

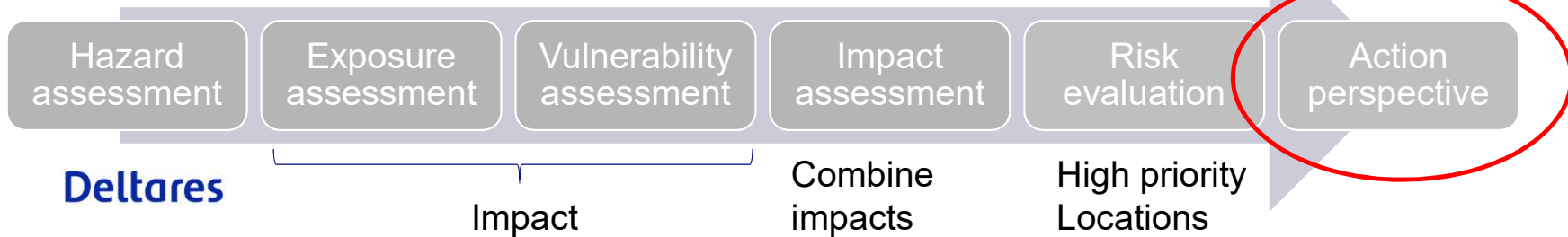
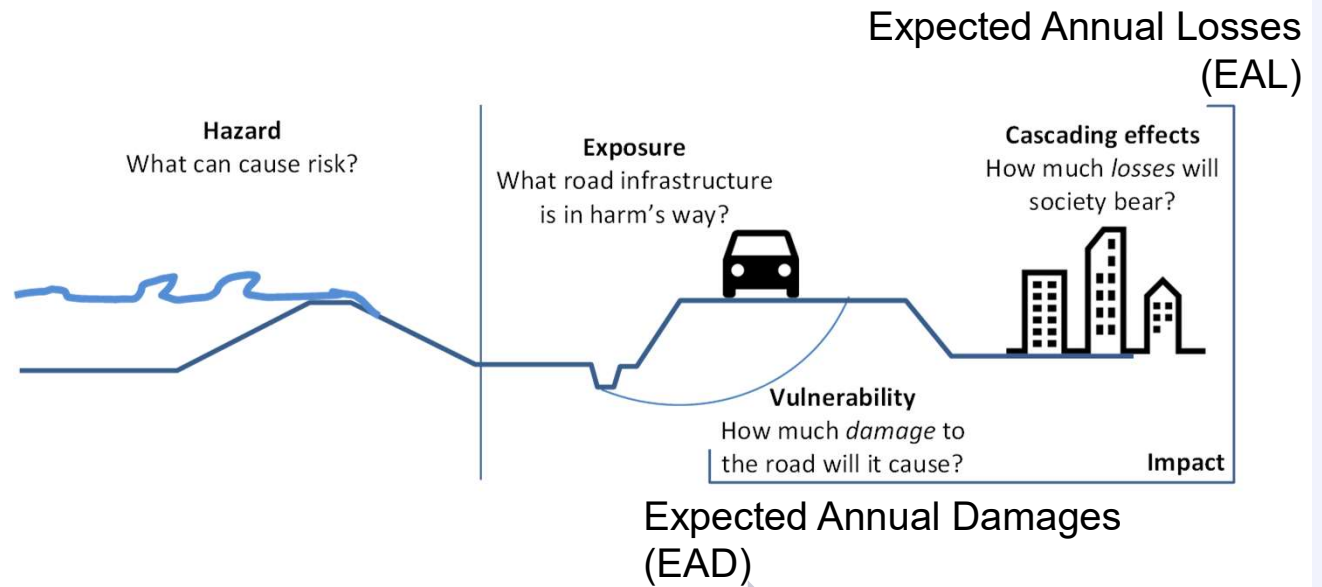
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**Thinking about strategies:
how to establish a proper
action planning for disaster
risk reduction and climate
change adaptation**

