Know your Researcher

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Asian Institute of Technology



Edition August 2011 : Prof Dennes T Bergado

Profile: Prof. Dennes T. Bergado

- Professor of Geotechnical and Earth Resources Engineering (GTE), School of Engineering and Technology (SET), Asian Institute of Technology (AIT)
- Member, Soil Improvement Committee, American Society of Civil Engineers (ASCE) since 1995
- Director, Asian Center for Ground Improvement and Geosynthetics (ACSIG) since 1998
- Secretary-General, Southeast Asian Geotechnical Society (SEAGS) since 2001
- President, International Geosynthetics Society (IGS) – Thailand Chapter since 2004

Profile: Prof. Dennes T. Bergado

- Executive Secretary of AIT Alumni Association (2002-2005)
- Coordinator of Geotechnical Engineering Program (2001-2004)
- Faculty Representative to the Board of Trustees from 2005 to 2007
- Director, Unified Bachelor-Master Program at AIT (2010-2012)
- Registered Civil Engineer No. 16821 (Philippines)

ACADEMIC QUALIFICATIONS

- B.S. in Civil Engineering (1974), Mindanao State University, Philippines (Magna Cum Laude) (Government Scholar)
- M. Eng. in Soil Engineering (1976), Asian Institute of Technology, Thailand (Scholarship Sponsor: Australia)
- Ph.D. in Civil/Geotechnical Engineering (1982), Utah State University, U.S.A. (Fulbright Scholar)

RECENT INTERNATIONAL RECOGNITION

- R.M. Quigley Award for the Best Paper in the Canadian Geotechnical Journal in 2002
- Selected by Marquis International Who's Who in Science and Engineering for 1996
- Distinguished Alumni Award in 1994-1995, Utah State University, U.S.A.

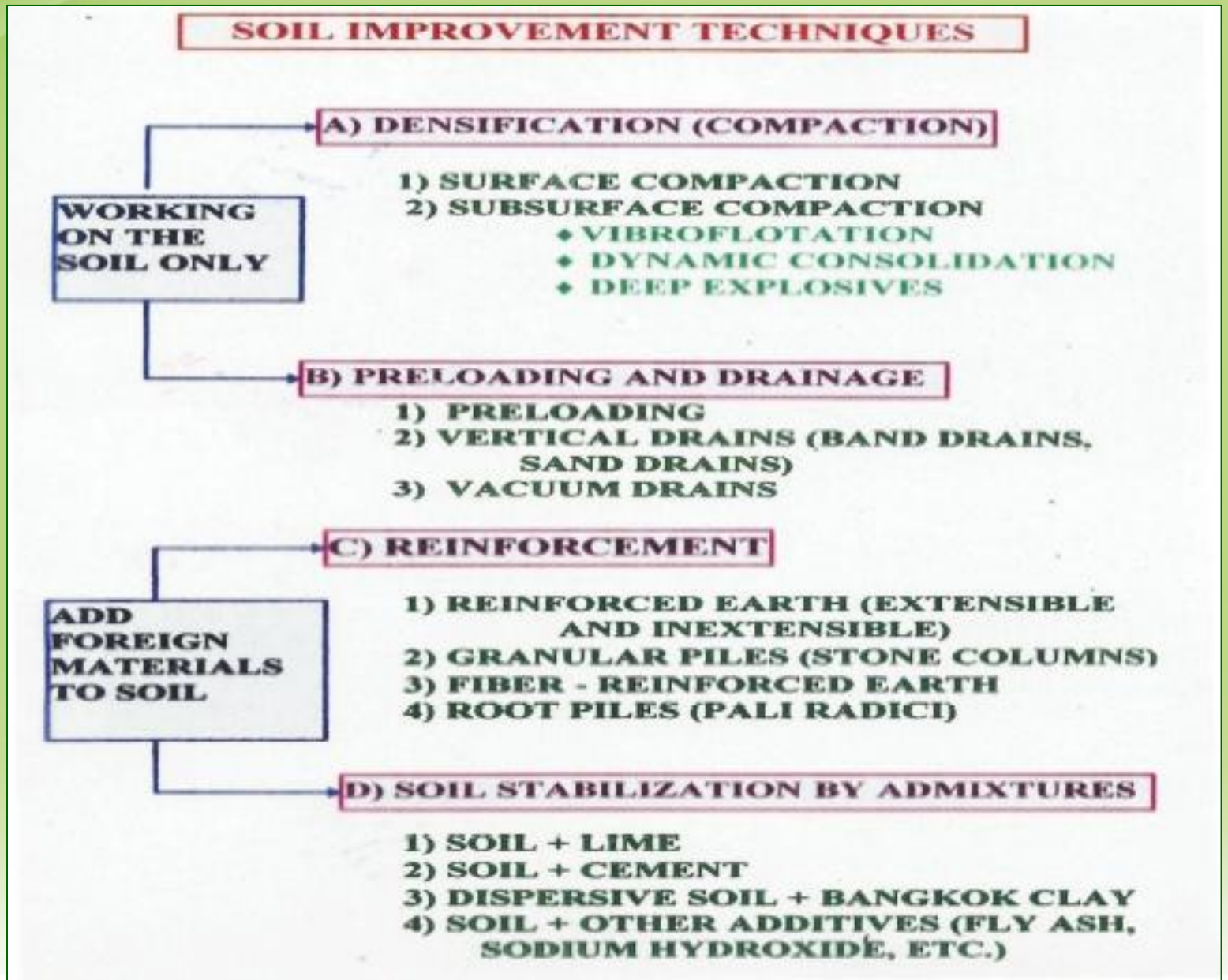
RECENT INTERNATIONAL RECOGNITION

- International Shamsher Prakash Award in 1993 for Significant Contributions in Geotechnical Engineering
- Distinguished AIT Alumni Award in 2006
- International Geosynthetic Society (IGS) Achievements Award 2006
- Editor-in-Chief, Lowland Technology International Journal since 2010
- Council Member of the International Geosynthetic Society (IGS) (2008-2012)
- Best Paper Award, International Symposium on Lowland Technology, Japan, 2010.

RESEARCH OVERVIEW

- **Probabilistic and reliability analyses of geotechnical properties and structures.**
- **Ground Improvement and Geosynthetics**
- **New and innovative concepts in modeling and design procedures.**
- **Use of prefabricated vertical drain (PVD) with Vacuum & Heat Preloading**
- **Recycled and lightweight geomaterials**
- **Deep cement mixing method (DCM)**
- **Vulnerability and sustainable erosion prevention and soil improvement using limited life geosynthetics (LLGs).**

RESEARCH OVERVIEW

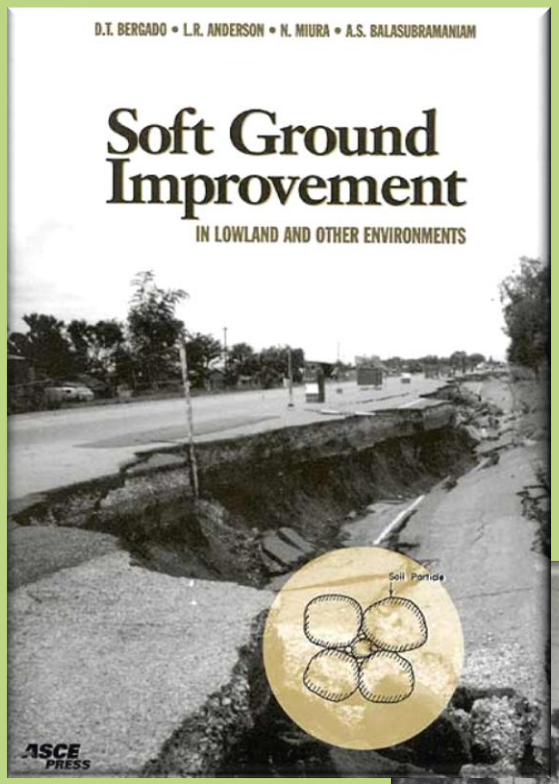


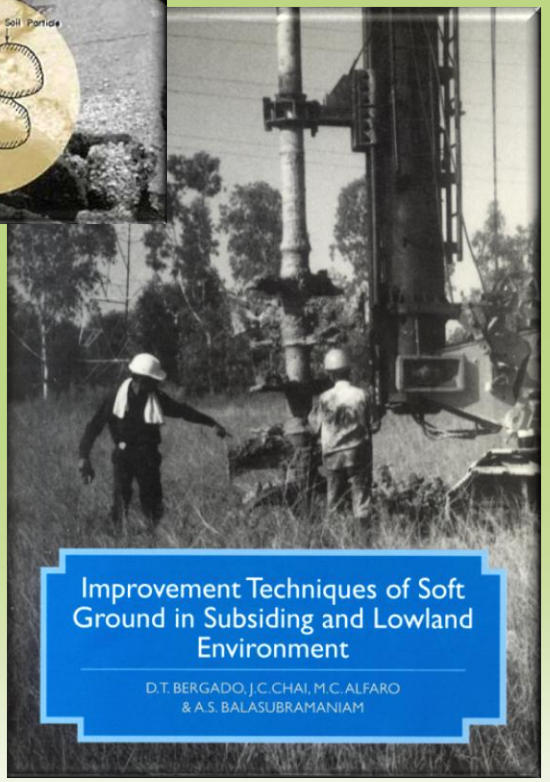
ACADEMIC PUBLICATIONS

- Chapters in Book - 4
- Edited Books - 20
- Guest Editorship of Journal - 3
- Refereed Journal Articles - 129
- Conference/Invited Papers - 264
- Invited/Keynote Papers - 66
- Sponsored Research Projects - 33
- Science Citations (SCOPUS) - 708

BOOKS PUBLISHED

- Soft Ground Improvement in Lowland and Other Environments
- Improvement Techniques of Soft Ground in Subsiding and Lowland Environment

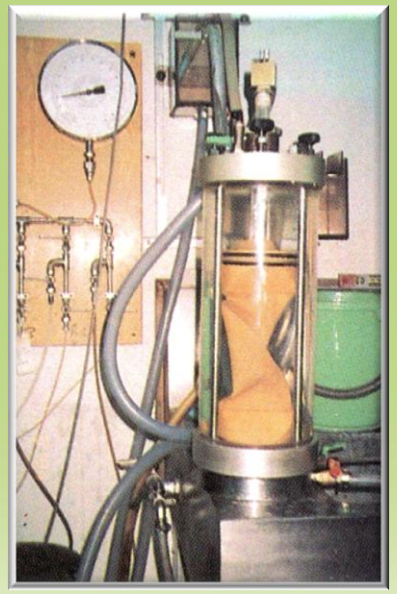




RESEARCH INVENTIONS

Professor Bergado developed and introduced research equipments such as the Field Screw Plate Test Apparatus, Large Scale Pullout Test Apparatus, Large Scale Apparatus for Geotextile Tests as well as Large Scale Model Tests for Prefabricated Vertical Drain (PVD) with and without Vacuum and Thermal Preloading. He invented a new version of the Mechanically Stabilized Earth (MSE) Wall as well as the innovative Thermo-PVD (Prefabricated Vertical Drain). He also introduced various equipments for geosynthetic tests.

PVD Model Test



PVD Discharge Test

Pullout Test Apparatus

Teaching and Research Supervision

INTRODUCED COURSES TO AIT:

- Geotechnical Earthquake Engineering
- Soil Improvement and Geosynthetics
- Waste Containment and Lining Technology

TEACHING OF COURSES:

- Soil Mechanics and Lab/Field Testing
- Soil Improvement and Geosynthetics
- Foundation Engineering

RESEARCH SUPERVISION:

- Doctoral Graduates - 14
- Masters Graduates - 153

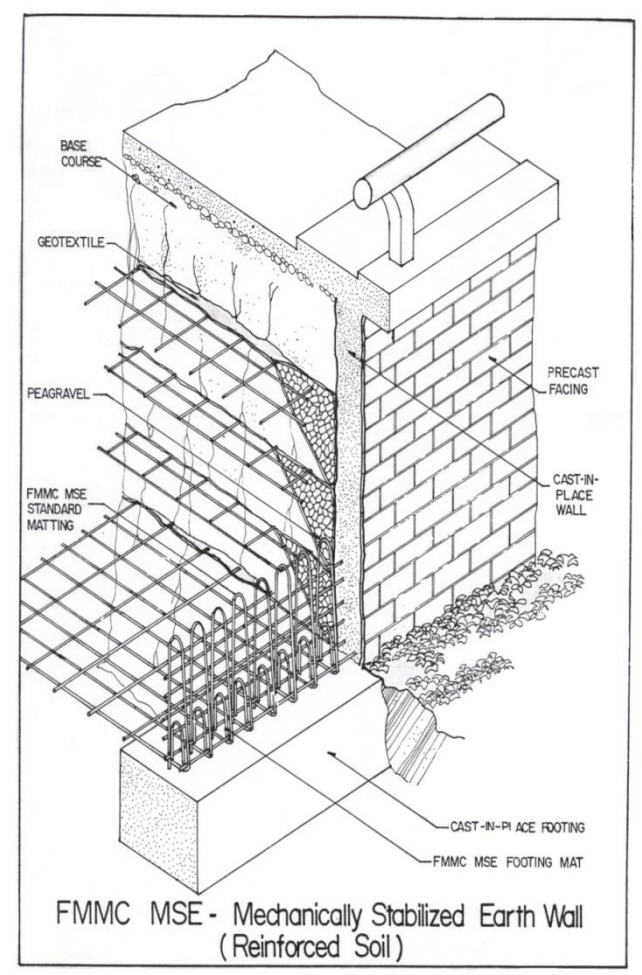
Main Fields of Interest

A. EARTH REINFORCEMENT/MECHANICALLY STABILIZED EARTH (MSE)

B. DEEP CEMENT MIXING (DCM) METHOD

C. PREFABRICATED VERTICAL DRAINS (PVDs)

A. EARTH REINFORCEMENT/MECHANICALLY STABILIZED EARTH (MSE)



Selected Journal Papers on MSE

- Bergado, D.T., Long, P.V. and Srivinasa Murthy, B.R. (2002), A Case Study of Geotextile-Reinforced Embankment on Soft Ground, Geotextiles and Geomembranes, Vol. 20, No. 6, pp. 343-365.

