

ANDREW FRANCIS SHIRLEY

Forensic, Civil & Geotechnical Engineer [Director]

QUALIFICATIONS & AFFILIATIONS

B.E.(Hons.) University of Sydney, 1963.

Fellow, Engineers Australia.

Member, Australian Geomechanics Society.

Immediate Past President, College of Investigative & Remedial Consulting Engineers.

Registered Specialist Professional Civil Engineer No. 477861.

Registered Professional Engineer [Queensland] No. 4904.

RTA accredited slope stability assessor.

AREAS OF EXPERTISE

Andrew Shirley has extensive experience in Civil, Geotechnical & Ground Engineering, has special expertise in soil / rock structure interaction and has considerable experience in the following fields:

Forensic Engineering & Insurance Investigations	Subdivisions & Landfill Remediation
Excavations, Retaining Walls & Basements	Mine Infrastructure & Mine Subsidence
Reinforced Soils, Ground Anchors & Rock Bolts	Earth & Rockfill Dams, Tunnels
Slope Stability, Landslides & Risk Assessment	Residential Buildings & Reactive Soils
Urban Planning and Coastal Hazard Management	Stormwater Harvesting & Subsoil Drainage

The first six years of Andrew's professional experience was gained on various construction projects in the NSW Snowy Mountains region and in Western Australia. On return to Sydney, Andrew joined a Sydney consulting firm and was responsible for the development and management of the firm's geotechnical section and materials testing laboratory.

Andrew established the practice of Shirley Consulting Engineers in 1974 [originally called Andrew Shirley & Associates Pty Limited] to provide an integrated source of advice in the Civil Engineering and Geological disciplines, together with design and construction services for ground structures.

Andrew developed, and was granted patents for an advanced form of soil nailing / excavation support [viz: Integrated Support System], as well as a method of treating harvested stormwater known as the StormSaver System. This research work enabled Andrew to gain a deep understanding of the way in which soil and rock materials react with [i.e. affect, or are affected by] man-made structures, and as such has considerable expertise in the structural design & construction of ground structures.

Whilst the firm initially focussed on slope stability issues & site investigations, in 1982 the engineering base was broadened to embrace the full design and construction review of civil and geotechnical engineering projects, including excavations, embankments, landslide stabilisation, tunnels, shafts, drainage works, etc. Since 2000, the firm has focussed on its forensic services, and is now well known for the high quality its investigations, reports and expert evidence associated with a variety of legal & insurance investigations.

Andrew often presents seminars / lectures on relevant topics to Technical / Professional groups, Engineers Australia and CIRCEA. In addition, Andrew has provided evidence for, and attended court to give expert evidence in a variety of court jurisdictions including the Supreme, District & Local Courts of NSW, the Coroner's Court of NSW, the Supreme Courts of Western Australia, Victoria & Queensland, and the Industrial Relations Court of NSW.

Some of the projects in which Andrew has played a major part, and / or was the principal engineer, are described in the following sections.



SELECTED EXPERIENCE BY EXPERTISE

1. Forensic Engineering Investigations

a) Commercial & Residential

Investigation, advice, reporting & expert evidence regarding:

1. Various damaged buildings [including a total building collapse], and excavation failures at Ambarvale, Bondi, Beecroft, Burwood Beach [near Newcastle], Drummoyne, Glebe, Cronulla, Manly, McMahons Point, Prospect, Sydney CBD, Tempe and Valentine for various insurance groups and the Workcover Authority of NSW.
2. Investigation and advice in relation to causes of residential building damage to properties in the Central Coast & Northern Beaches areas of NSW, Stanwell Park, Thirroul & Balgownie, Kiama & Narooma NSW.
3. Landsliding and associated drainage / retaining wall failures at a major shopping complex near Kenmore, Queensland.
4. The causes of failure of contiguous & secant pile and / or sheet pile walls in sand & clayey sands at various sites near and around Sydney NSW, including Alexandria, Bellevue Hill, Dee Why, Double Bay, Elizabeth Bay, Fairlight, Kingsford, Manly, Mascot, Mona Vale, Redfern, Rushcutters Bay, Woolloomooloo, and in Mooloolaba [Queensland].
5. The causes of failure of soldier pile & shotcrete / concrete pile shoring systems in clay, shale & sandstone at Castle Hill, Cremorne, Pennant Hills, Newtown & Wentworthville.
6. The cause of failure of a segmental concrete block wall within an industrial subdivision near Foster NSW, and a residential subdivision at Kellyville NSW.

b) Civil Engineering Structures

Investigation of the causes of failure / damage, advice & expert evidence in relation to:

