

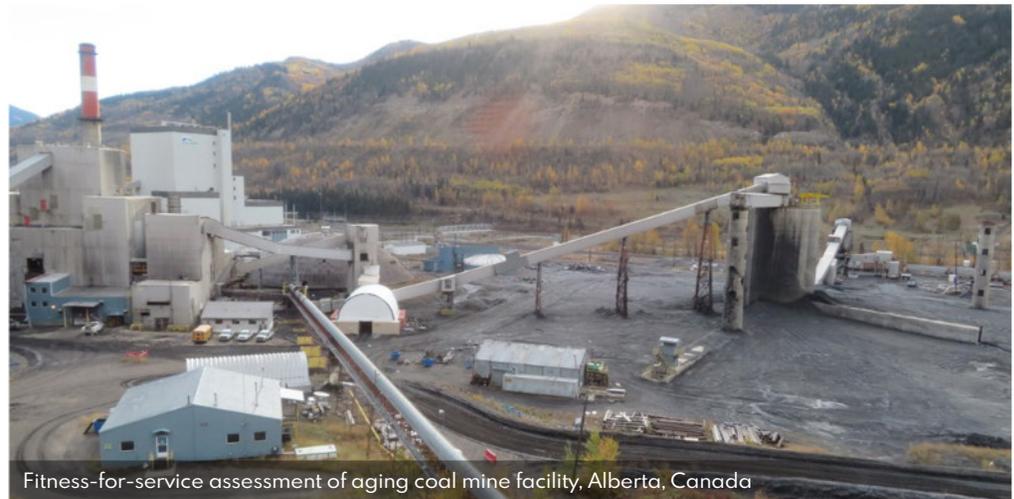


FITNESS FOR
SERVICE &
FORENSIC
ENGINEERING
PORTFOLIO





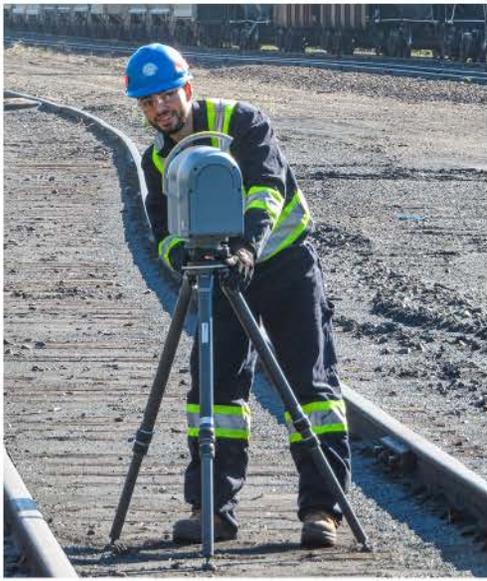
Structural assessment of fire damaged shiploader, Venezuela



Fitness-for-service assessment of aging coal mine facility, Alberta, Canada



Forensic engineering of catastrophic equipment failure, British Columbia, Canada



Fitness-for-service assessment of CST Coal plant building Alberta, Canada

The Company

MGA Engineering is a global leader in designing structural and mechanical systems in the infrastructure, building (commercial and industrial), mining, energy, and marine industries. Founded in 1996, MGA now staffs 65 highly experienced engineers, providing an exceptional level of technical expertise and innovative engineering solutions to commercial and industrial clients.

MGA offers a comprehensive portfolio of services for inspections, testing, certification, assessments, audits, and forensic engineering for both structures, infrastructure, and heavy bulk-material handling equipment. After completing the fitness for service assesment, MGA is prepared to design the necessary repairs needed to eliminate any hazards, including preparing construction documents and sequencing, creating fabrication drawings, and addressing installation concerns in the field. We take advantage of the latest available technology, such as BIM modelling, 3D laser scanning, digital measurements, and pair that with invaluable field measurements and observations to gain a full understanding of the existing conditions and any deficiencies.

A Global Footprint

MGA's head office is located in Calgary, Canada, and entails corporate, finance, project management and design functions. A large design office resides in Cairo, Egypt, and also serves as the base of operation for projects in Europe and Asia. MGA also operates several smaller satellite offices across Canada, the United States of America, and internationally (British Columbia, Quebec, Florida, New Jersey, Mexico, Brazil and Ecuador). Our footprint of past projects and active presence worldwide can be seen on a global scale.



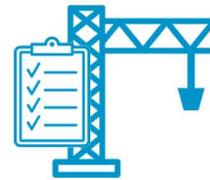


The Practice

MGA has been practicing integrity assessment and forensic engineering on equipment and buildings for nearly three decades. Whether an asset requires a routine inspection, has deficiencies, is on the verge of failure, or has failed entirely, the different types of assessments can be performed to determine lifespan, find the root cause of the problem or gain an understanding of the failure. These services are designed to keep the assets operating profitably throughout their economic life, with our services aimed squarely at risk mitigation: risks of failure, productivity, health and safety, the environment, reliability, budgets, and to returns on investment.

