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(CRS)

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() Lee et al. (ASTM - D4186, 2002)

(CRS)

Almeida et .

() Hamilton and Crawford

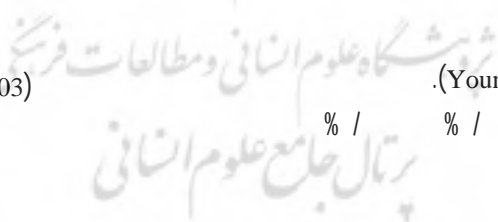
() al.

Lee et al. ()

CRS

(Dubak, 2003)

(Youne and Chung, 2005)



Esmith and Wahls .

() Hamilton and Crawford,)

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CRS

(1959)

() Wissa et al.

Wissa et al.

() Esmith and Wahls

() Sallfors .

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Gromen et %

CRS

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() al.

() Sheahan and Watters .

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(m_v)

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() Sheahan and Watters

(Load Cell)

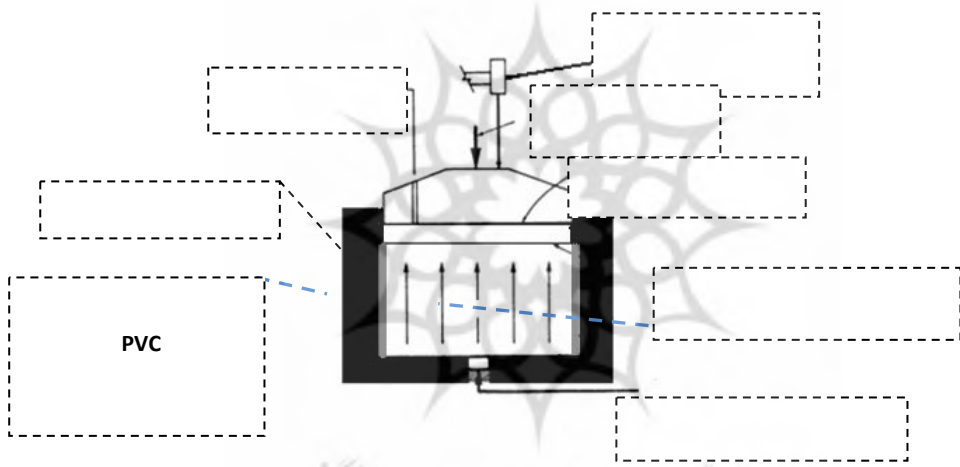
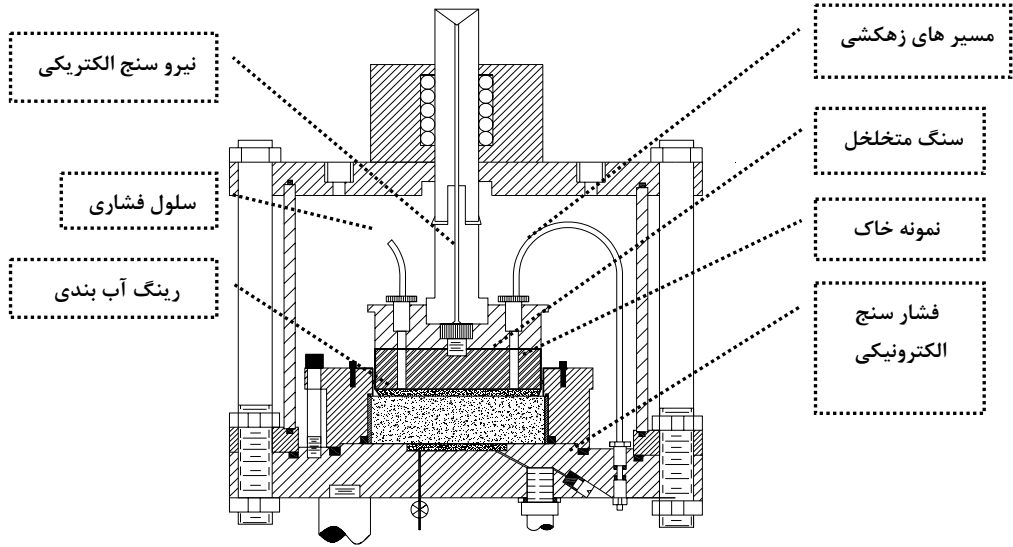
(LVDT)

