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## Design and Construction Quality: A Critical Factor in Disaster Preparedness by Vaughn I. Lezama, R. Eng.

CEO and Principal Engineer: Consulting Engineers Associates 2005 Ltd

#### Introduction

The built environment is comprised largely of buildings and infrastructures which we utilize for commercial, residential and recreational purposes and which shape our cities, towns, and livelihoods. The perennial disasters which we in the Caribbean face are predictable flooding and hurricanes, with earthquake being an ever present but unpredictable threat. Currently, flooding and hurricanes represent by far the most costly and disruptive events. While flooding invariably occurs on an annual basis, hurricanes do occur with alarming frequency and devastation. In the case of earthquakes, such as that which occurred in Haiti in January 2010, the major cause of deaths and injury is as a result of the partial or complete failure of structures built for human occupation or use.

Natural disasters are inevitable, but their impact on human lives and communities is not solely determined by the magnitude of the event. Instead, a significant determinant of the devastation is the quality of the built environment. The Haiti earthquake of January 2010 serves as a tragic reminder of the consequences of poor construction practices which translate into inadequate disaster preparedness. This article explores how the quality of the built environment serves as the first and most critical response to natural disasters.

#### **Disaster Preparedness**

Disaster preparedness refers to measures taken to prepare for and reduce the effects of disasters. That is, to predict and, where possible, prevent disasters, mitigate their impact, and to effectively response and cope with their consequences. However, earthquakes are the most unpredictable among the disasters we face and they can impact the build environment with devastating consequences.

Disaster preparedness planning usually involves identifying organizational resources as well as planning and developing policies, procedures and activities in order to achieve a level of preparedness to be able to respond timely and effectively to a disaster should one occur. However, we very often overlook the fact that the quality of the built environment could be a critical factor in mitigating the impact of hurricanes and earthquakes which are the two natural disasters to which we are particularly exposed.

#### The Built Environment as a Shield

There is indeed a level of disaster preparedness that hinges on the quality of the built environment and this was evidently demonstrated with the level of disaster which descended on the Haitian population on January 12, 2010. That earthquake event of Magnitude 7.0, when compared with two earthquake events of similar or higher intensity, namely the Mexico City EQ of 1985 (Magnitude 8.1) and the Kobe, Japan EQ of 1995 (Magnitude 6.9) resulted in far more death (230,000) and destruction than did Mexico City and Kobe (6,000) which respectively had a much larger or comparable magnitude and population size.

The built environment is more than a collection of structures; it is a frontline defense against natural disasters. Buildings, bridges, roads, and other infrastructure designed and constructed in accordance with applicable building codes and construction best practice can mitigate damage and save lives. A robust built environment ensures that structures:

- Withstand environmental stresses (e.g., earthquakes, hurricanes, floods).
- Provide safe refuge for occupants during emergencies.
- Facilitate rapid post-disaster recovery through functional infrastructure.

This protective function underscores the necessity for engineers, architects, and contractors to prioritize resilience in design and construction.

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#### The Case of Haiti: A Wake-Up Call

The impact of the 7.0 magnitude earthquake that struck Haiti in January 2010 should be a wake-up call to us here in Trinidad and Tobago and the wider Caribbean. That earthquake caused unprecedented devastation, resulting in over 200,000 deaths, countless injuries, and widespread destruction of property. While the earthquake's magnitude was significant, the staggering toll was largely attributed to the poor quality of the built environment.

#### Key factors to note include:

**Non-compliance with Construction Best Practice:** Many structures were built without adherence to even the most rudimentary elements of seismic-resistant design standards, making them susceptible to collapse.

**Substandard Materials and Construction Practices:** Poor-quality materials weakened the resilience of buildings.

**Overcrowding and Urbanization:** Dense, unregulated urban growth led to poorly constructed informal settlements that were highly vulnerable.

**Lack of Maintenance:** Many structures were already in a state of disrepair, further compounding the damage.

The disaster highlighted the fact that the earthquake itself did not kill; the collapse of poorly built structures did.

#### Hurricane Beryl: Another Wake-Up Call

Beryl became the earliest Category 5 hurricane on record in the Atlantic, achieving this status on June 29, 2024. The storm formed as a tropical depression on June 28, 2024, and rapidly intensified, reaching Category 5 strength within 24 hours. Beryl caused at least 36 deaths and resulted in estimated damages between US\$28 to US\$32 billion. The unprecedented intensity and early formation of Beryl have raised concerns among climate scientists about the influence of warming sea temperatures on hurricane activity. This hurricane which impacted several Caribbean islands is a wake-up call for climate resilience in the design and construction of the built environment as a disaster preparedness response.

#### Building Codes: The Cornerstone of Disaster Preparedness

Adherence to well-established building codes is the



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foundation of a resilient built environment. Building codes are informed by decades of research and lessons learned from past disasters, and they address critical aspects such as: Structural Integrity: Ensuring buildings can withstand seismic, wind, and flood forces and that foundations are compatible with the particular soils condition and terrain. • Material Quality: Specifying minimum standards for

construction materials.

• Occupant Safety: Mandating features such as fire exits, escape routes, and adequate ventilation.

• Site Selection: Avoiding construction in areas prone to flooding or landslides or alternatively taking the necessary precautions to ensure resilience.

• Quality Control Oversight: The absence of an appropriate level of quality control oversight, whether provided by a state regulator agency or a contracting agency is likely to result in undesirable outcomes. Even where a design may be code compliant, poor construction practice, if unchecked, can result in non-resilient building or infrastructure. Some countries , which experience frequent earthquakes for example, have demonstrate how strict enforcement of building codes can significantly reduce loss of life and property damage.

In Trinidad and Tobago, while engineers by virtue of their training adopt the application of established international building codes, there is as yet no legislated building code for the construction sector, except that there are local electrical and plumbing codes which are generally enforced by relevant agencies. However, the Design Branch of the Ministry of Works and Infrastructure provides guidelines for the use of relevant international codes for the design of building structures.

In addition, the Trinidad and Tobago Bureau of Standards publishes a document "Guidelines for the Design and Construction of Small Buildings", generally referred to as the "Small Building Code", which establishes minimum requirements for the design and construction of small buildings, including specific mitigation measures to minimize the impact of hurricanes, earthquakes and flooding. However, this is a voluntary Code to which little attention is paid by builders since it has no locus standi in statue, and there are no consequences for non-compliance, except that building



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inspectors in the Regional Corporations often use this Code as a guide for scrutinizing the design details of residential structures.

