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RIMANA 5 – New Swiss Army Risk Analysis Tool for Ammunition Storage

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Overview

- Introduction
- RIMANA 5 –
New Features
- Examples of new
Technical Models
- Conclusion

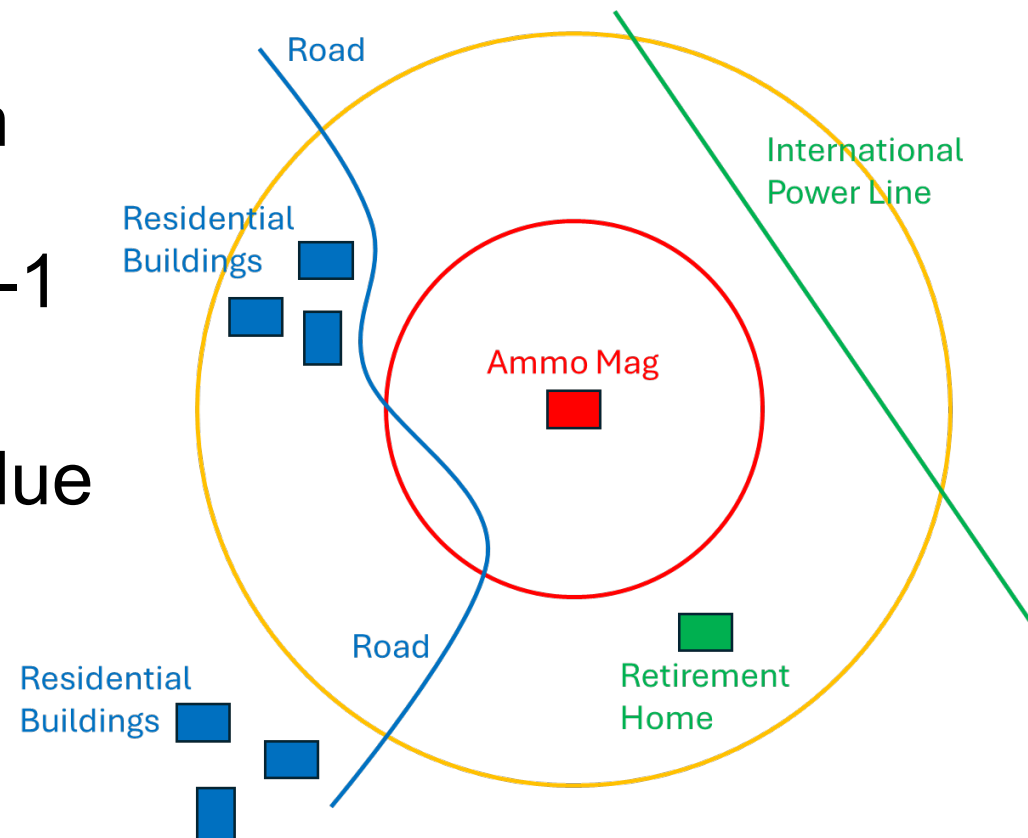


CUIRA Test Series 2022 – Foto from SWE drone



Introduction

- Common approach to ammunition storage safety in many countries
→ **Safety distances**, e.g. AASTP-1
- Special approach in Switzerland due to the densely populated non-mountainous area
→ **Risk based**, e.g. Swiss regulations and AASTP-4





Introduction

- Basic steps of a risk analysis of an ammunition storage site
 - **Events**: max. credible event and probability of explosion
 - **Consequences**: depending on storage type
 - Air blast, debris throw, etc. as a function of distance and azimuth
 - Lethality in buildings and on free field for each explosion effect
 - **Exposure**: Number of people, location, and duration
 - **Risk calculation** (risk = probability x consequences)
 - Max. fatalities, individual risk, collective risk
 - **Safety criteria**: military and civilian (major hazard ordinance)
- => **Support by IT tool advisable**



Introduction

- New policy of the office responsible for ammunition storage safety
 - Risk analysis is necessary for disaster prevention – where are the biggest hazards in terms of fatalities and how could these be prevented?
 - Risk analysis may not be sufficient for disaster management
 - Evacuation of a nursing home
 - Damage to an international power line
- => Such hazards may impact the allowable amount of ammunition