- a) A large underground plastic detention tank system in Brisbane Qld [Rocla].
- b) A cattle saleyard facility in Roma, North-west Queensland.
- c) A 13 metre high Soil Nailed wall at Noosa Heads, Queensland.
- d) Reinforced earth walls [metal straps] associated with the parallel runway project at Sydney Airport, related investigations of the geotextile performance & strap corrosion, and subsequent advice on appropriate remedial works on behalf of the project insurers.
- e) Waste water treatment plants at Apollo Bay & Lorne [Victoria], and advice in relation to possible responsibility of the design / investigation engineers.
- f) Earth dams at Penrith, Leura & Kulnura, NSW and a large concrete crib wall in Gosford; landsliding associated with a reclamation project in Singapore Harbour.
- g) A sheet pile coffer dam associated with the Sydney Airport railway near Tempe NSW [Workcover Authority of NSW].
- h) The causes of excessive settlement and deformation in the reinforced soil walls and associated racetrack [Keystone system] for the NSW Harness Racing Club at Glebe NSW. Subsequent to the investigations, SCE provided expert advice, design and construction review of the necessary remedial measures.

Investigations into job-site construction safety, and provision of expert advice in regard to cliff stability and adequacy of construction & excavation support systems at South Sydney, Bathurst and at the Burrinjuck Dam, NSW [Workcover].

c) Mining

Investigation of the causes of embankment failures associated with major flooding events and open pit flooding / failures at Rolleston Coal and Isaac Plains mine near Moranbah Queensland [Xstrata, Vale & Aquila Resources].



Investigation of the cause of the failure of the Main Seawall at Koolan Island, Western Australia that resulted in the flooding and closure of the Koolan Island iron ore mine.

Investigation & remedial works designs for rectification of failing coal reclaim tunnels [due to poor drainage of stockpiles] at Mount Arthur Coal [BHP Billiton - Hunter Valley NSW], and Carborough Downs Qld [Vale Australia].

Investigation and advice on required remedial works for:

- a) A 26 m high reinforced earth wall failure at the Moura Mine site, Queensland [Anglo Coal].
- b) Partial mine heading collapse at the Ellalong Colliery [near Cessnock].
- c) Tailings Thickener Tank failures in Kalgoorlie & Kambalda in Western Australia and advice as to design / construction aspects of the project.

Investigation and advice on the probable cause of a flooding overflow and resultant environmental damage from acid leachate at the Lady Annie Mine in north-west Queensland.

2. Excavations, Retaining Walls & Basements

Ground Engineering studies, design & construction inspection of basements for major building projects in the Sydney / Newcastle area, including dewatering systems and ground support [both temporary & permanent], at Double Bay, Haymarket, Campsie, Spit Junction, Dee Why, Newtown, Wynyard, Chatswood, Gosford, Terrigal & Avoca.

Investigation of basement construction alternatives and design of major excavations involving diaphragm walling and 'top-down' construction for the Atrium Hotel Development in Double Bay & Bridgepoint project at Spit Junction.

Murray 2 Power Station excavation and associated horizontal drain installation in the Snowy Mountains area [a 150 metre deep cut in weathered granite].

Investigation, development and adaptation of overseas practice to the Australian market of:

- a) Revetment style segmental block retaining wall systems [viz: the Terraforce System] for Boral Masonry Pty Ltd.
- b) Timber Crib Wall design systems for Plantation Pine Building Centre.
- c) The Integrated Support System method of soil nailing and its application to the Sydney market.

These projects included the development of computer programs for analysis of the systems.

Investigation and advice as to the causes of dampness in basements at a number of suburbs in Sydney, including Collaroy, Lindfield, Mosman, Paddington, Newtown, Queenscliff & Tamarama.

3. Reinforced Soils, Ground Anchors & Rock Bolts

Theoretical and experimental studies on artificial ground support techniques for the 'Integrated Support System' [a development of soil nailing] which is now a patented system, in Australia & New Zealand.

Participation in the committee processes, and writing of the first draft of several sections of the Australian Standard on Earth Retaining Structures [AS 4678 – 2002].

Investigation of causes of urban freeway reinforced soil wall movements associated with clay soils and recommendations on remedial works at Parramatta [NSW] and North Laverton [Vic.].

Investigation, design & construction review of soil nail and ground anchorage systems [including the Integrated Support System], at Palm Beach, Newport, Newtown, Mosman, Spit Junction, St Leonards & West Gosford, NSW.

Investigation, development and adaptation of overseas practice to the Australian market of reinforced soil systems using geosynthetics in conjunction with Austress Freyssinet Pty Ltd.

