

International Conference on Ground Anchorages and Anchored Structures in Service 2007

26th and 27th November 2007 Venue: Institution of Civil Engineers, London, UK

Who should attend?

- Civil engineering consultants
- Structural engineering consultants
- Specialist geotechnical contractors
- Senior Environment Agency engineers
- Senior engineers in water authorities
- Dam owners
- Network Rail engineers
- Specialists in corrosion and corrosion monitoring
- Academics in the fields of geotechnical engineering
- Academics in the fields of non-destructive testing

Why should you attend?

- Hear the very latest information on ground anchorages and anchored structures in service
- Benefit from the knowledge and experiences of key international speakers
- Network with colleagues in the industry and gain knowledge and contacts for the future
- Gain valuable CPD points and advance your career



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International Conference on Ground Anchorages and Anchored Structures in Service 2007

This two-day conference will provide guidelines on good practice in maintenance testing and service behaviour monitoring of individual ground anchorages and anchored structures. It will seek to illustrate the performance of anchorages in practice via case histories, together with recent developments in non-destructive testing and corrosion protection.

Millions of ground anchorages have been installed over the past 80 years with relatively few recorded failures. However, as permanent anchorages in service become older, the subject is of growing importance, particularly for anchorages installed over 30 years ago: many of which have been designed with corrosion protection considered inadequate by today's standards.

Water levels reached 150-year highs in 2002 with associated flooding across Central and Eastern Europe, so the importance of anchored river and seawalls cannot be overemphasised. Winter storms are now judged by the insurance industry to represent the largest potential event loss in Europe. Elsewhere in the world, the highest potential losses are associated with earthquakes and typhoons, where anchored slopes are vital in resisting landslides and rock avalanches.

Routine programmes of inspection and monitoring can extend the service life of the anchored structures that represent key elements of a country's infrastructure. Where inspection highlights unacceptable tendon corrosion or over-stressing, the results provide early warning of the need for precautionary or remedial measures, in order to safeguard the integrity of the anchored structure.

In spite of these benefits, sufficient attention is not currently paid to routine maintenance inspections and service behaviour monitoring. The potential consequences should not be ignored.

Papers for this conference will cover a wide range of topics including:

- Inspection procedures and physical condition recorded in service
- Service behaviour monitoring procedures and performance in service
- Dam rehabilitation
- Rock bolts in tunnels and mines
- Non-destructive integrity testing
- Corrosion monitoring and corrosion protection systems
- Case histories of satisfactory performance, shortcomings and failures in service
- Recommendations and standards of practice related to inspection and monitoring

Organising committee:

Professor Stuart Littlejohn
University of Bradford (Chairman)

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British Geotechnical Association