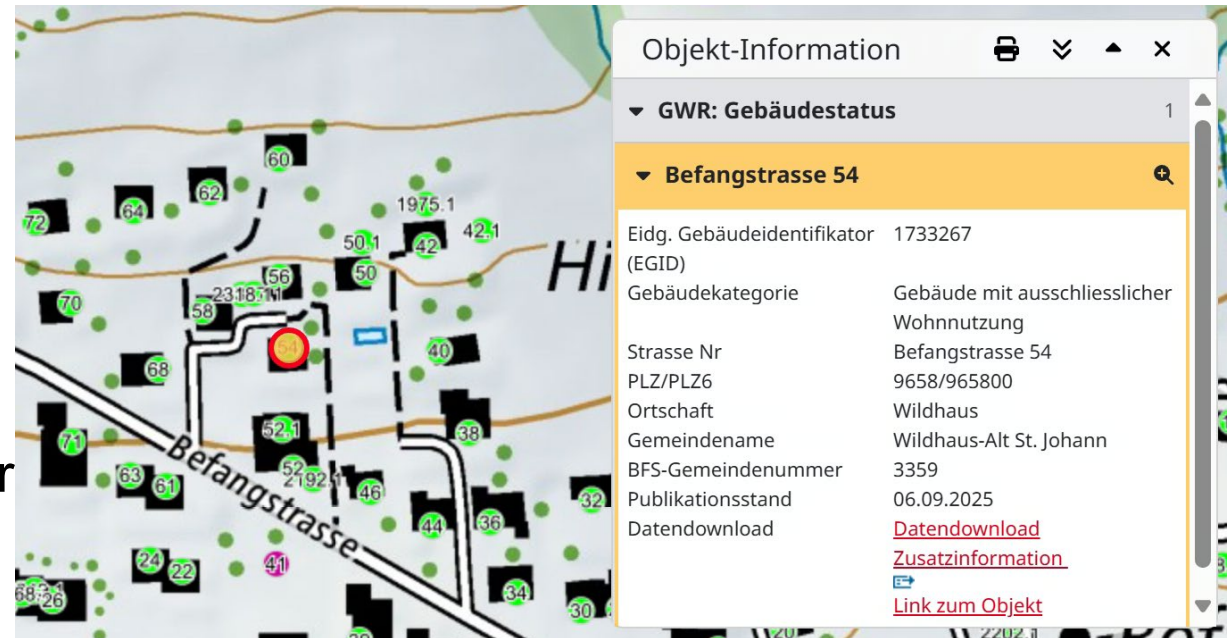
RIMANA 5 – New Features

- Civilian application of RIMANA 5 → standard case
 - Risk analysis for disaster prevention
 - Supported by critical infrastructure analysis for disaster management
- Military application of RIMANA 5 → readiness for war
 - Risks if the allowable amount of ammunition is increased
 - Risks if parts of big underground installations will be used for other activities than storage
 - Risks of field-storage of ammunition



RIMANA 5 – New Features

- Some new features
 - **Using data available on GIS systems**
 - Per inhabited building
 - Number of flats
 - Number of rooms per flat
 - Statistical data per state
→ Number of persons per flat with X rooms
 - Per road / highway
 - Number of cars per day (hour)
 - Statistical data per road type → Number of persons per car