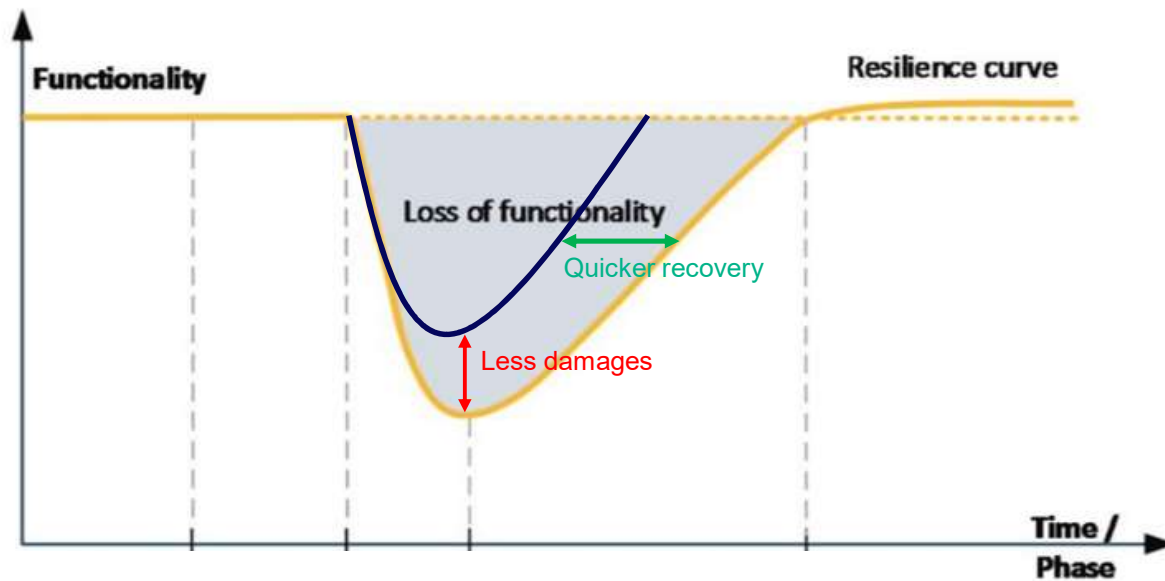
January 2021



What happened previously...



Why do we want to take measures?



Build resilience by taking measures that lead to

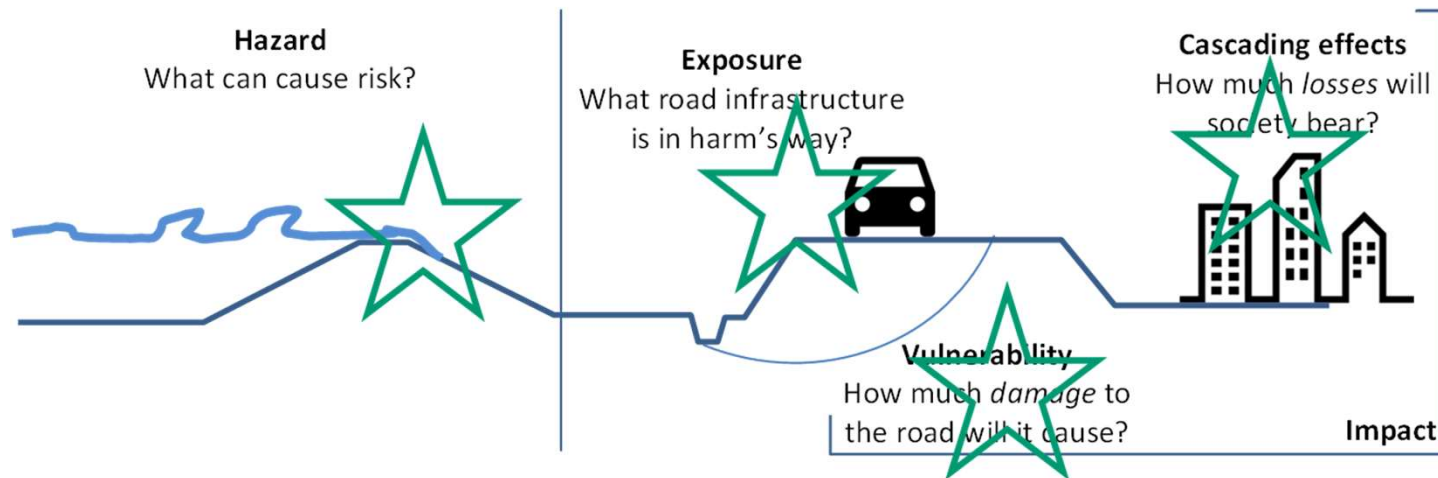
- **Less damages**
- **Quicker recovery**