## Architects, Engineers and Contractors: Guardians of Resilience

The responsibility for creating a disaster-resilient built environment lies primarily with engineers, architects, and contractors. Their expertise in applying design principles, selecting quality materials, and ensuring compliance with codes is crucial. However, this responsibility extends beyond technical competence:

- Ethical Responsibility: Prioritizing safety and resilience over costcutting measures.
- Continuous Education: Staying informed about advancements in disaster-resilient technologies and practices.
- Community Awareness: Educating stakeholders about the importance of investing in safe and resilient construction.

By collaborating effectively with architects, engineers, and stakeholders, contractors contribute significantly to creating buildings and infrastructure that can withstand environmental, social, and economic challenges.

Here are key roles Contractors can play:

#### Interpreting and Implementing Designs

- **Collaboration with Architects and Engineers:** Contractors can ensure that the designs created by architects and engineers are properly understood and translated into physical structures.
  - Precision in Execution: Contractors can ensure that they follow specifications, materials, and techniques outlined in the design to achieve the intended resilience, and where necessary draw attention to areas where these may be deficiencies.

#### **Material Selection and Procurement**

- Sourcing Durable Materials: Contractors should seek to select materials that meet resilience standards, such as those resistant to natural disasters, corrosion, or wear.
- Evaluating Alternatives: They can provide feedback on cost-effective and sustainable material options without compromising on strength and safety.

#### **Quality Control**

Inspection and Testing: Contractors perform ongoing



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checks to ensure that construction processes adhere to quality standards.

- **Compliance with Codes:** They ensure that construction
- complies with the applicable building codes and resilience requirements.
  - **Incorporating Resilient Construction Practices** 
    - Wind and Seismic Reinforcement: In collaboration with the design Engineer, Contractors could be proactive in seek to implement special techniques and practices to achieve wind and earthquake resistant capabilities in built environment.

• Floodproofing and Waterproofing: For flood-prone regions, ensure proper grading, drainage systems, and use of water-resistant materials.

#### **Risk Management**

- Adapting to Site Conditions: Identify and address unforeseen site challenges, such as unstable soil or extreme weather, that could impact structural integrity.
- **Mitigation Strategies:** Plan and implement strategies to reduce risks during construction, such as securing materials against high winds or flooding.

#### Sustainability Integration

- Energy Efficiency: Incorporate energy-efficient construction methods and systems, such as proper insulation or renewable energy installations.
- Green Building Practices: Implement sustainable techniques, like using recycled materials or reducing construction waste.

#### **Post-Construction Maintenance Planning**

- Maintenance Recommendations: Provide guidance on maintaining the building's resilience over time.
- Training for Stakeholders: Train facility managers or owners on best practices for preserving the structure's durability.

#### **Innovation and Value Engineering**

- Adopting Advanced Technologies: Utilize modern tools like Building Information Modeling (BIM) to simulate and enhance resilience during construction.
- **Cost Optimization:** Suggest practical changes to enhance resilience while staying within budget constraints.

#### **Emergency Preparedness and Recovery**

• **Construction for Disaster Recovery:** Contractors often play a role in rebuilding resilient structures post-disaster, incorporating lessons learned from previous failures.

• **Temporary Infrastructure:** They might construct temporary but robust facilities to ensure functionality during crises.

#### **Lessons for Future Disaster Preparedness**

- Invest in Quality Construction: Governments and private developers must allocate resources for durable materials and skilled labor to ensure safety.
- Enforce Building Codes: Regulatory bodies state agencies must enforce compliance with building codes and construction best practice through rigorous inspections and penalties for violations.
- **Retrofit Existing Structures:** Older buildings should be assessed and retrofitted to meet modern safety standards.
- Educate and Train: Training programs for engineers, architects, and contractors should emphasize disaster resilience.
- Integrate Community Planning: Urban planning should incorporate disaster risk reduction, such as zoning regulations and evacuation routes.

#### **Conclusions and Recommendations**

The quality of the built environment is indeed a critical factor in disaster preparedness and resilience. The Haiti earthquake of 2010 is a sobering reminder of the devastating consequences of neglecting this responsibility, while the experience of hurricane Beryl is a wake-up call to action for climate resilience of the built environment. By prioritizing compliance with building codes, using quality materials, and fostering a culture of resilience, our built environments can be transformed into effective first responders against natural disasters, ultimately saving lives and minimizing loss.

One conclusion that can be drawn is that deficiencies in the design and/or construction of building and structures constitute a lack of natural disaster preparedness which can be the cause of much death and injuries followed by dislocation and despair. Architects and Engineers by their training, practice and certified level of competency and professional commitment are best able to incorporate into their building designs the provisions of the relevant codes, standards and best practice which apply to resilient buildings and infrastructure. Contractors on the other hand, play a crucial role in ensuring the construction of resilient buildings and infrastructure as envisioned by architects and engineers. Their expertise and involvement impact the project at various stages, from planning to execution.

Adaptation of the International Building Codes of the International Code Council (ICC) through a Government / ICC agreement is highly recommended.

ICC building codes are updated periodically to ensure they meet modern standards of safety, energy efficiency and environmental concerns and as such adaptation of the ICC Codes which are already recognized locally will be more than worth the required license fees. Such adaptation would allow us the facility to tweak those areas of the codes where necessary to meet our particular local requirements and thereby forego the cost of the research and analysis required to periodically update such codes.

Another advantage of such agreement is that it would allow the adaptation of the training elements available through the ICC, for the training of local Building Inspectors. Such training for officers in the local Regional Corporations would be of great value, given the current dearth of oversight presence and competencies in these corporations. Although the procedural rules of the corporations require a level of construction inspection and approval on the part of the corporations, this is practically non-existent.



Author Vaughn I. Lezama BSc., R. Eng. MASCE, FAPETT

#### Consulting Engineers Associates 2005 Ltd

Vaughn Lezama is a Civil Engineer with over 44 years of engineering practice. He is the Chairman and Principal Engineer at Consulting Engineers Associates 2005 Ltd. Eng. Lezama is registered with the Board of Engineering of Trinidad and Tobago and is a Fellow and Past President of the Association of Professional Engineers of Trinidad and Tobago. He is also a Member of the American Society of Civil Engineers. Eng. Lezama has extensive experience in **Engineering Designs, Technical** Studies, Construction Supervision, and Contract Administration. He is highly trained in the use of the FIDIC suite of Contracts. Currently, Eng. Lezama serves as the Registrar of the Board of Engineering of Trinidad and Tobago (BOETT) and is responsible for maintaining the Register of Engineers in accordance with the **Engineering Profession Act No. 34** of 1985.



