

UNIVERSIDAD PARA LA COOPERACION INTERNACIONAL  
(UCI)

PROJECT MANAGEMENT PLAN FOR THE CONSTRUCTION OF THE EAST  
BANK-EAST COAST (DIAMOND TO OGLE) HIGHWAY LINKAGE PROJECT IN  
GUYANA.

SEON BRATHWAITE

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Master in Project Management (MPM) Degree

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James Perez  
TUTOR

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Róger Valverde Jiménez  
REVIEWER No.1

---

Carlos Brenes M  
REVIEWER No.2

---

Seon Brathwaite  
STUDENT

## **DEDICATION**

I dedicate my dissertation work to my family and many friends who have supported me throughout the process. I will always appreciate all they have done to ensure I was least distracted.

## **ACKNOWLEDGMENTS**

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## **ABBREVIATIONS AND ACRONYMS**

AASHTO - American Association of State Highway and Transportation Officials

AISI – American Iron and Steel Institute

ASTM - American Society for Testing and Materials

CBR - California Bearing Ratio

CBT - Cement Base Treated

CPI - Cost Performance Index

CTSB – Cement Treated Sub Base

EBDPR – East Bank Demerara Public Road

EPA – Environmental Protection Agency

FGP – Final Graduation Project

HSE – Health, Safety and Environment

IDB - Inter-American Development Bank

MPW – Ministry of Public Works

OPA – Organization Process Assets

PD – Project Director

PM – Project Manager

PM – Project Manager

PMBOK - Project Management Body of Knowledge

PMO – Project Management Office

QA – Quality Assurance

QC- Quality Control

RACI - Responsible, Accountable, Consult, and Inform

RBS – Risk Breakdown Structure

RFP – Request for Proposal

RFP - Request for Proposals

SMP - Scope Management Plan

SPI – Schedule Performance Index

UCI - Universidad para la Cooperación Internacional

WBS – Work Breakdown Structure

WSG – Work Services Group

## **EXECUTIVE SUMMARY (ABSTRACT)**

Guyana is on the cusp of economic development. This development will see numerous infrastructural development taking place. The Ministry of Public Works is the epicenter for public infrastructure and civil construction. With the country looking to modernize its transportation network and sea defenses, along with other construction projects, there is an anticipated boom in the construction sector. The government has embarked on several projects around the country to stimulate this development. Most recently on December 11, 2020, a contract was signed between the Ministry of Public Works and SINOHYDRO Corporation Ltd for the construction of the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project at a cost of USD 50,000,000. This project is expected to bring an ease to the congestion that currently exists on both the East Bank and East Coast highways, by providing an alternative route for commuters.

The Work Services Group (WSG) under the Ministry of Public Works currently serves as the Project Management Office (PMO) for the agency. It undertakes and oversees all infrastructural development projects throughout the country ranging from roads and bridges, transportation and aviation, to buildings and sea defenses. Currently the WSG lacks the ability to manage and oversee all of its projects effectively. While it serves as the PMO, it lacks the necessary project management processes and tools to achieve its intended goals.

The general objective of this FGP is to develop a Project Management Plan for the abovementioned project here in Guyana. The overall plan will see the development of several subsidiaries that are based on the ten (10) knowledge areas. These plans will include the creation of: an appropriate Scope Management Plan that defines the goals and the work breakdown structure; a realistic Schedule Management Plan for assigning duration to work packages that can be tracked; a realistic Cost Management Plan for assigning cost to work packages; a Quality Management Plan that captures the minimum acceptance criterion as specified by the stakeholder; a comprehensive Human Resource Management Plan that manages and assigns the appropriate resources to work packages in a manner that complies with the local labor requirements; an effective Communications Management Plan that clearly outlines the project communication goals and strategies; a robust Risk Management Plan that identifies all associated risks, and their mitigation strategies; an ethical Procurement Management Plan that outlines the process of identifying and assigning of contracts to suppliers; a comprehensive Stakeholders' Management Plan that identifies key stakeholders and their levels of interest; and management practices (Integration Plan) that seek to integrate or fuse all knowledge areas of project management. These plans will all be in keeping with the recommendation of the PMBOK guide.

