

# INFLUENCE OF SHEARING RATE ON RESIDUAL STRENGTH OF CLAYS

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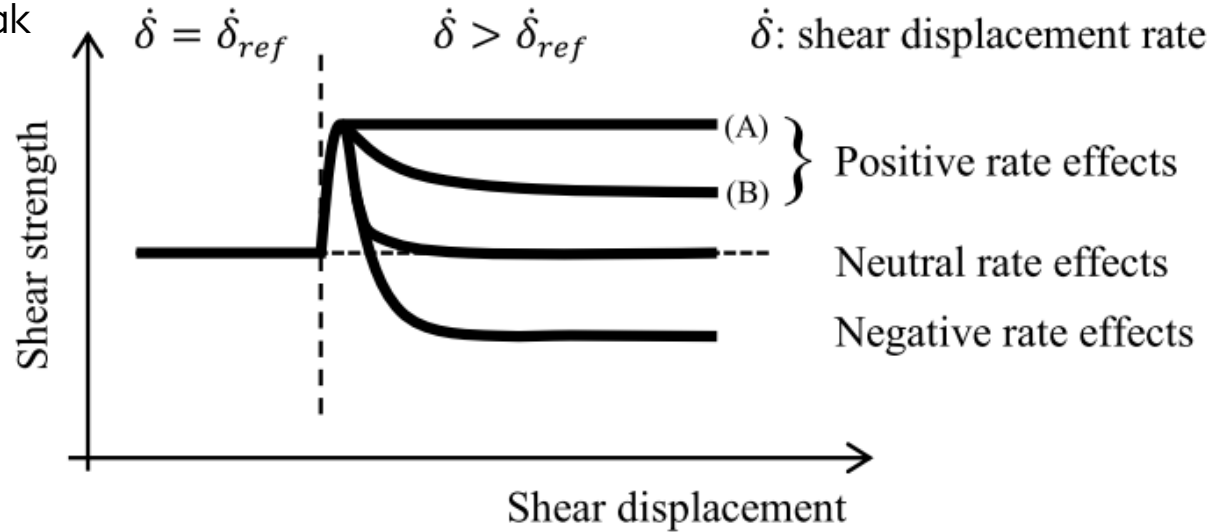
Paper ABS-1477

Topic: 3B 3 – Time dependent responses (ageing, viscous and cycling effects)



# Rate dependent behaviour of soils

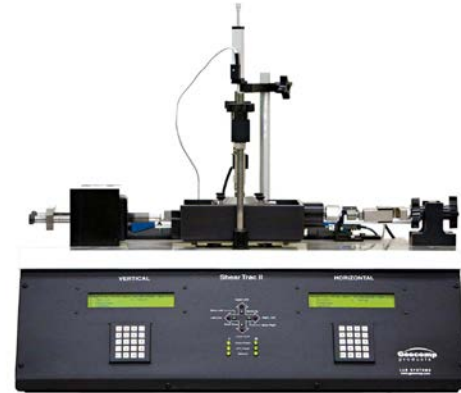
- ▶ Linked to shearing mode and influenced by particle size / mineralogy
- ▶ Similarity between pre-peak and post peak behaviour



# Materials and methods

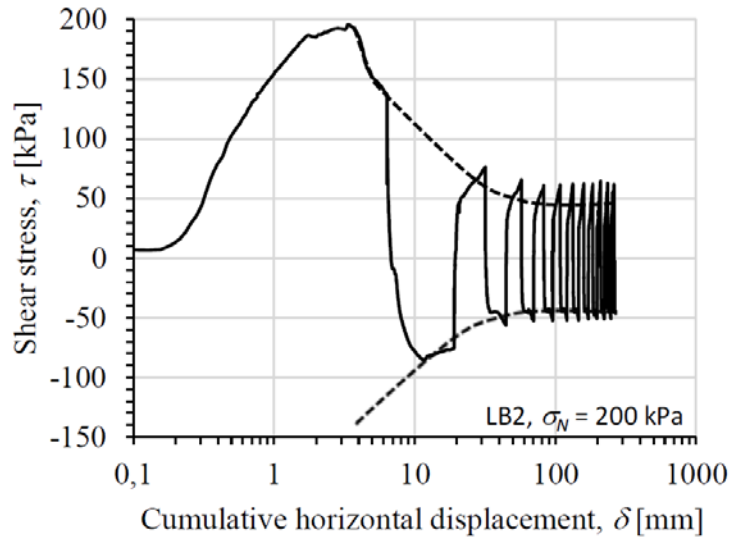
- ▶ Clay @ residual state:  
low PI (CL) to extr. high PI (CE) clays
- ▶ Multiple-reversal Direct Shear testing
- ▶ Slow rates of shearing
- ▶ Step-change in rate of shearing (SRS)
  - › Temporary strain acceleration
- ▶ Multiphase