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## Keeping Machines Moving: Equipment Maintenance in the Rainy Season

Article in collaboration with:



The rainy season introduces unique challenges for construction projects, with heavy downpours, sustained high humidity, and frequent flooding creating operational roadblocks. Beyond slowing down projects, these conditions can take a significant toll on your construction equipment, jeopardizing its reliability, longevity, and performance. For contractors, the key to overcoming these challenges lies in proactive and detailed maintenance practices that keep machinery running at its best.

#### The Challenges of the Rainy Season

The rainy season presents a substantial test for construction operations and their equipment. From persistent moisture to unstable terrain, here are some of the major issues that contractors face during this time:

1. Increased Moisture and Flooding Risks Excessive rainfall introduces excessive moisture into the environment, which can wreak havoc on construction machinery. Continuous exposure to water can lead to corrosion, rust, and even electrical system malfunctions. Poor site drainage further compounds these issues, frequently causing flooding that damages equipment stored in low-lying areas.

2. Muddy Terrain and Reduced Accessibility The wet conditions create soft, muddy terrain, making construction sites difficult to navigate. This can hinder equipment accessibility, escalate wear and tear on tires, and increase the probability of equipment becoming stuck. The risks of operator safety hazards also rise significantly.





## 3. Accelerated Wear and Tear on Machinery

Water exposure combined with high humidity speeds up the deterioration of sensitive machinery components, such as hydraulic systems, seals, bearings, and electrical parts. When these issues go unchecked, they result in premature breakdowns, costly repairs, and extended downtime.

#### Why Preventive Maintenance is a Must

Proactive maintenance plays a pivotal role in combating the challenges posed by the rainy season. Here's why making it a priority is critical for successful operations: **Prevents Costly Breakdowns and Delays** 

Equipment breakdowns during this season are not only disruptive but also expensive. Flooded sites and wet conditions make repairs more challenging, resulting in prolonged downtimes that delay project progress. Preventive maintenance helps address potential issues before they escalate into major failures.

#### **Ensures Operator and Crew Safety**

Properly maintained machines reduce safety risks by ensuring they perform reliably on hazardous, wet terrain. Preventive care minimizes accidents stemming from equipment malfunctions and keeps operators and site crews safe.

#### **Extends Machinery Lifespan**

Regular maintenance protects equipment from premature aging, allowing it to perform optimally in tough conditions. By addressing wear and tear systematically, contractors can prolong their machinery's useful life and avoid more frequent replacements down the line.

#### Key Maintenance Practices for the Rainy Season

To ensure the reliability and durability of your equipment, consider implementing these essential maintenance strategies:

#### **Regular Inspection of Machine Components**

Conduct frequent inspections of seals, tires, and hydraulic systems to detect any signs of cracks, leaks, or wear. Pay particular attention to areas prone to water infiltration, as these vulnerabilities can worsen quickly if neglected. Adherence to OEM-Recommended Service Checks and Intervals

One of the most critical steps in maintaining construction equipment is strictly following the Original Equipment Manufacturer (OEM)-recommended service checks and intervals. Most OEMs provide guidelines for daily, weekly, and monthly operator checks, including fluid levels, machine condition, and lubrication of critical grease points. These routine checks help prevent major issues by ensuring that machines are always in good operating condition and by allowing early detection of potential problems. Additionally, equipment owners must adjust these service intervals based on operator conditions. Harsh environments and poor-quality fuel may necessitate more frequent servicing to ensure optimal performance.

#### Waterproofing and Storing Equipment Safely

Protect sensitive components like electrical systems and electronics by covering or sealing them with waterproof materials. Store equipment in elevated, sheltered areas to keep floodwater and excess moisture at bay.

#### **Cleaning Drainage Systems and Filters**

Keep filters, ventilation, and drainage systems clean to prevent blockages. Mud, debris, and water in these areas can reduce equipment efficiency, cause overheating, and lead to mechanical breakdowns.

Use Weather-Appropriate Lubricants and Parts Standard lubricants may fail under the pressure of wet and humid conditions. Opt for weather-resistant lubricants designed to function effectively in these harsh environments. Consider using parts specifically engineered to withstand heavy moisture exposure for enhanced reliability.



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#### **The Business Case for Proactive Maintenance**

Committing to a comprehensive maintenance program during the rainy season offers both immediate and long-term benefits:

#### Lower Long-Term Costs

Though regular maintenance requires an upfront investment, it mitigates larger repair costs by addressing small issues before they escalate. Ignoring maintenance can lead to costly component failures and even complete machine overhauls.

#### Better Productivity in Adverse Weather

Equipment that is serviced consistently operates more reliably, reducing downtime caused by malfunctioning machines. This translates to improved efficiency and helps maintain productivity even during challenging weather conditions.

#### **Enhanced Equipment Resale Value**

A machine with a well-documented maintenance history holds its value far better than neglected equipment. Buyers are more likely to pay a premium for machinery they know has been properly cared for.

#### Improved Adherence to Project Timelines

Equipment failures can derail project schedules, causing missed deadlines and strained client relationships. Preventive maintenance helps ensure that your machines stay operational, supporting smoother workflows and timely project completion.

#### Invest in Maintenance to Keep Construction Moving



The rainy season is a test for any contractor, but it's also an opportunity to fortify your operations through smart maintenance practices. By adhering to OEM-recommended service checks, waterproofing sensitive components, and taking proactive steps to keep your equipment in peak condition, you can mitigate the risks posed by harsh weather.

The payoff is clear. Invest in proper maintenance today, and you'll protect your equipment, ensure operator safety, and maintain project momentum - even when faced with relentless rains. Take these steps now to keep your construction operations moving forward, rain or shine.