John Graham
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Roger Margerison
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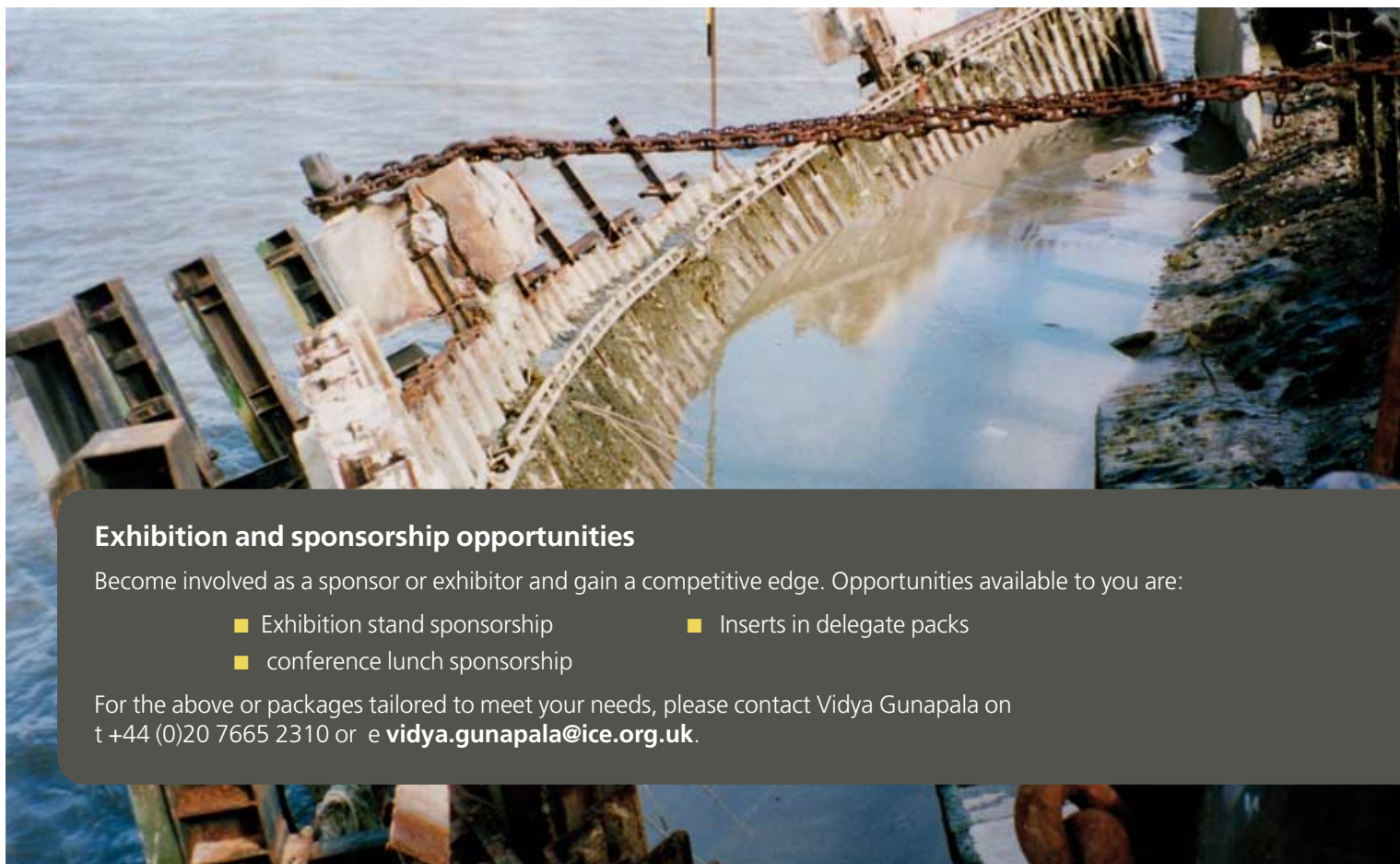
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Programme (subject to amendment)

Monday 26th November 2007

08:30 Registration

09:20 Opening remarks by the Chairman

Professor Stuart Littlejohn, University of Bradford

Session One: Inspection procedures and physical condition recorded in service

09:30 A case study of inspection, integrity investigation and repair of anchors used to stabilise slopes around dam lake

Minoru Okuno and Takahiro Takemata, Japan Anchor Association, Japan

Inspection of anchorages supporting waterside structures

Devon Mothersille, Geoserve Global Ltd and Tony Barley, Single Bore Multiple Anchor Ltd, UK

The instrumentation and performance of grout injection bored hollow thread bar anchors

Horst Aschenbroich, Con-Tech Systems Ltd, Canada and Ernst Ischebeck, Ischebeck-Titan, Germany

Inspection, integrity investigation and repair of 30-year old anchors

Yukio Fuseya and Hiroyuki Takeda, Nittoc Co. Ltd, Japan

Performance and condition assessment of 30 year old anchorages, River Clyde, Glasgow

Devon Mothersille, Geoserve Global Ltd, Stuart Jackman, Ritchies, and Jim Ferrier, Glasgow City Council, UK

Some examples of the poor application of electrically isolated prestressed ground anchors in Slovenia

Iztok Klemenc and Viljem Kuhar, Slovenian National Building and Civil Engineering Institute, Slovenia

