

Mining Sector

- Statement of Qualifications -



From Testing Through to Consultation, We Are Your "Down to Earth" Consultants

www.tbte.ca



Company Overview

TBT Engineering Limited (TBTE) is Northwestern Ontario's largest independently owned multi-disciplinary engineering consulting firm with headquarters in Thunder Bay, ON.

Originally established in 1968, TBTE currently employs over 100 full time professional and technical staff, with as many as 50 additional seasonal staff serving public and private clients across a diverse range of industries and sectors.



We have successfully completed numerous projects all across Ontario and Western Canada, from British Columbia all the way to Nunavut in Canada's Far North.

Our Areas of Expertise Include:

- Construction Contract Administration & Total Project Management
- Drilling Services & Drill Rentals
- Surveys & Plans
- Geotechnical (Ground) Engineering
- Environmental Services
- Construction Materials Testing & Inspection Services
- Transportation Engineering (Including Highway & Pavement Design)
- Structural Engineering and Building Sciences
- Geological Services Including Aggregate Prospecting & Investigations

Primary Sectors We Serve Include:

- Mining
- Infrastructure
- First Nations
- Government
- Energy
- Transportation

TBT Engineering is licensed to practice engineering in Ontario, Manitoba, Alberta and Saskatchewan. Our materials testing laboratory located in Thunder Bay, ON is CSA, CCIL, MTO, OPSS, MIT and ASTM certified. In addition, we are members in good standing with associations including ACEC, CEO, CGWA, IHSA and APGO



Commitment to Health & Safety

TBT Engineering Limited is committed to providing a safe and healthy environment for our employees, clients, contractors, suppliers, visitors and the general public. To achieve this goal, every reasonable effort is made to utilize the principles of incident and loss prevention in the management of all activities and programs as well as through support for and participation in community safety organizations, programs and events.

Our health and safety program consists of standards, policies, safe operating procedures



and training; and is driven by a strong safety culture, willfully supported by our Senior Management team. Management review and evaluation of safety systems, combined with a strong Joint Health and Safety Committee and valuable input from employees helps ensure our safety programs are up-to-date and workable for everyone, everyday, on every job.

TBT Engineering Limited realizes that there can be NO compromise for safety. To this end, we truly believe and take pride in our safety slogan....."No Job is so Important that we Cannot Take Time to do it Safely!"

Commitment to Our Communities

TBT Engineering is proud to be an active community partner, making a positive difference in the lives of people and families in our city. A stronger, healthier and happier community is something that benefits all of us!

Every year, TBT Engineering supports a wide range of community events, campaigns and causes. From social causes and cultural



events to education-based training and youth activities, we support various initiatives through financial assistance, prize donations, or corporate support.

Moving forward, TBT Engineering will continue to take a strategic approach to philanthropy by supporting causes, events, and activities that (a) align with our corporate beliefs and values and (b) enrich the communities in which we our employees and clients live, work and play.



Senior Management Team

Ms. Liana Frenette, B.A, B.Ed. - Chief Executive Officer



Liana has amassed over 20 years of experience in business management and ownership since purchasing TBT Engineering Limited in 1995 together with husband Rob and ultimately overseeing the company's metamorphosis into Northwestern Ontario's largest independently owned multi-disciplinary civil engineering consulting firm.

As company CEO, Liana remains directly responsible for overall management of business operations. In addition to supervising the daily work of engineers, technicians, administrative and field staff, she is also responsible for coordinating and auditing work projects and ensuring that objectives and deadlines are met. Liana coordinates all community relations and business development initiatives and oversees the creation and operation

of all company policy, employee benefits, workplace rules and procedures, safe operating procedures, as well as health and safety policies.

Liana is also very passionate about a number of causes including education, the environment, and health and safety in workplaces and communities. Past and present, she has chaired, co-chaired, or stood in good standing on a number of committees and community groups including the North Superior Workforce Planning Board, Lakehead University Alumni Board, Thunder Bay Chamber of Commerce Small Business Committee, Thunder Bay Safe Communities, Canadian Society of Safety Engineers – Thunder Bay Chapter, and the Association of Ontario Health Centers Board. Liana's passion for Health & Safety also included 5 years of teaching (Occupational Health & Safety – Business Division) at Thunder Bay's Confederation College.

Mr. Robert J. Frenette, P.Eng. - President



Rob has 25+ years of experience in civil engineering from planning through to contract administration. Rob has a strong background in total project management, construction and road design, surveying, environmental and materials engineering.

As President / Owner of TBT Engineering Limited, Rob is directly responsible for all corporate management of technical and business operations. He has over 20 years experience in business ownership providing quality assurance testing, project management, site inspections and various other engineering services.

Rob is an ACI Certified Examiner, a certified RMCAO Concrete Plant Inspector, an experienced QA/QC Administrator, an experienced highway and construction engineer, a past

experienced highway and construction engineer, a past sessional lecturer at Lakehead University, and a member of ASQ and CSCE. Prior to purchasing TBT in 1995, Rob worked 10 years at MTO NWR Planning and Design Section (Senior Project Engineer) and MTO NWR Construction Section (Project Supervisor) in the Northwestern Region.



Dr. Jag Mohan, PhD, PEng – Senior Vice President & Divisional Manager



As Senior Vice President of Engineering at TBTE, Jag is responsible for providing technical and project management services for many of TBT Engineering's divisions. Jag is also Manager of Structural Engineering as well as Research & Development at TBTE.

Jag is a Designated Consulting Engineer in Ontario and has over 30 years of professional engineering experience in building sector with expertise in multi-disciplinary design coordination, project management and contract administration of construction projects for public and private clients in the building industry. He has blended experience in both the engineering profession and leadership in engineering education (23 years) embedded with

research, thus enabling him to lead a large diverse team of professionals with a capacity to access, analyze and apply efficient cost effective solutions in projects.

Jag has been honored as a Fellow of Engineers Canada (FEC) in recognition for his contributions to the engineering profession and also received a "Distinguished Service Award" from Ontario Association of Certified Engineering Technicians and Technologists (OACETT).