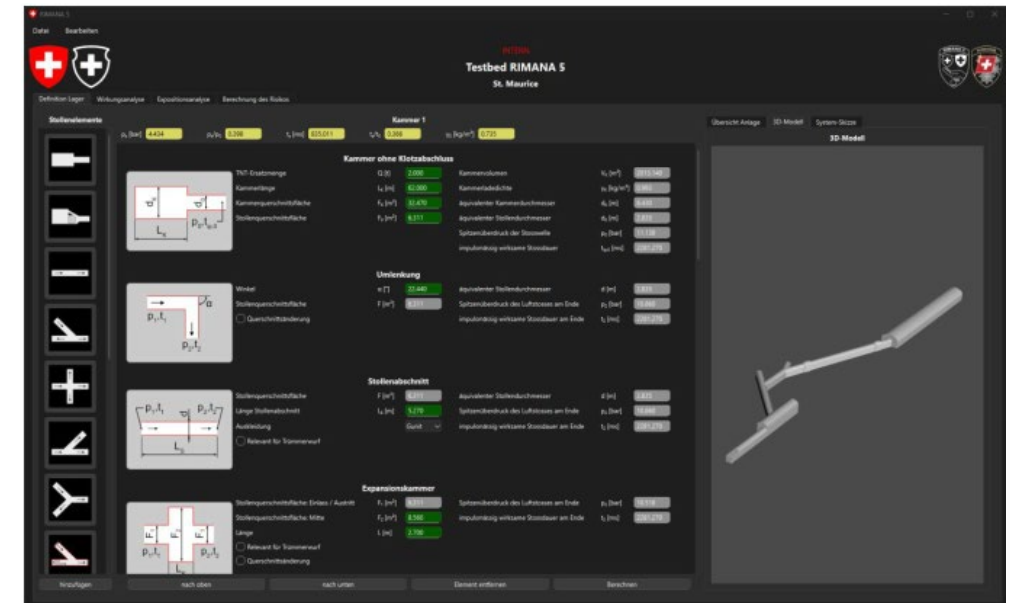


www.map.geo.admin



RIMANA 5 – New Features

- Some new features (continued)
 - Using 3D scans of installations
 - Daily calculation of hazard zones according to **actual** amount of ammunition for first responders
 - Automated short reports for stakeholders



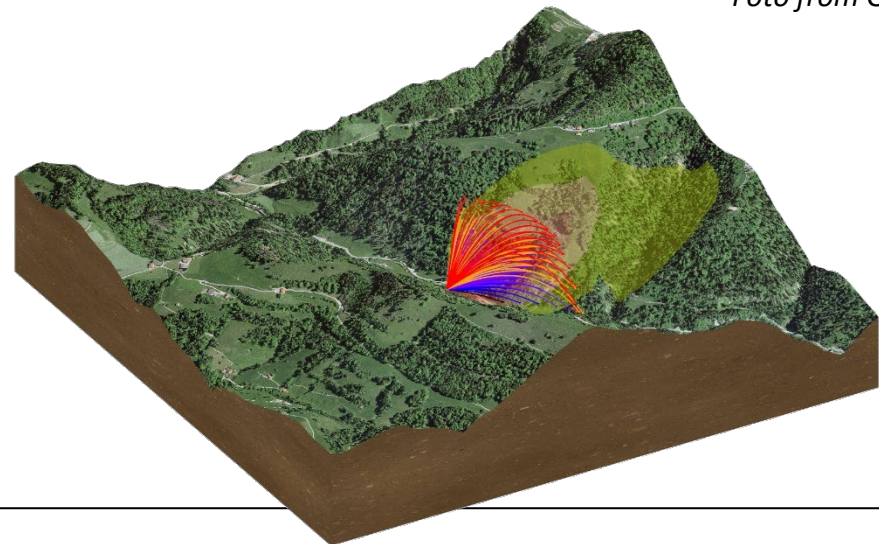


RIMANA 5 – New Features

- Some new features (end)
 - Using new data available from testing etc., such as from the **CUIRA test series**
 - Starting to use high resolution topographic data for newly developed models

