室蘭工業大学
学術資源アーカイブ
Muroran Institute of Technology Academic Resources Archive

ハノイ市における繊維質材料混合流動化処理土の埋戻し地盤への適用に関する研究

メタデータ	言語: eng 出版者: 公開日: 2015-12-22 キーワード (Ja): キーワード (En): 作成者: ズゥオン, クゥン フン メールアドレス: 所属:
URL	https://doi.org/10.15118/00005132

Chapter 8

Conclusions and Recommendations

8.1 CONCLUSIONS

This study has performed both experimental and analysis works to investigate the characteristics and performances as well of Liquefied Stabilized Soil (LSS) and LSS mixed with fibered material aiming to promote its application as backfilling material in underground construction projects of Vietnam in particular where a huge quantity of excavated soil forecasted will be discharged in the coming time. Firstly the strength and deformation characteristics of LSS mixed with fibered material has been investigated by both laboratory and field testing. On the other hand a procedure for prediction of train-induced vibration form tunnel in Vietnam has been established fully. Before that the methods for estimation of soil dynamic parameters in conformity with current condition of Vietnam have been suggested to be adopted. Subsequently by using the established procedure, the mitigation of train-induced vibration as using LSS of which Vinhphuc clay spreading in Hanoi city was original material for backfill ground of cut and cover tunnel has been evaluated. Based on the test and analysis results, the main findings can be revealed as follow:

1. Time-dependency on deformation property
   a. The maximum deviator stress, q_{max} in $q \sim \varepsilon_a$ curve of LSS mixed with fibered material indicates similar value independently of curing days. However, in case of LSS without fibered material, there is a tendency to increase the initial stiffness as increasing of curing days.
   b. The range of indicating E_{tan}/E_0 value of 1.0 tends to be larger on LSS mixed with fibered material. This is due to the reinforcing effect of the fibered material in LSS.
2. Strength and deformation characteristics of LSS prepared at laboratory and field

a. The maximum deviator stress, q_{max} in $q \sim \varepsilon_a$ curve of LSS mixed with fiber material cured at field substantially tend to be larger than that cured in laboratory. Moreover, by the addition of the fiber material, the brittle property of LSS cured in field after the peak is improved.

b. It is considered that the linear region on $q \sim \varepsilon_a$ relation increases immediately after creep due to reinforcing effect when the fiber material is mixed in LSS prepared at field.

c. It is suggested that the application of LSS mixed with fiber material as a backfilling material to construction sites enables to create a ground with the improved ductile characteristic, although it needs to conduct more study.

3. Evaluation of in-situ compressive stiffness of LSS reinforced with fiber

   a. The in-situ stiffness of the backfilling ground by LSS increases as the increasing of curing time. Moreover, by the addition of the fiber into LSS, the stiffness is increased faster due to the reinforcement effect.

   b. Besides the effect of curing time and addition of fiber into LSS, the stiffness of backfilling ground by LSS is affected by dry density.

   c. By comparison with the E_{tan} value obtained from indoor tests (CUB tests), it is considered that the stiffness of backfilling ground by LSS reinforced with fiber can be estimated by $K_{P.FWD}$-value obtained from in-situ tests (portable FWD tests).

4. Suggestion of methods for estimation of soil dynamic parameters

   a. The result from calculation of shear wave velocity based on CPT data for Metro line No.3 in Hanoi city agrees well with the measurement result reported in the literatures. Thus, the suggested methods were found to be reliable.

   b. The estimation of the soil dynamic parameters based on CPT data with low cost is feasible to apply in practical condition in Vietnam.

5. Establishment of a procedure for prediction of train-induced vibration from tunnel

   a. Modeling procedure of dynamic loading on tunnel was accomplished in Mathcad by programming. The numerical result with high reliability can be input data for ground-borne vibration analysis model.

   b. Use of Plaxis, a program being popular in Vietnam with application of Fourier spectrum method to estimate natural frequency for dynamic problem of multilayered ground system has brought the reliable results

   c. By numerical modeling in Plaxis, the vibration prediction has been performed. It indicated that if assuming allowable vibration of 75 VdB, the predicted vibration level at ground surface was exceeded. Thus, the appropriate measure should be taken to mitigation the vibration for the metro line No.3 in Hanoi.

6. Evaluation on mitigation of train-induced vibration as using LSS for backfill ground of cut and cover tunnel

   a. As compared with hill cut soil, LSS had the significantly better effect on mitigation of ground vibration induced by moving train in the cut and cover tunnel section of metro line No3 in Hanoi city.

b. In case of assumption which the tunnel was buried deeper, the analysis results indicated that effect of LSS on mitigation of vibration has been reduced as compared with hill cut soil. However, the level at the nearby points from the tunnel center line on the ground surface which is strongest impacted from the vibration in case of using LSS is lower.

c. From the above, it was concluded that LSS had an effective potential as countermeasure against train-induced vibration in cut and cover tunnel. This property was pointed out as a new advantage of LSS.

8.2 RECOMMENDATIONS

Based on the findings and conclusions, the following recommendations are made:

1. The triaxial tests under cyclic loading condition simulated as traffic loading need to be performed on specimens retrieved from model ground backfilled by fibered LSS. Then, a rational construction method on practical fieldwork will be proposed.
2. The model of train dynamic loading on tunnel can be improved by consideration of a wheel-rail contact force using Hertzian contact theory.
3. The established procedure for prediction of train-induced vibration are required for validation by comparing the measure results from the existing metro and the calculated results from the established procedure.