An integrity assessment is performed on an existing asset before a failure occurs, whereas forensic engineering is performed on an asset that has suffered a failure or loss of operability.

In all instances, the expression Fitness-for-Service carries the definition given in API 579-1: “Fitness-For-Service (FFS) assessments are quantitative engineering evaluations that are performed to demonstrate the structural integrity of an in-service component that may contain a flaw or damage, or that may be operating under a specific condition that might cause a failure.”



Integrity Assessment

Performed on an existing asset before a failure occurs. Its objective is to quantify the asset's fitness for service (structurally, mechanically, electrically, and/or operationally) for the present and the future. Different levels of inspections, condition assessments and audits are available, and take note of any concerns, deficiencies or otherwise noted issues during operation/occupancy.



Forensic Engineering

Is performed on an asset that has suffered a failure or loss of operability. Its objective is to determine the root causes of the condition, for the purpose of the owner or during litigation, and determine the economically viable options to prevent its re-occurrence in the future.



Assessment of Bloom Lake Iron Ore Mine's Stacker Reclaimer, Quebec, Canada



Methodology

The quantification of an asset's design life and its fitness for service is a complex, rarified process codified by a very limited number of globally approved codes & standards. Code knowledge alone is not sufficient to enable an analyst to produce credible, insurance-worthy results. Trustworthy results require years of acute practice in forensic engineering, analytical modelling, and legally proven expertise.

This demanding combination knowledge and experience is a hallmark of MGA Engineering's field of practice. MGA has played key role in helping clients prevent, control, and mitigate material & component flaws borne from fabrication, operations, design exceedances, fatigue, corrosion & erosion, creep, and environmental aggressions (storms, earthquakes, fires, floods, etc.). MGA's multidisciplinary approach integrates knowledge of materials, field inspections, fracture mechanics, nonlinear finite element modeling, and physical testing.

The underlying methodology abides by the standard-setting procedure ERDC/ITL TR-21-3, Classical and Innovative Methods of Fatigue and Fracture Repairs in Navigation Steel Structures, published by the Army Corp of Engineers document; and by the analytical prescriptions of the standard API 579, which deals with fitness for service.

The methodology brings into play engineering design reviews; field inspections and 3D scans of the asset's "as-is" condition; destructive and non-destructive tests; 3D modelling of the asset in that "as-is" condition; 3D and 4D stress simulations under static and dynamics loads; additional CFD simulations of loads contributed by fluid flows; and influences of material nonlinearities such as plasticity, fatigue, creep, and discrete particle behaviour.





CST Coal Mine Assessment and Rehabilitation



LOCATION
Grande Cache, Canada



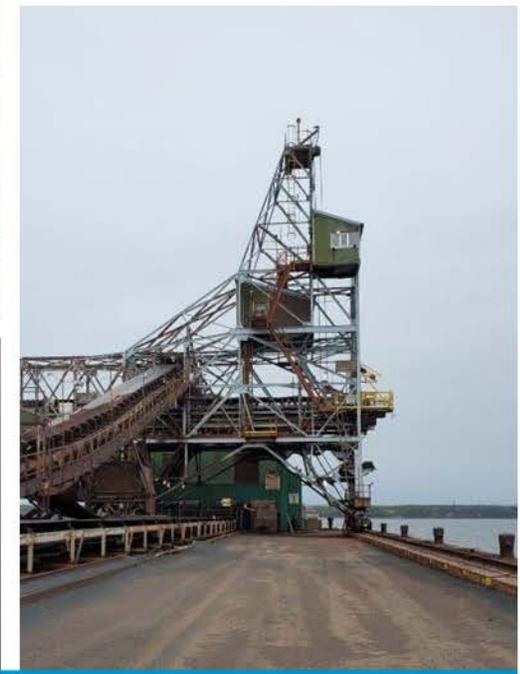
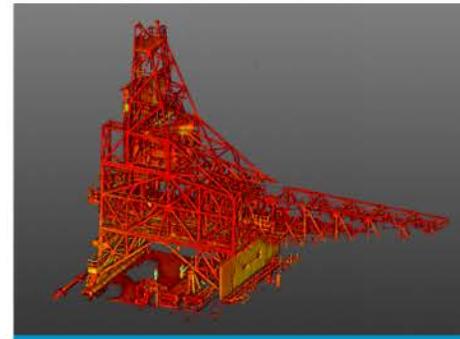
TIMELINE
2021-2022



CLIENT
CST Coal Canada

The facility was originally constructed in the 1970's and the equipment and infrastructure required structural and mechanical assessment and rehabilitation in order to address significant corrosion issues. MGA Engineering was engaged to conduct structural and mechanical assessments of the coal preparation plant, rail load-out facility, breaker building, conveyor gallery bent columns and a storage silo suspended truss structure.

