Sample animations in Teacher's guide

Soil Mechanics *Fundamentals*
and Applications

2nd Edition to Soil Mechanics Fundamentals, 2015

Click to begin sample demo.

Isao Ishibashi • Hemanta Hazarika

CRC Press

Fig. 1.5 Building tilt and settlement due to liquefaction during 1964 Niigata Earthquake
(click for earthquake)

During the 1964 Niigata Earthquake, Japan, with magnitude 7.5
Apartment buildings lost their foundation support and sank and tilted.

Foundation soil is transformed into ***viscous liquid*** due to earthquake vibration.

Soil Liquefaction

One of major geotechnical engineering problems during earthquakes.

Soil dynamics or **earthquake engineering**.

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Hydrometer analysis

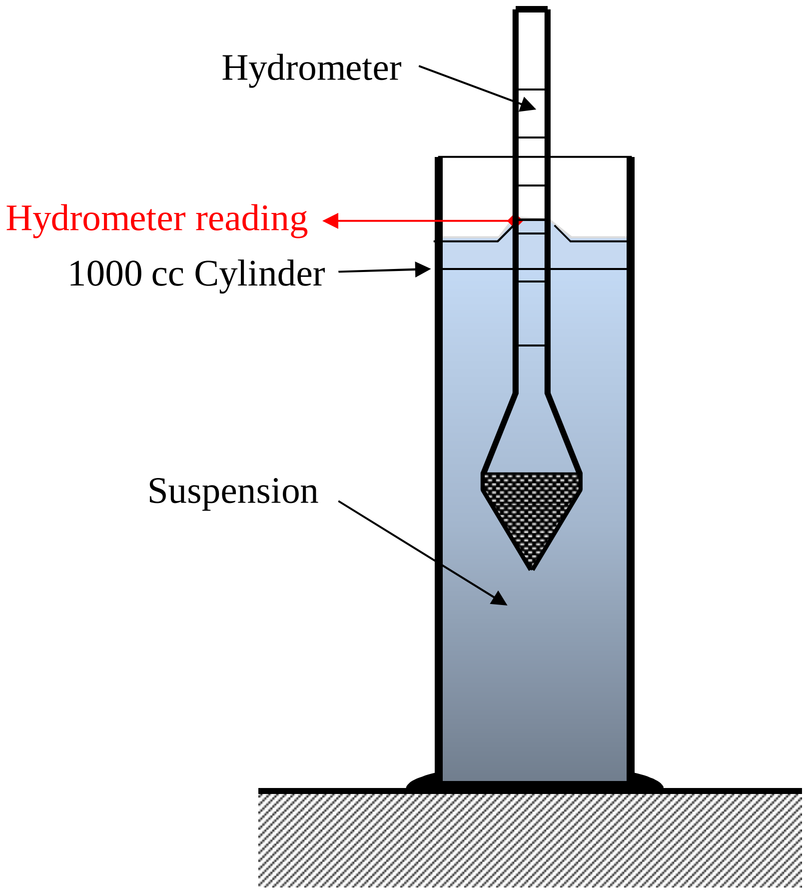

Fig. 2.10 Hydrometer test setup

(click for hydrometer test)

Table 2.3 Example of hydrometer test result

A Particle Dia. D, mm	B % finer	C Modified % finer
0.066	84.5	45.7
0.045	74.3	40.2
0.036	68.3	37.0
0.025	58.2	31.5
0.015	48.4	26.2
0.011	42.3	22.9
0.007	34.6	18.7
0.005	28.1	15.2
0.004	24.3	13.2
0.003	20.1	10.9
0.0018	16.2	8.8
0.0012	12.3	6.7

Column C = Column B x $F_{200\ (Curve\ 1)}/F_{200(Curve\ 2)}$

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(a) AASHTO method

% passing No.10 (2.0 mm) = 87 %
% passing No.40 (0.425 mm) = 63 %
% passing No.200 (0.075 mm) = 28 %
LL = 46
PI = 46 – 35 = 11

General Classification	Granular Materials (35 % or less passing 0.075 mm)							Silt-Clay Materials (More than 35% passing 0.075 mm)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7[a]
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6
Sieve analysis,% passing											
No.10 (2.00 mm)	50 max	-	-	-	-	-	-	-	-	-	-
No.40 (0.425 mm)	30 max	50 max	51 min	-	-	-	-	-	-	-	-
No. 200 (0.075 mm)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
For F_{40} materials											
Liquid limit	-		-	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[a]
Usual types of significant constituent materials	Stone fragments, gravel and sand		Fine sand	Silty or clayey gravel and sand				Silty soils		Clayey soils	
General ratings as subgrade	Excellent to good							Fair to Poor			

$$GI = 0.01(F_{200} - 15)(PI - 10) = 0.01(28-15)(11-10) = 0.13 \rightarrow 0$$

A-2-7 (GI=0)