CRS

()	PL (%)		LL (%)		Gs	
CL		/		/		A
CL	/	/		/		B
CH				/	()	C
CH				/	()	D

CRS

(kPa)	% /min			
۷/۲۴	۱/۷۸	۷۴/۲	/	1A
	۱/۸۰	۷۰/۲	/	2A
	۱/۷۶	۶۸/۱	/	3A
	۱/۷۷	۶۸/۱	/	4A
۹/۴	۱/۸۳	۶۷/۴	/	1B
۱۳۲/۶	۱/۸۱	۶۶/۲	/	2B
۲۵۳	۱/۸۷	۷۰/۱	/	3B
۵۲۶	۱/۸۰	۶۸/۴	/	4B
۲	۲/۴	۸۹	/	1C
۱۴	۲/۴	۸۸	/	2C
۲۲	۲/۴۱	۸۹	/	3C
۵۰/۶	۲/۵	۸۴	/	4C
۱/۷	۰/۹	۳۳	/	1D
۹/۶	۰/۹۵	۳۵	/	2D
۲۲	۰/۹۳	۳۲/۹۶	/	3D
۳۵/۵	۰/۹۲	۳۲/۹۶	/	4D



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1D 1C 1B 1A

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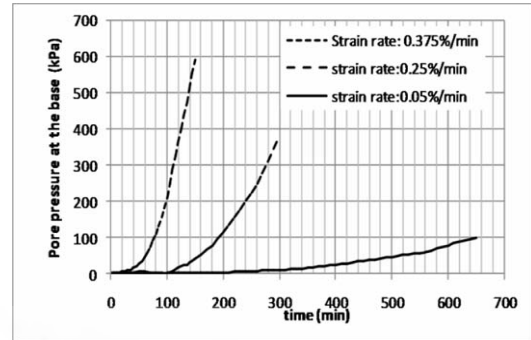
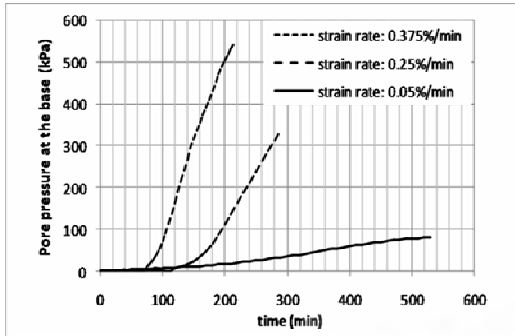
()

0.025%/mm

0.025%/min

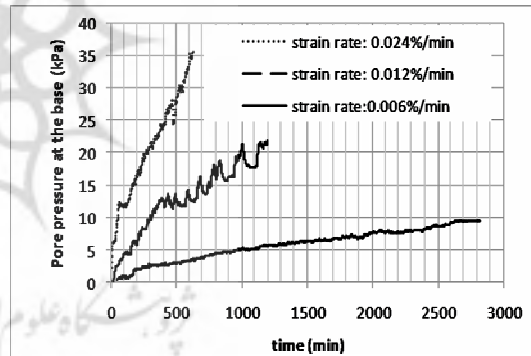
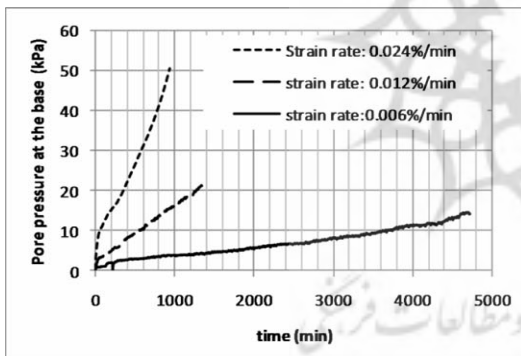
0.025%/mm

