

VEDLEGG 5

PLAXISBEREGNINGER

Plaxisberegninger er utført med Plaxis 2D, og under vises beregningsresultater hentet fra Plaxis Output. Plaxis 2D er et geoteknisk beregningsprogram som er basert på finite element-metoden (FEM).

Notatet viser lagdeling og bruddmekanisme med sikkerhetsfaktor for følgende snitt:

- Snitt A
- Snitt B
- Snitt C
- Snitt D

Beregningene viser bruddmekanisme med udrenert tilstand med NGI-ADP jordmodell og drenert tilstand med Hardening soil jordmodell.

For snitt B, C og snitt D er det utført beregninger i Holendalen og Sanddalen.

Laster og lastfaktor

Laster og lastfaktor fastsettes iht. Håndbook SVV N200 (Statens vegvesen, 2022) og Eurokode 0 (Norsk Standard).

Laster er hentet fra Eurokode 1 (Norsk Standard, 2010). Det er antatt 10-20 kPa for last fra boliger, avhengig av størrelse.

For geotekniske laster benyttes lastfaktor 1,0 for permanente laster og 1,3 for variable laster. (ECO: Tabell NA. A1. 2(C)).

Lagdeling og fargekoder

Lagdelingen som er presentert i snittene er oppsummert i figurene under, sammen med fargekode for tilhørende lag.



Tabell 1: Materialparametere (Hardening Soil Drenert) for tørrskorpe og fyllmasse.

Jordparametere	Tørrskorpe	Fyllmasse/sprengstein
Jordmodell	Hardening Soil	Hardening Soil
Dreneringstype	Drenert	Drenert
Tyngdetetthet, unsat	20 kN/m ³	19 kN/m ³
Tyngdetetthet, sat	20 kN/m ³	19 kN/m ³
E-modul, E50Ref	20E3 kN/m ²	40E3 kN/m ²
E-modul ødometer, EoedRef	20E3 kN/m ²	40E3 kN/m ²
E-modul unloading/reloading, EurRef	60E3 kN/m ²	120E3 kN/m ²
Poisson ratio, ν	0,2	0,2
Power m	1	1
Cohesion, C ref	5 kN/m ²	5 kN/m ²
Cohesion, c_{inc}	2,5 kN/m ² /m	2,5 kN/m ² /m
Yref, vertical ref, kote	*Varierer	*Varierer
Friksjonsvinkel, ϕ	33 grader	42 grader
psi	0 grader	0 grader

Tabell 2: Materialparametere (NGI-ADP Udrenert) for sprøbrudd/kvikkleire og leire.

Jordparametere	Sprøbrudd/kvikkleire	Leire
Jordmodell	NGI-ADP	NGI-ADP
Dreneringstype	Udrenert C	Udrenert C
Tyngdetetthet, unsat	18,5 kN/m ³	19,5 kN/m ³
Gur/SuA	250	350
Vu (nu)	Default (0,495)	Default (0,495)
SuAref	45-50 kN/m ²	65 kN/m ²
SuAinc	2,5 kN/m ² /m	5-7,5 kN/m ² /m
Yref, vertical ref, kote	*Varierer	*Varierer
SuP/SuA	0,35	0,36-0,38
SuDSS/SuA	0,63	0,64-0,66
Gamma fC	1,0	1,0
Gamma Fe	2,0	2,0
Gamma fDSS	1,5	1,5
Tau/Su_A	0,5	0,5

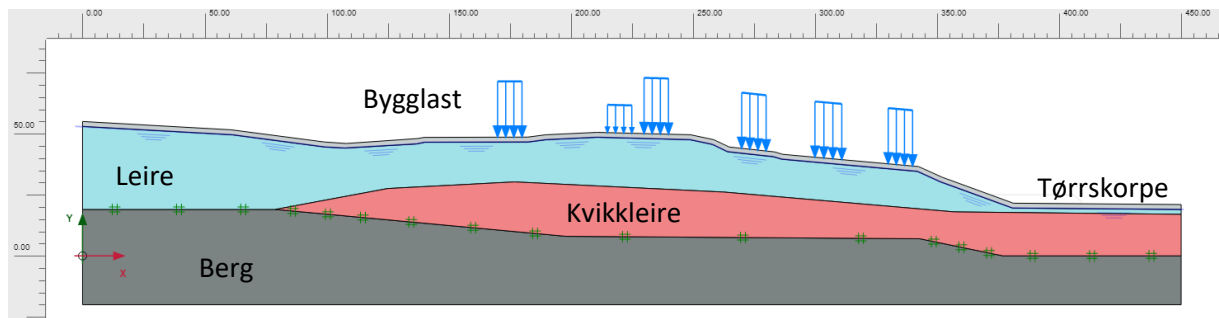


Tabell 3: Materialparametere (Hardening Soil Udrenert/Drenert) for sprøbrudd/kvikkleire og leire.

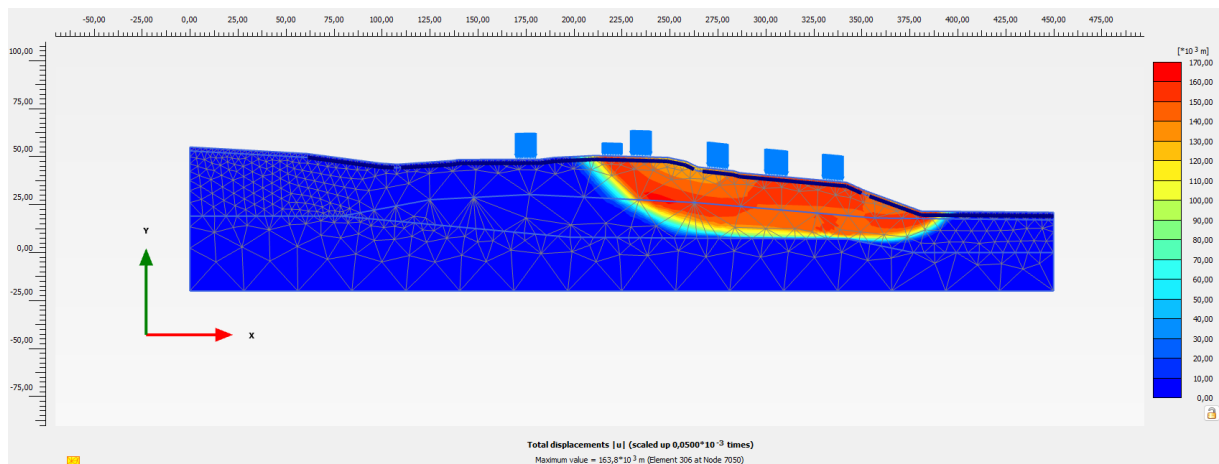
Jordparametere	Sprøbrudd/kvikkleire	Leire
Jordmodell	Hardening Soil	Hardening Soil
Dreneringstype	Udrenert/ Drenert	Udrenert/ Drenert
Tyngdetetthet, unsat	18,5 kN/m ³	19,5 kN/m ³
Tyngdetetthet, sat	18,5 kN/m ³	19,5 kN/m ³
E-modul, E50Ref	15E3 kN/m ²	15E3 kN/m ²
E-modul ødometer, EoedRef	15E3 kN/m ²	15E3 kN/m ²
E-modul unloading/reloading, EurRef	30E3 kN/m ²	45E3 kN/m ²
Poisson ratio, ν	0,2	0,2
Power m	1	1
Cohesion, C ref	2 kN/m ²	5 kN/m ²
Cohesion, c_{inc}'	1,5 kN/m ² /m	2,5 kN/m ² /m
Yref, vertical ref, kote	*Varierer	*Varierer
Friksjonsvinkel, ϕ	25 grader	27 grader
psi	0 grader	0 grader



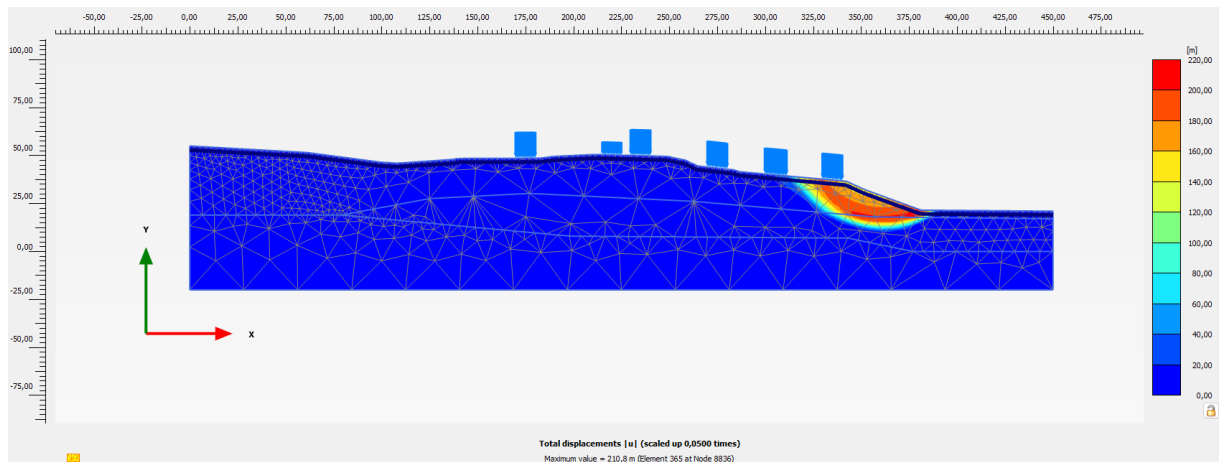
Snitt A



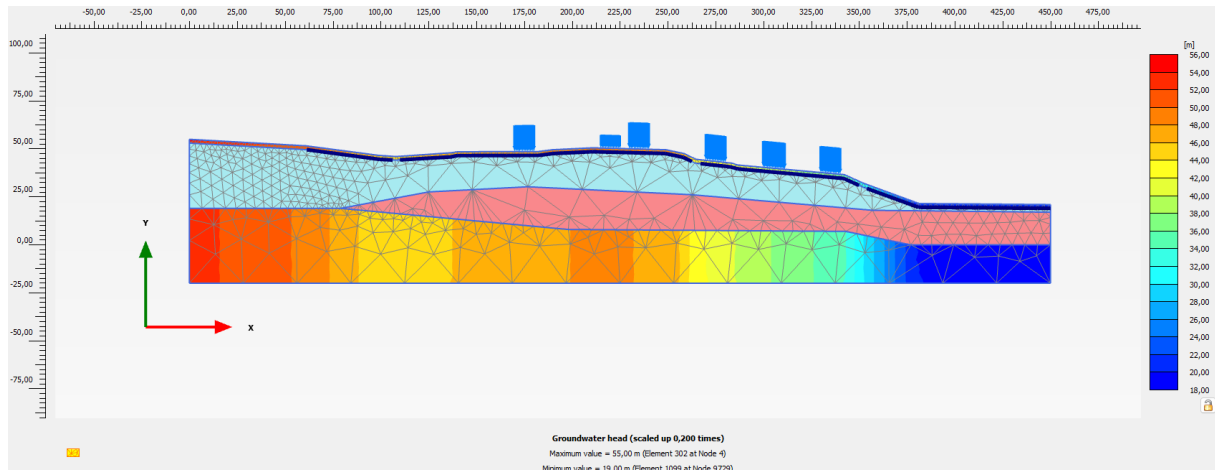
Figur 1: Snitt A med lagdeling.



