

Aspekte der bautechnischen Auslegung geologischer Tiefenlager

Construction aspects of deep repositories

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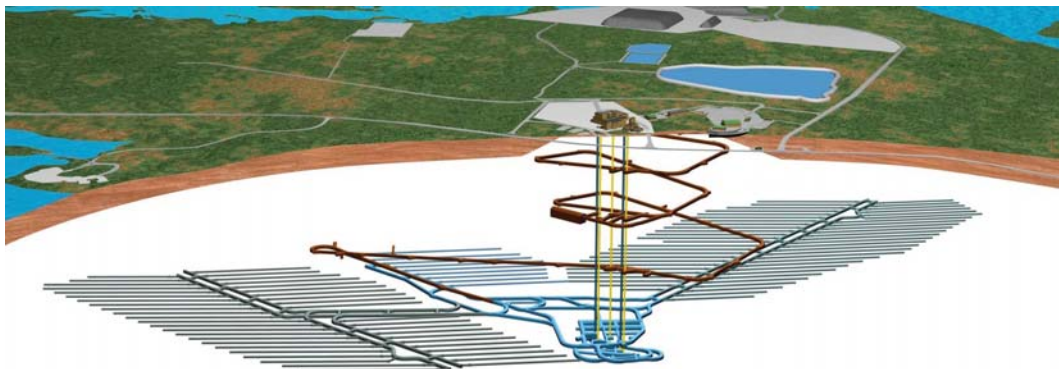
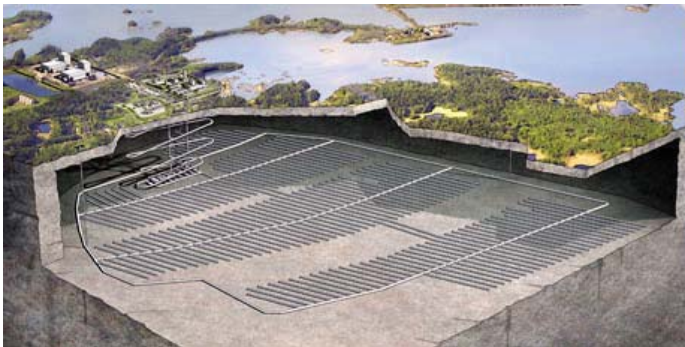
GENERAL REQUIREMENTS

- Long term stability
- Minimal disturbance of ground by underground construction
- Sufficient distance to major geological structures (faults, etc.)
- Minimal water inflow/circulation

INFLUENCING FACTORS

- Type of material to be stored
- Ground quality and structure
- Ground stresses – magnitude and orientation
- Geometry and dimensions of potential geological repository unit
- Type and size of containment
- Required distance between storage units
- Method of construction
- Handling and transport of containers
- Type of access

TYPICAL LAYOUTS

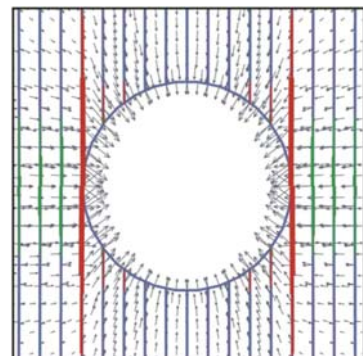
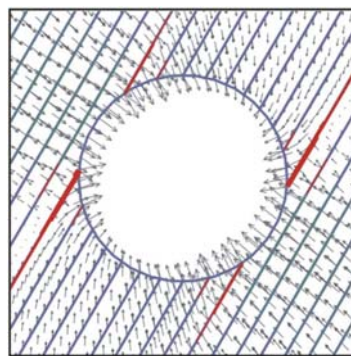
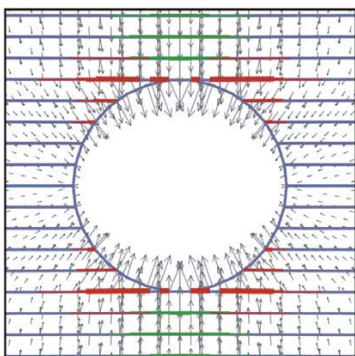


SOME GEOTECHNICAL ASPECTS

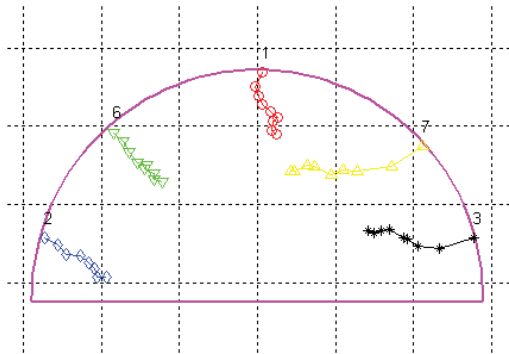
- Avoid disturbed/faulted rock mass
- Underground openings not larger than required for construction and operation
- Careful excavation to minimize damage zone (EDZ)
- Sufficient support to prevent overbreaks and degradation of ground quality
- Sufficient spacing between storage galleries to prevent interference (temperature, displacements)