# Reforming Structural Engineering Design Peer Review Practices in Trinidad and Tobago's Building Permit System

by Eng. Brendon C. Inniss BSc. MSc, R.Eng. C.Eng. FICE, FASCE, FAPETT

#### INTRODUCTION

The Republic of Trinidad and Tobago has a building permit system in place that is implemented by the Ministry of Works and Transport (MOWT), fourteen (14) regional corporations and the Division of Infrastructure, Quarries and Urban Development (DIQUD) in Tobago. Although the MOWT is responsible for the review and approval of major public building projects, the projects that are earmarked for the cities do not fall within its jurisdiction and thus the MOWT is not afforded the opportunity to provide the required oversight and due diligence that is required. Therefore, it is subsequently left up to the integrity of the consultant responsible for the project to finance a peer review of his own work. Thus, public safety is "compromised" by the same system that was created to protect and preserve it. Fortunately, State Contracting Agencies; UDECOTT, NIDCO, NIPDEC etc. within recent years have started a practice whereby the engagement of peer review consultants has

become the norm to provide the much-needed supplementary quality assurance measures on multi-million-dollar national projects. Unfortunately, it is the manner in which these peer reviews are conducted, that leads to lengthy and costly delays – the subject focus of which this paper will now seeks to explore.

**The Absence of an Appropriate Peer Review Procedure** Peer reviews have been enforced for some time now, but the manner in which they are executed results in lengthy delays, despite being set up to do the opposite. Structural design engineering can be subjective and is vulnerable to varying engineering opinions. A clash of professional opinions

typically results in long impasses which can inadvertently extend beyond the contract period of the reviewing consultant. A change to the reviewing consultant in mid-review, can lead to further clashes in professional opinions and the overturning of approvals that have already been granted and communicated. There are no known standard operating procedures that advise on how to treat with several issues originating from this situation. Fortunately, advice on how to treat with matters like these can be sought from FIDIC,

the Engineers Joint Contract Documents Committee (EJCDC) in the USA, the Practice Note 2 in New Zealand and Professional Engineers Ontario (PEO) in Canada all provide detailed insight on how to treat with third party peer reviews.

#### **Privatization of Structural Building Approvals**

The arrangement of course, should be carefully established and managed by a steering committee to ensure issues such as conflict of interest, nepotism and other acts of unethical and even illegal practices do not taint the overall objective. Currently, the Ministry of Energy and Energy Industries (MEEI) has a Technical Guidance Document that outlines the role of the Certified Verification Agent (CVA) in the MEEI's approval regime. A CVA is a qualified technical practitioner who has been approved by the MEEI to conduct peer reviews on engineering deliverables. The document clearly outlines; eligibility requirements, liability coverage, ethics, confidentiality, reporting and even has a register of CVAs approved to act on behalf of the MEEI. There is also a separate register from the MEEI that lists the names and addresses of all the CVAs authorized to perform third party peer reviews on behalf of the MEEI. However, the document does not address in detail a number of important issues such as the do's and don'ts of a CVA who is conducting a peer review. Notwithstanding that, at the very least, the framework is already in place for conducting third party reviews, even if there is room for improvement. The document unfortunately, stopped short of identifying more specifically, the challenge with the construction permitting process and the proposed SOPs for guiding the peer review process.

#### THIRD PARTY ENGINEERING REVIEWS

Third party engineering reviews or peer reviews is an excellent quality assurance measure geared towards ensuring a high standard or quality of deliverables, in terms of accuracy, safety, serviceability and economics. Peer reviews are typically utilized when a project is; complex, unique or has an unusual form, uses new technology or materials, or poses unusual risks. There are five (5) types of peer reviews;

- Forensic Peer Reviews required as part of an investigation in the aftermath of a failure
- Concept or Strategic Peer Review required prior to the commencement of engineering work
- Specific Peer Review focuses on a particular aspect of the works
- Expert Peer Review required as part of a legal or disciplinary process
- Regulatory Peer Review required by a regulatory body to verify compliance with building codes and standards

With respect to Regulatory Peer Reviews, there is no document available to the public from the MOWT that outlines in detail how peer design reviews should be conducted. The technical guidance documents prepared by; the EJCDC in the USA, the Practice Note 2 in New Zealand and PEO in Canada all provide information on:

- How a peer review should be conducted
- Divisions of responsibility for the client, designer and reviewer
- Qualifications of the reviewer
- Ethical Obligations
- Conflict of Interest
- Confidentiality
- Fairness
- Good Faith
- FAQs

By having a detailed technical guidance document, project stakeholders would avoid certain problems that could arise during the review, resulting in lengthy, expensive delays. Additional problems include;

> Acting in bad faith – intentionally making malicious statements that can be detrimental to the reputation, professional status or financial interests of the

> > design engineer. Result - dispute.

 Poor Engineering Judgment – requesting or demanding changes to the design that will compromise structural integrity due to its non-compliance with basic engineering first principles and/ or Code of Practice. Result – extended rounds of unnecessary back and forth communication

• Conflict of interest – executing a peer review contract with an ulterior motive to intentionally skew the facts or outcome of the review in favour of one party over

another. Result – dispute.

• Confidentiality – unauthorized disclosure of the authoring engineer's intellectual property to a third party or using proprietary material that can commercially benefit the reviewer. Result – dispute.

- Unfairness making unreasonable requests/demands that requires significant uncompensated man-hours for the authoring engineer to provide appropriate responses to. Result – extended rounds of unnecessary back and forth communication.
- Perfunctory Reviews submission of multiple defects lists based on initially hasty and cursory assessments of the works resulting in the identification of errors in the second or third round of reviews that were not (and should have been captured) during the first round of reviews. Result – extended rounds of unnecessary back and forth communication
- Liability imposing or forcing design alterations that essentially changes the authoring engineer's intent without accepting any form of liability. Result dispute.
- Negligence accepting peer review contracts when the reviewer is knowingly unqualified to properly fulfill the requirements of said contract. Result dispute.

#### The Role of the Peer Reviewer

One of the more comprehensive guidelines for the conducting of a peer review is outlined by FIDIC. In this document, it is stated that the reviewer's role is to provide a due diligence check on compliance with codes, standards and internationally recognized and accepted design engineering processes. It is not an opportunity to displace a designer from his position or to promote any unethical, self-laudatory behavior. To ensure that the process is always perceived as positive and non-threatening, the reviewer should discuss the findings of the review with the authoring engineer before issuing the final report to the client to avoid any misunderstanding, embarrassment and unnecessary resentment.





