

Principal Geotechnical Engineer, ITASCA Australia Pty Ltd

Expertise

David is a geotechnical engineer with 25 years of operations and consulting experience in the mining and civil industries. Since joining ITASCA in 2007, David has performed numerical back analyses and forward analyses for numerous open pit and underground mining operations around the world using ITASCA software. David has also performed numerical analyses for several surface and underground civil infrastructure projects. David has a Bachelor of Geological Engineering and a Master of Mining Engineering and is a Certified Professional Engineer with Engineers Australia.

Education

ME (Mining Engineering), 2001
Curtin University, Kalgoorlie, Western Australia

BE (Geological Engineering), 1995
Royal Melbourne Institute of Technology University (RMIT), Australia

Professional Affiliations

Member: Engineers Australia
Chartered Professional Engineer (CPEng), Engineers Australia
Member, Australian Geomechanics Society (AGS)

Professional Experience

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| 2014 - Present | ITASCA Australia Pty Ltd, Melbourne Principal Geotechnical Engineer, Director |
| 2007 - 2013 | ITASCA Australia Pty Ltd, Melbourne Senior Geotechnical Engineer, Director |
| 2003 - 2007 | Civil Geotechnical Services, Melbourne, Australia Senior Geotechnical Engineer |
| 2001 - 2003 | Sinclair Knight Merz Pty Ltd, Melbourne, Australia Geotechnical Engineer |
| 1999 - 2001 | Kalgoorlie Consolidated Gold Mines, Super Pit, Kalgoorlie, W.A. Geotechnical Engineer |
| 1996 - 1999 | BHP Iron Ore Pty Ltd, Mt Whaleback Mine, Newman, W.A. Geotechnical and Drill & Blast Engineer |
| 1994 - 1995 | Perseverance Exploration Ltd, Fosterville Gold Mine, Victoria, Australia Geotechnical Engineer |

Project Experience

Mining Projects:

Open Pit Mining

Slope stability assessments for open pit mines of various scale in both hard and soft rock environments. Activities include geotechnical field investigations, organization of laboratory testing programs, detailed analysis of soil, structural geological and rock mass data, and deterministic and probabilistic analyses for pit slope stability.

Detailed two and three-dimensional numerical modelling for pit slope stability for several large-scale open pits in Australia and overseas. This includes stability analyses for the following planned and operating mines:

- Mt Whaleback and Orebody 25 mines (BHP Iron Ore). Western Australia. Includes 3D slope stability analyses, and 2D slope stability analyses with hydromechanical coupling to assess the effects of pit excavation on pore pressures in the adjacent rock mass.
- Bingham Canyon (Rio Tinto). USA. 2D and 3D slope stability analyses. Includes back analysis of observed deformations, and back analysis of the 2013 Manefay slope failure.
- Blagodatnoye and Vostochny (Polyus). Russia. 3D slope stability analyses. Includes back analysis of slope failures.
- Cadia Hill (Newcrest). NSW, Australia. 3D slope stability analyses, including assessment of potential impacts on nearby infrastructure.
- Cowal (Evolution). NSW, Australia. 2D and 3D slope stability analyses. Includes back analysis of the 2013 slope failure, and assessment of potential impacts of future mining on nearby infrastructure.
- Damang (Gold Fields) Ghana. 2D and 3D slope stability analyses. Includes back analysis of a slope failure.
- Ernest Henry (then Glencore). Queensland, Australia. 3D slope stability analyses.
- Gruyere (Gold Fields). Western Australia. 3D slope stability analyses. Includes Probability of Failure (PoF) estimates.
- Hazelwood Brown Coal Mine. Victoria, Australia. 2D slope stability analyses with hydromechanical coupling.
- Kinsevere (MMG). DRC. 3D slope stability analyses.
- Macraes (OceanaGold). New Zealand. 3D slope stability analyses.
- Mt Rawdon (Evolution). Queensland, Australia. 3D slope stability analyses, including detailed representation of jointing in 3DEC.
- Oyu Tolgoi (Rio Tinto). Mongolia. 3D slope stability analyses. Includes back analysis of several slope failures, full-pit forward analyses for future cutbacks, and bench-scale 3DEC analyses with DFNs. Includes probabilistic analyses to determine Probability of Failure (PoF).
- Porgera (Barrick). PNG. 2D and 3D slope stability analyses.
- Ranger (Rio Tinto). Northern Territory, Australia. 3D slope stability analyses.
- Tom Price, B1, Hope Downs, Koodaideri, West Angelas, Yandi, Brockman and Marandoo mines (Rio Tinto Iron Ore). Western Australia. 3D slope stability analyses. Includes assessing the effects of pit excavation on sacred sites.
- Sepon (MMG). Laos. 3D slope stability analyses. Includes assessing the effects of pit excavation on a sacred site.
- Sino Iron Project (Citic Pacific Mining). Western Australia. 3D slope stability analyses.
- Sukhoi Log (SL Gold). Russia. 3D slope stability analyses. Includes back analysis of a slope failure.
- St Ives (Gold Fields). Western Australia. 3D slope stability analyses. Includes assessing the interaction between two open pits.
- Invincible (Gold Fields). Western Australia. 2D slope stability analyses.
- Six Mile Well and Goliath North mines (BHP). Western Australia. 3D slope stability analyses.
- Super Pit (KCGM). Western Australia. 2D and 3D slope stability analyses. Includes several back analyses of slope failures.