- Bergado, D.T. and Long, P.V. (2002), LEM Back-Analysis of Geotextile Reinforced Embankments on Soft Bangkok Clay-A Case Study, Geosynthetics International, Vol. 9, No. 3., pp. 217-245.

- Bergado, D.T., Youwai, S., Teerawattanasuk, P. and Visudmedanukul, P. (2003), The Interaction Mechanism and Behavior of Hexagonal Wire Mesh Reinforced Embankment with Silty Sand Backfill on Soft Clay, Computers and Geotechnics, Vol. 30, pp. 517-534.

Selected Journal Papers on MSE

- Teerawatanasuk, C., Bergado, D.T., and Kongkitkul, W. (2003), Numerical and Analytical Modeling on Pullout Capacity and Interaction between Hexagonal Wire Mesh and Silty Sand Backfill under In-Soil Pullout Test, Canadian Geotechnical Journal, Vol. 40, pp. 886-899.

- Youwai, S. and Bergado, D.T. (2004), Numerical Analysis of Reinforced Wall using Rubber Tire Chips-Sand Mixtures as Backfill Material, Computers and Geotechnics , Vol. 31, pp. 103-114.

- Lai, Y.P., Bergado, D.T., Lorenzo, G.A. and Duangchan, T. (2006), Full-Scale Reinforced Embankment on Deep Jet Mixing Improved Ground, Ground Improvement, Vol. 10, No. 4, pp. 153-164.

Selected Journal Papers on MSE

- Bergado, D.T. and Teerawattanasuk, C. (2008), 2D and 3D Numerical Simulations of Reinforced Embankments on Soft Ground, Geotextile and Geomembranes, Vol. 26, pp. 39-55.

- Tanchaisawat, T., Bergado, D.T., Voottipruex, P. (2009), 2D and 3D Simulations of Geogrid Reinforced Lightweight Embankment on Soft Clay, Geosynthetics International, Vol. 16, No. 6, pp. 420-432.

- Tin, N., Bergado, D.T., Anderson, L.R. and Voottipruex, P. (2010), Factors Affecting Kinked Steel Grid Reinforcement in MSE Structures, Geotextiles and Geomembranes, Vo. 29, pp. 172-180.

- Tin, N., Bergado, D.T., and Voottipruex, P. (2011), Modification of K-Stiffness Method in MSE Structures on Soft Ground, Geosynthetics International, Article in Press.

Mechanically Stabilized Earth (MSE) and Interactions of Soil and Rigid Inclusions

Unreinforced and Reinforced Slopes

Elements of MSE

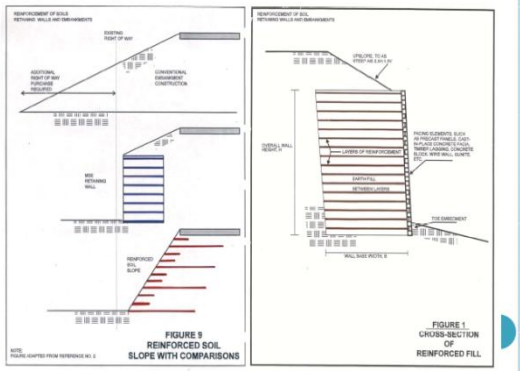


FIGURE 9 REINFORCED SOIL SLOPE WITH COMPARISONS

FIGURE 1 CROSS-SECTION OF REINFORCED FILL

MSE EMBANKMENT

FIRST LAYER LAYOUT OF STEEL GRIDS REINFORCEMENT

Cost Savings of MSE Constructions

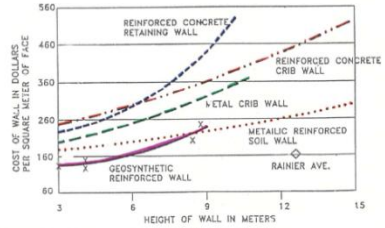
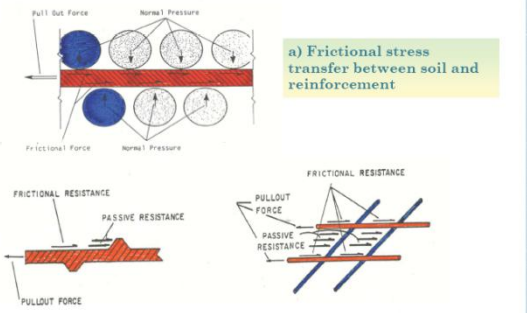


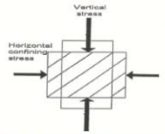
Figure 9-7 Cost comparison of reinforced systems.



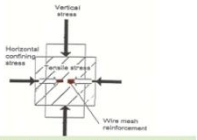
a) Frictional stress transfer between soil and reinforcement

a) Soil passive (bearing) resistance on reinforcement surfaces

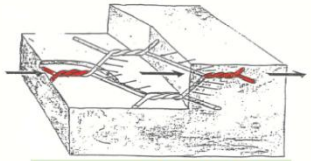
Soil-Reinforcement Interaction and Stress Transfer



a) Soil element without Reinforcement

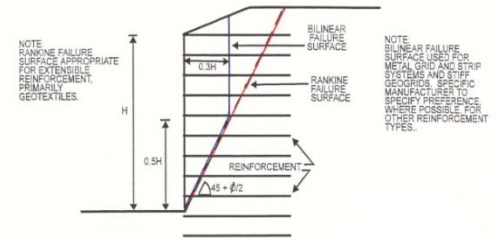


b) Soil element with hexagonal wire mesh reinforcement



c) Isometric view of reinforced soil element

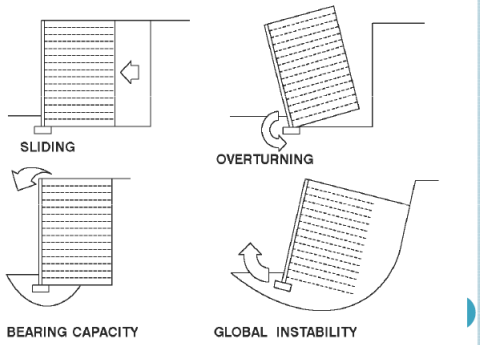
Concept of Hexagonal Wire Mesh Reinforced Soil



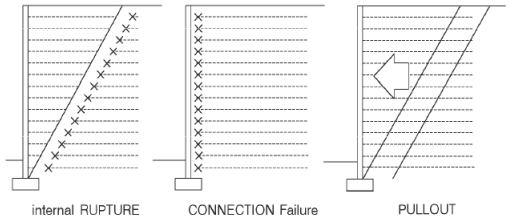
Retaining Wall Failure Surfaces

Mechanically Stabilized Earth (MSE) and Interactions of Soil and Rigid Inclusions

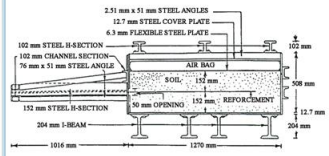
External modes of failure

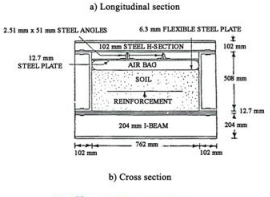


Internal modes of failure



Apparatus of the pullout test



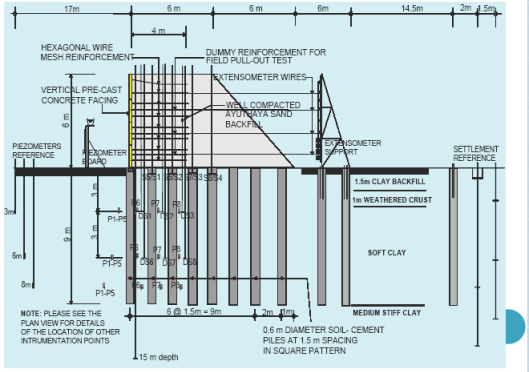


Pullout apparatus

In soil clamp

Full Scale Test Embankments

SECTION THRU CENTER LINE

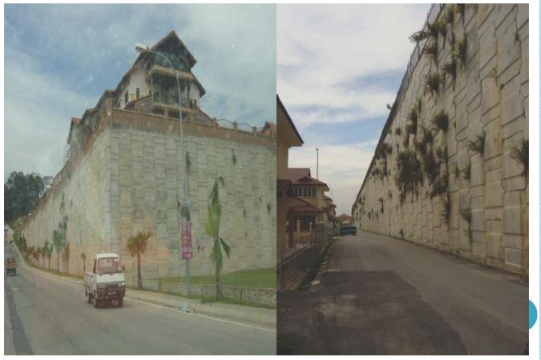


HEXAGONAL WIRE REINFORCEMENT CONNECTION

Mechanically Stabilized Earth (MSE) and Interactions of Soil and Rigid Inclusions

The Finished 6m High Reinforced Embankment

High MSE Project in Kuala Lumpur

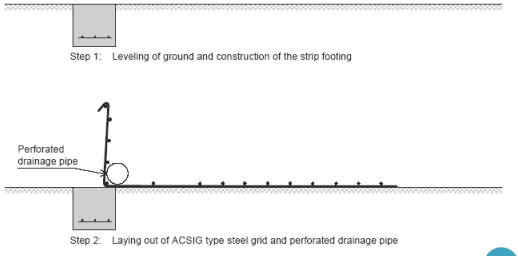


MSE for Bridge Approach

Hilfiker MSE Wall with Steel Grids Reinforcement in Park City, Utah

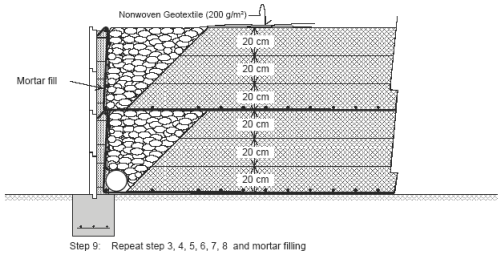
MSE with Steel Strip Reinforcement

Construction Method



Mechanically Stabilized Earth (MSE) and Interactions of Soil and Rigid Inclusions

Construction Method (Cont'd.)



PVC installation

Completion of 1st grid layer

Mortar Filling of Facing at Right Approach

Concrete Facing Installation sta.8+000 (Finishing Approach Bridge)

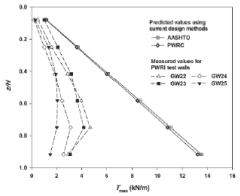
Side View of MSE wall Sta. 4+000 (Finishing Approach Bridge)

Mechanically Stabilized Earth (MSE) and Interactions of Soil and Rigid Inclusions

Working Stress Condition

North American working stress design practice: factors of safety have been assigned to failure modes such as external, internal or facing stability.

Some issues of current working stress design for geosynthetic reinforced soil retaining walls (Bathurst 2008):



The stresses at incipient collapse could not be simply considered to be the scaling of failure loads and resistance at limit equilibrium to working stress conditions using one or more factors of safety or partial factors

Predicted versus measured values of Tmax

Development of K-Stiffness Method

Allen *et al.* (2003)

$T_{max} = \frac{1}{2} K \gamma (H + S) S_v D_{tmax} \Phi_g \Phi_{local} \Phi_{fs} \Phi_{fb}$

γ = unit weight of the soil
H = height of the wall
S = equivalent height of uniform surcharge pressure q (i.e. S = q/γ)
S_v = tributary area

D_{tmax}: the load distribution factor

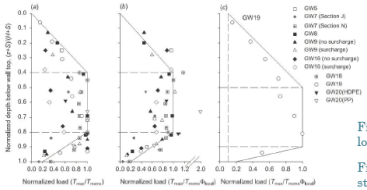


Fig b: better scatter when the local stiffness is considered

Fig c: distribution for polymer strap walls.

Development of K-Stiffness Method

Allen *et al.* (2004) steel reinforced soil walls

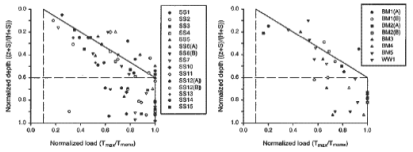
$T_{max} = \frac{1}{2} K \gamma (H + S) S_v D_{tmax} \Phi_g \Phi_{local} \Phi_{fs} \Phi_{fb}$

$K = K_o = 1 - \sin\phi_{ps}$ and $K \geq 0.3$ ($\phi_{ps} = 44^0$) for best correlation between K_o and T_{max}

$\Phi_{local} = 1$ because a = 0 for steel reinforcement.

