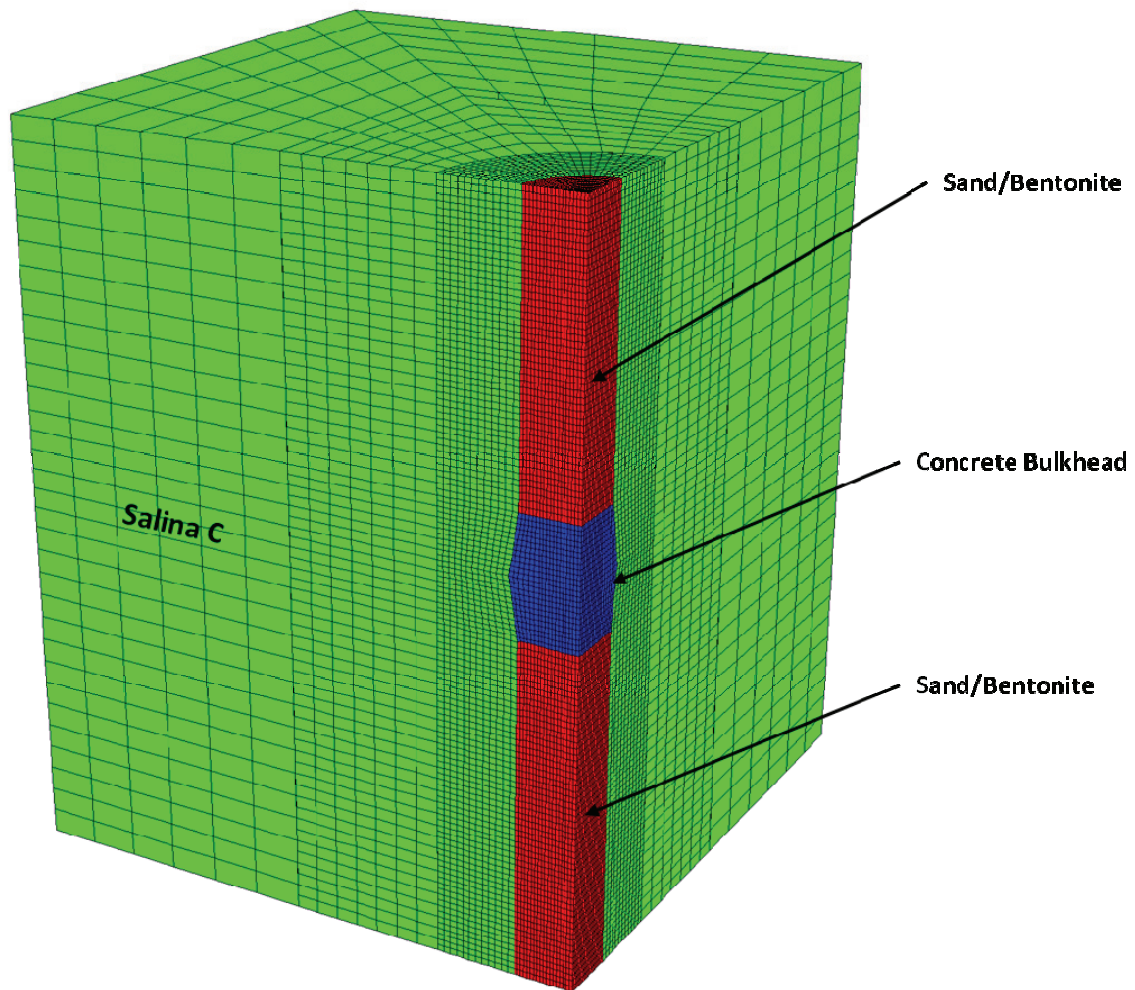


**APPENDIX F. SUPPLEMENTAL FLAC3D RESULTS FOR BULKHEAD IN SALINA C UNIT**

This appendix includes the plots with the results for bulkhead in the Salina C Unit. The summary plots show yielded zones in the model, contours of the shear and the volumetric strains in the isometric view but also in the horizontal cross-sections 22.4 m above the middle of the seal, in the middle of the seal and 22.4 m below the middle of the seal. The results are shown at the characteristic times, including: (1) time after shaft excavation, (2) 100 years (pre-closure), (3) 200 years (post-closure), (4) 100,000 years and (5) 1,000,000 years. The included results are for: (1) time-dependent strength degradation, and (2) time-dependent strength degradation and glacial load.



**Figure F.1: Layout of Quarter-Symmetrical FLAC3D Model of Over-excavated and Backfilled Main Shaft for Bulkhead Salina C Unit**

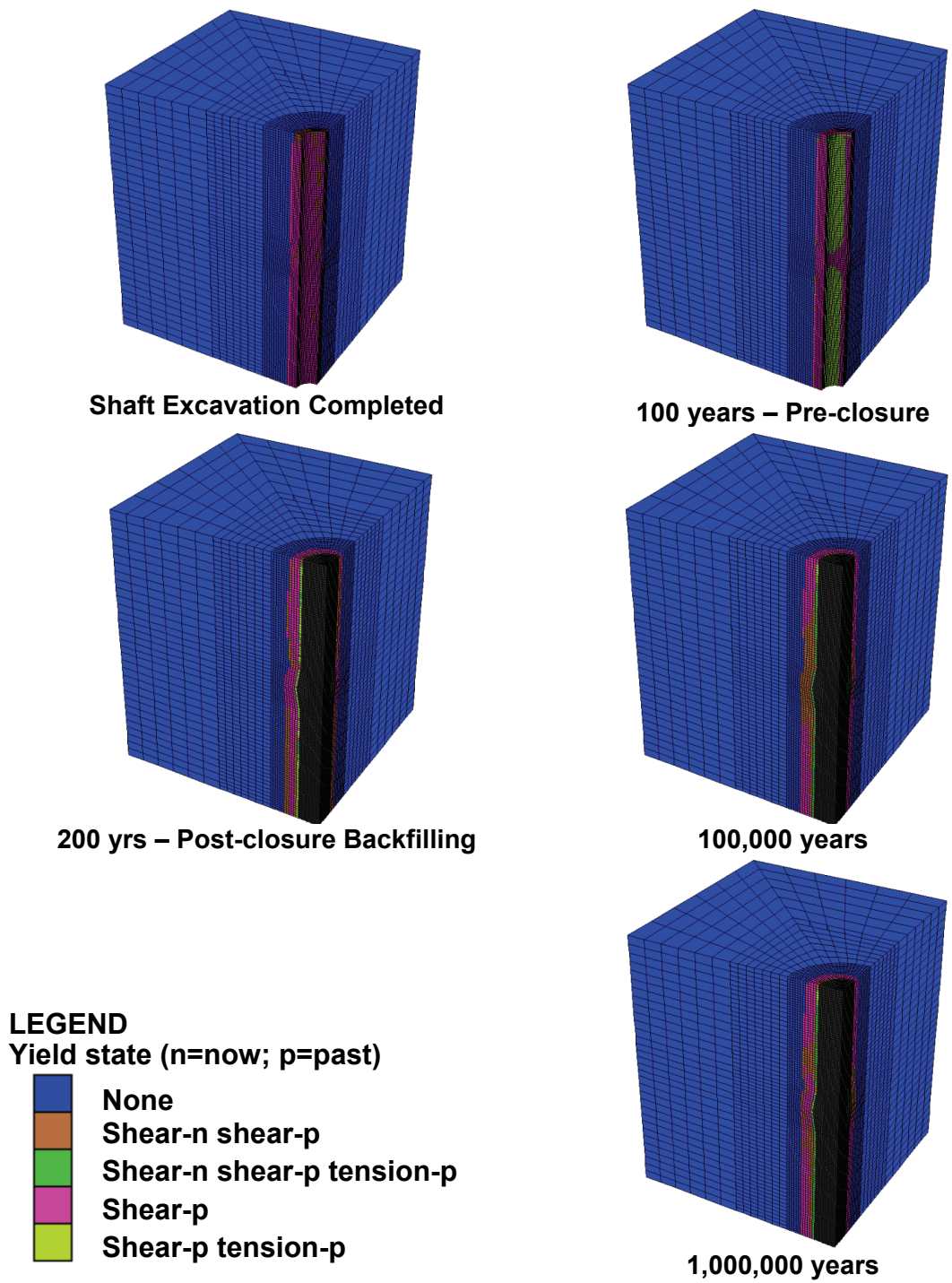


Figure F.2: Yield State – Concrete Bulkhead: Time-dependent Strength Degradation

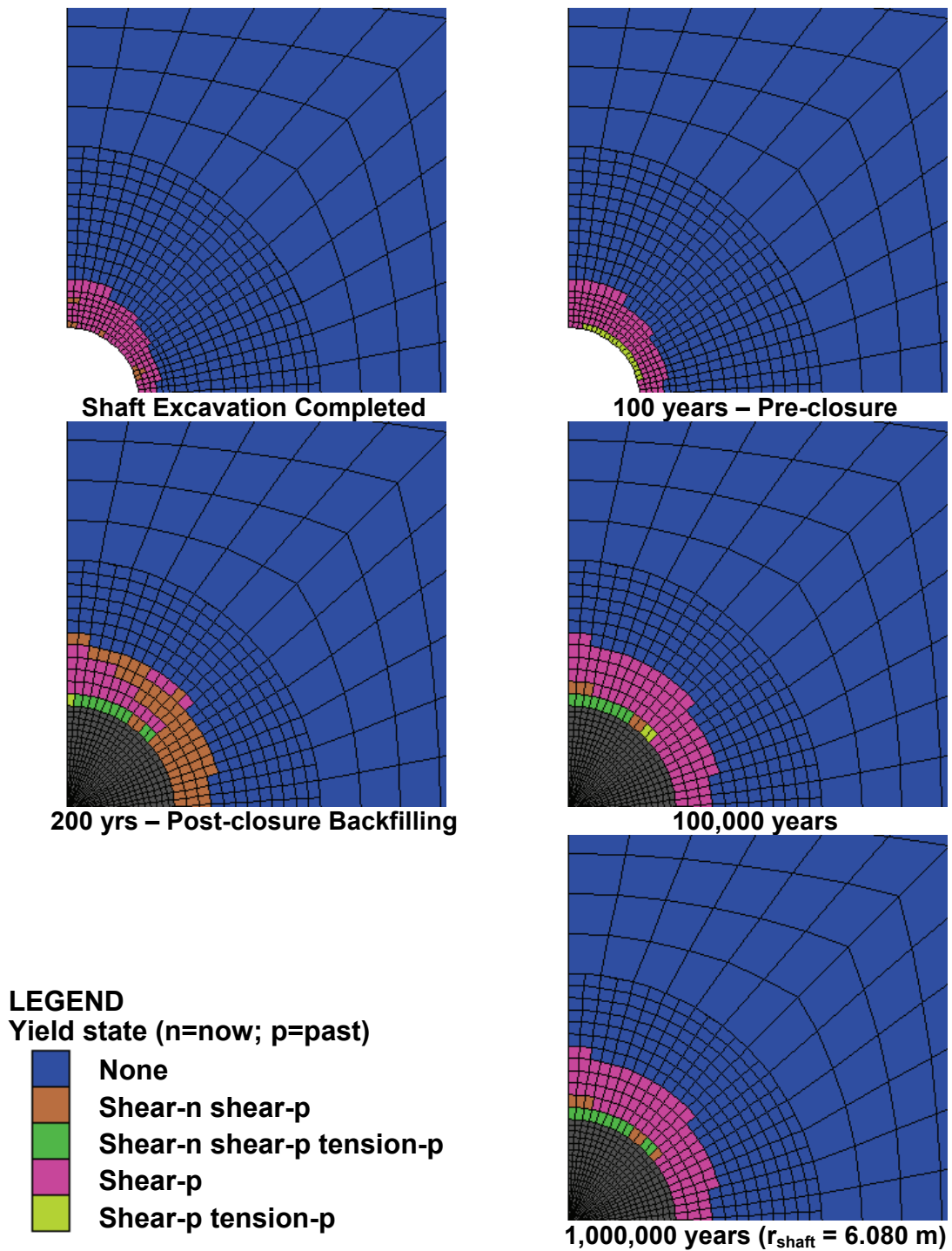


Figure F.3: Yield State – 22.4 m Above Concrete Bulkhead: Time-dependent Strength Degradation