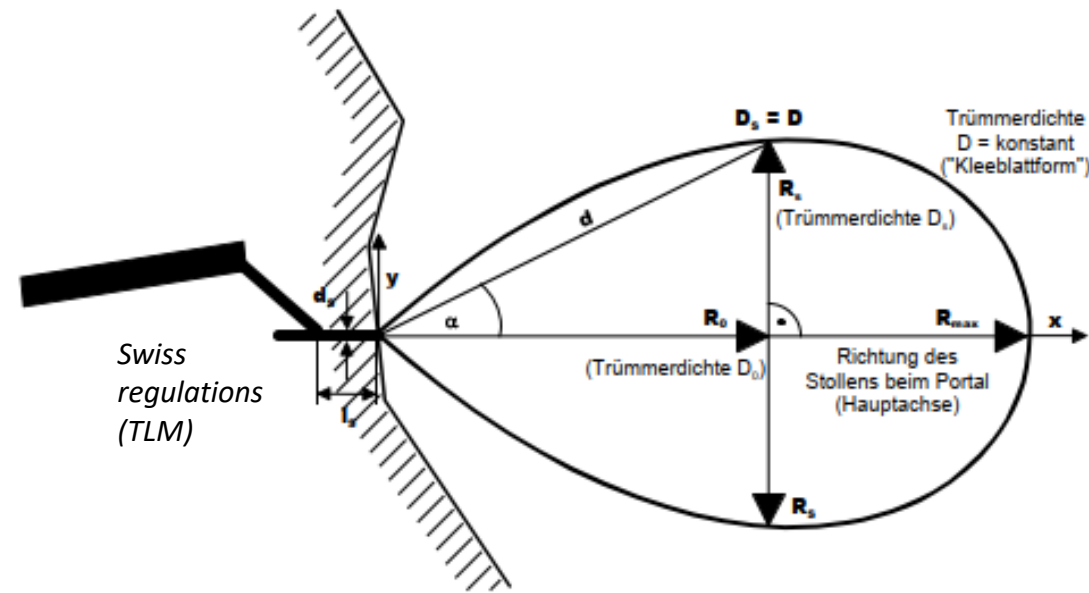


Foto from GER drone



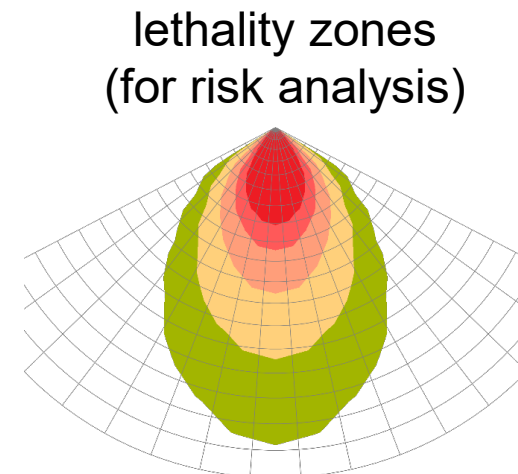
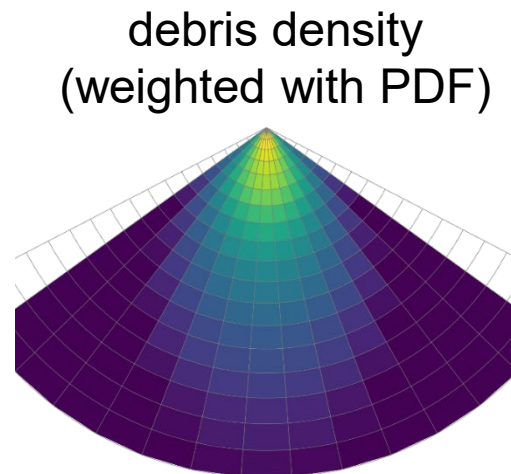
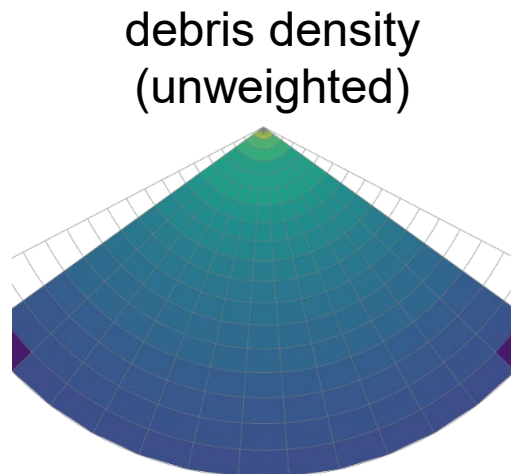
Examples of new Technical Models

- 3D Debris Throw Model from Underground Installations
 - Swiss regulations and NATO AASTP-4: model for flat terrain
 - Because of hills, debris distances in front may be conservative