ORIENTATION OF TUNNELS AND GALLERIES

- Ground structure (bedding, foliation, joints,..) influences behaviour of underground openings
- Shearing along discontinuities and opening of discontinuities dominant mechanisms



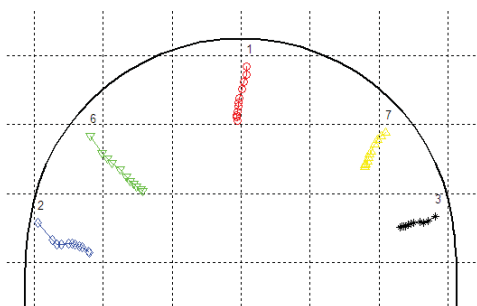
MONITORED DISPLACEMENTS AND SIMULATION



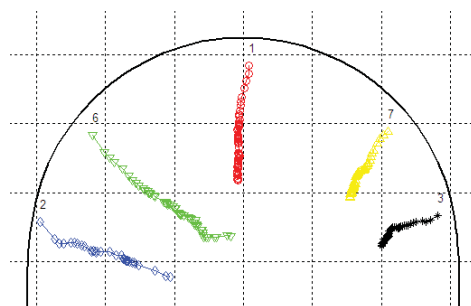
LONG TERM DISPLACEMENTS

- If not properly supported, shear strength can decrease, leading to additional displacements

t= 12 days

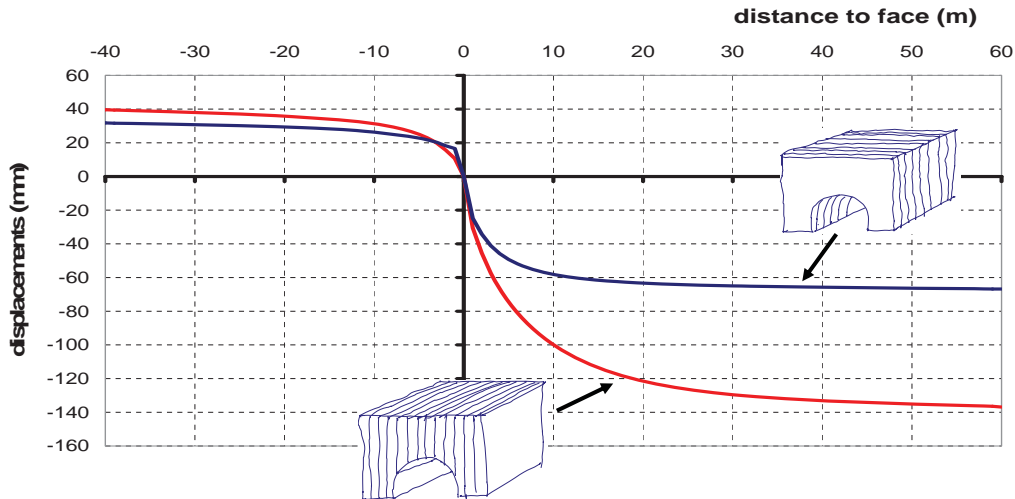


t= 5 months



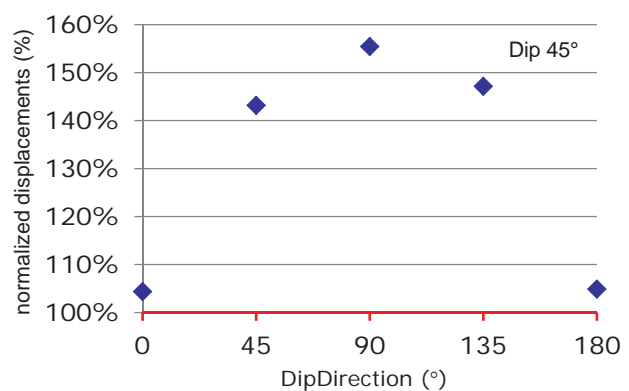
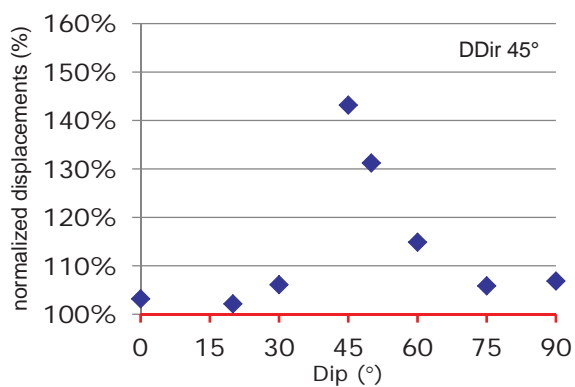
EFFECT OF BEDDING / FOLIATION ORIENTATION

- Relative orientation between foliation and tunnel axis strongly influences displacement development and magnitude

