

# THE EFFECT OF LEACHATE ON LIQUEFACTION

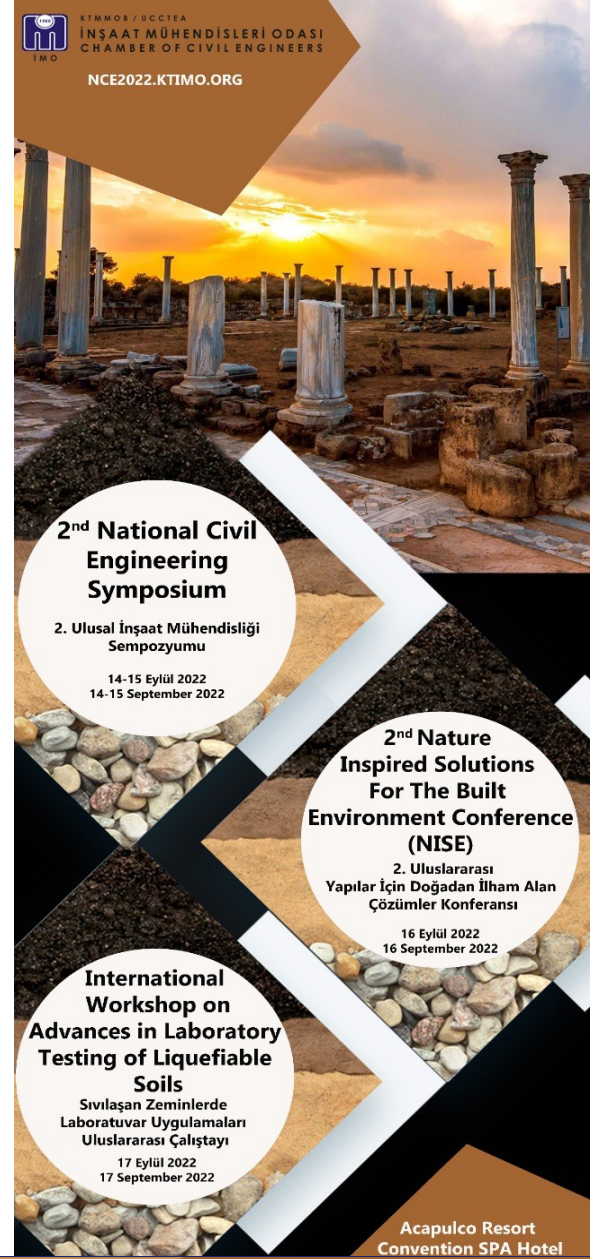
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**2<sup>nd</sup> National Civil Engineering Symposium**  
2. Ulusal İnşaat Mühendisliği Sempozyumu  
14-15 Eylül 2022  
14-15 September 2022

**2<sup>nd</sup> Nature Inspired Solutions For The Built Environment Conference (NISE)**  
2. Uluslararası Yapılar İçin Doğadan İlham Alan Çözümler Konferansı  
16 Eylül 2022  
16 September 2022

**International Workshop on Advances in Laboratory Testing of Liquefiable Soils**  
Sıvılaştan Zeminlerde Laboratuvar Uygulamaları Uluslararası Çalıştayı  
17 Eylül 2022  
17 September 2022

Acapulco Resort Convention SPA Hotel



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14 -17 Eylül 2022  
14 - 17 September 2022

# Outline

1. Introduction
2. Material (Sand, Leachate,)
3. Test Apparatus and Methods
4. Modified Split Mold, Sample Preparation
5. Results
6. Conclusion

# 1. Introduction

The storage of solid and liquid waste is one of the important environmental problems. The wrong storage of urban waste affects soil layers, ground, and underground water. In sanitary landfill sites, the wastewater leachate contamination affects the engineering properties of soil layers underlying solid waste landfill. Leachates disrupt the properties of soil within the chemical content.

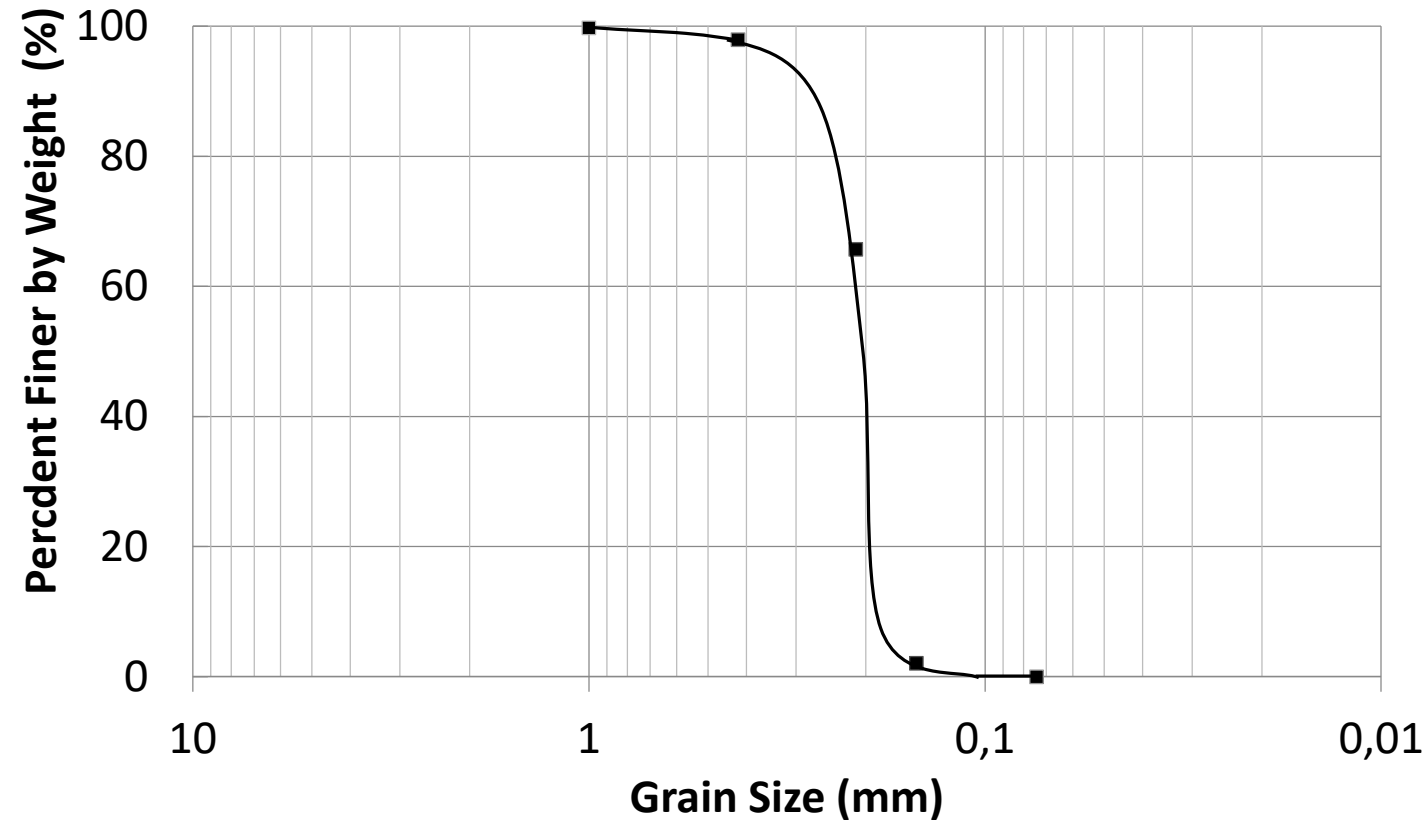
Clay soils contaminated with leachate have been studied by many researchers.