Action planning steps

- Identify relevant measures
- Select measures – evaluate te performance of measures
- Combine measures in adaptation strategy options
- Choose strategy

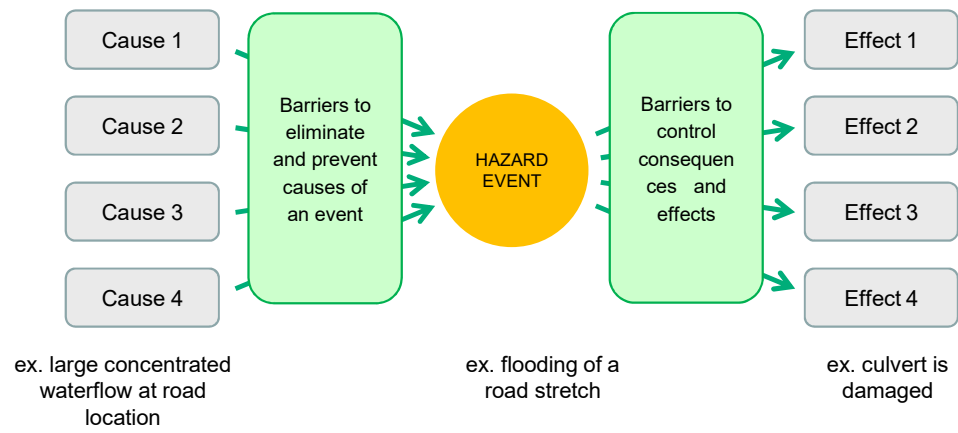
Identification of measures

- Example: we know our road is prone to flooding; which measures can we take?
 - 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
 - To take relevant measures, you have to understand the problem e.g. “flooding”
- All can be labeled ‘flooding’ but measures are totally different!



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



Which measures do we (maybe) want to take?

- Select measures that give 'biggest bang for buck'
- Where, i.e. perform best (Cost – effectiveness)
 - Benefits are impacts that are prevented/ lessened by measure(s), can also be non- monetary!
 - Costs are implementation and maintenance expenses, can also be non- monetary



- Fit within local practice e.g. type of measure, amount of maintenance, etc
- Have a fitting life time
- Fall within authority of your organisation e.g. regional flood defences often do not fall within scope of road authority

Adaptation strategy = choice of measure or combination of measures

- What we now know:
 - The biggest risks & vulnerable locations?
 - Best performing measures (higher benefits than costs)
- This needs to be combined with:
 - Expected changes of weather events in the future
 - Effectiveness of measures during these events
 - → when does the measure no longer work? i.e. what is the **tipping point** of the measure?

Tipping point example pluvial flooding

Precipitation in 2 hours

Low climate change scenario →

High climate change scenario →

Scenario	Climate previous century	Current climate (2014)	2030	2050	2085
G _L centre sub scenario (mm)	44	49	50	51	52
W _H upper sub scenario (mm)	44	49	51	59	68
G _L (%)	0%	11%	14%	16%	18%
W _H (%)	0%	11%	16%	34%	55%