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Brendon Inniss is the Principal Engineer, Chief Executive, Quality Assurance and Business Development Manager at Aleron Limited, a consultancy practice which he has headed since its inception in 2011. He is a Registered Structural Engineer with the Board of Enginering of Trinidad and Tobago, a Chartered Engineer (UK), a Fellow of the Institution of Civil Engineers (UK), a Fellow of the American Society of Civil Engineers and a Fellow of the Asociatioin of Professionl Engineers of Trinidad and Tobago. He has been the Engineer of Record on a broad spectrum of projects in Trinidad and Tobago and the Eastern Caribbean and has worked on a wide range of projects which includes: multi-storey commercial & residential buildings; primary & secondary schools; hotel resorts, warehouses and private single-family residences.

Brendon has acquired and maintained ISO 9001:2015 certification for Aleron and has continuously worked on improving QA/QC measures within his organization and ensures that he and his diverse team actively maintains technical capability and competency through Continuing Professional Development.

# Mastering a Bill of Quantities: A Comprehensive Guide for New Contractors



For new contractors stepping into the competitive world of construction, managing costs and ensuring accuracy in tendering processes can feel overwhelming. One document stands out as a beacon of clarity in this process: the Bill of Quantities (BoQ).

If you've heard the term thrown around but felt unsure about its purpose or how to approach it, this guide is for you. We'll simplify what a BoQ is, why it matters, and how you can avoid common pitfalls. By the end of this article, you'll have actionable tips to master your next BoQ and set yourself up for success.

#### What Is a Bill of Quantities?

A Bill of Quantities (BoQ) serves as a detailed document that breaks down all the work required for a construction project into measurable components. It serves as the accuracy baseline for pricing and tendering. But what exactly goes into a BoQ, and who is responsible for preparing it?

#### Key Components of a BoQ

#### **Description of Works**

Provides clear, itemized descriptions of the work to be carried out. For example, "excavation for foundation to a depth of 2 meters."

#### Quantities

Indicates the amount of each work item, typically measurable in square meters (m<sup>2</sup>), cubic meters (m<sup>3</sup>), kilograms (kg), or other standard units.

#### **Unit of Measurement**

Specifies how each item is measured, ensuring clarity and standardization.

#### **Unit Rates**

Lists the cost per unit of each work item, often based on materials, labor, and equipment usage.

#### **Total Costs**

Provides a cumulative figure, multiplying quantities by their respective unit rates.



The BoQ is typically prepared by a Quantity Surveyor after the design phase of a project and prior to the tendering stage. It acts as a bridge between the design on paper and the real-world implementation, ensuring all stakeholders are on the same page about the project's scope and cost.

#### Why a BoQ Matters for Cost Control

For contractors, especially those just starting out, a well-prepared BoQ is much more than a bureaucratic formality. It can be the difference between making a profit and taking a financial hit. Here's why: Budget Planning and Financial Forecasting

The BoQ provides a clear roadmap of anticipated costs, enabling effective budget allocation and cash flow planning. It helps you predict when and where your financial resources are needed, avoiding unpleasant surprises mid-project.



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Fair and Comparable Tendering By providing standardized pricing formats, BoQs make it easier to compare bids from contractors. This benefits contractors too, ensuring they compete on equal footing and can confidently showcase their value. Identifying Cost-Driving Elements A BoQ highlights parts of the project that drive costs, such as premium materials or intricate designs. Identifying these allows you to strategize on savings without compromising on quality. Reducing Disputes Scope and payment-related disputes

are minimized when clear, quantifiable records exist. The BoQ protects contractors and clients alike by reducing ambiguities.

#### **Common Mistakes Emerging Contractors Make with BoQs**

Emerging contractors often face steep learning curves when dealing with BoQs, which is why it's crucial to avoid these common mistakes: **Misreading Quantities or Units** 

Failing to correctly interpret measurements can lead to underpricing, overpricing, or even logistical issues on-site.

#### **Overlooking Provisional Sums or Contingencies**

Ignoring elements like provisional sums (i.e., allowances for undefined items) can leave you exposed to unexpected costs later on.

#### Failing to Include Overheads or Markups

Forgetting to factor in operational costs, contingency reserves, or profit margins can result in financial strain during project execution. **Not Aligning with Actual Site Conditions** 

Failing to assess on-the-ground site conditions against the BoQ assumptions can lead to costly miscalculations.

#### **Tips for Improving Accuracy and Reducing Risk**

Great news—not only can these mistakes be avoided, but you can even improve your chances of success by following these expert tips: **Cross-Check Drawings and Specifications** 

Ensure that the BoQ aligns perfectly with the project's designs and specifications. Double-check for discrepancies between engineering diagrams and the listed works.

#### Seek Clarification on Unclear Items

If anything in the BoQ feels ambiguous, don't hesitate to ask questions. Misinterpreting an unclear item today could cost you tomorrow.

#### Use Reliable Data for Pricing

To ensure accurate rates, lean on historical pricing data, local market insights, or verified supplier quotes. For larger projects, software like CostX or Buildsoft can help simulate costs based on past trends.

#### Account for Inflation and Lead Times

Construction schedules often span weeks or months. Factor in potential inflation or delivery delays when pricing long-term projects. **Review With a Quantity Surveyor** 

For emerging contractors, collaborating with a professional Quantity Surveyor can save time and money. Their expert eyes will catch any red flags before submission.

#### **Tools and Templates to Help Simplify BoQs**

Technology has made managing BoQs far easier than it once was. An array of tools and resources are available to streamline this process:

- Microsoft Excel Templates: Simple prebuilt templates available online can give you an easy start.
- Construction-Specific Software: Platforms like Candy CCS, CostX, or PlanSwift can automate processes like measurement and costing.
- Online Pricing Libraries: Tools like BCIS and RSMeans provide cost guidance for various building materials and civil works.
- Investing a little time to learn these tools will pay off in both accuracy and efficiency for your construction business.

#### Your BoQ Can Be a Strategic Advantage

A well-prepared BoQ isn't just "paperwork." It's a powerful tool that can directly impact the profitability and success of your projects. For emerging contractors, mastering the basics takes time, but the payoff is enormous. Attention to detail, proactive communication, and ongoing learning are your strongest allies as you tackle new projects.



