



Supporting the Oil and Gas Industry

Pipelines and Facilities

A Commitment to Through-Life Value

BMT applies engineering technical expertise to a variety of asset integrity assurance and management programs, assisting clients in meeting and exceeding the requirements of industry standards, codes and regulations. BMT develops practical and innovative solutions to engineering problems using advanced technical knowledge and expertise supported by experimentation and testing, field measurement, design and analysis.

Research and Innovation

Since 1973 BMT has been engaged in industry-leading research developing innovative tools and insights that support design, construction and operations, in-service assessment, root-cause investigations and repair solutions. The results of BMT's efforts are often used to develop and advance industry standards, codes and regulations and safety practices.

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Pipeline Integrity Assessment

- Strain-Based Assessments
- FEA Analysis
- Geohazard Assessments

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Design and Construction and Operations Consulting Services

- In-Service Support and Repair
- Field Instrumentation and Assessments

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Welding Engineering Expertise

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Materials Engineering and Testing

- Full-Scale Testing of Pipeline Anomalies

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Integrity Management Tools

- Software, Facilities, and Resources



Pipeline Integrity Assessment

BMT has developed advanced analysis techniques to assess pipeline integrity for a wide range of anomalies including pipe wall deformations such as dents and wrinkles. Fatigue, corrosion and environmentally-assisted cracking damage accumulation are considered with ILI data to establish optimal re-test/re-inspection intervals.



- Pipeline Response to Slope Movement and Ground Subsidence
- Strain Based Design
- Buckle/Wrinkle Assessment
- Dent/Mechanical Damage Assessment
- Girth Weld and Long Seam Crack Assessment
- Corrosion Assessment
- Environmentally-assisted and Fatigue Cracking Assessment
- Pressure Test Evaluation
- Engineering Critical Assessment
- Fitness-for-Service
- Failure Assessment
- Fatigue Life Prediction
- Test Interval Definition
- Forensic Investigation
- Rail and Road Crossing Assessment
- River Crossing and Flood Assessment
- Computational Fluid Dynamics and Vortex Induced Vibration
- Field Instrumentation and Assessment

Geohazard Strain-Based Assessments and Analysis

BMT provides conventional and advanced 3D continuum pipeline (pipe-soil interaction) modelling and expertise to deliver value in design, integrity assessment and remedial action development. The effects of non-typical surface loading and geotechnical hazards including slope movement, faulting or other ground movement are assessed and forecasted while considering soil type, pipe geometry, alignment and material properties of the pipeline.



Design and Construction and Operations Consulting Services

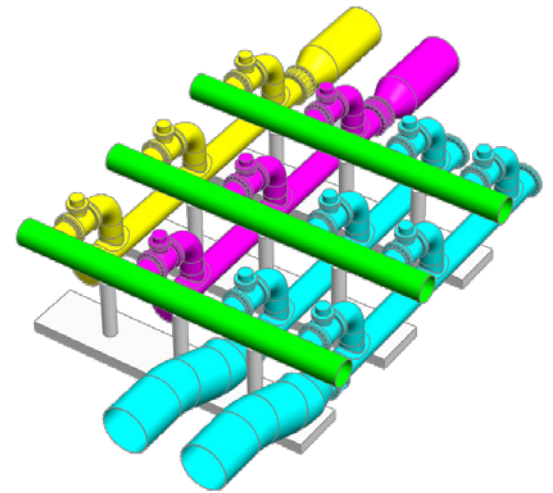
BMT offers a wide range of pipeline design, construction and operations support with a broad background in system design, analysis, hazard mitigation and regulatory and code compliance. Our services in these areas provide practical and innovative solutions, backed by more than 60 years of combined experience.

In-Service Support and Repair Solutions

BMT provides engineering and technical support to ensure safe and cost-effective operation of pipeline systems and facilities. Stress analysis, materials expertise and fatigue and fracture assessment tools are combined to provide design and in-service support for a wide range of pipeline and facility applications.

These services draw on BMT expertise with materials, welding, corrosion, mechanical, structural engineering and code compliance to deliver remedial action plans including complete engineering solutions, design and material specifications, welding procedures, and concept and detailed construction drawing packages.