Measure	Effectiveness (mm extra precipitation)
Larger capacity stormwater drainage system	Infinite
Ensuring drainage / flowing of water via a thicker porous top layer	Storage: 9 mm at thickness of 7 cm 24 mm at thickness of 18 cm
Use of gutters instead of manholes	Storage of 8 mm Extra 5 mm due to increased robustness
Ensuring levelness of longitudinal profile	25 mm
Realisation of water storage under the road and/or in hollow noise barriers	'infinite'
Adaptive maintenance	5 mm = 54mm
Improving traffic management; preventive speed reduction	No estimate possible
Technical adaptation of cars	No estimate possible

'Robust'

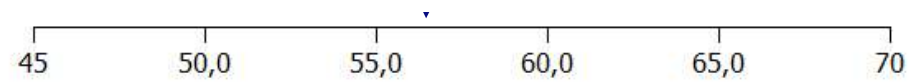
'Robust'

What is tipping point for adaptive maintenance? →

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Adaptation Strategies

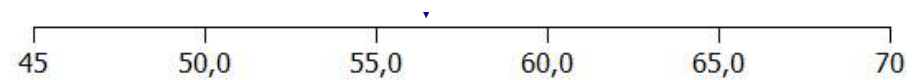
precipitation in 2 hours [mm]



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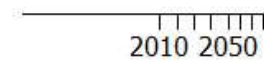
Adaptation Strategies

precipitation in 2 hours [mm]



Low climate change scenario →

High climate change scenario →



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Adaptation Strategies

Drainage via 7 cm thick porous layer (double layered PA)

Drainage via 10 cm thick porous layer

Drainage via 18 cm thick porous layer

Current Situation (storage in PA taken into account)

Enlarging capacity of stormwater drainage system

Use of gutters instead of manholes

Water storage under the road or in noise barrier

Adaptive maintenance

Ensuring levelness of longitudinal profile

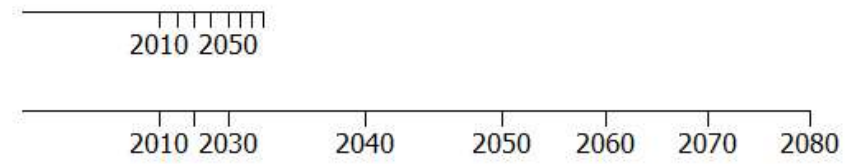


precipitation in 2 hours [mm]



Low climate change scenario →

High climate change scenario →



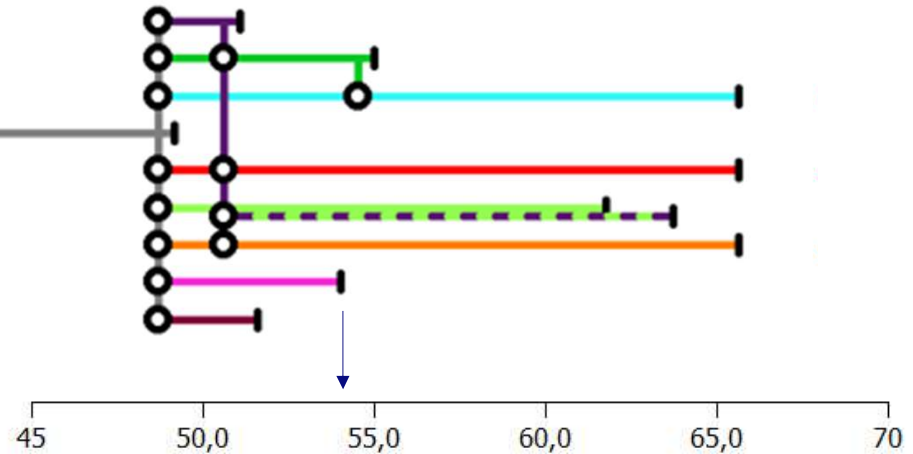
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Adaptation Strategies

- Drainage via 7 cm thick porous layer (double layers)
- Drainage via 10 cm thick porous layer
- Drainage via 18 cm thick porous layer
- Current Situation (storage in PA taken into account)
- Enlarging capacity of stormwater drainage system
- Use of gutters instead of manholes
- Water storage under the road or in noise barrier
- Adaptive maintenance
- Ensuring levelness of longitudinal profile