Design and installation of ground support and slope monitoring networks, detailed analysis of slope monitoring data, and detailed analysis of current and predicted stability for several active pit slope failures.

Geotechnical investigations and stability analyses for mineral sands mines and waste dumps.

Responsible for open pit production and limits blast pattern design and implementation at Mt Whaleback including pattern configuration, charge and tie-in, detailed blasting assessments, blast damage monitoring, developed site-specific guidelines for limits blasting practices.

Designed, installed and monitored standpipe and vibrating wire piezometer networks, and designed and assessed horizontal depressurization drilling programs.

Underground Mining

Two and three-dimensional numerical analyses for underground mine stability. Includes analyses for mines in Australia and overseas involving various mining techniques. Projects include:

- Cadia East (Newcrest). NSW, Australia. 3D analyses for subsidence and stability.
- Daisy Milano (Silver Lake Resources). Western Australia. 3D stability analyses.
- Deflector (Doray Minerals). Western Australia. 3D stability analyses.
- Gosowong (Newcrest). Indonesia. 3D stability analyses for the Kencana and Toguraci mines.
- Jadar (Rio Tinto). Serbia. Numerical synthetic rock mass testing.
- Mt Isa N3500 orebody (then Xstrata). Queensland, Australia. 2D and 3D stability analyses.
- Mt Lyell (Cooper Mines of Tasmania). Tasmania, Australia. 3D stability analyses for several cave mining options.
- Odysseus (Western Areas) Western Australia. 3D stability analyses.
- Rampura-Agucha mine (HZL). India. 3D analyses for infrastructure stability.
- Rosebery (MMG). Tasmania, Australia. 2D analyses for drive stability.
- Wafi-Golpu (Newcrest). PNG. 3D stability and stress analyses.

Open Pit / Underground Interaction

Numerical analyses to assess the interaction between open pit and underground mining. Includes the following projects:

- Ernest Henry (then Glencore). Queensland, Australia. 3D analyses to assess the effects of the SLC on slope and shaft stability.
- Macraes (OceanaGold). New Zealand. 3D analyses to assess the effects of the Frasers underground mine on slope stability.
- Porgera (Barrick). PNG. 2D and 3D slope stability analyses, including assessment of the effects of the underground mine on slope stability.
- Rampura Agucha Mine (Hindustan Zinc). India. 3D analyses to assess the potential effects of future underground excavation in the existing pit slopes and the surrounding ground surface.
- Ranger (Rio Tinto). Northern Territory, Australia. 3D slope stability analyses, including assessment of the effects of open pit mining on planned underground infrastructure.
- Super Pit (KCGM). Western Australia. 2D and 3D analyses to assess the effects of remnant stopes on slope stability.

Mine floor stability management at the Super Pit, including delineation of dangerous areas associated with remnant underground workings through dedicated probe drilling, downhole cavity laser surveys and microgravity surveys.

Involved in benchmarking study for transition from open pit to underground cave mining at Collahuasi.

Backfill

Three-dimensional numerical analysis of underground paste-fill barricade structures, including mullock, fibrecrete, masonry and hybrid structures for varying drive profiles. Three-dimensional numerical analyses for paste-fill exposure stability. Projects include Agnew, Cannington, Chelopech, CSA, Frogs Legs, Gosowong, Gwalia Deeps, Rubicon-Hornet, Kanowna Belle, Lightening Nickel, Leinster Nickel Operations, Nifty Copper, Prominent Hill, Raleigh, Savannah, Sunrise Dam and Tanami.

Undertook a review of design methodology for paste fill exposure at Glencore's George Fisher Mine.

Civil Projects:

Hydro Power

3D numerical analyses for tunnels/caverns associated with Kidston Pumped Storage Hydroelectricity project (Queensland). Slope stability analyses associated with Mt Rawdon Pumped Storage Hydroelectricity project (Queensland).

