LOSS Symposium
3 November 2022

Measures to mitigate subsidence in the built environment

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TU Delft

Practical information

This is an **interactive presentation**.

You will participate with your own inputs!

Keep **your cellphone** at hand, there will be **live polls**.

Follow the instructions below to connect.

Instructions

- Go to https://www.menti.com
- Enter the code **4352 0742**
- Answer the questions
- **Have fun!**

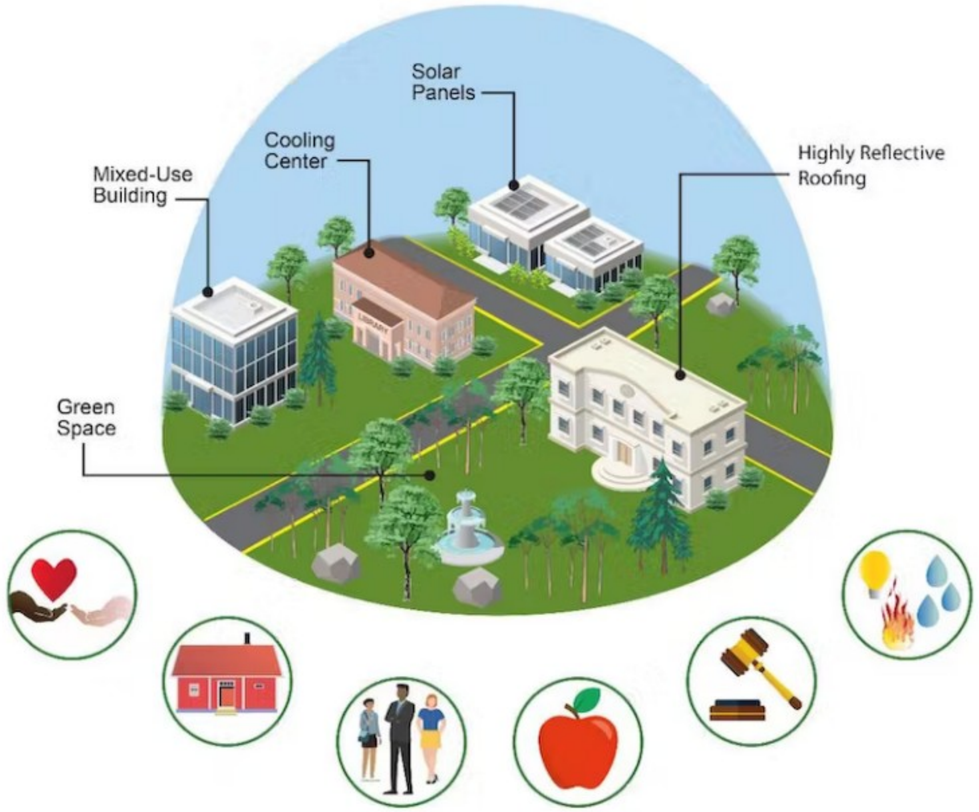
What is the *built environment*?

*"The **built environment** refers to all the **constructions** built to support day-to-day human activities" (Roof and Oleru 2008).*

Components of the bult environment:

- **Buildings** (commercial, residential, religious, touristic, sanitary, etc.)
- **Cultural heritage** (monuments, museums, archaeological sites, etc.)
- **Linear infrastructures** (roadways, railways, power lines, pipelines, waterways, etc.)
- **Parks and green spaces**
- **Other infrastructure** (transport, telecommunication, waste and water management, power supply, etc.)

Human settlement + Infrastructures = Urban Area



Roof, K, and N. Oleru. 2008. "Public Health: Seattle and King County's Push for the Built Environment". J Environ Health. 75: 24–27.

Why is it important to mitigate subsidence in urban areas?

