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Abstract

In this study, the applicability to back fill ground by Liquefied Stabilized Soil (LSS) mixed with fibered material in Hanoi city of Vietnam has been investigated. Research works including experiment and analysis have been conducted simultaneously aiming to promote the application of LSS in Vietnam in the coming time.

(1) Effect of time-dependency on strength and deformation characteristics of LSS mixed with fibered material was evaluated. A series of Consolidated–Undrained triaxial compression tests with measured pore water (CUB tests) under the various conditions at constant strain rates, constant deviator stress, and strain rates changed during monotonic loading have been carried out for LSS mixed with fibered material content of 0 and 20 kg/m³ at curing time of 28 and 56 days, respectively. Based on the test results, it was found that the effect of time-dependency is not seen in stress-strain curve independently of curing time.

(2) The difference in triaxial shear property of LSS mixed with fiber material cured in laboratory and at field was investigated to be carried out a series of CUB tests for both specimens of LSS mixed with fiber material amount of 0 and 20 kg/m³ prepared by trimming LSS retrieved from a model ground by block sampling and cured in laboratory at curing time of 28 and 56 days, respectively. Based on the test results, it was found that the maximum deviator stress in \( q_{\varepsilon_a} \) relations of LSS mixed with fiber material cured at field tend to be larger than that cured in laboratory, and the brittle property of LSS after the peak in \( q_{\varepsilon_a} \) relations has been improved to ductile property by the addition of fiber material even in field.

(3) In-situ stiffness of backfilling ground reinforced with fiber was investigated by using of portable Falling Weight Deflectometer at curing time of 28, 56 and 84 days, respectively. The stiffness was estimated by Young’s modulus \( E_{P,FWD} \) calculated from \( K_{P,FWD} \)-value. In parallel, in order to comparing with the tangent Young’s modulus \( E_{tan} \) obtained from \( q_{\varepsilon_a} \) relations, a series of CUB tests have been carried out for specimens prepared by trimming LSS retrieved by block sampling from the model ground. It is considered that the \( K_{P,FWD} \)-value is able to estimate the stiffness of backfilling ground by LSS reinforced with fiber.

(4) A procedure for prediction of train-induced vibration from railway tunnels in conformity with condition of Vietnam has been established as an example for Hanoi metro line No.3. The vibration propagation from the tunnel into the ground surface was analyzed by the 2-D FEM. The numerical results in terms of vibration velocity allow estimating the vibration velocity level, and then it is applicable to the prediction of train-induced vibration. The calculated vibrations indicated to be higher than the allowable threshold, therefore appropriate measures should be taken to decrease these vibrations.

(5) Using the established procedure, mitigation of train-induced vibration as using LSS for backfill ground of cut and cover tunnel was evaluated. If the LSS can mitigate the ground vibration, it will be a new advantage, and then LSS will be promoted more to use especially in metro projects in Vietnam. Thus, it is considered that LSS has an effective potential in mitigation of the train-induced vibration.
# Table of Contents

Acknowledgments .................................................................................................................................................................. i
Abstract ................................................................................................................................................................................ ii
List of Tables ......................................................................................................................................................................... vii
List of Figures ..................................................................................................................................................................... viii

## Chapter 1 Introduction ......................................................................................................................................................... 1
1.1 General background ............................................................................................................................................................. 1
1.2 Objective and scopes ......................................................................................................................................................... 3
1.3 Organization of thesis ....................................................................................................................................................... 5

## Chapter 2 Overview of Liquefied Stabilized Soil (LSS) in Japan and Its Feasibility in Vietnam ................................ 8
2.1 LSS - an effective method for utilization of excavated soil in Japan ......................................................................................... 8
2.2 Current situation of excavating work in Vietnam .................................................................................................................. 15
  2.2.1 Road cave-ins ................................................................................................................................................................. 15
  2.2.2 Inappropriate disposal of excavated soils .......................................................................................................................... 16
  2.2.3 Mining of new material from natural resources ......................................................................................................... 17
2.3 Feasibility for utilization of LSS in Vietnam .......................................................................................................................... 18
2.4 Summary ............................................................................................................................................................................. 19