Investigation of cliff stability & detailed design of slope stabilisation systems for the protection of residential / commercial properties, including rock fall netting and rock bolting at Bondi, Arncliffe, Bexley, Avalon, Palm Beach & Earlwood.



4. Slope Stability, Landslides & Risk Assessment

Extensive investigations & advice in regard to the cause(s) of the Thredbo landslide on behalf of the families of the victims, including evidence to the Coronial Inquiry [NSW Attorney General].

Investigation and design of remedial works for rail embankment subsidences & rail cut failures near Newee Creek, Otford, Stanwell Park, Coalcliff and Gosford, NSW for the NSW State Rail Authority.

Investigation and design of landslide remedial works for road failures at Bulli Pass and Newport in NSW [RTA], and the Capricorn Highway, Bogantungan Queensland.

Design & Project Management of landslide remedial works at Bowral, Umina, Bayview, Koolewong, Newport, Terrigal, Toowoomb Bay & Newcastle, NSW.

Risk assessments in relation to public safety, and site stability issues at Dawes Point [Sydney Harbour Foreshore Authority], Arncliffe, Bexley and a mine site access road near Bell NSW.

5. Urban Planning and Coastal Hazard Management

Coastal cliff hazard / planning studies at Copacabana, Avoca, Norah Head & Noraville using abseiling techniques for Gosford & Wyong Councils. Regional mapping & preparation of 1:4,000 scale coastal stability hazard assessment maps for the Central Coast Council coastline [the mapped area extended from Forresters Beach to Noraville].

Regional mapping & preparation of 1:25,000 scale land stability hazard assessment maps for the entire Central Coast Council area [area extended from Patonga to Forresters Beach and to Wiseman's Ferry]. Investigation and design of residential subdivisions near Campbelltown, Picton, Newport, Umina, Niagara Park and Lisarow.

Detailed mapping & assessment of the Cabbage Tree Harbour Area [near Norah Head] stability issues; the work also included the development, design and specification of coastal erosion control & drainage systems.

Terrain Evaluation & Geotechnical Investigations for urban subdivisions at Teralba, Speers Point, Camden, Campbelltown, Bateau Bay, Narara, Penrith, Kurrajong, Queanbeyan, Grafton, Wyoming and Minchinbury [Land Commission of NSW and private clients].

Investigation of possible impacts of sea level rise on residential areas of the Central Coast [Wyong Shire Council] and at Copacabana & North Avoca.

Investigation, design and construction review of a major Toe Drainage Structure / Revetment at Cabbage Tree Harbour to mitigate the effects of erosion & sea level rise.

6. Subdivisions & Landfill Remediation

Geotechnical advice & review of construction in relation to large residential subdivisions in the NSW Central Coast [Australia Avenue & Cowper Road, Umina, Brook Avenue, Bateau Bay and Church Street, Terrigal]. Geotechnical advice and construction inspections in relation to subdivisions at Lemon Tree Passage and Kooragang Island near Newcastle, NSW.

Investigation and advice regarding rehabilitation of former Service Station sites [oil waste] in the Sydney area and Bulli Pass, treatment of filled quarries [domestic & industrial waste] at Cronulla, Artarmon, Canterbury, St Peters, Mt Colah & Thornleigh. Advice in relation to use of filled sites for sportsfields & parks at Mt Colah, Thornleigh, St Peters & Merrylands.

Advice in relation to the rehabilitation of playing surface at the Parramatta Sports Stadium following rebuilding of the centre and failure of the playing surface.

Environmental impact studies for mines at Coalcliff and Marulan. Environmental auditing, from a geotechnical viewpoint, for sand / gravel mining operations at Castlereagh, Londonderry & Penrith. Design & construction review of a geomembrane to act as an environmental protection barrier under a new sulphuric acid complex in Kalgoorlie, Western Australia. Review of the effectiveness of the acid storage plant protective measures at Seven Hills, NSW.

Design assistance and construction review of 'reed bed' waste water treatment at Cecil Park, Spring Farm and Turlinjah [NSW south coast].



7. Mine Infrastructure & Mine Subsidence

Feasibility study, civil engineering design and construction review of coal stacker reclaimer at Coalcliff NSW [Illawarra Coal & Coke Company].

Development of excavation techniques and mining methods at the Nammuldi Iron Ore deposit in Western Australia; the first mining study [including the design of surface infrastructure] for the Vickery Coal Deposit near Gunnedah, NSW.

Economic investigation and engineering feasibility of new mine access haul road to the Hartley Valley Colliery near Lithgow NSW.