Mr. Scott Peterson, P.Geo. - Company Vice President & Divisional Manager



As Vice President of Engineering at TBTE, Scott is responsible for providing technical and project management services for many of TBT Engineering's divisions. Scott is also Manager of Geological and Pavement Engineering at TBTE and has more than 13 years experience in various aspects of geotechnical, geological, and environmental engineering.

He specializes in geotechnical & geological investigations and design studies, environmental & hydrogeological investigations and assessments, pavement structure evaluation and rehabilitation investigations and design reports, aggregate and quarry source studies, and waste water management solutions.

Mr. Doug Otto, C.E.T. – Company Vice President & Divisional Manager



As Vice President of Engineering at TBTE, Doug is responsible for providing technical and project management services for many of TBT Engineering's divisions.

Doug is also Manager of Drilling Services at TBT Engineering and has 16 years experience providing field-testing and inspection services including concrete, granular, pipe installation, rebar and grout ensuring completeness and accuracy, compliance to industry and government standards and corporate administration procedures.

He has extensive experience as a road supervisor responsible for construction and maintenance of winter-road projects.



Environmental Services

Our Environmental department consists of expert biologists, technologists and scientists. They specialize in providing services including groundwater monitoring programs, environmental site assessments, baseline studies, delineation and mitigation plans, aquatic studies, and environmental permitting. The team uses state-of-the-art equipment to help ensure their services provide results of the highest quality.



Project Experience

Our Environmental team has completed a wide variety of projects for government, the mining industry, private enterprise and private property owners. These include Phase I and II environmental assessments, permitting of highway and industrial projects, environmental assessments and biological sampling. Our broad scope of expertise provides all the services needed to carry a project from conceptual phase to a permitted operation. TBTE Engineering offers Ministry of Transportation approved individuals in categories including Natural Sciences and Fisheries Compliance During Construction.

The following is a small sample of our environmental projects:

Advanced Exploration Permitting Kodiak Exploration (now Prodigy Gold) – Hercules Project Greenstone, Ontario

In cooperation with our Geological Studies Group, the Environmental Services Division devised and undertook a Baseline Environmental Program for the Hercules exploration project as it progressed to an Advanced Exploration phase. Services that were provided included background research and field investigation, public consultation, client and regulatory liaison, fisheries assessment, selection of surface water sampling stations, site rehabilitation monitoring and Closure Pan development.

• Certificate of Approval for Industrial Sewage Work & Closure Plan Amendment,

North American Palladium - Lac des lles Mine

Thunder Bay, Ontario

In concert with our Geotechnical Division's project to design an expansion to Lac des Iles' Tailings Management Facility, we identified permitting requirements for both construction and operation, completed liaison with government agencies regarding the project and completed and submitted required application packages and provided technical information to regulators.

• Tailings Management Area Expansion Agrium Inc. – Kapuskasing Operations

Kapuskasing, Ontario

In conjunction with our Geotechnical Division, we developed a Risk Assessment Matrix as a tool to assess a number of potential solutions to a lack of tailings



deposition space. The tool was used to assess the project from a variety of standpoints including environmental concerns, capacity, project complexity and cost and overall project feasibility. A second phase of preliminary design and fine tuning of the Risk Matrix to identify information gaps and environmental concerns is currently in developments phases and expected to be complete in the near future.



• Aquatic Survey and Environmental Monitoring for C of A for Industrial Sewage Works

Xstrata Canada Corporation – Xstrata Zinc Canada Mattabi Mine

Study included surface water monitoring and sampling, sediment collection and analysis, aquatic survey, regulatory consultation and associated reporting.

Baseline Environmental Program
 Linear Metals Corporation - KM61 Project
 Armstrong, Ontario

Establishment of Baseline Environmental Program for mining exploration project including background research and field investigation, client liaison, selection of surface water sampling stations, site map preparations and preliminary reporting.

Baseline Environmental Program for Future Advanced Exploration Permit
 Prodigy Gold Inc (formerly Kodiak Exploration) – Milestone Project
 Greenstone, Ontario:

Currently, the Environmental Services Division continues to work with Prodigy to collect baseline environmental data in preparation for potential advanced exploration at their Milestone Property. Surface water monitoring has been ongoing since 2010, and in 2011 the program has expanded to include more surface-water monitoring sites and general terrestrial and aquatic assessment in anticipation of further exploration activities planned for the area in the near future.

• Category 2 Permit to Take Water Application Golden Goose Resources – Magino Mine Site

Unorganized Township of Finan, District of Algoma TBT Engineering was retained to complete a Category 2 Permit To Take Water application for exploratory drilling requirements as outlined by Golden Goose Resources. Tasks included assessing potential water sources, all regulatory consultation and associated reporting.

Hydrogeological Assessment for Category 3 PTTW
 Goldcorp Canada Limited – Musslewhite Mine

Opapimiskan Lake (130 km Northwest of Pickle Lake)

Our Geological Services Department completed a Hydrogeological Assessment in the area of a proposed mine shaft at the Musslewhite Mine. The assessment was conducted in support of a Category 3 Permit to Take Water (PTTW) application for two proposed consumptive takings; (i) short-term dewatering operations required during the shaft collar advancement; and, (ii) proposed long-



term taking for mine processing operations. The hydrogeological assessment was conducted to confirm the ability of the localized area to provide the necessary water volume and to assess the potential implications of the water removal.

Biological / Aquatic Study

• Brett Resources – Hammond Reef Project

Atikokan, Ontario

Exploration identified an ore body beneath a small unproductive water body. For the project to progress, authorisation and compensation of a Harmful Alteration Disruption or Destruction (HADD) under the Fisheries Act was required. The Environmental Division identified the studies necessary to characterise the physical environment of the lake and the fish and benthic communities it supported. Studies were planned and completed during the field season to support consultation and negotiation with government agencies including the Department of Fisheries and Oceans, Ontario Ministry of Natural Resources and Ministry of Northern Development and Mines.

Hydrogeological Investigation

Rio Tinto – Kennecott Canada Lagoon Site

Stanley, Ontario

Hydrogeological Investigation for processing facility including well installation, groundwater and surface water monitoring and sampling, surveying, closure plan preparation, regulatory consultation and associated reporting.

Temporary Containment Pond Design & Construction North American Palladium Ltd.

