



HOKKAIDO UNIVERSITY

Title	Stability assessment approach for soil slopes in seasonal cold regions
Author(s)	Subramanian, Srikrishnan Siva; Ishikawa, Tatsuya; Tokoro, Tetsuya
Citation	Engineering geology, 221, 154-169 https://doi.org/10.1016/j.enggeo.2017.03.008
Issue Date	2017-04-20
Doc URL	https://hdl.handle.net/2115/73692
Rights	© 2017. This manuscript version is made available under the CC-BY-NC-ND 4.0 license
Rights(URL)	https://creativecommons.org/licenses/by-nc-nd/4.0/
Type	journal article
File Information	Tables_Revise.pdf, 表



Table 1. Soil properties used for the simulation of volcanic soil embankment slope

Property name	Volcanic soil
Dry density of soil (ρ_d)	1020 kg/m ³
Porosity (n)	0.63
Hydraulic conductivity of saturated soil (k_s)	6.00×10^{-6} m/s
Volumetric water content of soil at 0°C (θ_{wf})	0.19 m ³ /m ³
Volumetric water content of saturated soil (θ_s)	0.63 m ³ /m ³
Unfrozen thermal conductivity (λ_u)	107.8 kJ/(Day·m·°C)
Frozen thermal conductivity (λ_f)	171.7 kJ/(Day·m·°C)
Unfrozen volumetric heat capacity (ζ_u)	3372 kJ/(m ³ ·°C)
Frozen volumetric heat capacity (ζ_f)	1193 kJ/(m ³ ·°C)
Effective cohesion (c')	0 kPa
Effective angle of internal friction (ϕ')	35°

Table 2. Soil properties used for the simulation of highway slope

Property name	Embankment filling	Talus materials
Dry density of soil (ρ_d)	1400 kg/m ³	1200 kg/m ³
Porosity (n)	0.47	0.53
Hydraulic conductivity of saturated soil (k_s)	5.62×10^{-7} m/s	1×10^{-4} m/s
Volumetric water content of soil at 0°C (θ_{wf})	0.15 m ³ /m ³	0.10 m ³ /m ³
Volumetric water content of saturated soil (θ_s)	0.47 m ³ /m ³	0.53 m ³ /m ³
Unfrozen thermal conductivity (λ_u)	127.04 kJ/(Day·m·°C)	103.7 kJ/(Day·m·°C)
Frozen thermal conductivity (λ_f)	132.24 kJ/(Day·m·°C)	135.7 kJ/(Day·m·°C)
Unfrozen volumetric heat capacity (ζ_u)	2237 kJ/(m ³ ·°C)	2398 kJ/(m ³ ·°C)
Frozen volumetric heat capacity (ζ_f)	1624 kJ/(m ³ ·°C)	1392 kJ/(m ³ ·°C)
Undrained shear strength (q_u)	52 kPa	-
Effective cohesion (c')	9.75 kPa	52 kPa
Effective angle of internal friction (ϕ')	35°	11.36°

Table 3. Analytical conditions for parametric studies

Targeted parameter for investigation	Case study	Additional factors and analytical conditions considered in simulations					
		Rainfall	Freeze-thaw action	Snowfall/snowmelt water	Weight of snow	Change in slope angle	Shear strength of frozen soil
Effect of increased amount of rainfall	ES	O (Twice and Thrice)	O	X	X	X	X
Effect of increased amount of snowfall	ES	O	O	O (Twice and Thrice)	X	X	X
Effect of Freeze-thaw action	ES and HS	O	O	O	X	X	X
		O	X	O	X	X	X
Effect of snowfall/snowmelt water	ES and HS	O	O	O	X	X	X
		O	O	X	X	X	X
Effect of weight of snow	ES	O	O	O	O	X	X
Effect of slope angle	ES	O	O	O	X	O	X
Effect of frozen soil shear strength	ES	O	O	O	X	X	O

Note: ES = Embankment slope; HS = Highway slope; O = parameter considered; X = parameter not considered.