

Proceedings of the conference on  
**SOFT GROUND ENGINEERING**

organised by the Geotechnical Society of Ireland

at The Heritage Hotel  
Portlaoise, Co. Laois, Ireland.

15th & 16th February 2007



Editors  
Dr. Mike Long (UCD)  
Dr. Paul Jennings (AGEC Ltd)  
Mr. Peter Rutty (AGEC Ltd)

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ISBN: 1 898 012 83 0

Published by:  
Engineers Ireland  
22 Clyde Road, Ballsbridge, Dublin 4, Ireland  
[www.engineersireland.ie](http://www.engineersireland.ie)

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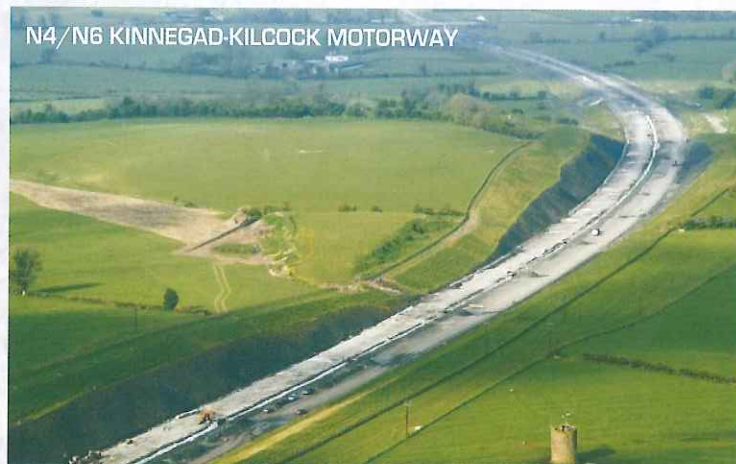
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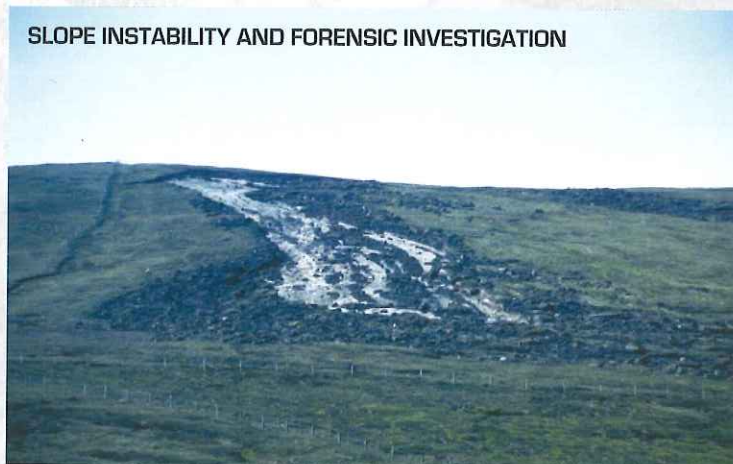


## Applied Ground Engineering Consultants

AGEC provide specialist geotechnical engineering and engineering geology advice to local authorities, contractors and consultants.



AGEC designed and supervised construction of earthworks for Ireland's first PPP road scheme, the N4/N6 Kinnegad to Kilcock motorway. The new road includes some 36 kilometres of new dual carriageway with excavations in rock and glacial soils, and construction over peat and other soft soils.



AGEC have been involved in many slope instability and forensic landslide investigations (for example: Derrybrien and North Mayo Landslides) as part of site development or accessing geotechnical hazards.

We have been involved particularly with infrastructure projects forming part of the National Development Plan.

We also work on other infrastructure projects, private commercial and residential developments especially as these move on to sites with more complex ground conditions.

### Services Provided

- Management of Ground Investigations
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- Design of Retaining Structures
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- Specialist Technical Advice
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### Some Recent Projects Undertaken

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- N25 Waterford Bypass PPP Scheme

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- Group Water Schemes throughout Ireland
- Limerick Main Drainage

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- Lough Ree Power Station
- Huntstown Power Station

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- Derrybrien Windfarm Project
- Janssen Pharmaceutical
- Retail Developments throughout Ireland
- Adamstown Development, Co. Dublin.
- Farr Wind Farm, Scotland.
- Paul's Hill Wind Farm, Scotland.

### AGEC

Singletons Lane, Bagenalstown, Carlow, Ireland.

