Characterization of the viscoelastic effects of thawed frozen soil on pile by measurement of free response

Feng Xiao, Gang S. Chen, J. Leroy Hulsey, Duane Davis, Zhaohui Yang

PII: S0165-232X(16)30218-X
DOI: doi:10.1016/j.coldregions.2017.09.011
Reference: COLTEC 2453

To appear in: *Cold Regions Science and Technology*

Received date: 19 September 2016
Revised date: 29 August 2017
Accepted date: 20 September 2017

Please cite this article as: Feng Xiao, Gang S. Chen, J. Leroy Hulsey, Duane Davis, Zhaohui Yang , Characterization of the viscoelastic effects of thawed frozen soil on pile by measurement of free response. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Coltec(2017), doi:10.1016/j.coldregions.2017.09.011

Characterization of the Viscoelastic Effects of Thawing Frozen Soil on Pile by Measurement of Free Response

[1]J. Leroy Hulsey, [1]Feng Xiao, [2]Gang S Chen, [1]Duane Davis, [3]Zhaohui Yang

[1]College of Engineering and Mines, University of Alaska, Fairbanks, Alaska 99775

[2]College of IT & Engineering, Marshall University, Huntington, WV 25755

[3]College of Engineering, University of Alaska Anchorage, Alaska 99508

Abstract

Most of the man-made structures in cold regions could expose in seasonally frozen conditions which could have significant impact on the soil-pile systems of structures. Little research has been conducted to investigate the thawing frozen soil effects on the dynamic performance of pile structures. An experimental investigation of the thawing frozen soil effects on the dynamic behavior of a pile structure is presented. Free-decay response approach is used to estimate the dynamic properties of a pile partially embedded in Fairbanks silt in summer. The frequency spectrum analyses are used to evaluate system's vibration properties. The empirical modal decomposition is used to decompose response signal for system parameter identification. Results show that two dominant modes can be used to characterize pile dynamic response, one is a component at 14 Hz and the other one is at 920 Hz. The former is a pile rocking mode in which pile behaves like a rigid body; the latter is the first order structural bending mode of the embedded pile. The rocking mode exhibits nonlinear characteristics in the time-frequency domain which is dominated by strong soil nonlinearity. The structural modes of embedded pile exhibit weak nonlinear characteristics. The damping ratios are identified, which can be used to