

Suggestion for a documentation of unexpected standstills in TBM-tunnelling

Katharina Hofer, Alexander Kluckner, Wulf Schubert

Institute for Rock Mechanics and Tunnelling,
Graz University of Technology, Graz, Austria

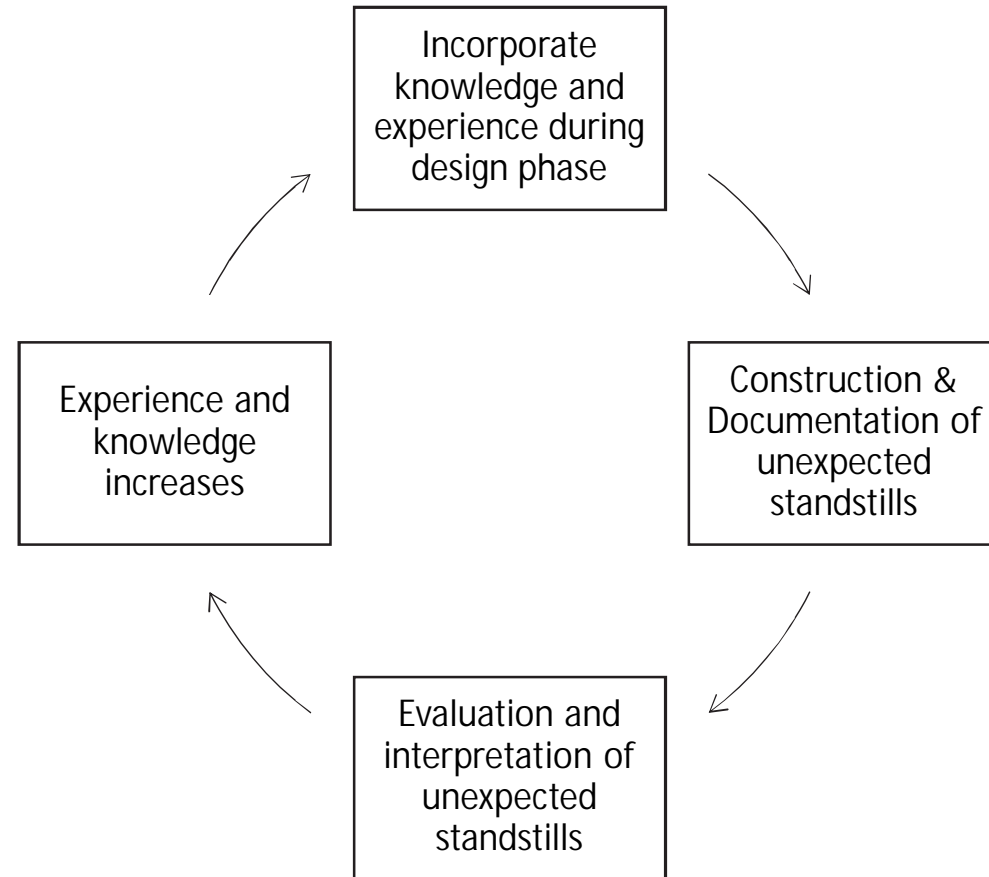
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Purpose and introduction

- Currently no uniform and consistent documentation of unexpected standstills available
- Questionnaire and spreadsheet were developed and tested on ongoing and completed projects
- Sensitive handling with data

Advantage of an uniform documentation



General information about the project

- Geological conditions along the tunnel alignment / in the project area and maximum overburden

Categories for the maximum overburden

Maximum overburden	Category
0 – 20 m	O1
20 – 200 m	O2
200 – 1,000 m	O3
1,000 – 2,000 m	O4
> 2,000 m	O5

General information about the project

- Geological conditions along the tunnel alignment / in the project area
- Machine type (open gripper TBM, single shield TBM or double shield TBM)
- Tunnel diameter and length of the tunnel