*"**Mitigation measures** aim at **minimizing the adverse impacts** of subsidence on the built environment and the society, fundamental when subsidence **cannot** be fully prevented." (UNDRR, 2022)*

Impacts of land subsidence:

- **Physical (deformation and/or damage)**

https://hamiltonfraser.co.uk/knowledge/subsidence/

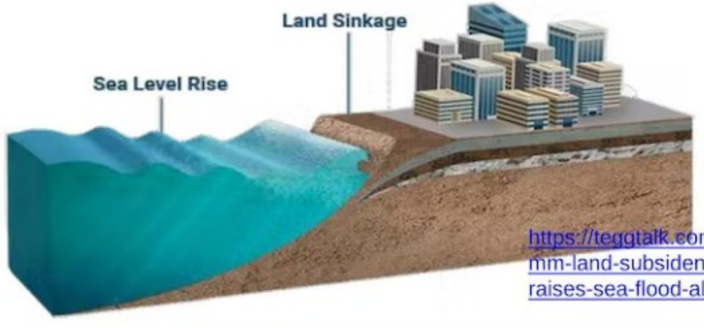
https://www.zurich.co.uk/news-and-insights/in-depth-look-at-subsidence

- **Economic**

https://economics.rabobank.com/publications/2020/december/house-prices-expected-to-rise-urbanites-continue-to-buy-homes-in-cities/

https://www.dreamstime.com/financial-loss-icon-beautiful-meticulously-designed-image120778614

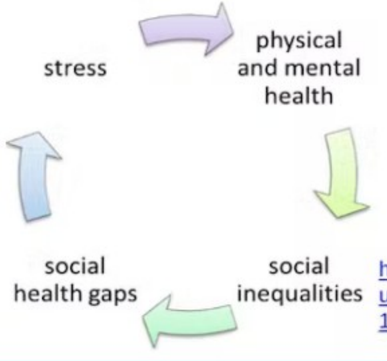
- **Environmental**



https://teggtalk.com/2018/12/04/2-mm-land-subsidence-in-dunedin-raises-sea-flood-alarm/

- **Social**

https://www.theguardian.com/world/2020/dec/31/land-subsidence-will-affect-almost-fifth-of-global-population



https://opentextbc.ca/introductiontopsychology/chapter/15-1-health-and-stress/

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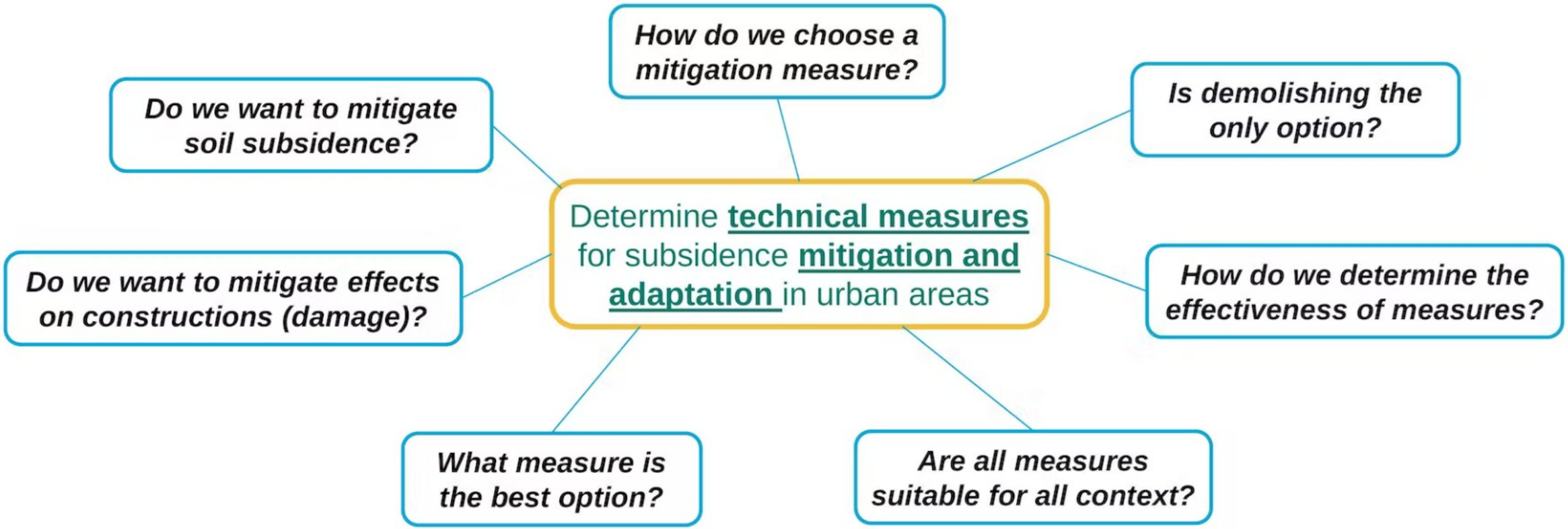
UNDRR, 2022. https://www.undrr.org/terminology