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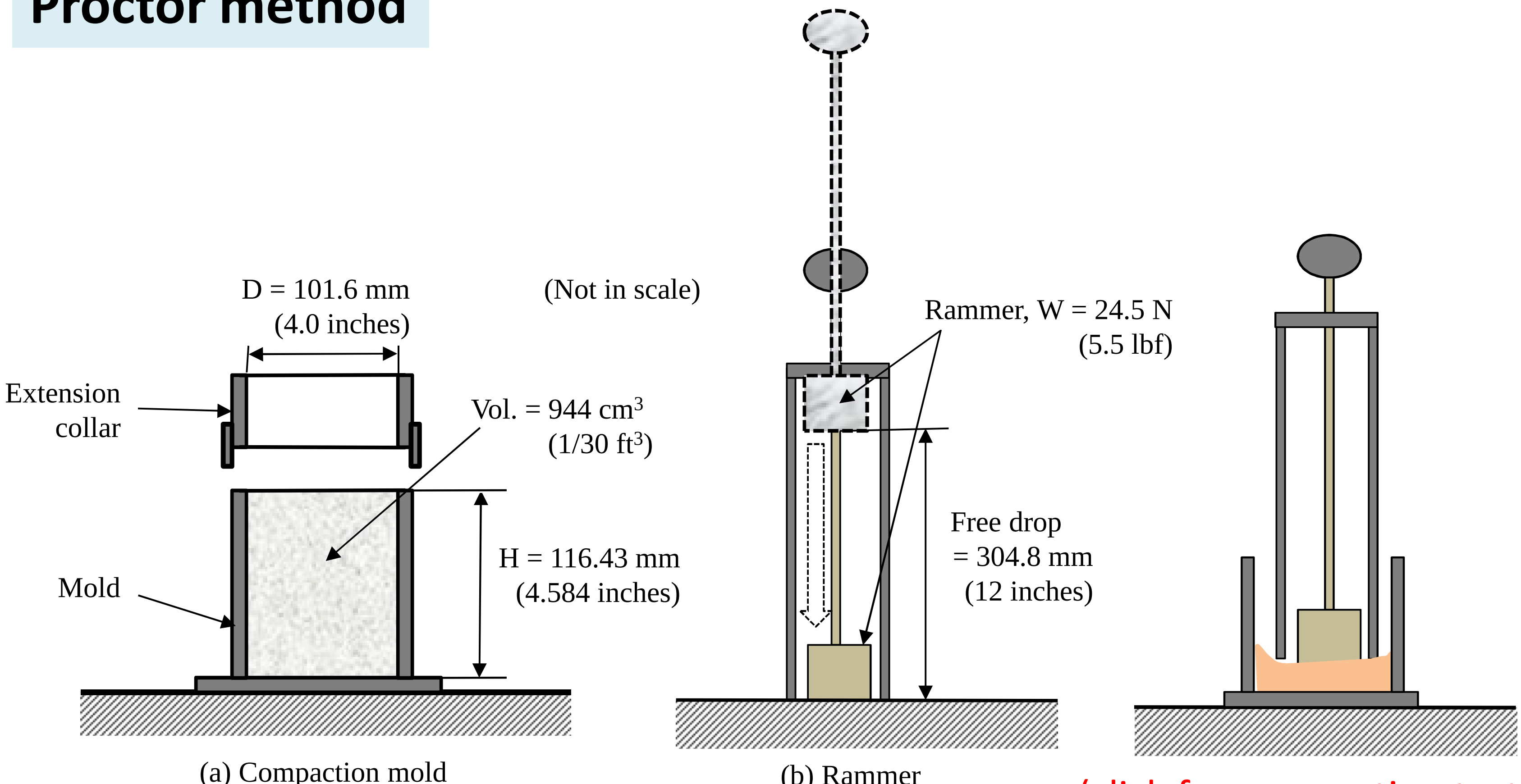
5.3 Laboratory Compaction Test

Proctor method



(click for compaction test)

Fig. 5.2 Standard Proctor compaction device

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5.6 Field Density Determinations