MGA conducted the assessments using visual inspection, 3D laser scanning, ultrasonic thickness testing and NDE testing (magnetic particle). Structural and mechanical analysis was conducted to determine the stability/adequacy of the existing equipment in its degraded condition. MGA carried out service life analysis to determine the remaining useful life of the rehabilitated structures and developed the ongoing monitoring and maintenance plans. The assessments were followed by reports that provided recommendations of reinforcements and resulted in several engineered rehabilitation projects that followed.



SFP Pointe-Noire Shiploader Assessment



LOCATION
Quebec, Canada



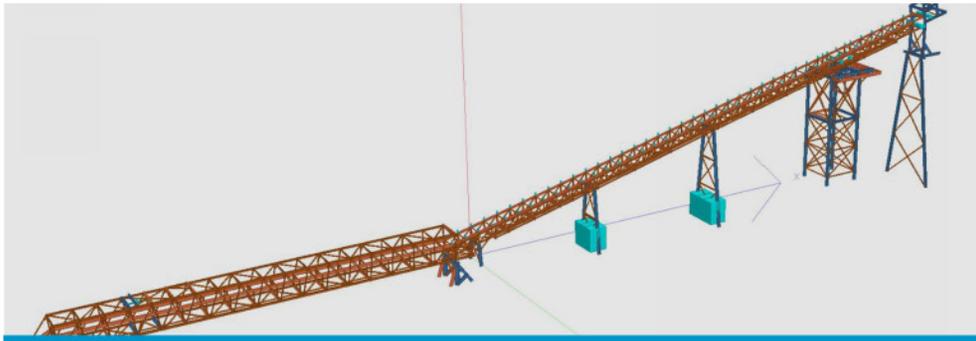
TIMELINE
2020-2021



CLIENT
SFP Pointe-Noire

Rail-mounted shiploader SL2 was built in the early seventies for transferring iron ore concentrate to ocean-going vessels. The shiploader had been experiencing extensive corrosion from exposure to marine environments and age. MGA was tasked with undertaking an assessment of the condition of the shiploader to determine the structural adequacy and fitness-for-service condition, by determining the extent of corrosion on the load-bearing elements and to qualify the risk of collapse in inactive condition.

The assessment included extensive site condition surveys and 3D laser scanning, in parallel with structural evaluation of the structural adequacy. Finite Element Method (FEM) modeling was used to assess equipment instability, the likelihood of collapse, the closure of limbs, and member pressures. After determining the current state of the structure, MGA modeled various reinforcement and rehabilitation alternatives, and prepared a full report on the results, conclusions, and recommendations to avoid collapse.



Lafarge Plant Structural Assessment

 LOCATION
Vancouver, Canada

 TIMELINE
2018

 CLIENT
FWS Group

The Lafarge Plant located in Vancouver, was built in 1974 next to the Fraser River, was experiencing extensive corrosion, foundation settlement and degradation due to age. The intent of this study was to provide the Owner with options to restore and renovate a structure or to replace it completely, taking into consideration the six-month operational needs and ensuring public safety.

MGA used a collection of available documents, in addition to field measurements of existing structure, to create models and simulations. These models were developed to simulate the existing conditions observed from the site surveys. MGA's analysis and simulations confirmed major structural issues with deformation, buckling, discontinuity, lamination and shifting of the entire structure. The current conditions were inadequate to provide the safety levels suitable for the continued safe operation of the facility. Therefore, MGA recommended full replacement of the structure with temporary reinforcement plan for safe operation for a limited time, during construction of the replacement.

American Dream Assessment and Rehabilitation

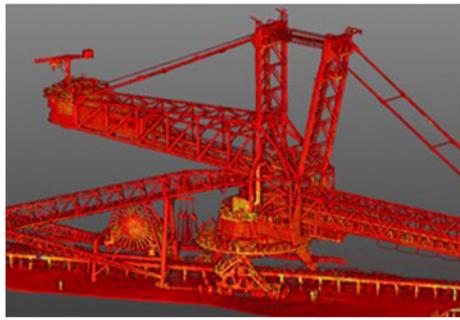
 LOCATION
New Jersey, USA

 TIMELINE
2012 - 2020

 CLIENT
Triple Five Group

The American Dream Meadowlands mall is a major commercial development with a value exceeding 6B USD. MGA is the structural engineering of record for four of the major buildings, with a value of about 1.6B USD, and covered an area of 4.8 million sf, including 500 stores and restaurants, an indoor waterpark with wave pool and an indoor amusement park. Over 3,000 piles were installed, 27,000 tons of steel was erected, and 91,000 cubic meters of concrete poured. During the construction phase that lasted from 2017-2019, critical field non-conformances and errors were reported daily and every structural non-conformance was remediated by MGA in a time-critical manner.