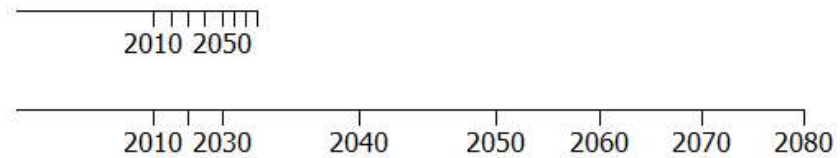


precipitation in 2 hours [mm]



Low climate change scenario →

High climate change scenario →

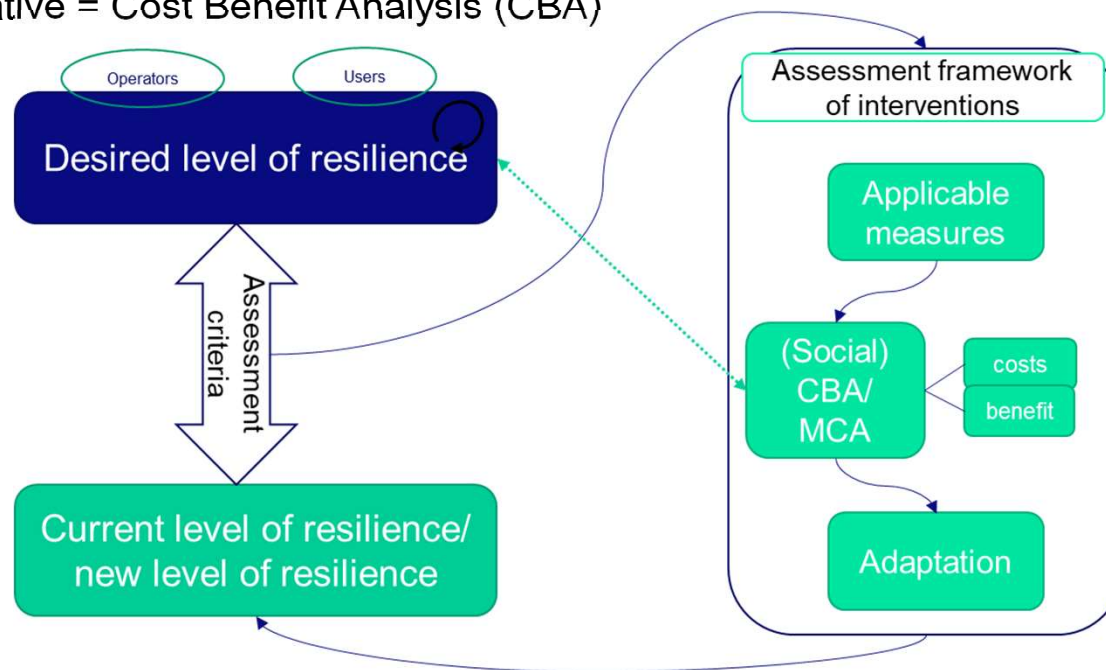


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Evaluate strategy performance

- A strategy costs money to implement and maintain (= costs)
- A strategy 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)



Multi-Criteria Analysis

- Simple MCA: *Example - Buying a Car*

Criterion	Afford-ability	Safety	Comfort	Looks
	+++	++	++	+
	+	+++	+++	++
	++	+	+	+++

Conclusions

- Required input – risk analysis results
- Why to take measures- decrease amount of damage or duration of down time (or societal impact)
- Identification of measures – understand situation (bow ties)
look at disaster risk cycle for full spectrum of measures
- Selecting suitable measures – cost – effectiveness: does the effect outweigh the costs?
does the measure fit with local situation, culture, use?
- Planning implementation - what is the tipping point of the measure
not all measures need to be taken NOW; plan for future
take measures in regular workflow when possible
choose strategy with highest cost - benefit analysis
(this can be 1 measure OR a combination of measures)