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Effect of Fiber Inclusion on the Geotechnical Parameters of Clayey Soil Subjected to Freeze-Thaw Cycles

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Abstract : A number of studies have been conducted recently to investigate the influence of randomly oriented fibers on some engineering properties of cohesive soils.Freezing and thawing of soil affects the strength, durability and permeability of soil adversely. Experiments were carried out in order to investigate the effect of inclusion of randomly distributed polypropylene fibers on the strength, hydraulic conductivity and durability of local soil (CL) subjected to freeze–thaw cycles. For evaluating the change in strength of soil, a series of unconfined compression tests as well as tri-axial tests were carried out on reinforced and unreinforced soil samples. All the samples were subjected to seven cycles of freezing and thawing. Freezing was carried out at a temperature of - 15 to -18 °C; and thawing was carried out by keeping the samples at room temperature. The reinforcement of soil samples was done by mixing with polypropylene fibers, 12 mm long and with an aspect ratio of 240. The content of fibers was varied from 0.25 to 1% by dry weight of soil. The maximum strength of soil was found in samples having a fiber content of 0.75% for all the samples that were prepared at optimum moisture content (OMC), and if the OMC was increased (+2% OMC) or decreased (-2% OMC), the maximum strength observed at 0.5% fiber inclusion. The effect of fiber inclusion and freeze–thaw on the hydraulic conductivity was studied increased from around 25 times to 300 times that of the unreinforced soil, without subjected to any freeze-thaw cycles. For studying the increased durability of soil, mass loss after each freeze-thaw cycle was calculated and it was found that samples reinforced with polypropylene fibers show 50-60% less loss in weight than that of the unreinforced soil.

Keywords : fiber reinforcement, freezingand thawing, hydraulic conductivity, unconfined compressive strength
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