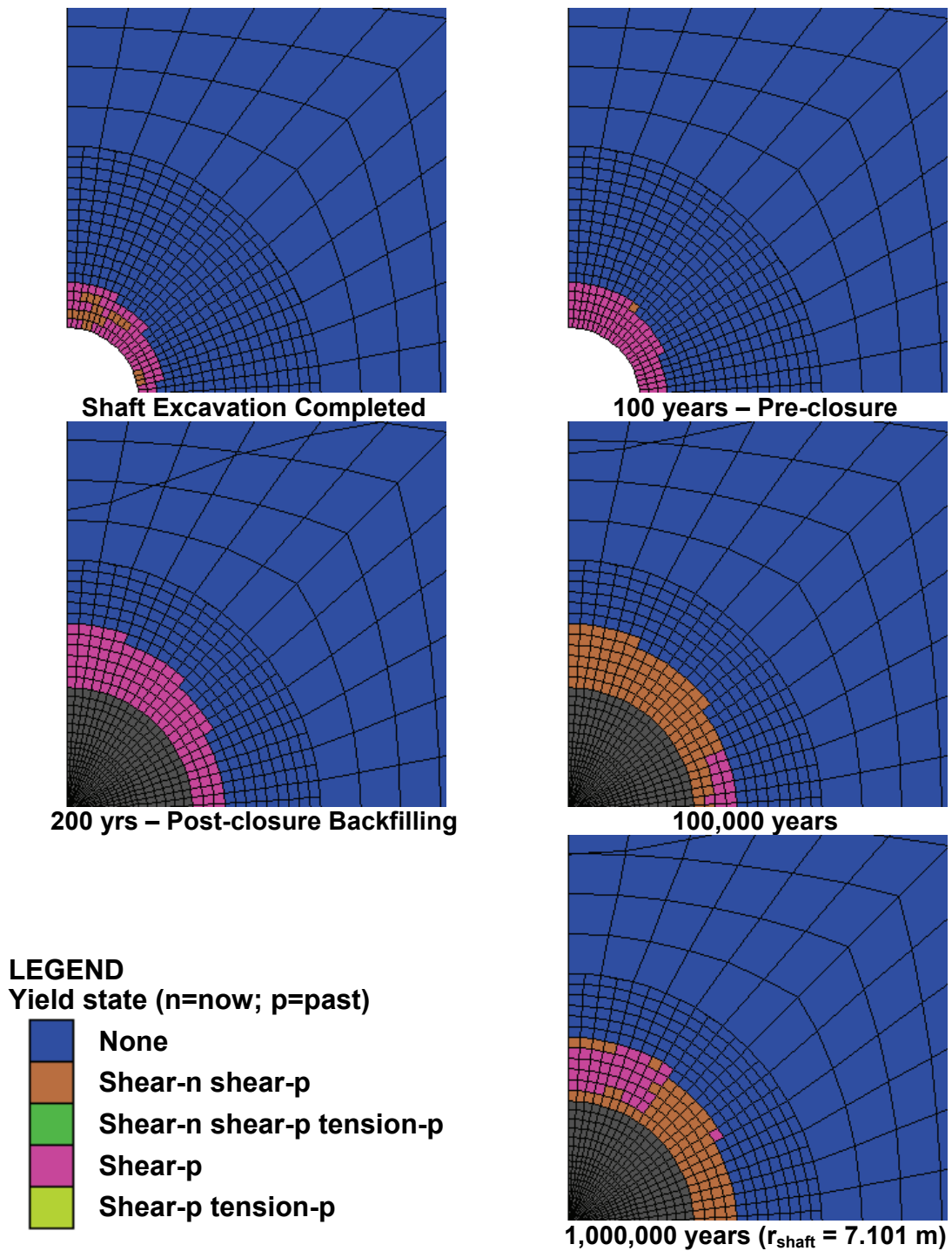


Figure F.4: Yield State – Middle of Concrete Bulkhead: Time-dependent Strength Degradation

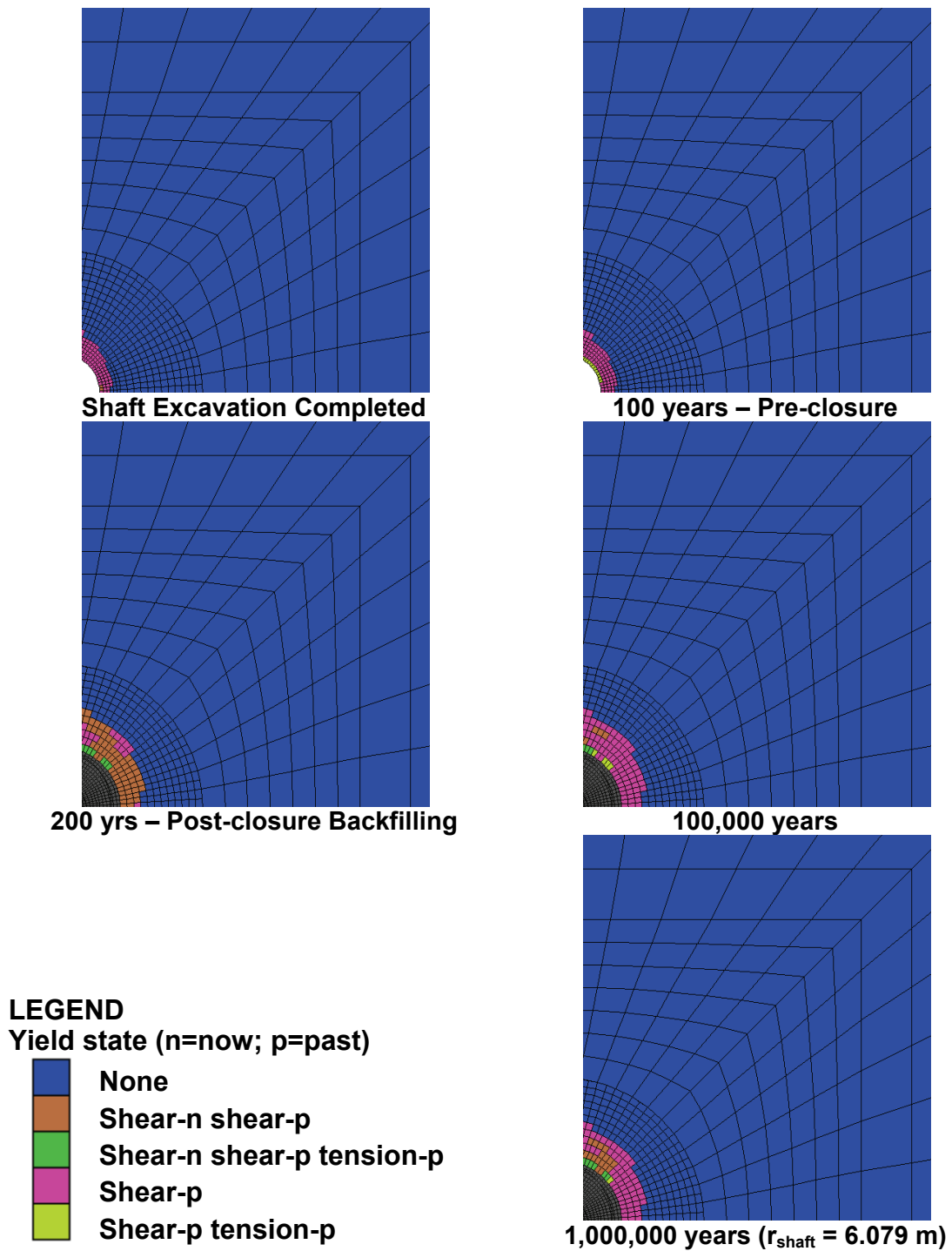


Figure F.5: Yield State – 22.4 m Below Concrete Bulkhead: Time-dependent Strength Degradation

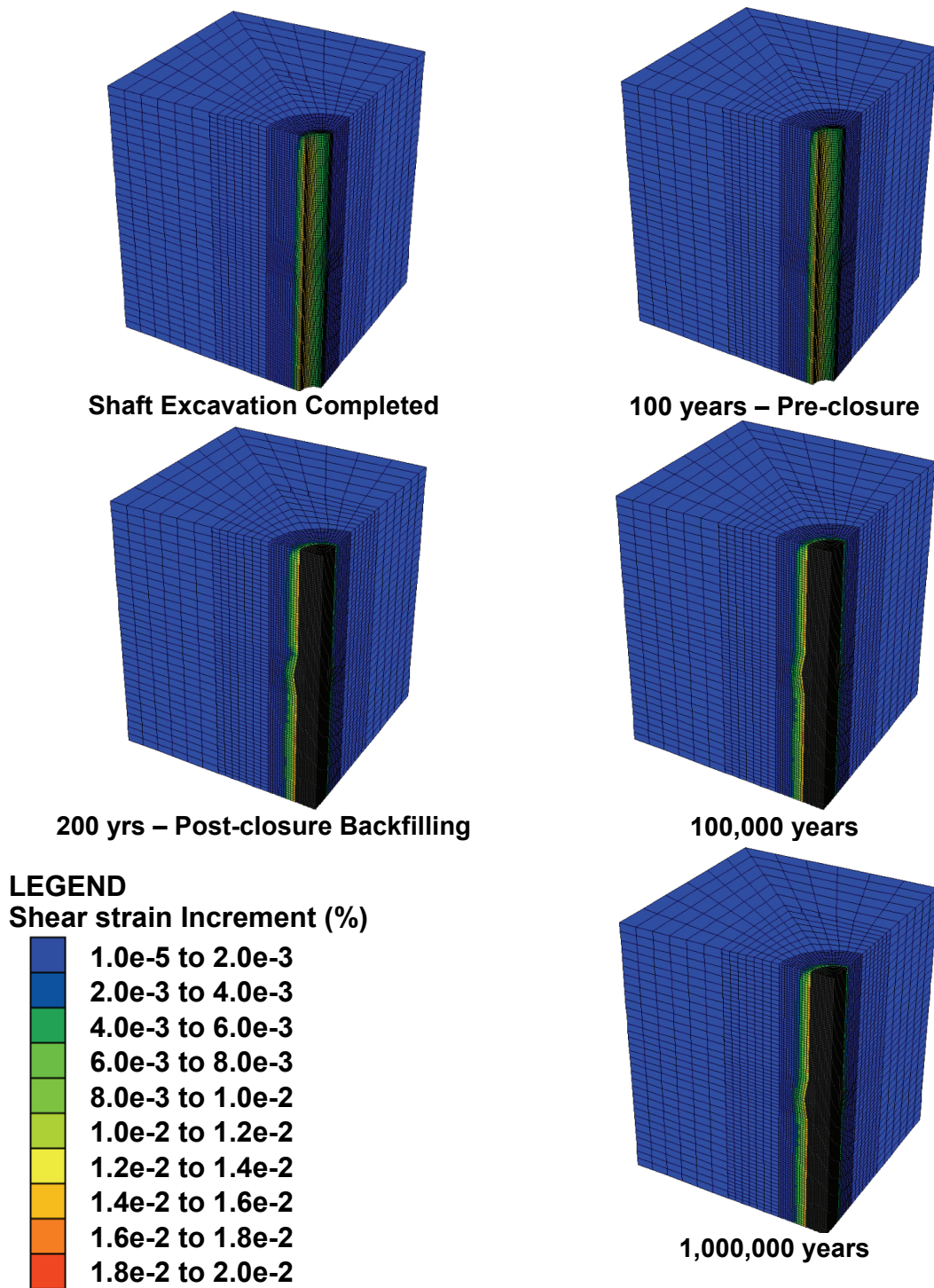


Figure F.6: Shear Strain – Concrete Bulkhead: Time-dependent Strength Degradation