Φ_{fs} could be taken as $\Phi_{fs} = 1$

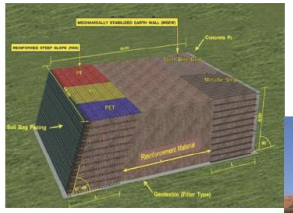
D_{tmax}: Load distribution factor



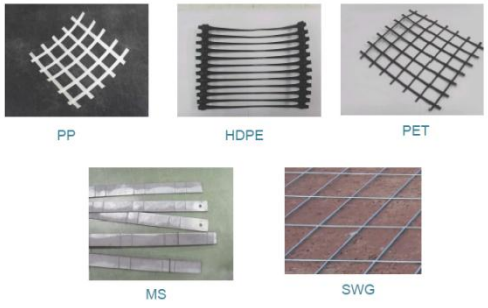
steel strip

steel bar mat and welded wire

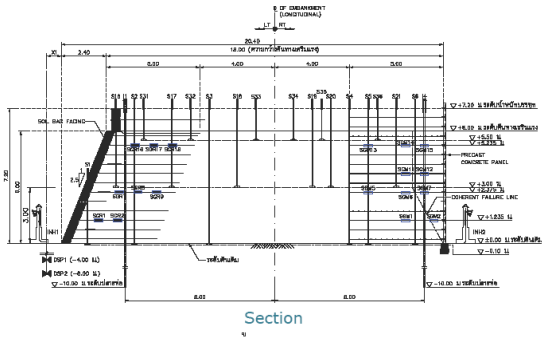
MSE Wall/Embankment



Reinforcing Materials



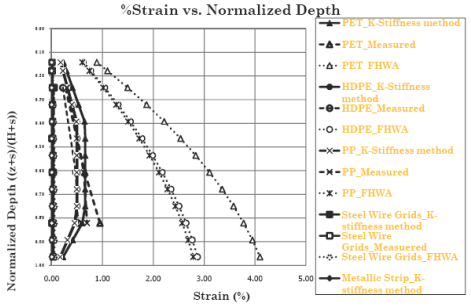
Instrumentation



Section

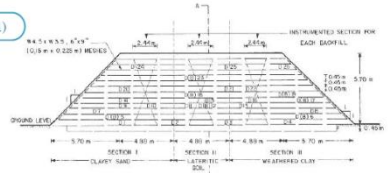
Mechanically Stabilized Earth (MSE) and Interactions of Soil and Rigid Inclusions

Measurements and internal design by the K-stiffness method compared with internal design by FHWA structure stiffness method



Data obtained from previous studies of MSE structures at AIT Campus on soft ground

Bergado *et al.* (1991)

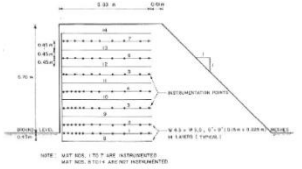


Front (longitudinal) section of the welded wire wall

Facing: vertical wire mesh
Backfills: Clayey sand
Lateritic soil
Weathered clay
Reinforcement: welded wire mats
2.44 m wide and 5.0 m long, 6 x 9 in. (0.15 x 0.225 m) grid opening
H = 5.7m
L = 14.64m at the top, divided into three sections along its length

Data obtained from previous studies of MSE structures at AIT Campus

Bergado *et al.* (1991)

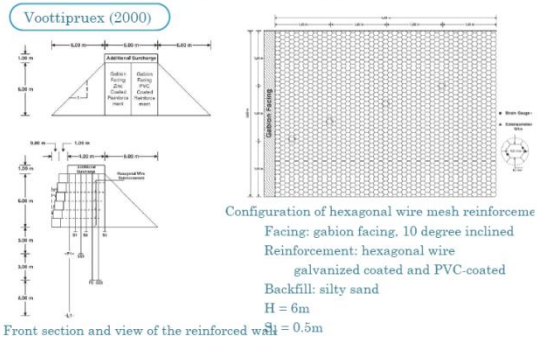


- S_v = 0.45m
- 7 mats instrumented with self-temperature compensating electrical resistant strain gages

View of the welded wire wall along section A-A

Data obtained from previous studies of MSE structures at AIT Campus

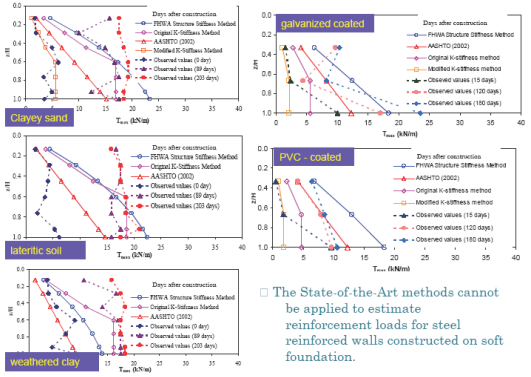
Voottipruex (2000)



Configuration of hexagonal wire mesh reinforceme
Facing: gabion facing, 10 degree inclined
Reinforcement: hexagonal wire
galvanized coated and PVC-coated
Backfill: silty sand
H = 6m
S_v = 0.5m

Front section and view of the reinforced wall

Comparison of calculated and observed values

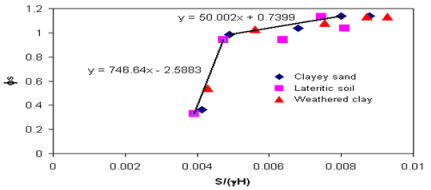


- The State-of-the-Art methods cannot be applied to estimate reinforcement loads for steel reinforced walls constructed on soft foundation.

Modification of Original K-stiffness method

$T_{max} = ½ K \Phi (H + S) S_v D_{tmax} \Phi_g \Phi_{local} \Phi_{fs} \Phi_{fb} \Phi_s$ (Φ_s = the settlement factor)

$$\Phi_s(back-calculated) = \frac{T_{mmx}(measured)}{½ K \gamma (H+S) S_v \Phi_g \Phi_{local} \Phi_{fb} \Phi_{fs}}$$



If S/gH < 0.005: $f_s = 746.64(S/gH) + 2.59$

If S/gH > 0.005: $f_s = 50(S/gH) - 0.74$

Suggestion: $D_{tmax} = 1$ for $0 < z/H < 1$

B. DEEP CEMENT MIXING (DCM) METHOD

Selected Journal Papers on DCM Method


Fundamental Parameters of Cement-Admixed Clay—New Approach

- Lorenzo et. al. (2004), Fundamental Parameters of Cement-Admixed Clay - New Approach, ASCE Journal of Geotechnical and Geoenvironmental Engineering, Vol. 130, No. 10, pp. 1042-1050.


CONSOLIDATION SETTLEMENT OF REINFORCED EMBANKMENT ON DEEP MIXING CEMENT PILES

- Bergado et. al. (2005), Consolidation Settlement of Reinforced Embankment on Deep Mixing Cement Pile, Geotechnical Engineering Journal, Vol. 36, No. 1, pp. 77-84.


New and Economical Mixing Method of Cement-Admixed Clay for DMM Application

- Lorenzo et. al. (2006), New and Economical Method of Cement Admixed Clay for DMM Application, Geotechnical Testing Journal, Vol. 29, No. 1, pp. 54-63.


Fundamental Characteristics of Cement-Admixed Clay in Deep Mixing

- Lorenzo and Bergado (2006), Fundamental Characteristics of Cement-Admixed Clay in Deep Mixing, ASCE Journal of Materials in Civil Engineering, Vol. 18, N. 2, pp. 161-174.

Selected Journal Papers on DCM Method


Field behaviour of stiffened deep cement mixing piles

- Jamsawang et. al. (2011), Field Behavior of Stiffened Deep Cement Mixing Piles, Ground Improvement Journal, Vol. 164, Issue G-11, pp. 1-17.


Computers and Geotechnics

Numerical simulations and parametric study of SDCM and DCM piles under full scale axial and lateral loads

- Voottipruex et. al. (2011), Numerical Simulations and Parametric Study of SDCM and DCM Piles under Full Scale Axial and Lateral Loads. Computers and Geotechnics, Vol. 38, pp. 318-329.


BEHAVIOR AND SIMULATION OF DEEP CEMENT MIXING (DCM) AND STIFFENED DEEP CEMENT MIXING (SDCM) PILES UNDER FULL SCALE LOADING

- Voottipruex et. al. (2011), Behavior and Simulation of Deep Cement Mixing (DCM) and Stiffened Deep Cement Mixing (SDCM) Piles under Full Scale Loading, Soils and Foundations, Vol. 51, No. 2, pp. 307-320.

Deep Cement Mixing (DCM) Method: New Approach and Optimum Water Contents

Mechanism of Soil-Cement Stabilization

Hydration: $C_3S + H_2O = C_3S_2H_x$ (hydrated gel) + $Ca(OH)_2$
(Primary cementing products) (Hydrated lime)

Hydrolysis: $Ca(OH)_2 = Ca^{++} + 2(OH)^-$
Rise of pH (base), hence dissolves the soil silica and alumina (acidic) from the clay minerals and amorphous materials on the surface of clay

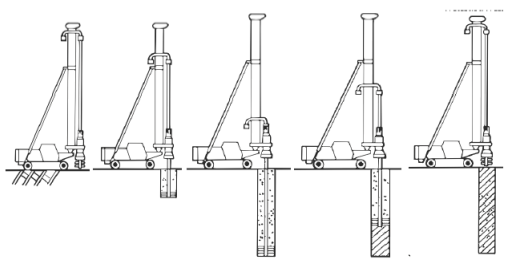
Ion Exchange and Flocculation
Ca^{++} + Clay → Ca^{++} exchanged with monovalent ions (K^+, Na^+)

Pozzolanic reactions:
with soil silica: $Ca^{++} + 2(OH)^- + SiO_2$ (soil silica) = CSH
(secondary cementing product)

with soil alumina: $Ca^{++} + 2(OH)^- + Al2O3$ (soil alumina) = CAH
(secondary cementing product)

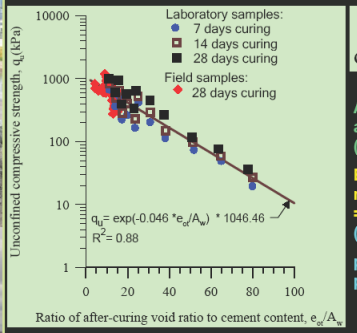
When pH< 12.6, then the following reaction occurs:
$C_3S_2H_x = C_3S_2H_x$ (hydrated gel) + $Ca(OH)_2$

Why mixing at higher water content?



(1) Positioning (2) Penetration (Remolding; water added) (3) Completion of penetration (4) Feeding of cementing agent-slurry (withdrawal) (5) Completion

q_u versus e_{ot}/A_w Ratio



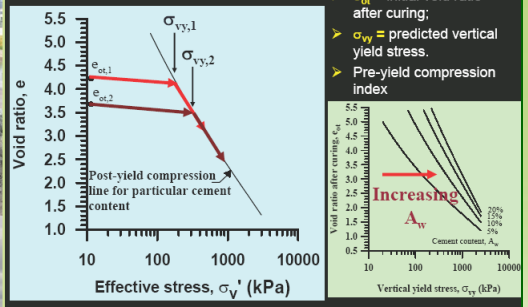
$$q_u = Ap_a e^{B\left(\frac{e_{ot}}{A_w}\right)}$$

A = intercept (type of admixture) = 10.33 (dimensionless)

B = f (clay type, mineralogy.) = slope = -0.046 (Bangkok) (dimensionless)

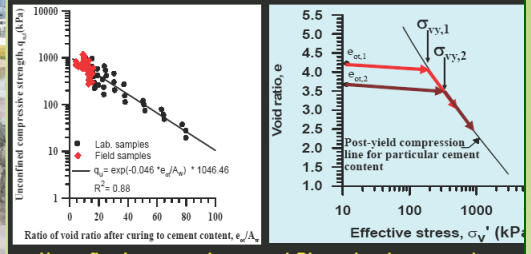
p_a = atmospheric pressure (kPa)

Schematic Diagram for Predicting Compression Line of Cement Treated Clay (curing time: at least one month)



- e_{ot} = initial void ratio after curing;
- σ_{vy} = predicted vertical yield stress.
- Pre-yield compression index

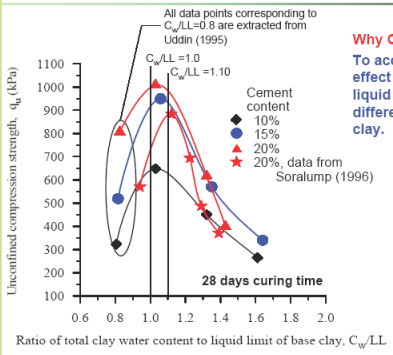
Summary: Prediction of Strength and Compressibility



Unconfined compression | 1-Dimensional compression

Two parameters: (1) after-curing void ratio, e_{ot},
(2) cement content, A_w

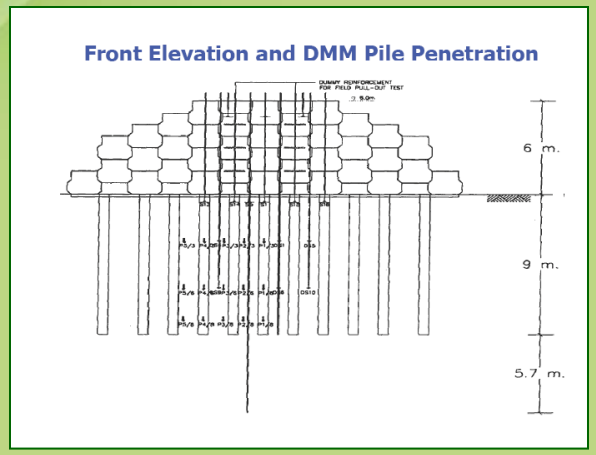
Strength Curve and Optimum Mixing Water Content

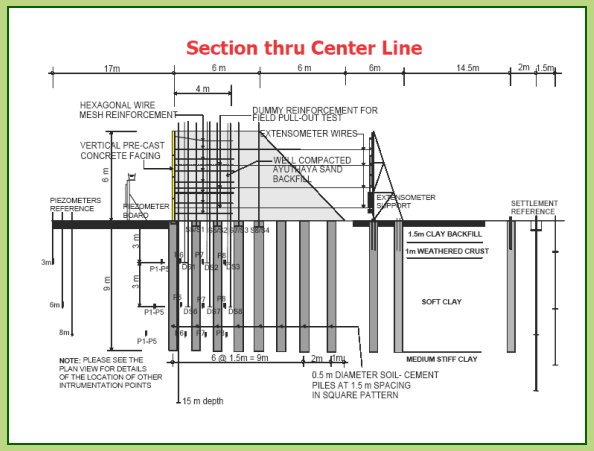


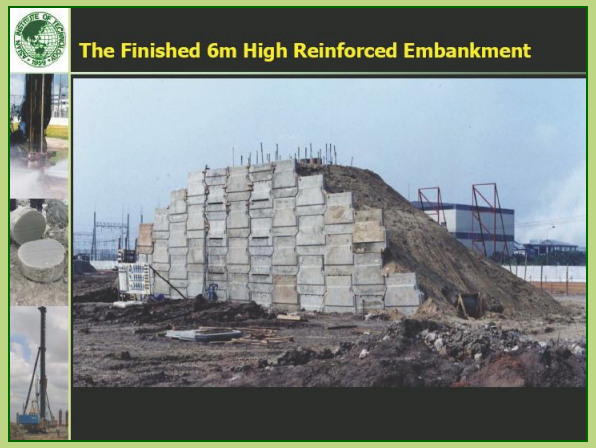
Why C_w/LL?