Tuncan et al.,1988 [4] conducted a series of laboratory tests on clay soils mixed, and cured with leachate to study the unconfined compressive strength, stress-strain relationship and permeability.

Erken et al (2005), studied the effect of leachate on the strength of compacted clayey soils. Erken and Yasargün (2009) also studied the effect of leachate on the cyclic behavior and post-cyclic nonotonic strength of clays.

## 2. Material-Sand

Coefficient of Uniformity,  
 $U=1.434$   
 $FC=0$   
 $GS=2.60$   
 $D_{50}=0.20$  mm  
 $e_{max}=0.874$   
 $e_{min}=0.558$   
 $USCS=SP$



## 2. Material- Leachate

1. The leachate was obtained from the site of Kemerburgaz solid waste landfill in Istanbul.
2. Test was conducted in Environmental Laboratory under the supervision Prof.Dr.Kadir Alp



## 2. Material- Leachate

3. The sample I is young leachate (one week old), the sample II is 22 months old leachate wastewater.

4. Amount of organic matters which is high in young deposition decreases by increasing time.



## 2. Material- Leachate

5. The BOI/COI ratio of Kemerburgaz-Istanbul solid waste leachate is 0.65 for young leachate and 0.11 for old leachate.

6. As the age of solid waste landfill increases Ph increases due to decreasing organic matters.

## 2. Material -The composition of Leachate (1)

Parameter	Unit	Sample 1	Sample 2
		26/12/2017 (young-1 week)	27/02/2016 (old-22 months)
pH	-	7.30	9.25
Total Solids	mg/l	29710	15350
Total Volatile Solids	mg/l	13055	2670
Total Dissolved Solids	mg/l	27950	12320
Total Volatile Dissolved Solids	mg/l	13510	1385
Alkalinity	mg/l CaCO <sub>3</sub>	14300	7740

## 2. Material -The composition of Leachate (cont.)

COD	mg/l	37665	3595
Soluble COD	mg/l	30000	1570
BOD	mg/l	24450	400
T.P	mg/l	30	10
TKN	mg/l	2780	1120
NH3-N	mg/l	2550	820
Cl	mg/l	3266	4190
Sulphate	mg/l	120	356
Calcium hardness	mg/l CaCO3	6919	110
Total hardness	mg/l CaCO3	8595	1808

## 2. Material -The composition of Leachate (cont.)

Ca	mg/l	2773	44
Mg	mg/l	409	468
Na	mg/l	2590	2853
K	mg/l	1700	1700
Fe	mg/l	41.2	184
Ni	mg/l	0.82	1.16
Cr	mg/l	0.64	0.76
Zn	mg/l	1.27	3.04

### 3. Test Apparatus and Methods

1. The stress-controlled cyclic triaxial test was used to evaluate the cyclic behavior of laboratory reconstituted clean and polluted sand samples prepared by dry raining.
2. In this study, the specimens with 5 cm diameter and 10 cm height were isotropically consolidated to the 100 kPa in the triaxial cell and the backpressures is 300 kPa.

3. Dr is varied between 50% to 57%.
4. CO<sub>2</sub> and deaired water were applied to clean sands.
5. CO<sub>2</sub> and deaired water weren't applied to polluted sand samples by 100 % leachate to avoid the change in its characteristics.
6. Cyclic Axial Stress 28 kN/m<sup>2</sup> to 30 kN/m<sup>2</sup>

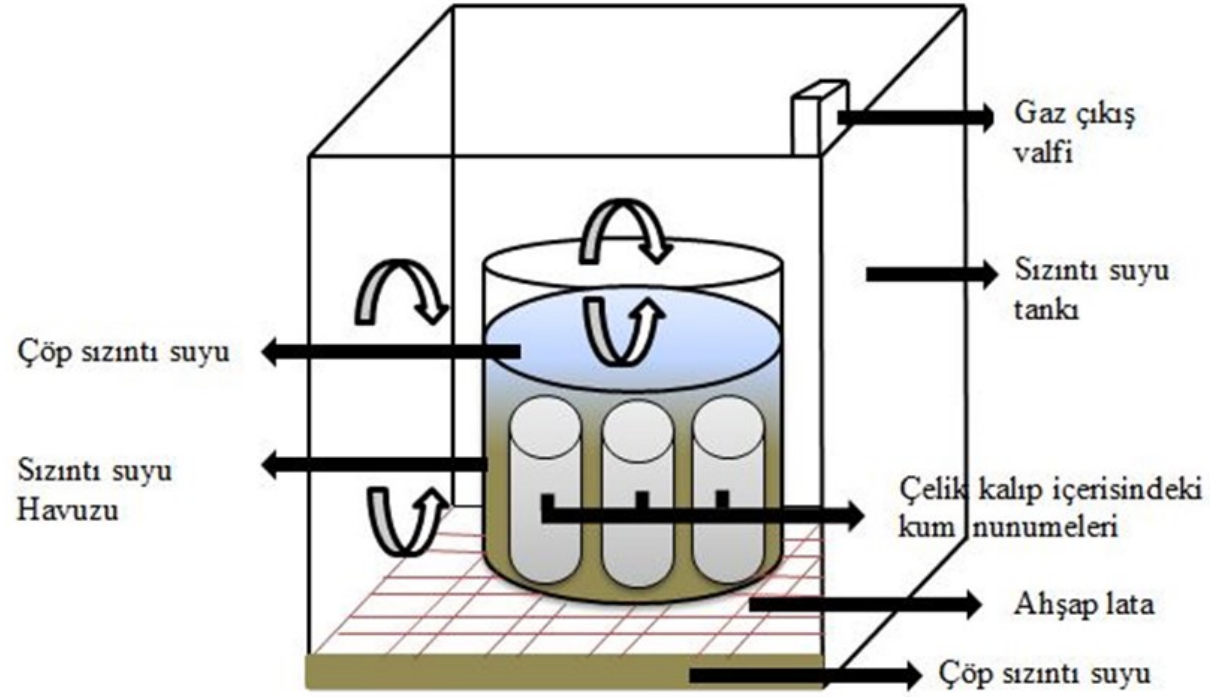
3. Curing time is varied from 1 day to 717 days.
4. The B values were between 43-100 %.
5. The frequency of cyclic load was 0.1 Hz during the tests.