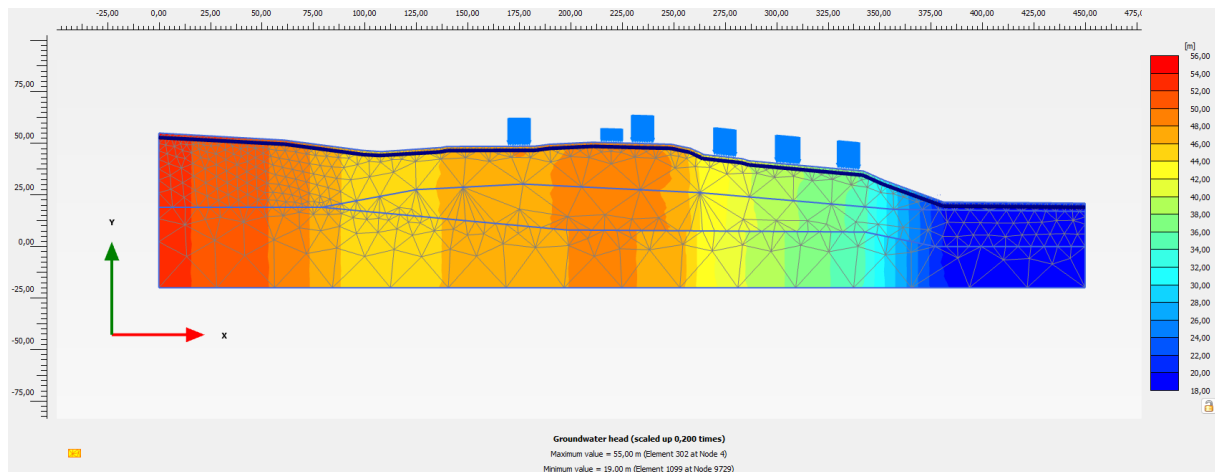
Figur 2: Brudmekanisme for snitt A med $SF = 1,15$ i udrenert analyse (NGI-ADP).



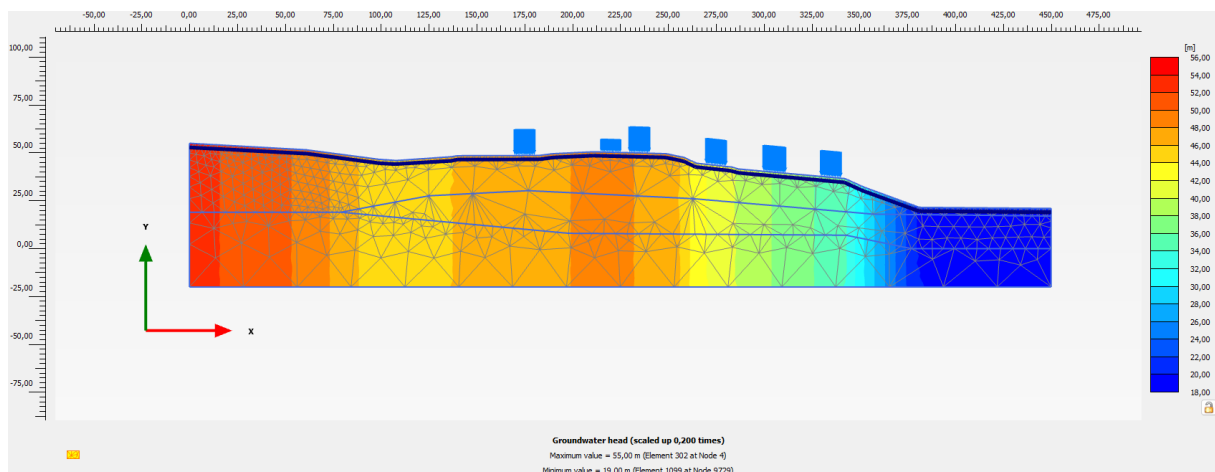
Figur 3: Brudmekanisme for snitt A med $SF = 1,80$ i drenert analyse (HS).



Figur 4: Groundwater head med NGI-ADP (udrenert) for snitt A.



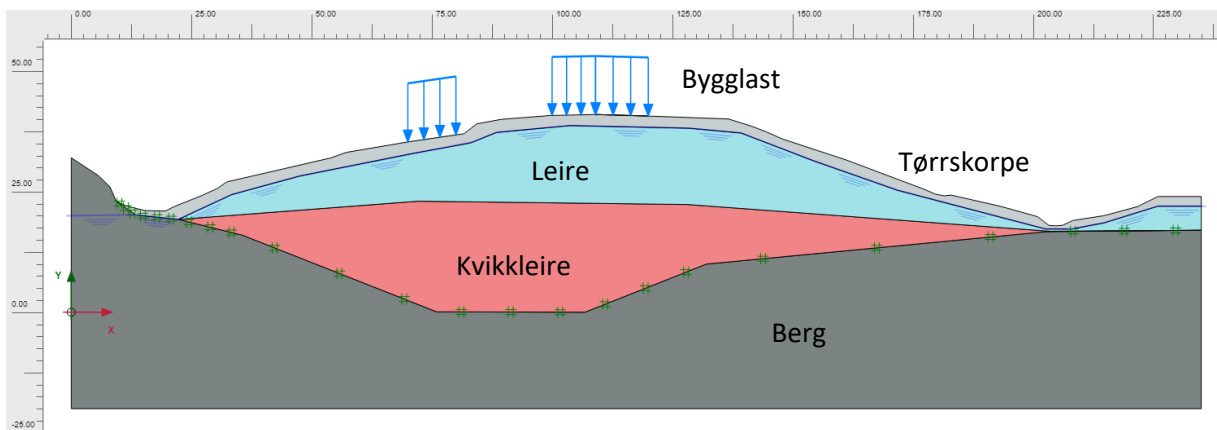
Figur 5: Groundwater head med HS (udrenert) for snitt A.



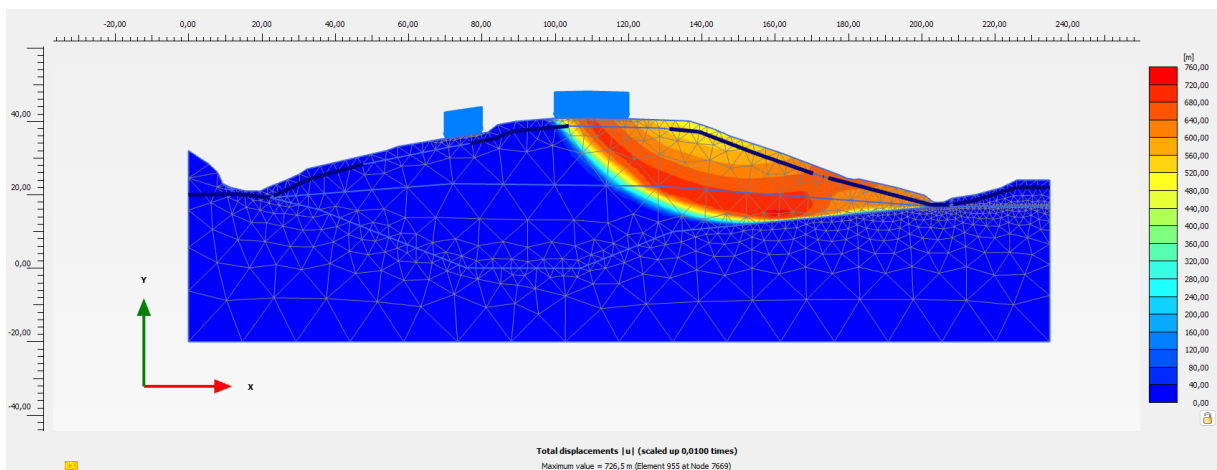
Figur 6: Groundwater head med HS (drenert) for snitt A.



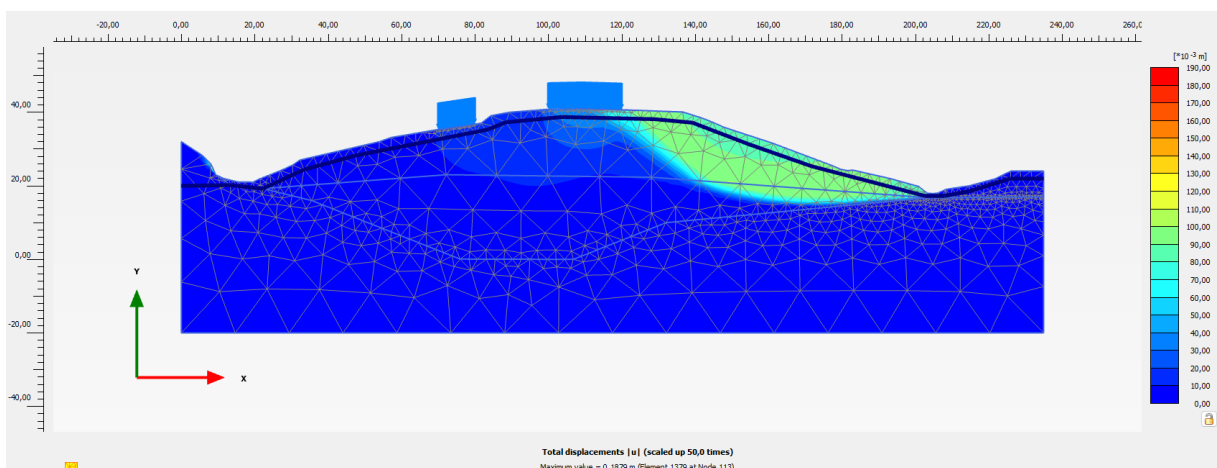
Snitt B (Holendalen)



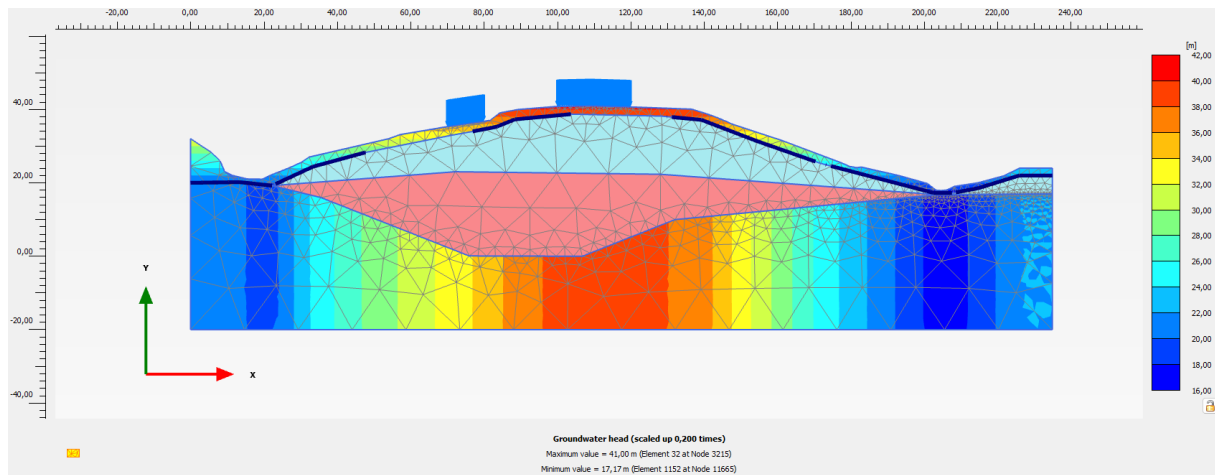
Figur 7: Snitt B med lagdeling.