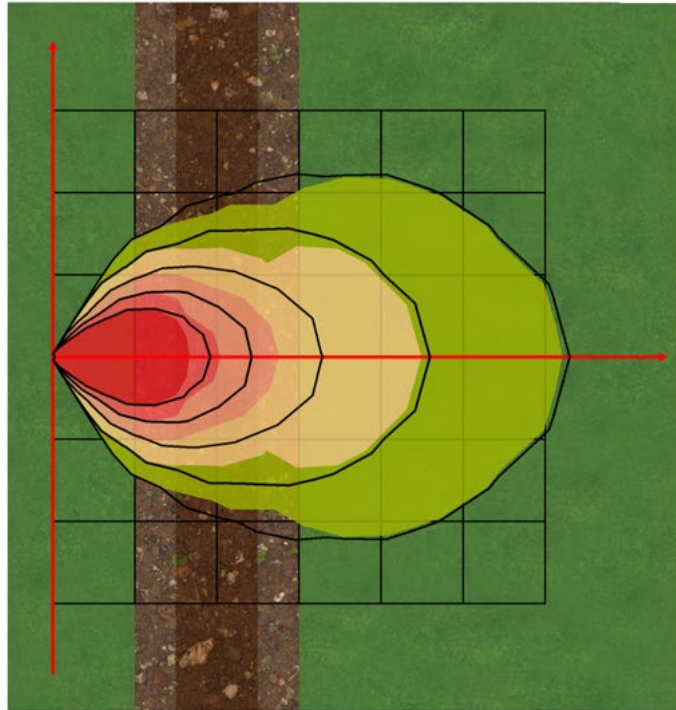
Examples of new Technical Models

- 3D Debris Throw Model from Underground Installations
 - Simulation of 35'100 fragments based on uniform distributions for velocities and angles, and non-uniform mass distribution
 - Resulting debris density computed by weighing trajectory-terrain intersections according to the probability density function (PDF)



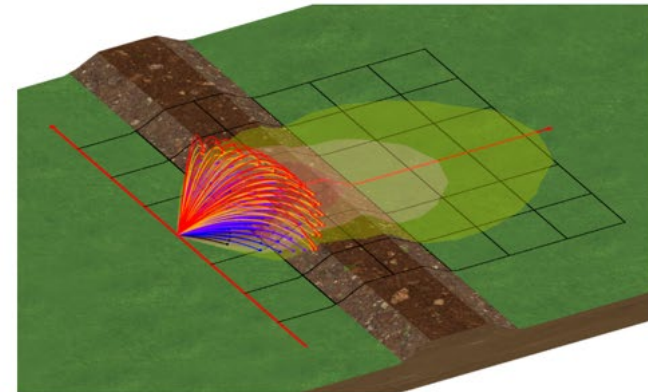
Examples of new Technical Models

- 3D Debris Throw Model from Underground Installations
 - Test topography with hill