Sand cone method

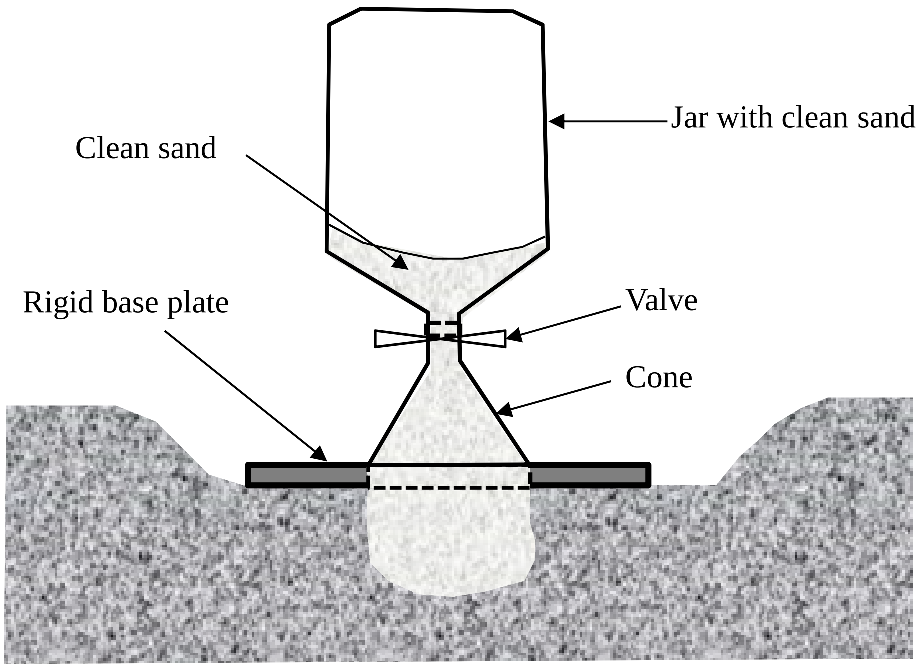
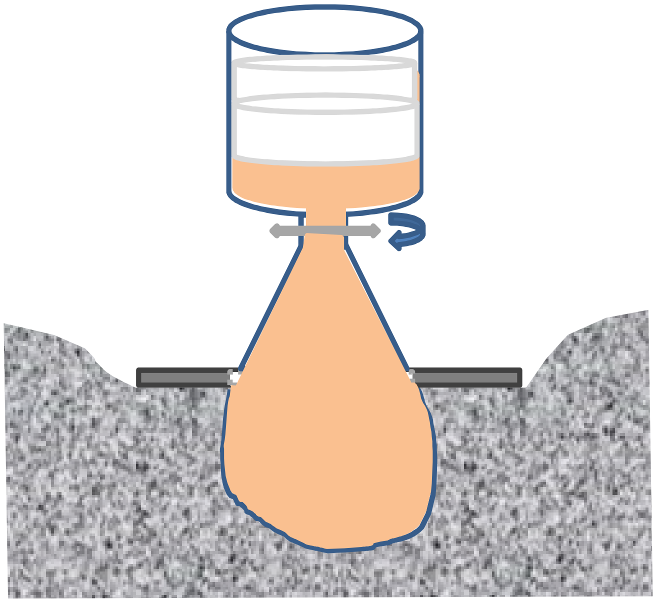


Fig. 5.10 Sand cone method



(click for sand cone test)

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2-D flow net construction

(1) Draw the geometry of structure correctly on the paper. The horizontal and vertical scales shall be the same. Otherwise, the square shape requirement cannot be met.

(2) Select a proper N_f values. Normally, N_f of 3 or 4 is adequate for the first trial.

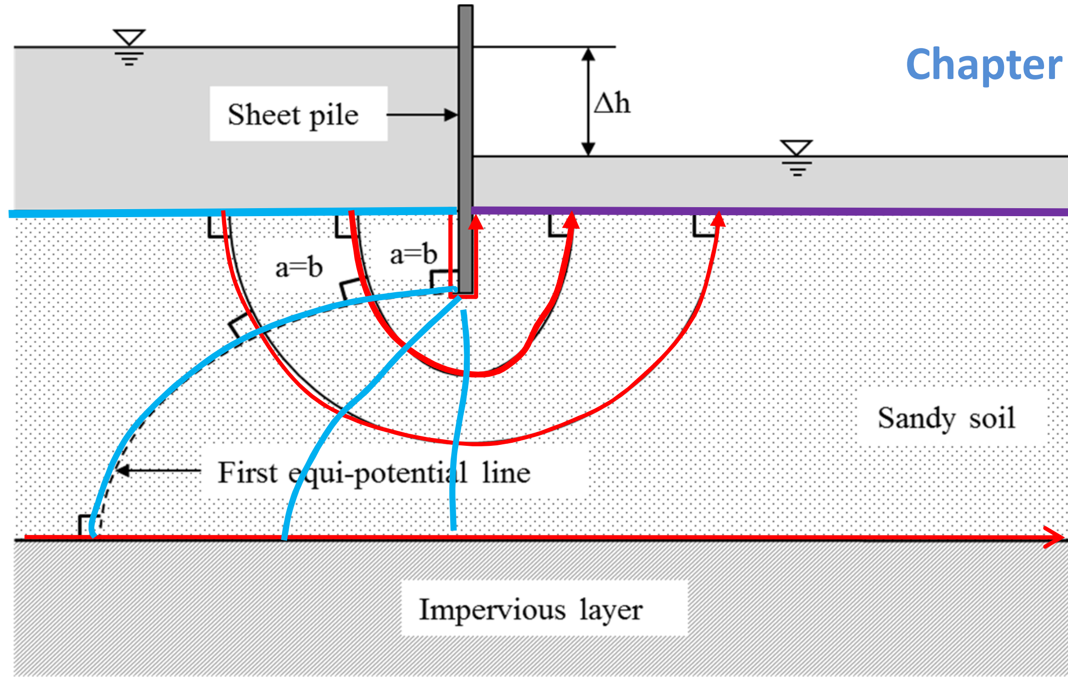

Fig. 6.10 Flow net construction

(3) Identify the boundary flow lines and boundary equi-potential lines on the drawing.

