Landslide risks in the Göta River Valley in a changing climate



Exchange New Orleans - Gothenburg



Making Cities Resilient, 26-28 May 2015

Glaciated landscape with soft sediments (silt-clay)

Valleys and Low-lands



Post-glacial rebound – Erosion and landslides







Landslides and mudflows in Sweden





Dynamic landscape of landslide scars



The Göta river valley





- Large run-off area
- Source of water supply for 8% of the population
- Important infrastructure and settlements
- Sensitive to landslides

Catastrophic consequences of landslides





Landslide retrogression in areas with highly sensitive clay



Relative change in precipitation for a period of 30years i the Vänerns runoff area (moving average)

Vänern - Ändring av nederbörd



Mapping of landslide risks - The Government's commission

"In order to address forthcoming climate changes and handle increased flow in the Göta River, greater understanding is required of the stability conditions along the entire Göta River. The funding is to be used for the improvement and production of landslide analyses and stability mapping along the Göta River."

Landslides in a changing climate

- Driving forces affected by:
- Increased groundwater pressure climate related
- ➢ Flow and river erosion *climate related*
- > Loading by houses and infrastructure *development*





Field and laboratory investigations









Methodology

- Extension of quick clays
- Geometry of the river
- Groundwater modelling
- Erosion
- Consequences





Life Buildings Industry Energy supply Water supply Roads and railroads Shipping Contaminated sediments

Bild: Sjöfartsverket

Stability calculation



probability

consequence





Probability categories



Figure 4-1 Matrix with landslide risk levels based on the probability of a landslide and its consequences

Consequence categories

areas with a **low** landslide risk areas with a **medium** landslide risk areas with a **high** landslide risk





Conclusions

Current conditions:

- Many areas with high risk (red)
- High risk also in built-up areas

- Large areas with poor stability closest to the river and conditions for large landslides

Future conditions:

- Climate change means that the risks increase
- The area with the highest risk level (red) increases 10%
- The probability of landslides further increases in high-risk areas unless action is taken



- Necessary to take actions to reduce the current landslide risks which also provide opportunities for increased flows in the future
- The estimated cost for the entire Gota River and the Northern River:
 - 4-5 billion SEK at today's maximum flows5-6 billion SEK for increased maximum flows

Example of what can be done



Swedish Geotechnical Institute SGI

masses.

GIS platform

SGI Tittskåp - Göta Älv

SGI | SGI Intranät | Hjälp | Lägg till som bokmärke





Thank you

