TSLOPE

THE 1979 ABBOTSFORD LANDSLIDE, DUNEDIN, NEW ZEALAND

An instructive example of how TSLOPE can carry out 2D and 3D stability analyses using a geotechnical model constructed in Leapfrog®.

Background

The Third Australia - New Zealand Conference on Geomechanics was held in Wellington in May 1980. This was soon after the Abbotsford landslide of 8 August 1979, and because of the widespread interest at the time it was the subject of an informal presentation at the conference by Graham Hancox (Geological Survey) and Graham Ramsay (Ministry of Works).

A Commission of Inquiry was set up by government to look into all aspects of the event. Their report dated 1980 made a number of recommendations including the need for professional recognition of geologists in matters of land stability. In 2014 (34 years later) IPENZ established a Competence Register of Professional Engineering Geologists (PEngGeol).

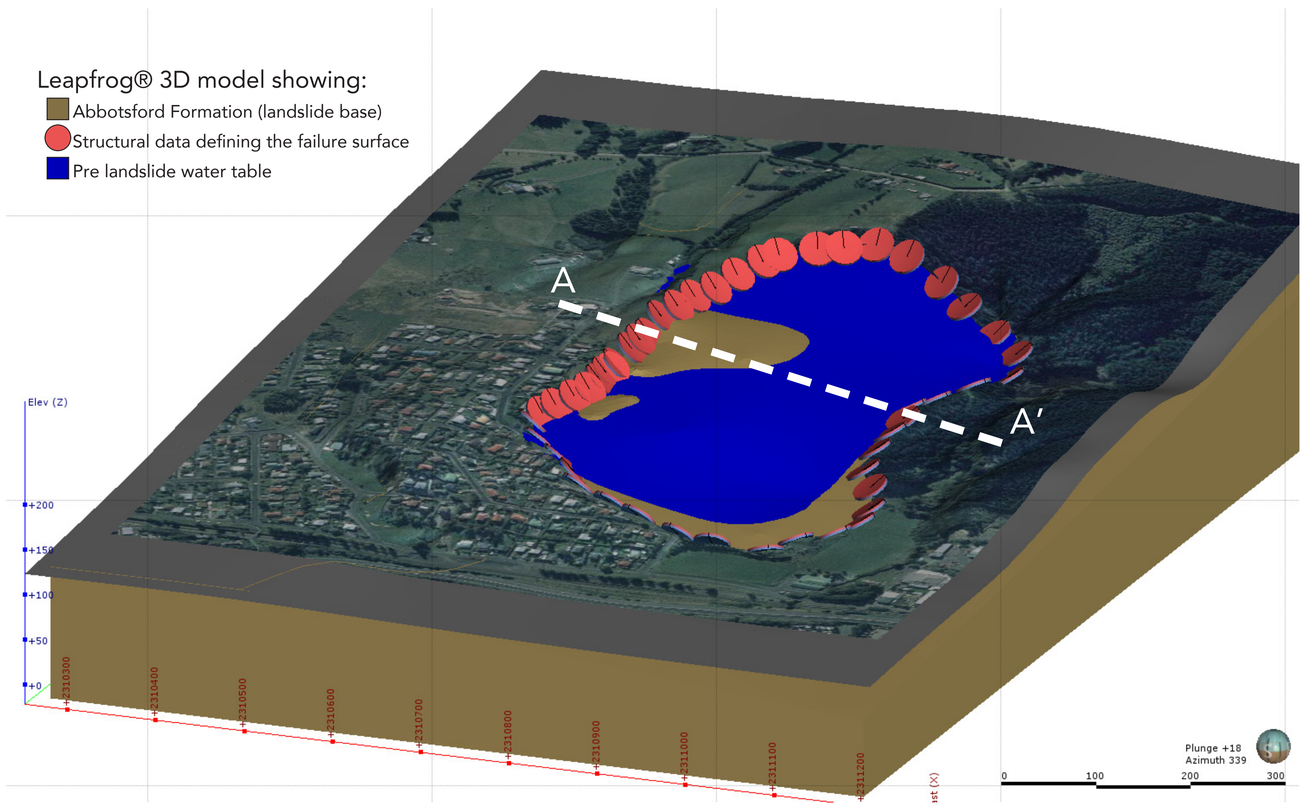
More than 200 people were displaced by the landslide, and 69 houses were either destroyed or relocated. The careful monitoring that took place prior to failure enabled evacuation of all residents, and no one was injured.