(4) First draw trial flow lines with selected N_f for the entire earth structures. Note that there are equal amounts of water flow through all flow channels.

(5) By starting from the upstream site, draw the first equi-potential line to have all net openings squares or near squares with 90 degree intersections

(6) Continue the above step for the second and third equi-potential lines and so on.

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Downstream exit equi-potential line

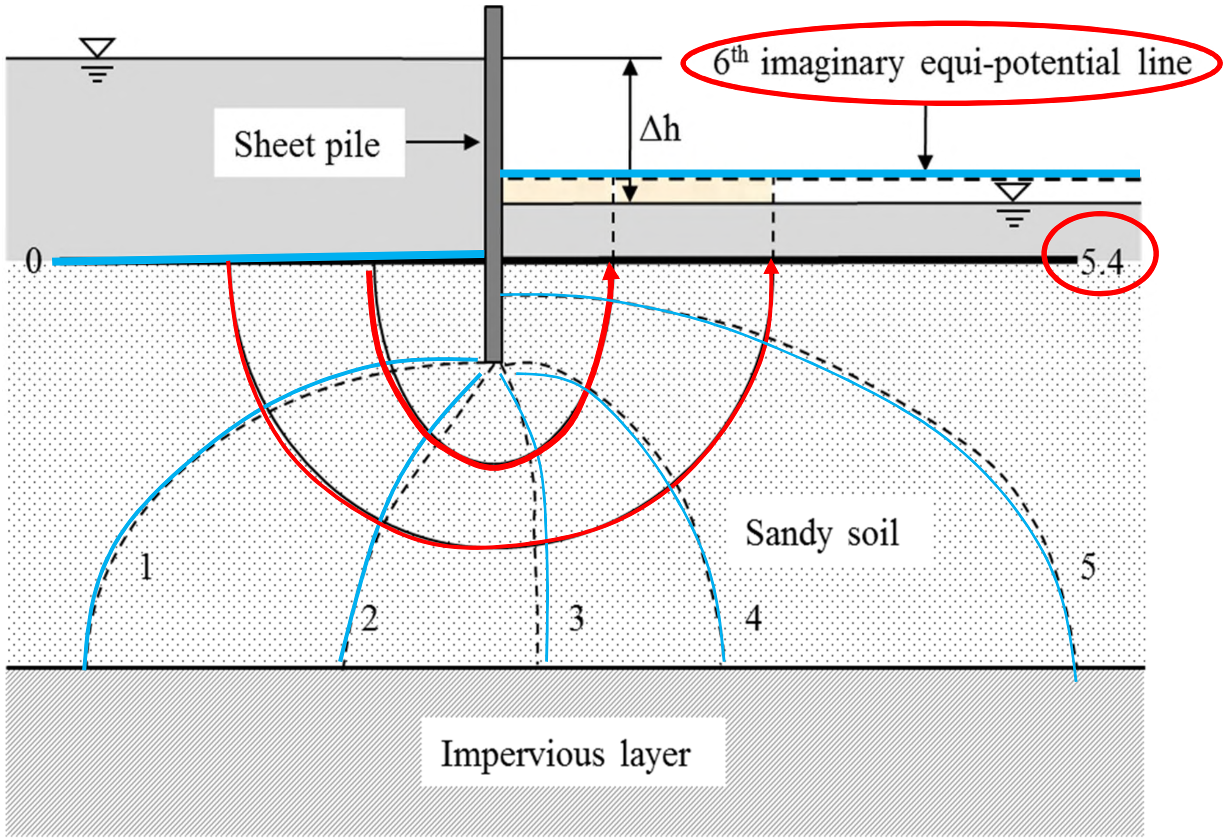

Fig. 6.12 Completion of flow net construction

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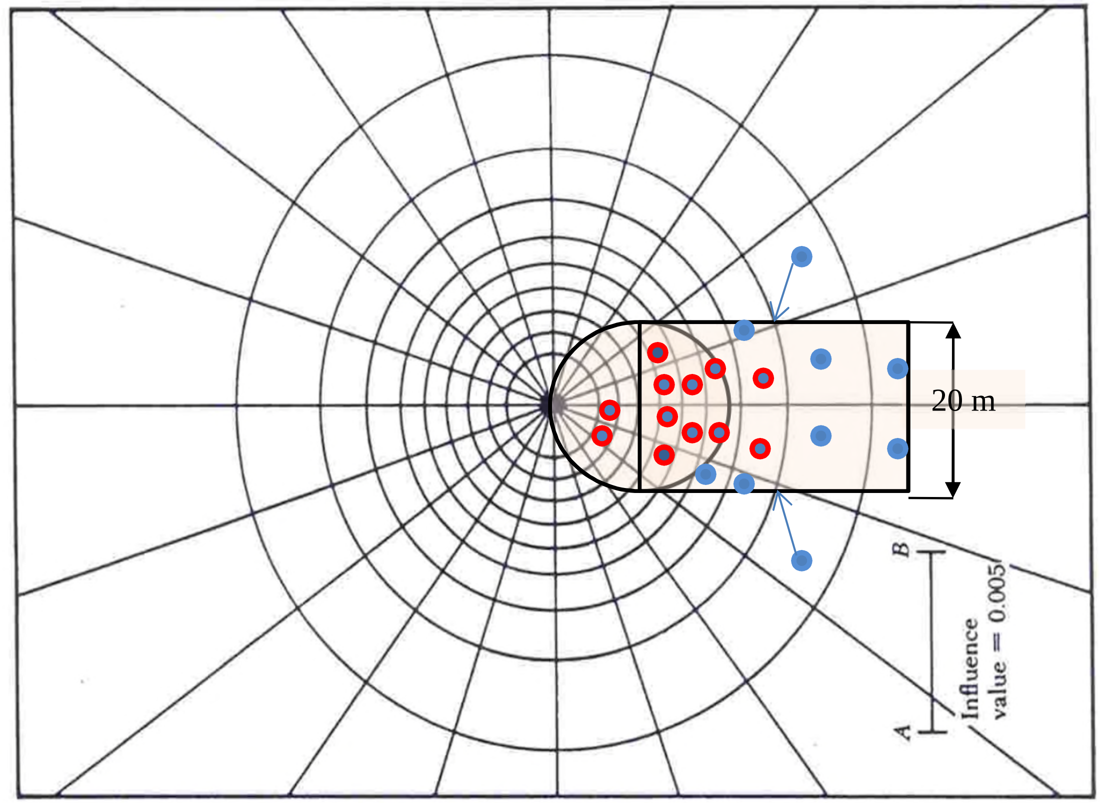
Solution:

On an influence chart, the given footing shape is drawn with AB =z = 20 m and with Point A at the center of the chart as in Fig. 8.23.



N_{full} = 32, and $N_{partial}$ = 22 are obtained from Fig. 8.23.

N= N_{full} + ½$N_{partial}$ = 32 + ½ (22) = 43

From Eq. 8.16,

$\Delta\sigma_v$ = q N (I.V.) = 200 x 43 x 0.005 =

43 kN/m² ←

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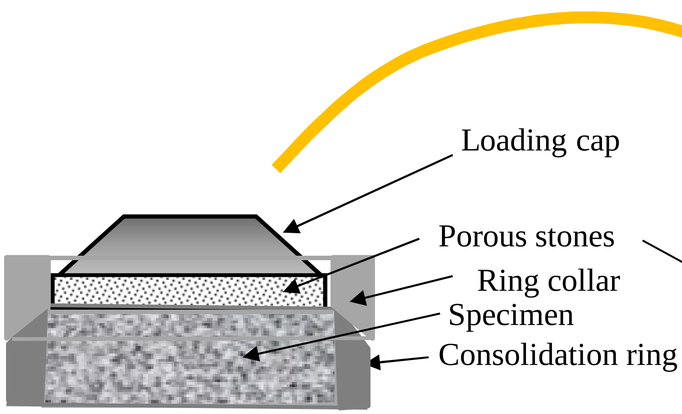
9.6 Laboratory Consolidation Test



Specimen in consolidation ring

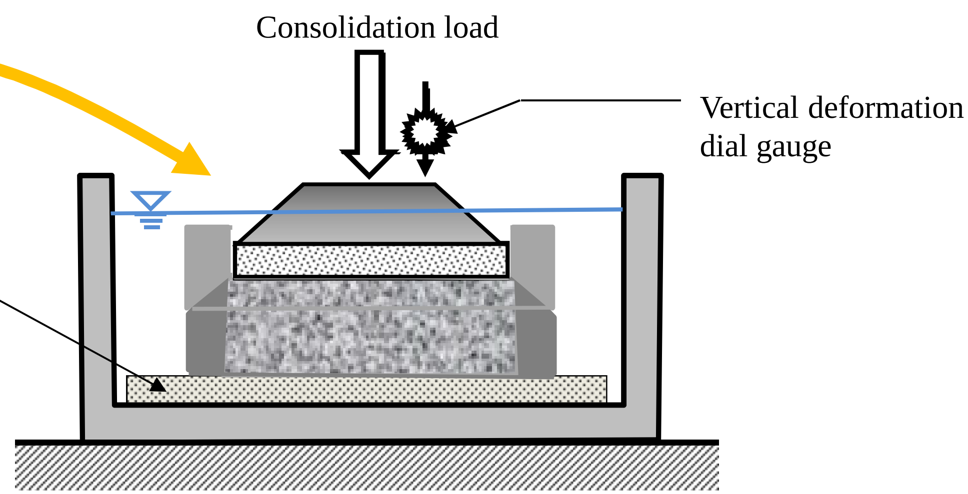


Fig. 9.8 Consolidation test setup

(click for consolidation test setup)

Loading process: 25, 50, 100, 200, 400, 800, 1600 kPa, ...