Categories for tunnel diameter

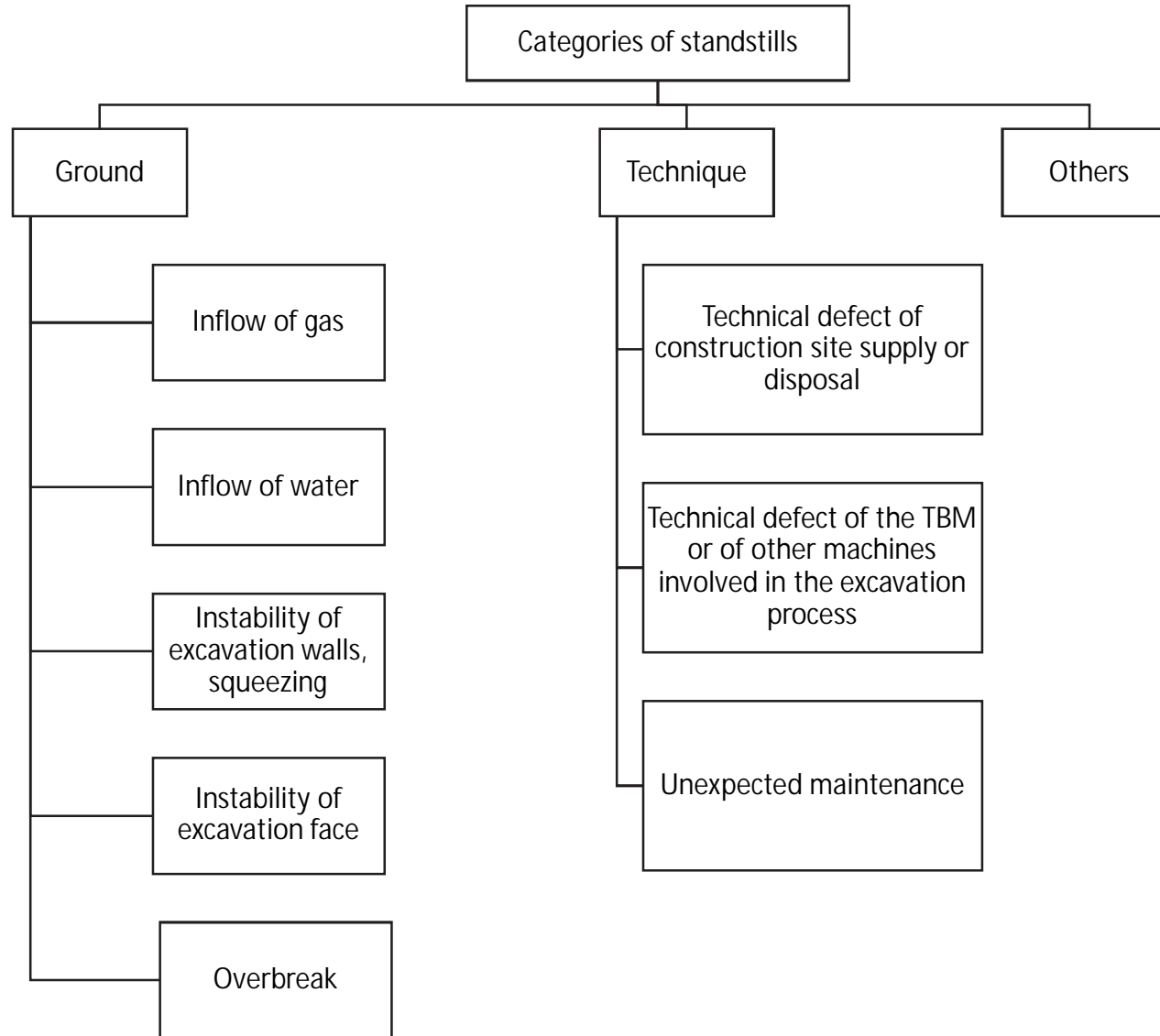
Tunnel diameter	Category
0 – 4,000 mm	D1
4,000 – 8,000 mm	D2
8,000 – 12,000 mm	D3
12,000 – 14,000 mm	D4
> 14,000 mm	D5

