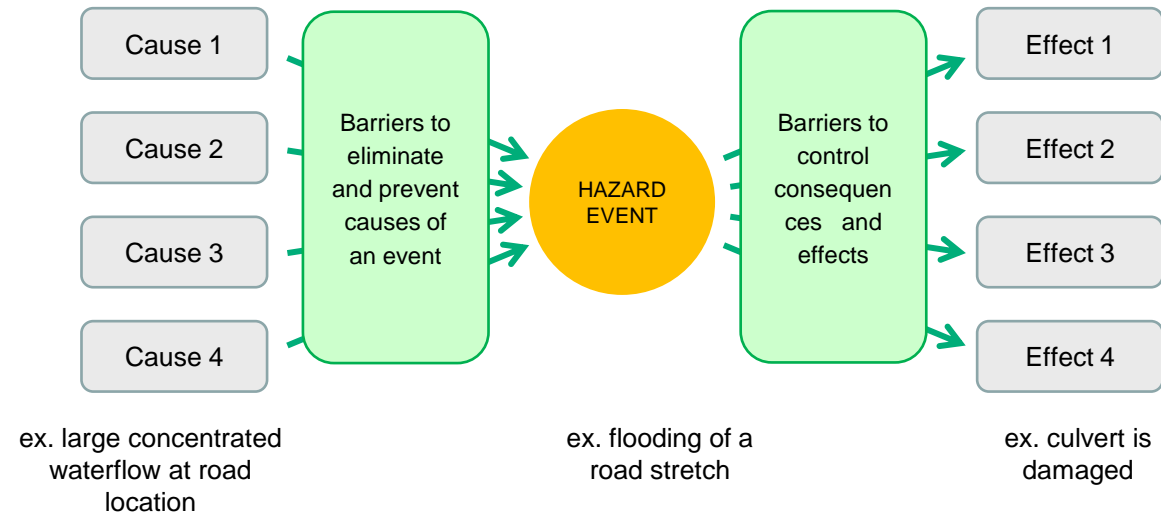
Identification of measures

- Example: we know our road is prone to flooding
 - Peak of rain water run off is too high → retain water in catchment area
 - Road is inundated → change road location (higher ground)
 - Culvert capacity is insufficient → increase culvert size
 - Road embankment is eroded → increase robustness of protection
- All can be labeled 'flooding' but measures are totally different!
- To take relevant measures, you have to understand the problem e.g. "flooding"