$w_L$	$\delta_H'$	$\sigma'_N$
30 → 117 %	0.02 – 2 mm/hr	100 → 600 kPa



Direct shear apparatus

# Post peak strength degradation

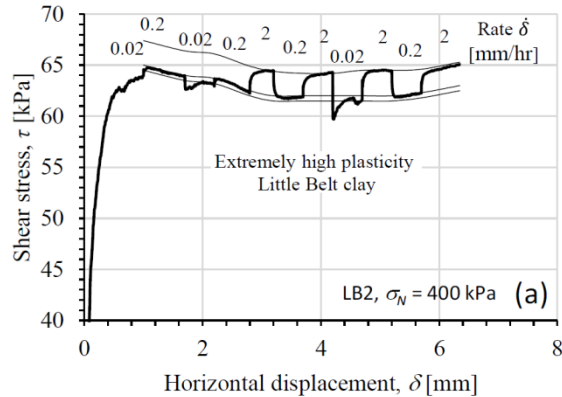


- ▶ Significant strength reduction (intact clays, CM to CE)
- ▶ ~ 60-80mm hor. def. to reach residual state

Example:

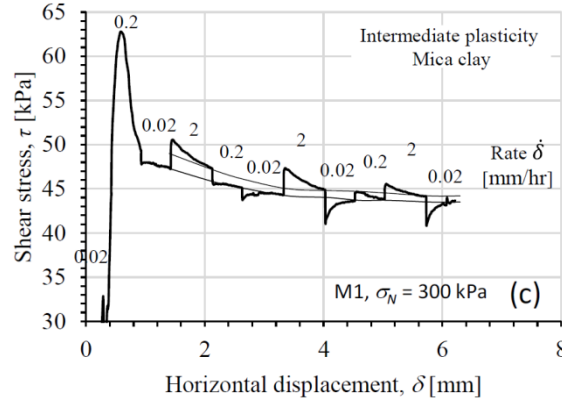
Intact specimen, Little Belt clay ( $w_L = 111-117\%$ )

# Observed rate dependent behaviour



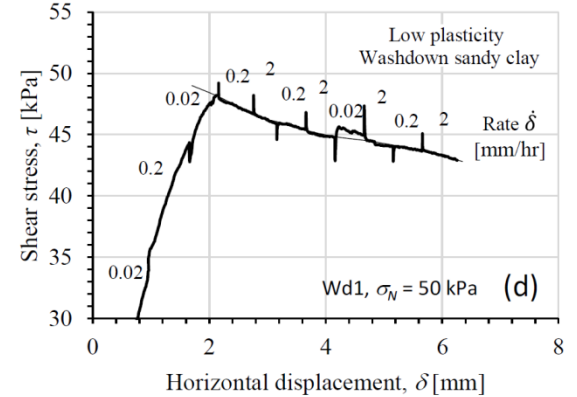
High and extremely high plasticity clay (CH and CE):

- Persistent effects



Intermediate plasticity clay (CM):

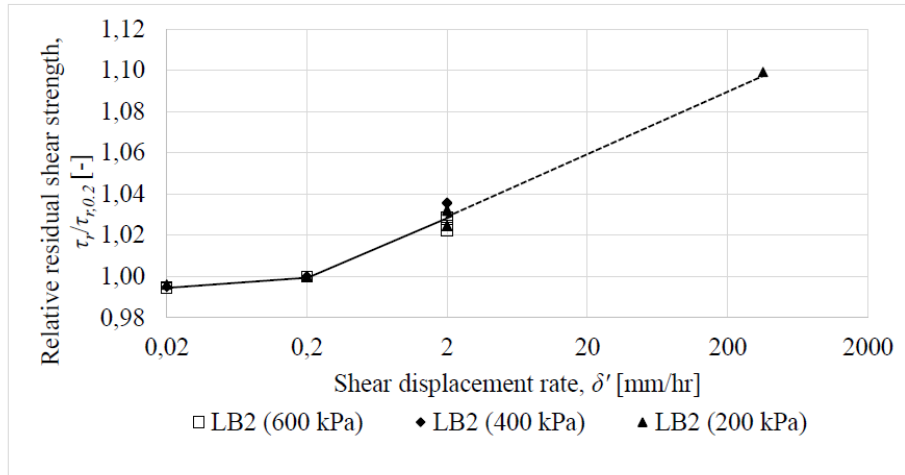
- Temporary and persistent effects
- At high  $\sigma'_N$  dominant persistent effect



Low plasticity clay (CL):

- Temporary effects

# Relationship between res. strength and rate



- ▶ Log linear relationship between residual strength and rate indicated (>0.2mm/hr – CM to CE)

# Conclusions

- ▶ Rate dependent behaviour at residual state - strongly influenced by mineralogy (plasticity) and normal stress (CM)
- ▶ Positive (temp. and persistent) and neutral effects are observed
- ▶ Magnitude of persistent effects – not significantly influenced by plasticity (CM to CE)
- ▶ Micromechanisms and link between pre-peak and residual behaviour need further investigation



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