The Canadian Geotechnical Society

Manitoba Section

La Société Canadienne de Géotechnique

CGS Luncheon Presentation

Passive Groundwater Depressurization System for Improving Road Embankment Stability, Case Study: Powerview Creek, Manitoba

Presented by: Rob Kenyon, Ph.D., P.Eng., KGS Group

A passive groundwater depressurization system was implemented as an initial element of slope stabilization works at a road embankment on provincial highway PTH 11 near Powerview/Pine Falls, Manitoba. The embankment and concrete box culvert at the Powerview Creek crossing was actively moving for several years, necessitating temporary repairs along with several episodes of road regrading to maintain highway safety and sightlines. The crossing is situated adjacent to the Winnipeg River, which along with localized low-lying bogs and creek tributaries, forms an extensive groundwater discharge zone for the confined fractured Precambrian bedrock and overlying silty sand till. The till is capped by intermediate to high plasticity lacustrine silty clay. Groundwater discharge is characterized by strong upward gradients, and spring discharges, sometimes associated with soil piping. Geotechnical investigations, test well drilling, and pumping tests quantified the measurement of flowing artesian groundwater pressures hosted within the bedrock and till at the Powerview Creek site. These piezometric pressures were overall characteristic of naturally occurring pressures measured within the till and bedrock at Winnipeg River groundwater discharge areas. A passive depressurization system consisting of a series of wells, flowing to discharge by gravity, was designed and implemented to reduce the flowing artesian piezometric pressures acting on the overlying lacustrine clays. Several years of monitoring data indicates a significant reduction (up to 6.5 m) in the driving piezometric pressures within the bedrock and till. Overlying clays responded incrementally, with the largest response within clays immediately overlying the tills (between 3.0 m and 6.0 m), and responses in the order of 1.0 m within the upper clays. Measured movements of site slope inclinometers indicate that the displacements within the embankment at two discrete lacustrine clay failure planes have effectively ceased as a response to groundwater depressurization. Back analysis of the slope stability condition, coupled with seepage analysis, indicates significant improvement (approximately 10%) to the overall stability of the embankment by groundwater depressurization alone. Groundwater depressurization was implemented at a relatively low cost in comparison to more traditional stability improvement measures, at this sensitive site. It also allowed time and flexibility for the Owner to explore and optimize several options for moving the project forward to final design and replacement of the failed box culvert. Site investigations, monitoring, and fully coupled stability modeling results are documented within this paper, along with discussion related to the effectiveness of the depressurization.

About the presenter:
Rob Kenyon, Ph.D., P.Eng., is Manager of Geotechnical Engineering for KGS Group. He has over 30 years of experience in emergency geotechnical engineering, forensic geotechnical engineering, geotechnical site investigations, design of earthworks for roadways, bridges, railways, airports and water retaining structures, design of slope stability measures and of heavy industrial foundations, and expert witness in dispute mediation. Dr. Kenyon holds a Ph.D. in Soil Mechanics and taught Geotechnical Engineering course at the University of Manitoba last year. He has worked all across Canada from Yukon, to BC, to Alberta, Northwest Territories, Manitoba, Saskatchewan, Ontario, and the Maritimes. Dr. Kenyon was part of the KGS Team that was awarded the 2012 Consulting Engineers of Canada “Keystone Award” for best engineering project in 2011. The award was for all emergency flood response activities provided to Manitoba in the 2011 flood. In 2012 Dr. Kenyon was awarded the Canadian Geotechnical Society R.M. Hardy award for his keynote presentation “The History of Flood Fighting on the Red and Assiniboine Rivers”.

Pullout Resistance of Geotextiles With and Without Wicking Function

Presented by: Samuel Kaluzny, University of Manitoba

Geotextiles have been commonly used as slope and basal reinforcements to improve the stability of embankments. Slopes are exposed to natural events such as seasonal wetting and drying as well as freezing and thawing. Water that accumulates in the slope reduces its shear strength, thus increasing the embankment’s susceptibility to slope movements. The performance of a woven geotextile with wicking capabilities is evaluated. The wicking function of the geotextile provides in-plane drainage for the water to flow out of the embankment. The wicking geotextile is compared to that of a geotextile with similar stiffness and surface texture but without the in-plane drainage capability. A series of pullout tests at different confining pressures were tested for both geotextiles (wicking and non-wicking) to study the effect of the in-plane drainage to the shear stiffness and strength at the soil-geotextile interface. The tests were conducted with soils compacted at 95% of the maximum dry density on the wet side of the optimum moisture content. Telltales were used to measure relative displacements and strain distributions along the length of the geotextile. Earth-pressure cells and suction sensors were installed close to the geotextile. Tests were only conducted along the cross-direction parallel to the direction of wicking. This paper presents the results of the testing program.

About the presenter:
Samuel Kaluzny is currently an M.Sc. student at the University of Manitoba. His Bachelor of Science degree in Civil Engineering was completed at University of Manitoba with great interest in Geotechnical Engineering. He has worked during the summer of his undergraduate years at AMEC/AMEC Foster Wheeler as a Materials/Junior Geotechnical Technician. In his final undergraduate year, Mr. Kaluzny completed an undergraduate thesis and has been awarded the 2016 CGS National Undergraduate Report Award (Individual Submission) as well as the 2016 Canadian Geotechnical Society Manitoba Section travel award for the upcoming GeoVancouver Conference and will be presenting the paper “Tensile and Pullout Properties of Geotextiles with and Without Wicking Function”.

Date: Wednesday, September 28, 2016
Time: Lunch at 12:00 PM, Presentation at 12:20 PM
Location: Holiday Inn South, 1330 Pembina Highway
RSVP: 12:00 PM, Friday, September 23, 2016

To attend, please supply names to:
Earl Marvin B. De Guzman, M.Sc., E.I.T.
University of Manitoba
P: 204-474-8072 E: cgs.manitoba@gmail.com

Cost (cash or cheque):
Members: $ 20
Non Members: $ 25
Students: $ 15

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