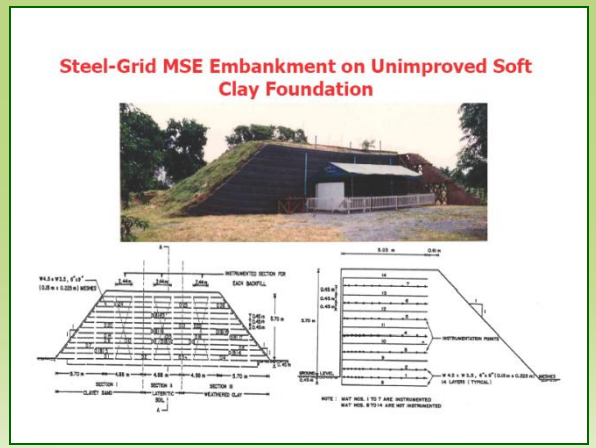
To account for the effect of varying liquid limits from different types of clay.

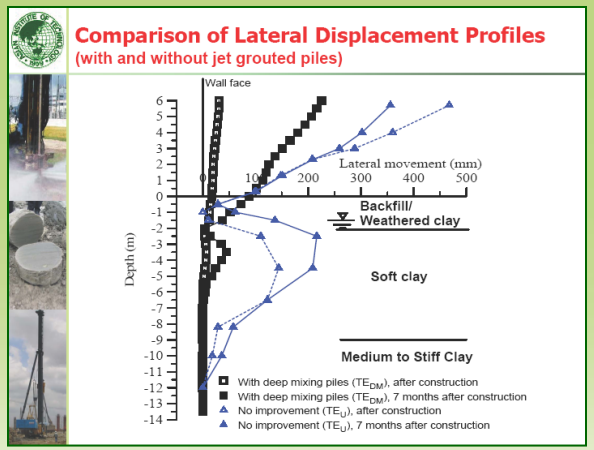
Deep Cement Mixing (DCM) Method: New Approach and Optimum Water Contents

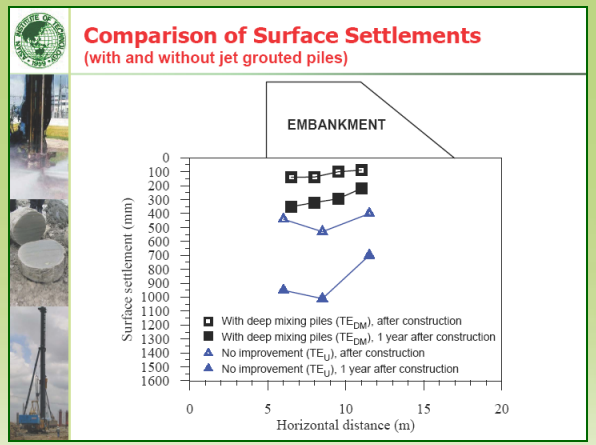






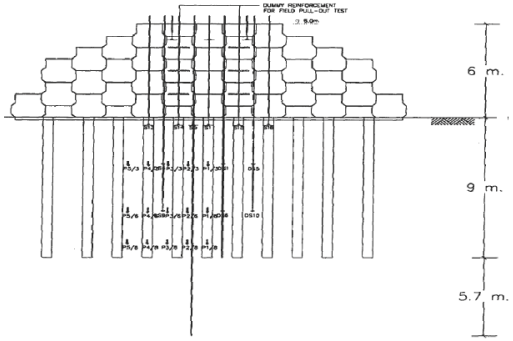






Deep Cement Mixing (DCM) Method: New Approach and Optimum Water Contents

Front Elevation and DMM Pile Penetration



Governing Equation for the Consolidation of Deep Mixing Improved Ground *(Lorenzo and Bergado, 2003)*

$$\left[\left(\frac{\partial \bar{u}_{up}}{\partial t}\right)+\left(n^2-1\right)\left(\frac{m_{v,c}}{m_{v,p}}\right)\left(\frac{C_c}{C_s}\right)_p\left(\frac{\partial \bar{u}_c}{\partial t}\right)\right]=c_{v,p}\left(\frac{\partial^2 \bar{u}_{up}}{\partial z^2}\right)$$

$(C_c/C_s)_p$ = is the ratio of the compression and swelling indices of the pile at loading condition;

$m_{v,p}=\dfrac{k_{v,p}}{c_{v,p}\gamma_w}$ = coefficient of volume change of the pile;

$m_{v,c}=\dfrac{k_{h,c}}{c_{h,c}\gamma_w}\approx\dfrac{k_{v,c}}{c_{v,c}\gamma_w}$ = coeff. of volume change of adjacent clay;

$c_{v,p}$; $c_{v,c}$= coefficient of consolidation of the pile and clay, respectively;
$k_{v,p}$; $k_{v,c}$= coefficient of permeability of the pile and clay, respectively;
$n = D_e/d_p$

Time Factors for DMM Improved Ground *(after Lorenzo and Bergado, 2003)*

Equal stress condition:

$$T_{v,\sigma}=\left(\frac{\left(\frac{m_{v,p}}{m_{v,c}}\right)}{\left(\frac{m_{v,p}}{m_{v,c}}\right)+\left(n^2-1\right)\left(\frac{C_c}{C_s}\right)_p}\right)\left(\frac{c_{v,p}\,t}{H_p^{\,2}}\right)$$

Equal strain condition:

$$T_{v,\varepsilon}=\left(\frac{1}{1+\left(n^2-1\right)\left(\frac{C_c}{C_s}\right)_p}\right)\left(\frac{c_{v,p}\,t}{H_p^{\,2}}\right)$$

Calculation of Settlement vs. Time Plot

During staged construction:

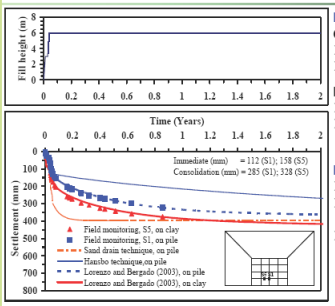
$$S_{t_{i+1}}=S_{t_i}+S_e\left(\frac{\Delta h}{H_{total}}\right)_{t_i\to t_{i+1}}+S_c\left(\frac{\Delta H}{H_{total}}\right)_{t_{i+1}}\left(\alpha_\sigma \bar{U}_\sigma+\alpha_\varepsilon \bar{U}_\varepsilon\right)_{\Delta t=t_i\to t_{i+1}}$$

After the end of staged construction:

$$S_t=S_{t=end}+\left[S_c-\left(S_{t=end}-S_e\right)\right]\left(\alpha_\sigma \bar{U}_\sigma+\alpha_\varepsilon \bar{U}_\varepsilon\right)_{\Delta t=from\,end}$$

- S_e = elastic settlement; S_c = consolidation settlement. These are to be adjusted by trial until good agreement between the measured and projected settlement time plot is obtained.

Back-analysis of Wangnoi Embankment Surface Settlement (S1 vs. S5)



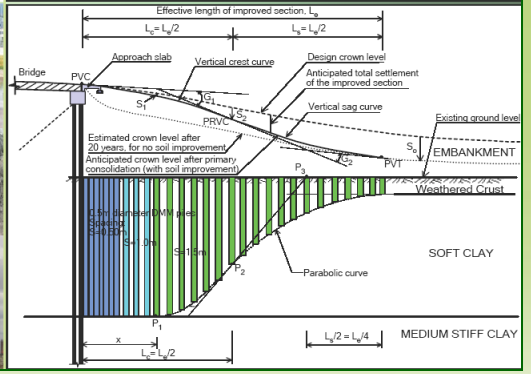
Measured paramaters:
Clay:
- C_{vc} = 1~3 m²/yr
- K_{vc} = 3~6 x 10^{-10} m/s

DMM:
- C_{vp}(lab)=200-400 m²/yr
- K_{vp} (lab) =150-200 x 10^{-10} m/s

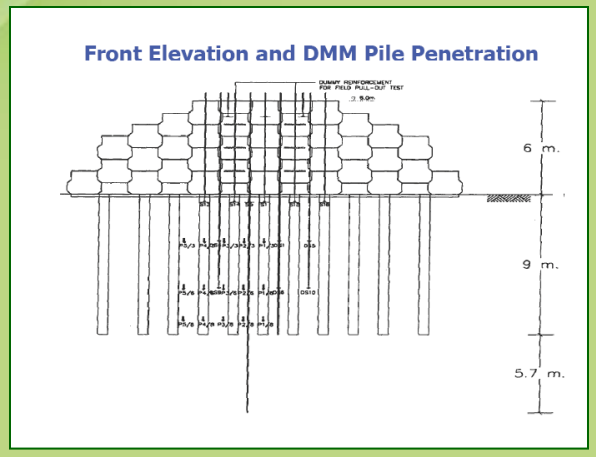
Back-analyzed:
- $C_{vp,\,back}$ = 800 m²/yr
- $K_{v,p}/K_{vc}$ =40 ($m_{v,p}/m_{vc}$ =0.10)
- Best fit: 80% equal strain; 20% equal stress.

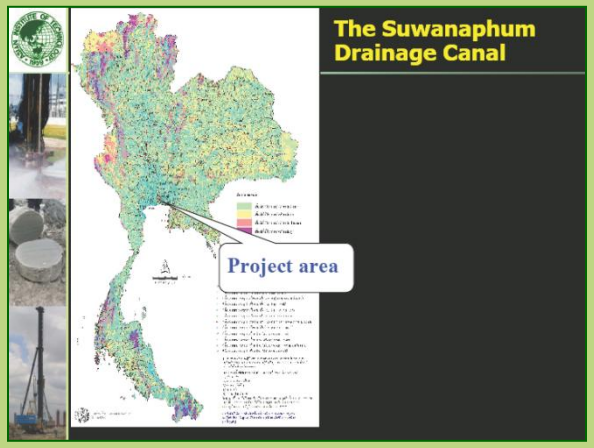
Immediate (mm) = 112 (S1); 158 (S5)
Consolidation (mm) = 285 (S1); 328 (S5)

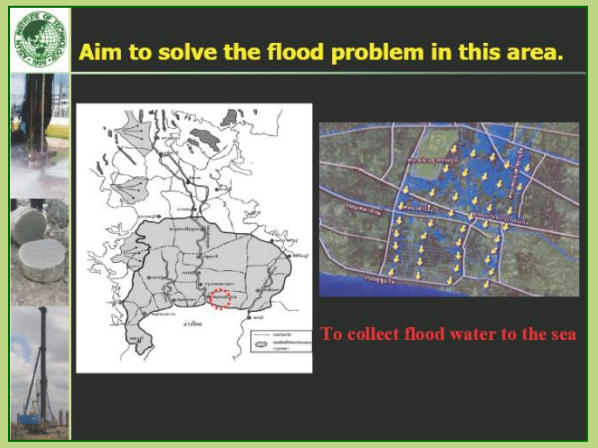
Suggested Scheme of Deep Mixing Installation for Bridge Approach Embankment on Soft Clay Ground

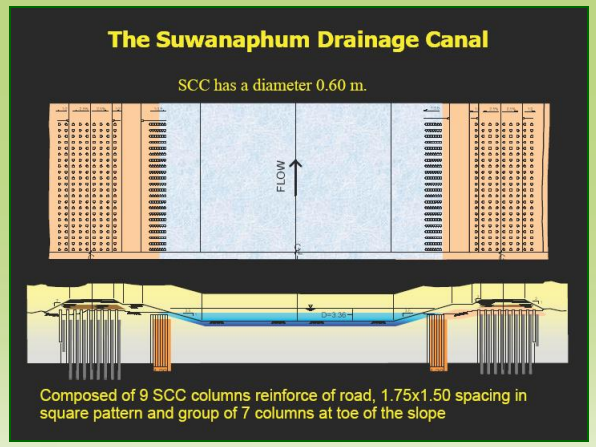


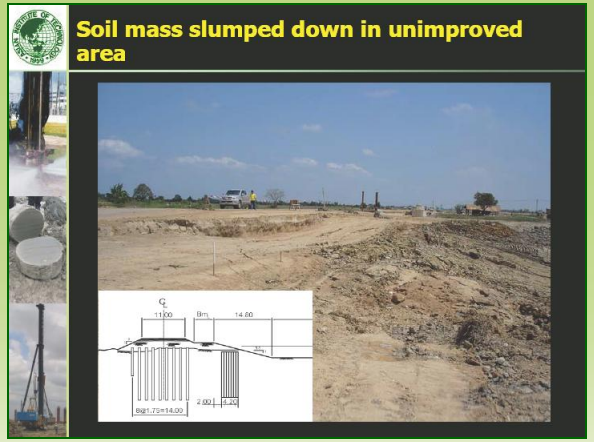
Deep Cement Mixing (DCM) Method: New Approach and Optimum Water Contents