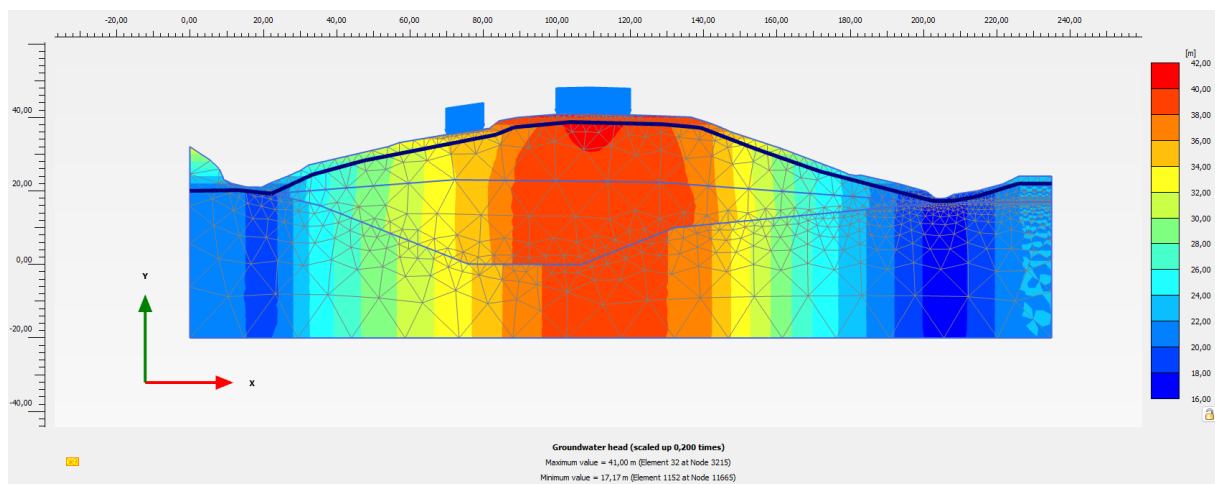
Figur 8: Bruddmekanisme for snitt B med $SF = 1,08$ i udrenert analyse (NGI-ADP).



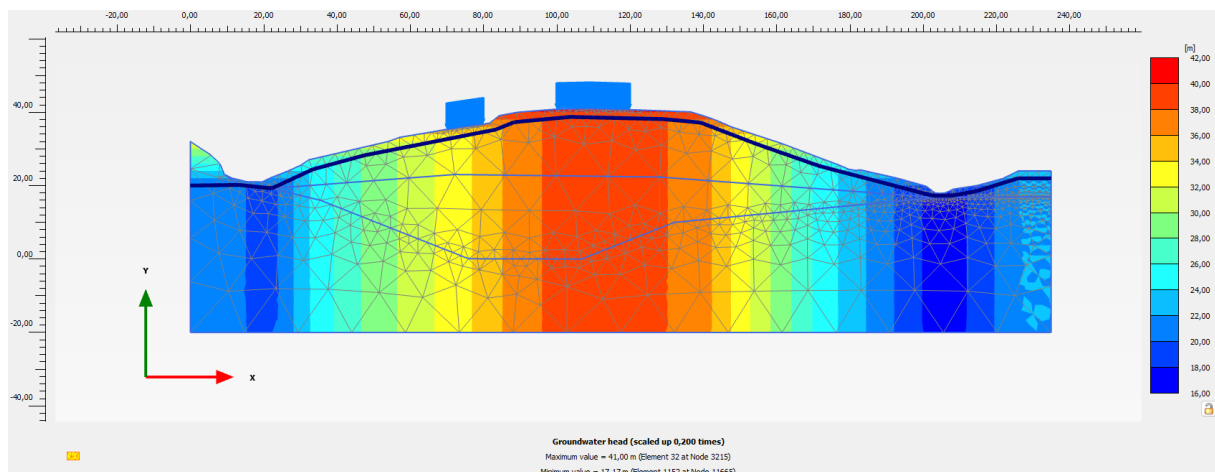
Figur 9: Bruddmekanisme for snitt B med $SF = 1,35$ i drenert analyse (HS).



Figur 10: Groundwater head med NGI-ADP (udrenert) for snitt B.



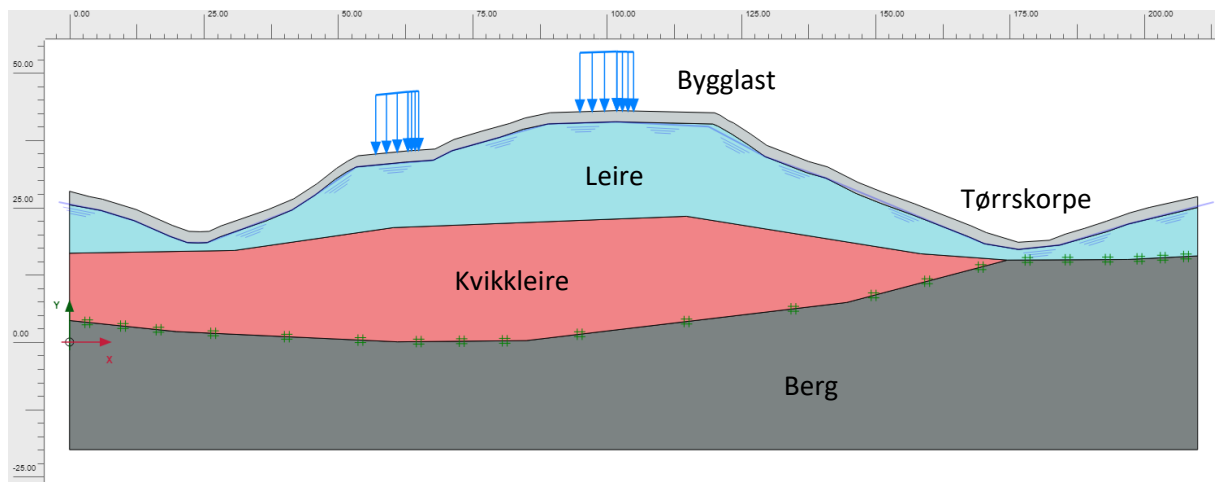
Figur 11: Groundwater head med HS (udrenert) for snitt B.



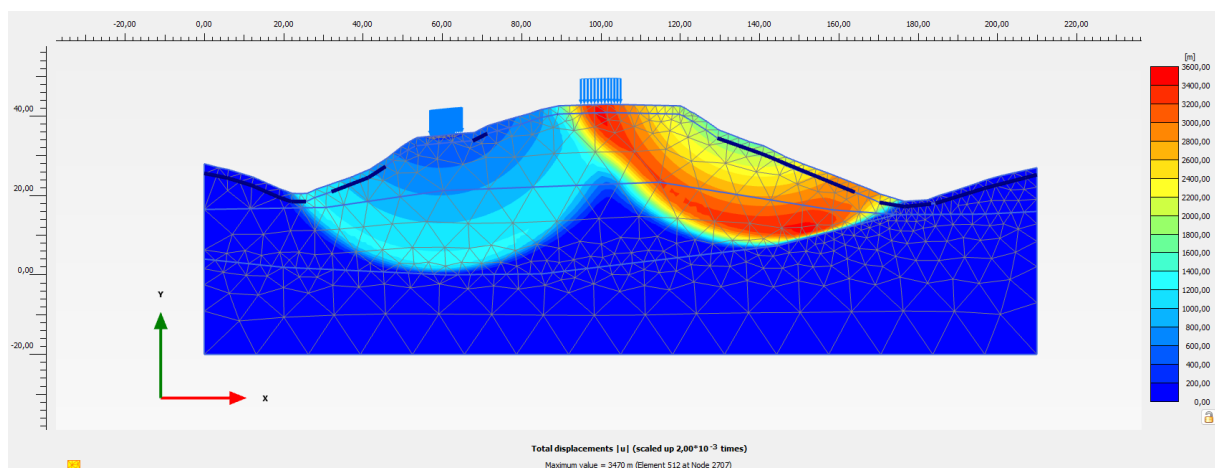
Figur 12: Groundwater head med HS (drenert) for snitt B.



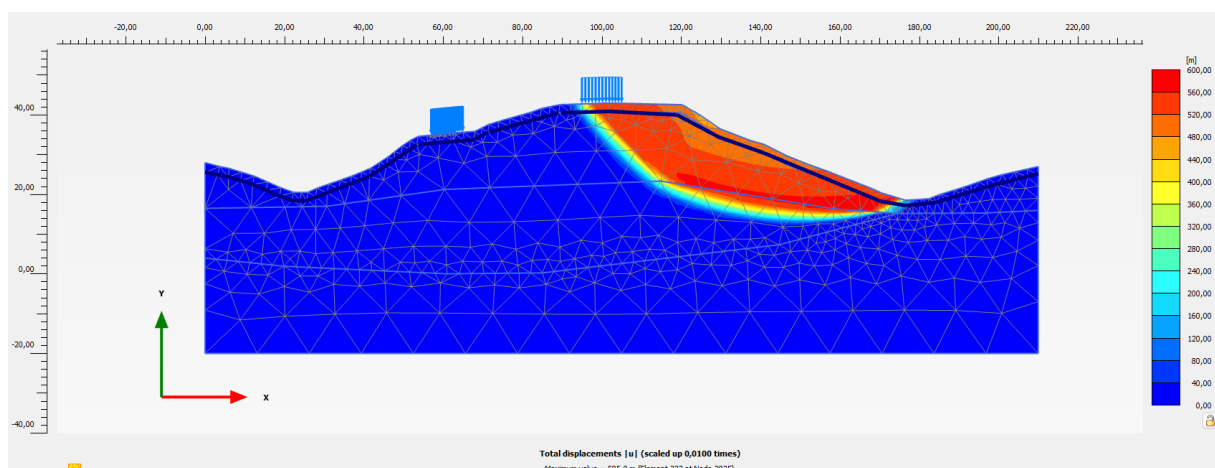
Snitt C (Holendalen)



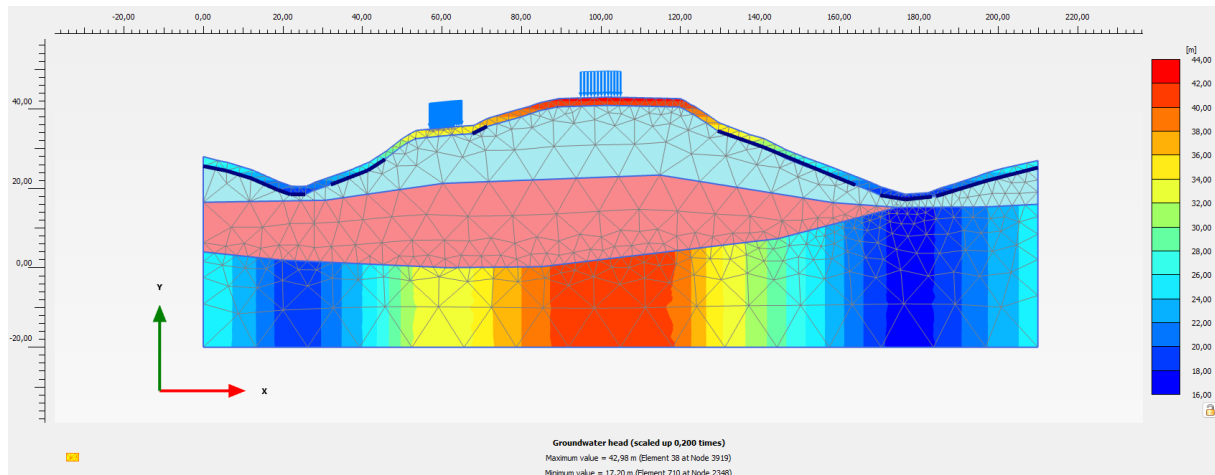
Figur 13: Snitt C med lagdeling.