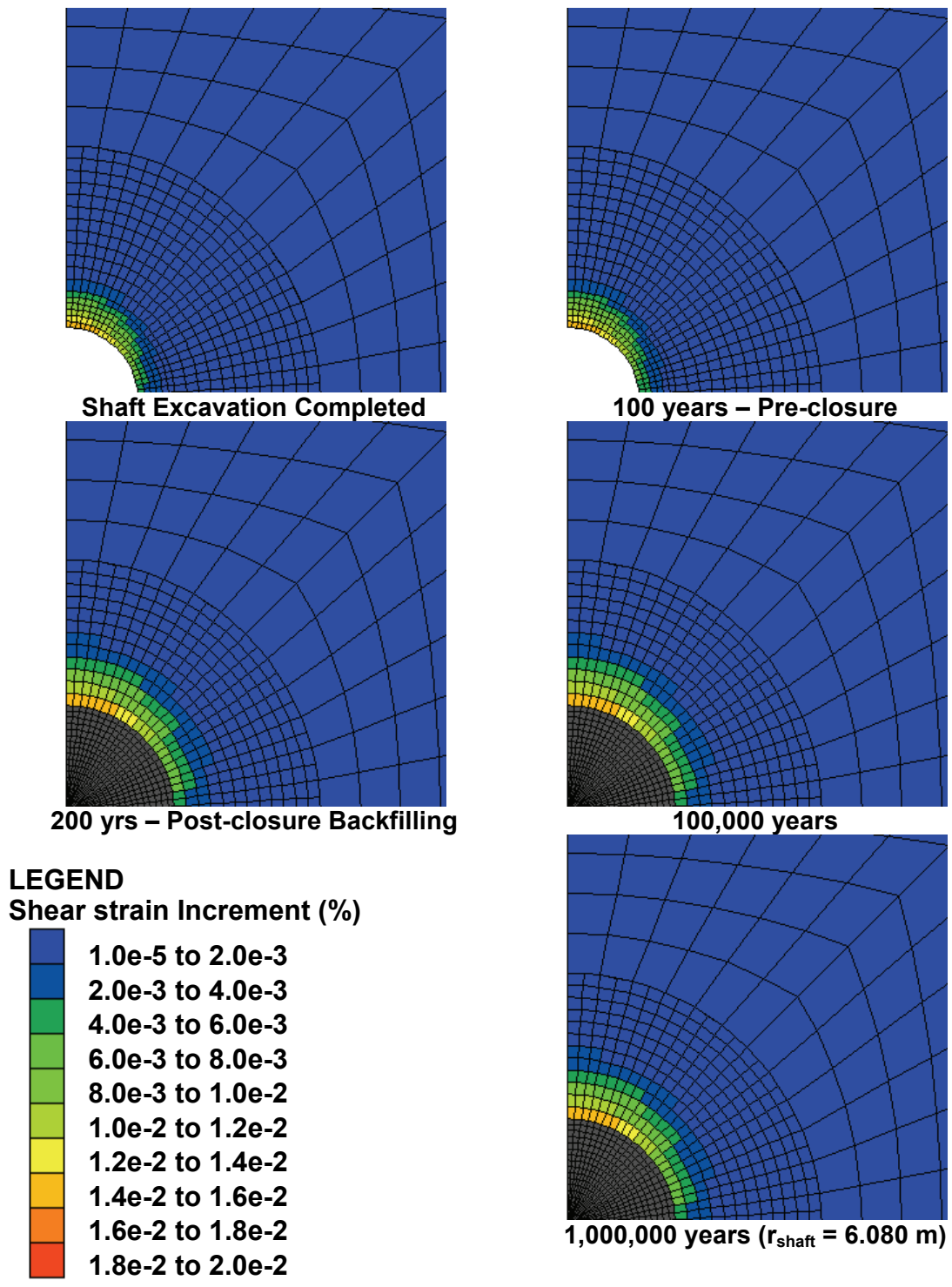


Figure F.7: Shear Strain – 22.4 m Above Concrete Bulkhead: Time-dependent Strength Degradation



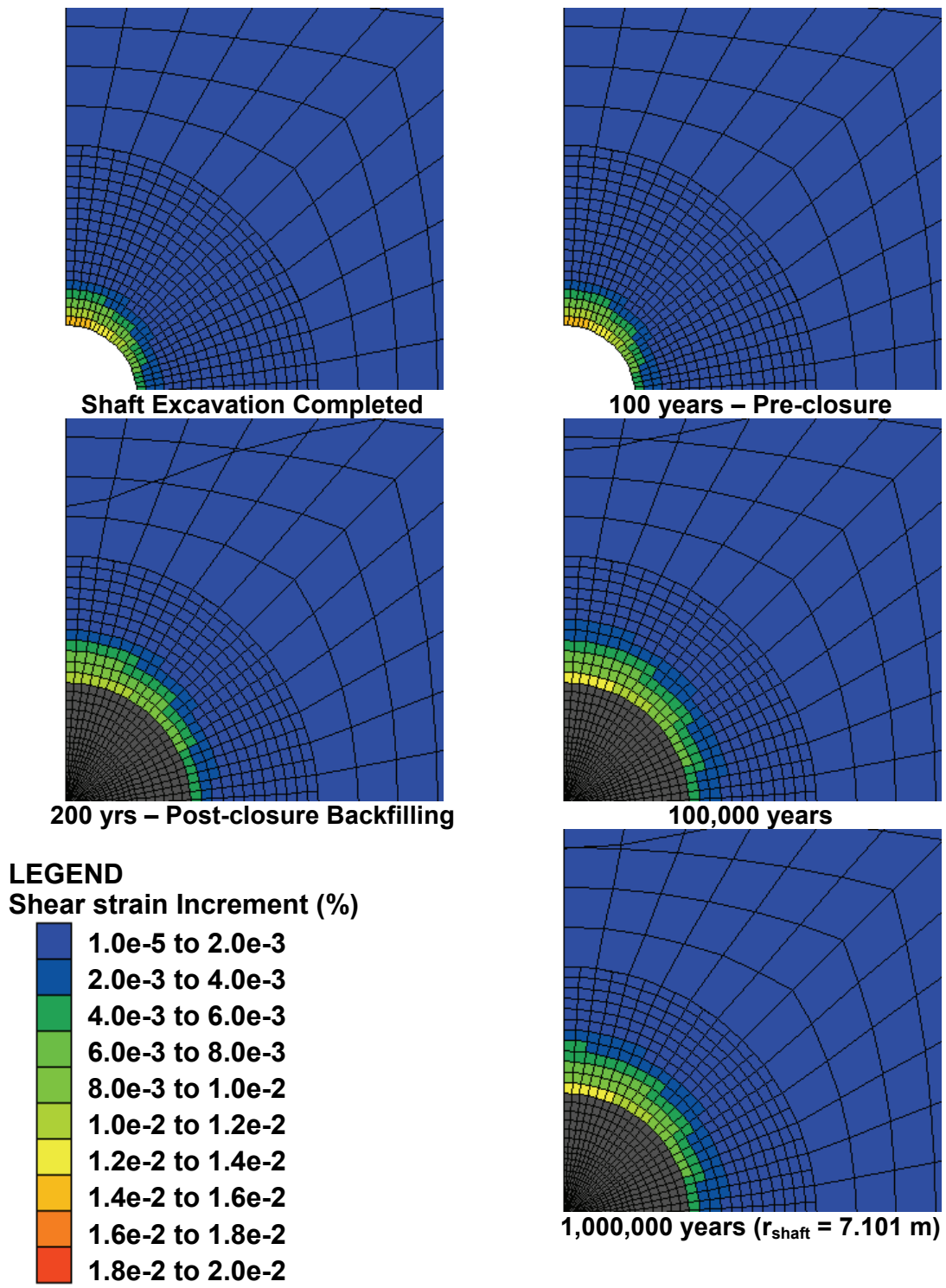


Figure F.8: Shear Strain – Middle of Concrete Bulkhead: Time-dependent Strength Degradation

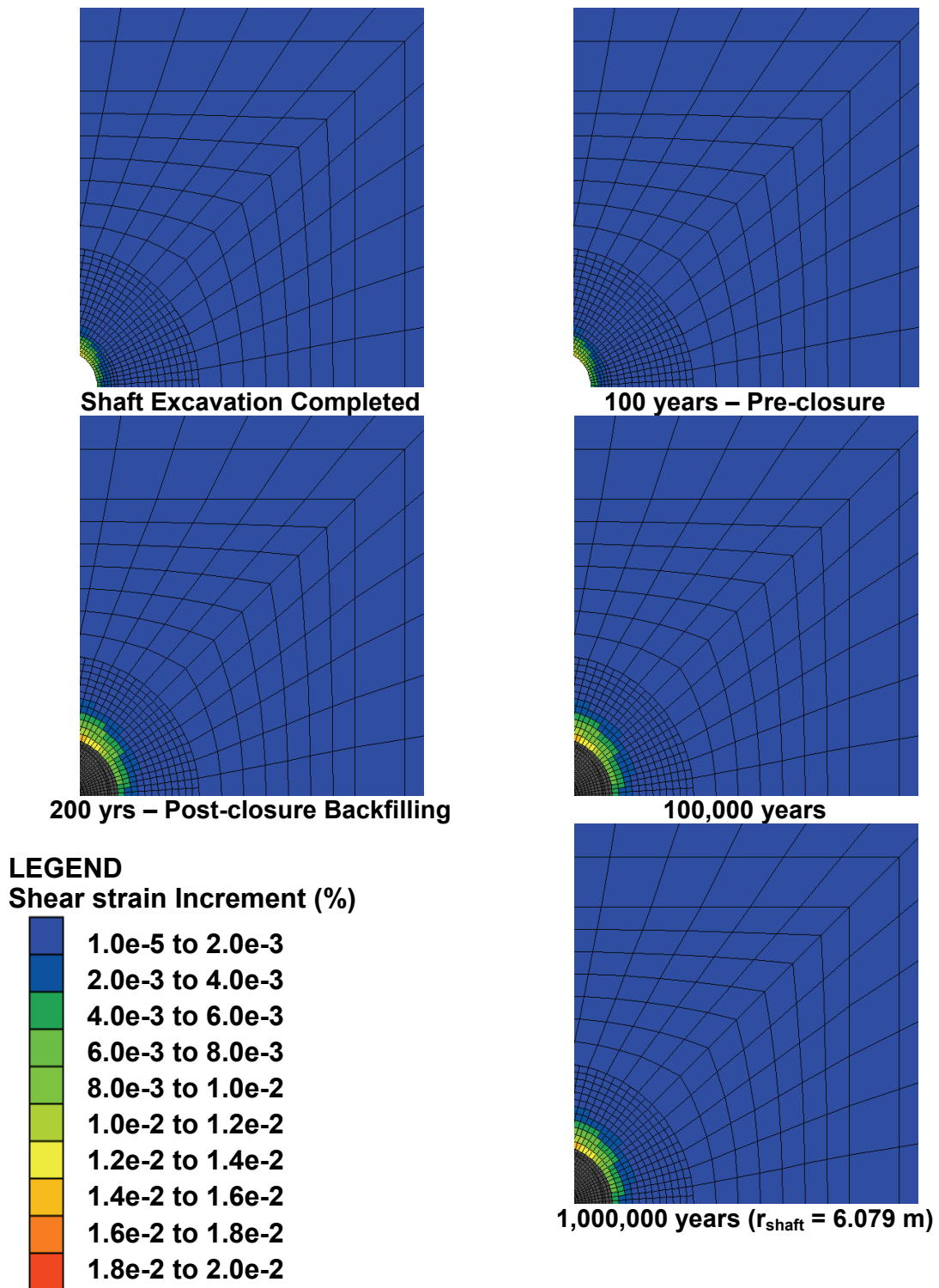


Figure F.9: Shear Strain – 22.4 m Below Concrete Bulkhead: Time-dependent Strength Degradation