- Design, and Construction and Operations Consulting
- Pipeline Engineering Assessment
- Geo and Hydrotechnical Hazard Assessment and Mitigation Design
- Pipeline and Facility Piping Stress Analysis
- HDD Profile Design and Analysis
- Specialized Repair Design and Analysis
- Design, Construction and Operations Standards Development
- Regulatory Support
- FEED
- Excavation and Backfilling Procedure Development
- Code Interpretation
- Major Project Review and Oversight
- Emergency Response Protocol Development



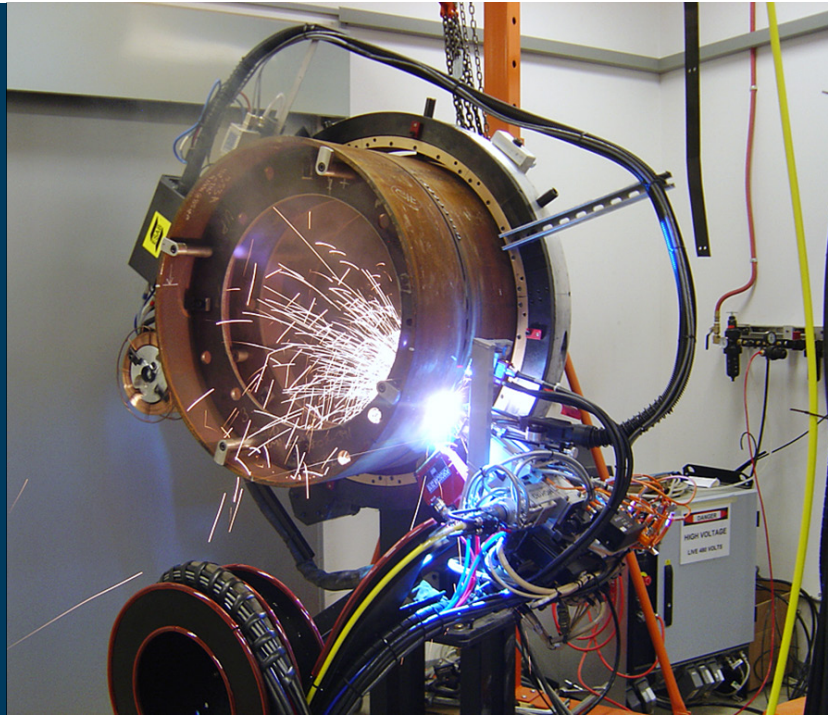
Field Instrumentation and Assessments

BMT has a wealth of experience supporting long- and short-term data acquisition and monitoring projects in the field including development of instrumentation plans, design and assembly of data acquisition, storage, power and reporting systems for on- or off-grid systems. Our instrumentations have been used for monitoring, processing and reporting strain, temperature, accelerations, motions and visual observations on pipelines, and facility piping.



Welding Engineering Expertise

BMT leads welding engineering with a complete range of procedure development, material selection, simulation, testing and forensic services. Our team of welding and mechanical engineers, technologists and metallurgists provide troubleshooting, production and code compliance solutions.



Welding Engineering and Process Optimization

Research targeting the expansion of industry-understanding of weld behaviour and the parameters that efficiently produce sound welds is used to provide welding engineering support. Weld procedures, consumables and technologies are evaluated, demonstrated and advanced through physical trials and simulation. BMT ensures fitness-for-service of welded assets by considering the effects or potential for hydrogen cracking, lack of fusion, porosity and laminations. Production and in-service welding and repair solutions are developed according to industry standards, codes and regulations.

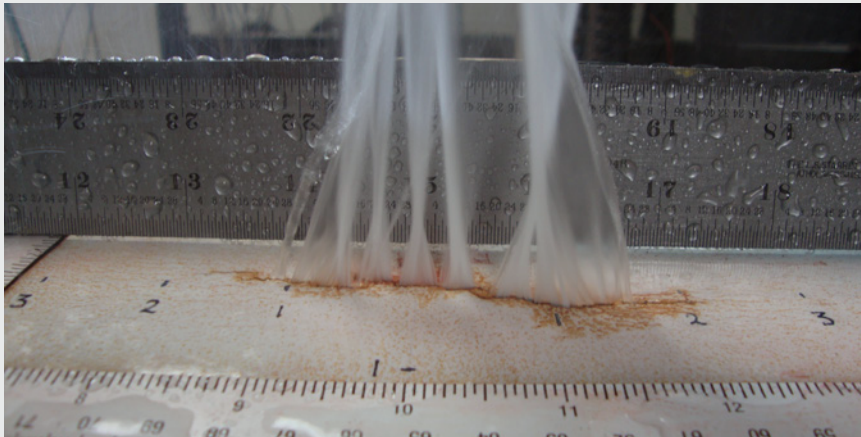
Materials Research and Engineering

The suitability or interaction of materials are evaluated to support design, maintenance and forensic investigations. Metallurgical, weldability and mechanical issues are considered to ensure compliance with codes and standards, enhance construction and repair solution success and reduce the potential for in-service degradation and failure. Experience and research-inspired expertise supports vintage and modern material focused design and repair solution development, specification and documentation. Stress analysis, material behaviour (strength, fatigue and fracture), testing and analysis are employed in root-cause failure analysis.