Objectives



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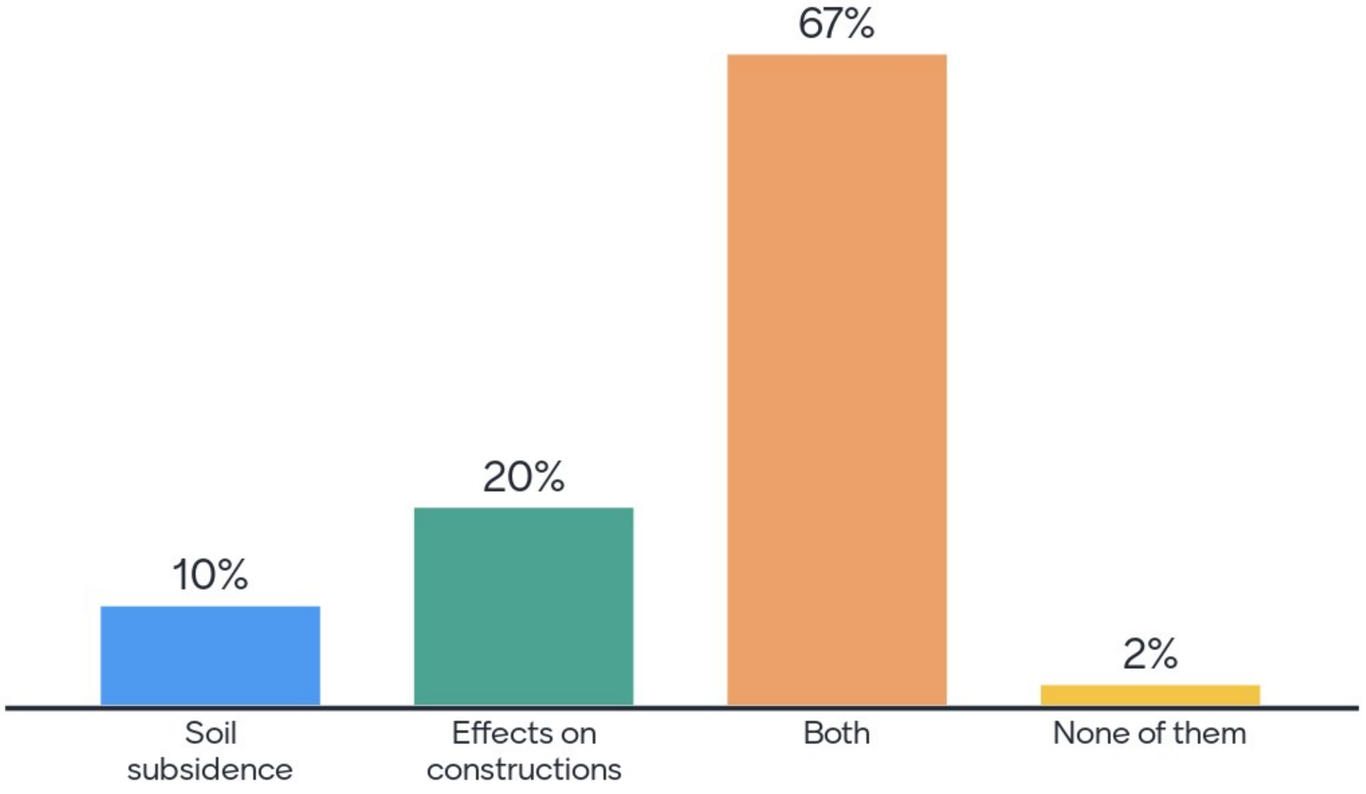