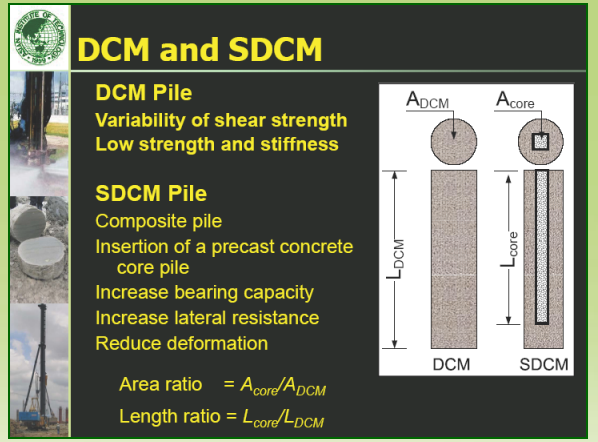








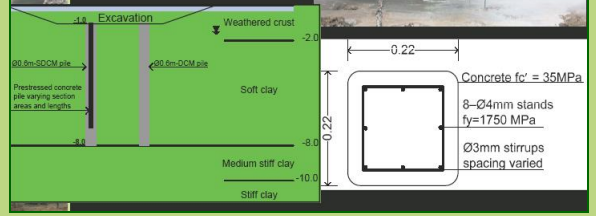




Deep Cement Mixing (DCM) Method: New Approach and Optimum Water Contents

Construction of Deep Mixing Piles

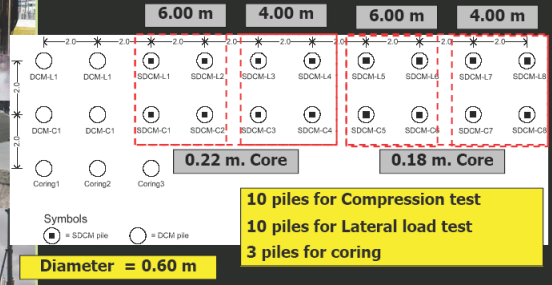
2.0 m spacing in square pattern
a jet pressure of 22 MPa
D_{DCM} = 0.6 m, L_{DCM}=7.0 m.
A_w = 150 kg/m^{3}of soil



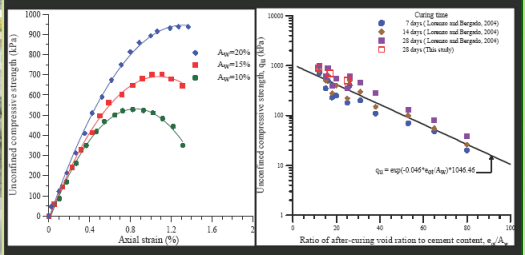
Construction of SDCM Piles

Insertion of prestressed concrete pile.
No pushing force due to very low fiction
Curing time in-situ for 80 days.

Arrangement of Full Scale Pile Load Test (Shinwuttiwong, 2007; Jamsawang, 2008)

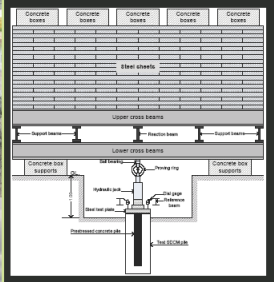


UC Test results of Cement-Admixed Clay



Effects of cement content on unconfined compressive strength.

Axial compression piles



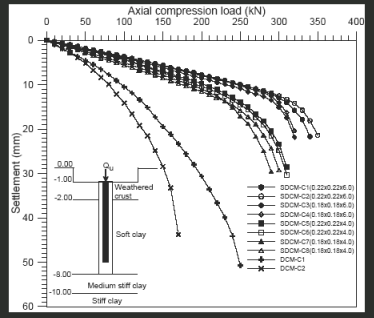
28 Cases

Different core size:
0.18, 0.22, 0.26, 0.30 m.

Different length:
1.00, 2.00, 3.00, 4.00, 5.00, 6.00, 7.00 m.

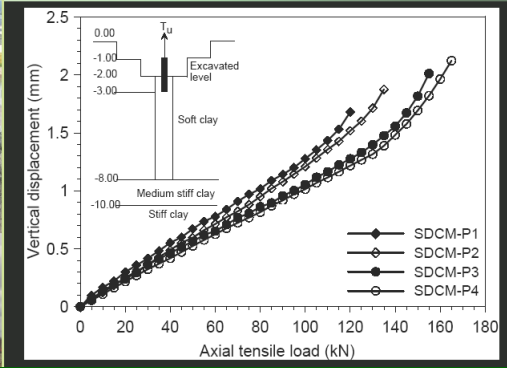
Based on the tangent method by Butler and Hoy (1977).

Axial compression piles



Deep Cement Mixing (DCM) Method: New Approach and Optimum Water Contents

Full Scale Pile Load Test



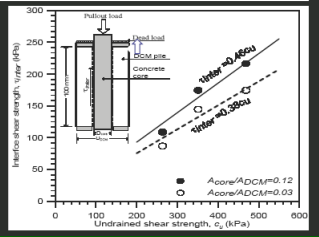
Full Scale-Pullout Test Results

Number	Concrete core pile Size (mxm)	L (m)	Surface area (m^2)	Maximum tensile load (kN)	Interface shear strength (kPa)
P1	0.22x0.22	1.0	0.88	165	188
P2	0.22x0.22	1.0	0.88	155	176
P3	0.18x0.18	1.0	0.72	135	188
P4	0.18x0.18	1.0	0.72	120	167

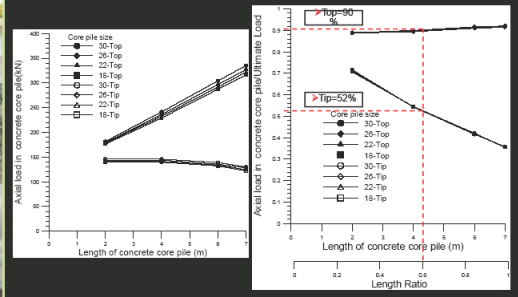
$R_{inter} = \tau_{interface(average)} / c_{soil}$

=179/450

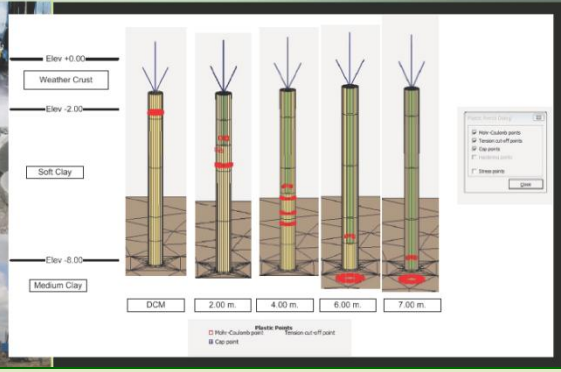
= 0.40 is within the range of pullout interface test results in lab.



Effect of Length



Failure Mode



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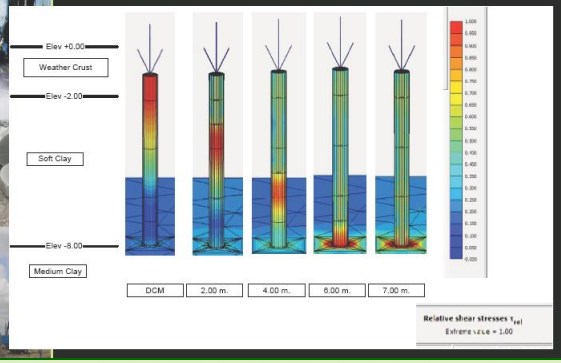
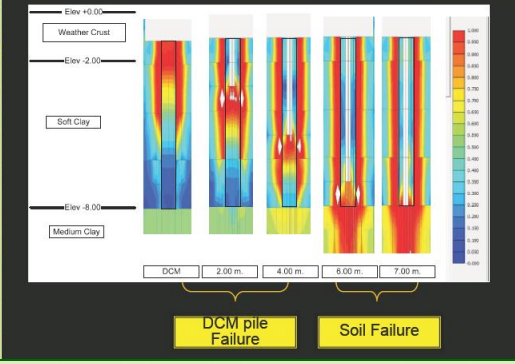
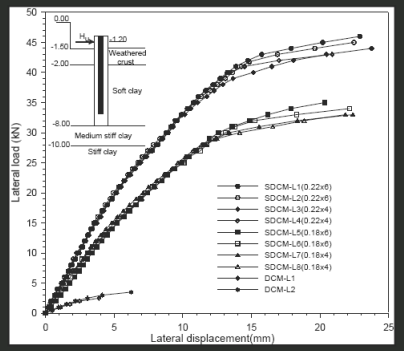


Failure Mode

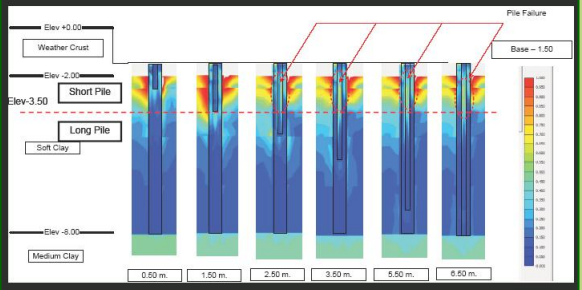


Deep Cement Mixing (DCM) Method: New Approach and Optimum Water Contents

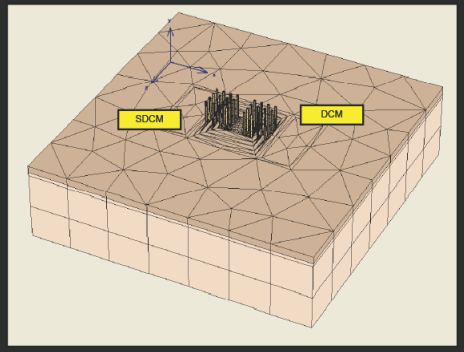
Lateral piles



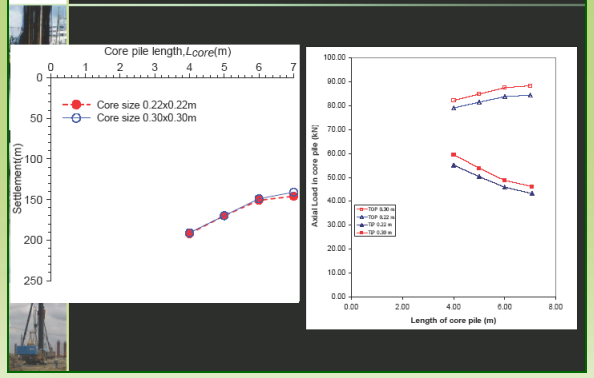
Failure Mode



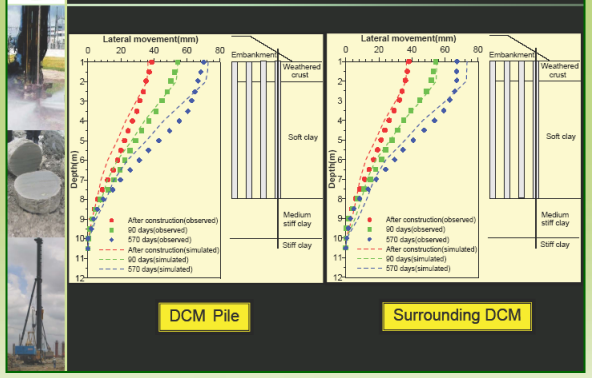
Embankment



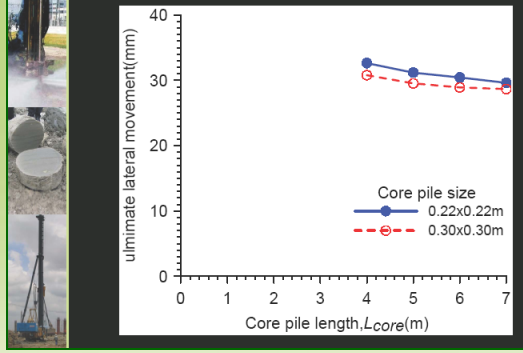
Embankment



Lateral movement



Lateral movement



C. PREFABRICATED VERTICAL DRAINS (PVDs)

Selected Journal Papers on PVDs

- Bergado, D.T., Balasubramaniam, A.S., Fannin, R.J., and Holtz, R.D. (2002), Prefabricated Vertical Drains (PVD) in Soft Bangkok Clay: A Case of the NBIA Project, Canadian Geotechnical Journal, Vol. 39, pp. 304-315 (Runner-up Winner of R.M. Quigley Award, 2003).

- Abuel-Naga, H.M., Bergado, D.T. and Chaiprakaikeow, S. (2006), Innovative Thermal Technique for Enhancing the Performance of Prefabricated Vertical Drain during the Preloading Process, Geotextiles and Geomembranes, Vol. 24, pp. 359-370.

- Chai, J.C., Miura, N. and Bergado, D.T. (2008), Preloading Clayey Deposit by Vacuum Pressure with Cap-Drain: Analysis versus Performance, Geotextiles and Geomembranes, Vol., 26, No. 3, pp. 220-230.

Selected Journal Papers on PVDs

- Pothiraksanun, C., Saowapakpiboon, J., Bergado, D.T., Than, N.Y. (2008), Reduction of Smear Effects Around PVD using Thermo-PVD, Ground Improvement Journal, Vol. 161, G14, pp. 179-187.

- Saowapakpiboon, J., Bergado, D.T., Thann, Y.M. and Voottipruex, P. (2009), Assessing the Performance of Prefabricated Vertical Drain (PVD) on Soft Ground using Vacuum and Heat Preloading, Geosynthetics International, Vol. 16, No. 5, pp. 384-392.

- Saowapakpiboon, J., Bergado, D.T., Youwai, S., Chai, J.C., Wanthong, P. and Voottipruex, P. (2010), Measured and Predicted Performance of Prefabricated Vertical Drains (PVDs) with and without Vacuum Preloading, Geotextiles and Geomembranes, Vol. 28, pp. 1-11.