# Modified Split Mold





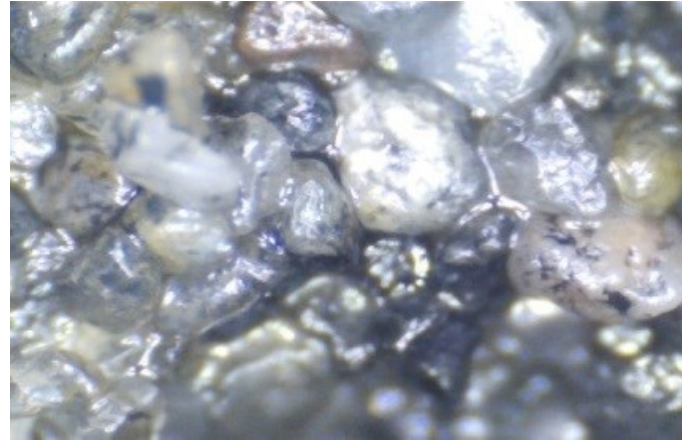






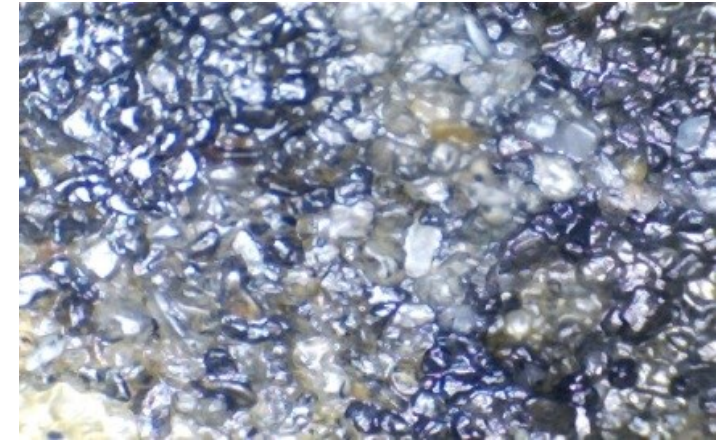
200Xzoom

Clean Sand



200Xzoom

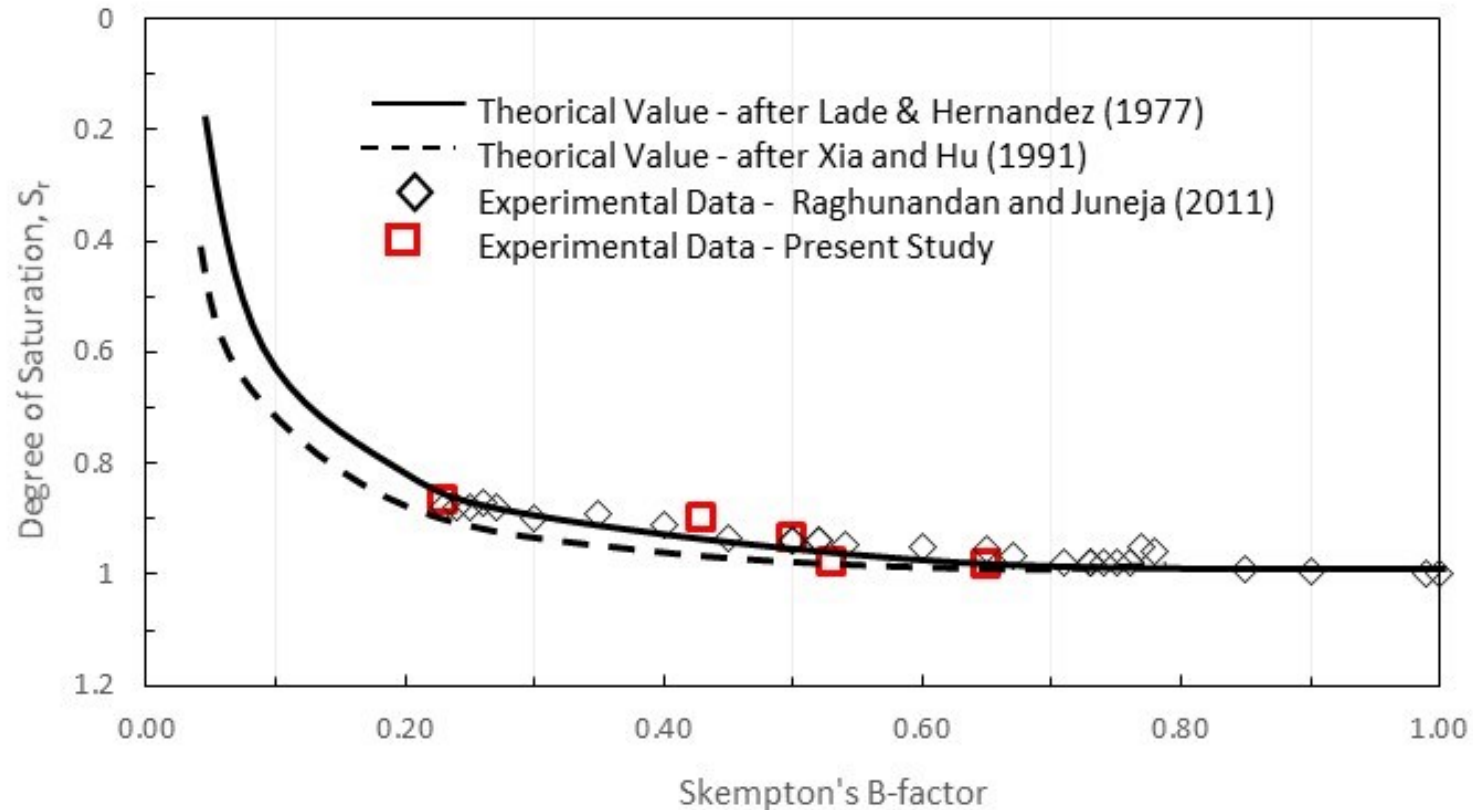
Polluted Sand