0.025%/mm



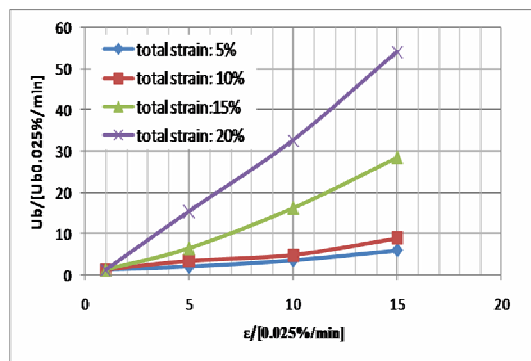
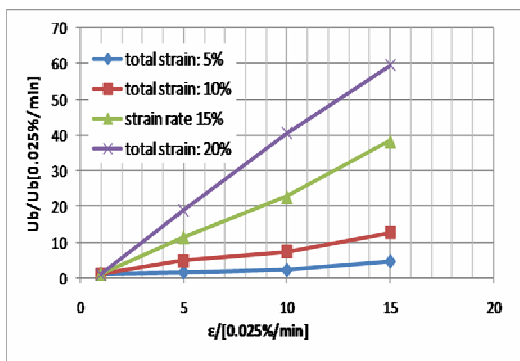
B

A



D

C



B

0.025%/min

A

0.025%/min

() ()

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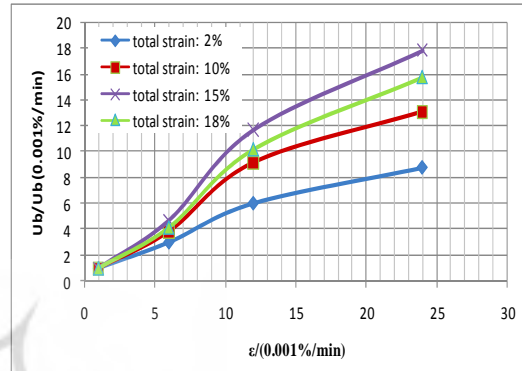
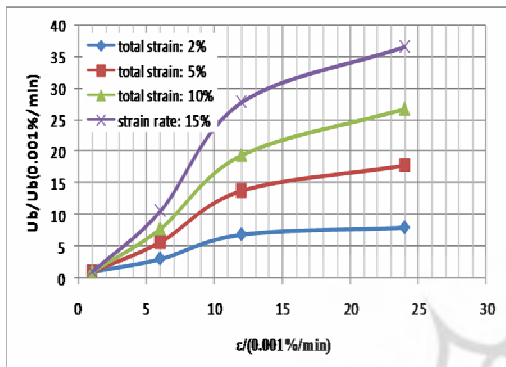
0.001%/min

() () ()

B A

D C

B A



0.001%/min

D

0.001%/min

C

() ()

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() () (u_b/σ)

() ()

B A

()