Debris throw with hill close-in

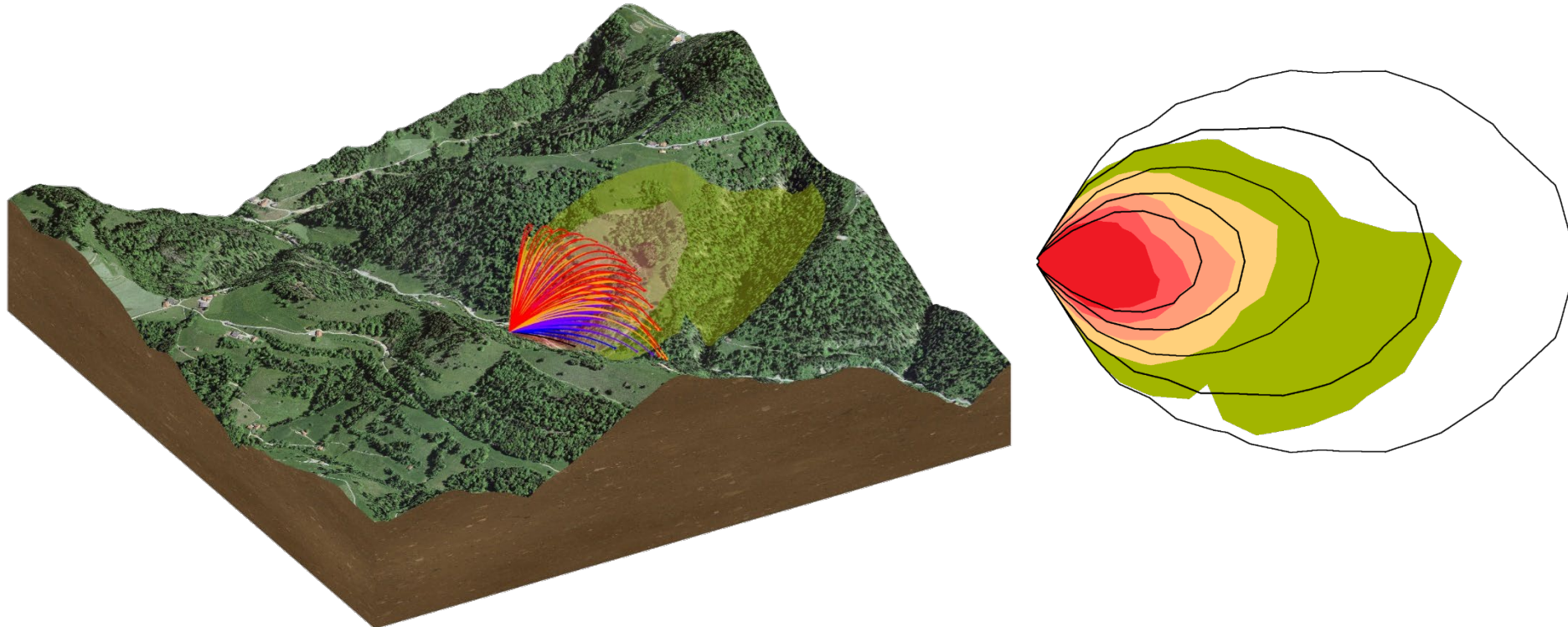
- 50 m high
- 200 m distance
- 50% slope



picture from Testbed RIMANA 5 (only a few trajectories shown for illustration)

Examples of new Technical Models

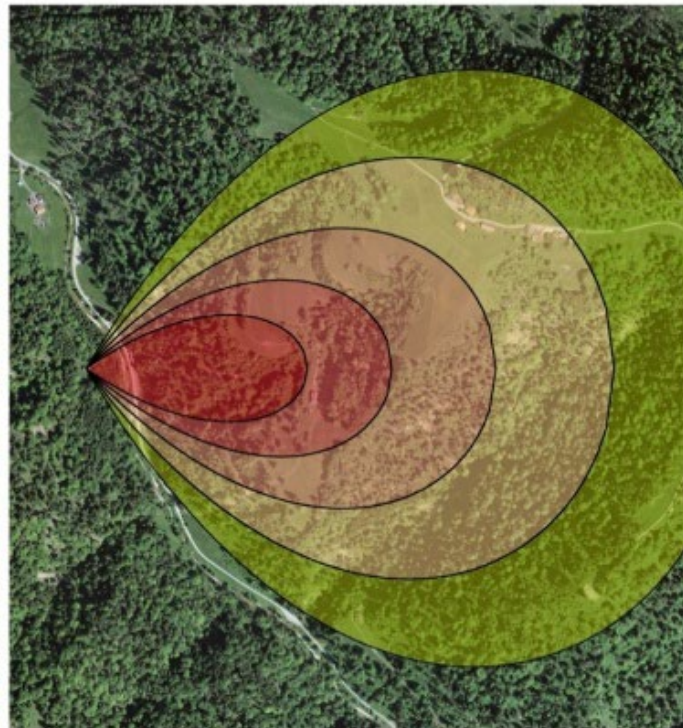
- 3D Debris Throw Model from Underground Installations
 - Real topography with valley