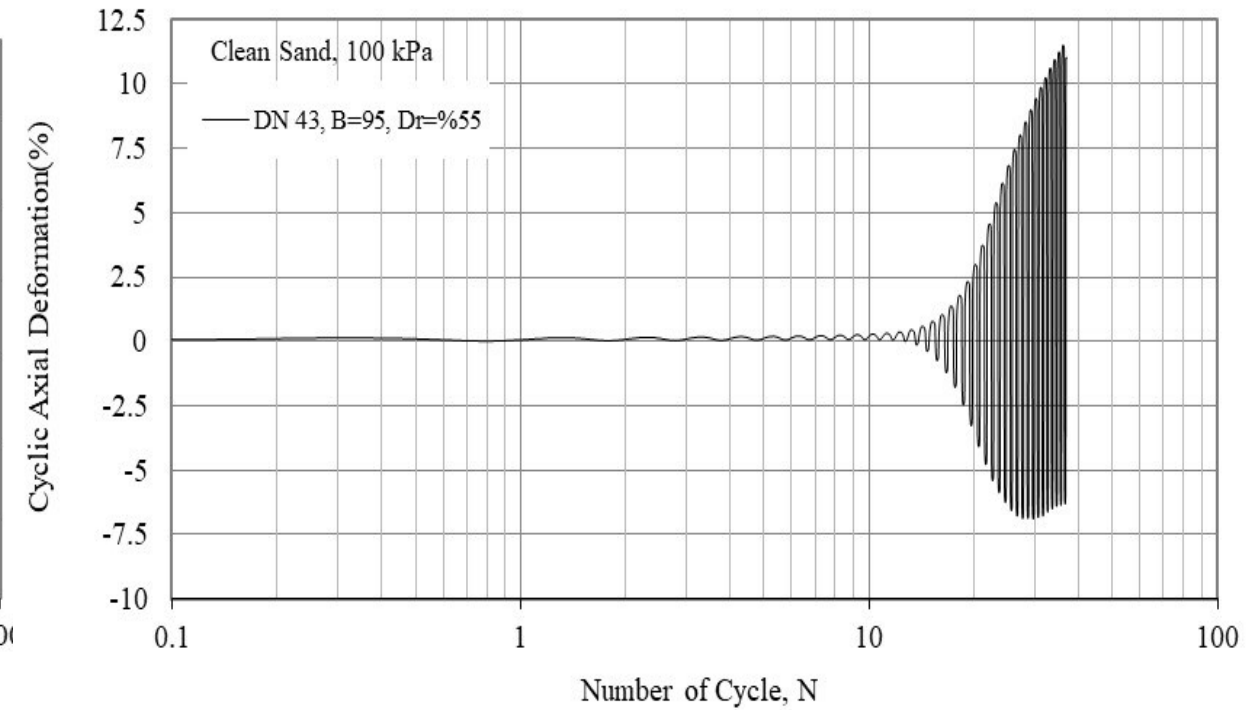
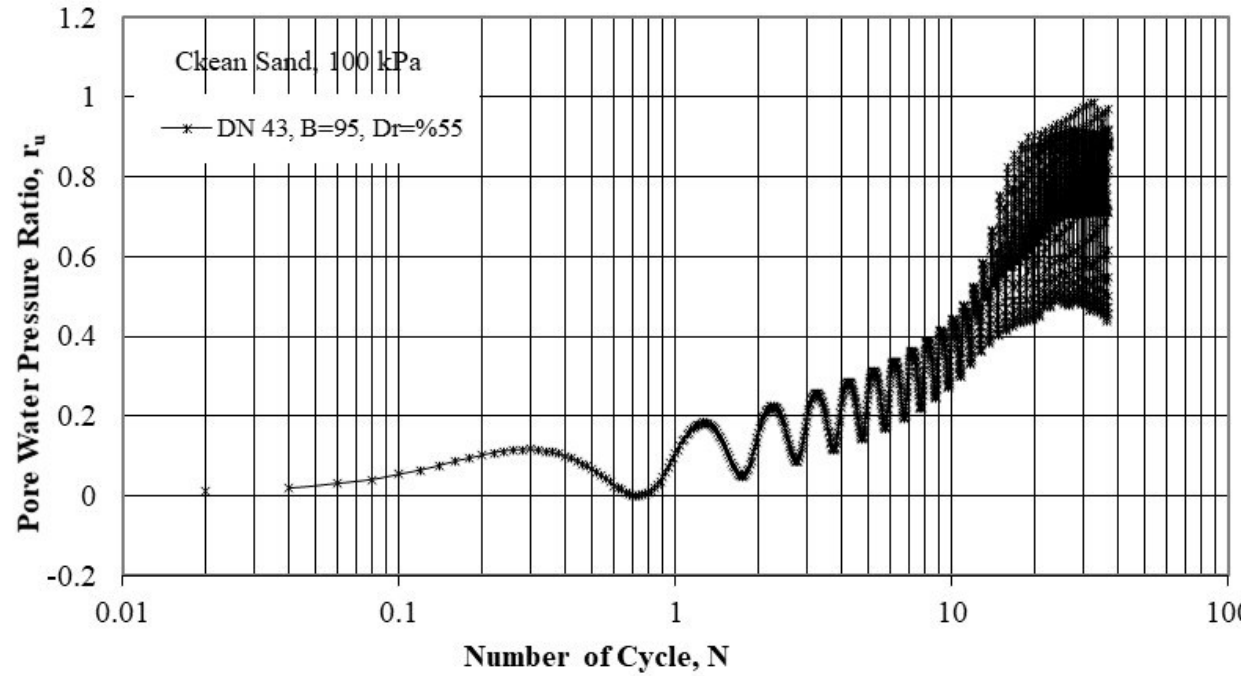
10Xzoom

Curing Time 712 days

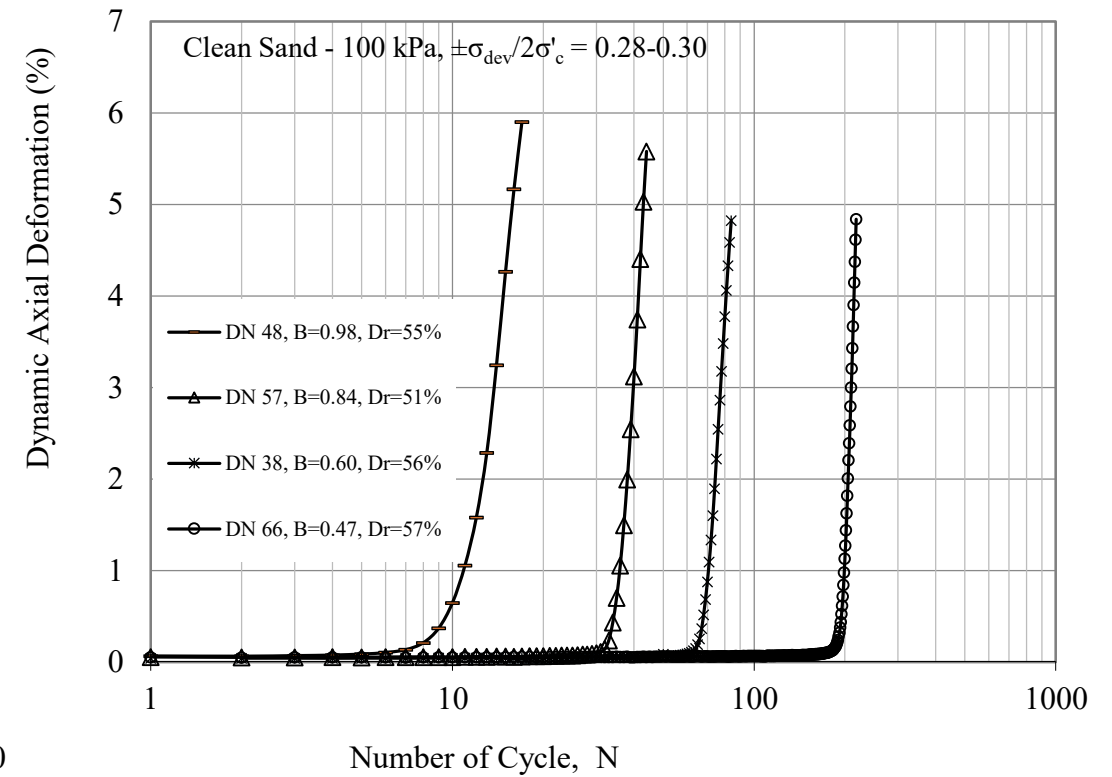
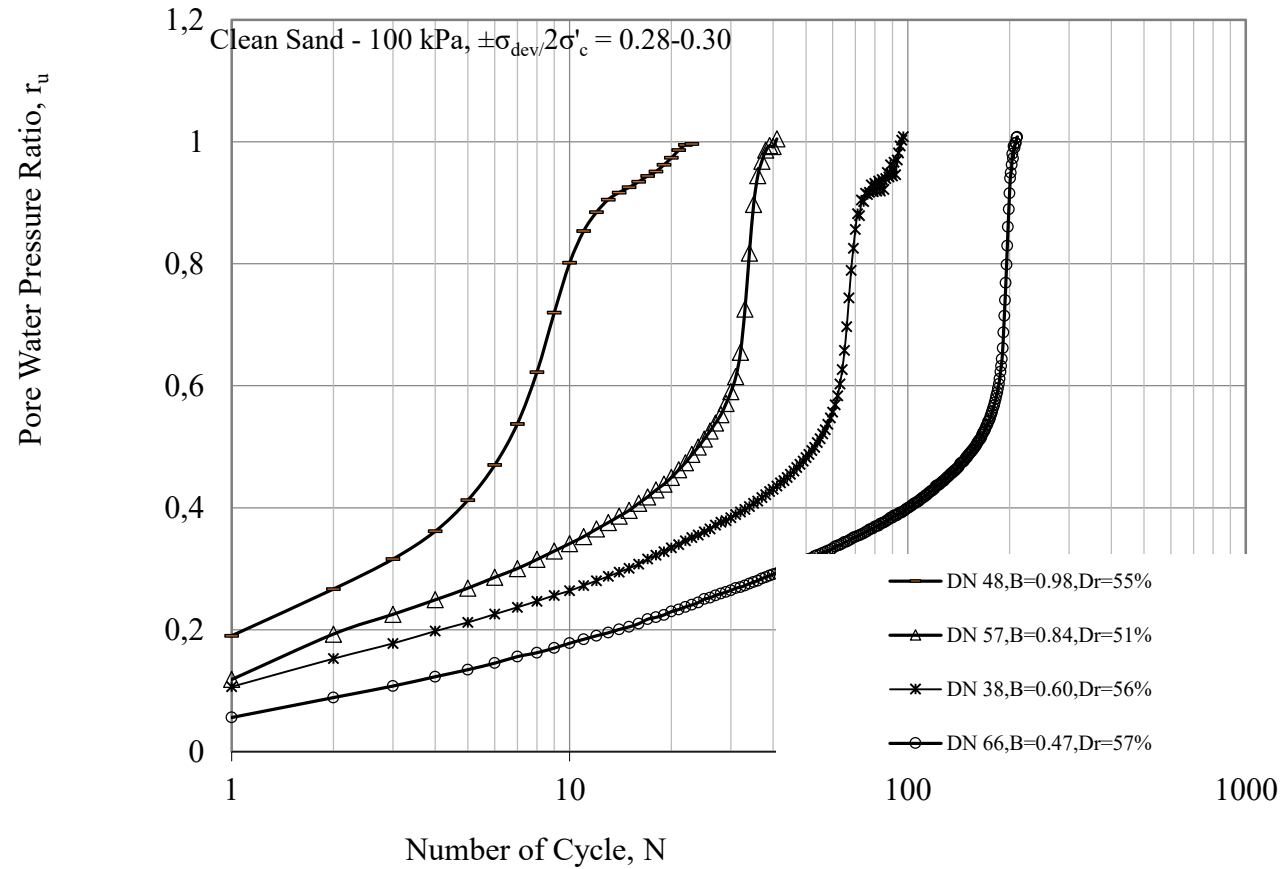
# Partially Saturated Sand