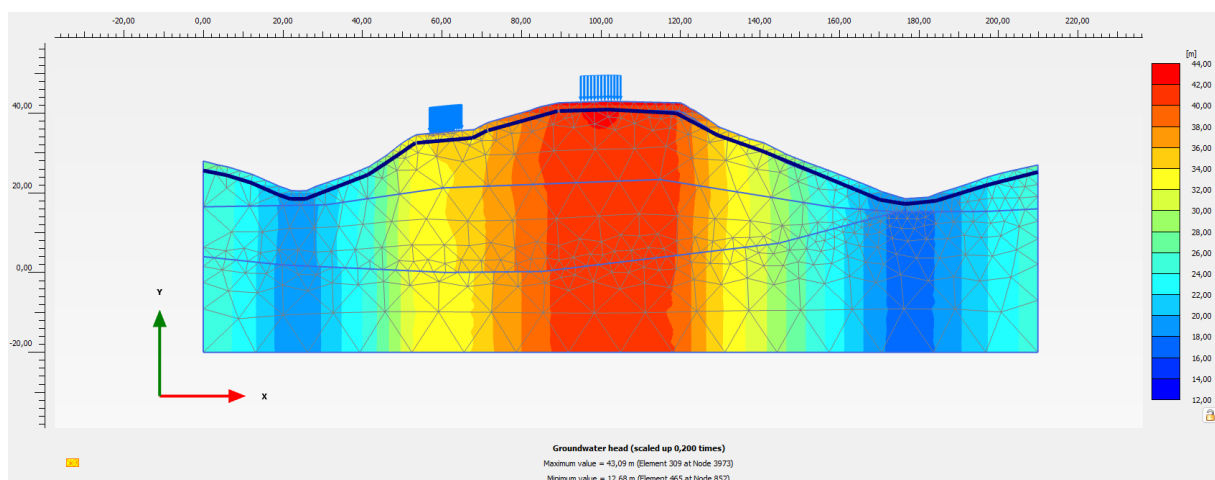
Figur 14: Brudmekanisme for snitt C med SF = 1,06 i udrenert analyse (NGI-ADP).



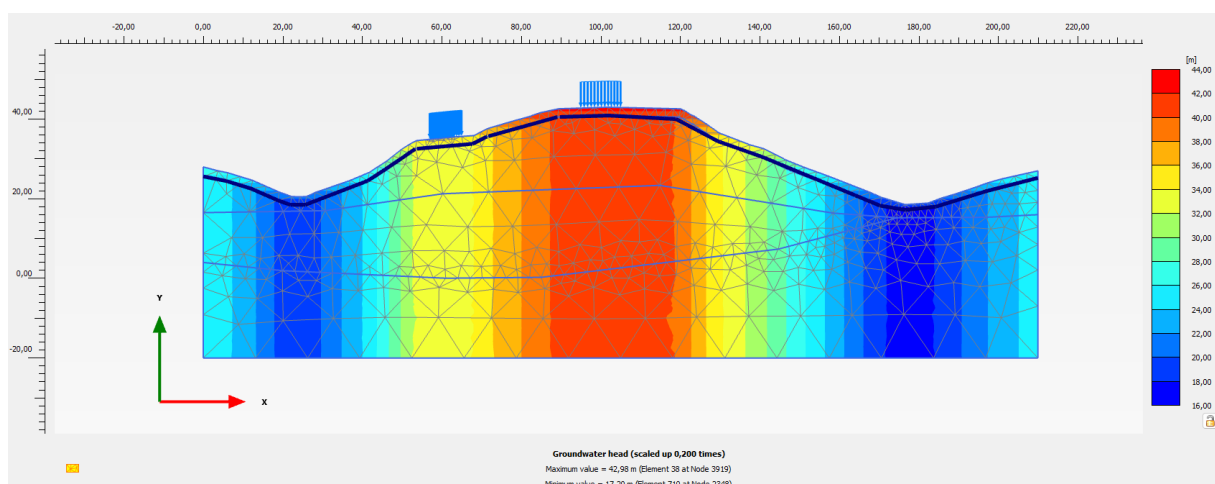
Figur 15: Brudmekanisme for snitt C med SF = 1,20 i drenert analyse (HS).



Figur 16: Groundwater head med NGI-ADP (udrenert) for snitt C.



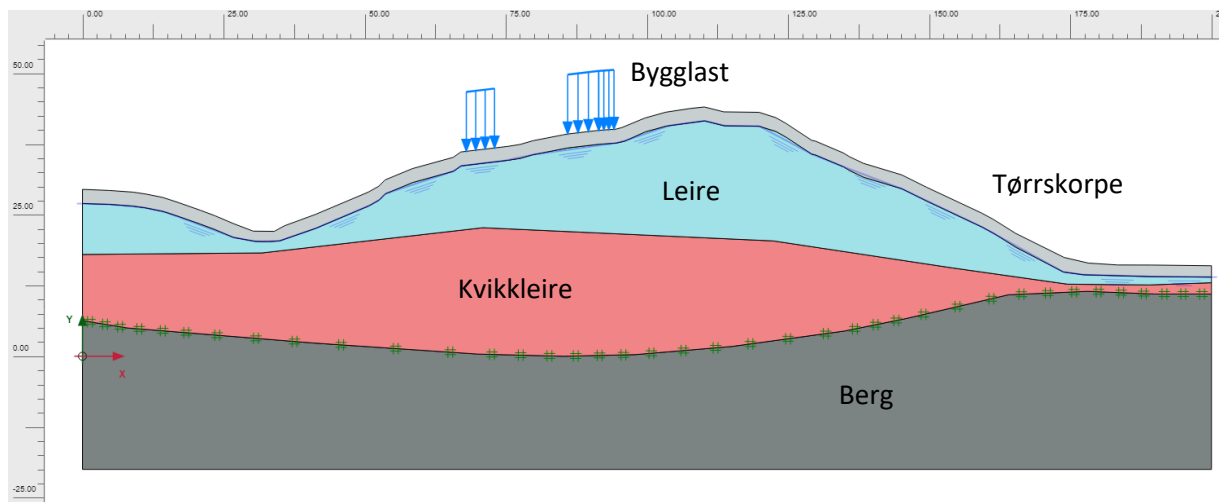
Figur 17: Groundwater head med HS (udrenert) for snitt C.



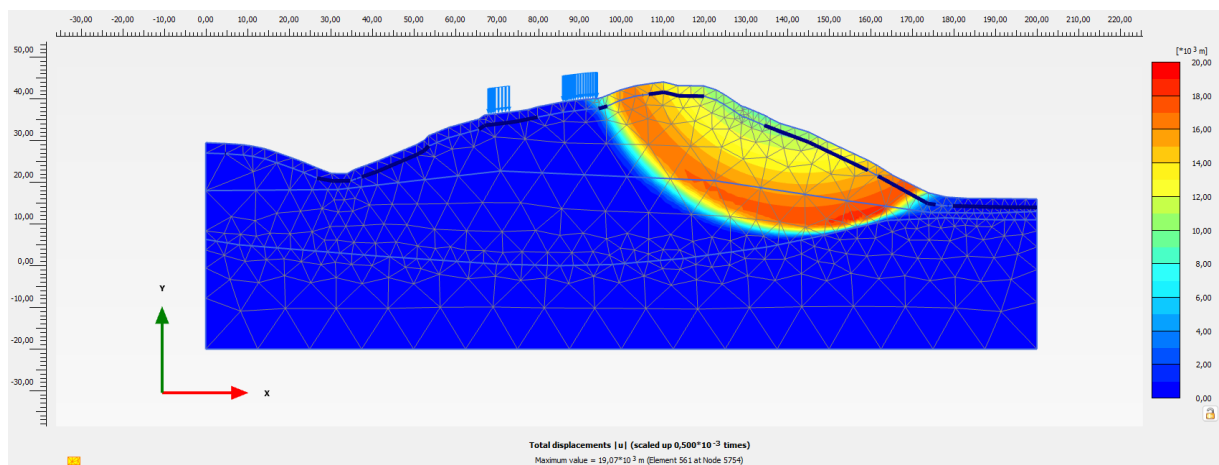
Figur 18: Groundwater head med HS (drenert) for snitt C.



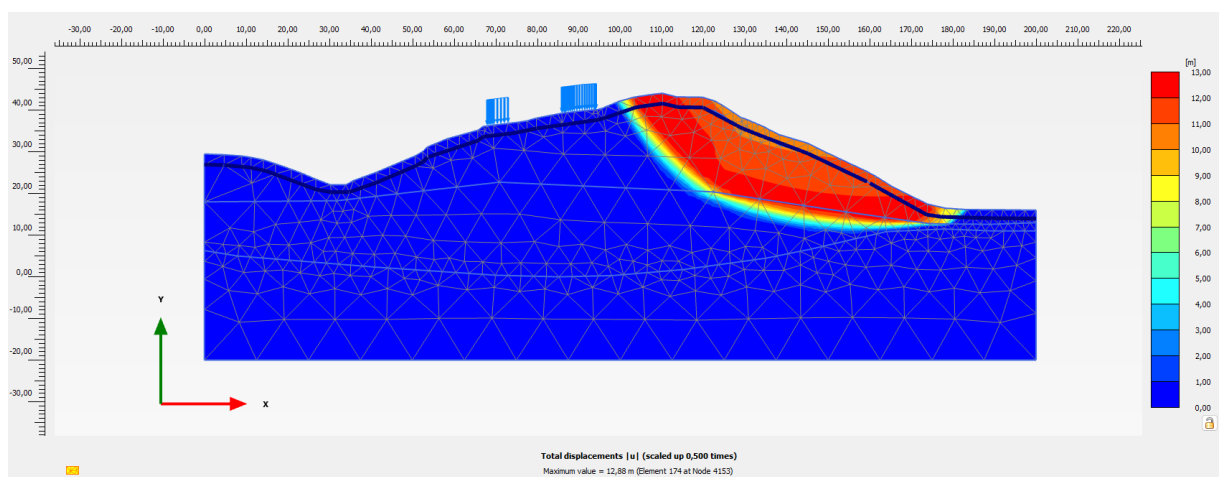
Snitt D (Holendalen)



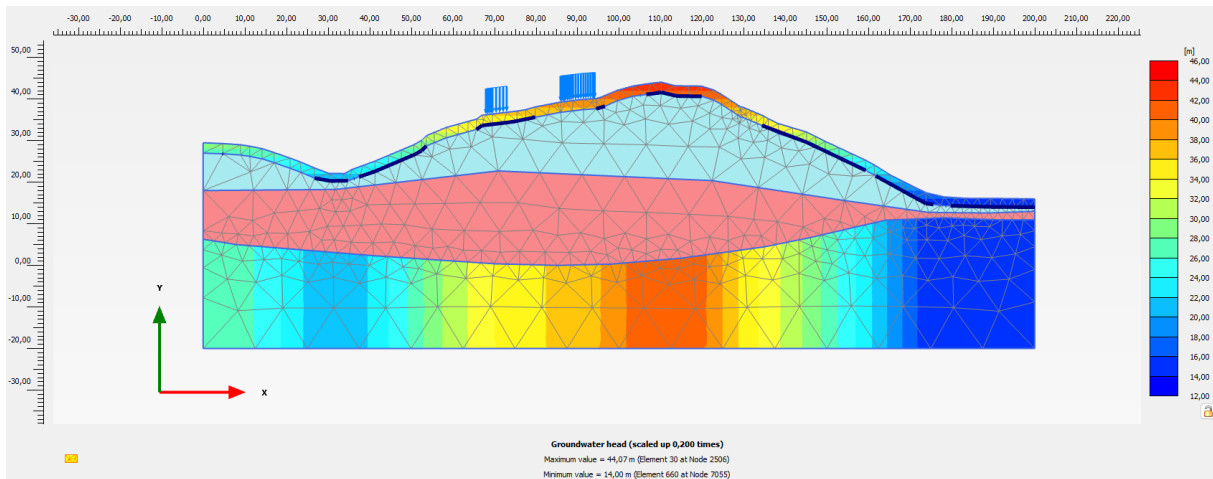
Figur 19: Snitt D med lagdeling.