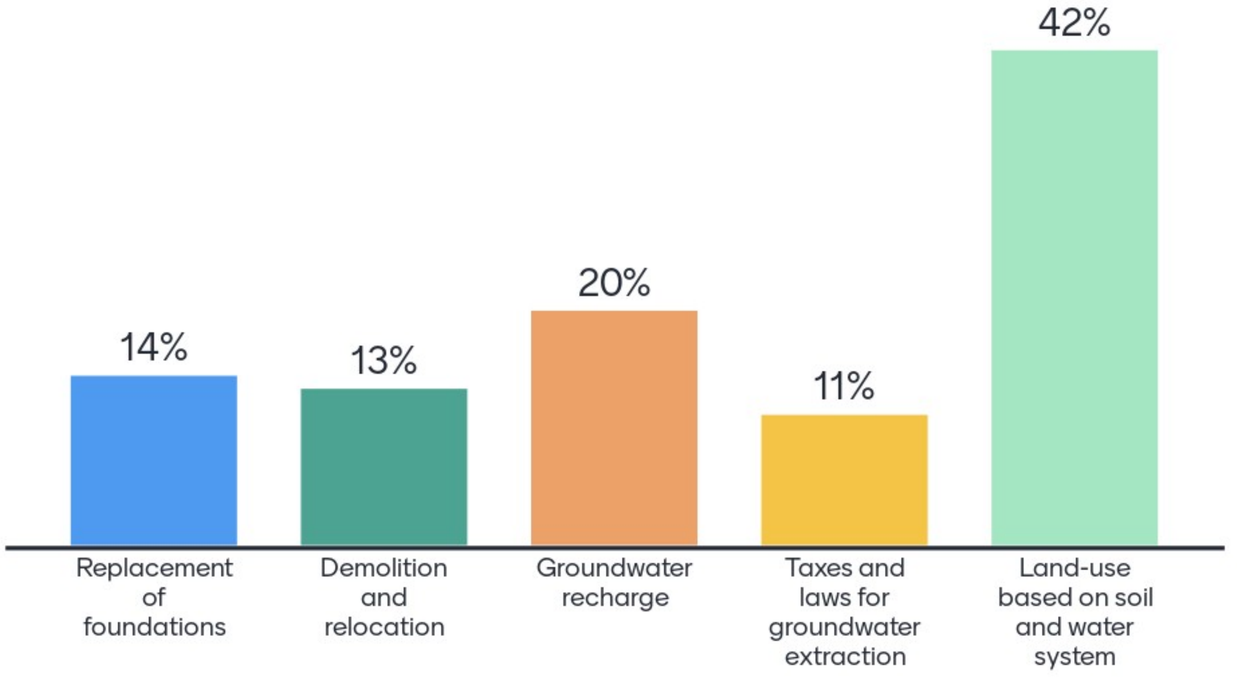
Poll nr.1: What do you want to mitigate?