Tel: +353 59 9723800 Fax: +353 59 9723793

Email: [info@agec.ie](mailto:info@agec.ie)

Web: [www.agec.ie](http://www.agec.ie)



## Preface

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### Introduction

Constructing on soft ground presents many challenges, not least site investigation, laboratory testing, geotechnical interpretation, design and construction. In recent years, reported examples of failure and excessive outturn costs bear out the need to better understand the engineering behaviour of soft ground. So-called 'marginal land' is increasingly used, and often acquired at apparently low cost, both for infrastructure projects, and for private commercial or residential developments. However, the consequences of ignoring or underestimating the value of geotechnical input, even in the due diligence assessment of the 'marginal land', can be significant for the developer. Thereafter the value placed on the proper acquisition and interpretation of geotechnical data is too often inversely proportionate to the manifested – at least to the experienced professional – construction risks. Greater use of soft ground is also driving technological advances: in geotechnical understanding, in design methods, and more significantly in the technologies, materials and plant employed.

Against this background, and recognising the prevalence of soft ground conditions in Ireland, it was considered timely to convene this conference and to publish proceedings that describe current research and other developments of soft ground engineering.

### The Papers

The papers have been grouped into four categories; ground investigation (Session 1a) geotechnical interpretation and design (Session 1b), soft ground design and construction solutions (Session 2a & 2b) and case histories (Session 3a & 3b).

The two keynote speakers will make presentations on technical sustainability of construction and on a recent failure of a deep excavation in soft ground.

Session 1a papers address the use of cone penetration testing and alternative techniques, the investigation of soft mud tailings and geophysics using shear wave velocity from soft ground in Ireland.

Session 1b papers address settlement predictions on peat, design of piles in soft clay and characterization of soft alluvium. In addition a commercial perspective is presented on site investigation data and construction contracts.

Session 2a papers cover ground improvement solutions for motorway widening and new highway embankments, ground improvement using vibro stone columns and the design of piled embankments. Session 2b papers cover the re-engineering of ground to support structural loads, dry soil mixing to increase strength and the stability of peat dams and embankments.

Sessions 3a and 3b describe a series of case histories with papers on predicted and observed performance of embankments, geotextile encased columns, the design and construction of the Limavady Bypass embankment, the sampling, in situ testing and settlement of embankments at the Loughmore Link, use of geosynthetics in ground subsidence risk mitigation and finally mass stabilisation of peat, clay and sediments at Vuosaari in Finland.

## Acknowledgements

The quality of the papers in the proceedings is a direct reflection of the time and effort spent by the authors. Special mention is made of the keynote speakers and to all those who travelled great distances to present at the conference.

The sterling work of the editors and the support of Engineers Ireland and the Geotechnical Society of Ireland are also acknowledged.

Finally the financial support of our sponsors is gratefully acknowledged.

Turlough Johnston  
Peter Ruddy  
c/o Applied Ground Engineering Consultants (AGEC) Ltd  
The Grainstore  
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Ireland

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- 1.2** The investigation of soft mud tailings – an overview of the challenges, results and comparison with natural soft deposits. W. Orsmond (RPS Consulting)
- 1.3** The application of shear wave velocity to soft ground site investigation in Ireland. S. Donohue (UCD), M. Long (UCD) & P. O'Connor (Apex Geoservices)
- 1.4** Simple and sophisticated methods for predicting settlement of embankments constructed on peat. C. O'Loughlin (BMA GeoServices Ltd)
- 1.5** Design of piles in soft clay. K. Gavin (UCD), D. Gallagher (UCD) & B. McCabe (NUI Galway)
- 1.6** Site investigation and characterization of soft alluvium for Limerick Southern Ring Road – Phase II. F. Buggy (Roughan & O'Donovan) & M. Peters (Faber-Maunsell)
- 1.7** Site investigation information and construction contracts: a commercial perspective. M. Wearen (Bruce Shaw Partnership)
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- 2.6** Geotechnical stability of peat dams and embankments. G. P. McInerney, B.C. O'Kelly & P.M. Johnston (all TCD)



**Keynote 2** Deep Excavations in Soft Ground with particular reference to the Nicoll Highway collapse in Singapore. Richard Davies (Benaim Associates). Presentation only.

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**3.2** Geotextile encased columns – theory and a recent case study. D. Alexiew (Huesker Synthetic GmbH), G.J. Horgan (Huesker Ltd) & G. Brokemper (Huesker Synthetic GmbH)

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**3.4** Sampling , in situ testing and long term settlement of soft soils at the Loughmore Link embankment. M.Long (UCD), G. Gudjonsson (Almenna Consulting, formerly UCD) & F. Callanan (Geotechnology Inc., formerly Arup Consulting)

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**3.6** Mass stabilisation of peat, clays and sediments - Case Vuosaari. J. Havukainen, M. Leppänen & A. Piispanen, (Ramboll Finland Oy)