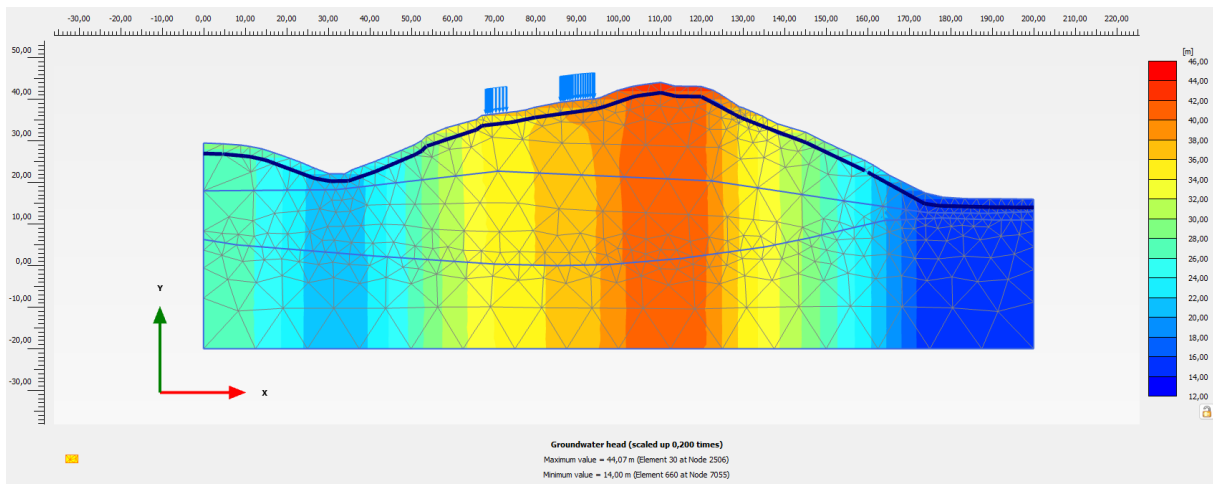
Figur 20: Bruddmekanisme for snitt D med $SF = 1,05$ i udrenert analyse (NGI-ADP).



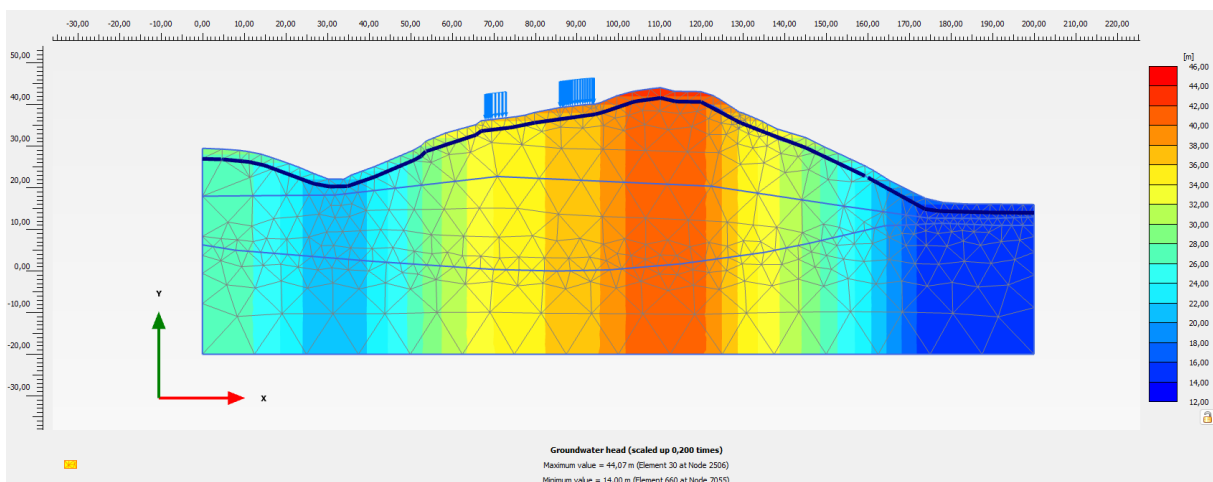
Figur 21: Bruddmekanisme for snitt D med $SF = 1,10$ i drenert analyse (HS).



Figur 22: Groundwater head med NGI-ADP (udrenert) for snitt D.



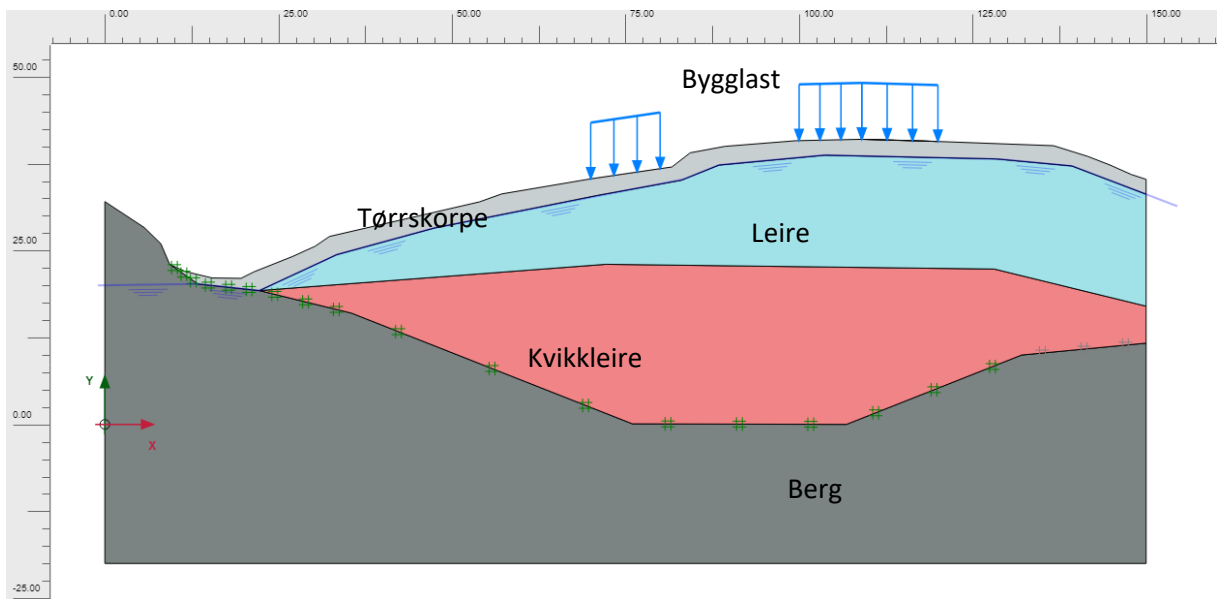
Figur 23: Groundwater head med HS (udrenert) for snitt D.



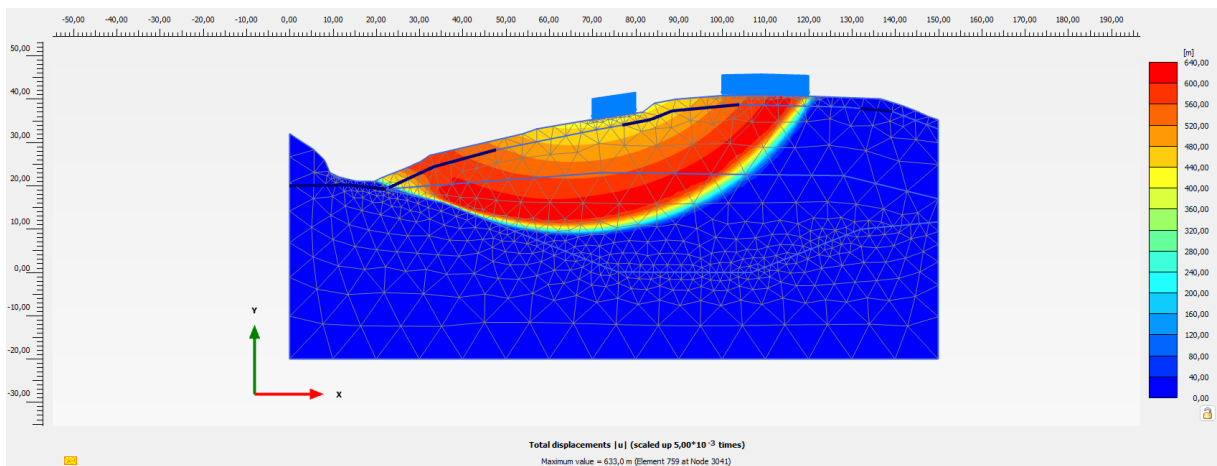
Figur 24: Groundwater head med HS (drenert) for snitt D.



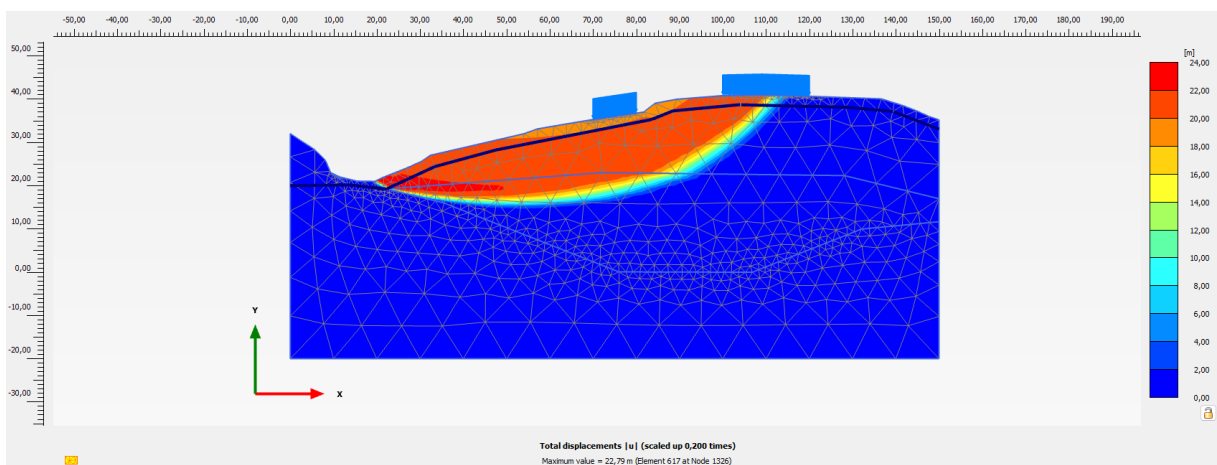
Snitt B (Sanddalen)



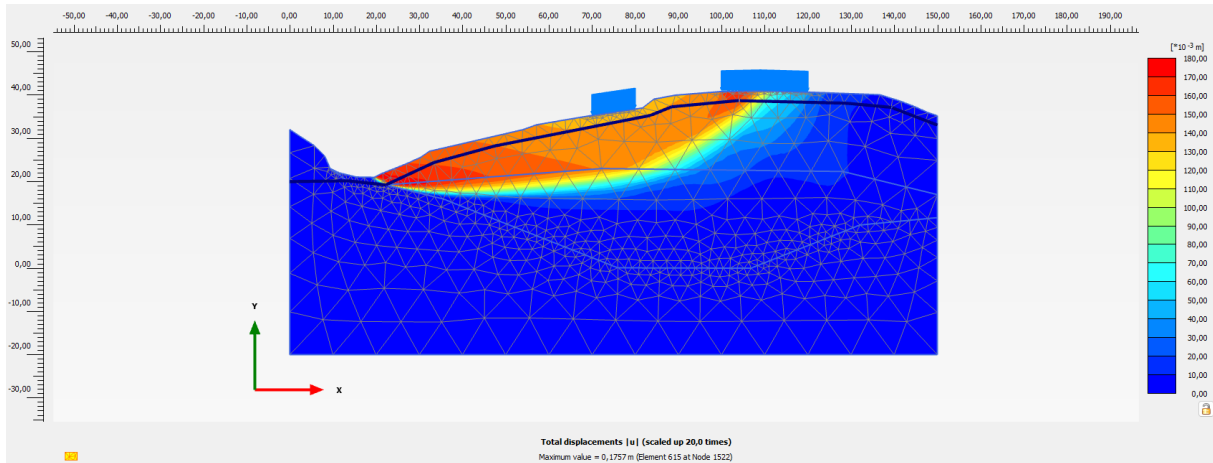
Figur 25: Snitt B med lagdeling.