The Commission of Inquiry was provided with a number of expert reports and evidence. In 2008 Graham Hancox completed a very good case history summary of the geotechnical aspects of the landslide and its causes. (reference: Hancox, G.T. 2008 The 1979 Abbotsford Landslide, Dunedin, New Zealand: a retrospective look at its nature and causes. *Landslide 5*: 177 - 188)

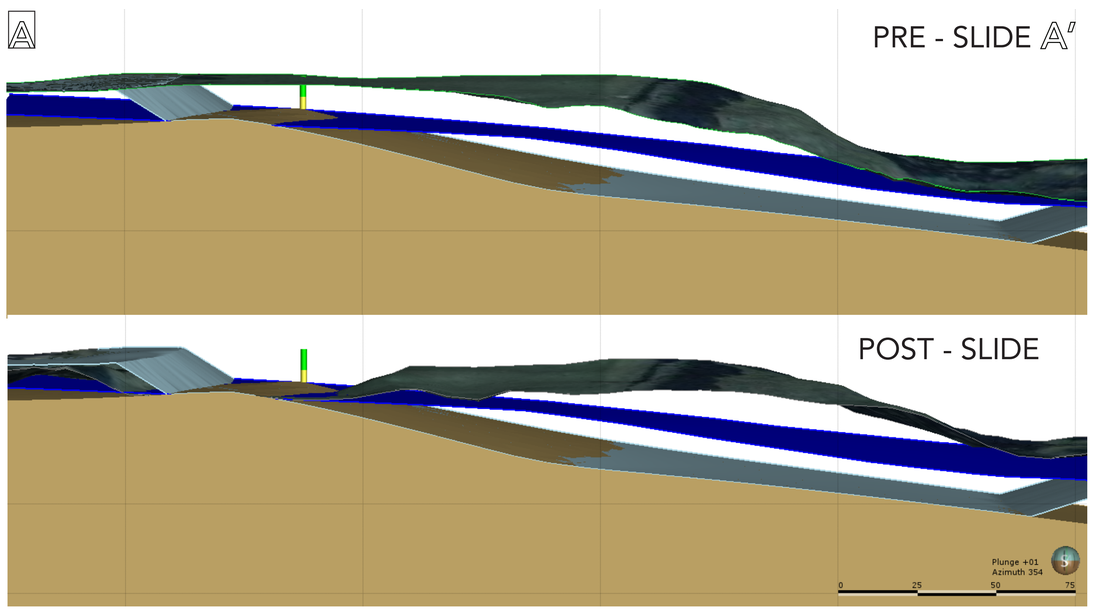
Landslide setting

The landslide failure surface was a weak clay layer at the interface of Tertiary age Abbotsford Formation (a weak relatively dense, green-gray mudstone, with sand lenses and thin montmorillonitic clay layers) and overlying Green Island Sand (a weak, noncohesive, pale yellow-brown clayey to silty sand). The failure surface followed bedding dip, about 7 degrees.

An old sand quarry at the toe of the slope and a leaking water main above the slide area were found to be man-made factors that contributed to the failure. It was concluded that a long-term rise in groundwater levels because of the increased rainfall over the previous decade and leakage from the water main controlled the timing of the failure, and in this sense, are considered to have triggered the landslide.