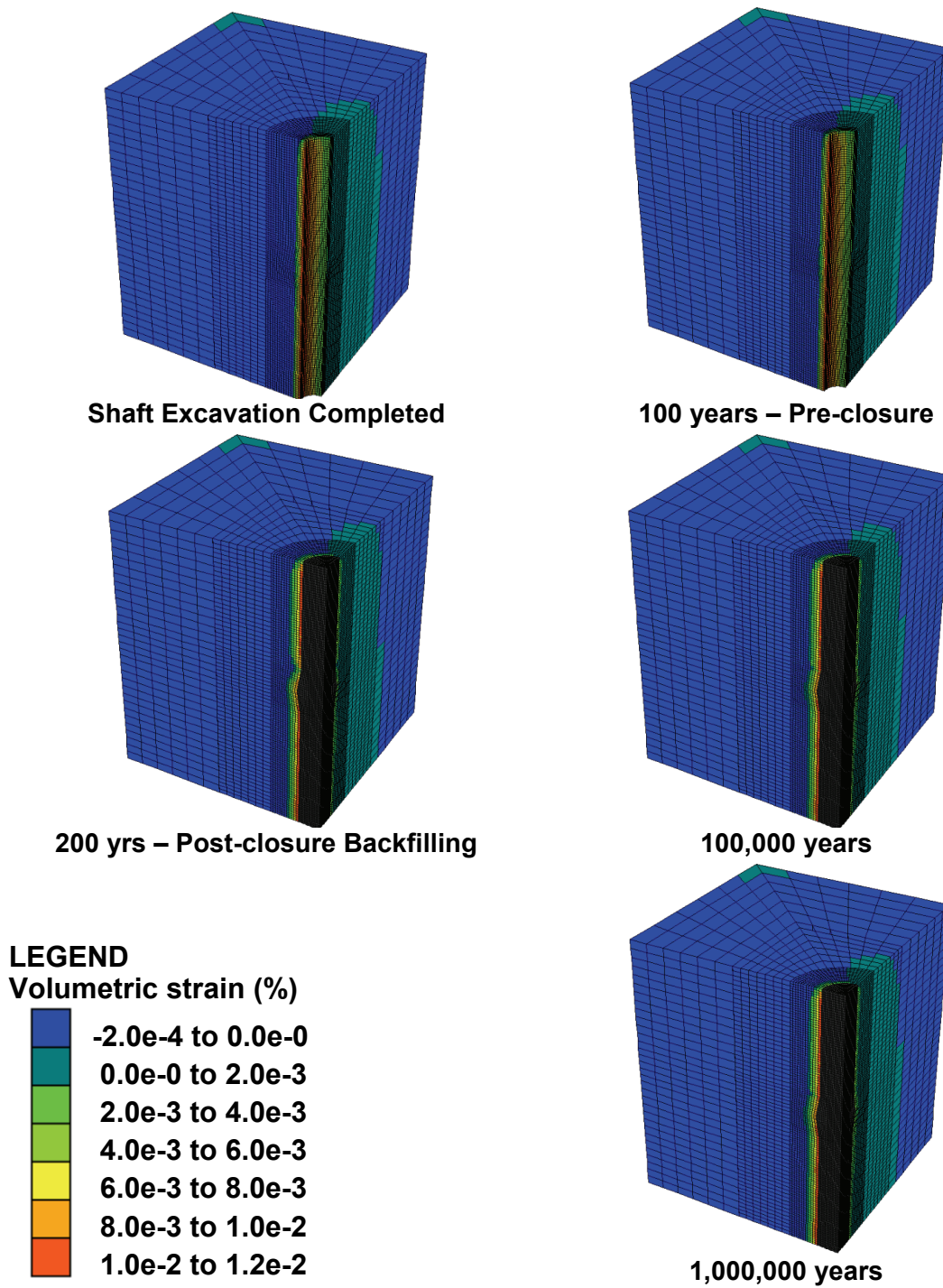


Figure F.10: Volumetric Strain – Concrete Bulkhead: Time-dependent Strength Degradation

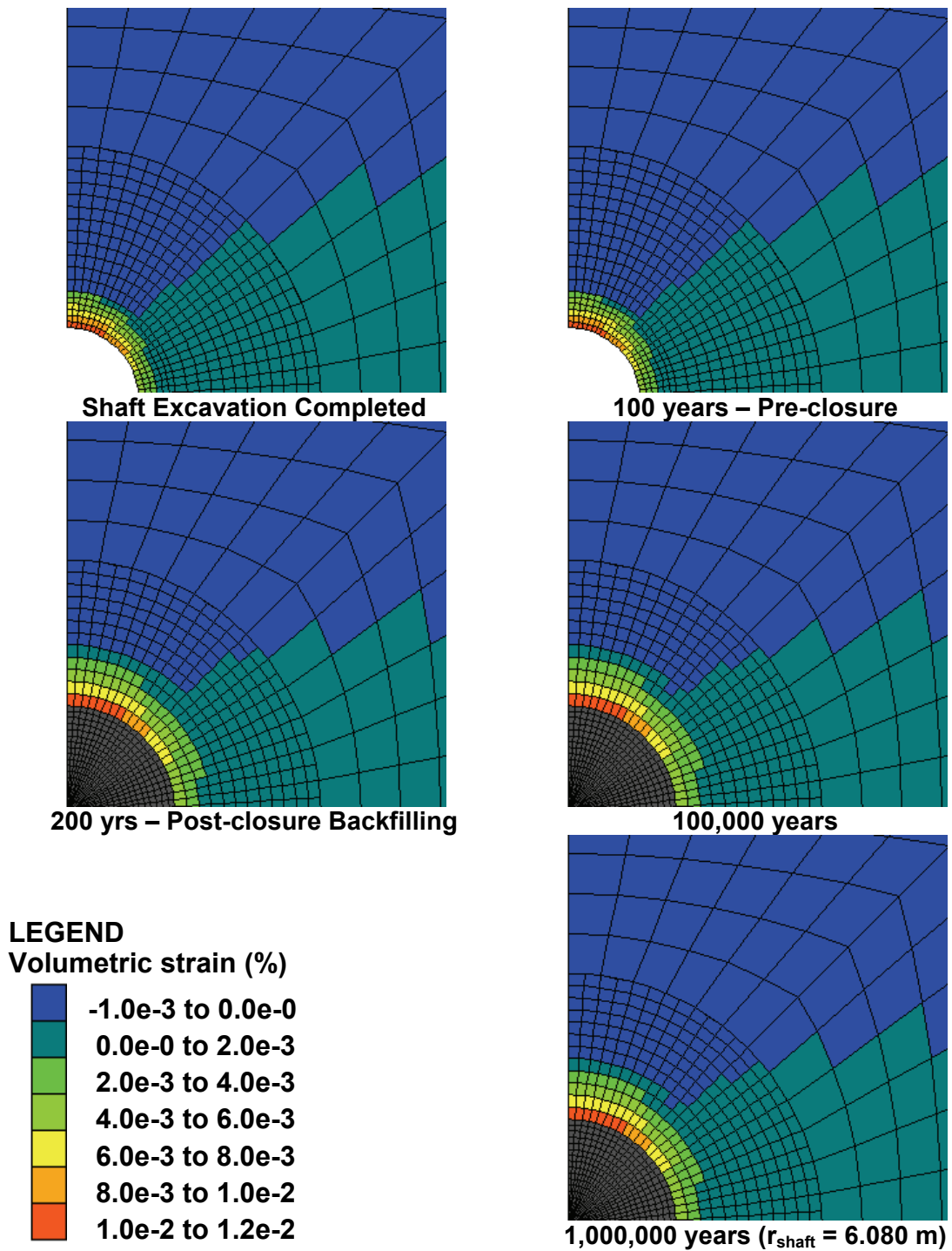
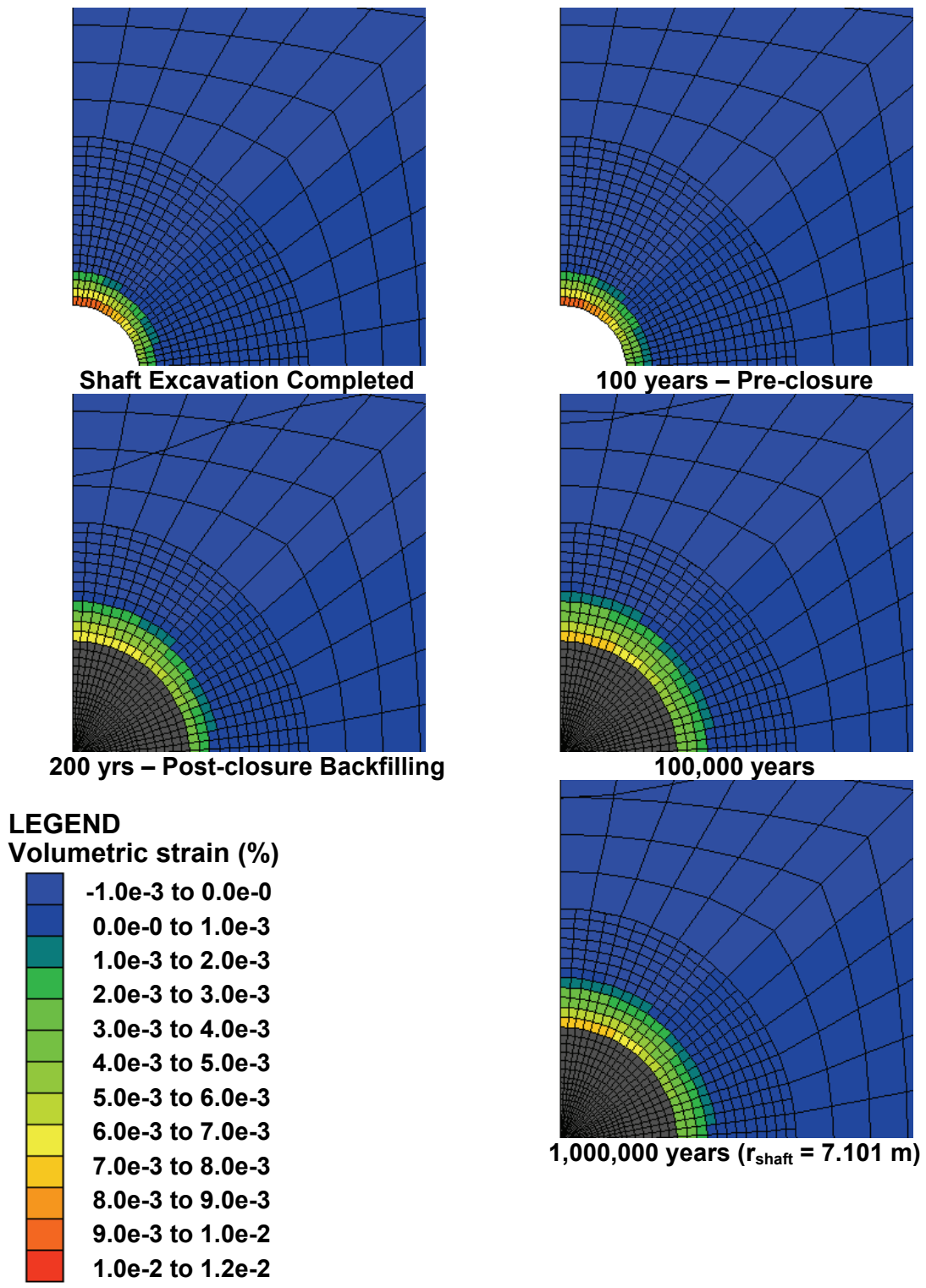


Figure F.11: Volumetric Strain – 22.4 m Above Concrete Bulkhead: Time-dependent Strength Degradation