Shebandowan, ON

Completed design and construction inspections for a temporary water containment pond for water storage during mine development. Project involved the following components: location and layout section, foundation investigation, laboratory testing, design of containment structures, development of construction drawings and specification, surveying, and construction inspection and testing services.





HIGHLIGHTED EXPERIENCE

Treasury Metals - Goliath Gold Project – Dryden, ON

TBT Engineering is providing consultation services for permitting requirements in association with the Goliath Gold Project near Thunder Lake, a short distance east of Dryden, Ontario.

TBT Engineering is assisting Treasury with this process by providing consultant services for the following tasks:

- Preparation of a formal Project Definition for regulatory review
 - Working with Treasury and assigned MNDMF coordinator
 - Commissioning new aerial photo coverage for use in site plan preparation
- Preparation of a Permit to Take Water Application (Category 3) for Ministry of Environment (MOE) review
 - Completion of a hydrogeological assessment
 - Review of available geological mapping, audit of historic site documentation, and MOE well records to assist in the development of field program and understanding of groundwater regime
 - Implementation of a field program including investigation of aquifer properties and groundwater quality
 - Overseeing the laboratory chemical analysis and completion of an aquifer assessment
- Hydrogeological Assessment for Pre-Feasibility Study
 - Completion of all required packer testing, overburden drilling and monitoring well installations
- Geotechnical Investigations
 - Currently completing preliminary geotechnical investigations for the Tailings Management Facility (TMF) and proposed mill / mine site.



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Geotechnical Engineering

Our Geotechnical Engineering Division provides a wide range of services. We have fully equipped drill rigs and specialized field and laboratory testing equipment to handle almost any ground condition and/or project requirement. These are discussed further in subsequent sections of this document. Our staff has extensive technical capabilities and experience in modeling and analyzing routine to complex geotechnical problems.

Modeling Capabilities:

- Foundation Analyses (Piles, Footings, Compensated Mat Foundations)
- Bearing Capacity
- Settlement Performance Analyses
- Ground Improvement (Site Preloads, Dynamic Compaction)
- Pile Analyses (All Pile, Driven, GRL Weap)
- Slope / Embankment Stability (Slope/W by Geoslope International Inc.)
- Seepage Analyses (Finite Element Seep/W by Geoslope International Inc.)
- Stress and Deformation Analyses Finite Element (Sigma/W by Geoslope International Inc.)
- Liquefaction Assessment (Liquefy Pro)
- Geothermal Modeling

Instrumentation:

- Slope Inclinometers
- Piezometers
- Thermocouples
- Settlement Gauges
- Vibration Measurements and Monitoring

Project Experience:

TBT Engineering has extensive experience in a wide range of geotechnical projects including foundation investigations for commercial and industrial projects, bridges, culverts, embankments, marine structures, and earth dams.

Dams and Containment Structures:

TBT Engineering and its staff are well qualified with experience in geotechnical and foundation engineering for dam design and containment structures. Past project experience includes new dam design, earth dam rehabilitation works, containment ponds, stability and seepage loss assessments, dam inspections and forensic analyses. Design experience includes seepage modeling of groundwater control and pressure relief systems including pressure relief wells, seepage control, downstream blanket drains and innovative upstream blanket drains to improve the passage of water while mitigating piping issues. A partial list of relevant project experience for TBT Engineering and/or its staff is as follows:





• Annual Dam Safety Inspection, Tailings Containment Perimeter Dams, Lupin Mine, Nunavut:

MMG Resources Inc.

Annual inspection of eight earth dam structures for tailings containment was carried out. The project involved historical data review, field inspections, collection and interpretation of thermal couple data and reporting which included inspection records, photographic records, and recommendations for upgrading and further investigation where appropriate.

 Dam Safety Inspection, Mattabi Mine Site, Ignace, ON: Xstrata Zinc – Mattabi Division

Annual inspection of eleven earth dam/dyke structures for various water ponds and/or tailings/sludge containment cells. Project involved historical data review, field inspections and reporting which included dam safety inspection records, photographic records, and recommendations for further actions.

• Geotechnical Investigation for New Zinc Mine, Tulsequah, BC.

Redfern Mines / Wardrop Engineering Inc.

Geotechnical Investigation and Design for new mine in Northern B.C. The new mine infrastructure included Mill, Accommodation, Maintenance and Process buildings. Existing potential acid generating (PAG) wastes were quantified using a combination of drilling and geophysical means. Designs were prepared for long term storage of the PAG materials as well as lined ponds for interim pyrite materials. This site is in remote mountainous terrain and was accessible only by air.

• Design of South Tailings Management Facility, Lac des lles, ON: North American Palladium Ltd.

Geotechnical design of new tailings facility which covers an area of approximately 1.1 mill m2 with dam heights of up to 32 m. Main components include membrane lined perimeter rock fill dams and a splitter dyke to create a reclaim pond. Design components included: location and layout selection, operation and staging, hazard potential classification, foundation investigation, laboratory testing, liquefaction assessment, development of design concepts, stability analysis, seepage analysis, freeboard assessment, spillway sizing, development on construction drawings and specifications and construction supervision.

• Design of Dam Monitoring and Instrumentation Plan, Agrium Inc., Kapuskasing, ON:

Agrium Kapuskasing Phosphate Operations

Design of a monitoring and instrumentation plan for two dams at Agrium's tailings management area. Preparation of the plan involved seepage modeling, stress distribution analyses and stability modeling to determine locations of and alarm levels for various instruments. Instrumentation included piezometers, settlement gauges, and slope inclinometers. The instrumentation plan provided detailed procedures for monitoring and reporting both during construction and operation of the dams.



- Review of Piping Issues, Tailings Management Facility, North-Western ON:
 - Assessment of historical piping issues for an existing tailings facility. Scope of work involved review of facility operations, history of piping events, and a detailed review of construction records to identify potential zones/areas at risk for piping. Seepage modeling was also carried out to identify critical levels for potential piping instability.



• **Temporary Containment Pond, Shebandowan, ON:** North American Palladium Ltd.

Design and construction inspection for a temporary water containment pond for water storage during mine development. Project involved the following components: location and layout section, foundation investigation, laboratory testing, design of containment structures, development of construction drawings and specification, surveying, and construction inspection and testing services.

Weir Replacement Berm, Musselwhite Mine, ON:
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Goldcorp Canada Ltd.