Unloading process: 1600, 400, 100, 25 kPa

(click for consolidation settlement)

δ_v measurement: at t=0, 0.1, 0.25, 0.5, 1, 2, 4, 8, 15, 30 minutes, and 1, 2, 4, 8, 24 hours

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10.6 Pole (Origin of Planes) of Mohr's Circle

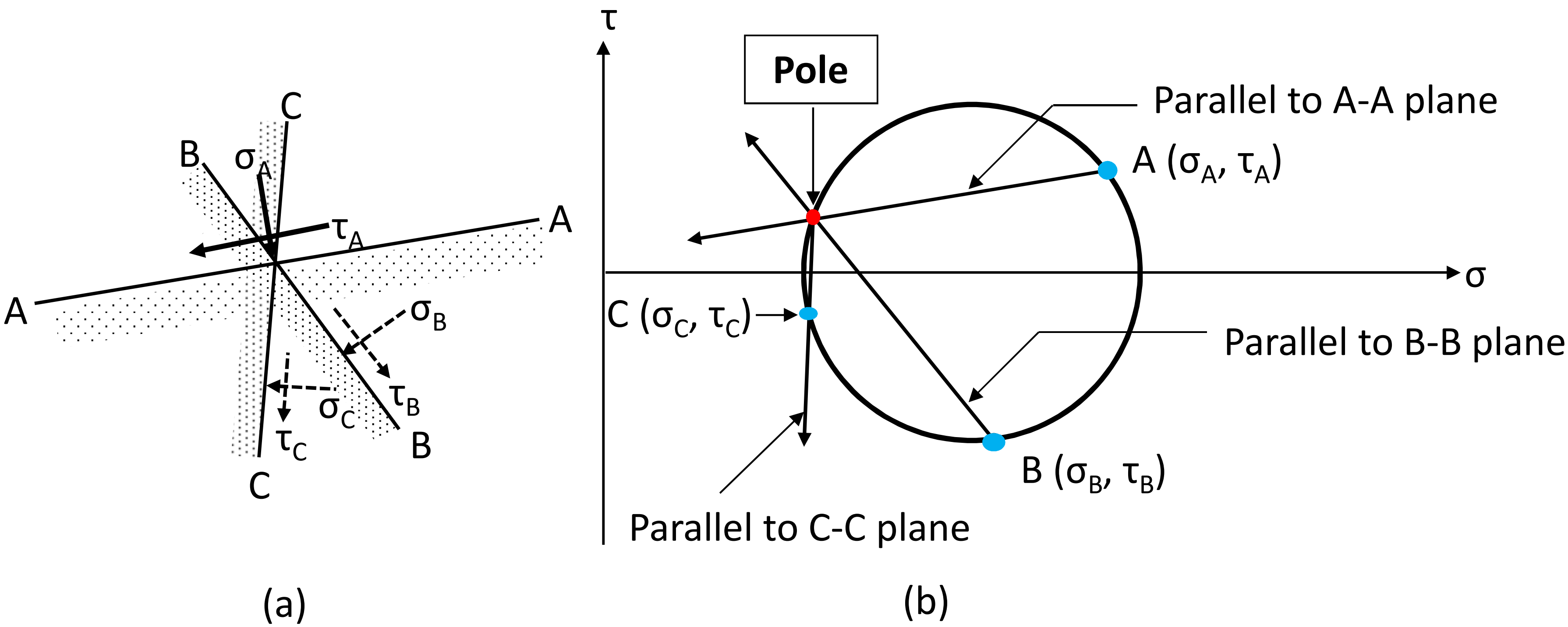

Fig. 10.9 Determination of the pole

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11.3 Direct Shear Test

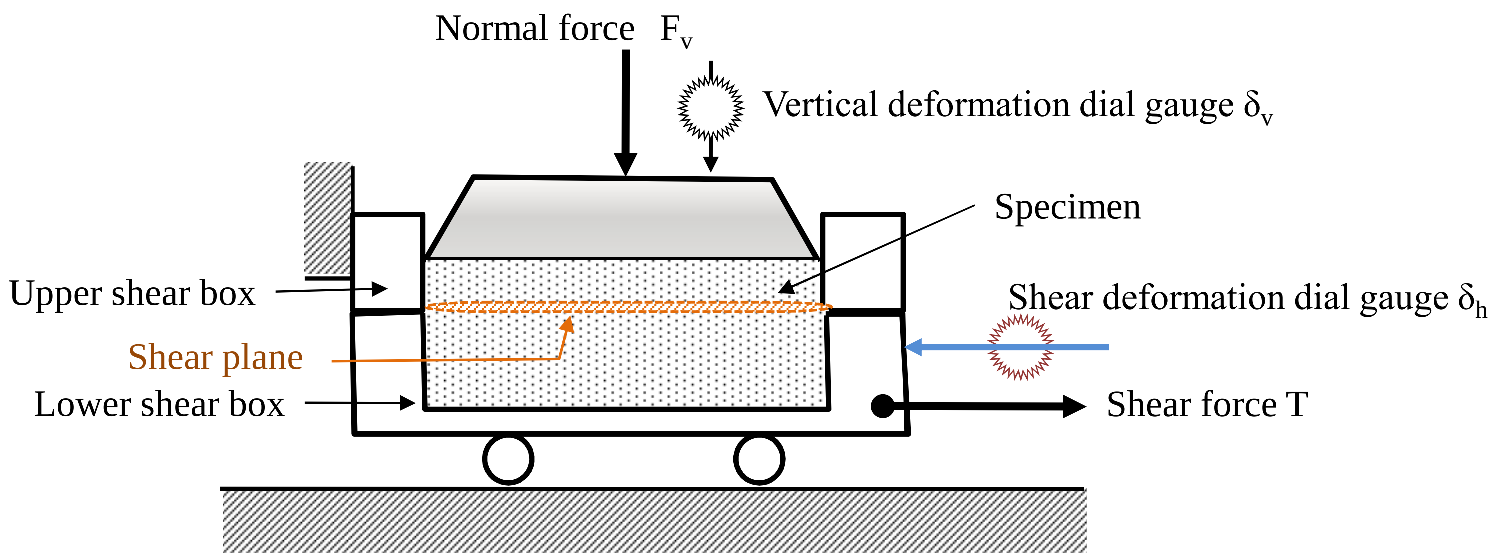

Fig. 11.4 Direct shear test setup

(click for direct shear test)