Building a model in Leapfrog®

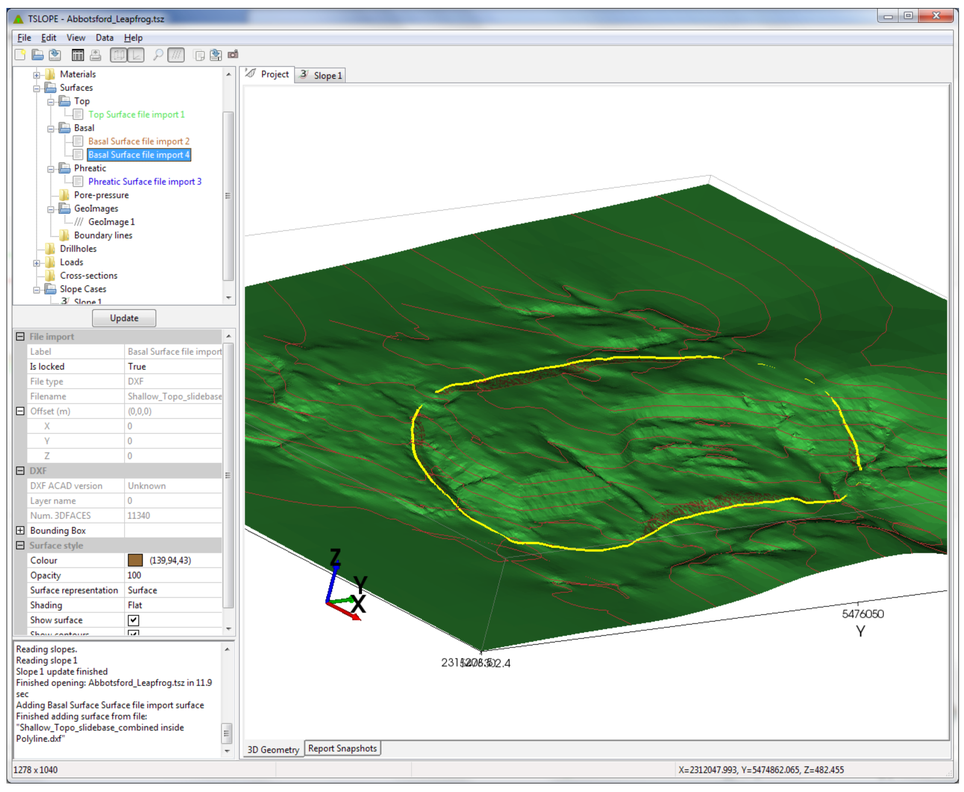


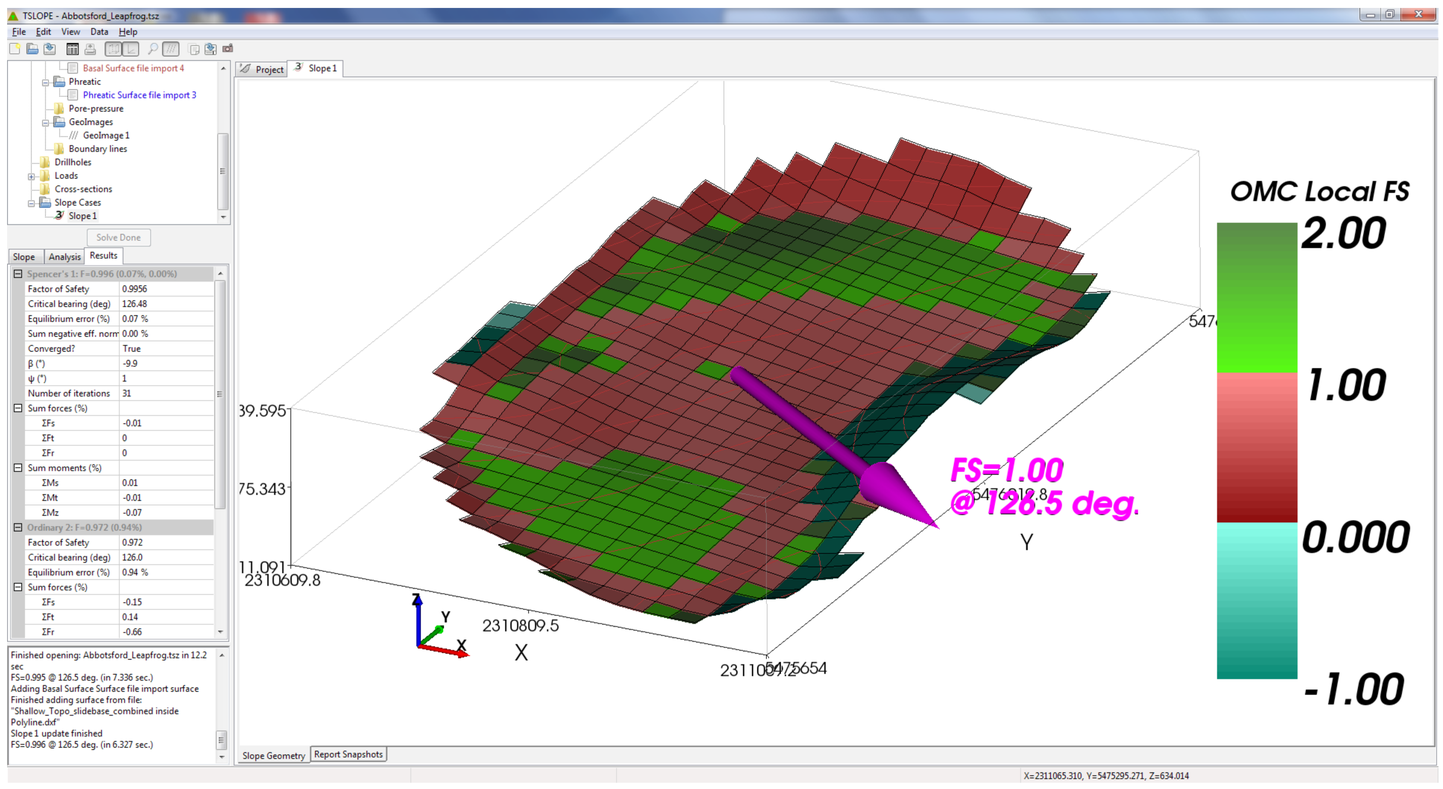
The model within Leapfrog® shown in 3D view, and in sections.

TAGAsoft have worked with Graham Hancox to assemble the data that were used to build a Leapfrog® model of the landslide area. These included geological maps, drill hole logs, topographic maps at different times, groundwater data, and geotechnical laboratory testing data.

Calculating 3D slope stability in TSLOPE

The modelled topographic, failure, and piezometric surfaces were exported to TSLOPE in dxf format. These are the key surfaces to define the geometry of the slope analysis problem. Appropriate strengths were assigned to the failure surface, and 2D analyses carried out to replicate analyses carried out for the Commission of Inquiry. However there was one analysis that has only been able to be carried out recently; that is a 3D analysis from TSLOPE.





Geotechnical software for a 3D world

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