Design and construction inspection of a berm and associated partial flume to replace and existing weir to measure the discharge volumes from an existing retention pond. Design included stability analyses and seepage modeling.

• Design of Dams 3A and 3B North, Lac des Iles Mine, ON: North American Palladium

Geotechnical dam design of new tailings dams to be construction over an existing tailings pond. Detailed design work included interpretation of electronic cone penetration testing, seepage analyses, piping assessment, settlement analysis and stability analyses. The dams were designed as lined rockfill dams with downstream blanket drains to improve resist to piping. Dam 3A was also designed with a low permeable upstream liner to facilitate a temporary settling pond.

• Design of Dam 6, Lac des lles Mine, ON:

North American Palladium Ltd.

Geotechnical design of a new perimeter tailings dam to facilitate an increase in tailings storage capacity. The dam was designed as a rockfill dam with an upstream geosynthetic clay liner. The dam was constructed over an abandoned spillway cut through bedrock.

• Design of West Cell Dams, Agrium Inc., Kapuskasing, ON:

Agrium Kapuskasing Phosphate Operations

Design of two tailings pond dams. The West Cell Dam was designed as a lined rockfill dam founded on soft sensitive clay foundation soils to replace an existing dam and increase the total height of the dam to 13 m. Splitter Dyke No. 1 was designed as flow through rock-fill dam with a downstream toe drain to prevent piping of the foundation soils. This dam was founded over a layer of tailings slims. Key design analyses included assessment of strain softening within the foundation soils and seismic stability analyses.



• North American Palladium Ltd., Lac des lles Mine, ON:

Dam 5 is a splitter dam which separates two tailings ponds. The functions of the dam are to provide road access, support for mill pipelines and retain tailings while allowing water to pass through. The design of the dam included an innovative upstream blanket drain to facilitate passing of water and to mitigate the potential for piping. Staged construction was utilized to ensure stability during construction.

• Raise of Emergency Spillway, Lac des lles Mine, ON:

North American Palladium

In order to optimize the operating efficiency of the Tailings Management Facility, an assessment of raising the Emergency Spillway of the Water Reservoir was carried out. The assessment concluded that spillway could be raised significantly leading to a substantial increase in available. The assessment included review of dam stability, wave effects and modeling of seepage losses.

• Various Tailings Dams, Pickle Crow Mine, Pickle Lake, ON: Cantera Mining Ltd.

Detailed design of various dams for tailings and water retention. Work included: geotechnical investigations, detailed design, construction drawings, technical specifications and quality control and inspection services.

• Tailings Impoundment Dams, Kam Kotia Mine Rehabilitation Project, Timmins, ON:

Ministry of Northern Development and Mines

Design of new impoundment dams and assessment of the stability and seepage characteristics of an existing dam for the Kam Kotia Mine Rehabilitation project. Design included: liquefaction assessment, slope stability analyses considering seismic loading and design of measures to control seepage losses.

Foundations and Embankments:

TBT Engineering and its staff are well qualified with extensive experience in geotechnical engineering for foundations. Our foundation experience covers a wide range of project types including infrastructure, heavy industrial foundations, commercial structures, bridges, culverts, and highway and railway embankments. Foundation types, stabilization measures and ground improvement techniques include piles, rock anchors, retaining structures, lightweight fills, footings, mat foundations, frost protection measures, dynamic compaction, and lightweight fills. A partial list of relevant Project experience for TBT Engineering and/or its staff is as follows:

• Mine Mill Expansion Project, Lac Des Iles, ON:

AGRA Simons Ltd.

Detailed geotechnical investigation and recommendations for various components of a new mine mill including; a primary crusher, SAG/Ball mill, pebble crusher, coarse ore stockpile, mill building, run-off pond and operations camp. Key investigation and design components included: down hole seismic testing, shallow foundations on soil/bedrock, mat foundations, assessment of dynamic soil property and detailed settlement analyses of coarse ore stockpile in relation of feed lines.



• Realignment of Highway 11/17 at Pearl Lake, ON:

Ministry of Transportation Ontario, Northwestern Region

Foundation investigation and recommendations for a new alignment of the Highway 11/17. Construction involved up to 5 m of peat removal and site preloading for a new 5 m high highway embankment adjacent to the exiting highway. Stability and settlement analyses were required to ensure stability during construction and to determine surcharge pressures and durations. In addition, detailed settlement analysis was required to assess deformation along the existing highway during construction.

• Fuel Tank Farm, Thunder Bay, ON: Canadian Operators Petroleum

Detailed geotechnical investigation for a fuel tank farm. For the weak and highly compressible foundation soils, the tank sizing was modified to allow construction to be carried out using a mat foundation without piles and/or a long term site preload. Detailed settlement analysis was carried out to optimize the design of the mat foundation.



• Secondary Crusher Facility, Lac Des Iles Mine, Lac Des Iles, ON: North American Palladium Ltd.

The facility included the construction of a secondary crusher plant, transfer tower and conveyor take-up tower. Given the highly variable depth to bedrock, recommendations were provided for rock socketted piles and shallow footings on bedrock. Recommendations were also provided for structural slabs, slab-ongrade with site preloading and dynamic properties of the overburden and bedrock. Lateral piles analysis was also carried out for the proposed piles. A large stockpile of rock fill was used to preload the site and eliminate the need for a structural slab.

• Bridge Approach Grading, Eleanor Bay and Big Grassy River Bridges, Morson, ON:

McCormick Rankin Corporation

Geotechnical investigations for bridge approach grading for two bridges. The existing approaches were to be raised by 1 to 2 m. The approaches were situated over existing causeways, which were underlain by soft clays. To facilitate construction of the grade raise while maintaining embankment stability and improving settlement performance various geotechnical treatments were designed and evaluated. Extensive consolidation and strength testing of the foundation soils were required for detailed design. Key geotechnical tasks and issues included:

- o back analyses of existing conditions
- assessment of various stabilization and settlement improvement options including:
 - construction of flanking berms,
 - lightweight slag fills,
 - Elastizell foam concrete, and/or foam insulation



Transportation Engineering

At TBT Engineering, we provide complete engineering services for road improvements, new road construction and highway maintenance systems. We manage all aspects of highway engineering projects, including consulting, researching and planning, designing, and building.