## Chapter 3 Deformation and Strength Characteristics of Liquefied Stabilized Soil (LSS) Evaluated by Laboratory Testing ................................................................................................................................. 22
3.1 Introduction ........................................................................................................................................................................... 22
3.2 Time-dependency on deformation property of LSS .................................................................................................................. 23
  3.2.1 Test procedure ................................................................................................................................................................. 23
    3.2.1.1 Test material ............................................................................................................................................................ 23
    3.2.1.2 Mixing method ......................................................................................................................................................... 24
    3.2.1.3 Specimen preparation ............................................................................................................................................... 24
    3.2.1.4 Test method and equipment .................................................................................................................................. 24
  3.2.2 Test results and discussion ................................................................................................................................................ 25
    3.2.2.1 Relationship between deviator stress and axial strain ............................................................................................ 25
    3.2.2.2 Deformation property ............................................................................................................................................... 27
  3.2.3 Summary ........................................................................................................................................................................ 30
3.3 Strength and deformation characteristics of LSS prepared at laboratory and field ......................................................... 30
  3.3.1 Test procedure ................................................................................................................................................................. 30
3.3.1.1 Test material and mixing method ......................................................... 30
3.3.1.2 Specimen preparation .......................................................................... 31
3.3.1.3 Test method .......................................................................................... 31
3.3.2 Test results and discussion ....................................................................... 32
3.3.2.1 Relationship between deviator stress and axial strain ......................... 32
3.3.2.2 Deformation property .......................................................................... 33
3.3.3 Summary .................................................................................................. 36

Chapter 4 Mechanical Properties of Liquefied Stabilized Soil (LSS) Evaluated by Field Testing Method .................................................................................................................. 39
4.1 Introduction .................................................................................................. 39
4.2 Test procedure.............................................................................................. 40
4.2.1 Test material, mixing method and specimen preparation ....................... 40
4.2.2 Test method and equipment .................................................................... 40
4.2.2.1 Potable FWD test .................................................................................. 40
4.2.2.2 CUB test ............................................................................................... 41
4.3 Test result and discussion .......................................................................... 42
4.3.1 Effect of curing days on Kp,FWD-value ................................................... 42
4.3.2 Effect of dry density on Kp,FWD-value .................................................... 42
4.3.3 Strain level-dependency of Young’s modulus ........................................ 42
4.4 Summary .................................................................................................... 43

Chapter 5 Suggestion of Methods for Estimation of Soil Dynamic Parameters in Conformity with Actual Condition in Vietnam .............................................. 45
5.1 Introduction ................................................................................................ 45
5.2 Soil dynamic parameter and estimating methods ....................................... 45
5.3 Estimation of dynamic soil properties .......................................................... 49
5.3.1 Estimation of shear wave velocity, $v_s$, from SPT data ......................... 49
5.3.2 Estimation of shear wave velocity, $v_s$, from CPT data ......................... 50
5.3.3 Estimation of damping ratio .................................................................... 52
5.4 Estimation of dynamic soil parameters for metro line No.3 in Hanoi city .... 53
5.4 Summary .................................................................................................... 58

Chapter 6 Study on Establishment Procedure for Prediction of Train-induced Vibration from Tunnel in Vietnam ................................................................. 60
6.1 Introduction ................................................................................................ 60
6.1.1 Definition of vibration level .................................................................... 61
Chapter 7 Evaluation on Mitigation of Train-induced Vibration as Using LSS for Backfill Ground of Cut and Cover Tunnel

7.1 Introduction

7.2 Analysis procedures

7.3 Results and discussion

7.4 Summary

Chapter 8 Conclusions and Recommendations

8.1 Conclusions
8.2 Recommendations ........................................................................................................................................... 110

Appendix A Simulation of moving train load with velocity of 80 km/h by empirical method ............................................................. 111

Appendix B Simulation of moving train load with velocity of 80 km/h by Newmark numerical method ............................................................. 115

Appendix C Simulation of moving train load with velocity of 60 km/h by Newmark numerical method ............................................................. 121

Appendix D Contour of displacement and acceleration for case 1 and case 2 ............ 127

Appendix E Contour of displacement and acceleration for case 3 and case 4 ............ 129
List of Tables