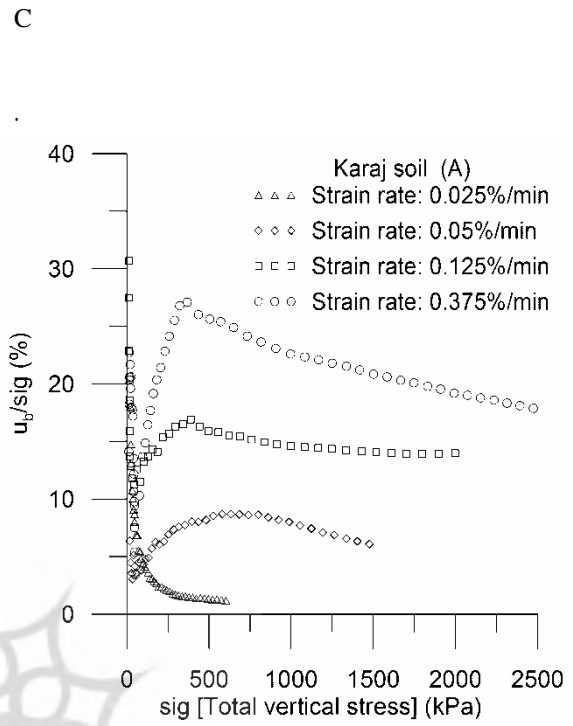
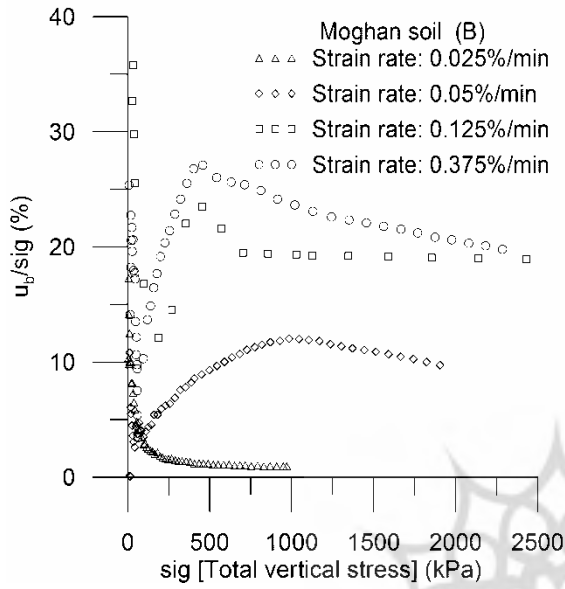
() ()

D C

C

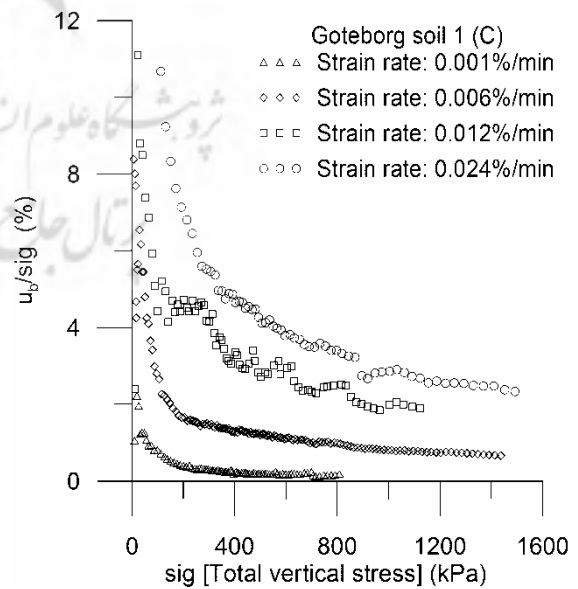
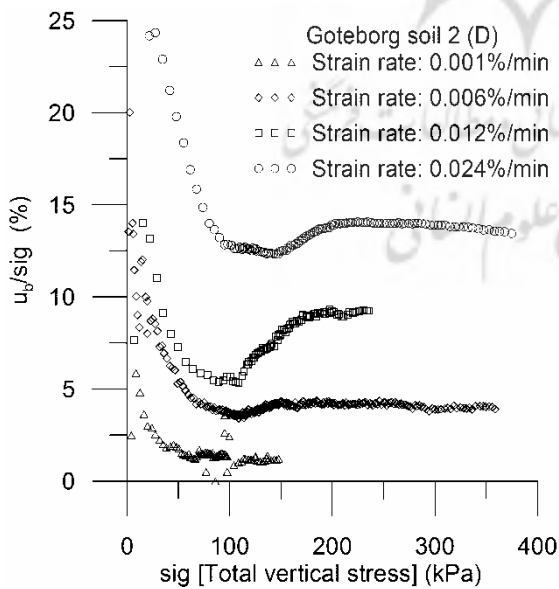
C
C
D