TBT Engineering can provide clients with

feasibility studies that outline the scope of the project, summarizing preferred routes, possible alternatives, assumptions, any environmental and social considerations, economic justification, as well as interim and final reports.

With every project, extensive research and planning are key. TBT Engineering has the expertise to manage and coordinate large teams of industry professionals, incorporating multiple disciplines. Noise and air quality, landscaping, structural design, drainage, and geotechnical appraisals are all aspects we take into consideration.

Select List of Services Offered

Road Study (Preliminary Design) Phase I

- Assembly of all pertinent data
- Meet with residents (if applicable) and Project Team representatives
- Perform a detailed field review and assessment of the roadway
- Perform a detailed assessment of existing culverts and drainage facilities
- Complete engineering field surveys and plans preparation
- Complete preliminary geotechnical investigations
- Preparation of applicable design criteria
- Develop alternatives/recommendations for roadway improvements
- Perform Class C estimates for improvements
- Provide recommended staging plans
- Prepare Road Study Report detailing findings and recommendations
- Present recommendations to residents (if applicable) and Project Team
- Update Road Study Report based on comments

Detail Design Phase II

- Undertake additional surveys/geotechnical/environmental investigations
- Identify all applicable stakeholders and agencies
- Complete required environmental documentation
- Assess existing and new aggregate sources for suitability
- Develop detailed drainage improvements including ditching and culvert replacements
- Complete detailed plans and drawings for 66% and 99% review
- Provide detailed Class B Cost Estimates for 66% and 99% review
- Prepare an Interim and Draft Final Report for 66% and 99% review
- Prepare Final Tender Package(s) and Final Report with Class A cost estimate



We are fully qualified to perform all aspects of road design projects and have over 15 years experience undertaking such services for First Nations, Municipalities, MTO, Mining and Industrial clients within Ontario, Manitoba, British Columbia and Nunavut.

We recently completed a transportation assignment for Wabaseemong (White Dog) First Nation near Kenora for upgrading and surfacing of 15.5 km of access and community roads. A three contract approach was recommended for that project including an Aggregate Preparation Contract, Grading Contract and Surfacing Contract.

We have previously provided roadway engineering services for various clients such as Lac Seul FN (Kajic Bay Road), Pikangikum FN (Pikangikum Road), Shebandowan Mine, and Ontario Power Generation.

We have undertaken municipal road design projects for the City of Thunder Bay, Town of Fort Frances, Town of Atikokan, Municipality of Oliver Paipoonge and Municipality of Shuniah.

HIGHLIGHTED ROAD DESIGN PROJECT – GPAR Road, Nunavut

Between 2005 and 2009 TBTE provided route planning, preliminary design, surveying, and preliminary aggregate source plan preparation for the GPAR road extending from Gray's Bay on Coronation Gulf southerly through High Lake and Ulu to Lupin, then westerly in direction generally along the BIPAR route to IZOK.



Route planning was completed using available base plan mapping and LIDAR

surveys where available. Preliminary design was completed using topographic base mapping developed from LIDAR and photogrammetric mapping and supplemented by ground based surveys where necessary. Staking of the alignment from High Lake to Gray's Bay was completed for the entire alignment using alignment markers visible from air for helicopter reconnaissance.

Preliminary aggregate sources identified from base maps were subjected to a visual assessment and preliminary test pits conducted by hand shovel to verify aggregate characteristics. Preliminary quarry sources identified from base maps were subjected to a visual assessment for quality purposes.

CURRENT PROJECT – Feasibility Study - Rainy River Resources

TBT Engineering has recently completed a feasibility study for Rainy River Resources which includes route study and preliminary design. TBT Engineering conducted environmental, geotechnical and geomatics studies as well as quantitiave and qualitivite analysis of transporation alternatives.



Field Services

Our Field Services Division provides a wide range of services. We have a fully trained staff in the use of our field testing equipment. These are discussed further in subsequent sections of this document. Our staff has extensive technical capabilities and experience in routine to complex Field Services and Inspection Projects.



Instrumentation:

- Tensile Bond Machine
- Dowel Testing Machine
- Thermocouples
- Nuclear Densometers
- Concrete Testing Equipment
- Concrete Coring Equipment
- Half Cell Survey Equipment
- Chain dragging Equipment
- Moisture Testing Equipment
- Torque Wrench
- High speed Inertial Profilograph
- CCTV
- Pipe Deflection Instrumentation

Types of Testing:

- Concrete Testing (CSA Standards)
- Compaction Testing (ASTM, CSA, MTO)
- Tensile Bond Testing (CSA, MTO, ASTM)
- Dowel Testing (MTO)
- Concrete Investigations(Concrete Coring, Half Cell Survey and Delaminating)
- Roof Inspections
- Structural and Reinforcing Steel Inspections
- Bolt Torque Testing
- Fire Proof Inspection
- Sub grade Inspection
- Inertial Profilograph Analysis
- Material Sampling
- Pile Inspection
- NASCO Certified Pipe Inspections

Project Experience:



TBT Engineering has extensive experience in a wide range of field services and inspection projects from material testing and inspections for commercial and industrial projects, bridges, culverts, roadways, and earth dams.

Material Testing - Musselwhite Mine

Esker Site Expansion

Gold Corp / Tom Jones / Pierre Gagne

• Conducted compaction testing for various projects throughout mine site such as sub-station and building foundation.

Inspection Services – Lac Des Illes Mine

Tailings Management Facility Expansion North American Palladium

• Provided construction inspection and design verification of the temporary raise of the Emergency Spillway and Water Reservoir Dam located in the east tailings management facility.

Mobile Quality Control Testing – Young Davidson Mine

Earthworks Construction

AuRico Gold / MLA Construction

- TBT Engineering provided on-site Quality Control testing of aggregates intended for use during earthworks construction.
- Aggregate materials including Granular A, Granular B, Clear Stone, Concrete Aggregates, Sand and Rip Rap
- A fully equipped mobile laboratory was put into operation to expedited testing and reporting

Lab / Mobile Testing & Concrete Mix Design – Musselwhite Mine

2012 Construction Projects Gold Corp Canada

• Provided concrete mix designs for 2012 construction projects as requested by the client. Aggregate(s), grading(s) and characteristics where tested on site and in the Thunder Bay laboratory.