Maintenance control of ground anchors constructed in Japanese Expressways

Masahiro Yoshimura, Masaru Takemoto and Kiyoyuki Amano, NEXCO Expressway Research Institute, Japan

10:40 Questions and discussion

11:00 Morning tea and networking

Session Two: Service behaviour monitoring procedures and performance in service

11:30 Long term monitoring and routine maintenance of ground anchorages at Devonport Royal Dockyard, Plymouth UK

Michael Whitworth, Devonport Royal Dockyard Ltd and Steve Parrish, Jacobs, UK

A review of the performance of permanent ground anchors installed as part of the Thames Barrier project

Mike Turner, Applied Geotechnical Engineering Ltd and David Richards, Ken Rush Associates, UK

25 years monitoring of rock anchors installed for landslide stabilisation at Nantgarw, South Wales

Hugo Wood and Peter Martin, High-Point Rendel, UK

Investigation of ground anchors in Japanese Expressways

Katsumi Okubo, Masaru Takemoto, NEXCO Expressway Research Institute and Hiroshi Yamada, Nittoc Construction Co. Ltd, Japan

Monitoring of multi-strand ground anchors at the City of Manchester stadium

Lee Jordan, Arup Ltd, UK

Repeated lift-off testing of single bore multiple anchors for dam retaining wall over a five year period

Mary Ellen Bruce, geotechnica, s.a and Jesús Gómez, Schnabel Engineering, USA

12:30 Questions and discussion

12:50 Lunch and networking

Session Three: North American Dam rehabilitation

13:50 Rock anchors for North American dams: conclusions from the national research program

Donald Bruce, Geosystems, L.P. and John Wolfhope, Freese and Nichols, Inc, USA

Post-tensioned rehabilitation applied to hydropower dams: continuously improving on an anchor program

John Wolfhope, Freese and Nichols, Inc. Donald Bruce, Geosystems, L.P, Gregor Forbes, Lower Colorado River Authority and Leslie Boyd, Freese & Nichols Inc, USA

Case histories of high capacity anchors for dams in Canada

Horst Aschenbroich, Con-Tech Systems Ltd, Canada

The stabilization of Gilboa Dam, New York using high capacity rock anchors: addressing service performance issues

Donald Bruce, Geosystems, L.P. Robert Kline and Kessi Zicko, Gannett Fleming Inc, USA

The performance of Pacoima Dam in two major earthquakes, with and without post-tensioned anchors

Mark Schultz, Shawn Jones and Jeff Howard, California Department of Water Resources, USA

14:40 Questions and discussion

15:00 Afternoon tea and networking

Session Four: Rock bolts in tunnels and mines

15:30 A review of glass fibre reinforced polymer (GFRP) for rock bolting in tunnels

Alison Littlejohn, Ramboll Whitbybird, UK

Design and construction of large rock caverns supported by ground anchorages

Kenjii Aoki, Kyoto University, Japan

Monitoring and testing of mine anchor systems: cases studies and applications to the civil industry

Peter Altounyan, David Bigby and Lorraine Kent, Rock Mechanics Technology, UK

16:00 Question and discussion

Session Five: Non-destructive integrity testing

- 16:10 **Common anchorage issues addressed by numerical modelling**
 Ana Ivanovic, Richard Neilson, Andrew Starkey and Albert Rodger, University of Aberdeen, UK
- Non-destructive testing of mine anchorages**
 Andrew Starkey, Richard Neilson, Ana Ivanovic and Albert Rodger, University of Aberdeen, UK
- Ultrasonic technique for rock bolt and rock mass bond quality control**
 Takayuki Mori, Makoto Nakajima, Kajima Corporation and Tohru Tsutsui, Tsutsui Denshi Co. Ltd, Japan
- The development of the method of detecting the anchor tensile force to impact elastic wave**
 Kuniyasu Tanaka, Shikoku Electric Power Co. Inc, Hidenobu Okada, Ikata Civil & Architectural Engineering JV and Masayasu Izakura, Shikoku Electric Power Co. Inc, Japan
- Development of loading apparatus and test procedure of rapid load test for ground anchors**
 Tatsuro Sueyoshi, Raito Kogyo Co. Ltd. and Kazuo Tani, Yokohama National University, Japan
- 17:10 **Question and discussion**
- 17:30 **Close of day one**
- 20.00 **Conference dinner**