# Digital Tools Revolutionizing Construction in Trinidad & Tobago

From faster decision-making to better project precision, digital tools are reshaping how construction firms operate globally. Trinidad and Tobago's construction sector is showing signs of catching up. Although the pace of adoption may be slower than in some countries, local firms are gradually turning to these tools to boost their efficiency and competitiveness.

Whether it's drones offering a bird's-eye view of project sites or project management apps streamlining schedules, one thing is clear: digital tools aren't just an option anymore. They're a necessity for staying relevant in a rapidly evolving industry.





#### The Shift Toward Digital Construction in T&T

Across the globe, the construction industry is undergoing a tech revolution. Companies are turning to digital solutions to solve common industry pain points such as communication hurdles, cost overruns, and slow project timelines. Trinidad and Tobago is no exception.

Though traditionally slow to adopt cutting-edge tech, Trinidad and Tobago's construction firms are beginning to see the value in digital transformation. The COVID-19 pandemic acted as a major catalyst, pushing many organizations to experiment with digital tools for remote site monitoring, virtual meetings, and streamlined project management.

#### Why this shift matters for T&T:

- Faster decision-making with real-time data tracking.
- Cost savings through optimized resource allocation.
- Improved worker safety from tools like drones and predictive safety software.

While government incentives or large-scale national infrastructure projects to drive adoption are still sparse, there's significant potential for growth. Public sector-backed training programs or subsidy initiatives could further accelerate this adoption and make digital resources accessible even to SMEs striving to stay competitive.

#### Eye in the Sky – Drones for Surveying and Site Monitoring

What's faster, cheaper, and more precise than traditional land surveys? A drone!



Drones are emerging as gamechangers in Trinidad and Tobago's construction market. They simplify processes like aerial mapping, site surveys, progress monitoring, and even safety inspections. These compact tools eliminate the necessity of labor-intensive groundwork, allowing site managers to track progress in hours versus days.

#### Key Benefits of Using Drones Locally

**Aerial Mapping:** Generate high-resolution site maps for planning and inspection purposes.

**Cost Savings**: Reduce expenses associated with extensive manual surveying.

**Improved Safety:** Avoid putting workers in hazardous areas by using drones for inspections.

Local construction firms or even independent contractors can access drone services through global providers or purchase entry-level equipment from domestic suppliers. While upfront costs may seem steep, many businesses quickly recoup their investments through time and labor savings.

#### **Project Management Apps – From WhatsApp to Full Platforms**

Construction management is no longer a paper-and-pen effort. Digital tools ranging from basic apps to robust project management platforms are transforming oversight and collaboration for construction firms.

#### Local Adoption - What Are Firms Using?

WhatsApp Groups: Often used informally for quick jobsite updates, but lacking dedicated features.

**Basecamp and Trello:** Affordable entry-level project management tools ideal for small teams.

**Procore and Buildertrend:** Advanced platforms designed for comprehensive oversight, from scheduling to client communications.

Even introducing simple solutions like Google Workspace or Microsoft Teams can help smaller firms organize their files, schedules, and teams. These tools don't just save time; they enhance transparency and collaboration, which is critical in high-stakes, deadline-driven environments like construction.
### **Estimating and Tendering Software**

Cost estimation is a notoriously complicated aspect of project planning. Enter estimating and tendering software. By digitizing these processes, construction firms can quickly create accurate quotes, bills of quantities, and tender documents.

### **Benefits for T&T Firms**

Speed: Quote large projects in hours, not days. Accuracy: Reduce costly errors caused by manual calculations. Competitiveness: Present professional, precise estimates to gain an edge over competition.

For smaller firms, templates made in tools like Excel or Google Sheets can bridge the gap while more complex platforms like CostX or ProEst remain ideal for larger projects. Free trial versions of such tools can help firms explore their value before committing.

### Virtual Design & Collaboration Tools

Gone are the days of static 2D blueprints. Today, architects and engineers are harnessing tools like AutoCAD, Revit, and SketchUp for immersive 3D designs and collaborative creation.

### Key Advantages of 3D Tools in T&T:

- Create detailed, client-friendly visualizations of finished projects.
- Detect design errors earlier, saving time and money during the construction phase.
- Facilitate remote collaboration among teams spread across different locations.

While these tools are becoming increasingly popular among larger firms and architecture studios, even smaller businesses can adopt basic versions or free platforms to start offering added value to their clients' experience.





### Challenges and Opportunities in Digital Adoption Challenges

Adopting digital tools isn't without hurdles, especially for SMEs in Trinidad and Tobago. **Key barriers include:** 

**Cost:** High upfront software or equipment costs remain a concern for smaller organizations.

**Lack of Training:** Employees may feel unprepared to adopt or use the technology effectively.

**Resistance to Change:** Old habits die hard, and many are hesitant to move away from traditional methods.

### **Opportunities**

Fortunately, growth in tech accessibility is helping overcome these issues. Consider these advantages available locally and globally. Subsidized training programs for construction software or drone operations.

Affordable subscription plans for many highquality digital tools.

Leveraging younger employees' technical skill sets to upskill teams internally.

Educational institutions can also play a significant role in embedding these skills into their construction curricula, ensuring the next generation is fully equipped to lead the industry forward.

### **Taking the Leap Forward**

Digital transformation isn't just a passing trend; it's a fundamental shift in how the construction industry operates. For firms in Trinidad and Tobago, integrating even simple tools like project management apps or dipping into 3D design software can drastically improve productivity, client satisfaction, and profitability.

## Hold the Line – And In So Doing, Uphold Integrity The Essential Role of a Project Manager in the Caribbean and Beyond

The phrase 'hold the line' resonates deeper in construction than many realize. It's a call not just to resist compromise but to carry the banner of professional discipline when the more straightforward path tempts you. Discipline in this business isn't just about moral standing—it's the cement that binds your work ethic, decisions, and leadership. Every project, especially in the Caribbean, where resources are limited and cultural pressure is present, tests this resolve. In the blazing heat of a construction site in Dominica—dust swirling, tempers flaring, and the client breathing down your neck like the midday sun—you'll hear it before you feel it: "Boss, we need to move the deadline."

"Run the pipe as the supplier sent it."

"That's minor—just patch it and paint."

"The concrete slump is only 1 inch over, it's getting dark let's use it."

In those moments, when the pressure is thick and your options are thin, a project manager must reach for the core of what they are made of.

That's when you must hold the line.

Because in construction, especially in the Caribbean, your role isn't to bend. It's to build boundaries that protect your project, people, and principles.