Mobile Quality Control Testing – Detour Lake Mine

Tailings Management Area Expansion

Detour Lake Gold Corporation / Chartrand Equipment

• TBT Engineering provided on-site QC testing of construction soils and aggregates in accordance with relevant project specifications and ASTM procedures at required frequencies for determining product quality and acceptance during production and placement operations.

Materials Testing & Inspection – Copper Cliff Mine

Engineering Evaluation of South Mine Shaft, Headframe & Hoist House Vale Canada Limited / Stantec Consulting Limited

• Performed concrete condition survey including concrete sampling and concrete testing to establish the condition of a headframe and hoist house.



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Materials Testing and Inspection

TBT Engineering provides a wide range of material testing and laboratory services to the construction industry. Our laboratory and technologists are fully certified to meet the needs of our clients.

Laboratory Services

- Grain Size Analyses
- Atterberg Limits
- Unconfined Compression Strength Testing of Soil
- Unconfined Compressive Strength of Testing Rock
- Concrete Compressive Strength Testing
- Consolidation Testing
- Direct Shear Testing
- Hydraulic Conductivity of Soil
- Soil and Aggregate Permeability
- Water Soluble Chloride for Concrete (3rd Party)
- Rapid Chloride of Concrete (3rd Party)
- Air voids Analysis of Hardened Concrete (3rd Party)
- Triaxial Testing of Soil
- Asphalt Testing Marshall Method & Super Pave
- Asphalt and Concrete Mix Designs
- Mortar & Grout Compressive Strength Testing
- Concrete Admixture Testing
- Aggregate Physical Property Testing (such as LA abrasion, Soundness, Low Density Materials Content)
- Point Load Testing Rock
- Bond Tests of Overlays
- Petrographic Analysis
- Rock Core Logging

Certifications

- Canadian Standards Association
- Canadian Council of Independent Laboratories
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Project Experience

TBT Engineering has provided material testing services to a broad range of clients and industries. Some of these segments and clients are listed on the next page:







Many of our clients have come from the mining sector including:

- Noranda Mine
- Lac des lles Mine
- Shebandowan Mine
- Williams Mine
- Battle Mountain Gold Creek
- INCO Shebandowan Mine

We have also worked extensively in other sectors including:

- Federal and Provincial Government

 Ontario Ministry of Transportation
- Pipelines
 - Trans Canada Pipelines
- First Nations
 - o Worked with various communities all over Northwestern Ontario
- Education
 - o Lakehead University, Confederation College, and others
- Forestry
 - Resulote Forest Products, Domtar, and Weyerhaeuser
- Hydro Generation
 - o Ontario Power Generation, Thunder Bay Hydro
- Commercial Clients
 - Real Estate Developers, General Contractors, and many more!
- Airports
 - Thunder Bay, Red Lake, Nakina, Geraldton, Sioux Lookout, and more.
- Municipalities
 - o Thunder Bay, Dryden, Fort Frances, Atikokan, and Greenstone

INNOVATIVE PRODUCT PROFILE – "WipFrag" Fragmentation Analysis Software



When it comes to predicting blast results, it's no secret that accurate fragmentation analysis is vital. TBT Engineering utilizes cutting-edge "WipFrag" fragmentation analysis software to help ensure accurate grain size photoanalysis. This helps ensure clients have the proper information needed to properly determine blast models, formulas and expected results. Fragmentation analysis has been proven useful in the

mining, forestry and aggregate industries by helping cut energy costs, improving efficiency and minimizing equipment maintenance costs.





Mobile QA / QC Laboratories

TBT Engineering has the capabilities to provide fully equipped mobile Quality Control / Quality Assurance laboratories to remote locations such as mines. Our mobile laboratories offer expedited testing and reporting services and are CSA, CCIL and CNSC certified for construction material testing.



Mobile Laboratory Equipment

The following is a partial list of resources and equipment that we are able to include with our mobile laboratories:

- CSA / CCIL Certified Technicians
- 22 Kg capacity electronic balance (0.1gram accuracy)
- Sample splitting equipment
- 200 mm diameter brass sieve set
- 8 inch diameter brass sieve set
- 0.75 mm wash sieve
- Sample heating and drying oven
- Gilson Sieve Shaker complete with screens
- Riprap sieves or templates
- Flat and elongated callipers
- Nuclear density gauges

Types of Testing:

TBT Engineering can undertaking onsite QC testing of construction soils and aggregates in accordance with relevant project specifications and ASTM procedures at required frequencies for determining product quality and acceptance during production and placement operations. Primary on-site testing can encompassed testing such as gradation, moisture-density testing, and field density (compaction) testing. Aggregate samples are taken in accordance with LS 625. Compaction testing is undertaken in accordance with ASTM D6938-10, In-Place Density and Water Content of Soil by Nuclear Methods. In addition to on site testing, samples can be taken at appropriate frequencies and then be shipped to our Thunder Bay laboratory for physical quality testing. TBTE maintains up-to-date diaries and lab reports for all material produced and samples taken throughout the duration of material production and placement.

Project Experience:

TBT Engineering has set up and operated mobile labs at locations such as North American Palladium's Lac Des Illes Mine Site, and Detour Lake Gold Mine. Project profiles are available upon request.



Need a topographic or construction survey completed? Consider letting TBT Surveyors Inc. (a TBT Engineering Consulting Group company) be your full service engineering survey providers! Our technical professionals have satisfied hundreds of clients over the years across a broad range of industries. Using a combination of cutting edge equipment and the latest in engineering survey techniques, we combine solutions of the highest quality with first class customer service.

Engineering Survey Services

- Topographic Surveys
- Digital Terrain Modeling
- Site Plans / Building Layout
- Municipal Design & Drainage Services
- Construction Layout
- Land Development Services
- Bathymetric Surveys
- Remote Surveys

Engineering Client Services

- Preparation of Reference & Crown Land Plans
- Preparation of draft plans and final plans for subdivision and condominiums
- Preparation of plans for building permits and site plan agreements
- Committee of Adjustment/Land
- Division & Zoning applications

Equipment:

- Trimble Series 3 R8 RTK Survey Grade GPS Systems (12 heads)
 - These systems allow us to survey large areas without needing line of site. Eliminates line cutting, significantly reduces vegetation damage, and results in cost savings. We are capable of fielding 4 independent teams.
- Sokkia Set 3110 Total Stations (5 heads)
 - Two and Three second total stations
- Reflectorless Technology
 - We can survey a point without placing a prism target on that location. We are capable of conducting these surveys in difficult to traverse terrain such as rock faces, bridge abutments, buildings, etc.