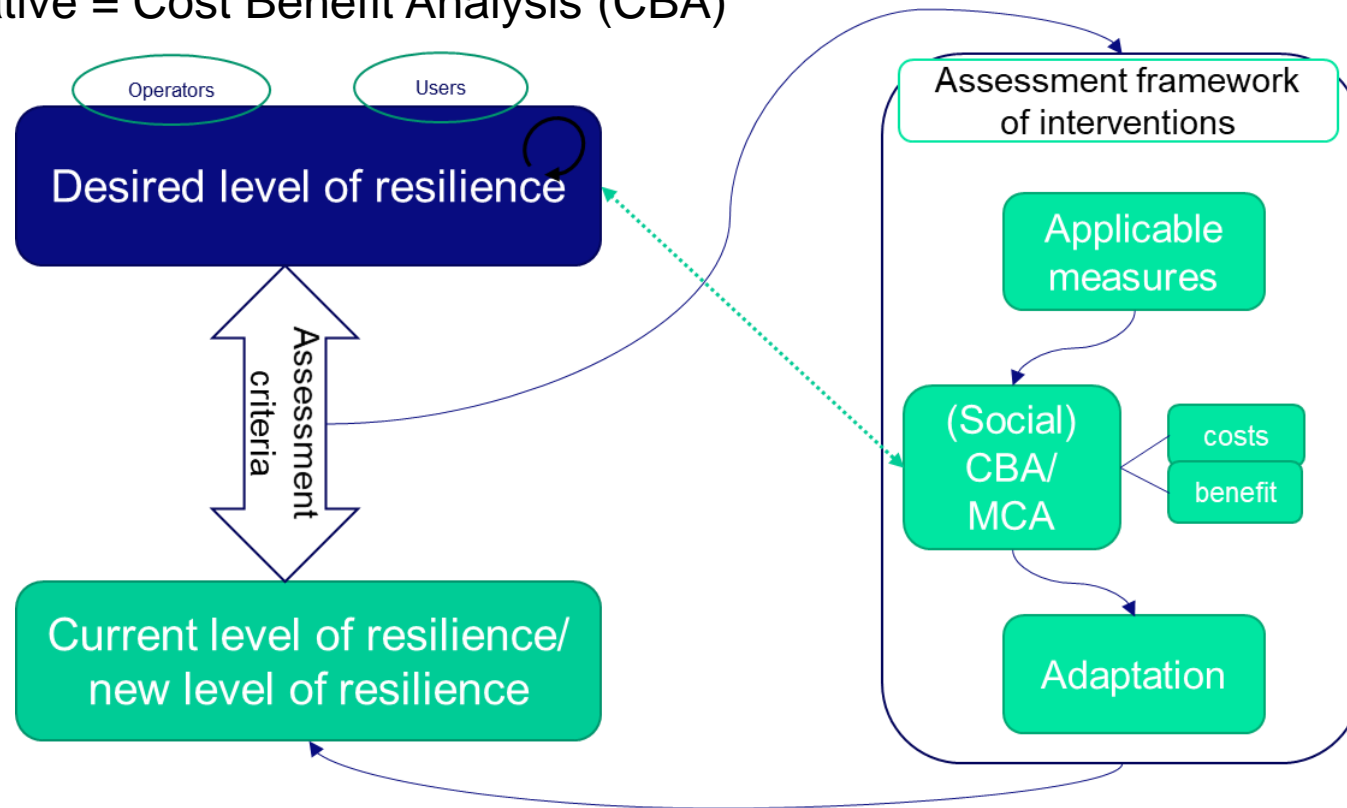
Identification of measures

- To take relevant measures, you have to understand the problem e.g. “flooding”
 - Bow ties may help understand how road is affected and which measures could help
- Keep Disaster Management Cycle in mind for various types of measures



Selecting suitable measures

- A measure costs money to implement and maintain (= costs)
- A measure reduces the impact (damages, losses, societal) (=benefits)
- Compare costs and benefits
 - Semi Quantitative using criteria & classes = Multi Criteria Analysis (MCA)
 - Quantitative = Cost Benefit Analysis (CBA)



Example of an MCA

- Make scoring location specific
- Rank measures based on performance

		Culverts	bridges	no asset	Criteria for evaluating measures (1- 5)						Ranking
					effectiveness to increase safety	effectiveness to increase availability	Costs	benefits	physical robustness	flexibility	
					40%	23%	15%	8%	8%	5%	
Relative weighting of criteria											
Flooding/ prevention:											
FP1	manage hydraulic properties (dams, retention ponds, vegetation) of catchment area	x	x	x	5	5	3	3	5	4	4,4
FP2	enhance/ build clear in-land drainage paths (i.e. prevent slow flow, meandering waterways)	x	x	x	5	5	3	3	4	3	4,3
FP3	monitoring of drainage system and subsequent removal of floating snow/ ice (links to FP2)	x	x		5	5	3	1	1	5	4,0
FP5	install dam to direct waterflow to culvert (links to FP2)	x	x	x	2	2	2	2	3	2	2,1
FP6	resize drainage systems (culverts)	x		x	5	5	4	1	4	2	4,3
FP7	resize drainage systems (bridges)		x	x							
FP8	apply slope stability/ erosion protection	x	x		4	4	3	1	5	5	3,7
FP9	remove (potential) obstructions	x			2	2	2	2	1	5	2,1
FP10	Plan and execute maintenance before the flood season (spring) – removing debris	x	x		2	2	3	2	1	5	2,2
FP11	Elevate the road	x	x	x	4	4	1	2	4	1	3,2
FP12	build retaining pond next to road itself (within the jurisdiction of the road operator)	x			4	4	2	2	5	4	3,6

Measure implementation

- Select measures that...
 - Perform best (MCA, CBA)
 - Fit within local practice e.g. type of measure, amount of maintenance, etc
 - Fall within authority of your organisation e.g. regional flood defences often do not fall within scope of road authority
- Plan measures in time (not all measures have to be taken NOW)
 - Try to implement measures naturally with regular work flow e.g.
- Maintenance
 - Yearly
 - Probably no regret to strengthen maintenance
- Reconstruction
 - 20 – 40 years
 - Adaptation during reconstruction more cost effective
- Construction
 - Location to have climate resilient regulation and design standards

Conclusions

- Required input – risk analysis results
- Why to take measures- decrease amount of damage or duration of down time (or societal impact)
- Prioritizing locations – locations with highest risk (also societal aspects?)
- Identification of measures – understand situation (bow ties)
look at disaster risk cycle for full spectrum of measures
- Selecting suitable measures – does the effect outweigh the costs? MCA or Societal CBA
does the measure fit with local situation
- Planning implementation - not all measures need to be taken NOW; plan for future
take measures in regular workflow as much as possible

Questions?