# Clean Sand

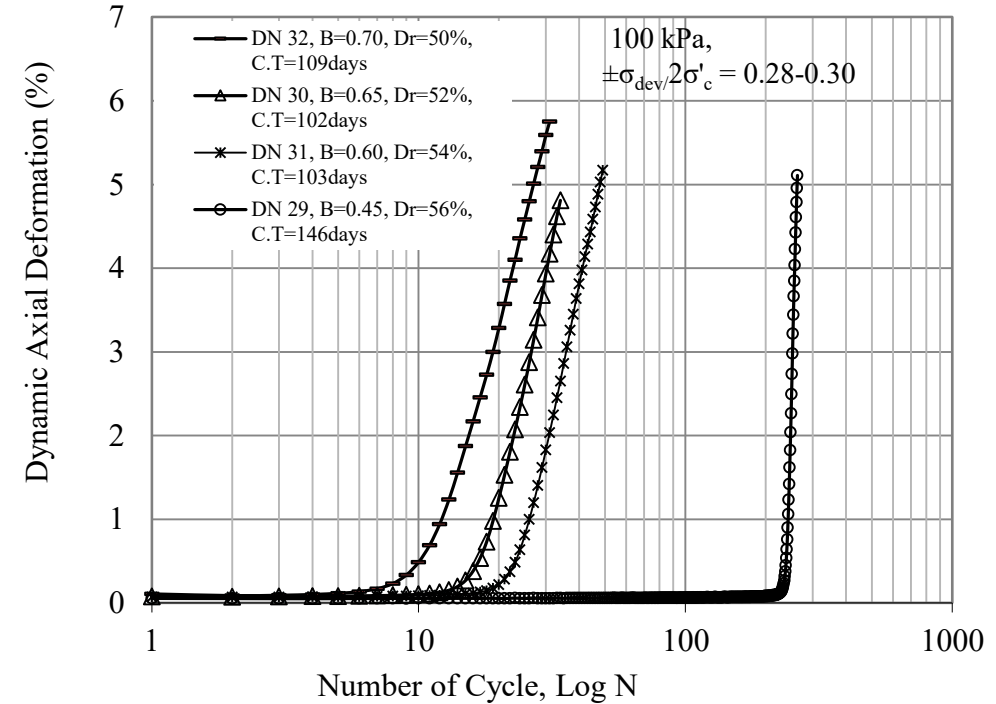
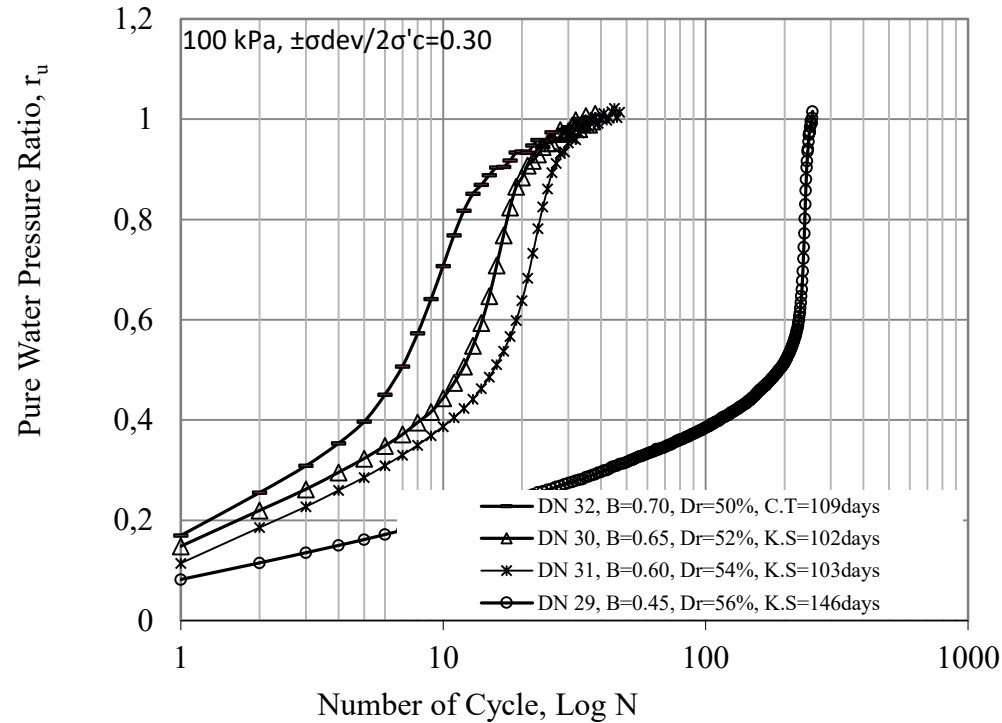