**Figure F.12: Volumetric Strain – Middle of Concrete Bulkhead: Time-dependent Strength Degradation**

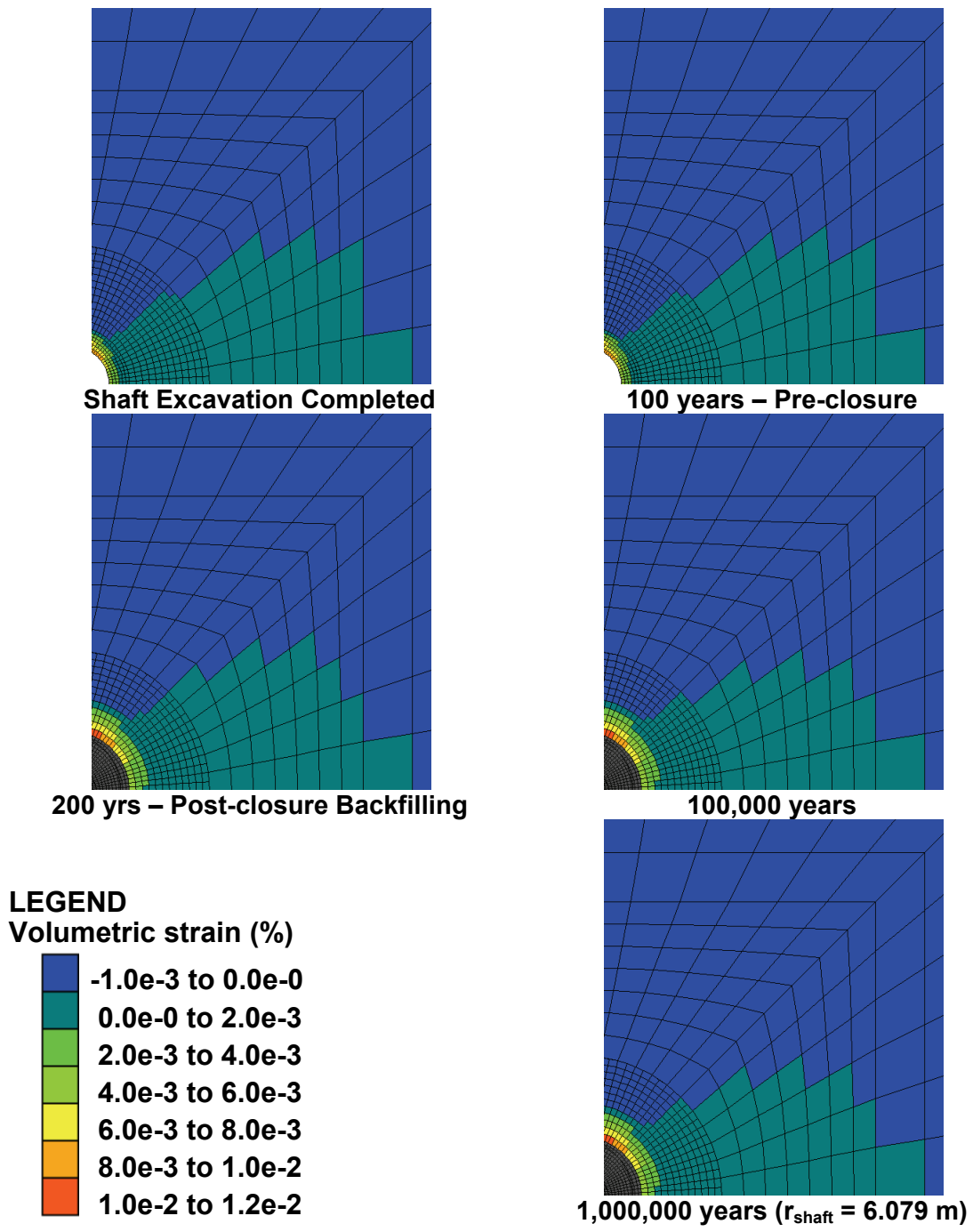


Figure F.13: Volumetric Strain – 22.4 m Below Concrete Bulkhead: Time-dependent Strength Degradation

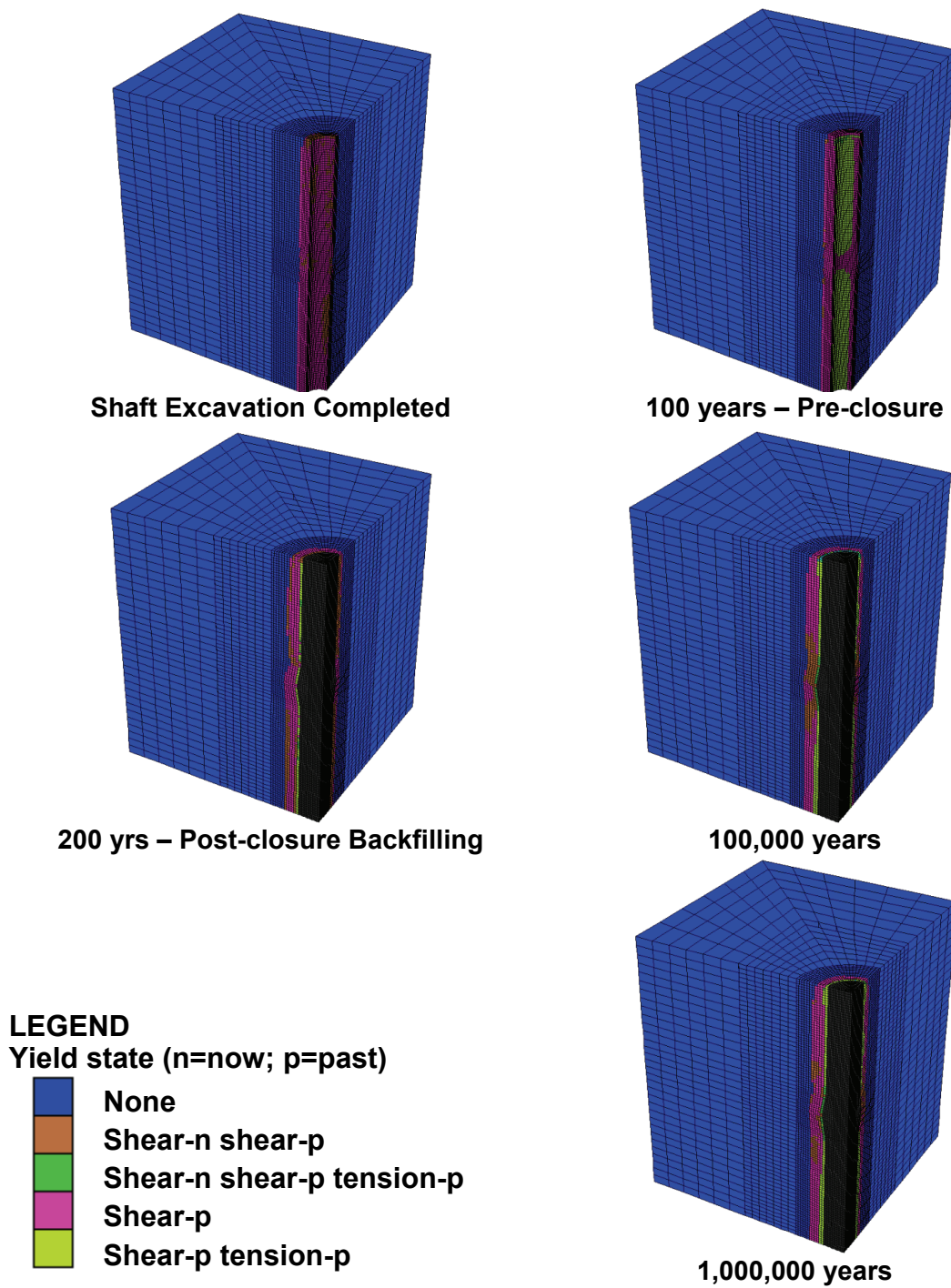


Figure F.14: Yield State – Concrete Bulkhead: Time-dependent Strength Degradation + Glacial Load

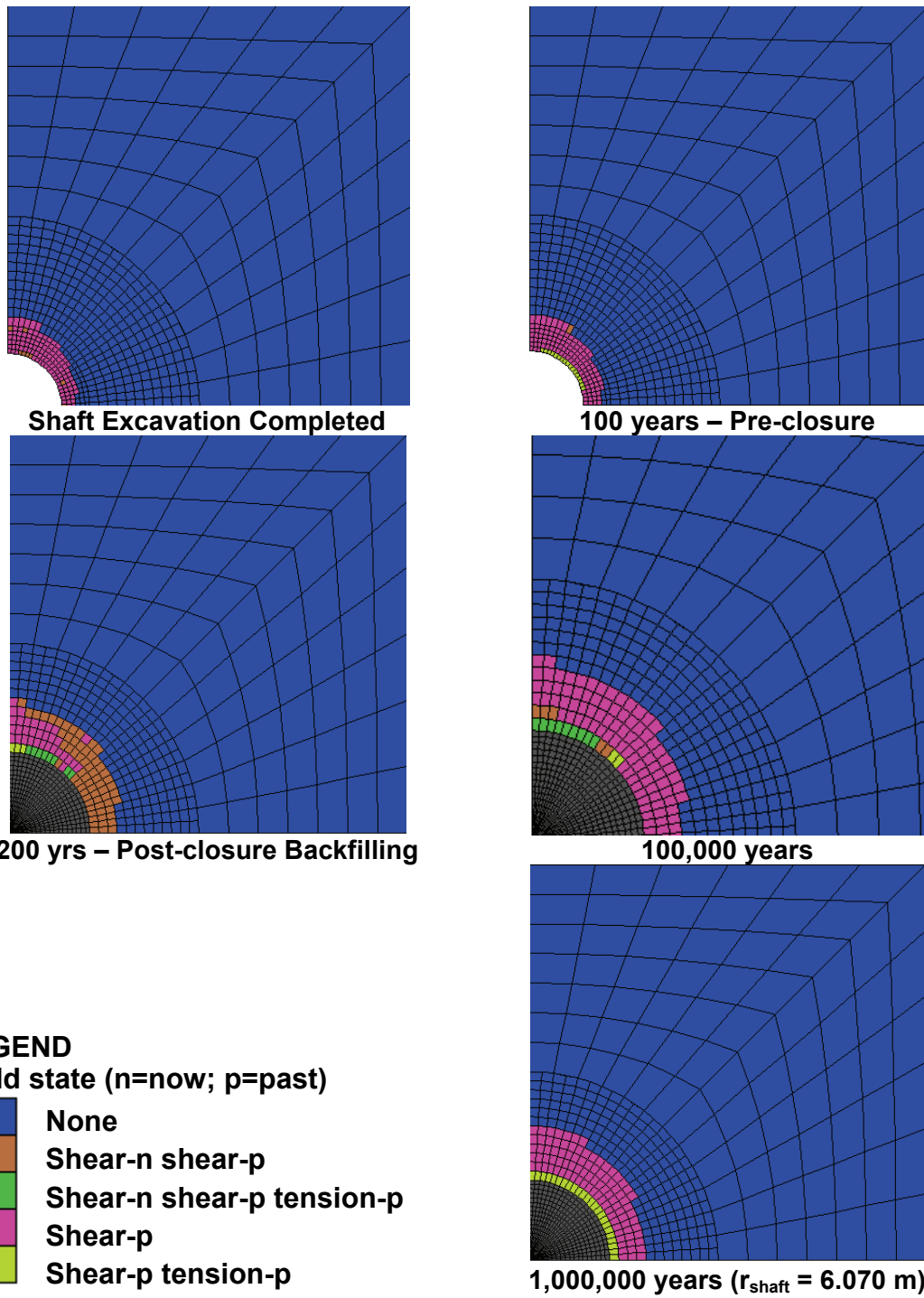
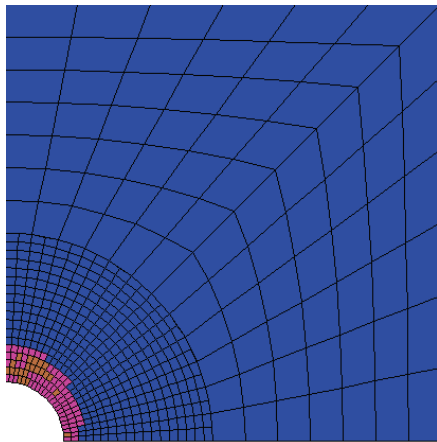
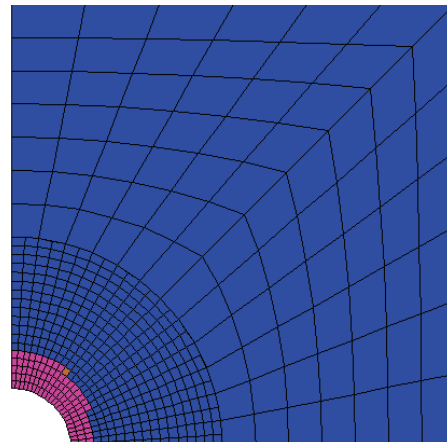


Figure F.15: Yield State – 22.4 m Above Concrete Bulkhead: Time-dependent Strength Degradation + Glacial Load