Poll nr.2: How can we mitigate subsidence and its effects in urban areas?



How can we mitigate subsidence and its effects in urban areas?

Contrast bacterial decay
Waterproof basement
Vegetation
Replacement of foundation
Fracture filling
Sand layer
Taxes
Demolition
Permeable pavement
Infiltration sewer
Water extraction
Biopore hole
Bridge elevation
Relocation
Regulations
Garden elevation
Infiltration well
Soil injections
Relevelling
Compartmentalization
Sediment restoration
Void filling
Artificial pumping (recharge)
Lightweight material
Artificial repressuring of confined aquifers
Road elevation
Retention pond
Flexible pipelines

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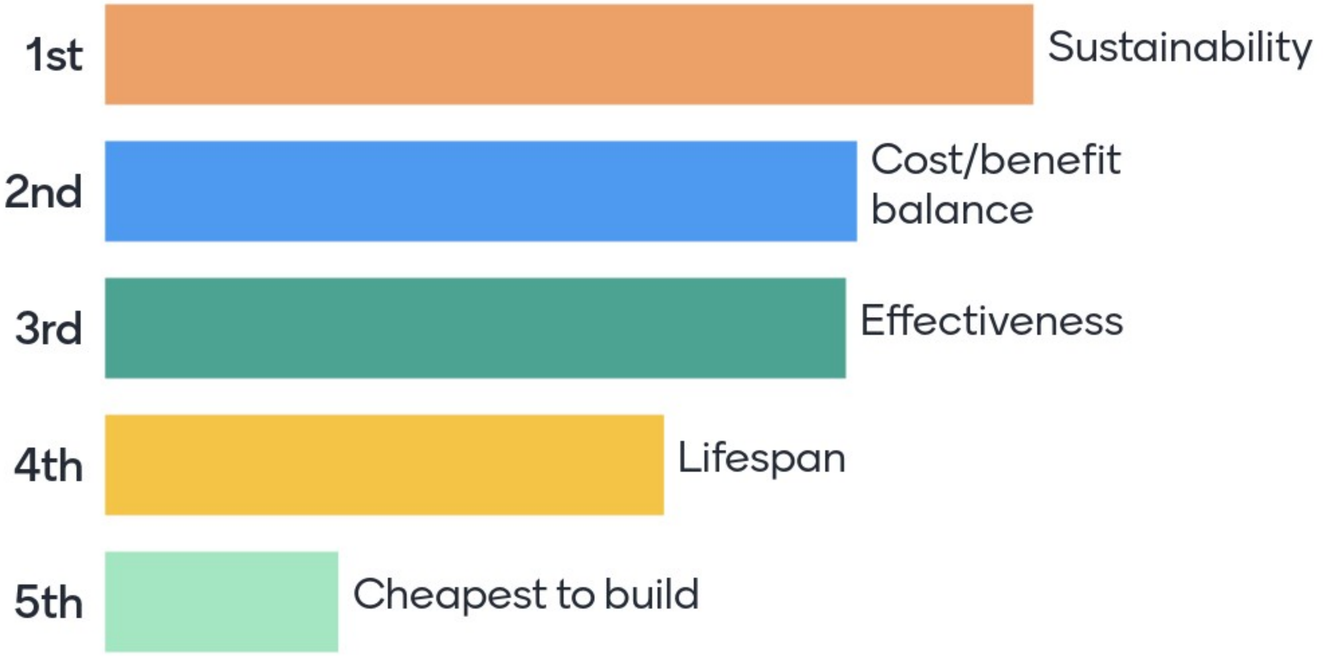
Poll nr.3: What criteria are important to select mitigation measures?