These non-conformances required additional repair work to restore the existing condition, included undertaking detailed site condition inspections to determine the causes of failures, preparing detailed repair procedures and construction methods. This included reinforcement of as-built existing conditions where design changes were requested by the owner to suit tenant requirement.



Wabush Stacker-Reclaimer Condition Assessment

 LOCATION
Quebec, Canada

 TIMELINE
2020-2021

 CLIENT
SFP Pointe-Noire

The Wabush Stacker-Reclaimer, which was constructed in 1963, was experiencing corrosion and other issues related to equipment wear. MGA was tasked with carrying out structural and mechanical condition assessments to determine the remaining service life. The structural portion of the inspection consisted of visual inspection, ultrasonic thickness testing and NDE testing (magnetic particle), laser scanning, 3D modelling, and a structural audit by de-rating corroded members. The mechanical portion of the inspection included assessment of the of equipment: hydraulic systems, control gates, large pinion and open gears, slew bearings, braking systems, rail travel systems, etc.

Following the inspections, MGA carried out analysis on the field measurements and prepared engineering reports with rehabilitation recommendations. MGA carried out service life analysis to determine the remaining useful life of the rehabilitated structures and develop the ongoing monitoring and maintenance plans for the equipment.



Confidential Forensic Engineering Project #1

 LOCATION
Vancouver, Canada

 TIMELINE
2020-2022

 CLIENT
Confidential

Undertaking condition assessment, detailed analysis, redesign, replacement, repair, and reinforcement for a major bulk materials export facility in the Vancouver harbour. This work is undertaken due to discovered major design deficiencies in a newly constructed facility.

Confidential Forensic Engineering Project #2

 LOCATION
Vancouver, Canada

 TIMELINE
2019-2021

 CLIENT
Confidential

Redesign and replacement of special storage grain export facility due to a catastrophic failure of the original facility. The redesign included major departure from the existing system but must match the existing foundation system. The new design involved the replacement of 1300 tonnes of structural steel. Detailed erection procedure was developed to facilitate replacement of the non-conforming structures.

Confidential Foundation Settlement Investigation

 LOCATION
Vancouver, Canada

 TIMELINE
2018-2019

 CLIENT
Confidential

The facility experienced settlement, which was believed to cause damage and non-performance to the superstructure. The review included extensive review of the design practice of similar installations.

Detailed assessment of the existing foundation design, review of the as built site settlement monitoring data, including the construction inspection reports. Structural assessment review of superstructure structural non-performance. Rendered professional opinion on the settlement and its effect on the performance of the foundation and the superstructure.



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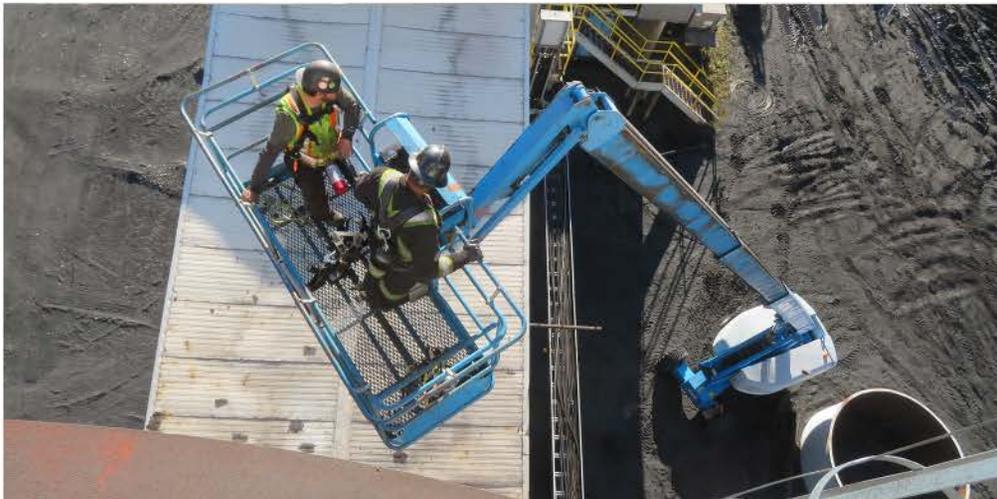
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