Categories for the length of the tunnel

Tunnel length	Category
0 – 4,000 m	L1
4,000 – 10,000 m	L2
10,000 – 16,000 m	L3
16,000 – 20,000 m	L4
> 20,000 m	L5

General information about the project

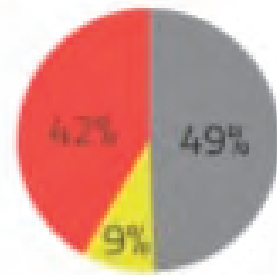
- Geological conditions along the tunnel alignment / in the project area and maximum overburden
- Machine type (open gripper TBM, single shield TBM or double shield TBM)
- Tunnel diameter and length of the tunnel
- Duration of the excavation (days of construction)
- Method of site supply and disposal
- Information about maintenance shifts and planned standstills



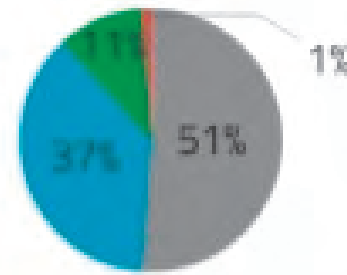
Evaluated projects

Tunnel	Length	Machine type	Bore diameter	Maximum overburden	Project status
1	L1	TBM-S	D4	O2	completed
2	L1	TBM-S	D4	O2	completed
3	L1	TBM-S	D4	O2	completed
4	L2	DSM	D2	O3	completed
5	L2	DSM	D2	O4	completed
6	L1	DSM	D3	O3	ongoing
7	L1	DSM	D3	O3	ongoing

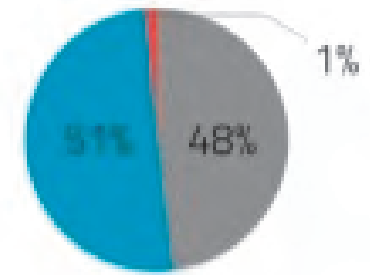
Evaluation of the unexpected standstills of seven projects



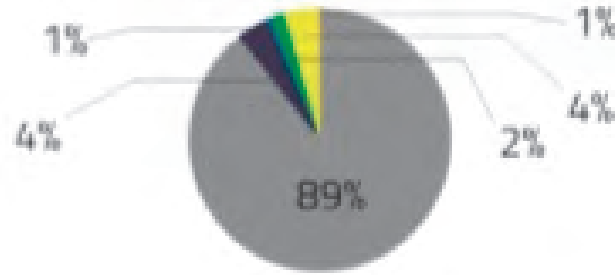
Tunnel 1
(TBM-S, L1, D4, O2)



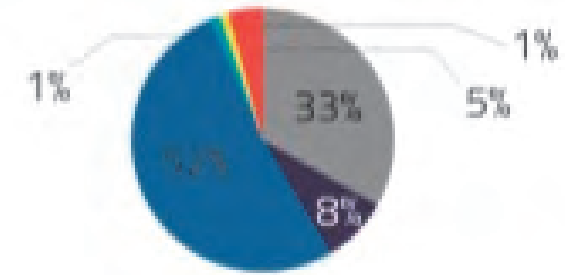
Tunnel 2
(TBM-S, L1, D4, O2)



Tunnel 3
(TBM-S, L1, D4, O2)



