

PROJECT PROFILE



Title	Long term geotechnical monitoring and deterioration modelling of earthwork slopes
Contractor	University College Dublin / ARUP Consulting Engineers
Contractor details	c/o Mike Long, UCD School of Civil Engineering, Newstead Building, Belfield, Dublin 4, Ireland. Mike.Long@ucd.ie
TII mentor	Miles Friedman
Start date	November 2021
End date	May 2024
Status	Completed
Type of project	TII research project
Project reference	TII 268 Lot 4
Objectives	<p>Many international highways agencies, including Transport Infrastructure Ireland (TII), face significant challenges with respect to long term maintenance of highway networks. The long-term effects of weather and changing climate are one important factor in this regard. Specifically, TII clearly recognise the need to understand the long-term behaviour of geotechnical assets and they need to be able to predict this to inform long term planning of the National Road network.</p> <p>In this project it was intended to identify, investigate and remotely monitor the geotechnical behaviour of both a cut and an embankment slope on the National Road network as well as monitoring the associated drainage, vegetation and climate conditions on these two slopes over an extended period. The plan was for the work to feed into the subsequent development of models to predict future deterioration. The data recovered will be used to calibrate these models. Ultimately it is intended that the deterioration model will be applicable to all geotechnical assets across the National Road network.</p>
Description	<p>The project began with a detailed site selection process which used an agreed set of criteria to identify a cut slope and an embankment which would form the basis of the research. Finally two sites on the N2 road just to the west and north of Castleblaney were identified as being the best options.</p>



Figure 1. Chosen embankment site on N2 at Monaghan GAA, Centre of Excellence, Cloghan, Co. Monaghan



Figure 2. Chosen cutting site on N2 at Tullyvin, Co. Monaghan

A detailed literature review of geotechnical asset deterioration modelling (GADM) was carried out. International literature was widely referred to. A focus was placed on the three similar UK projects Achilles, iSMART and Bionics. The work done as part of this project has been published in the Journal Structures and

	<p>Infrastructure Engineering by Marin and Long (2024a). A model most appropriate to Irish glacial till and Irish conditions was identified. A detailed review was made of the geotechnical characteristics of Irish glacial till and the mechanisms impacting long-term slope stability.</p> <p>Some the preliminary 2D and 3D slope stability analyses were then performed using the N2 site as a case history. The work involved a novel use a probabilistic framework and has been published in the Journal GEORISK by Marin and Long (2024b).</p> <p>Use was made of the original ground investigation for the N2 project (from 2001/2002) as well as other publicly available information (e.g. from Geological Survey Ireland website) to make a detailed assessment of three chosen cutting sites along the N2.</p> <p>A study of the ground stability in the area using publicly available InSAR data was also carried out.</p> <p>A detailed design was made for a ground investigation, instrumentation, a monitoring system together with supporting laboratory and field tests. A set of contract documents was produced. Tenders were sought. However due to financial constraints the physical work on site has yet to commence.</p>
Benefits	<p>This project has made a significant contribution in satisfying the overall TII ambitions and objectives as described above. Research sites have been selected after a thorough search. A detailed literature review has been performed and a suitable model for Irish conditions identified. Preliminary numerical modelling has been carried out using a novel approach. Available data on Irish glacial tills has been summarised. Conditions at the proposed research cutting sites have been detailed using exiting information. An InSAR / satellite data study of the area has been performed. A comprehensive set of contract documents which incorporate the design of an instrumentation and monitoring system have been produced and are ready for use. Two papers in peer review journal have been published and a detailed final report for the project has been written.</p>
Outputs	<p>Marin, R.J. and Long, M. (2024a). "Deterioration models for geotechnical slopes: A systematic review on the long-term behaviour of earthwork assets". Structure and Infrastructure Engineering, Taylor and Francis Group. Published online May 2024. https://doi.org/10.1080/15732479.2024.2344662.</p> <p>Marin, R.J. and Long, M. (2024b). "2D and 3D numerical modelling for preliminary assessment of long-term deterioration in Irish glacial till geotechnical slopes". Georisk: Assessment and Management of Risk for Engineered Systems and Geohazards, first published online July 2024, https://doi.org/10.1080/17499518.2024.2379946</p>

	Final project report by UCD and ARUP. "TII268 Lot 4: Long term geotechnical monitoring and deterioration modelling of earthwork slopes". Report Ref. 2024/Geo1, May 2024
--	--