Table 3.1 Physical Properties of NSF-CLAY ................................................................. 23
Table 3.2 Test conditions of axial strain rate................................................................. 25
Table 3.3 Initial Young’s modulus E₀ (MPa) ................................................................. 27
Table 5.1 SPT \(N^*_{60}\) – Shear Wave Velocity, \(v_s\), Equation for Sand ................. 49
Table 5.2 Recommended Age Scaling Factors (ASF) for SPT .................................... 49
Table 5.3 CPT (\(q_c\)) – Shear Wave Velocity, \(v_s\), Equations for Soils .................. 50
Table 5.4 Recommended Age Scaling Factors (ASF) for CPT ................................. 51
Table 5.5 Geological classification ............................................................................. 54
Table 5.6 Estimation of shear wave velocity, \(v_s\) with depth of soil layers for metro line No.3 in Hanoi city ................................................................. 57
Table 5.7 Results of computing the shear wave velocity and damping ratio at Km0+940 .... 58
Table 5.8 Results of computing the shear wave velocity and damping ratio at Km6+700 .... 58
Table 6.1 Geotechnical properties of soil layers in Metro line No.3 ....................... 79
Table 6.2 Parameters of tunnel .................................................................................... 81
Table 7.1 Geotechnical properties of soil layers ......................................................... 97
Table 7.2 Parameters of tunnel .................................................................................... 98
Table 7.3 Physical properties of backfilling material ................................................ 98
List of Figures