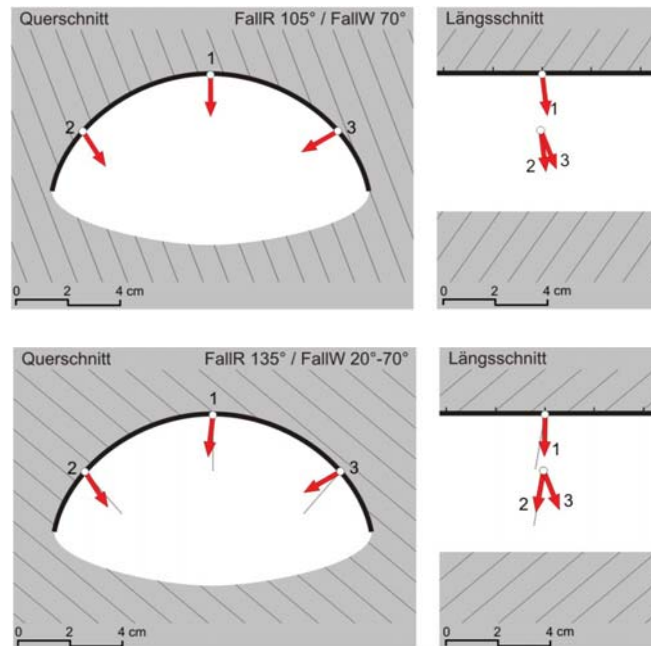


SPATIAL ORIENTATION

- Influence of dip angle and dip direction on magnitude of displacement

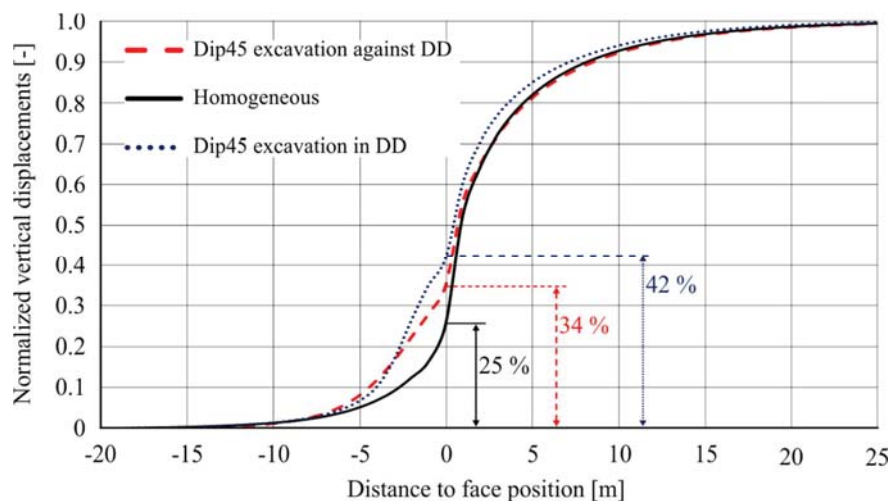


SOME EXAMPLES OF INFLUENCE OF FOLIATION ON DISPLACEMENT ORIENTATION



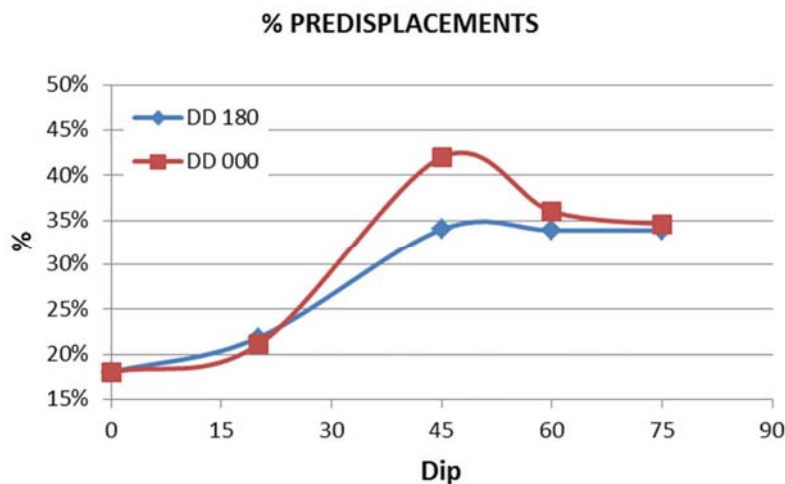
EXCAVATION DIRECTION

- Amount of displacements ahead of the face varies, depending on excavation direction
- Lower pre-displacements allow reducing damage zone by „earlier“ installation of support



PRE - DISPLACEMENTS IN RELATION TO DIP ANGLE

- Dip angle influences the proportion of displacements ahead of face



SUMMARY

- A number of parameters control the layout of repositories, leaving only little room for changes
- Some optimization potential: With „smart“ orientation of tunnels and storage galleries damage to the rock mass can be minimized and support reduced
- Eine Anzahl von Parametern bestimmt die Lagerauslegung, was nur wenig Raum für Änderungen lässt
- Optimierungspotenzial: Bei entsprechender Orientierung der Hohlräume zu den existierenden Strukturen kann die Schädigung des Gebirges und der Stützmittelaufwand reduziert werden