




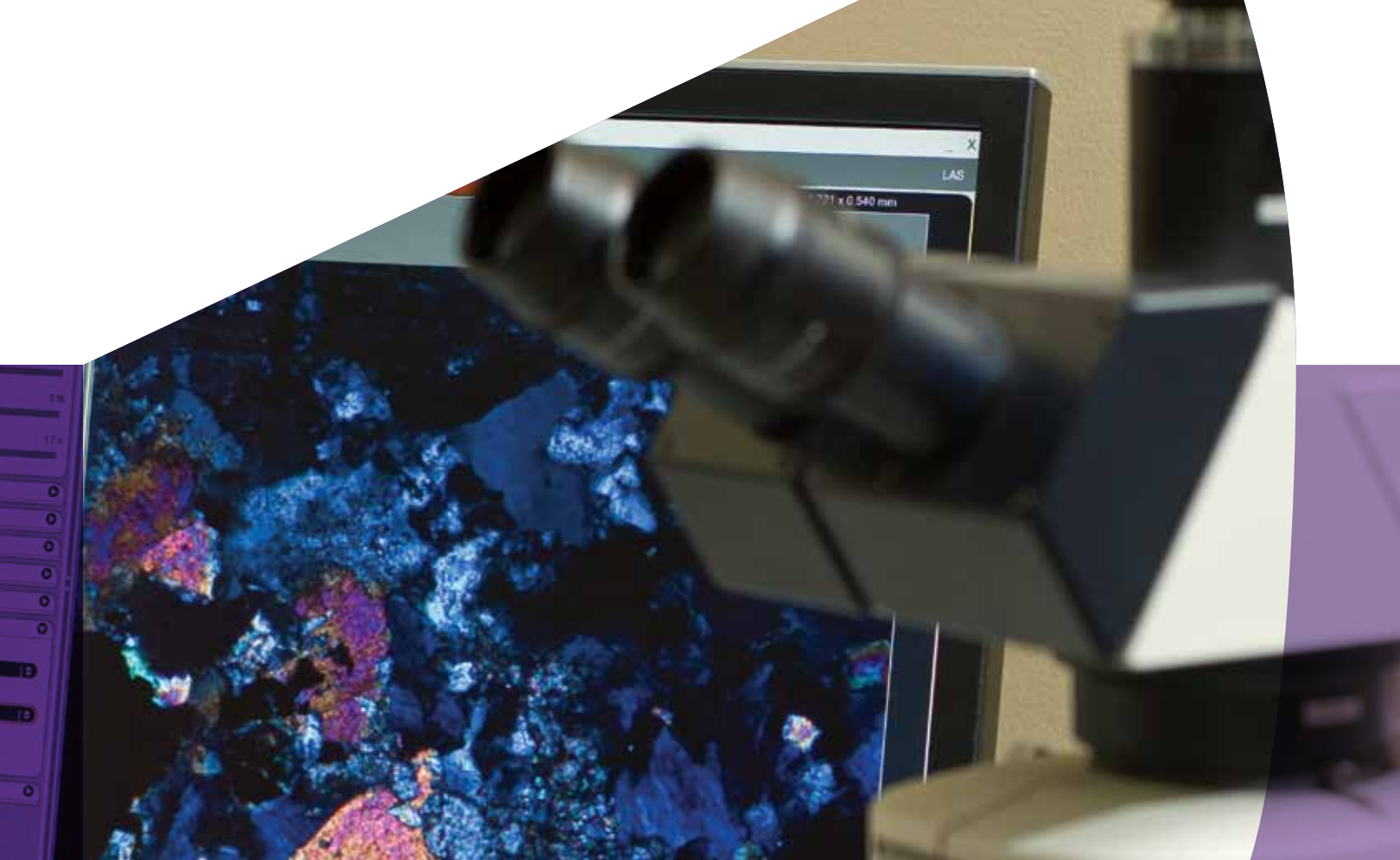
amec
foster
wheeler

**Rock
Engineering
Laboratory**
Mining & Metals



Amec Foster Wheeler's rock engineering laboratory in Hamilton, Ontario is dedicated to providing specialized consulting and analytical services for rock mechanics; tailings, paste and backfill characterization and design; aggregate resource assessment and petrography; and mine infrastructure investigations and forensic analysis.

150+
year history
operating in over
50 countries



Aggregate resources assessment and petrography

Amec Foster Wheeler provides a full range of field and laboratory services for the identification, assessment, permitting and development of aggregate resources for industrial mineral development and mine infrastructure construction. We are well-versed in evaluating the suitability of granular (sand and gravel) and bedrock deposits for mineral and building stone properties, as well as for construction aggregate applications including concrete, hot-mix asphalt, ballast stone, riprap, rockfill, earth dam construction, and granular fill, in climates from the tropics to the Arctic. We apply petrographic techniques for studies of concrete deterioration due to alkali-aggregate reaction, frost action, acid attack, retempering, impact damage, fire and other mechanisms. Services include:

- ▶ granular and bedrock aggregate prospecting and resource evaluation
- ▶ field performance studies and investigations
- ▶ material suitability evaluations and new product R&D
- ▶ construction aggregate materials consulting
- ▶ alkali-aggregate reactivity evaluations
- ▶ construction materials specifications and QA/QC
- ▶ production trouble-shooting and product compliance testing
- ▶ petrographic examination of aggregates (ASTM C295, CSA A23.2-15A, BS 812)
- ▶ full-scale mix implementation.