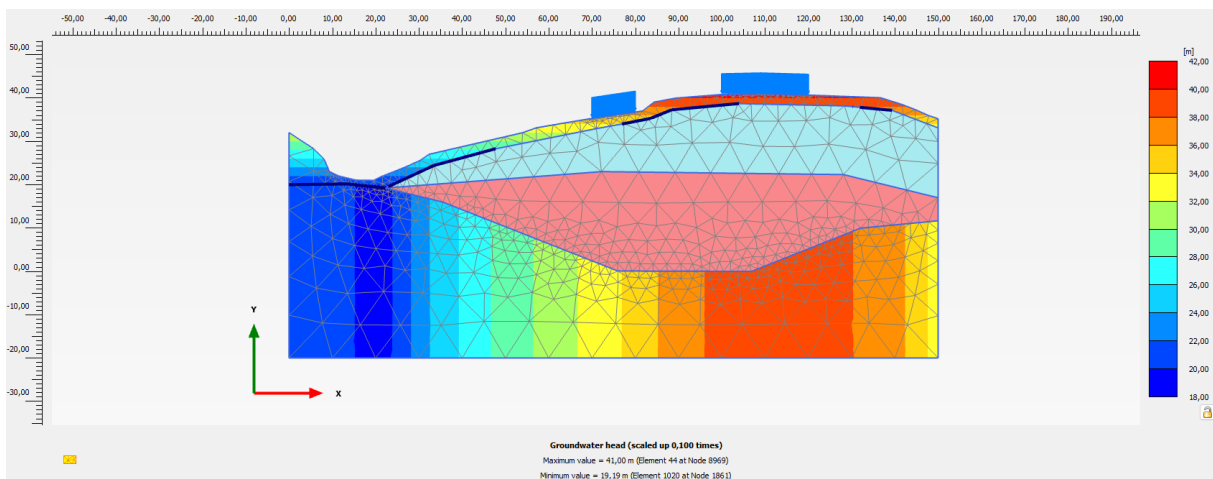
Figur 26: Bruddmekanisme for snitt B med SF = 1,19 i udrenert analyse (NGI-ADP).



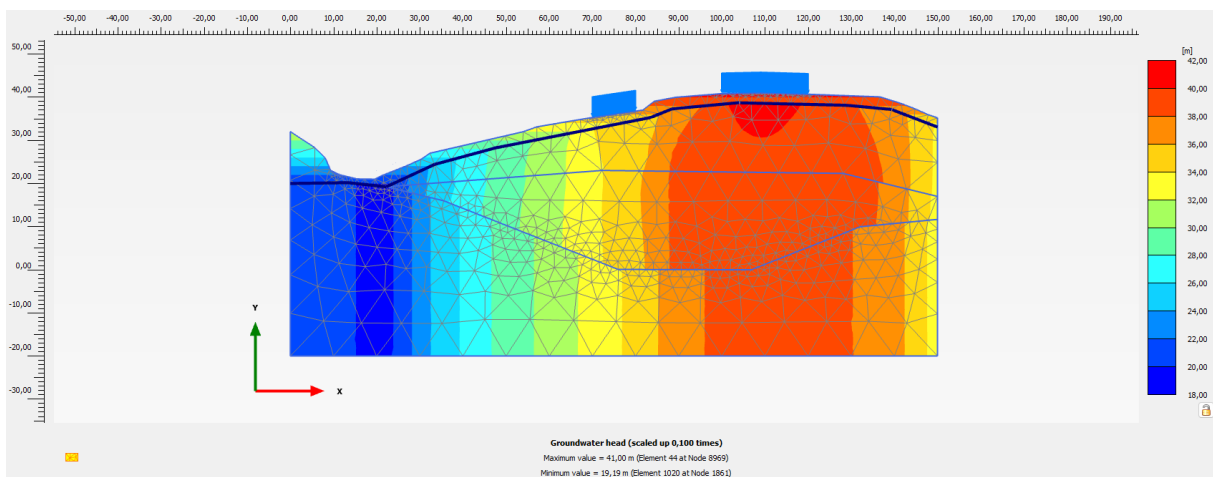
Figur 27: Bruddmekanisme for snitt B med SF = 1,60 i udrenert analyse (HS). Figur 28: Bruddmekanisme for snitt B med SF = 1,60 i udrenert analyse (HS).



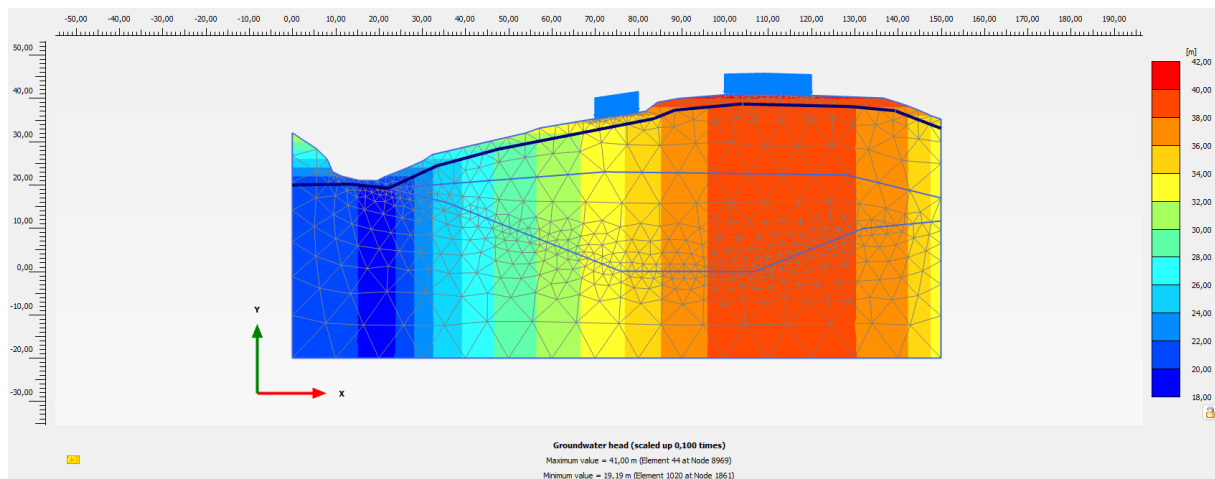
Figur 29: Bruddmekanisme for snitt B med SF = 1,75 i drenert analyse (HS). Figur 30: Bruddmekanisme for snitt B med SF = 1,75 i drenert analyse (HS).



Figur 31: Groundwater head med NGI-ADP (udrenert) for snitt B.



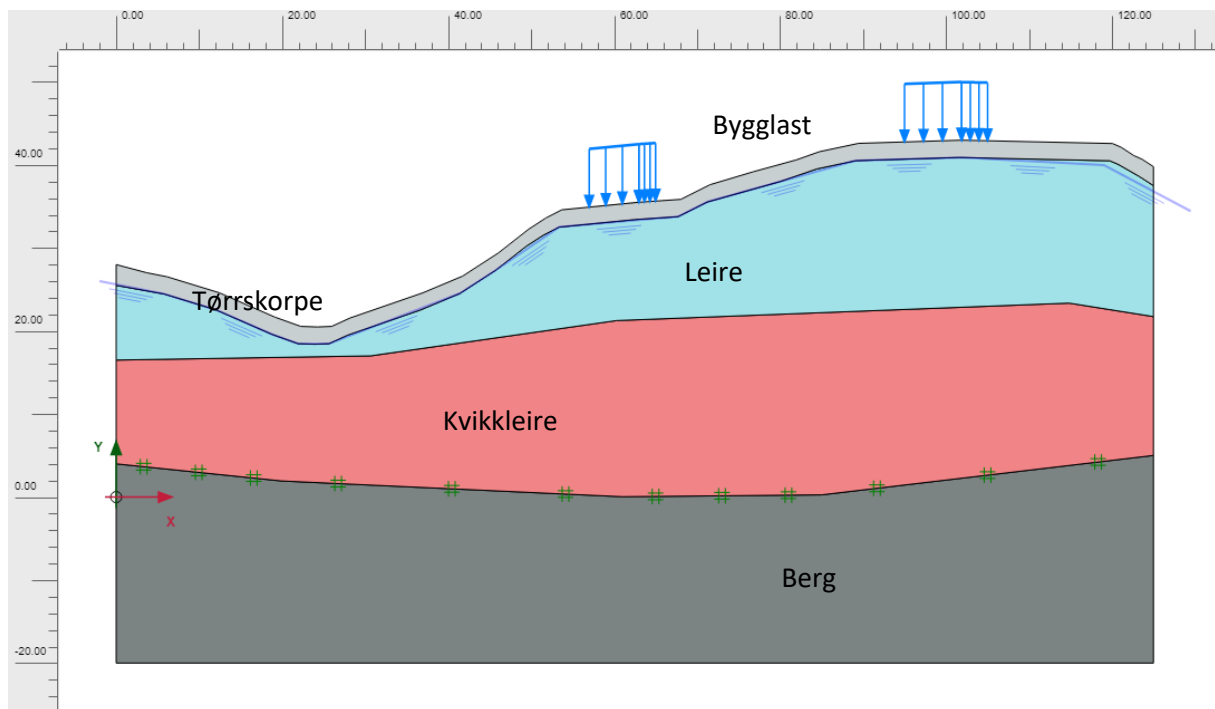
Figur 32: Groundwater head med HS (udrenert) for snitt B.



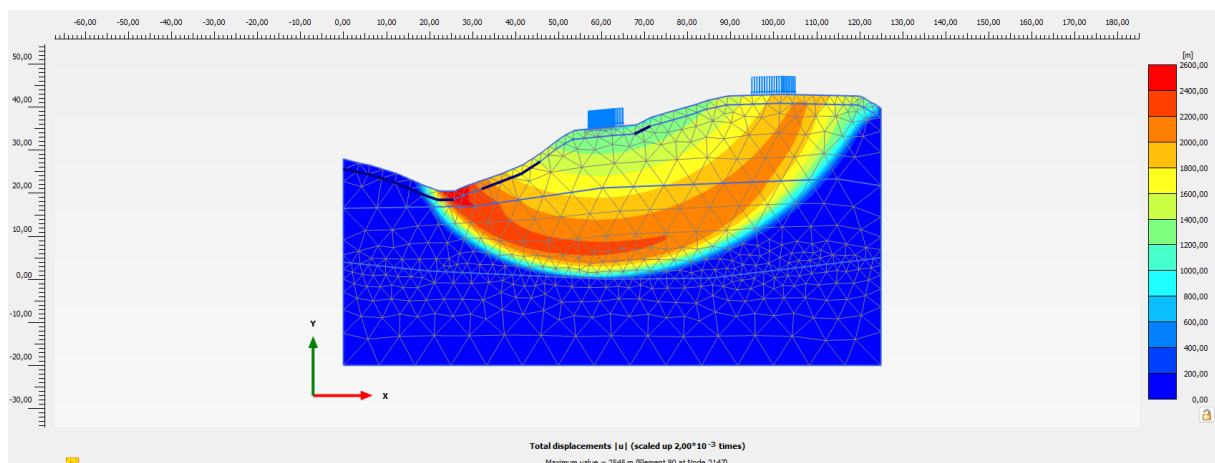
Figur 33: Groundwater head med HS (drenert) for snitt B.