# Clean Sand B=0.98-0.47

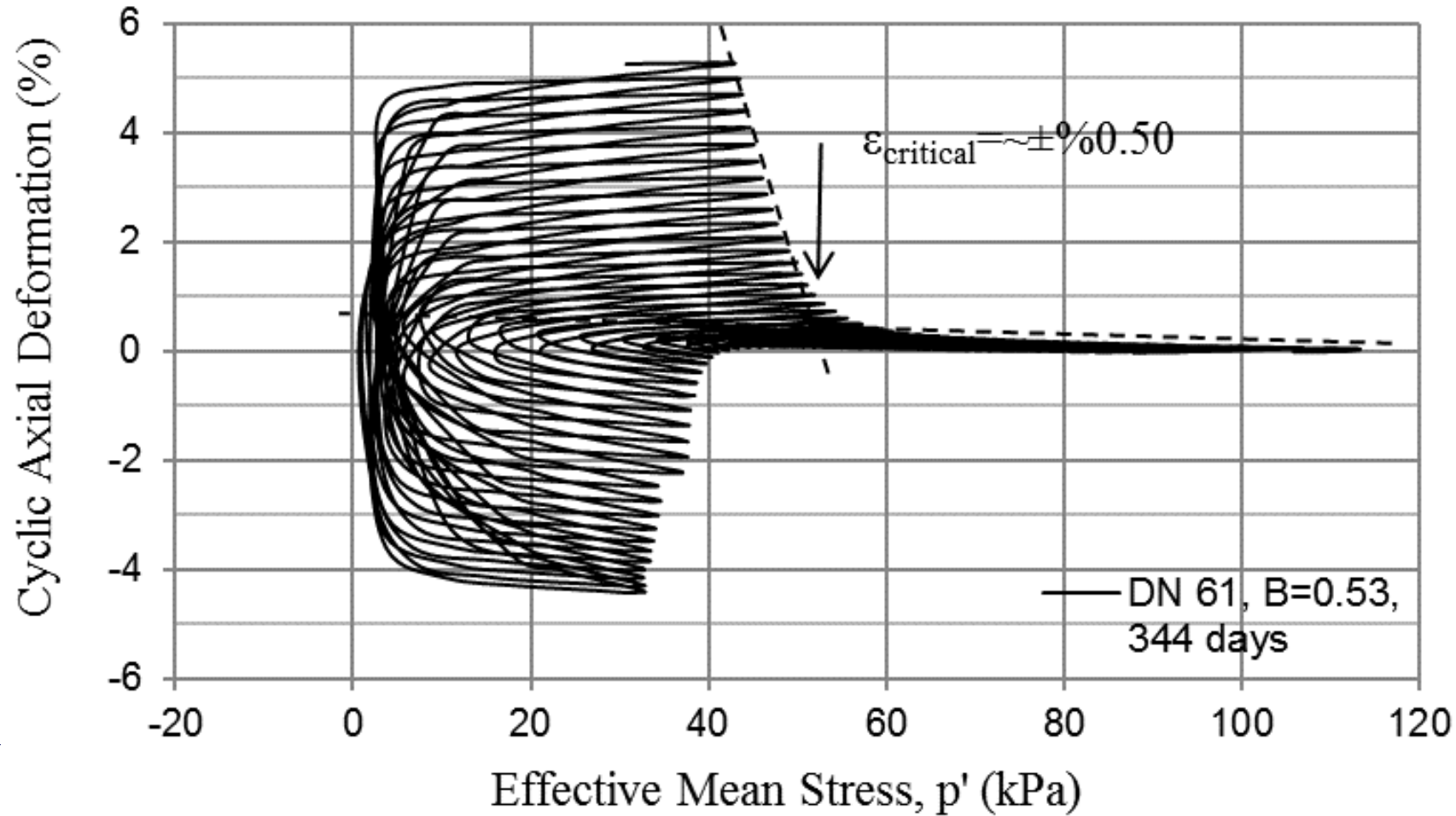




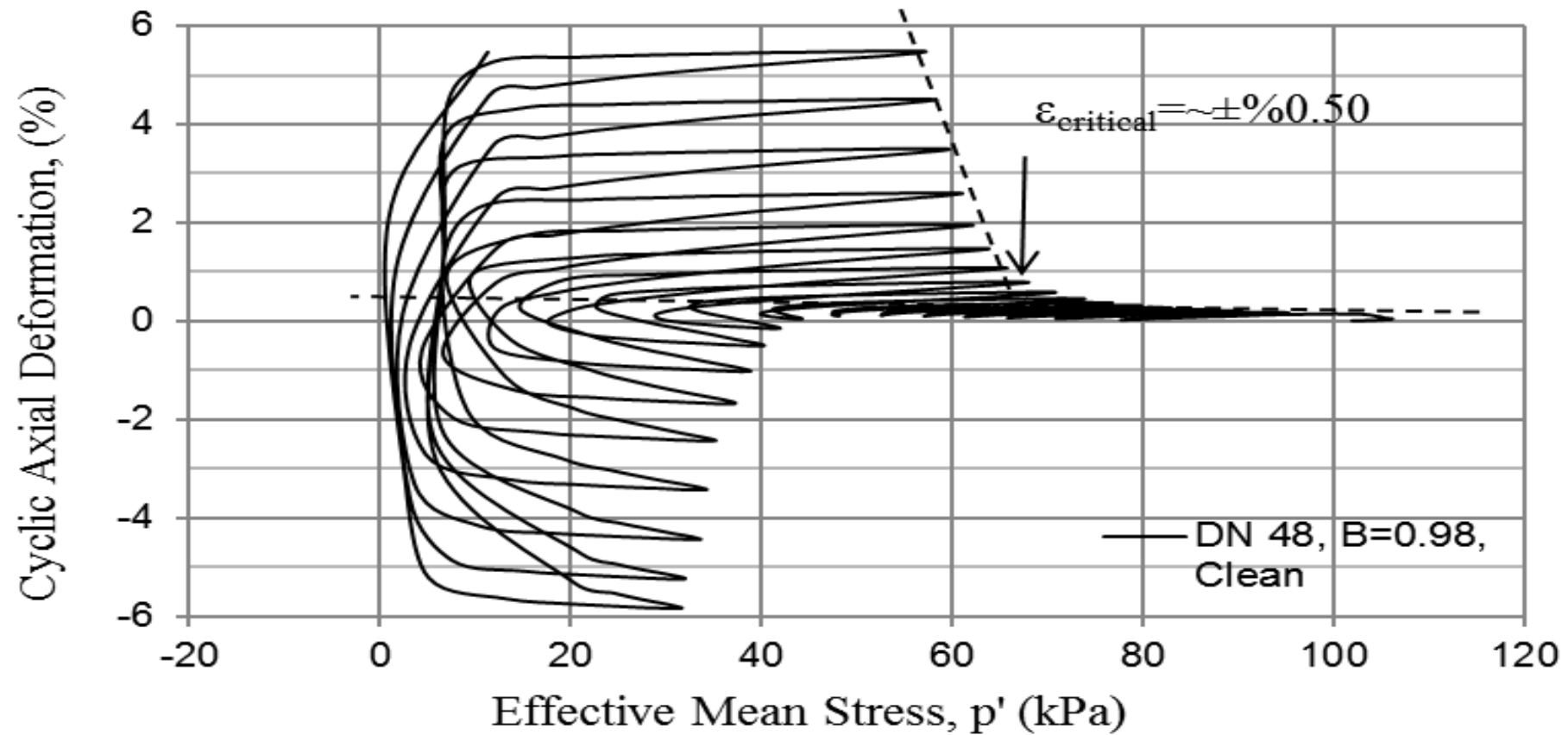
# Polluted Sand B=0.70-0.45 Cure Time 102-136 days