Selected Journal Papers on PVDs

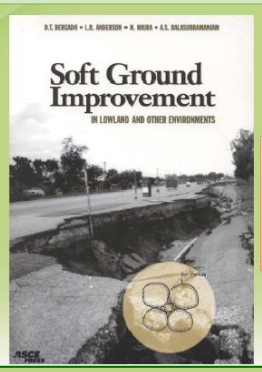
- Saowapakpiboon, J., Bergado, D.T., Voottipruex, P., Lam, L.G., and Nakakuma, K. (2010), PVD Improvement Combined with Surcharge and Vacuum Preloading including Simulations, Geotextiles and Geomembranes, Vol. 29, pp. 74-82.

- Pothiraksanon, C., Bergado, D.T., and Abuel-Naga, H.M. (2010), Full Scale Embankment Consolidation Test using Prefabricated Vertical Thermal Drains, Soils and Foundations, Vol. 50, No. 5, pp. 579-588.

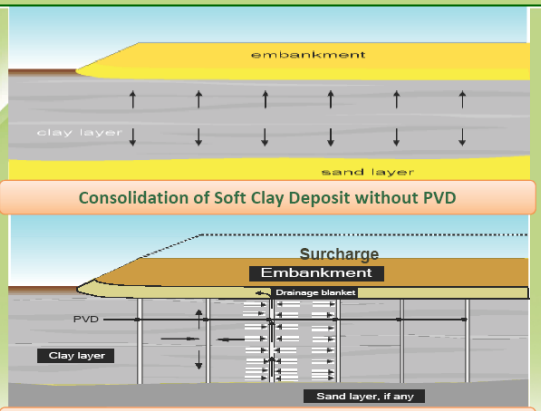
- Artidteang, S., Bergado, D.T., Saowapakpibboon, J., Teerachaikulpanich, N., and Kumar, A. (2011), Enhancement of Efficiency of Prefabricated Vetrical Drains using Surcharge, Vacuum and Heat Preloading, Geosynthetics International, Vol. 18, No. 1, pp. 35-47.

Recent Developments of Soil Improvement using PVDs with Vacuum & Heat Preloading

Soft Ground Improvement with Preloading and Prefabricated Vertical Drain (PVD)

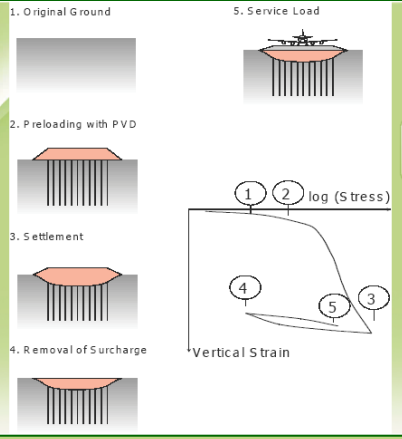


Prof. DENNES T. BERGADO
Geotechnical and Geoenvironmental Program
School of Civil Engineering
Asian Institute of Technology
Bangkok, Thailand



Consolidation of Soft Clay Deposit without PVD

Consolidation of Soft Clay Deposit by Preloading with PVD



Preloading Principle

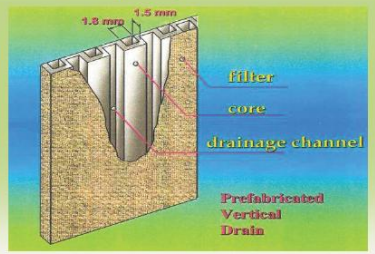
PVDs are artificially-created drainage path consisting of a central core wrapped around by a filter jacket.

a) PVD core:

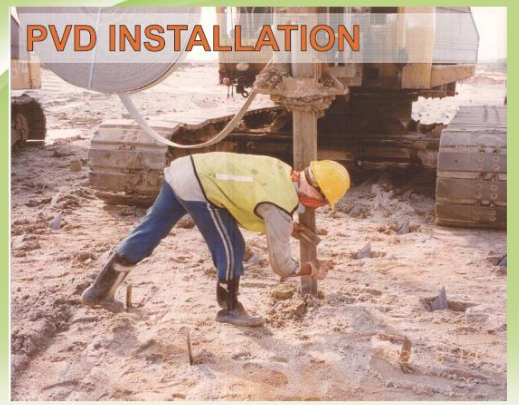
* Channels of flow
* Prevents buckling
* Supports the filter jacket

b) Filter Jacket:

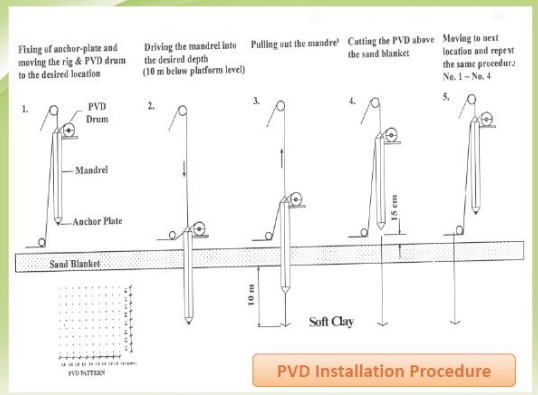
* Allow porewater to pass but minimize fine clay particles
* Reacts against lateral pressures



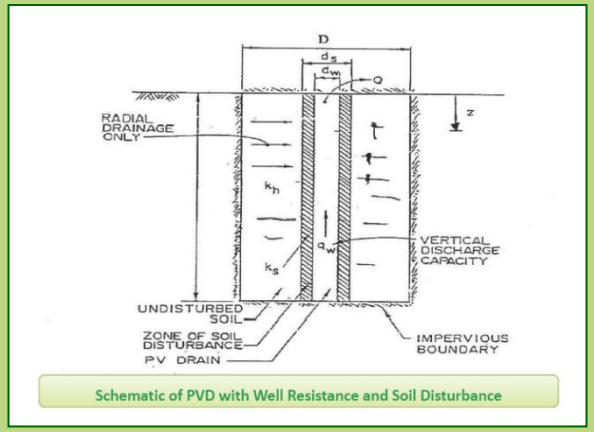
PVD Installation at Second Bangkok International Airport



Recent Developments of Soil Improvement using PVDs with Vacuum & Heat Preloading

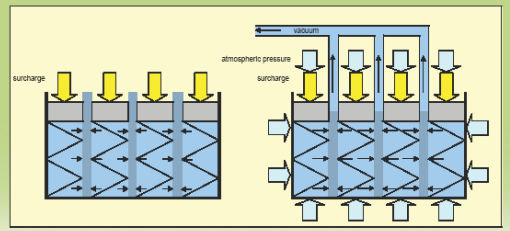


PVD Installation Procedure



Schematic of PVD with Well Resistance and Soil Disturbance

Model for Vacuum consolidation



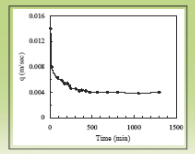
Effect of temperature on hydraulic conductivity

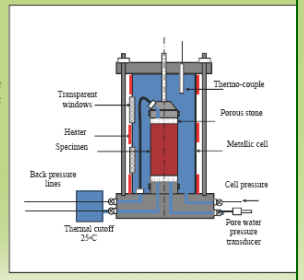
Test apparatus

Constant head method was employed using modified flexible wall permeameter setup

$$k = \frac{q}{i}$$

where q is the flow flux at the steady state condition and i is the applied hydraulic gradient to create flow through the soil.



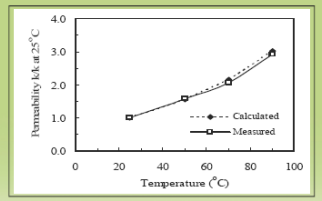


Effect of temperature on hydraulic conductivity

Predicting the temperature effect on hydraulic permeability

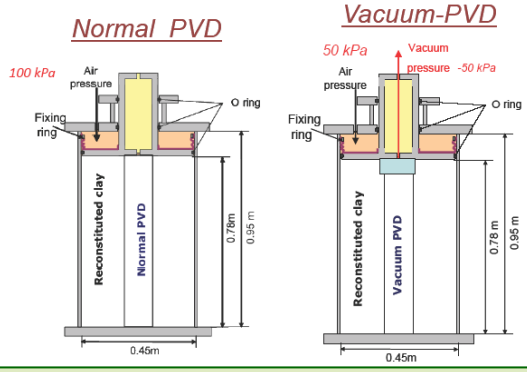
The effect of temperature on the hydraulic permeability can be predicted as follows:

$$\frac{k(T)}{k(T_o)} = \frac{\mu(T_o)\gamma_w(T)}{\mu(T)\gamma_w(T_o)}$$



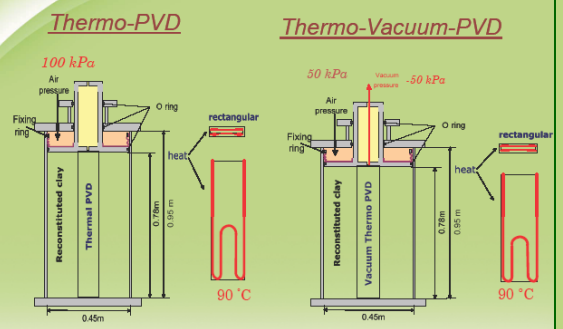
Raising the soil temp. from 22 to 90ºC increases its permeability about 3 to 4 times

Schematic diagram of large scale consolidometer

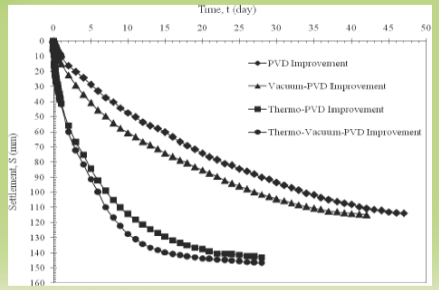


Recent Developments of Soil Improvement using PVDs with Vacuum & Heat Preloading

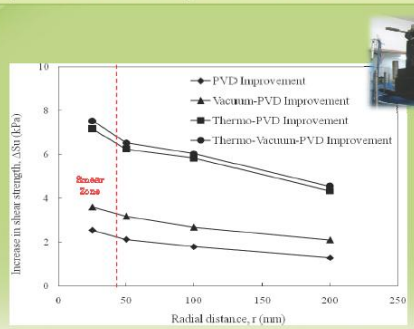
Schematic diagram of large scale consolidometer



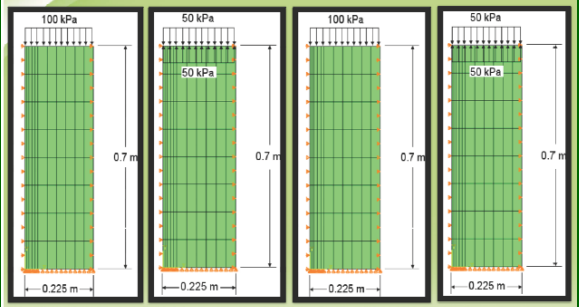
Comparison of all settlement behavior



Comparison of Shear strength increase after consolidation test



MODEL OF PVD PRELOADING IN THE LABORATORY



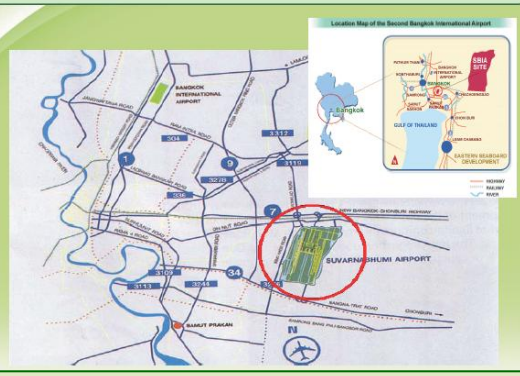
Summary of changes in flow parameters

Flow parameters	Normal PVD	Vacuum-PVD	Thermo-PVD	Thermo-Vacuum-PVD
C_h (m²/yr)	1.93	2.23	4.17	4.38
k_h/k_s	3.00	2.70	1.40	1.10

Comparison of C_h and k_h/k_s values in percent for all tests sample compared with normal PVD

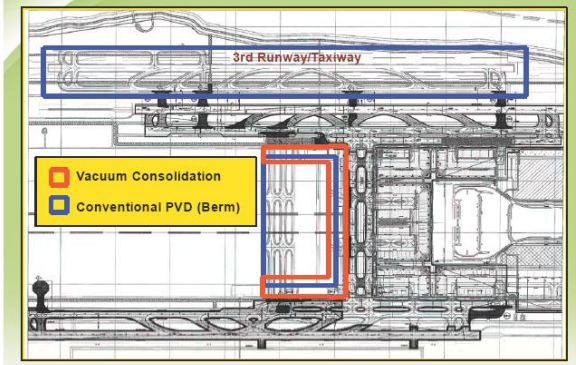
Percent Compared with normal PVD	% increased C_h	% decreased k_h/k_s
Vacuum PVD	15.54	10.00
Thermo-PVD	116.06	53.33
Thermo-Vacuum PVD	126.94	63.33

The Second Bangkok International Airport

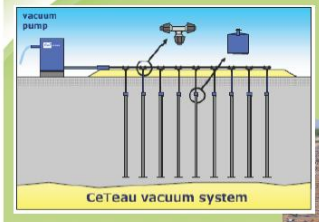


Recent Developments of Soil Improvement using PVDs with Vacuum & Heat Preloading

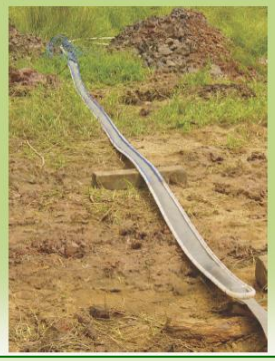
MODEL OF PVD PRELOADING IN THE FIELD CONDITION



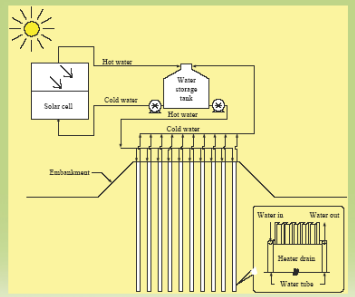
MODEL OF PVD PRELOADING IN THE FIELD CONDITION



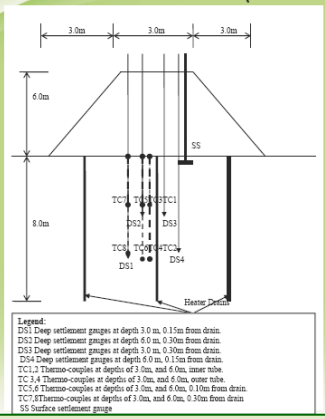
Thermo-PVD



Schematic Diagram of Field Scale Tests (Heated Test Site)



Cross Section of Test Embankment (Heated Test Site)



Recent Developments of Soil Improvement using PVDs with Vacuum & Heat Preloading

Heated Test Embankment
Total height: 5.60 m.
Unit weight of
the first embankment : 18.6 kN/m³

Non-Heated Test Embankment Total height 5.50 m.
Unit weight of
second embankment : 19 kN/m³

FEM SIMULATION IN THE FIELD CONDITION

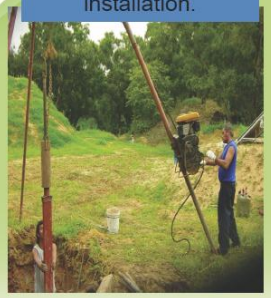
Summary of changes in flow parameters

Type	C_h (m²/yr)	k_h/k_s
PVDs	6.69	6.20
Thermo-PVDs	8.51	4.10

Item	Thermo-PVD improvement
Increase in C_h (%)	27.20
Decrease in k_h/k_s (%)	33.87

Installation in Field

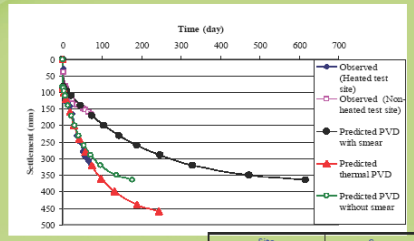
1st Mandrel installation.