• Software Capabilities

- We use AutoCAD, Land Desktop, Civil 3d and Bentley InRoads for plans processing of survey data
- GIS Capabilities
 - We have full GIS capabilities for road and infrastructure planning. We can provide resource inventory mapping and analysis, integration of field survey data to GIS mapping, layout planning and general mapping services for all levels of presentation. TBT Surveyors Inc. uses ArcGIS software.







Project Experience

TBT Engineering has delivered engineering surveys to a wide range of clients across industries that include mining, forestry, transportation, real estate, first nations, railways and contractors. A small sample of these projects is listed below. A more extensive list of clients and projects is available upon request.

• DGS Exploration Inc. – Worthington Bay Schreiber, Ontario

TBT successfully completed a collar survey and control establishment. Final deliverables to the client included a collar coordinate and elevation spreadsheet and control report. This engineering survey was conducted in North American Datum 1983 CSRS UTM.



Treasury Metals Corporation – Goliath Gold Project

Wabigoon, Ontario

TBT successfully completed an air photo control (reference) survey for the client. Among the tasks completed by the crew was tying in cross-roads north of Wabigoon for vertical control. Final deliverables, including a control report and points list, where produced for the client.

HIGHLIGHTED EXPERIENCE

Fladgate Exploration Consulting Corporation – Engineering Surveys

Site: Goldlund Property Locaton: Sioux Lookout, Ontario

TBTE successfully completed a 67 kilometer engineering survey for the client. Survey lines where located along Hwy 72 with access provided by multiple side roads. Where necessary, ATV and snowmobile transportation was used for access and mobility. TBTE provided all layout and control establishment. In situations where GPS had difficulty receiving satellite data, a Sokkia Set 3110 Total Station was used to complete the survey work. A total of 5 survey lines where completed included all clearing, staking and surveying. Bi- weekly mapping updates showing the completed to-date layout progress where submitted to the client as where permanent control point data and control point location plans. The control points had both horizontal and vertical control data. Plans where generated using NAD 83 UTM CSRS Zone 15 and Canadian Geodetic Vertical Datum.





Drilling Services & Rentals

TBT Engineering's Drilling Services Department offers comprehensive drilling services and rentals for both environmental and geotechnical projects. From split spoon sampling to hollow or solid stem auguring, we use cutting edge technology and equipment to ensure you get results of the highest quality, completed on time and on budget. TBTE's in-house drilling rigs and equipment ensure optimal project scheduling, and our knowledgeable staff will get the job done right the first time, saving you both time and money.

Largest Drill Inventory in the Region!

- Truck Mounted Sterling Solid Stem Kelly Bar Power Auger
- Track Mounted Acker Bushmaster Heli-portable Rig
- Truck Mounted Pioneer Drill Rig
- Trailer Mounted CME 45 Drill Rig
- Track Mounted CME 55 All Terrain Rig
- Truck Mounted CME 55 Drill Rig
- Skidder Mounted CME 750 All Terrain Rig
- Tri-pod supported Cathead equipment
- PEDO Hand Auger equipment
- Drill Barge and Pontoon Platform
- Support vehicles including trucks, floats, snow machines and 4 wheelers

Services Offered

- Solid stem auguring
- O. Reg 903 Certified Groundwater Monitoring Well Installations
- O. Reg 903 Certified Groundwater Monitoring Well Decommissioning
- Geotechnical Subsurface Condition Investigations
- Roadway / Highway / Pavement Investigations
- Environment Soil Sampling & Investigations
- Aggregate Source Investigations (ASIs)
- Rock Quarry Investigations
- Environmental & Geotechnical Marine Investigations
- Construction Site Assessments
- Hazard Assessments

Project Experience

We have completed hundreds of projects for clients ranging from Canadian Pacific Railway and Goldcorp to the City of Thunder Bay.





<u>HIGHLIGHTED EXPERIENCE</u> Drill Rental for Geotechnical Investigation

Client: AMEC Earth & Environmental Site: Detour Lake Gold Mine Location: Cochrane, Ontario

As part of a larger subsurface investigation being performed by the client, TBT Engineering was subcontracted to assist with the completion of geotechnical boreholes. Boreholes where cored 3 m into rock for bedrock confirmation and standpipe piezometers were also installed in selected holes.

Drilling was carried out using TBT Engineering's rubber tracked CME 55 rig. The rig was outfitted with hollow/solid stem augers and a split spoon sampler. As per client specifications, the rig also came equipped with



all the necessary hollow stem augers, rods, plugs, centre assemblies, split spoon samplers (a minimum of 2), supply pumps with a minimum of 100 feet of 1" diameter water line and automatic 140 lbs. sample hammers.

Standard Penetration Testing (SPT) (ASTM D1586) was carried out along with split spoon sampling at about 0.75 in intervals down to 3.0 m depth and then at every 1.5 m to the bottom of the hole.

HIGHLIGHTED EXPERIENCE

Internal Department Support - Monitoring Well Installations

Client: Rio Tinto Site: Processing and Storage Site Location: Municipality of Oliver Paipoonge, Ontario

As part of a larger environmental investigation carried out by TBT Engineering Limited that included a background assessment of soil and groundwater activities, the drilling department installed multiple monitoring wells surrounding the area designated for storage of processed material. The monitoring wells where installed using a CME 45 drill rig equipped with 108 mm (diameter) hollow stem augers. Subsurface soil conditions were identified and recorded for each borehole to a maximum depth of 6.6 m below grade.



Monitoring wells were installed using standard 50 mm Schedule 40 PVC pipe with #10 slot PVC screen. All wells were installed in accordance with O.Reg. 903. The monitoring wells were then surveyed for elevation to incorporate them with the existing monitoring well network on site.