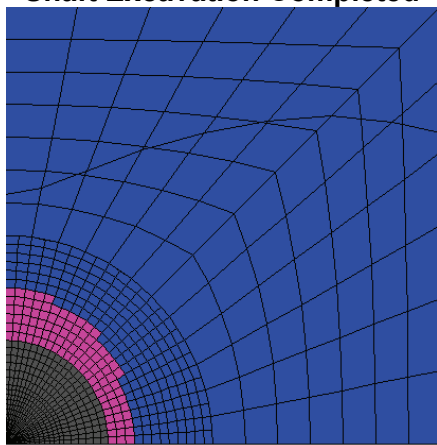




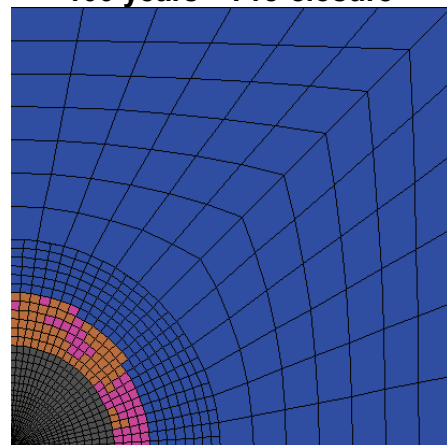
**Shaft Excavation Completed**



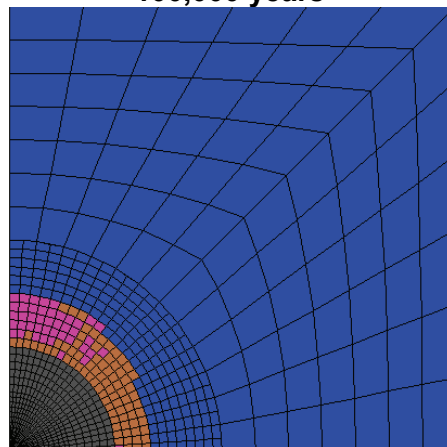
**100 years - Pre-closure**



**200 yrs - Post-closure Backfilling**



**100,000 years**



**1,000,000 years ( $r_{\text{shaft}} = 7.100 \text{ m}$ )**

**LEGEND**

Yield state (n=now; p=past)

- None
- Shear-n shear-p
- Shear-n shear-p tension-p
- Shear-p
- Shear-p tension-p

**Figure F.16: Yield State – Middle of Concrete Bulkhead: Time-dependent Strength Degradation + Glacial Load**

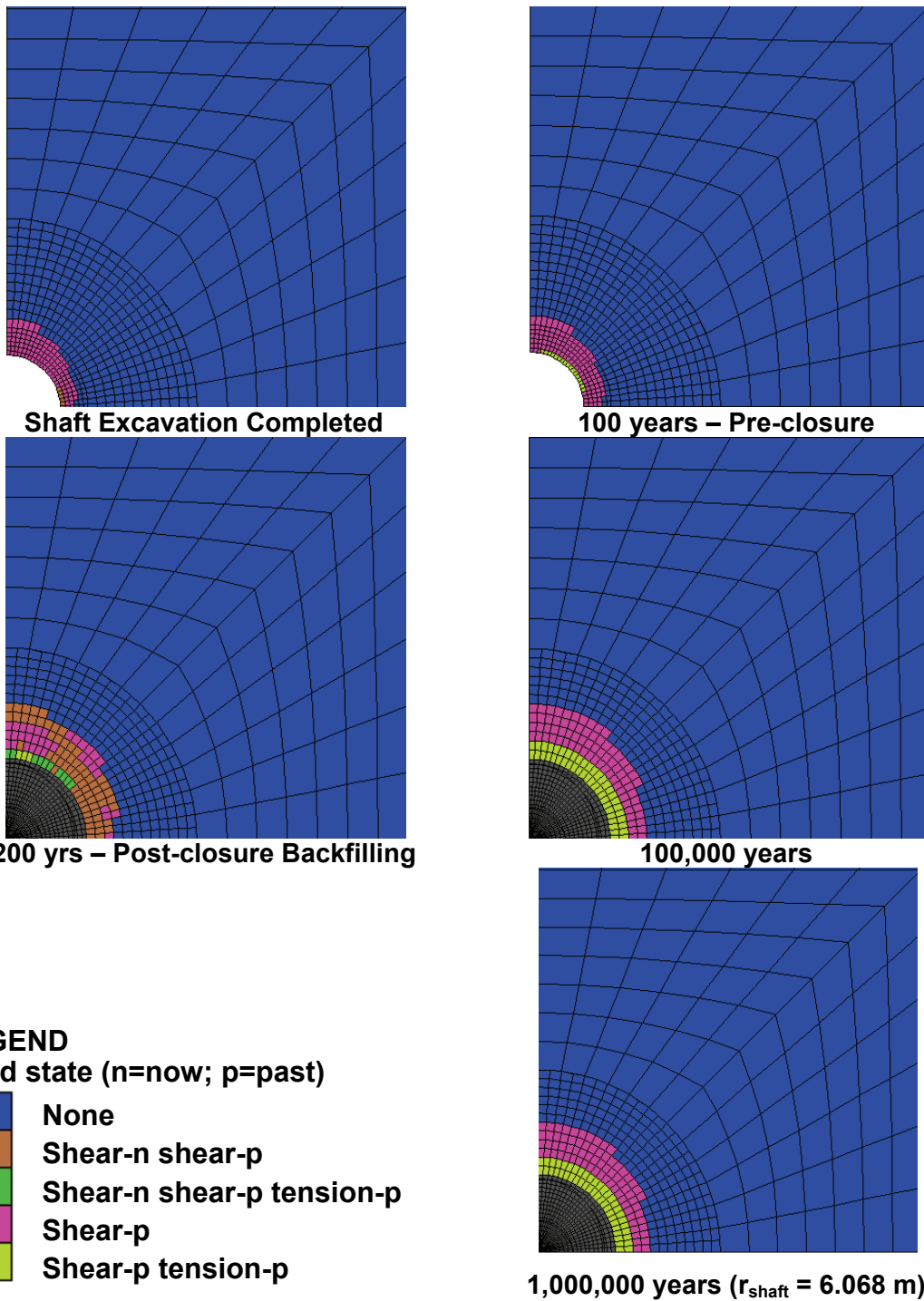


Figure F.17: Yield State – 22.4 m Below Concrete Bulkhead: Time-dependent Strength Degradation + Glacial Load

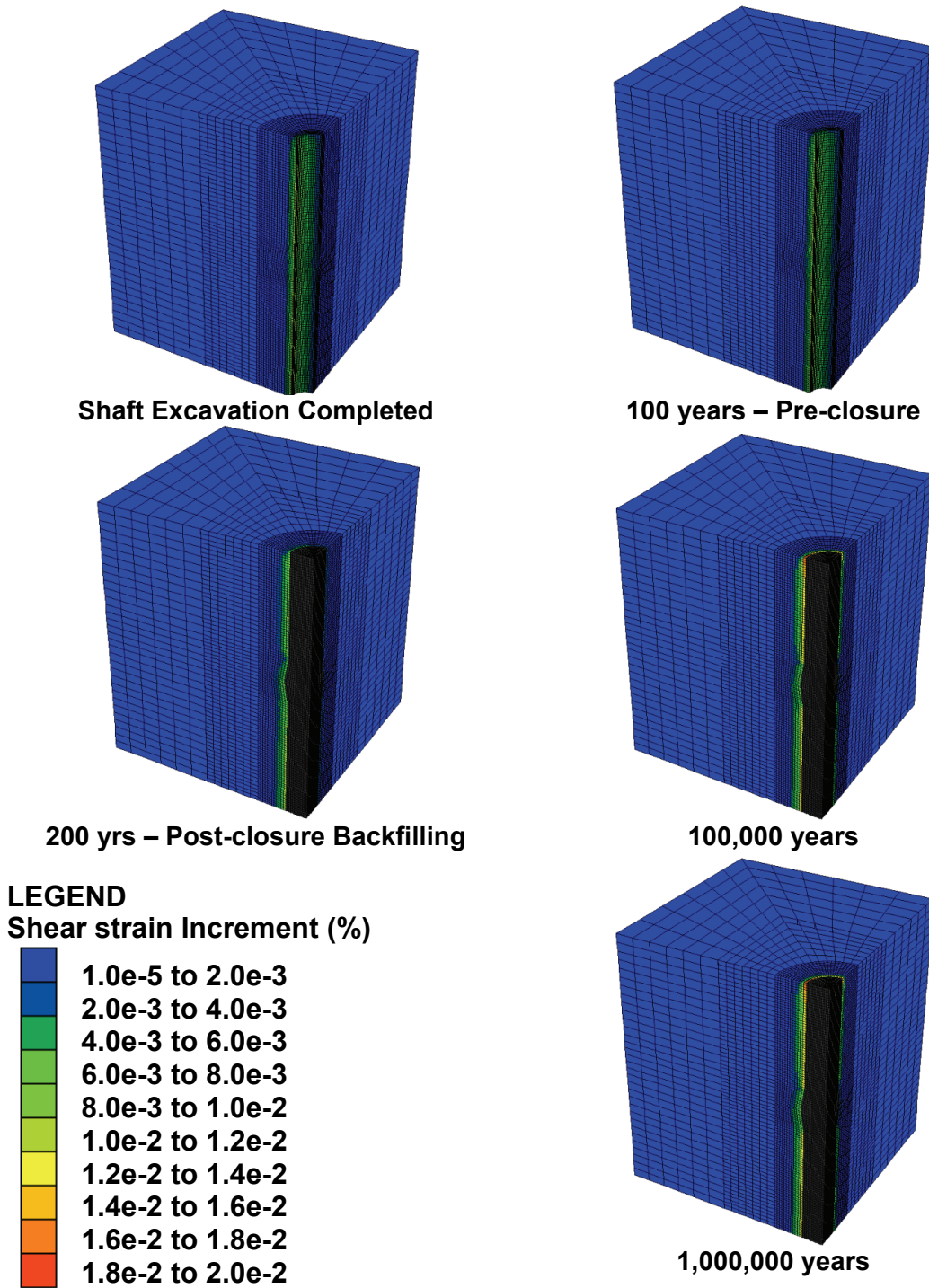


Figure F.18: Shear Strain – Concrete Bulkhead: Time-dependent Strength degradation + Glacial Load

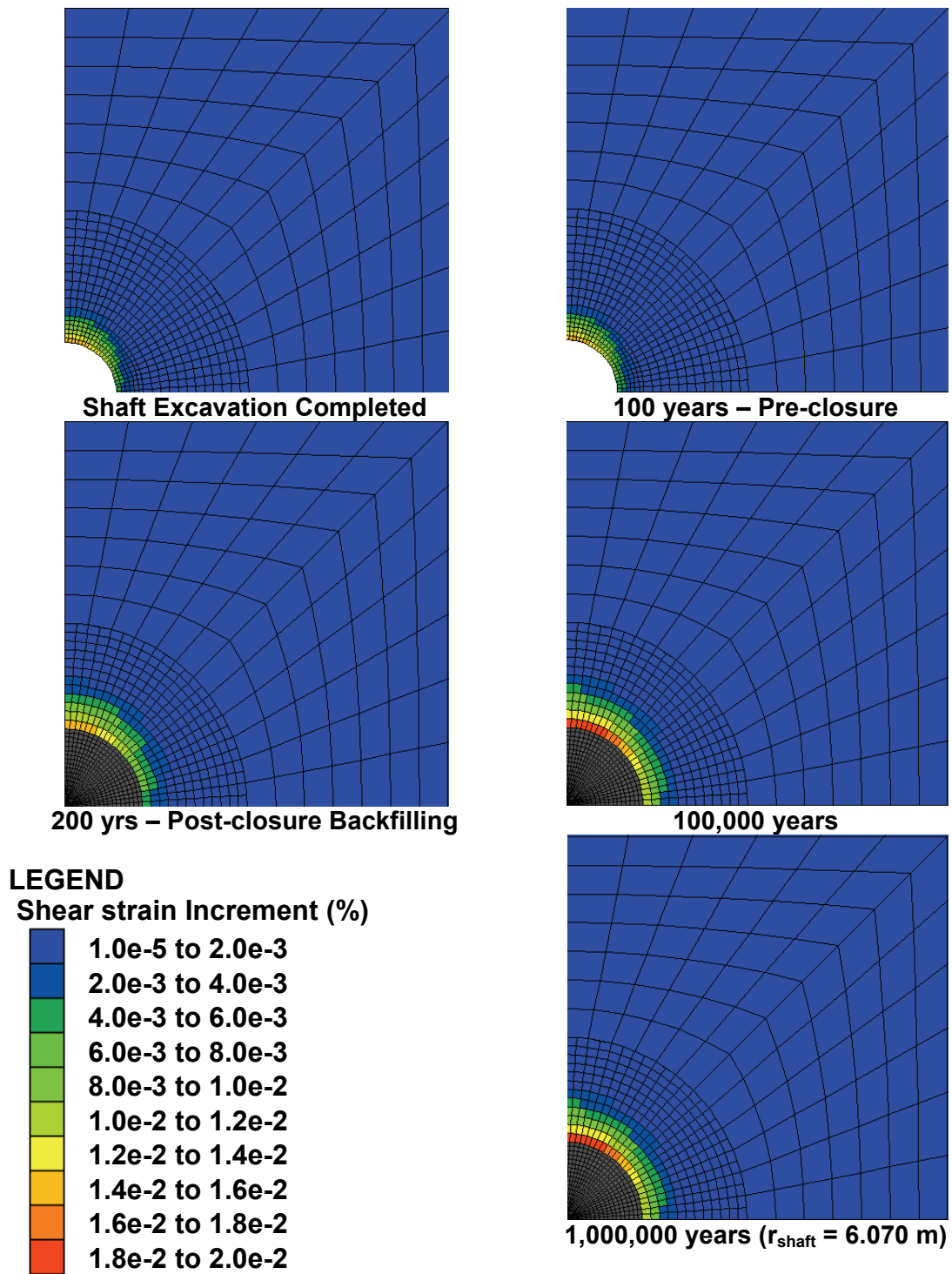


Figure F.19: Shear Strain – 22.4 m Above Concrete Bulkhead: Time-dependent Strength Degradation + Glacial Load