2nd Installation Thermo-PVD in mandrel

Pipe and Pump System

Observed and Predicted Settlements



$C_h(\text{Thermo-PVD}) = 1.52\ C_h$

Site	C_h m²/year	k_h/k_s
Non-heated test site	2.3	10
Heated test site	3.5	5

Therefore, the thermo-PVD system can significantly accelerate the ground improvement process.

Organizing Conferences, Seminars, Etc.

Organizing Conferences, Seminars, Etc.

ORGANIZING CONFERENCES, SERVING ON PROGRAM COMMITTEES

- Member, Organizing Committee, International Symposium on Theory and Practice of Earth Reinforcement, Fukuoka, Japan, 1988.
- Member, Organizing Committee, Symposium Underground Excavations of Soils and Rocks, Bangkok, 1989.
- Member, Organizing Committee, Symposium Development of Laboratory and Field Tests Geotechnical Engineering, Practice, Bangkok, 1990.
- Member, Organizing Committee, 9th Asian Regional Conference on Soil Mechanics and Geotechnical Engineering, Bangkok, Thailand, 1991
- Member, Organizing Committee, Geotech '92 Prediction versus Performance in Geotechnical Engineering, December, 1992, Bangkok, Thailand.
- Co-Chairman, Organizing Committee, Second Young Geotechnical Conference, Bangkok, Thailand, June, 1994.
- Course Director, Symposium on Soil Improvement and Geosynthetics, 5 November 1999, AIT, Bangkok, Thailand.

Organizing Conferences, Seminars, Etc.

ORGANIZING CONFERENCES, SERVING ON PROGRAM COMMITTEES

- Organizer, Symposium on Ground Improvement and Geosynthetics, King Mongkut Univ. of Tech. Thonburi, December, 2000.
- Co-organizer, AIT Symposium on Soft Ground Improvement and Geosynthetic Applications, AIT Center, 22 to 23 November, 2001.
- Organizer, Symposium 2002 on Soil/Ground Improvement and Geosynthetic Applications, KMUTT Campus, December, 2002.
- Co-Organizer, AIT Symposium 2003 on Ground Improvement and Geosynthetic Applications on Waste Containment, AIT Conference Center, December 2003.
- Organizer, AIT Symposium 2003 on Ground Improvement and Geosynthetic Applications on Waste Containment, AIT Conference Center, December 2003.
- Chairman, Technical Committee, 15th Southeast Asian Geotechnical Conference, Bangkok, Thailand, November 2004.
- Organizer, International Symposium on Tsunami Reconstruction with Geosynthetics, Bangkok, Thailand, December 2005.

Organizing Conferences, Seminars, Etc.

ORGANIZING CONFERENCES, SERVING ON PROGRAM COMMITTEES

- Organizer, International Symposium on Geotechnical Aspects for the Second Bangkok International Airport, Bangkok, Thailand, 2006.
- Organizer, International Symposium on Ground Improvement and Geosynthetics for Human Security and Environmental Protection, Bangkok, Thailand, 2007.
- Organizer, International Symposium on Geotechnical Engineering, Ground Improvement, and Geosynthetics for Sustainable Mitigation and Adaptation to Climate Change including Global Warming, 2009.
- Organizer, International Symposium on Geotechnical and Geosynthetics Engineering: Challenges and Opportunities on Climate Change, Bangkok, Thailand, 2010.

Organizing Conferences, Seminars, Etc.

ORGANIZING TRAINING COURSES, SEMINARS, WORKSHOPS

- Member, Organizing Committee and Organizer of Exhibition at the Lobby of AIT Center, Annual Symposium and Short Course on Ground Improvement Tech. including Modern Piling Methods, AIT Center, 1982.
- Secretary to the Organizing Committee and Organizer of Exhibition at the Lobby of AIT Center, Annual Symposium and Short Course on Recent Developments on Laboratory and Field Testing and Analysis on Geotechnical Engineering, AIT Center, 1983.
- Member, Organizing Committee and Organizer of Exhibition at the Lobby of AIT Center, Annual Symposium and Short Course on Geotechnical Aspects of Mass and Material Transport., AIT Center, 1984.
- Member, Organizing Committee, Annual Symposium and Short Course on Environmental Geotechnics and Problematic Soils and Rocks, AIT Center, 1985.
- Member, Organizing Committee, Annual Symposium and Short Course on Computer Aided Design and Monitoring in Geotechnical Engineering, AIT, Bangkok, Thailand, 1986.

Organizing Conferences, Seminars, Etc.

ORGANIZING TRAINING COURSES, SEMINARS, WORKSHOPS

- Co Chairman, Organizing Committee, Short Course and Seminar on Ground Improvement, Jakarta, Indonesia, 1988.
- Member, Organizing Committee, Seminar Coastal Dev., Bangkok, 1989.
- Co Chairman, Organizing Committee, Short Course on Mechanically Stabilized Earth and Its Application, Jakarta, 1990.
- Course Director, Short Course on Soil/Ground Improvement Techniques, 18 October-12 November 1993, AIT, Bangkok, Thailand.
- Course Director, Short Course on Soil/Ground Improvement Techniques, 7 to 11 November 1994, AIT, Bangkok, Thailand.
- Course Director, Short Course on Soil/Ground Improvement Techniques, 6 to 12 December 1995, AIT, Bangkok, Thailand.
- Course Director, Short Course on Soil Improvement and Geosynthetics, 2 to 7 December 1996, AIT, Bangkok, Thailand.
- Course Director, Short Course on Building Geotechnics, 21 to 23 April 1997, School of Building, Housing and Planning, University of Sains Malaysia, Penang, Malaysia.

Organizing Conferences, Seminars, Etc.

ORGANIZING TRAINING COURSES, SEMINARS, WORKSHOPS

- Course Director, Short Courses on Ground Improvement and Mechanically Stabilized Earth, 11 to 17 December 1997, AIT, Bangkok, Thailand.
- Course Director, Short Course on Mechanically Stabilized Earth, AIT Center, 20 November 2001.
- Course Director, Short Course on Ground Improvement using PVD, AIT Center, 21 November 2001.
- Organizer, Seminar 2002 on Geoenvironmental Engineering: Assessment and Remediation of Contaminated Sites, AIT Center.
- Course Director, Short Course on Designing with Geosynthetics, KMUTT Campus, December, 2002.
- Course Director, Short Course on Geosynthetic Applications, AIT Conference Center, December 2003.
- Organizer, Applications Seminar, The Augeo Pile/BeauDrain System and Geosynthetics, Amari Atrium Hotel, March 2004.
- Course Director, Pre-Conference Short Course on Dam Safety Risk Assessment, AIT Conference Center, November 2004.

Organizing Conferences, Seminars, Etc.

ORGANIZING TRAINING COURSES, SEMINARS, WORKSHOPS

- Course Director, Professors Training Course for Geosynthetics, AIT Conference Center, December 2005.
- Organizer, One Day Workshop on Earth Reinforcement, Bangkok, Thailand, December 2005.
- Organizer, One Day Seminar on Geosynthetics and Applications, Angeles University, Philippines, 2006.
- Organizer, One Day Seminar on Environmental Geotechnics and Waste Management, Cagayan de Oro City, Philippines, 2007.
- Organizer, One Day Short Course on Geosynthetics and PLAXIS Software Applications, Bangkok, Thailand, 2009.
- Lecturer, Int'l. Training Course on Rural Road Development and Maintainance, Sripathum Univ. 2009.
- Organizer, Short Course on Geosynthetics Applications and Case Histories, Bangkok, Thailand, 2010.

Future Activities

SGCC2011

International Symposium on

Sustainable Geosynthetics and Green Technology for Climate Change

(Retirement Symposium for Prof. Dennes T. Bergado)

7 to 8 December 2011 | Bangkok, Thailand

VENUE

Viphavadee Ballroom C, Sofitel Centara Grand Bangkok, 1695 Phaholyothin Rd., Chatuchak 10900 Bangkok, Thailand

CONFERENCE COMMITTEE

Prof. Dennes T. Bergado (Chairman)	Thailand
Prof. Suksun Horpibulsuk	Thailand
Dr. Sompote Youwai	Thailand
Mr. Nuttapong Kovittayanun	Thailand
Dr. Suttisak Soralump	Thailand
Dr. Montri Dechasakulsom	Thailand
Dr. Panich Voottipruex	Thailand
Dr. Apiniti Jotisankasa	Thailand
Dr. Yip Poon Lai	Malaysia
Dr. Pham Van Long	Vietnam
Dr. Soktay Lim	Cambodia

CONFERENCE SECRETARIAT

SGCC2011 Secretariat
c/o Asian Center for Soil Improvement and Geosynthetics (ACSIG), GTE/SET, Asian Institute of Technology,
P.O. Box 4, Klong Luang, Pathumthani 12120 Thailand

Tel. No.: +66-2 524 5523
Fax. No.: +66-2 524 6050
Email: climatechange@ait.ac.th or igs-thailand@ait.ac.th
http://www.set.ait.ac.th/acsig/sgcc2011/

REGISTRATION FORM

Name: _____
Organization: _____
Mailing Address: _____
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Telephone: _____ Facsimile: _____
Mobile: _____ E-mail: _____

☐ Participant ☐ Presenter

Title of Paper: _____
_____
_____

Method of Payment

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  Account Name: Asian Institute of Technology
  Account Number: 359-3-00001-2
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  ☐ American Express (4-digit personal code: _____)
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*Registration Fee:

	Foreign		Local
	USD	THB	THB
Participant/Presenter	150	5,000	3,000
IGS/SEAGS/TGS Member	120	4,000	2,000
Corporate Members (at least 5 members)	120	4,000	2,000
Student Participants (lunch not included)	30	1,000	1,000

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*covers the Conference Proceedings, lunch and coffee breaks

SGCC2011

International Symposium on
Sustainable Geosynthetics & Green Technology for Climate Change
(Retirement Symposium for Prof. D.T. Bergado)

7 and 8 December 2011 — Bangkok, Thailand

Call for Papers

Organized by:

International Geosynthetics Society - Thailand | Asian Center for Soil Improvement and Geosynthetics | Southeast Asian Geotechnical Society | Suranaree University of Technology | International Geosynthetics Society

INTRODUCTION

Signs of abnormal weather and climate change are evident nowadays, including rain-triggered landslides, riverbank and coastal erosions, flooding, rising sea levels, and many more. Geosynthetics are now being increasingly used for many applications in civil/geotechnical engineering including road and railway embankments, retaining walls, slope and erosion protection, drainage/filtration and seepage control, approach embankments, waste containment and lining, geo-containers and geobags, etc.

Thus, this International Symposium on Sustainable Geosynthetics and Green Technology for Climate Change (SGCC2011) will be held from 7 to 8 December 2011 at the Grand Centara Convention Hotel, Bangkok, Thailand. This Symposium is hosted by the Asian Center for Soil Improvement and Geosynthetics (ACSIG) in the Geotechnical and Earth Resources Engineering Program (GTE) under the School of Engineering and Technology (SET) at the Asian Institute of Technology (AIT), the Southeast Asian Geotechnical Society (SEAGS), the International Geosynthetics Society - Thailand Chapter (IGS-Thailand), and Suranaree University of Technology (SUT), under the auspices of the International Geosynthetics Society (IGS).

SGCC2011 will also serve as the Retirement Symposium of Prof. Dennes T. Bergado. Prof. D.T. Bergado started his research on probabilistic analyses of geotechnical properties and structures. Subsequently, he branched out to Ground Improvement and Geosynthetics. He established the ACSIG and initiated IGS-Thailand. He published 2 books, more than 100 journal articles, and more than 200 conference papers mainly in this area. He pioneered the use of prefabricated vertical drain (PVD) in soft Bangkok clay with subsequent combinations of vacuum and heat preloading with notable applications in the Second Bangkok-International Airport as well as the Outer Ring Roads and Motorway Projects. He also did sustainable research work on recycled and lightweight geomaterials such as rubber tire chips mixed with sand. Currently, his research projects involve new and creative ideas regarding deep cement mixing method (DMM) such as optimum mixing water contents, fundamental parameters as well as reinforced DMM called SDCM piles. His recent research works consist of risk reduction, sustainable mitigation of rain-triggered landslides, root reinforcement and soil erosions as well as ecological ground improvement and limited life geosynthetics (LLGs).