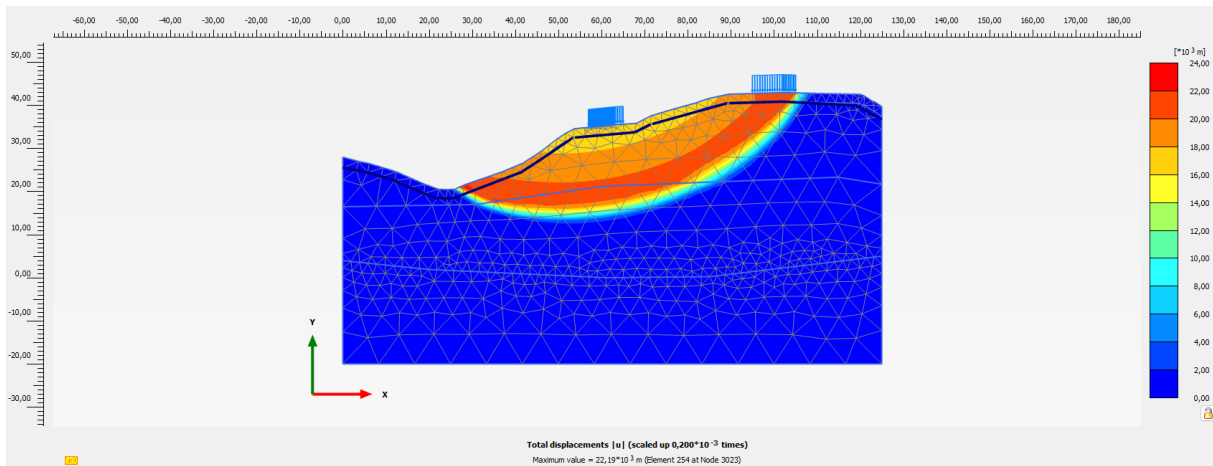
Snitt C (Sanddalen)



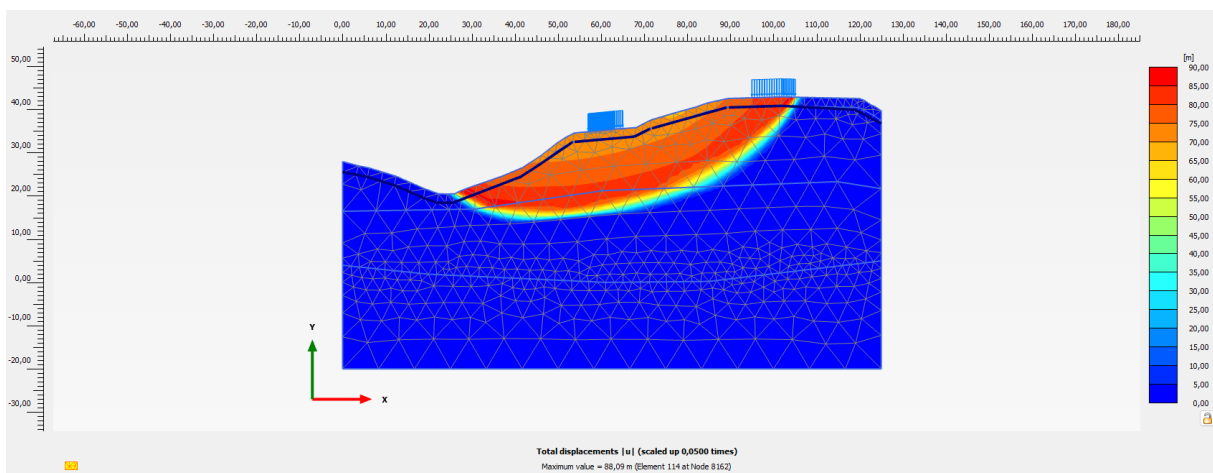
Figur 34: Snitt C med lagdeling.



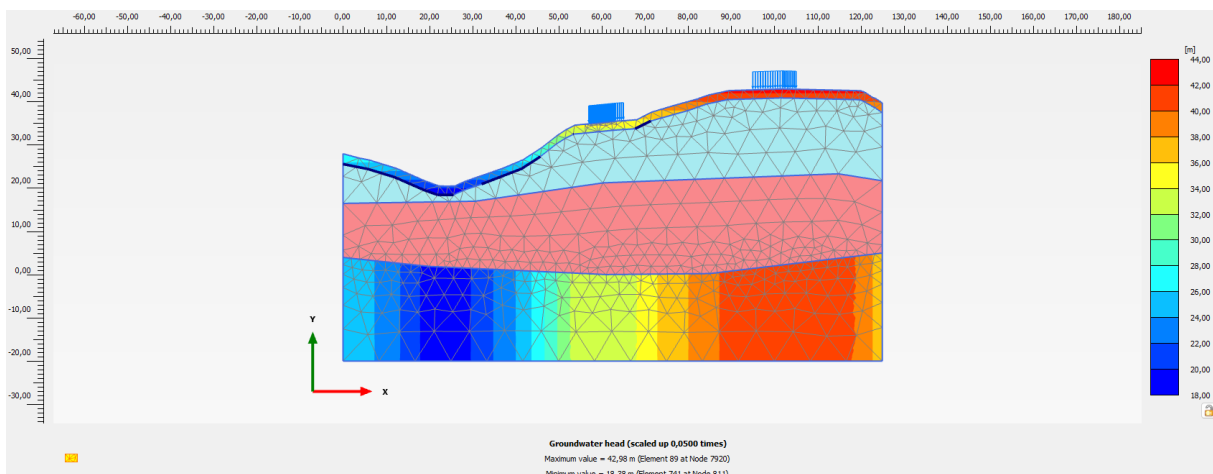
Figur 35: Bruddmekanisme for snitt C med $SF = 1,10$ i udrenert analyse (NGI-ADP). Figur 36: Bruddmekanisme for snitt C med $SF = 1,10$ i udrenert analyse (NGI-ADP).



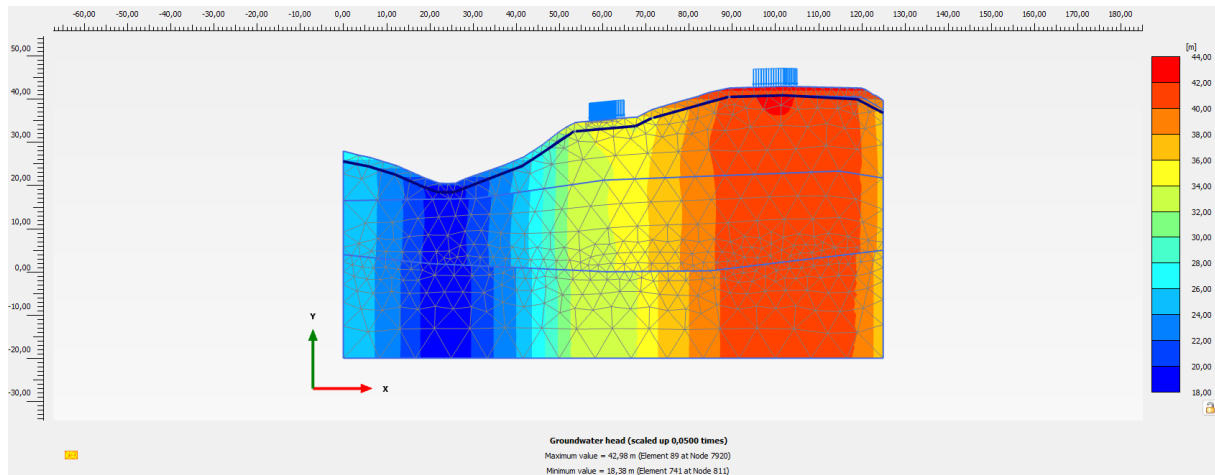
Figur 37: Bruddmekanisme for snitt C med $SF = 1,33$ i udrenert analyse (HS).



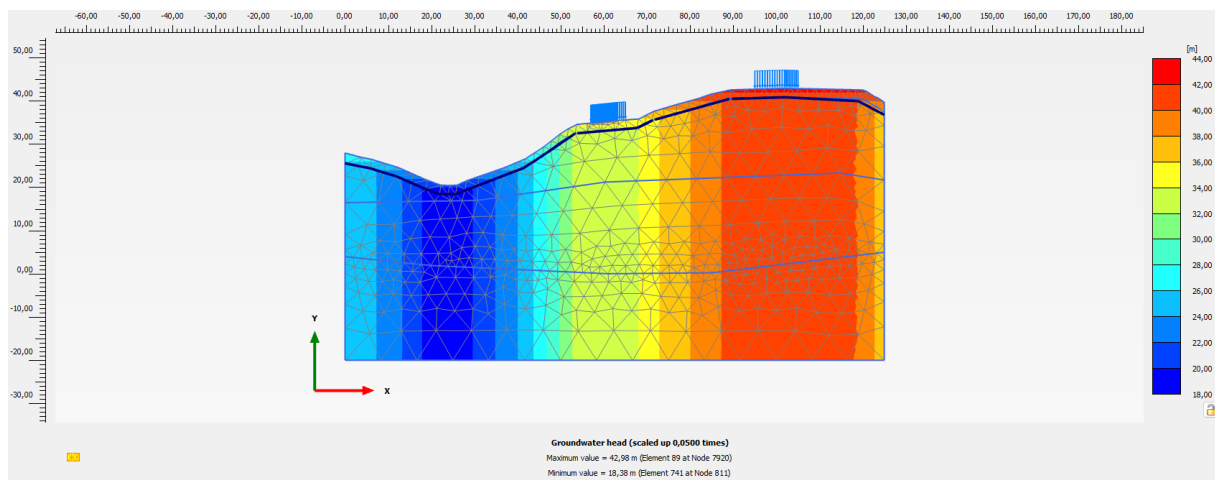
Figur 38: Bruddmekanisme for snitt C med $SF = 1,43$ i drenert analyse (HS). Figur 39: Bruddmekanisme for snitt C med $SF = 1,43$ i drenert analyse (HS).



Figur 40: Groundwater head med NGI-ADP (udrenert) for snitt C.



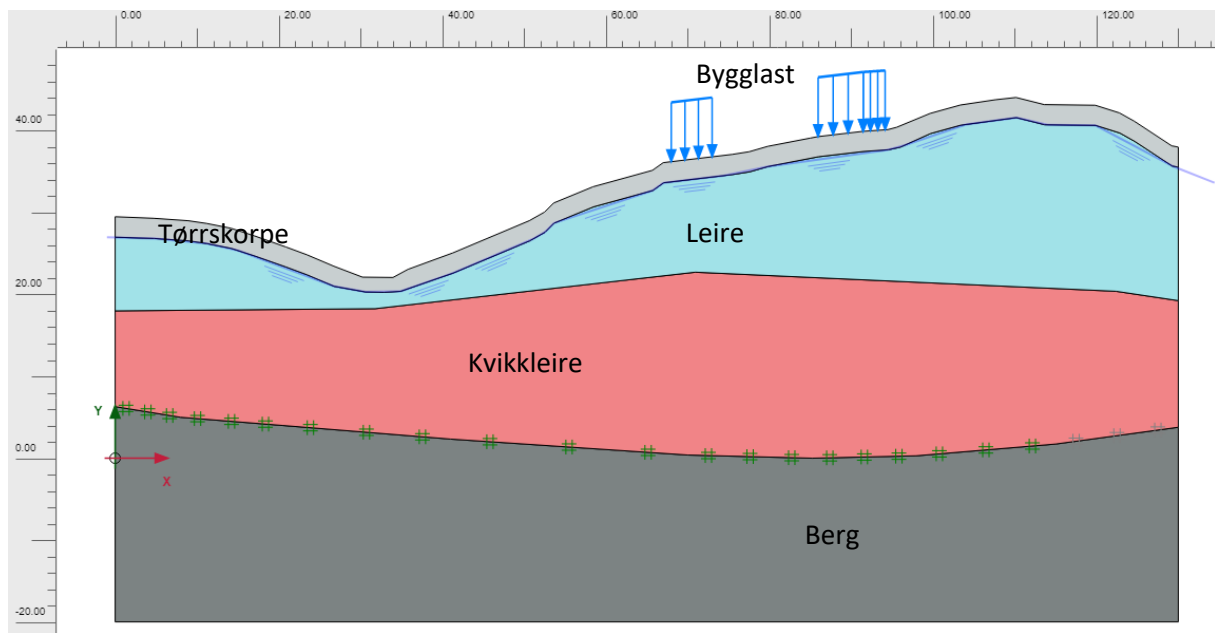
Figur 41: Groundwater head med HS (udrenert) for snitt C.