Aggregate Applications

It's no secret that establishing a new pit or quarry in Ontario can be both challenging and complex. Whether on private or public land, the maze of approvals and permits needed for a pit, quarry, or wayside can be daunting.

TBT Engineering Limited has been helping aggregate operators navigate this process for more than 13 years. We are proud to have assisted in or managed the permitting and application process for over 500 pits and quarries!



Our diverse team of professionals can help prepare and process concurrent Planning Act applications, conduct engineering surveys, prepare sight plans, even organize and lead public consultant forums. We even undertake quality analysis for existing operations.

Whether you are prospecting for a new aggregate source, or looking to get your current sources up to code as specified in the Aggregate Resource Act, we can help!

Services Offered:

Preparation of Applications

- Aggregate Resource Act approvals
 - License applications (private land)
 - Permit applications (crown land)
 - Wayside permits (public authority highway construction projects)
 - Preparation and processing of Planning Act applications
- Permits to Take Water
- Certificates of Approval for MOE (Air and Noise)

Planning & Consultation

- Total Project Management
- Expert Testimony at the Ontario Municipal Board
- Public, Government, and First Nations Consultation
- Third party mitigation and mediation

Surveying

- Aggregate quantity calculations and estimates (Volumetric Surveying)
- Topographic Surveying and Mapping
- Survey-Grade (RTK) GPS Site Mapping, Pit Plans, & Summary Reports
- Digital Terrain Modeling
- GIS Mapping and Date-bases



Environmental Services

- Environmental Site Assessments and reporting Phase I & II
- Well and Piezometer Installations and Monitoring
- Biology
- Compliance monitoring and reporting
- Planning and design for final site rehabilitation

Geological Services

- Hydrogeological investigations and reporting
- Watershed studies and modeling
- Aggregate Prospecting & Identification

 Core Drilling
 - Feasibility Studies

Other

- Materials Testing
- CADD deliverables
- Complete petrographic services

Profiling TBT Engineering's Expertise in Aggregate Source Investigations

Since 1998, TBT Engineering has undertaken multiple Aggregate Source Investigations for the Ministry of Transportation – Northwest Region.

TBT Engineering is the prime consultant, performing a significant portion of the work including Power Equipment investigations, diamond drilling investigations, field surveying & site plan preparation, laboratory testing and reporting.



In addition to overseeing Cultural/Heritage technical reports, TBT Engineering prepares and coordinates Natural Science technical reports, hydrogeological services and Groundwater Summary Statements.

Laboratory testing is completed by TBT Engineering's Thunder Bay materials testing laboratory. Crushable and non-crushable granular samples as well as crushed rock core samples are processed to provide material test qualities, including superpave consensus properties.

TBT Engineering conducts Field Surveys and prepares Site Plans for permitting. TBTE utilizes in-house R8 RTK GPS to establish coordinates at sites as required.

Quality Assurance



Review procedures

TBTE has a wealth of experience conducting review procedures including Core Plans, Generic Category Plans, and Supplementary Specialty Plans (project specific) for the Ministry of Transportation. These plans are submitted through the Registry, Appraisal & Qualification System (RAQS). The plans constitute quality control procedures for the quality assurance tasks that we perform during contract administration projects. Staff members who perform quality control are independent of the quality assurance activities to help ensure neutrality.



Minimum certifications/training/education

Staff certification and licenses are continually updated and renewed to ensure regulatory compliance. This practice also ensures that TBTE can meet and exceed staff standards and expectations as set out in client contracts. When working on MTO contracts, for example, all staff from - junior inspectors up to contract administrators – are OACETT approved and certified.

In addition to proper certification and licensing, our key QA staff, including project managers and contract administrators, have a wealth of demonstrated Construction Contract Administration experience.

Minimum standards and regulatory requirements

Regulatory requirements are always satisfied prior to beginning any project. As an example, the Occupational Health and Safety Act requires that traffic control plans be put in place for the safety of both construction workers and the general public. WHIMIS training for all employees is another example of how TBTE meets the requirements of this piece of provincial legislation. Our dedication to providing a culture of Health and Safety at TBTE has resulted in the creation of a corporate H&S policy. As well as well as a plethora of related initiatives that have made us an industry leader in working safe. Environmental legislation also plays a major role in many projects that we are associated with. TBTE's Environmental Division plays a key role in ensuring that our staff are aware of the latest regulatory requirements and that compliance is assured.

Reporting periodically to customer

An example of our periodic reporting procedures includes the monthly meetings that we schedule which we invite our client(s) to attend. At these meetings, we give progress reports on the project. Project status reports are also prepared monthly by the Project Manager and submitted with billing / invoice statements.

Aside from monthly reports, shorter accountability intervals exist as well, such as the weekly status reports that take place to summarize staff hours, as well as tasks completed by both the contractor and contract administrator.

STATEMENT OF QUALIFICATIONS - MINING SECTOR



A plethora of reporting takes place at the end of a project. We engage in contractor performance rating activities which gives the client a professional record of how the contractor performed duties for a specified project. We review these ratings with the client. We also create construction reports, which summarize the work of a completed project. These reports include recommendations for improving and/or maintaining future construction effectiveness and efficiency on similar projects. Design package evaluations are completed summarize any design issues that were identified during the course of the project. Environmental reporting also takes place.

Reporting on a weekly, monthly, and contractual basis ensures the client is continually aware of what work is taking (took) place, how it is taking (took) place, and what the final result will be (was). This reporting structure also ensures that any contractor deviations from the project specifications are identified and dealt with quickly thereby helping keep the project is on time, on specification, and on budget.

Schedule control

Physical (field) audits for large jobs and document audits for small jobs take place. These auditing processes help ensure that tasks are being completed in the time frames stipulated in project documents such as an RFP or RFQ.

Insurance Policies

TBT Engineering Limited carries a Professional Liability Policy (Errors and Omission) with liability coverage of \$5,000,000 per any one occurrence and in the aggregate.

TBTE also has a Commercial General Liability Policy with \$1,000,000 if liability coverage backed up by a \$4,000,000 umbrella policy for a total of \$5,000,000 commercial general liability coverage.

With regards to Employer Liability insurance, we are in good standing and are fully covered under the Workplace Safety and Insurance Board (WSIB).