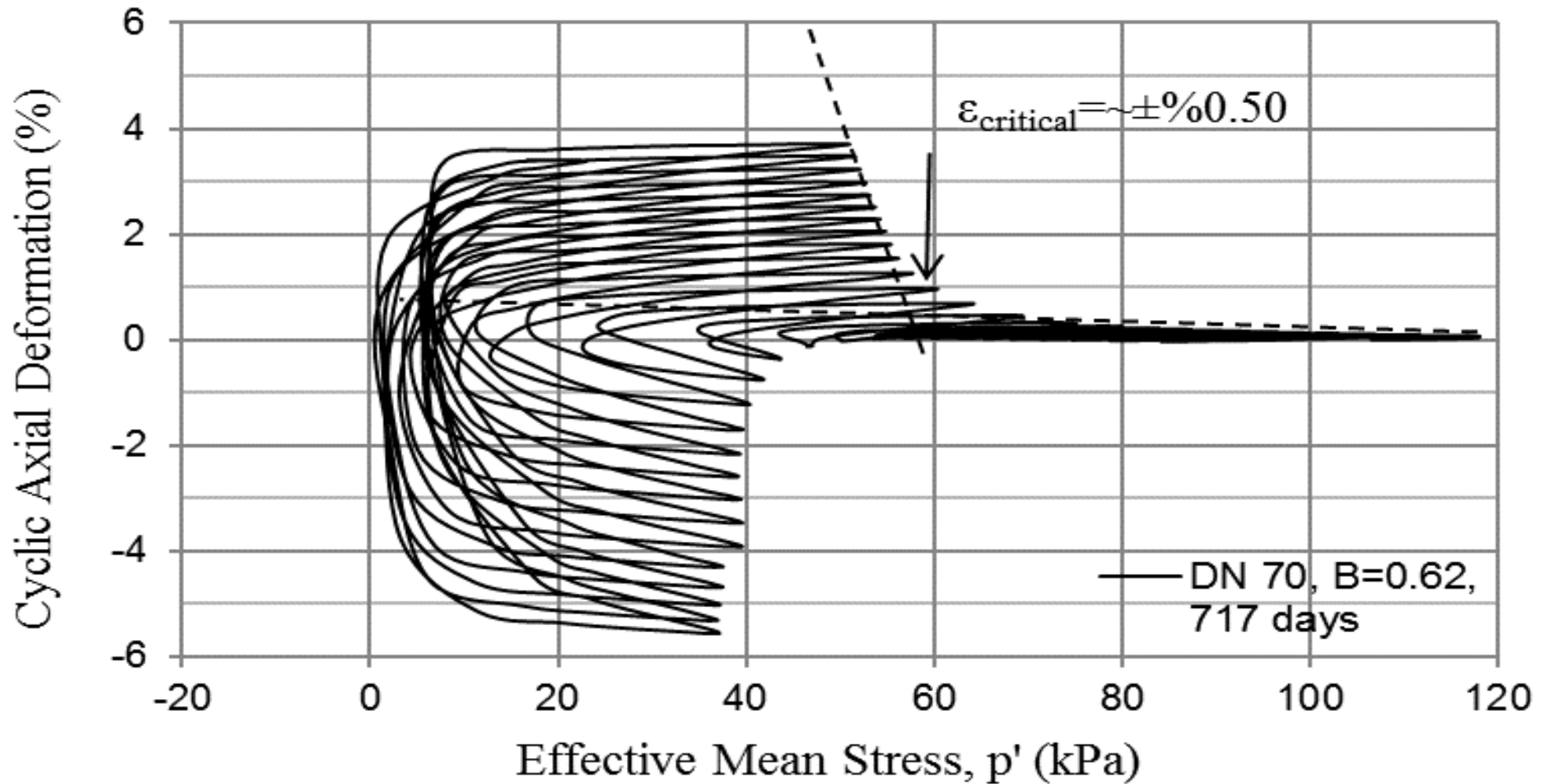
# Polluted Sand



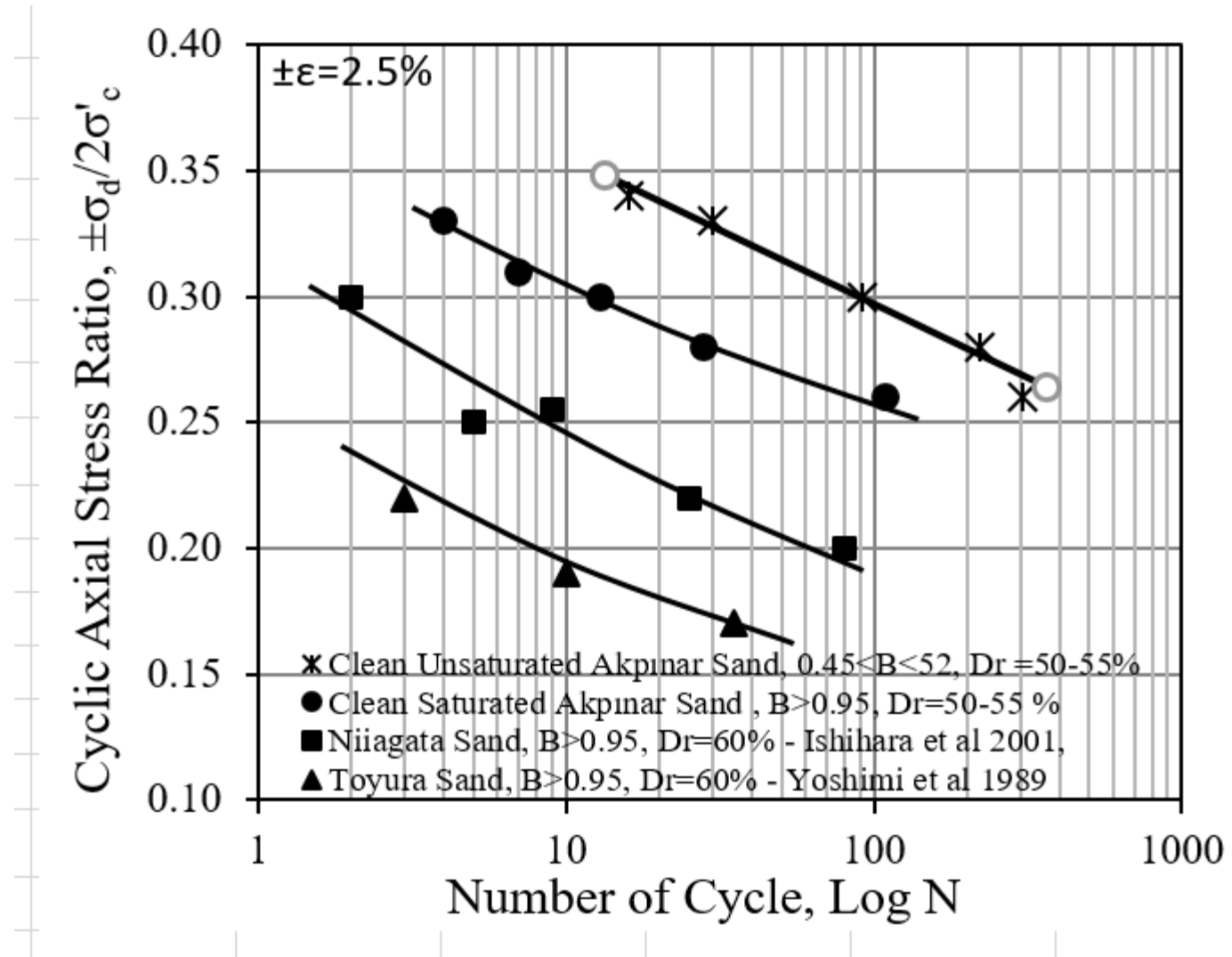
# Clean Sand



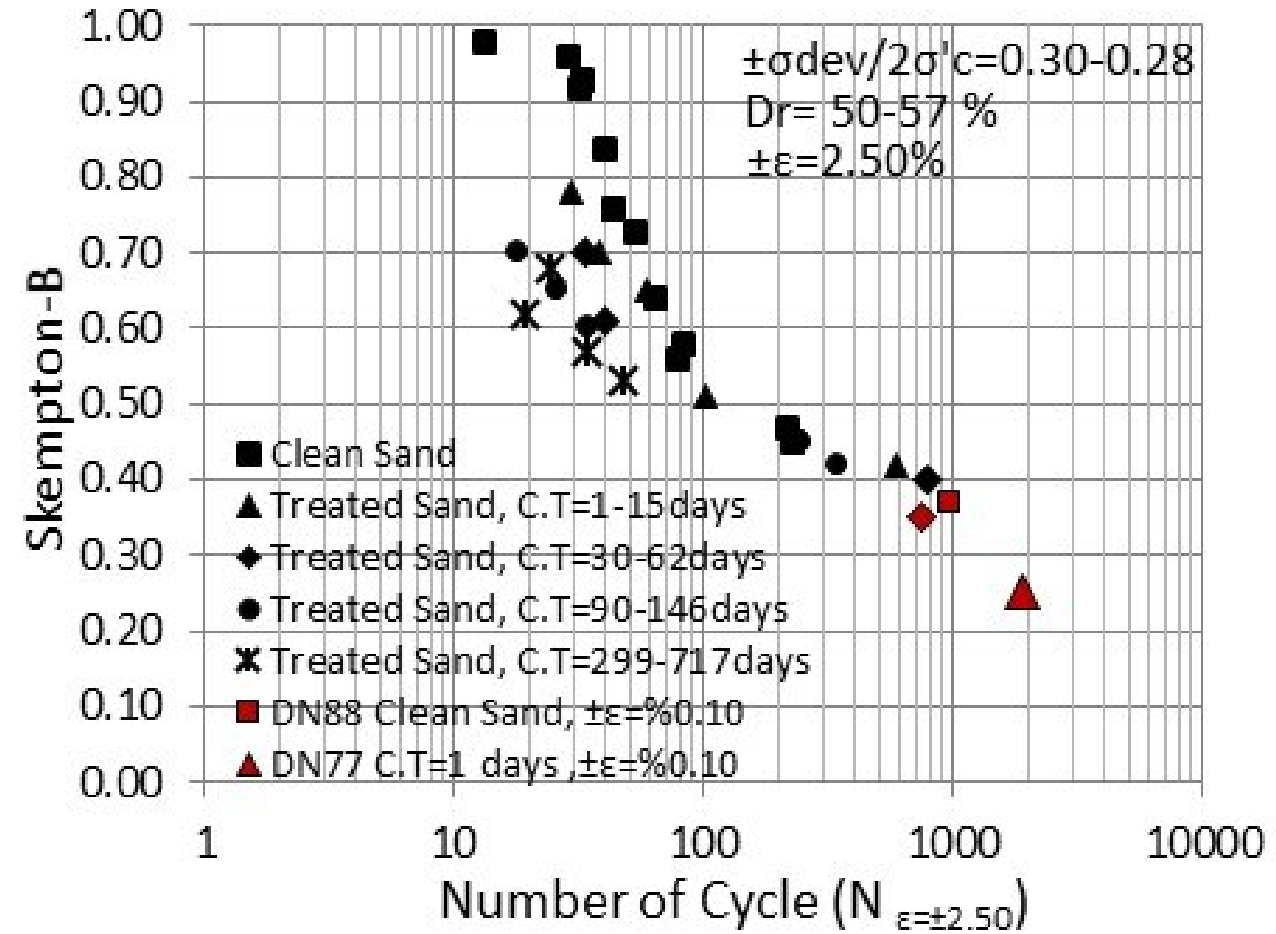
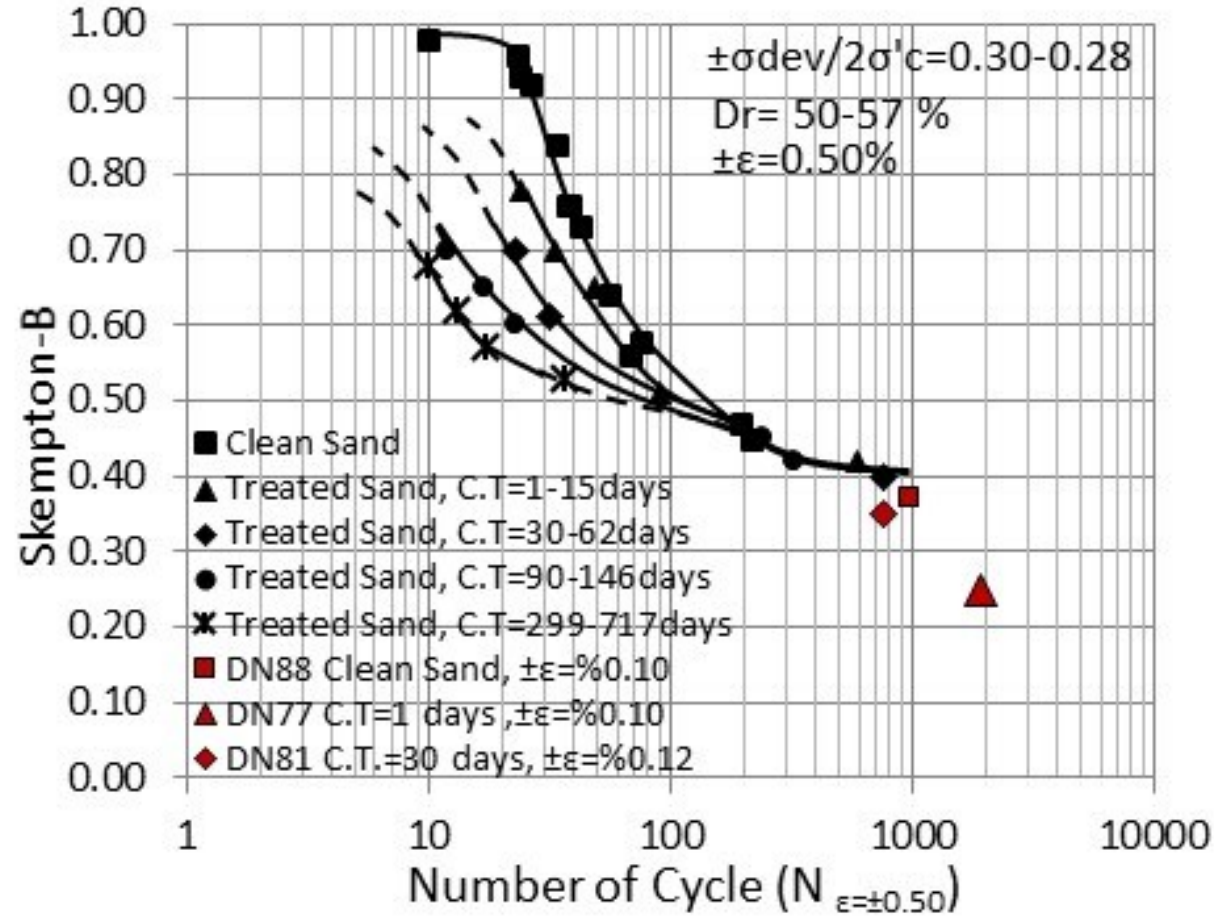
# Polluted Sand



B=45% to 52







## 6. Conclusion

In this research the effect of leachate on sand samples has been studied in the cyclic triaxial test system. According to cyclic loading tests the following results have been obtained.

1. Soil pollution is one of the factors affecting liquefaction.



- 2.The samples treated with 100% leachate have no significant effect during a short time curing period.
- 3.Liquefaction resistance increases as the degree of saturation decrease in clean sand and polluted sand by leachate.
- 4.Increasing cure time causes an increase in liquefaction potential

# Thank you very much



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