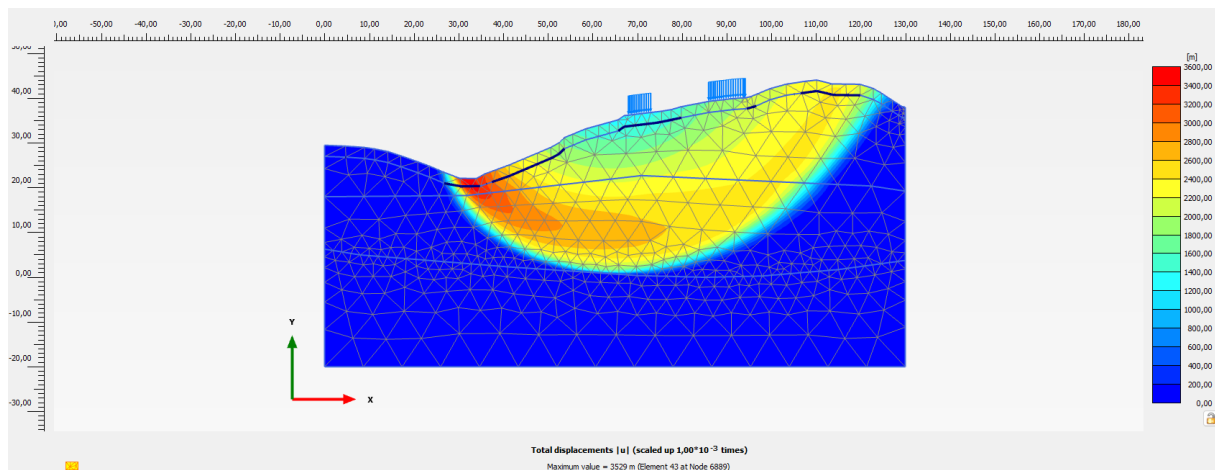
Figur 42: Groundwater head med HS (drenert) for snitt C.



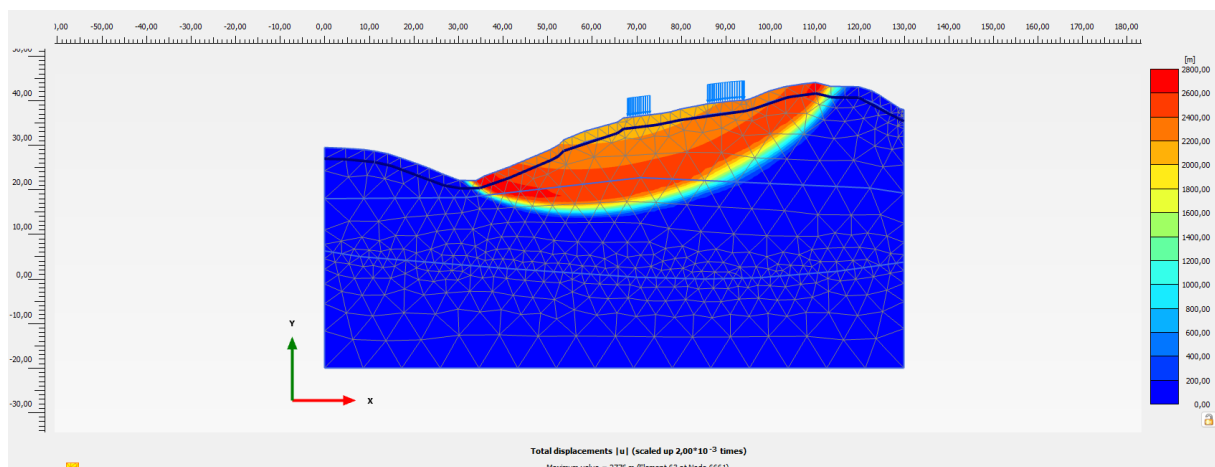
Snitt D (Sanddalen)



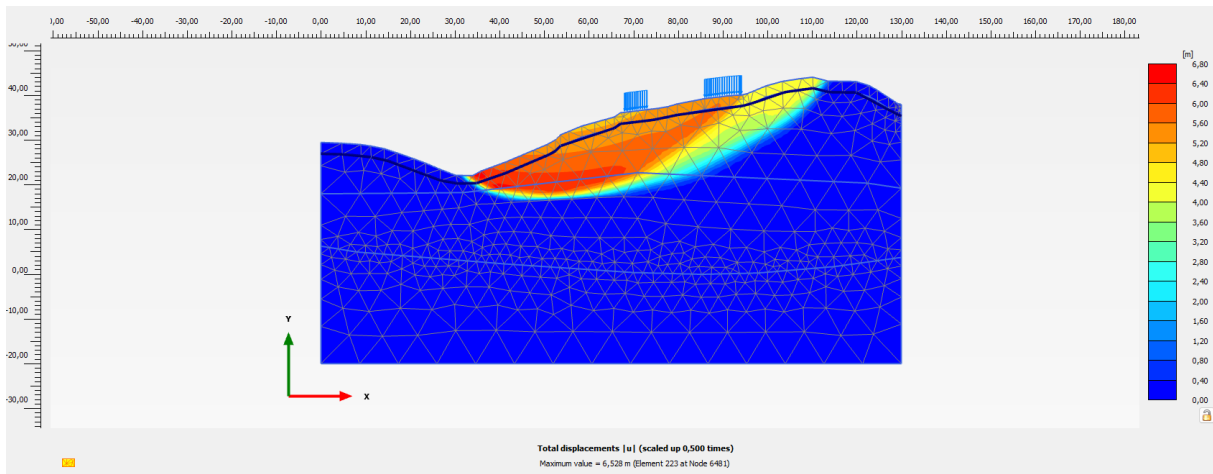
Figur 43: Snitt D med lagdeling.



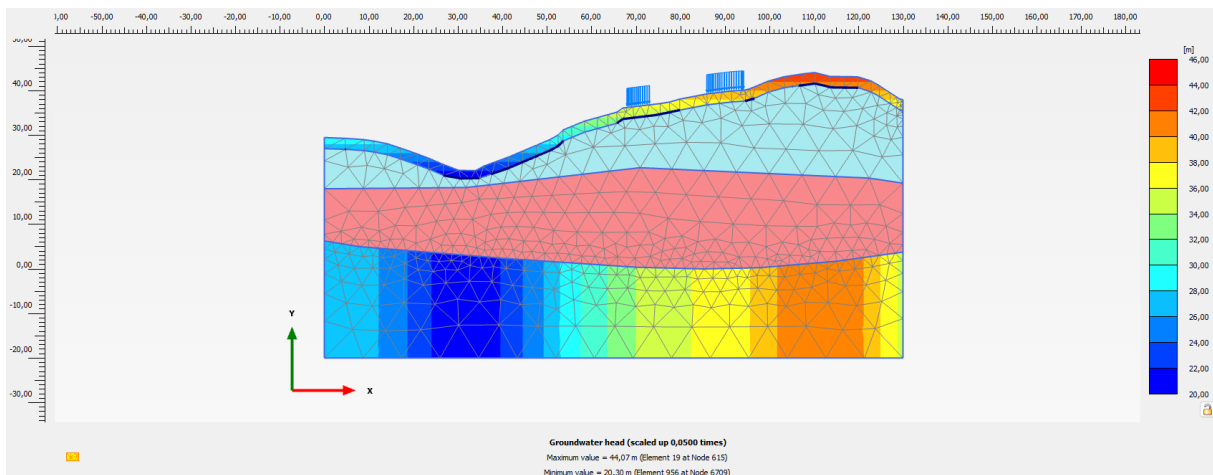
Figur 44: Brudmekanisme for snitt D med SF = 1,20 i udrenert analyse (NGI-ADP).



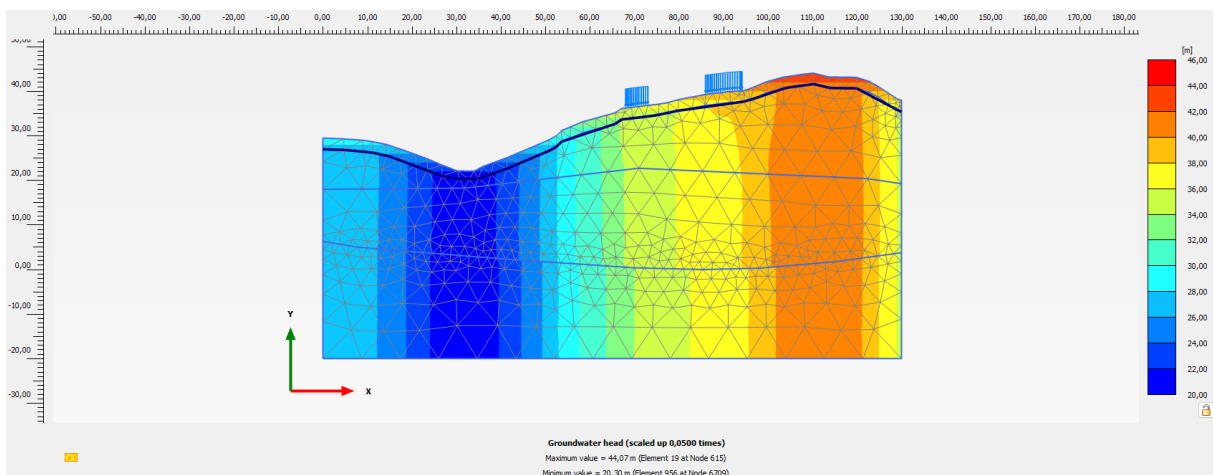
Figur 45: Brudmekanisme for snitt D med SF = 1,45 i udrenert analyse (HS).



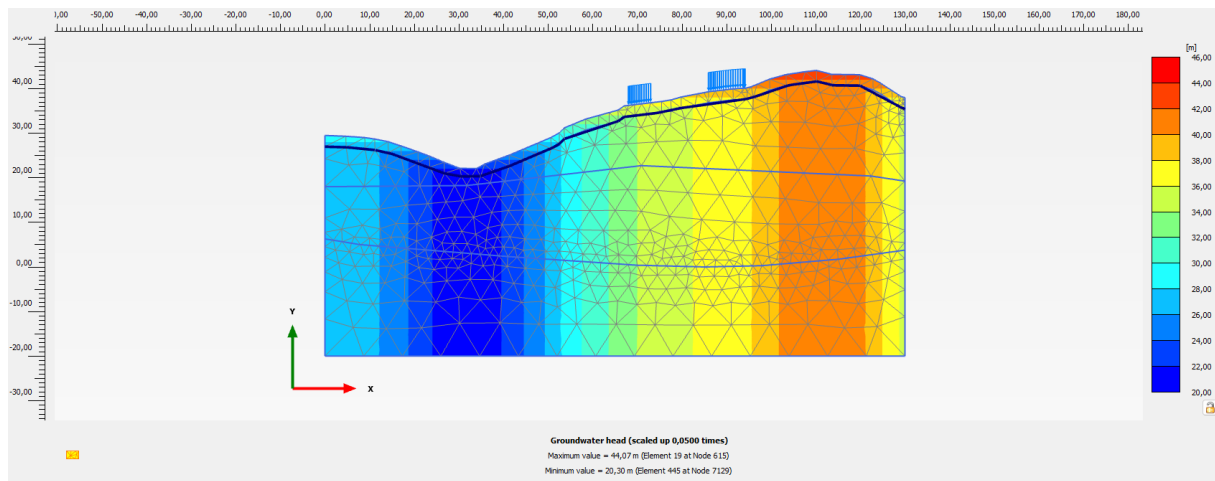
Figur 46: Brudmekanisme for snitt D med $SF = 1,54$ i drenert analyse (HS).



Figur 47: Groundwater head med NGI-ADP (udrenert) for snitt D.



Figur 48: Groundwater head med HS (udrenert) for snitt D.



Figur 49: Groundwater head med HS (drenert) for snitt D.