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Chapter 12 Lateral Earth Pressure

12.2 At-Rest, Active, and Passive Pressures

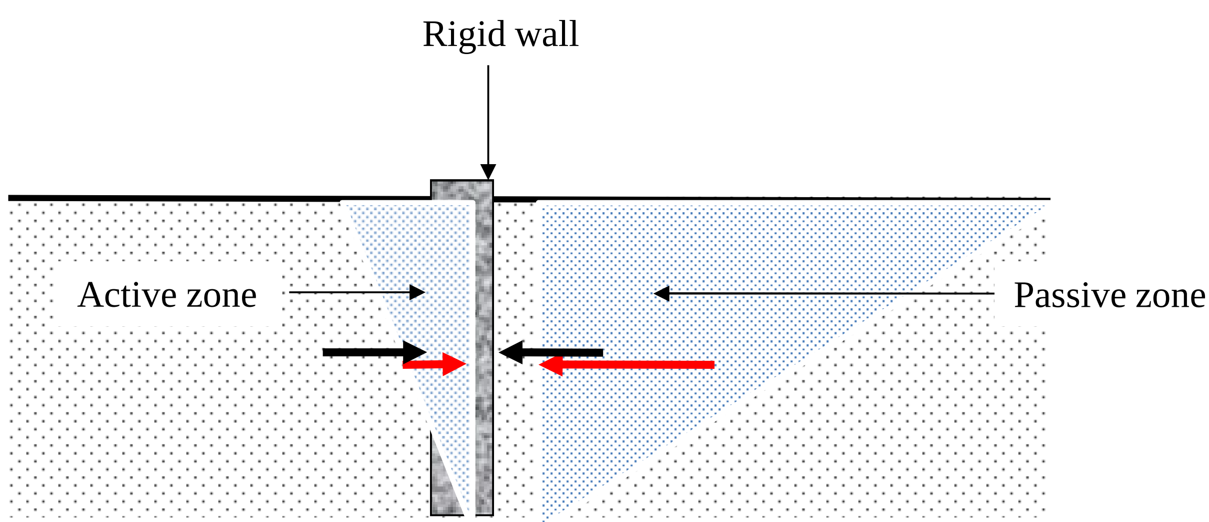

Fig. 12.1 Lateral earth pressure against an underground wall

Move the wall (click)

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12.5 Coulomb's Earth Pressure (1776)

For **sandy soils** (c=0 and φ materials) when the **soil wedge** behind the rigid wall just slides due to a sufficient wall movement, He established the **force equilibrium** on the **sliding soil wedge**