Rock mechanics

Amec Foster Wheeler's rock mechanics services range from site investigations and studies through detailed design, construction management and operations evaluation and monitoring. We have experience in the installation, monitoring and analysis of surface and underground mining field monitoring instrumentation such as displacement extensometers, SMART cables, stress cells, strain gauges, microseismic monitors and ground penetrating radar. Our laboratory facilities include a servo-hydraulic 3500kN load frame, in addition to 2000 and 1000 kN load frames.

Our laboratory tests are undertaken to ASTM and ISRM standards, and include:

- ▶ pulse velocity (p-wave) transmission speed characterization
- ▶ uniaxial compressive strength
- ▶ elastic constants E (Young modulus), ν (Poisson ratio), G (shear modulus) and K (bulk modulus), and continuous stress strain measurement
- ▶ crack initiation through acoustic emission count monitoring
- ▶ triaxial and biaxial testing for core sizes of BQ, NQ and HQ
- ▶ cyclic post-peak failure behaviour analysis.
- ▶ brazilian indirect tensile testing
- ▶ direct shear testing of natural joints or discontinuities
- ▶ point load testing
- ▶ slake durability
- ▶ hydraulic conductivity of rock (modified custom radial flow permeameter)

Tailings, paste and backfill characterization and design

We routinely customize paste tailings technologies to meet project-specific requirements and conditions while achieving optimal performance and cost.

Our laboratory facilities include a HAAKE Viscotester 550, a rheometer mixer and Rowe cells. We are experienced in paste systems for both surface and underground applications, and for continuous or batch operations.

Our laboratory tests are undertaken to ASTM standards. Services include:

- ▶ physical, chemical and mineralogical characterization and testing of tailings, aggregate and rock
- ▶ settling and flocculant screening
- ▶ rheology testing
- ▶ evaluation of tailings for suitability for use in paste backfill
- ▶ evaluation of conventional cementitious materials (Portland cement, slag, fly ash and silica fume) for use in cemented backfill
- ▶ evaluation of alternative cementitious materials for use in cemented backfill
- ▶ development of mix designs
- ▶ evaluation of mine backfill options: paste, rock and hydraulic fill
- ▶ long-term durability testing
- ▶ site quality control of backfill formulations
- ▶ full-scale mix implementation
- ▶ backfill material forensic analysis



Amec Foster Wheeler can develop specialized testing procedures to address client requirements for specific ground response conditions.

Mine infrastructure investigations

Amec Foster Wheeler provides engineering and testing services to support a wide range of mine infrastructure investigations. Our knowledge of material specifications and testing procedures, practices and theory are applied to evaluate material performance and conduct forensic analyses. Services include:

- ▶ drill program supervision, core logging and geological mapping
- ▶ construction inspection, testing and supervision
- ▶ concrete design
- ▶ structural monitoring using non-destructive techniques
- ▶ hydrogeological characterization and monitoring
- ▶ ground penetrating radar investigations
- ▶ petrographic examination of hardened concrete (ASTM C-856)
- ▶ forensic analyses to determine cause of failure or deterioration
- ▶ alkali-aggregate reactivity
- ▶ concrete acid attack
- ▶ low-temperature sulphate-carbonate deterioration (Thaumasite)
- ▶ effect of elevated temperature on concrete
- ▶ refractory material contamination
- ▶ fire damage
- ▶ air voids in concrete
- ▶ deep hydrogeological, thermal and displacement instrumentation installation for permafrost, geothermal and mining environments
- ▶ condition assessment of mine concrete infrastructure
- ▶ development of mine concrete infrastructure repair and rehabilitation procedures



servo-hydraulic 3500kN load frame



Global Mining Solutions

From concept
through closure

Selected clients:

Agnico-Eagle | Apoquindo Minerals

ArcelorMittal | AuRico Gold | Aura

Minerals | Barrick | Capstone Mining

De Beers | Denison Mines | Detour Gold

Dufferin Aggregates | Glencore | Golder

Associates | Government of Manitoba

Government of Yukon | Holcim | Hudbay

Minerals | K pferschiefer Lausitz | Lafarge

Meridian Minerals | Minera IRL | New Gold

Newmont Mining | NovaGold Resources

Ontario Graphite | Ontario Power Generation

Orosur Mining | Piteau Associates | Quest

Rare Minerals | Rio Tinto | Teck

Tintina Resources | Torex Gold


Resources | Vale | Vista Gold

Connected excellence

In all we do

For more than 60 years, Amec Foster Wheeler has provided a full range of services for mining projects, from front-end geology and environmental consulting through to design, project and construction management, operations support and mine closure.

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