In the chaos of project pressures, 'holding the line' must become a reflex. This principle serves as your compass, steadying you against fluctuating expectations, unclear directions, and the temptations of shortcuts. Holding the line is an internal decision made hundreds of times each



day, visible in the external quality of your work. It could be refusing to compromise on safety standards, insisting on proper documentation, or standing firm on the agreed timeline.

### What Does It Mean to "Hold the Line"?

It's a military term: Don't give up ground, no matter the pressure.

In project management, it means:

- Protecting the scope
- Upholding quality
- Refusing shortcuts
- Documenting everything
- Saying "no" when "yes" is easier

Holding the line is about discipline, accountability, and integrity.

Mistakes have a way of making the message hit harder. It's easy to preach standards from a place of theory, but owning past lapses gives your leadership roots. It tells your team: I've been there, and I've learned the hard way—so now, I lead the right way. In that honesty lies transformation.

### I've Walked the Line—and Slipped

Let me be honest: I've folded before.

• Agreed to undocumented changes

• Accepted out-of-spec materials to "keep moving"

• Stayed quiet when the client asked for something outside the contract

Each time I compromised, I paid the price. The project suffered, the company spent more, and my reputation took a hit. But more importantly, the integrity of the project was compromised, and the safety and satisfaction of the end-users were put at risk. These are the real costs of not holding the line.

But from those falls came the lesson:

Examples like this become folklore within teams—they teach silently but powerfully. You reinforce technical knowledge and a culture of care and precision. These stories are not about perfection but about pursuing it





under fire. That's what makes leadership both heavy and sacred.

"A project manager's job is not to be liked but to be responsible."

### **Real Example: Lumber That Warped**

A supplier tried to pass off subpar lumber that didn't meet moisture content specs. We were behind. My foreman said, "Boss, nobody will notice."

But I held the line. Sent it back. Lost a month. This image isn't just dramatic—it's accurate. A project manager's role is lonely, exposed, and critical. There is no safety net, just your track record, clarity, and ability to stay upright when every distraction tugs at your balance. Knowing that keeps you alert and sharp. Later, we learned that the lumber was twisted and warped. If we had used it, the floor would've failed.

That's what holding the line looks like. Yes, it may cause short-term pain but leads to long-term gain. The project is saved, and your integrity remains intact. Remember, the decisions you make today will shape the future of your project. Stay strong and hold the line.

Picture This...

Imagine a tightrope walker between two towers.

- The rope is your contract
- The wind is a client request

It's not always malicious—sometimes naivety, pressure from above, or lack of technical understanding. But the result is the same: unapproved scope leads to chaos. Your job is to translate good intentions into a proper process. Professional doesn't mean dismissive—it means deliberate.

• The noise below is supplier excuses, consultant chaos, and on-site drama

You're that walker. No net. No pole. Just your judgment, resolve, and records.

Lean too far toward convenience, cost-cutting, or appeasement—and you fall.

### When Clients Push Scope

In the Caribbean, scope creep often wears a smile: "It's just a small change."

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"Just a few more tiles—don't charge us." "Let's just get it done."

That "just" becomes a habit. Soon, you'll deliver a new project with the same timeline and budget.

Suppliers are part of your team, but their goals aren't always aligned with yours. Trust is essential, but so is verification. Don't allow friendship pricing or longstanding relationships to override your obligation to your client or craft. Specs are not suggestions—they are the minimum standard of performance. That's not management. That's madness. You must protect the integrity of the scope:

- "Let's assess the change."
- "Let's document it."
- "Let's price it."
- "Let's be professional."

They may frown now, but they'll thank you when it's done, clean, and closed.

We don't manage projects in a vacuum but in heat, bureaucracy, scarcity, and culture. Understanding the landscape is not an excuse for failure, but a requirement for strategic navigation. Great Caribbean project managers don't complain—they adapt, anticipate, and deliver excellence.

### When Suppliers Fall Short

Specs matter. Submittals matter—accountability matters.

Because when the concrete cracks or the finishes fade, they don't call the supplier.

They call you.

Leadership is not about who gets blamed—it's about who takes responsibility. Supporting your team when they're right or even when they're learning builds a culture of growth and loyalty. A strong team doesn't emerge by accident—it's forged by the leader's consistent advocacy and fairness.

Don't inherit someone else's mistake. Read the fine print. Ask the hard questions. You're not being difficult—you're being professional.





### **Caribbean Reality Check**

Let's be real:

Politics hum behind public tenders Suppliers expect full payment for half the delivery. Labour comes undertrained or absent. Consultants react instead of anticipate Clients want Champagne finishes on a Mauby budget Still—this is our crucible.

If you can thrive here, you can thrive anywhere. This list isn't theory—it's field-tested, dust-covered, sweat-earned practice. Each item is a battle scar that teaches you to fight for your standards without becoming rigid. Balance conviction with flexibility, but never at the cost of core quality or ethical erosion.

### When Holding the Line Means Backing Your Team

Holding the line isn't just standing up to pressure it's standing for your people.

Caribbean culture values relationships, and rightly so. However, relationships built on silence, compromise, or compliance erode trust over time. Proper respect is born from consistency and courage, not convenience. The leaders who dare to say 'no' respectfully often become the ones others trust most in the long run.

Sometimes your engineer, foreman, or site clerk gets blamed. Maybe they messed up. Perhaps they didn't. But they need to know you won't throw them under the bus.

I once had to publicly defend a Foreman against a consultant who didn't realize the drawings were issued late. The easy path was silence, but I stood up, backed my team, and let the records speak. "My engineer stood taller that day. And so did I." Backing your team doesn't mean shielding them from accountability. It means ensuring fairness, respect, and truth.

This is a reminder that leadership is not volume—it's vision. Your influence is not in how loudly you speak, but how firmly you act. Let your conduct inspire

others to raise their game, not out of fear, but from respect for the craft and the cause. Because when your team knows their leader has their back, they stand up, not just show up.

### What It Looks Like to Hold the Line

Reject undocumented variations—no matter who asks. Refuse handover until snags are complete. Don't sign off on subpar materials. Keep records of everything. Call out your team when needed. Say "no" when others say "just this once."

### **The Cultural Dilemma**

In Caribbean culture, being a "yes man" often wins you friends.

But saying yes to everything is not leadership.