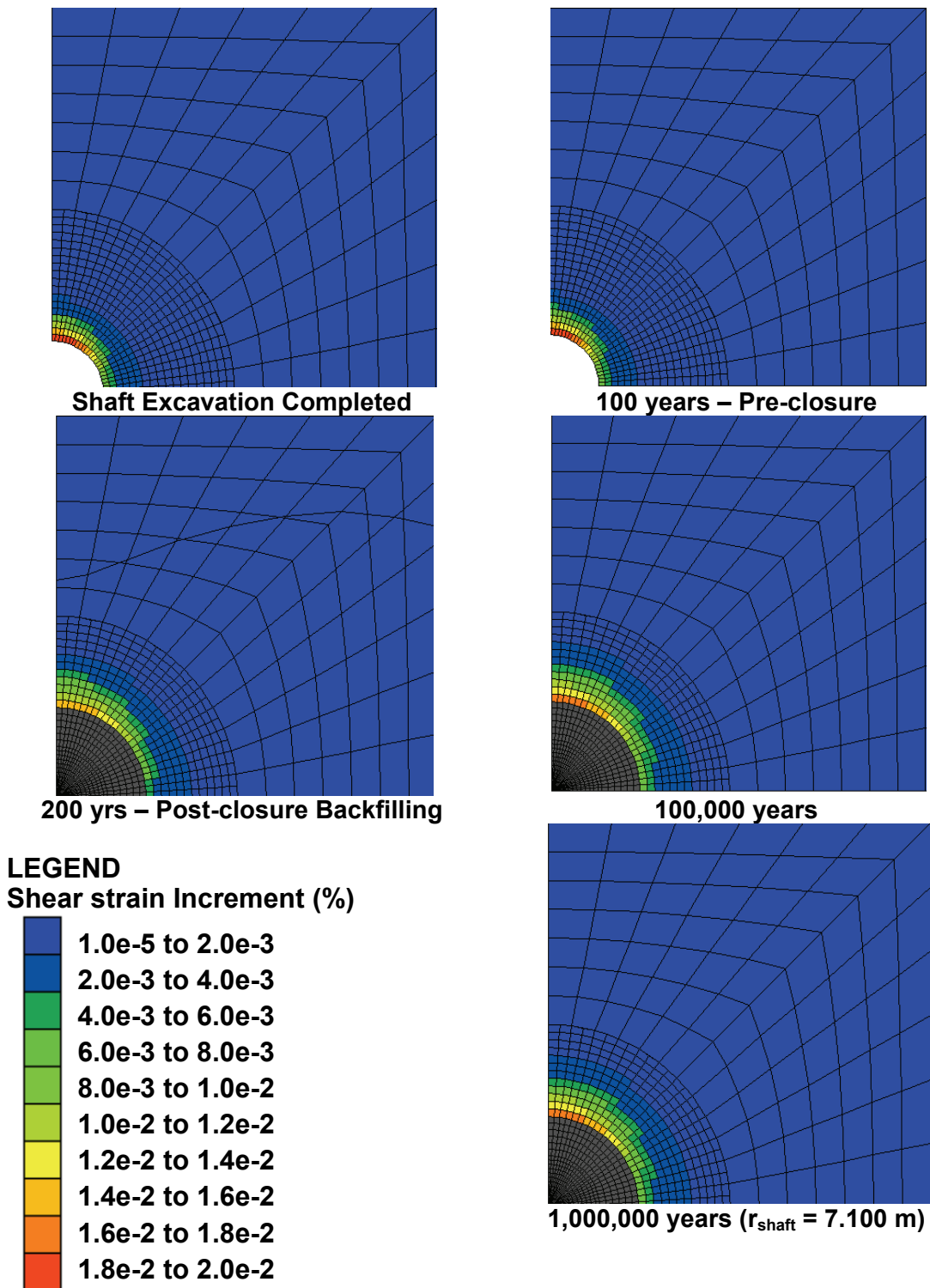


Figure F.20: Shear Strain – Middle of Concrete Bulkhead: Time-dependent Strength Degradation + Glacial Load

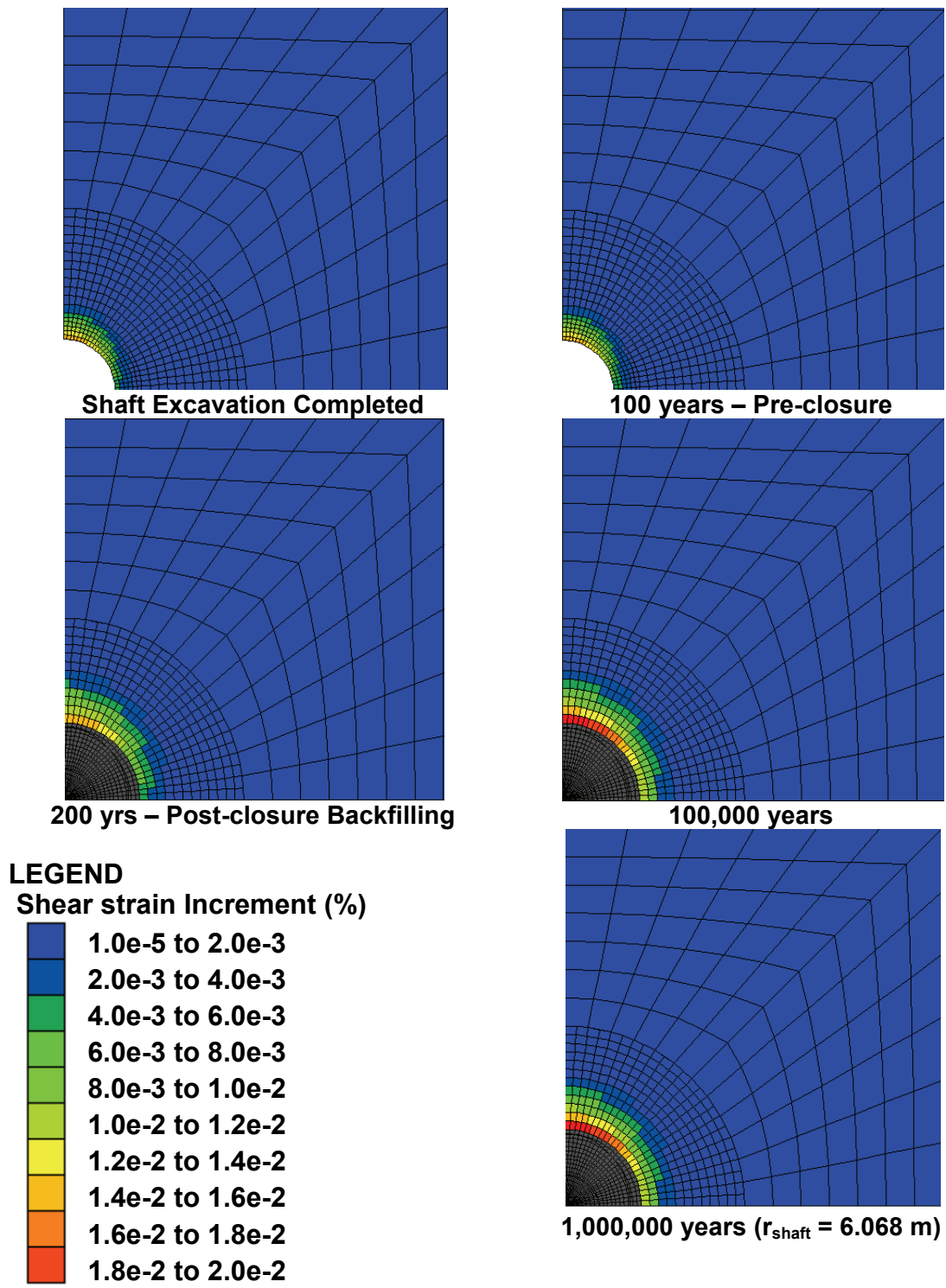


Figure F.21: Shear Strain – 22.4 m Below Concrete Bulkhead: Time-dependent Strength Degradation + Glacial Load

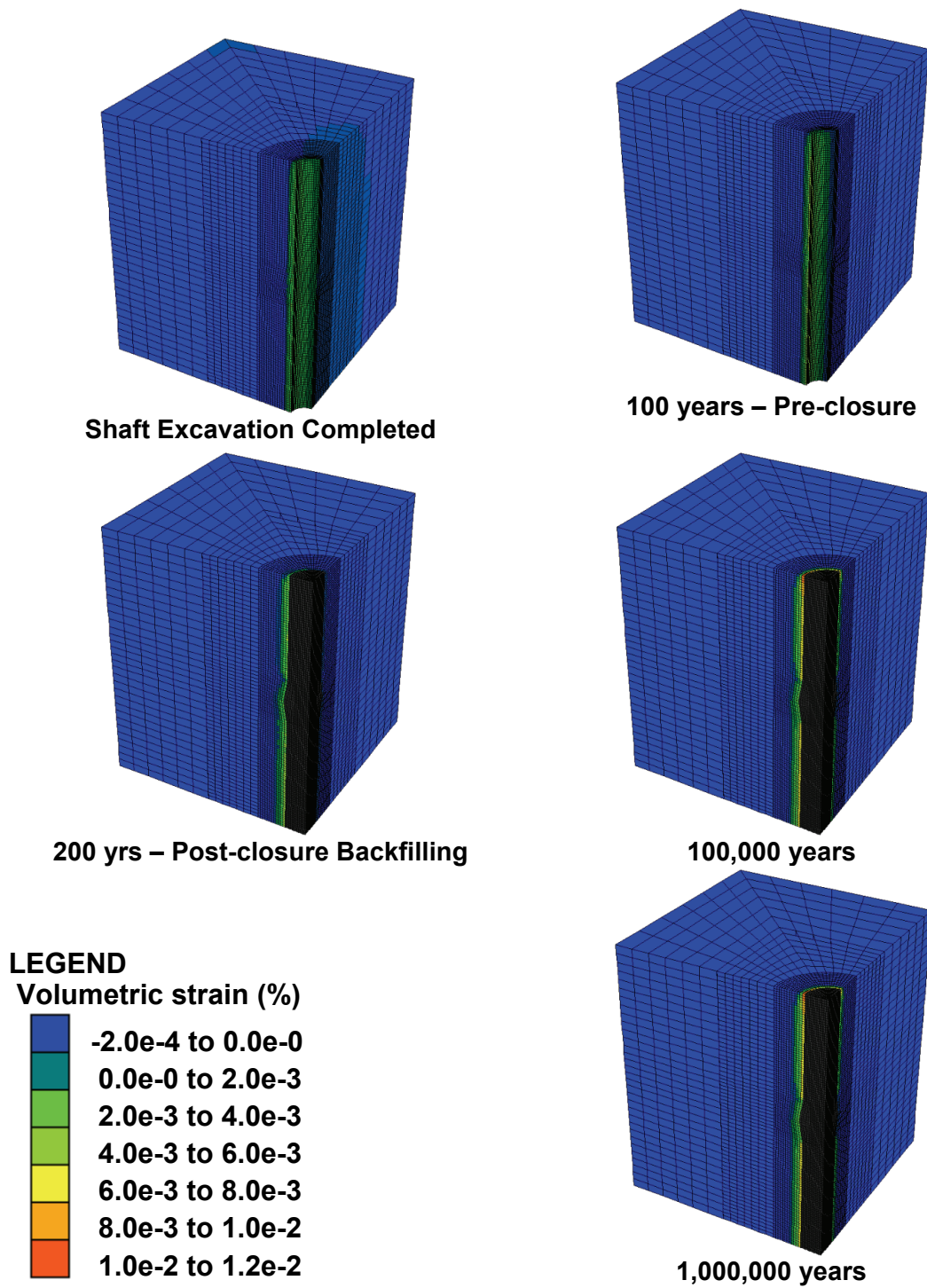


Figure F.22: Volumetric Strain – Concrete Bulkhead: Time-dependent Strength Degradation + Glacial Load