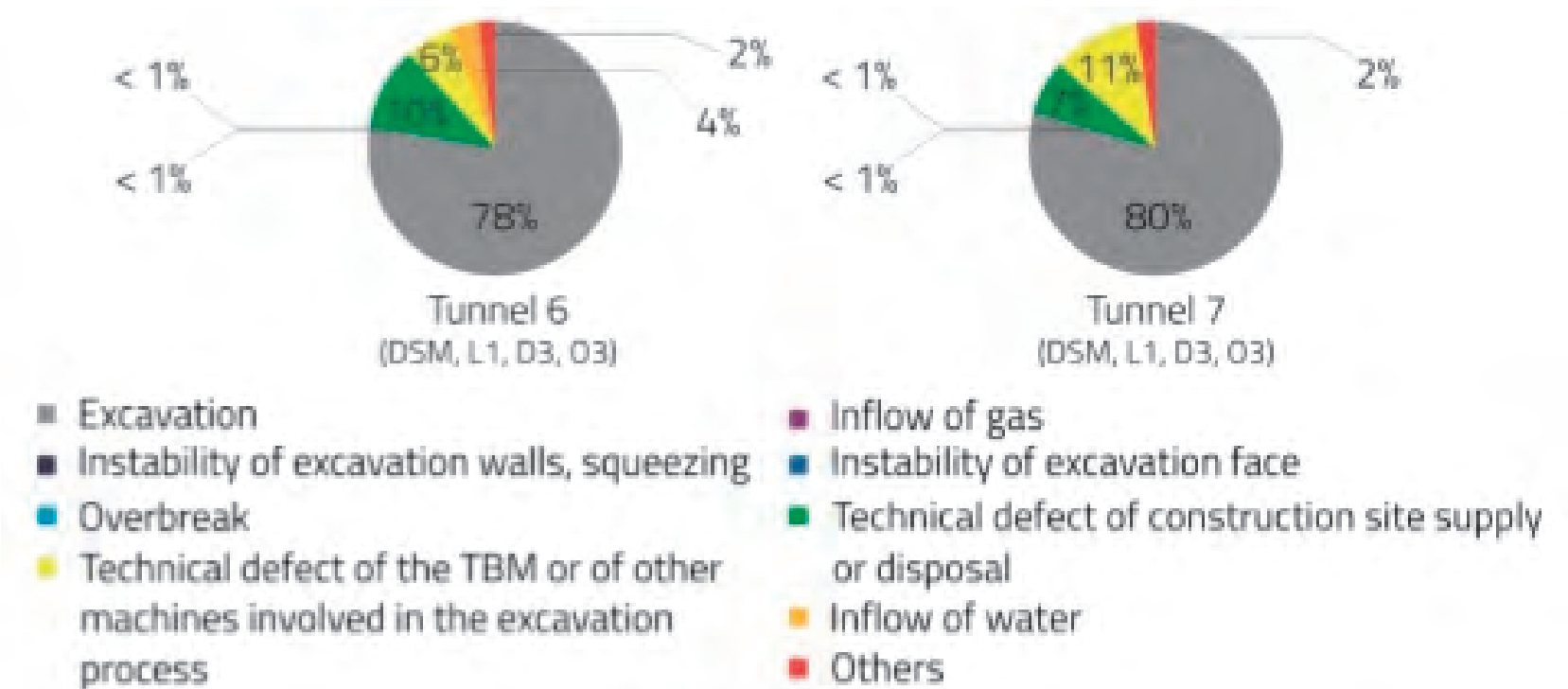
Tunnel 4
(DSM, L2, D2, O3)



Tunnel 5
(DSM, L2, D2, O4)

- Excavation
- Instability of excavation walls, squeezing
- Overbreak
- Technical defect of the TBM or of other machines involved in the excavation process
- Inflow of gas
- Instability of excavation face
- Technical defect of construction site supply or disposal
- Inflow of water
- Others

Evaluation of the unexpected standstills of seven projects



Conclusion

- Documentation procedure should be generalized and provided by the owner.
- Simultaneous recording of the standstills and their causes, in combination with the geological and geotechnical documentation and the machine data
- Results summarized in a database

Thank you for your attention!