Investigation & design of an 8 m deep slag granulation pit and associated excavation support under an operating mining facility at Mt Isa Queensland.

Investigation of suitable methods for providing environmental membranes underneath rail loading facilities associated with a sulphuric acid plant, design of the membrane associated witness sump protection system and review of the construction itself [Simon Engineering].

Investigation of waste dump instability above a steep National Park Gorge [Bungonia Gorge], design of associated stabilisation works and specialised leachate filter system [constructed with the aid of a helicopter] and related stability of the open pit at Marulan, NSW (Limestone) [Southern Cement Ltd]. The project also included extensive collaborative work with the environmental consultant engaged on the project.

Investigation of likely causes of pit instability at Lawlers, Western Australia (Gold), and advice as to appropriate methods of pit monitoring to enable stabilisation works to be implemented in association with the mine access haul roads [Barrick Australia].

Review of all the methods of tailings disposal, consideration & advice on the implementation of modified methods of tailings disposal [alluvial tin] for the Pioneer Tin Mine, Pioneer, Tasmania.

Investigation of tailings dam stability and alternate / improved methods of mine waste tailings disposal [gravel quarries] at Londonderry and Castlereagh (NSW).

Investigation of cause of leakage and related site geotechnical & environmental issues from Tailings Thickener Tanks [gold & nickel] in Kalgoorlie & Kambalda in Western Australia; engineering advice as to design / construction aspects of the project and necessary remedial works.

Investigation of potential stability issues and design of necessary remedial works for a major waste disposal dump at Coalcliff NSW.

Note: This major study was necessary as a result of a previous major collapse of a waste disposal dam in the United Kingdom which caused the death of 38 children.

Investigation of alternate locations for coal waste mullock dumps in valleys associated with the Illawarra escarpment [near Wollongong NSW], assessment of the likely environmental impact of each of the dump sites selected, and design of the mullock dump facility itself [CRA Australia].

Investigation of the causes of a partial mine heading collapse at the Ellalong Underground Colliery [near Cessnock NSW], and advice as to appropriate strengthening / remedial measures and adjustments to mining operations to ensure ongoing safety.

Assessment of the effects of mine subsidence & related building damage at Chain Valley Bay and Morisset [on behalf of the NSW Mine Subsidence Board and resident groups].

Investigations into the stability of the rock materials surrounding the coal seams associated with the Bulli coal seam [near Wollongong NSW], and advice as to the likely impact of mining operations / mine subsidence on a major highway and water supply dams [Roads & Traffic Authority of NSW].



8. Earth & Rock Fill Dams, Tunnels

Investigation & design of earth dams for water supply to mining operations at Emmaville (15 m high - Base Minerals Limited), and Stanwell Park (10 m high - Illawarra Coal & Coke Company, and route selection for water supply pipelines. Project management of the construction of Stanwell Park Dam.

Design and preparation of plans and specifications for Malpas Dam, Armidale, NSW (a 35 m high earth / rockfill dam). Construction review of the Gungarlin Concrete Weir & Khancoban Dam [earth & rock fill] in the Snowy Mountains area.

Investigation of the use of Lime Treated Breccia for road pavements & the causes of poor performance; project included extensive laboratory / field trial programs to determine methods of improving base course performance [Pioneer Concrete].

Investigation and planning of re-alignment of Pearl Beach Road, Pearl Beach NSW. Planning, design & construction review of residential access road at Palm Beach NSW.

Construction planning and execution [as Project Engineer] of Stage 1 of the US Navy VLF Station at Exmouth, Western Australia, which included the central transmitter helix building, cable stayed steel antennae towers [up to 400 m high] and jacketed pier construction.

Investigation and design of small diameter, 'road header' excavated electricity supply cable tunnels for a number of locations in the Sydney region; the tunnels were typically 2.2 m in diameter with varying lengths of between 100 m and 300 m [Balfour Beatty Australia].

Investigation, design and construction review of 'road header' excavated sewer tunnels at Penrith & Erina NSW [NSW Public Works Department].

9. Residential Buildings & Reactive Soils

Investigation of the cause of damage and related advice on remedial works to residential buildings due to expansive [i.e. shrink / swell] clays in Moree, Wagga Wagga [22 homes], Pymble, Turramurra, Newtown, Dubbo and many other suburbs in the northern & western parts of Sydney.

Investigation of the cause of damage and related advice on remedial works to residential buildings due differential ground movement, dampness, brick growth and site fill issues in Castle Hill, Erskineville, Mosman, Turramurra, Pennant Hills, Tamworth & Moree NSW.