Active case

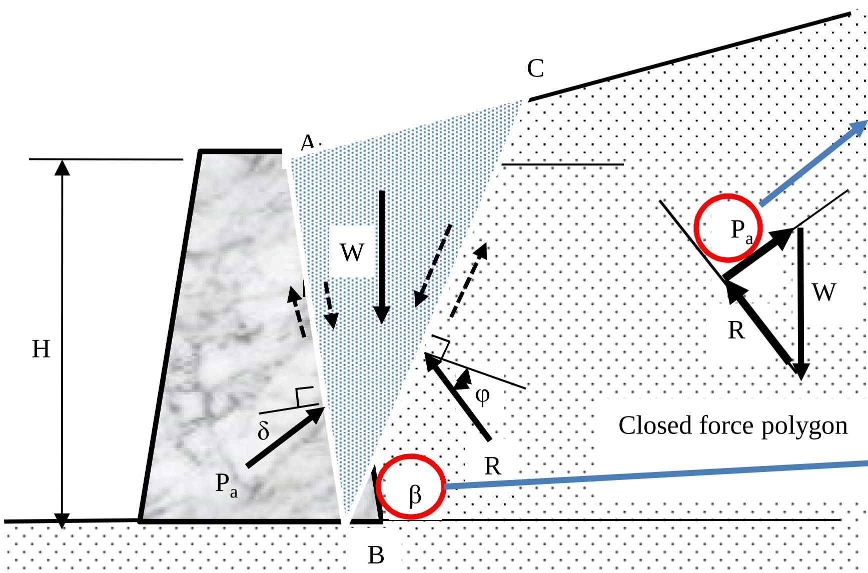

Fig. 12.20 Coulomb's active earth pressure

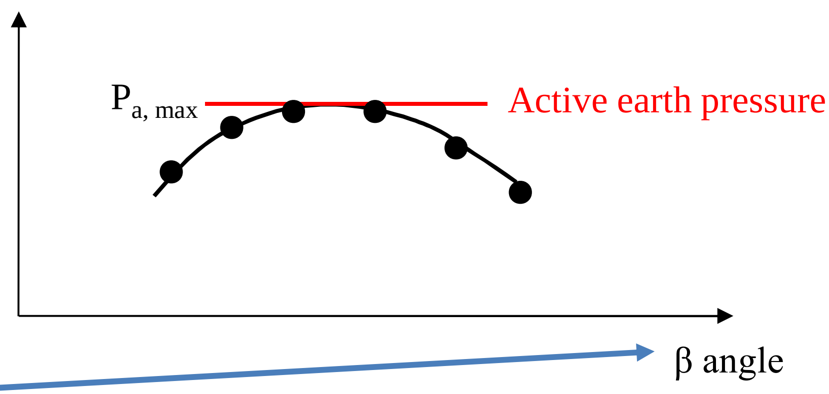

Fig. 12.21 Active earth pressure determination by trials

Ready for active failure (click)

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Passive case

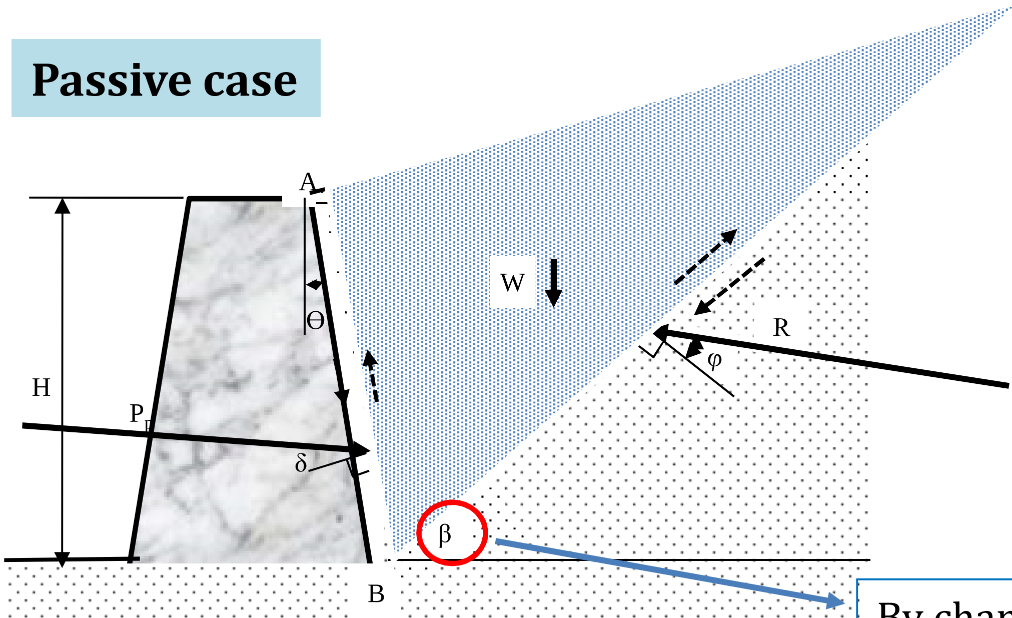
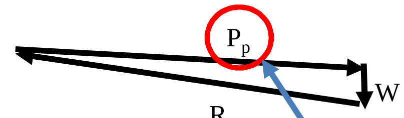


Fig. 12.23 Coulomb's passive earth pressure

Ready for passive failure (click)



Closed force polygon

By changing β values, the **minimum P_p** is assigned as the **passive earth thrust**.

$$P_p = \frac{1}{2}\gamma H^2 \frac{\cos^2(\varphi+\theta)}{\cos^2\theta\cos(\delta-\theta)\left[1-\sqrt{\dfrac{\sin(\delta+\varphi)\sin(\varphi+\alpha)}{\cos(\delta-\theta)\cos(\theta-\alpha)}}\right]^2} = \frac{1}{2}\gamma K_p H^2 \qquad (12.38)$$

$$K_p = \frac{\cos^2(\varphi+\theta)}{\cos^2\theta\cos(\delta-\theta)\left[1-\sqrt{\dfrac{\sin(\delta+\varphi)\sin(\varphi+\alpha)}{\cos(\delta-\theta)\cos(\theta-\alpha)}}\right]^2} \qquad (12.39)$$

End of demo.
Thank you