It's fear dressed as diplomacy.

People will respect you when you are fair, consistent, and professional—even if they dislike your words.

### A Final Word: Lead With Backbone, Not Bluster

Holding the line is not about barking orders.

It's about leading with calm conviction, holding everyone, including yourself, to the highest standard.

Because you're not just delivering a structure.

You're building trust.

You're defending reputations.

You're raising the standard for how construction is done in the Caribbean.

You won't always get applause.

But when the dust settles, your integrity will still be standing.

So I'll ask you:

Where are you feeling the pull to give in?

Where is your line being tested?

Do you have the strength—and support—to hold it? Because when we hold the line, we don't just finish the job.

We build the standard.



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Mr. Mikey Thackoor is an experienced professional in the construction industry with a track record of over 25 years working across the globe. Presently, he holds the position of Head of Operations (Eastern Caribbean) at NH International Caribbean Ltd. In this role, Mr. Thackoor provides expert leadership in project development, design, implementation, and execution to ensure optimal results are achieved.



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## Understanding Employment Contracts: Avoiding Pitfalls in Contractual Relationships

Over the years as an HR professional, I have encountered many variations of employment contracts—many of which were incorrectly applied. A company must determine the correct type of contractual arrangement—whether it is a contract of service or a contract for service. I have seen instances where contracts of service were issued to independent contractors when in fact they should have been contracts for service. The conditions of the relationship differ significantly between these two arrangements, particularly when distinguishing an employee from a contractor. Let us take a closer look at these:

### Contract OF Service

- The contract may be fixed-term with defined dates or full-time with no termination date.
- It outlines the formal relationship between employer and employee.
- It governs terms such as working hours, probationary period, compensation, vacation, duties and responsibilities, and other employment conditions.
- The employee is obligated to perform tasks personally and cannot delegate them to others.
- The company is responsible for statutory deductions.
- Performance is managed through scheduled assessments.
- Working hours are regulated by the contract.

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### Contract FOR Service

- This is not an employment contract but an independent contractor agreement.
- It is an agreement between a business and a selfemployed person or another business to provide a specific service for a defined period.
- The contractor may subcontract tasks.
- The contractor is not entitled to employee benefits.
- The company is not responsible for statutory deductions.
- Performance is measured against agreed contract deliverables.
- Working hours are not regulated by the company.

### **Legal Framework**

In Trinidad and Tobago, two courts have jurisdiction to determine employment contract disputes: the High Court and the Industrial Court. Before the establishment of the Industrial Court, the High Court settled all employment disputes based on common law principles, focusing strictly on the boundaries of the contract itself.



To address these limitations, the Industrial Court was established. It has jurisdiction over employment contract disputes and can grant remedies to workers. Importantly, the Industrial Court considers not just the cause of dismissal, but also how the dismissal was handled and whether it aligns with good industrial relations practices. These practices refer to fairness, transparency, and respect for employee rights throughout the employment and termination process. The Court adheres to ILO Convention 158, which outlines fair termination standards.

### **Essentials of an Employment Contract**

The terms of an employment contract define the rights and obligations of both the employer and employee. These terms may be mandated by legislation, a collective agreement, or established through custom and practice. While common law does not require that employment contracts be in writing, oral agreements are equally binding.



However, based on industry best practices,

a written contract offers the clearest evidence of mutual agreement and serves as the most reliable record of the employment relationship.

### Key components of an employment contract include:

- Start and end dates for fixed-term contracts; start date for full-time employment.
- Probationary period and conditions governing confirmation.
- Duties and responsibilities, typically outlined in a job description.
- Key performance indicators (KPIs) for performance measurement.
- Benefits such as vacation leave, sick leave, casual leave, pension, and health plans, where applicable.
- Compensation, which must meet or exceed the rates outlined in the Minimum Wages Act.
- Termination clauses and notice periods.

#### **Implied Duties**

The contract implies certain duties on both parties. The employee is expected to follow reasonable and lawful instructions, exercise due diligence, cooperate with the employer, act with honesty, and refrain from disrupting or harming the business. Conversely, the employer is expected to provide work, pay wages, ensure a safe working environment, and maintain trust and confidence in the employment relationship.

### **Variation of Terms**

In addition to the employment contract itself, organizations may use supplementary documents such as employee handbooks, confidentiality agreements, and codes of conduct. However, it is critical to note that the employer cannot unilaterally change the terms of employment. Any amendments must be discussed and mutually agreed upon with the employee.

### **Override by Law or Practice**

There are instances where the terms of the employment contract may be overridden. For example, while a contract might specify a one-month notice period, this provision may not always be enforceable in dismissal cases. The Industrial Court evaluates whether the termination was reasonable and conducted in accordance with good industrial relations practices. If not, the Court has the authority to invalidate the action or award compensation or reinstatement.



### **Relevant Case Law**

The following cases from the Industrial Court demonstrate how these principles are applied in practice:

### TD 140 of 1997 – Bank and General Workers' Union v. Home Mortgage Bank

The employer terminated the worker's employment without notice nearly four months before the contract's expiry date. Although the employer relied on its contractual right to terminate, the Court held: "The employer was nevertheless required to give a reason or reasons for the termination and the worker was entitled to have such reason or reasons before the termination to enable him to make any representation... The employer's failure to do so was in breach of good industrial relations practice. It does not matter that the contract was a short-term contract. The Act's protection applies to all persons who work under contracts of employment, regardless of the duration."

### TD 21 of 2015 – Bank and General Workers' Union v. Tobago House of Assembly

The worker was employed on successive fixed-term contracts for 11 years before being informed that his contract would not be renewed, even though the position still existed. The Court ruled:

- The worker was not on annual fixed-term contracts but was continuously employed for eleven years.
- The Assembly failed to justify the worker's removal.
- The job of Environmental Investigator still existed.
- The removal was harsh, oppressive, and contrary to good industrial relations practices.
- The Assembly was ordered to pay \$325,000.00 in damages.

### Conclusion

In summary, employment contracts are not absolute instruments. Their provisions must align with statutory requirements (such as the Minimum Wages Act), any applicable collective agreements, implied duties of both parties, and the overarching principles of good industrial relations practice. Where inconsistencies arise, the courts may override contractual terms in favor of equity and fairness.

If you require further information and advice on employment contracts or employment matters, please reach out to the author at humancapitalsolutions18@gmail.com.

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