- Procedure Development, Review and Optimization
- Procedure Testing and Qualification
- Material Selection and Specification
- Hydrogen Cracking Inspection Delay Time and Susceptibility Evaluation
- Forensic Investigation
- Fitness-for-Service Assessment
- Process and Consumable Development
- Productivity Audits and Training
- Standards and Specifications Development
- In-Service Weld Procedure Simulation and Trials

Materials Engineering and Testing

BMT operates fully equipped laboratories having machining, welding, metallurgical, material, component and full-scale testing capabilities. Customized material and pipe tests and advanced finite element modelling are used to characterize buckling, fatigue, and fracture and to identify root-cause of failure.



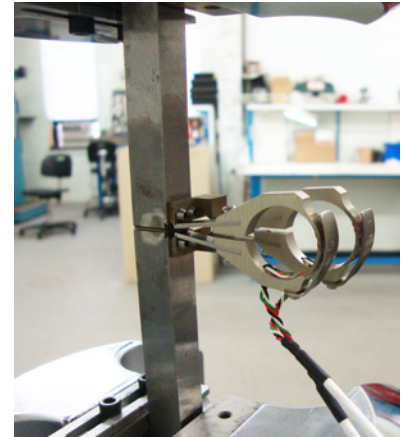
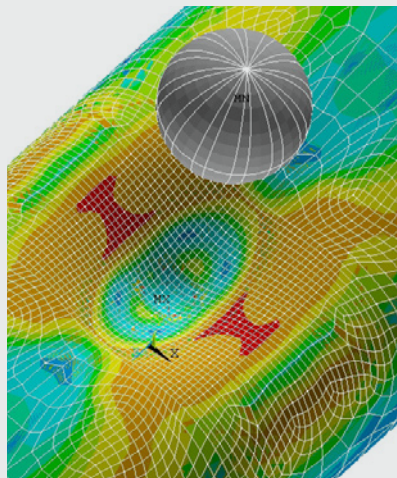
Full-Scale Testing of Pipeline Anomalies

BMT has developed full-scale testing facilities and procedures to evaluate the strength and fatigue life of damaged or degraded (cracked, corroded, dented, buckled or wrinkled) pipe.