Tunnelling/Caverns

Two and three-dimensional numerical analyses for several TBM and mined tunnels, including detailed analysis of stress redistribution, ground deformation and the behaviour of various temporary and permanent ground support systems (Airport Link, Brisbane).

Foundation investigations

Geotechnical investigations and foundation analyses for various structures including large-scale power stations, electrical substations, water tanks, pipelines, school sites, service stations, residential developments and bridges. Activities include organization and implementation of field investigation and laboratory testing programs, analysis of field and laboratory data, site classification according to Australian Standards, recommendations regarding founding materials, bearing capacity, settlement, excavation characteristics and the controlled placement of structural fill. Geotechnical field investigations and data analysis for wharf redevelopments, recommendations regarding pile driving, pile depths and wharf reconstruction. Three-dimensional numerical analyses of wind turbine foundations for several proposed wind farms in the US.

Landslides and soil slope stability

Geotechnical investigations and stability assessments for river and coastal slopes and for batters and trenches. Provided recommendations regarding batter and trench stability, excavation sequence for basements and shoring requirements, and parameters for retaining wall design. Detailed three-dimensional numerical modeling for a large shopping centre basement excavation in Sydney, involving soldier piles, anchors and waler beams. Performed Landslide Risk Assessments in accordance with Australian Geomechanics Society Guidelines, including field investigations, data analysis, slope stability analysis and risk analysis for damage to property and loss of human life.

Water resources and waste disposal

Geotechnical investigations for proposed water storage lagoons, leachate ponds and wetland sites, including data analysis and recommendations regarding liner and embankment construction requirements, embankment stability, seepage analysis and potential borrow areas. Geotechnical investigations for proposed salt harvesting works, including geotechnical and hydrogeological data

collection and analysis, seepage modeling and subsequent design and specification of the pond lining and embankments. Included the design of groundwater monitoring programs, and analysis of the effects of water chemistry on soil permeability. Supervision, testing and reporting for the construction of clay lined landfill cells.

Other civil projects

Geotechnical investigations for existing and planned pavements, pavement design, pavement condition assessments, recommendations for pavement rehabilitation. Offshore geotechnical investigations for a proposed channel deepening project, including supervision of borehole drilling from a barge through soft marine sediments and organisation and presentation of geotechnical data for dredging analysis. Site contamination investigations for proposed developments, including field investigations, organization of laboratory testing, data analysis and reporting. Supervision for the placement of structural fill in accordance with Australian Standards, including field testing with nuclear density gauge, laboratory testing, data analysis and reporting. Forensic investigations for settlement and rising damp problems at residential and commercial building sites, including preparation of information to be used in legal hearings. Analysis and reporting of geotechnical laboratory testing for soil and rock at a NATA accredited laboratory, including consolidation, shrink-swell, permeability, triaxial shear strength, compaction, soaked CBR and basic index testing.

Research Projects:

Authored Master of Engineering thesis on the analysis of an interim slope at the Super Pit, Kalgoorlie, which included research into various topics associated with the data collection, data analysis and stability analyses.

Mass Mining Technology Project 3 (MMT3) – Development of Cave Database.

Papers and Publications

Creighton, A., Elmoultie, M., Hassall, M., Hodgkinson, J., Marinoni, O., Bixley, M., Wessels, F., Juldz, A., Kinakin, D., Whittall, J. and **Wines**, D. (2022) "A Reliability and Risk Framework to Support Pit Slope Design" in *Slope Stability 2022 (Proceedings, Int. Symp. on Slope Stability, Tucson, October 2022)*, The University of Arizona, School of Mining and Mineral Resources, 2022.

Crouse, R. L. and **Wines**, D. R. "Cowal gold mine - documentation of slope deformations due to mining to final pit walls - a case history," in *APSSIM 2016 (Proceedings of the First Asia Pacific Slope Stability in Mining Conference, Brisbane, September 2016)*, pp. 39-53. P. M. Dight, Ed. Perth: Australian Centre for Geomechanics, 2016.

Ghee, E. H., B. T. Zhu and D. R. **Wines**. "Numerical Analysis of Twin Road Tunnels Using Two- and Three-Dimensional Modeling Techniques," in *Continuum and Distinct Element Modeling in Geomechanics — 2011 (Proceedings, 2nd International FLAC/DEM Symposium, Melbourne, February 2011)*, Paper 03-02, pp. 105-116. D. Sainsbury, R. Hart, C. Detournay, and M. Nelson, Eds. Minneapolis: Itasca International Inc., 2011.