Tuesday 27th November 2007

- 08:45 **Registration**
- 09:15 **Opening remarks by the chairman**
 Professor Stuart Littlejohn, University of Bradford

Session Six: Corrosion monitoring and corrosion protection systems

- 09:20 **Durability of buried and encased ground anchorages and structural components – requirements for corrosivity assessment and protection to ensure service life**
 Gareth John, CAPCIS Ltd. and Stuart Littlejohn, University of Bradford, UK
- Application of linear polarisation resistance measurements and system modelling to corrosion assessment of high capacity rock anchorages**
 Gareth John and Petra Ernst, CAPCIS Ltd, UK
- Corrosion protection options for permanent ground anchorages**
 Chris Irvin, Dywidag-Systems International and Devon Mothersille, Geoserve Global Ltd, UK
- Replenishment of underhead protection**
 Kouichi Suga, Akira Yonemura and Yoshio Iwaida, Japan Anchor Association, Japan
- Durability of ground anchors in concrete reinforcement steel quality subject to new European regulations**
 Dieter Jungwirth, Technische Universität München and Susanne Adler, Stahlwerk Annahutte Max Aicher GmbH & Co. KG, Germany
- A case study of corrosion protection effect of using field-mixed resin as tie-back anchors' grout material for retaining wall and its inspection method**
 Chihping Kuo and Hung-Jiun Liao, National Taiwan University of Science and Technology, Taiwan
- 10:30 **Questions and discussion**
- 10:50 **Morning tea and networking**
- 11:20 **Durability of carbon fibre reinforced polymer (CFRP) strand for use in high capacity ground anchors**
 Matthew Sentry, Abdelmalek Bouazza, Riadh Al-Mahaidi, Monash University, Darren Loidl, Chris Bluff and Len Carrigan, Geotech Pty Ltd, Australia
- Carbon fibre reinforced polymer (CFRP) strand – grout adhesion for applications in high capacity ground anchors**
 Matthew Sentry, Abdelmalek Bouazza, Riadh Al-Mahaidi, Monash University, Darren Loidl, Chris Bluff and Len Carrigan, Geotech Pty Ltd, Australia



Programme (subject to amendment)

Advancements in ground anchors: carbon fibre reinforced polymer (CFRP) strands

Matthew Sentry, Abdelmalek Bouazza, Riadh Al-Mahaidi, Monash University, Darren Loidl, Chris Bluff and Len Carrigan, Geotech Pty Ltd, Australia

Ground anchor tendons of carbon fibre

John Hartley, Fibreforce Composites Ltd, UK

Ground anchor made of new materials applicable for highly corrosive environments

Tsuyoshi Enomoto, Tokyo Rope Mfg. Co. Ltd, Toshio Sugisaki, Sekisui Chemical Co. Ltd, Kouichi Suga, Nittoc Construction Co. Ltd. and Tatsuro Sueyoshi, Raito Kogyo Co. Ltd, Japan

New developments of low relaxation epoxy coated strand

Tiger Kido, Takayuki Yamagiwa, Toshihiko Niki and Yoshihiko Touda, Sumitomo (SEI) Steel Wire Corporation, Japan

12:20 Questions and discussion

12:40 Lunch and networking

Session Seven: Case histories of satisfactory performance, shortcomings and failures in service

13:40 **Performance of cement grout cover as sole corrosion protection of permanent tensioned steel tendons**

Stuart Littlejohn, University of Bradford, UK

The failure of an anchorage at Devonport Royal Dockyard, Plymouth; lessons learnt

Michael Whitworth, Devonport Royal Dockyard Ltd. and Steve Parrish, Jacobs, UK

Engineering shortcomings in anchor performance – The importance of high quality ground investigation for the design of anchors in stiff clays to weak mudstones