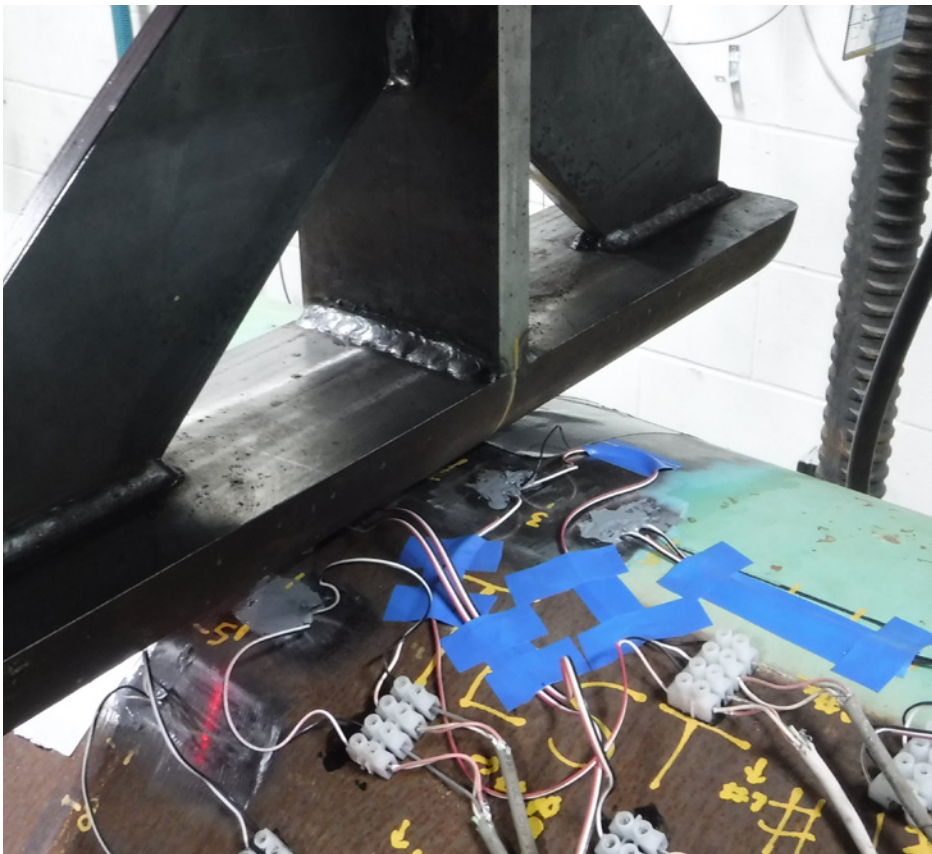
Facilities and Resources

- Modelling (ANSYS, ABAQUS, LS-DYNA, Caesar II, AutoCAD, Auto Pipe, and SOLIDWORKS)
- Mechanical test laboratory for material and component testing
- Metallurgical facility for microstructure and forensic investigations
- Full-scale testing for pipe with pressure, evaluating degradation or anomalies
- Welding laboratory for procedure, material and equipment development
- Field instrumentation and data acquisition
- Software and database development

The facility is used extensively to create and test dents (simulated and removed from service) with and without corrosion and weld interaction to evaluate fatigue life. BMT also conducts leak rate testing to support consequence evaluation of through-wall cracks.



- Failure Analysis
- Novel Test Procedure Development/Application
- Standard Testing Services
 - Tensile Strength
 - Toughness (CTOD, J-R, SENT, CVN)
 - Fatigue (SN, Strain Life, Crack Growth Rate)
 - Weld (Bend, Tekken, WIC)
 - Hardness
- Full-Scale Testing Services
- Dent With and Without Weld, Metal Loss, Cracks, Assessment and Performance Evaluation
- Wrinkle and Wrinkle Bend Assessment and Performance Evaluation
- Feature Assessment based on ILI data defining integrity and inspection interval
- Fatigue Crack Growth in Pipe Body and Long Seam
- Pressure Testing
- Leak Rate Evaluation
- In-Service Material Characterization



Integrity Management Tools

FlawCheck

Our structural integrity assessment software analyzes crack-like flaws for fatigue life and failure assessments using a range of operating loads and a variety of industry standards (i.e., BS 7910, API 579, CSA Z662, NG-18 and others).

SpanCheck

Unsupported pipeline span and river crossing scenario safety.

DentCheck

Fatigue life evaluation of dented pipe with and without interacting features.

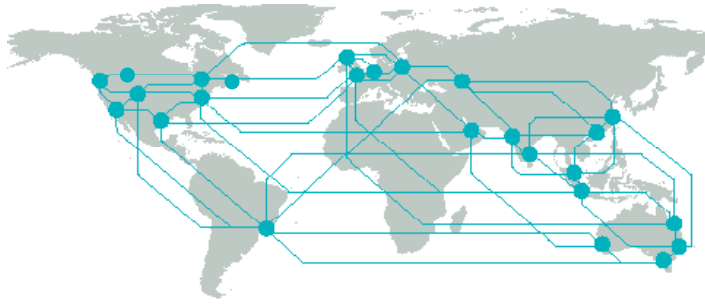
CheckMate

Supporting non-destructive material characterization and validation.

Proudly Supporting

- Pipeline Research Council International (PRCI)
- American Society of Mechanical Engineers (ASME)
- American Petroleum Institute (API)
- Canadian Energy Pipeline Association (CEPA)
- CSA Standards Group (CSA)
- Interstate Natural Gas Association of America (INGAA)
- Department of Transportation Pipelines and Hazardous Materials Safety Administration (PHMSA)





BMT Canada is an independent consulting company specializing in engineering, science and management services in the defense, energy and transport sectors. BMT supplies customers with unbiased solutions and trusted and experienced professionals who provide proven capability to a broad range of complex engineering and program management challenges. BMT Canada is an operating company of BMT Limited.

BMT Canada Ltd.
311 Legget Drive
Ottawa, Ontario
Canada | K2K 1Z8

Ottawa - Head office +1 613 592 2830


Halifax energy@bmtglobal.com


Calgary www.bmt.org/energy


Victoria



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