CALL FOR PAPERS

Abstracts on the following themes are particularly welcome:

- Roads/Railways/Transport Applications
- Flood Control/Reservoirs/Hydraulic Applications
- Mining/Waste Containment/Environmental Protection
- Ground Improvement/Remediation/Case Studies
- Reinforced Slopes/Walls and Geohazard Mitigations
- Geosynthetic for Renewable Energy
- Geo-Containers and Geotubes
- Behavior of Unsaturated Soils/Rain-Triggered Landslides
- Earthquake Engineering/Geophysics
- Foundation Engineering/Retaining Walls
- Laboratory/Field Tests/Durability of Geosynthetics
- Sustainable Limited Life Geosynthetics (LLGs)
- Case Histories and Geosynthetics Innovations
- Sustainable Geosynthetics Engineering/Applications

IMPORTANT DATES

Deadline for Abstract Submission	30 July 2011
Notification of Abstracts Acceptance	15 August 2011
Deadline for Manuscript Submission	1 October 2011
Notification of Manuscript Acceptance	15 October 2011
Deadline for Author Registration	1 November 2011
SGCC2011	7 to 8 December 2011

LANGUAGE

English will be the official language of this symposium.

KEYNOTE GUESTS AND INVITED LECTURES

The Keynote Guests and Invited Lectures will be mainly represented by the professional colleagues and friends, as well as the successful former students of Prof. D.T. Bergado. Other interested presenters are very much welcome.

THE ORGANIZERS

The **Asian Institute of Technology (AIT)** is an international post graduate institute founded in 1959, and is Asia's pioneer institution established to help meet the region's growing need for advanced learning in engineering, science, technology and management, research and capacity building. Recognized for its multi-national, multi-cultural ethos, the Institute operates as a self-contained international community at its campus located 40 km north of Bangkok city center, Thailand. To further achieve an efficient and effective delivery of its mission in Asia and the Pacific Region, several Outreach Centers have been established in mobilized in AIT. This includes the **Asian Center for Soil Improvement and Geosynthetics (ACSIG)**.

ACSIG acts as catalyst in the advancement of soil/ground improvement techniques and the subsequent effective utilization of geosynthetics for environmental preservation and to mitigate existing geotechnical problems in Asia and the Pacific through competent, updated and sustainable education, research and outreach activities.

The **International Geosynthetics Society (IGS)** is a non-profit organization dedicated to the scientific and engineering development of geosynthetics and associated technologies. The IGS-Thailand Chapter (IGS-Thailand) was established in 2002 to meet the local needs and disseminate further the geosynthetics and associated technologies in Thailand and beyond.

The **Southeast Asian Geotechnical Society (SEAGS)** was founded in 1967 by Dr. Za-Chieh Moh as a regional society encompassing countries or territories in Southeast Asia, to promote the cooperation among engineers, geologists and other scientists in Southeast Asia for the advancement of knowledge in geotechnical engineering. Dr. Ooi Teik Aun now serves as the SEAGS President while Prof. Dennes T. Bergado serves as the Secretary-General.

Suranaree University of Technology (SUT) is a public autonomous university under the Royal Thai Government supervision. From its first operation in 1993 to 2008, SUT has so far produced 11 classes of Bachelors, 8 classes of Masters, and 8 classes of doctoral graduates. SUT is determined to achieve excellence in learning and teaching activities, and progress as a research university by strengthening its research activities. In addition, SUT also places high importance on academic services and preservation of arts and culture on a continual basis.

http://www.set.ait.ac.th/acsig/sgcc2011/home.htm

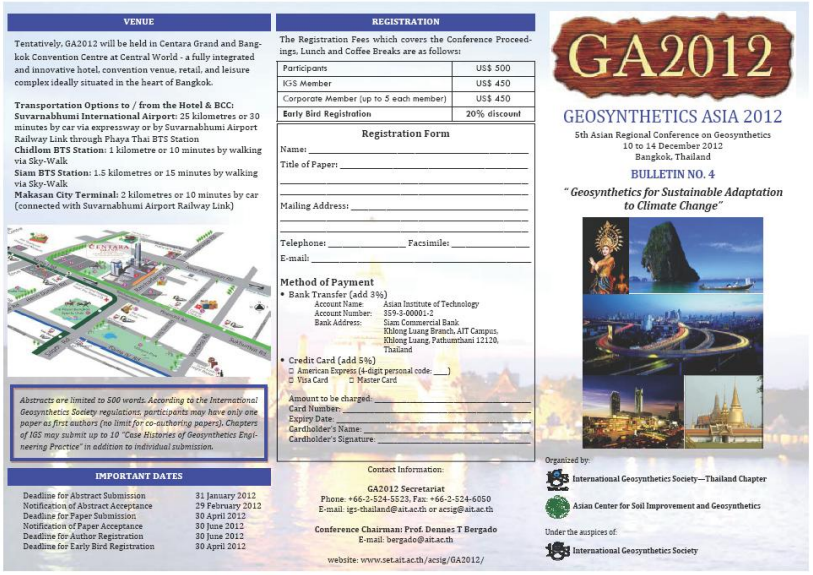
Future Activities

GA2012

GEOSYNTHETICS ASIA 2012

5th Asian Regional Conference on Geosynthetics

10 to 14 December 2012
Bangkok, Thailand



VENUE

Tentatively, GA2012 will be held in Centara Grand and Bangkok Convention Centre at Central World - a fully integrated and innovative hotel, convention venue, retail, and leisure complex ideally situated in the heart of Bangkok.

Transportation Options to / from the Hotel & BCC:
Suvarnabhumi International Airport: 25 kilometres or 30 minutes by car via expressway or by Suvarnabhumi Airport Railway Link through Phaya Thai BTS Station
Chidlom BTS Station: 1 kilometre or 10 minutes by walking via Sky-Walk
Siam BTS Station: 1.5 kilometres or 15 minutes by walking via Sky-Walk
Makasan City Terminal: 2 kilometres or 10 minutes by car (connected with Suvarnabhumi Airport Railway Link)

Abstracts are limited to 500 words. According to the International Geosynthetics Society regulations, participants may have only one paper as first authors (no limit for co-authoring papers). Chapters of IGS may submit up to 10 "Case Histories of Geosynthetics Engineering Practice" in addition to individual submission.

IMPORTANT DATES

Deadline for Abstract Submission	31 January 2012
Notification of Abstract Acceptance	29 February 2012
Deadline for Paper Submission	30 April 2012
Notification of Paper Acceptance	30 June 2012
Deadline for Author Registration	30 June 2012
Deadline for Early Bird Registration	30 April 2012

REGISTRATION

The Registration Fees which covers the Conference Proceedings, Lunch and Coffee Breaks are as follows:

Participants	US$ 500
IGS Member	US$ 450
Corporate Member (up to 5 each member)	US$ 450
Early Bird Registration	20% discount

Registration Form

Name: _____
Title of Paper: _____
_____
_____
Mailing Address: _____
_____
_____
Telephone: _____ Facsimiles: _____
E-mail: _____

Method of Payment

- Bank Transfer (add 3%)
  Account Name: Asian Institute of Technology
  Account Number: 359-3-00001-2
  Bank Address: Siam Commercial Bank
  Khlong Luang Branch, AIT Campus,
  Khlong Luang, Pathumthani 12120,
  Thailand
- Credit Card (add 5%)
  ☐ American Express (4-digit personal code: ____)
  ☐ Visa Card ☐ Master Card

Amount to be charged: _____
Card Number: _____
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Contact Information:

GA2012 Secretariat
Phone: +66-2-524-5523, Fax: +66-2-524-6050
E-mail: igs-thailand@ait.ac.th or acsig@ait.ac.th

Conference Chairman: Prof. Dennes T Bergado
E-mail: bergado@ait.ac.th

website: www.set.ait.ac.th/acsig/GA2012/

GA2012

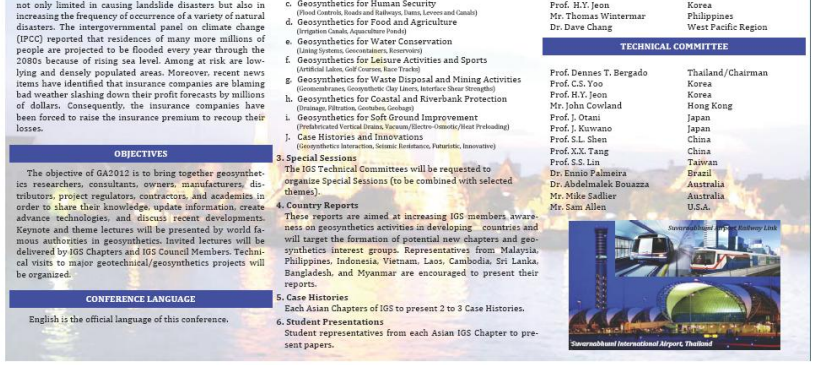
GEOSYNTHETICS ASIA 2012
5th Asian Regional Conference on Geosynthetics
10 to 14 December 2012
Bangkok, Thailand

BULLETIN NO. 4

"Geosynthetics for Sustainable Adaptation to Climate Change"

Organized by:
International Geosynthetics Society—Thailand Chapter
Asian Center for Soil Improvement and Geosynthetics

Under the auspices of:
International Geosynthetics Society



INTRODUCTION

The International Geosynthetics Society—Thailand Chapter (IGS-Thailand), under the auspices of International Geosynthetics Society (IGS), organizes the Fifth Asian Regional Conference on Geosynthetics or Geosynthetics Asia 2012, which is scheduled from 10 to 14 December 2012 at Grand Centara Convention Hotel, Bangkok, Thailand. GA2012 will be hosted by the Asian Center for Soil Improvement and Geosynthetics (ACSIG) in the Geotechnical and Earth Resources Engineering (GTE) Program under the School of Engineering and Technology (SET) at the Asian Institute of Technology (AIT). The theme of this Conference is "Geosynthetics for Sustainable Adaptation to Climate Change".

The effect of climate change including global warming is not only limited in causing landslide disasters but also in increasing the frequency of occurrence of a variety of natural disasters. The intergovernmental panel on climate change (IPCC) reported that residences of many more millions of people are projected to be flooded every year through the 2080s because of rising sea level. Among at risk are low-lying and densely populated areas. Moreover, recent news items have identified that insurance companies are blaming bad weather slashing down their profit forecasts by millions of dollars. Consequently, the insurance companies have been forced to raise the insurance premium to recoup their losses.

OBJECTIVES

The objective of GA2012 is to bring together geosynthetics researchers, consultants, owners, manufacturers, distributors, project regulators, contractors, and academics in order to share their knowledge, update information, create advance technologies, and discuss recent developments. Keynote and theme lectures will be presented by world famous authorities in geosynthetics. Invited lectures will be delivered by IGS Chapters and IGS Council Members. Technical visits to major geotechnical/geosynthetics projects will be organized.

CONFERENCE LANGUAGE

English is the official language of this conference.

CONFERENCE THEME

1. **Keynote Lectures**
   - Keynote 1: Embankments on Soft Ground and Ground Improvement
   - Keynote 2: Riverbank and Coastal Protection
   - Keynote 3: Geosynthetics for Environmental Protection
   - Keynote 4: Reinforced Earth Structures
   - Keynote 5: Geosynthetics Innovation for Sustainable Engineering
2. **Theme Lectures**
   a. Geosynthetics for Climate Change due to Global Warming (Reinforced Slopes, Reinforced Embankment/Walls, Erosion Control)
   b. Sustainable Infrastructure including Limited Life Geosynthetics (LLGs) (Green Geosynthetics, Bioplastics, Natural Fibers, Renewable, Durability)
   c. Geosynthetics for Human Security (Flood Controls, Roads and Railways, Dams, Levees and Canals)
   d. Geosynthetics for Food and Agriculture (Irrigation Canals, Aquaculture Ponds)
   e. Geosynthetics for Water Conservation (Lining Systems, Geocontainers, Reservoirs)
   f. Geosynthetics for Leisure Activities and Sports (Artificial Lakes, Golf Courses, Race Tracks)
   g. Geosynthetics for Waste Disposal and Mining Activities (Geomembranes, Geosynthetic Clay Liners, Interface Shear Strengths)
   h. Geosynthetics for Coastal and Riverbank Protection (Drainage, Filtration, Geotubes, Geobags)
   i. Geosynthetics for Soft Ground Improvement (Prefabricated Vertical Drains, Vacuum/Electro-Osmotic/Heat Preloading)
   j. Case Histories and Innovations (Geosynthetics Interaction, Seismic Resistance, Futuristic, Innovative)
3. **Special Sessions**
   The IGS Technical Committees will be requested to organize Special Sessions (to be combined with selected themes).
4. **Country Reports**
   These reports are aimed at increasing IGS members, awareness on geosynthetics activities in developing countries and will target the formation of potential new chapters and geosynthetics interest groups. Representatives from Malaysia, Philippines, Indonesia, Vietnam, Laos, Cambodia, Sri Lanka, Bangladesh, and Myanmar are encouraged to present their reports.
5. **Case Histories**
   Each Asian Chapters of IGS to present 2 to 3 Case Histories.
6. **Student Presentations**
   Student representatives from each Asian IGS Chapter to present papers.

LOCAL ORGANIZING COMMITTEE

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http://www.set.ait.ac.th/acsig/GA2012/home.htm

Thank you……..

If you would like to highlight your research activities do send in your inputs to

scpo@ait.ac.th