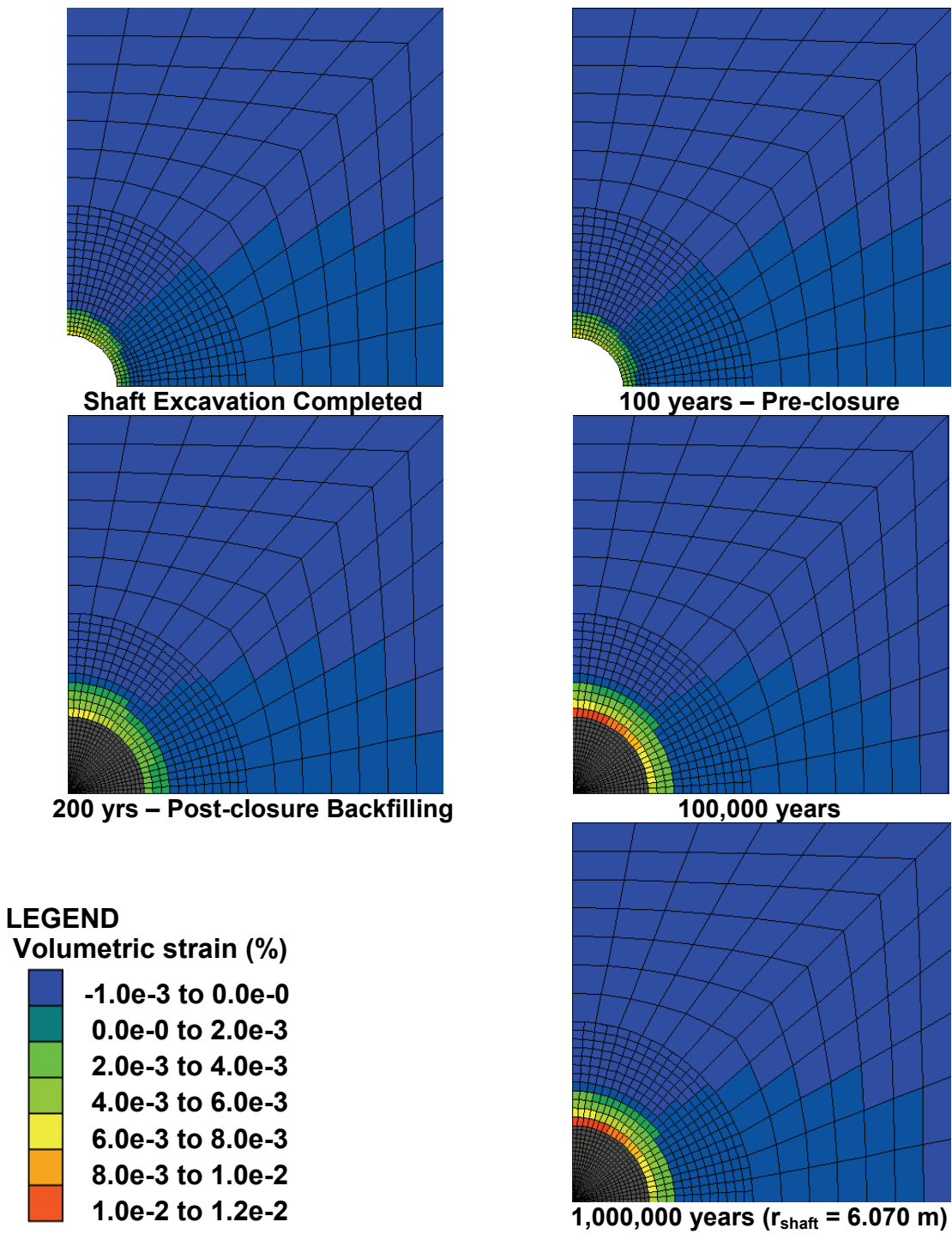


Figure F.23: Volumetric Strain – 22.4 m Above Concrete Bulkhead: Time-dependent Strength Degradation + Glacial Load



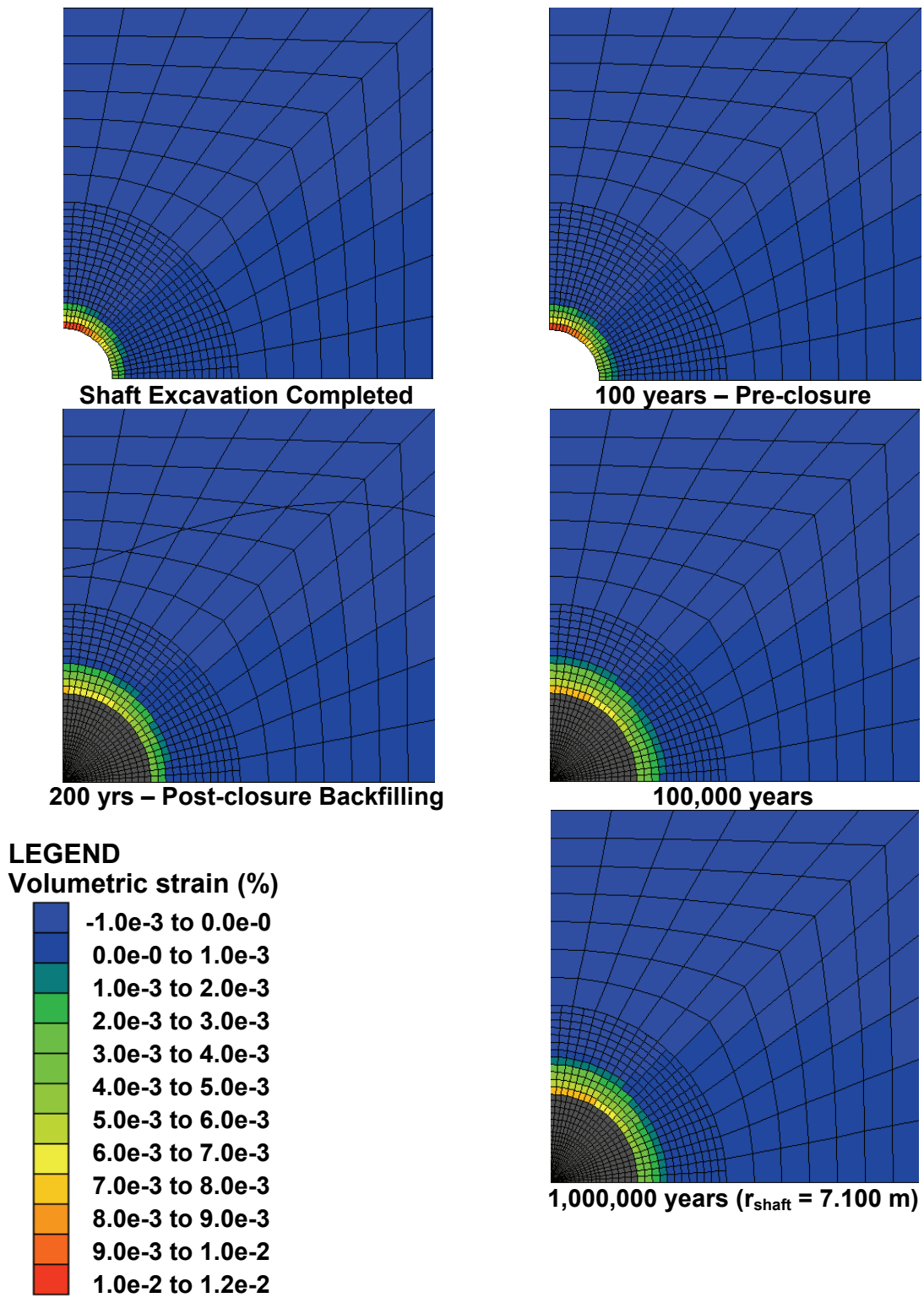


Figure F.24: Volumetric Strain – Middle of Concrete Bulkhead: Time-dependent Strength Degradation + Glacial Load

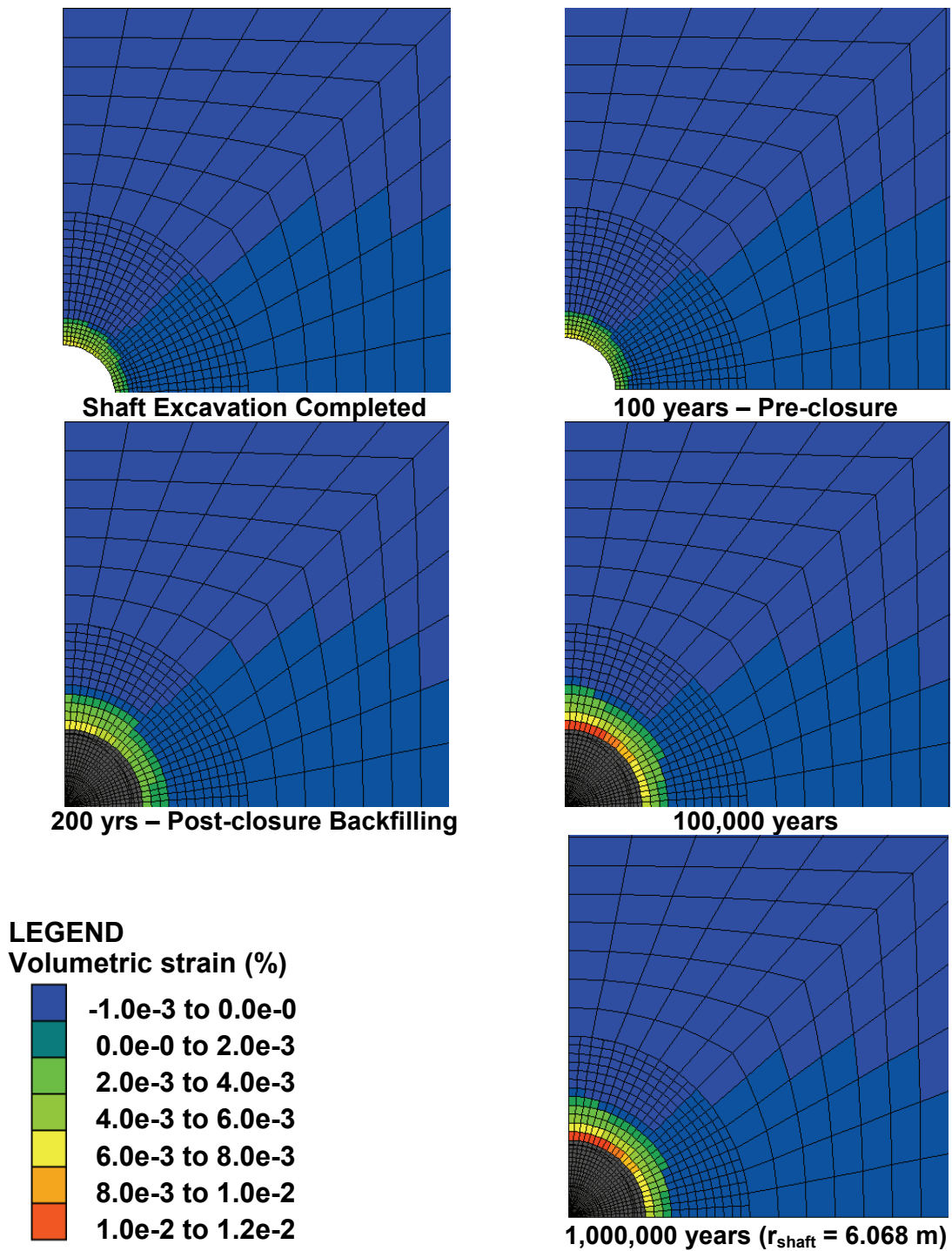


Figure F.25: Volumetric Strain – 22.4 m Below Concrete Bulkhead: Time-dependent Strength Degradation + Glacial Load