Tony Barley, Single Bore Multiple Anchor Ltd. and John Judge, Corus Engineering, UK

Performance of multiple anchors in difficult ground conditions for both permanent and temporary removable usage

Tony Barley, Single Bore Multiple Anchor Ltd. and Mark Edwards, Keller Ground Engineering, UK

Investigation of the failure of permanent anchorages adjacent to a tidal surge barrier

Tony Barley, Single Bore Multiple Anchor Ltd, Devon Mothersille, Geoserve Global Ltd, UK and Peter Chamley, Arup & Partners, USA

Reliability-based failure probability and resistance factor of flush-drilled anchors in Taipei Basin

Hung-Jiun Liao, Jianye Ching and Chia-Wei Sue, National Taiwan University of Science and Technology, Taiwan

Arduous conditions: a review of ground anchor head design and performance requirements (and failures in service)

Mike Turner and Garry Cooper, Applied Geotechnical Engineering Ltd, UK

The performance of anchored slopes subjected to seismic loading

Jiro Takemura, Tokyo Institute of Technology, Hiroaki Kubo, Japan Anchor Association and Junichi Tamazaki, Sanshin Corporation, Japan

15:00 Questions and discussion

15:20 Morning tea and networking

15:50 **Rehabilitation of failing anchored retaining wall**

Thomas Richards and Daniel Thome, Nicholson Construction Company, USA

Predicted and observed performance of an anchored retaining wall in granite

Abid Adekunle, Douglas Madsen, Neil Margetson, Parsons Brinckerhoff Ltd, Ireland and Liam Quinn, Quinn Piling Ltd, UK

Freeport mine soil anchors in service

Paul McBarron and Philippe Vincent, Austress Menard, Australia

The design, installation and monitoring of high capacity antiflotation bar anchors to restrain deep basements in Dublin

Jim Martin, Byland Engineering Ltd, UK, Philip Daynes, Atkins China Ltd, Cathal McDonnell, Carew White Young Green, Ireland and Martin Pedley, Cementation Foundations Skanska Ltd, UK

16:50 Question and discussion

Session Eight : Recommendations and standards for inspection, monitoring and repair

17:00 **Engineering assessment of the grease-filled annulus of sheathed prestressing strand for use in permanent ground anchorages**

Tony Barley, Single Bore Multiple Anchor Ltd. and Devon Mothersille, Geoserve Global Ltd, UK

A new manual for ground anchor inspection, integrity investigation and remedial measures

Hiroaki Miyatake, Takeshi Oshita, Public Works Research Institute, Hiroaki Kubo and Mitsunari Takeyama, Japan Anchor Association, Japan

Structural integrity and durability of ground anchors – general programme of research in Japan

Junichi Yamazaki, Tatsuro Sueyoshi and Nobuyuki Urakawa, Japan Anchor Association, Japan

17:20 Question and discussion

17:30 Closing remarks by the chairman

Introducing our sponsors



Dywidag-Systems are specialist manufacturers and suppliers of geotechnical products for ground engineering applications. The company has specialised in the production of ground anchors for over 40 years and leads the market in the manufacture of permanent anchors with double corrosion protection (bar or strand), high capacity strand anchors for dams and large diameter bar anchors for uplift resistance.

The range of ground anchors includes: Temporary and Permanent Ground Anchors with Double Corrosion Protection in accordance with BS8081 and EN1537. Multi-Stage Ground Anchors for weak ground and Removable Ground Anchors for inner city locations. Other products include: Soil Nails, Self-Drilling Hollow Bars, Micro Piles, Driven Piles, Stressing and Testing Services.

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SBMA Ltd and their sister Company (GMG Europe) provide combined service to stabilise, and carry out Real Time Monitoring of slopes or geotechnical structures.



The Japan Anchor Association was established in 1970 for the purpose of improving and promoting technology relating to ground anchors and the conservation of land. In Japan, about 3,600 ground anchors are installed annually for landslide prevention, slope stabilization and reinforcement of structures. The total length of the anchors installed each year is approximately 2,500km. The JAA presently has 243 member companies.

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