B A



B

A



D

C

B A

D

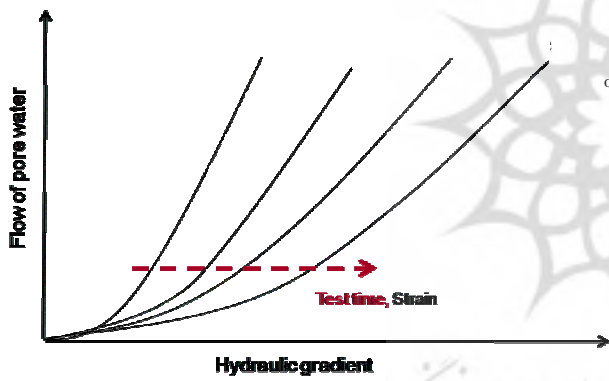
() () ()

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CD

(Dubak, 2003)



Mitchell and Younger,)

(1967

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() Hansbo

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v-i

(i)

(v)

()

v-i

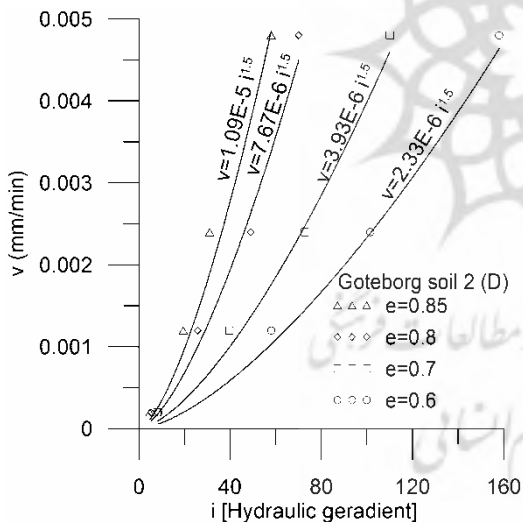
() ()

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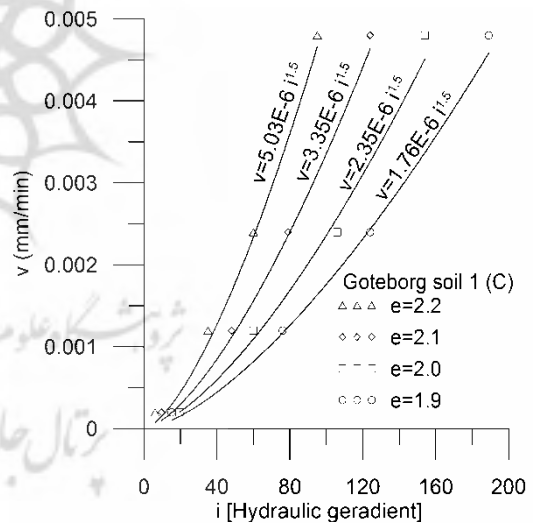
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(Mitchell and Soga, 2005)



(PI=66) D



(PI=60) C

v-i

v-i

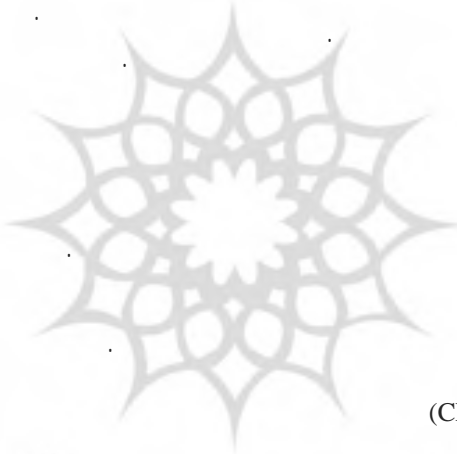
(u_b/σ)

()

CRS

(CL)

%



()

(CL)

(CH)

CRS

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