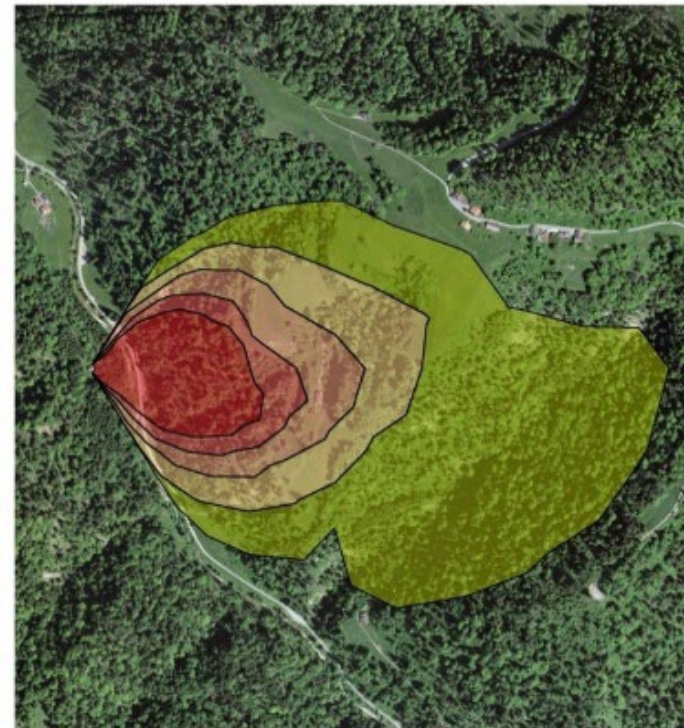
Examples of new Technical Models

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TLM (no topography)



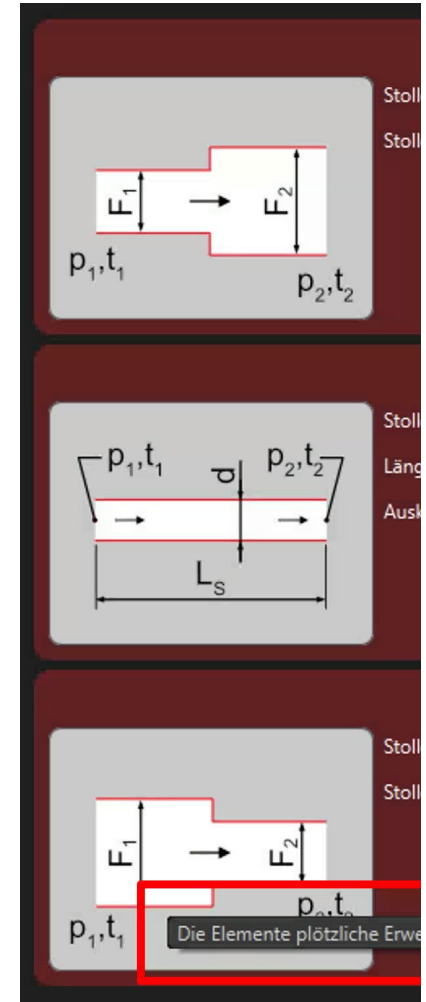
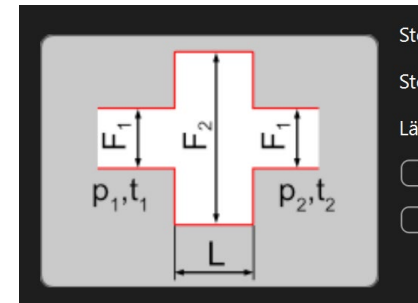
New model





Examples of new Technical Models

- Air Blast Model from Underground Installations
 - Swiss regulations and AASTP-4:
„catalogue“ of adit tunnel elements
 - Long tunnels can be complex:
turns, constrictions, crossings, ...
 - RIMANA 5 helps with quality
control: warning if combinations
are not correct, e.g. expansion
chamber (left) vs. expansion –
tunnel – constriction (right)





Conclusion

- RIMANA 5 will be:
 - State-of-the-art risk assessment tool, e.g. using GIS data
 - Disaster prevention → risk analysis and critical infrastructure
 - Disaster management → hazard zone based on actual quantity
- Acknowledgements
 - Dr. Daniel Oberle, BK&P, Developer of RIMANA Testbed
 - Stephan Joss, Army Staff, Head of Ammunition Storage Safety (SUME)