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The Geological, Geomorphological and Geotechnical Setting of the Zungwini Rail Tunnel in Northern Kwa Zulu-Natal, Republic of South Africa

“Mistakes Made - An Accident Waiting to Happen”

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In March 1987, a twenty meter section of the crown and upper western sidewall of the Zungwini Twin Rail Tunnel in Northern KwaZulu-Natal, collapsed catastrophically. The collapse was transmitted to surface, producing two elliptical sinkholes along the tunnel's center line, the damage extending over a distance along the tunnel center line of more than 80m at surface.

This event can be considered as the culmination of a series of geological, geomorphological and man-made processes, spanning a period of 250My, from the Upper Permian to Present. The surface expression of a significant geological “anomaly” in the hillside overlying the tunnel center line was evident, but was not recognised at the time of design.

This paper focuses on the Manzana River Valley in the northern KwaZulu-Natal Province of South Africa and seeks to develop a model which may be used to guide engineering geological investigations and development planning in the region. It is based on an intensely challenging investigation of an important civil engineering failure, which nearly cost the author his life.

The factors leading to the near catastrophe at Zungwini need to be brought to the attention of the geotechnical community. In addition, the need for careful, integrated, holistic investigations, with due emphasis on Quaternary to Holocene geological processes and stratigraphy, is vitally important. The future safety of housing, infrastructural and mining developments within the entire eastern, hinterland of South Africa, will from time to time, depend on the early recognition of buried post Miocene sediments.

The unique skills of the geologist to recognise and understand the “big” picture must be utilized to its full capacity in the investigations for these features. The recognition of the various types of Plio-Pleistocene debris, colluvial and alluvial deposits could save many millions of Rands. At best, the early discovery of buried channel bodies or their remnants may save lives in addition to the savings in construction costs due to the reduction in errors. It is both a duty and professional responsibility for engineering and environmental geologists to conduct adequately comprehensive investigations.