Figure 1.1 Metro rout map of Hanoi city up to 2020 ....................................................... 2
Figure 1.2 Metro rout map of Hochiminh city up to 2020 ........................................... 2
Figure 1.3(a) $q$–$\varepsilon_a$ relation of Vinh Phuc-Clay LSS ........................................ 4
Figure 1.3(b) $q$–$\varepsilon_a$ relation of NSF-Clay LSS ..................................................... 4
Figure 1.4 Flow chart of this dissertation ..................................................................... 5
Figure 2.1 Flow of Liquefied soil stabilized method (Tomoharu et al., 2005) ............ 10
Figure 2.2 Liquefied soil stabilizing method (LSS method, Miki et al., 2005) .......... 10
Figure 2.3 Production system for foam mixed lightweight soil ................................. 11
Figure 2.4 Light-weight banking method using in-situ surface soils ......................... 11
Figure 2.5 Cement treated soil using as slope protection (Tang et al., 2001) .......... 12
Figure 2.6 Placement of cement treated soil along slope (Tang et al., 2001) .......... 12
Figure 2.7 Two stages construction method using lightly lime/cement treated clayey soils (Hino et al., 2008) ................................................................. 12
Figure 2.8 Use of LSS for filling cavity under road surface ....................................... 13
Figure 2.9a LSS used for backfill at upper part of cut and cover tunnel .................. 13
Figure 2.9b LSS used for invert material of shield tunnel .......................................... 13
Figure 2.10a Backfilling of building foundation ....................................................... 14
Figure 2.10b Backfilling of underwater seawall ....................................................... 14
Figure 2.10c Backfilling of abutment ....................................................................... 14
Figure 2.10d Backfilling of box culvert ................................................................. 14
Figure 2.10e Backfilling of underground pipe ....................................................... 14
Figure 2.10f Filling of void under floor due to subsidence ....................................... 14
Figure 2.11 Backfilling of LSS .................................................................................. 15
Figure 2.12 Cave-ins and road collapses in Hanoi city ........................................... 15
Figure 2.13 Cave-ins and road collapses in Ho Chi Minh city .................................. 15
Figure 2.14 Broken water supply pipe line in Hanoi .............................................. 16
Figure 2.15 Repairing and backfilling work of the broken water supply pipe line ... 16
Figure 2.16 Inappropriate disposal of excavated soils from construction sites in Hanoi .............................................................................................. 17
Figure 2.17 Bank erosion due to depletion of sand in streambed ............................. 17
Figure 2.18a Sand mining near Thang Long Bridge ............................................... 18
Figure 2.18b Sand mining near Can Tho Bridge ..................................................... 18
Figure 3.1 Aging effect on stress-strain ................................................................. 23
Figure 3.2 Loading rate effect on stress-strain relation .......................................... 23
Figure 3.3 Schematic of CUB test apparatus ......................................................... 24
Figure 3.4 $q$–$\varepsilon_a$ relation for all cases .............................................................. 25
Figure 3.5 $q - \varepsilon_a$ relation for case 1, 2 ................................................................. 26
Figure 3.6 $q - \varepsilon_a$ relation for case 3, 4 ................................................................. 26
Figure 3.7 $q - \varepsilon_a$ relation at small strain for case 1, 2 ........................................ 26
Figure 3.8 $q - \varepsilon_a$ relation at small strain for case 3, 4 ........................................ 26
Figure 3.9 Definition of various Young’s moduli ......................................................... 27
Figure 3.10 $E_{\text{tan}}/E_0 - q/q_{\text{max}}$ relation for case 1, 2 ........................................ 28
Figure 3.11 $E_{\text{tan}}/E_0 - q/q_{\text{max}}$ relation for case 3, 4 ........................................ 28
Figure 3.12 $E_{\text{tan}} - \log \varepsilon_a$ relation for case 1, 2 ............................................... 29
Figure 3.13 $E_{\text{tan}} - \log \varepsilon_a$ relation for case 3, 4 ............................................... 29
Figure 3.14 Schematic drawing of pits ........................................................................ 31
Figure 3.15 Case 1 of test condition ............................................................................ 31
Figure 3.16 Case 2 of test condition ............................................................................ 31
Figure 3.17 $q - \varepsilon_a$ relations at 28 days ................................................................. 32
Figure 3.18 $q - \varepsilon_a$ relations at 56 days ................................................................. 32
Figure 3.19 Definition of various Young’s moduli ......................................................... 33
Figure 3.20a $q_{\text{max}}$-curing days relations .............................................................. 33
Figure 3.20b $E_0$-curing days relations ....................................................................... 33
Figure 3.21 $E_{\text{tan}}/E_0 - q/q_{\text{max}}$ relations for case 1 ............................................. 34
Figure 3.22 $E_{\text{tan}}/E_0 - q/q_{\text{max}}$ relations for case 2 ............................................. 34
Figure 3.23 $E_{\text{tan}} - \log \varepsilon_a$ relations for case 1 ....................................................... 35
Figure 3.24 $E_{\text{tan}} - \log \varepsilon_a$ relations for case 2 ....................................................... 35
Figure 3.25 $E_{\text{eq}}/E_0 - q/q_{\text{max}}$ relations ................................................................. 36
Figure 4.1 Schematic of portable FWD test apparatus .............................................. 40
Figure 4.2 An example of displacement and loading stress at one measurement point 41
Figure 4.3 $K_{P, \text{FWD}}$-value-curing days relation ............................................................ 42
Figure 4.4 $K_{P, \text{FWD}}$-value-dry density relation ........................................................... 42
Figure 4.5 Figure 4.5 $E_{P, \text{FWD}}$ and $E_{\text{tan}} - \log \varepsilon_a$ relations ................................. 43
Figure 5.1 Field and laboratory methods for determining dynamic parameters ........ 46
Figure 5.2 Overview of possible shear strain amplitudes ......................................... 47
Figure 5.3 $h - \gamma$ relation of sandy soils (PI = 0 %) .................................................... 53
Figure 5.4 $h - \gamma$ relation of plastic soils (PI = 35 %) ................................................ 53
Figure 5.5 Computing result of shear wave velocity from CPT data at penetration point HX02 of metro line 03 ......................................................... 56
Figure 5.6 Computing result of shear wave velocity from CPT data at penetration point HX08 of metro line 03 ......................................................... 56
Figure 6.1 Schematic simplified the model of train-track-tunnel problem .................. 62
Figure 6.2 Schematic diagram of prediction procedure for train-induced vibration from tunnel..................................................................................................................................................................65
Figure 6.3 Mohr-Coulomb model parameters in Plaxis...........................................................................................................................................................................67
Figure 6.4 Cam-Clay model parameters in Plaxis..................................................................................................................67
Figure 6.5 Schematic of single wheel load on track and diagram of its function according to Bernoulli-Euler..........................................................................................................69
Figure 6.6 Geometric profile of train wheel loads ................................................................................................................70
Figure 6.7 Characteristic of the dynamic load applied to the tunnel.....................................................................................72
Figure 6.8 Input excitation........................................................................................................................................................73
Figure 6.9 Procedure for estimation of natural frequency in Plaxis..............................................................................................74
Figure 6.10 Estimation of natural frequency of ground at Km0+940...............................................................................................75
Figure 6.11 Estimation of natural frequency of ground at Km6+700............................................................................................76
Figure 6.12 Influence of multi-layered ground on natural frequency..........................................................................................77
Figure 6.13 Influence of damping of soil on natural frequency.................................................................................................78
Figure 6.14 Tunnel shape and ground profile at Km0+940..............................................................................................................80
Figure 6.15 Tunnel shape and ground profile at Km6+700..............................................................................................................80
Figure 6.16 Finite element model with symmetrical loading at Km0+940......................................................................................81
Figure 6.17 Finite element mesh..................................................................................................................................................81
Figure 6.18 Graph of total vibration velocity with time at B with $v=80$ km/h, $f_r=63$ Hz in the case of symmetrical and nonsymmetrical loading..........................................................................................82
Figure 6.19 Graph of vertical and horizontal vibration velocities with time at B of Km0+940 with $v = 80$ km/h, $f_r = 63$ Hz................................................................................................................................................83
Figure 6.20 Graph of total vibration velocities with time at B, E, H of Km0+940 with $v = 80$ km/h, $f_r = 63$ Hz................................................................................................................................................83
Figure 6.21 Relationship between vibration level and elapsed time of loading at B, E, H of Km0+940 with $v = 80$ km/h, $f_r = 63$ Hz................................................................................................................................................84
Figure 6.22 Relationship between distance and maximum vibration velocity and level at Km0+940 with $v = 80$ km/h ................................................................................................................................................84
Figure 6.23 Relationship between distance and maximum vibration velocity and level at Km6+700, $v = 80$ km/h................................................................................................................................................84
Figure 6.24 Relationship between maximum vibration level and velocity and random frequency at B of Km0+940 with $v = 80$ Km/h................................................................................................................................................85
Figure 6.25 Relationship between maximum vibration level and velocity and train velocity at B of Km0+940, $L_{ir} = 30$ cm................................................................................................................................................85
Figure 6.26 Relationship between distance and maximum vibration level and velocity at Km6+700 with $v = 80$ Km/h, $L_{ir} = 30$ cm in case of the circle and rectangle tunnel shape................................................................................................................................................86
Figure 6.27 Relationship between distance and maximum vibration level and velocity at Km0+940 with $v=80$ Km/h, $L_{ir}=30$ cm in the case of different tunnel thicknesses................................................................................................................................................86
Figure 6.28 Graph of horizontal vibration velocity with time at bottom (X=7, Y=-16.4 m) and top (X=7 m, Y=-4.79 m) of layer 1 with \( v = 80 \) km/h, \( f_r = 63 \) Hz