Expert advice regarding the Uretek method of underpinning, and effect of patent infringement by others who claimed knowledge of reactive [shrink / swell] soil behaviour.

The development of specialist hillside building systems for use in hillside areas, and areas subject to potential surficial soil instability, including concrete shear beams and flexible retaining systems.

The provision of geotechnical advice & reports associated with residential building works in the Gosford, Wyong, Pittwater, Warringah, Manly, Hornsby, Ku-Ring-Gai and Hills Council areas [over 1,000 reports were prepared].

10. Stormwater Harvesting & Subsoil Drainage

Since the mid-1980s, Andrew Shirley has had significant experience with the investigation and design of underground detention tanks systems using several types of 'plastic boxes' and large diameter drainage [viz: Plastream] pipes, including those manufactured by the Atlantis Corporation, Water Recycle Solutions & Rocla Pipeline Products.

In addition, Andrew Shirley developed and lodged applications for a patent in Australia & New Zealand for the StormSaver stormwater harvesting system in 2007 which utilises public parkland to store and treat the water under sportsfields & other public land.

Design of 'on-site' detention systems for stormwater control & on-site detentions systems in various Dual Occupancy developments in the Sydney region and at St. Kevin's College, Toorak Melbourne. Investigation, design and construction review of subsoil drainage systems to stabilise soil instability at many residential sites including Hardy's Bay, Terrigal, Koolewong & Killcare, NSW.

Feasibility studies for improvement of golf course drainage arrangements at Woollooware, Beacon Hill and a recreation reserve over a reservoir at Centennial Park.



LIST OF PUBLICATIONS

1. 'The Theoretical & Practical Aspects of Land Stability Classification'.
2nd Aust. - N Z Conference Geomechanics, Brisbane July 1975. Part reprinted in the Bulletin of the International Association of Engineering Geology (I.A.E.G.) No. 12 December 1975.
2. 'A Review of the Variety of Unstable Landforms in NSW and the Problems They Present'.
Symposium of the Water Research Foundation of Australia July 1976 - Published as Report No. 48.
3. 'Some Guidelines to Preferred Practice in Hillside Construction'.
Australian Geomechanics Journal - 1976 (with P J Burgess).
4. 'Techniques of Landslide Control Using Drainage'.
Annual Engineering Conference of the Institution of Engineers, Australia - March 1977.
(with K W Francis).
5. 'The Problems for Government Associated with Geological Hazards in the Urban Area'.
Paper prepared for 28th ANZAAS Conference, Melbourne 1977.
Section 3 - 'Geology in Urban and Regional Development'.
6. 'The Scope & Extent of Geotechnical Reports for Residential Subdivisions'.
Paper presented to the 77th Annual Conference of the Local Government Engineers Association (NSW) - ACEA. Conference Session 2 April 1982.
7. 'Town Planning in Geologically Complex Areas'.
Paper presented to the 78th Annual Conference of the Local Government Engineers Association (NSW) - ACEA. Conference Session 22 March 1983.
8. 'A Survey of Excavations & Their Support'.
1987 L.G.E.A. Annual Conference, Sydney pp 54 & 55.
9. 'The Integrated Support System - A new approach to excavation design'.
Paper presented to the Civil Branch of the Institution of Engineers, Australia in June 1989.
10. 'New Draft AS - Earth Retaining Structures (including Reinforced Soils)'.
Paper presented to 7th ANZ Conference on Geomechanics in Adelaide - July, 1996. With Dr M R Haussmann [UTS Sydney] & M Boyd [Reinforced Earth Company].
11. 'Building in Areas of Landslide, Subsidence & Rockfall' [including hillside building guidelines].
Australian Geomechanics Vol 37 No. 3 June, 2002 [with O G Ingles].
12. 'Pitfalls & Risks in Engaging Geotechnical Consultants'.
Presentation to Engineers Australia [Civil & Structural Panel] - 22 August 2006.
13. 'An Overview of AS 4678 – Earth Retaining Structures'.
Presentation to ACSE Annual Seminar : 5 July 2007.
14. 'Anchor Design & Construction For Shoring Systems : Fundamentals'.
Presentations to IQPC Piling Conference Brisbane November 2012 & Engineers Australia [Civil & Structural Panel] – 19 March, 2013.
15. 'Subsidence Events, Investigations & Litigation - The Need for a Forensic Approach' [with Simon Fagg].
Proceedings of the Tenth Triennial Conference of the Mine Subsidence Technical Society, November 2017, pp 283-301.
16. 'A Technical Note on Subsoil Drains.'
Australian Geomechanics Vol 55 No. 4 December 2020.