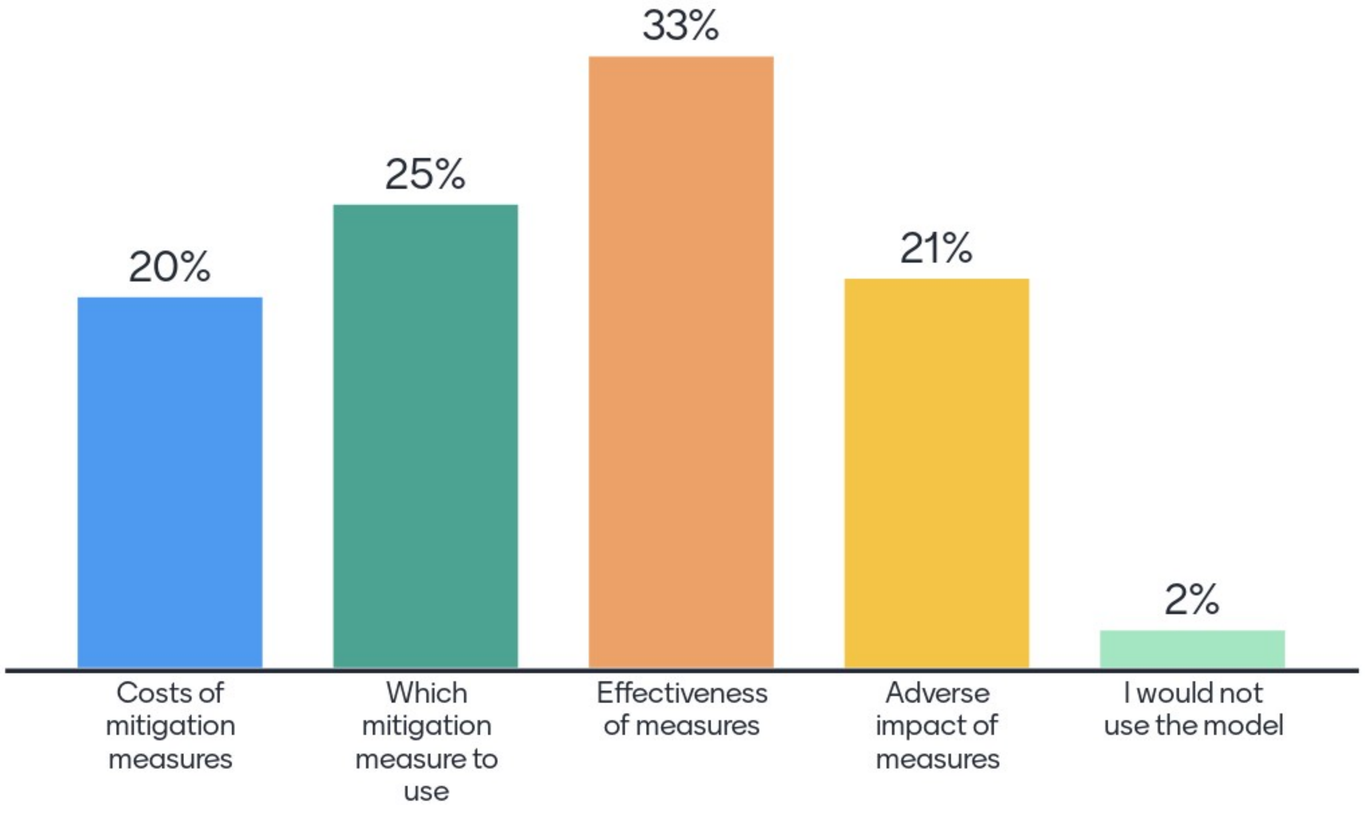
Model for selecting suitable mitigation measures

Subsidence mitigation measures

- **Application to**
  - Single asset
  - Neighbourhood
  - Municipality
  - Province
  - Nation
  - **Link with climate change**
- **Driver of subsidence**
  - Low groundwater level
  - Soil compaction
  - Peat oxidation
  - Shrinking and swelling
  - Water or fluid extraction
  - Soil loading (relevelling)
  - Construction loading (urbanization)
  - Traffic and vibrations
- **Existing area**
  - **Newly built area**
    - **Time consume**
      - Construction time
      - (expected) Lifetime
      - Maintenance frequency
- **Private construction**
  - **Public space**
    - **Costs**
      - Construction cost
      - Maintenance cost
      - Reparation cost
      - **Use of innovative material**
- **Mitigation of**
  - Soil Subsidence
  - Effects of subsidence (e.g., damage)

Which mitigation measure is suitable for my case?

Poll nr.4: What would you like to know from such model?



Workshop on subsidence mitigation measure in urban areas

What: Expert session workshop to brainstorm on what measures can be adopted to mitigate subsidence and its effects in urban areas.

Where: Deltares, Delft

When: January-February 2023.

How: The workshop will be composed of two sessions, each of half-day duration, and there will be 2 or 3 weeks between the sessions. Participants will work individually and in groups.

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Nicoletta Nappo

Do you want to participate to the workshop?

Then, send an email with your name, email address and field of expertise to:

n.nappo@tudelft.nl

nicoletta.nappo@deltares.nl