Figure 6.29 Graph of vertical vibration velocity with time at bottom (X=7, Y=-16.4 m) and top (X=7 m, Y=-4.79 m) of layer 1 with \( v = 80 \) km/h, \( f_r = 63 \) Hz

Figure 6.30 Change of vibration level with depth at X=7 m with \( v = 80 \) km/h, \( L_r = 30 \) cm

Figure 7.1 Schematic simplified vibration model of train

Figure 7.2 Characteristic of dynamic load applied to the tunnel

Figure 7.3 Tunnel shape and ground profile

Figure 7.4 View of modelling in Plaxis

Figure 7.5 Finite element generation in Plaxis

Figure 7.6 Graph of velocity at A in case 1 and case 2, respectively with \( v = 60 \) km/h

Figure 7.7 Graph of velocity at B in case 1 and case 2, respectively with \( v = 60 \) km/h

Figure 7.8 Graph of velocity at E in case 1 and case 2, respectively with \( v = 60 \) km/h

Figure 7.9 Graph of velocity at H in case 1 and case 2, respectively with \( v = 60 \) km/h

Figure 7.10 Contour of velocity at 1.5 sec of loading in case 1

Figure 7.11 Contour of velocity at 1.5 sec of loading in case 2

Figure 7.12 Relationship between distance and maximum vibration velocity and level in case 1 and case 2, respectively with \( v = 60 \) km/h

Figure 7.13 Graph of velocity at A in case 3 and case 4, respectively with \( v = 60 \) km/h

Figure 7.14 Graph of velocity at B in case 3 and case 4, respectively with \( v = 60 \) km/h

Figure 7.15 Graph of velocity at E in case 3 and case 4, respectively with \( v = 60 \) km/h

Figure 7.16 Graph of velocity at H in case 3 and case 4, respectively with \( v = 60 \) km/h

Figure 7.17 Contour of velocity at 1.5 sec of loading in case 3

Figure 7.18 Contour of velocity at 1.5 sec of loading in case 4

Figure 7.19 Relationship between distance and maximum vibration velocity and level in case 3 and case 4, respectively with \( v = 60 \) km/h