Helinski, M., D. R. **Wines**, M. Revell and D. Sainsbury. "Critical Factors Influencing the Capacity of Arched Fibrecrete Bulkheads and Waste Rock Barricades," in *Minefill 2011 (Proceedings, 10th International Symposium on Mining with Backfill, Cape Town, March 2011)*, pp. 293-303. Johannesburg: The Southern African Institute of Mining and Metallurgy, 2011.

Johnson, T. M., Pere, V., Dixon, R., de Graaf, P., **Wines**, D. R. and Y. Hebert. "Geotechnical optimisation of Southern Ridge Cutback 3 at Tom Price mining operations," in *APSSIM 2016 (Proceedings of the First*

Asia Pacific Slope Stability in Mining Conference, Brisbane, September 2016), pp. 78-84. P. M. Dight, Ed. Perth: Australian Centre for Geomechanics, 2016.

Wines, D. R., E. H. Ghee and B. T. Zhu. "Analysis of Twin Road Tunnels Using Numerical Modelling Techniques," in *Development of Underground Space (Proceedings, 14th Australasian Tunnelling Conference 2011, Auckland, March 2011)*, pp. 443-454. Melbourne: The Australasian Institute of Mining and Metallurgy.

Wines, D. R. and S. Hewson. "Use of Three-Dimensional Distinct Element Numerical Modelling to Determine Ultimate Pit Slope Stability in Areas of Highly Dense Relict Underground Openings: Super Pit, Kalgoorlie" in *Slope Stability 2011 (Proceedings, Int. Symp. on Rock Slope in Open Pit Mining and Civil Engineering, Vancouver, September 2011)*, Paper No. 296. E. Eberhardt and D. Stead, Eds. Vancouver: Canada Rock Mechanics Association, 2011.

Wines, D. R., I. Hulls, E. Woods and A. Creighton. "The use of numerical modelling, slope monitoring and operational procedures to manage slope deformations at the Ranger 3 Pit" in *Slope Stability 2013 (Proceedings, Int. Symp. on Slope Stability in Open Pit Mining and Civil Engineering, Brisbane, September 2013)*, Paper No. 40. P. M. Dight, Ed. Perth: Australian Centre for Geomechanics, 2013.

Wines, D. R. and P. A. Lilly. "Estimates of Rock Joint Shear Strength in Part of the Fimiston Open Pit Operation in Western Australia," *Int. J. Rock Mech. & Min. Sci.*, 40, 929-937 (2003).

Wines, D. R. and P. A. Lilly. "Measurement and Analysis of Rock Mass Discontinuity Spacing and Frequency in Part of the Fimiston Open Pit Operation in Kalgoorlie, Western Australia: A Case Study," *Int. J. Rock Mech. Min. Sci.*, 39, 589-602 (2002).

Wines, D. R. and P. A. Lilly. "A Comparative Analysis of Rock Mass Classification Schemes in Part of the Fimiston Open Pit Operation in Kalgoorlie, Western Australia," *Aus. Geomech.*, 36(4), 59-72 (December 2001).

Wines, D. R. and D. Raisbeck. "Impacts of Ordnance Training on Neighbouring Communities," in *Land Warfare Conference 2002: Proceedings — Future Wars, Futuristic Forces (Brisbane, October 2002)*, pp. 467-474. V. Puri et al., Eds. Salisbury, South Australia: Defence Science and Technology (Australia), 2002.

Wines, D. R., W. Zhang, J. van Rensburg and A. Lucarelli. "Selection of appropriate strength envelopes for open pit slope stability analyses in soils and weak rocks", in *SSIM 2023, Proceedings of the Third International Slope Stability in Mining Conference*, P. M. Dight, Ed. Perth: Australian Centre for Geomechanics, 2023.

Wines, D. R. "A comparison of slope stability analyses in two and three dimensions," in *Slope Stability 2015 (Proceedings, Int. Symp. on Slope Stability in Open Pit Mining and Civil Engineering, Cape Town, October 2015)*, pp. 305-316. The Southern African Institute of Mining and Metallurgy, Johannesburg, 2015.

Wines, D. R. "A comparison of slope stability analyses in two and three dimensions," *J. S. Afr. Inst. Min. Metall.* 116(5), 399-406, Johannesburg (May 2016).

Wines, D. R. "Understanding the sensitivity of numerical slope stability analyses to geotechnical and other input parameters", in *Slope Stability 2020, Proceedings of the 2020 International Symposium on Slope Stability in Open Pit Mining and Civil Engineering*, P. M. Dight, Ed. Perth: Australian Centre for Geomechanics, 2020.