The methodology that will be used by the researcher for the completion of this FGP will be both explanatory and exploratory in nature. It will be supported by primary and secondary data that are both qualitative and quantitative in nature. The sources

will include the use of observations, interviews, meeting proceedings, books, and internet sources, and the findings will be presented using templates approved by the UCI in keeping with the PMBOK guide.

It can be concluded that the Project Management Plan (PMP) was created in accordance with the requirements from the PMBOK Guide's sixth edition. The results indicate that the researcher has also conducted extensive research and has consulted with multiple stakeholders in the process of constructing this PMP. In addition, frequent meetings were held with the Project Director of the Work Services Group to ascertain the necessary information needed to attain the specified objectives for each subsidiary plan that was covered in this FGP. The creation of the holistic PMP will allow the Project Team from SINOHYDRO to successfully execute the works and the Ministry of Public Works to manage the overall activities associated with the construction of the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.

It is highly recommended that the Ministry of Public Works through its Work Services Group adopt the use of the PMP to execute its mandate of implementing all major infrastructural development projects planned for Guyana. The WSG should utilize this PMP for this specific project and tailor the PMP to suit all other projects that may come under its purview. The Ministry by extension should also recommend to all other Ministries and State Entities the adoption of the PMP in their project management functions, to ensure that society as a whole can benefit from the effective and efficient management of their resources. It is also essential that all technical staff of the Ministry be formally training in the area of Project Management to aid in a smooth adaptation of the PMP in all projects.

# 1 INTRODUCTION

## 1.1. Background

The Ministry of Public Works is Guyana's premier epicenter for engineering and technical excellence. The key responsibilities of the Ministry of Public Works include, but are not limited to, the planning, creation and maintenance of major civil works infrastructure throughout Guyana.

Guyana is on the cusp of major development. With significant oil and gas discoveries offshore, the Government has developed an extensive and comprehensive Investment and Infrastructure Development Plan. The plan includes the rehabilitation and widening all major roadways, bridges and culverts throughout the country, as well as the development of new ones.

On December 11, 2020, a contract was signed between the Ministry of Public Works and Sinohydro Corporation Ltd for the construction of the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project at a cost of USD 50,000,000. With funding, construction works are expected to commence in March, 2021. The funding is being provided through the loan LO 2741/BL-GY: Road Network Upgrade & Expansion Program and forms Component 2 (C2) of the reformulated loan programme between the Cooperative Republic of Guyana and the Inter-American Development Bank (IDB). Component 1 is a housing sector development project to be undertaken by the Ministry of Communities. The contract of the construction works is a measured works contract where the stakeholders, Ministry of Public Works and the contractor will collaborate to reduce and achieve a cost effective and complete project. SINOHYDRO Corporation limited is a subsidiary company that forms part of the international flagship of POWERCHINA. The company's regional offices spread across Asia/Pacific, Africa, Eurasia, and West Asia/North Africa. These five offices are responsible for directing the market development of 116 overseas offices in over 87 countries.

As a global enterprise, SINOHYDRO manages a range of businesses inclusive of water conservancy and hydropower construction to project financing, design, implementation and operation in a variety of infrastructure such as power, transportation, infrastructural work, mining and real estate (SINOHYDRO Corporation Limited, 2002).

## **1.2. Statement of the problem**

The Ministry of Public Works is currently faced with a dilemma when executing projects that fall under the purview of its Works Services Group. While the department operates as the Project Management Office, the engineers that manage its work have little to no project management knowledge. The department has been operating without developing project management plans to execute projects. As a result of this, projects that are managed by the WSG are often times reviewed poorly because of issues in relation to cost overruns, time and schedule delays, changes to the scope of work and most recently poor stakeholder management. The intention of this FGP is to develop a Project Management Plan that will aid the department in managing their projects more efficiently and effectively. The plan will allow the engineers going forward to use it as a template to further develop project management plans for subsequent infrastructural projects that will follow.

The infrastructural development that has occurred in Guyana over the past decade all face some level of public criticism relating to its time, cost and even the scope of its works. The Ministry has a group of professional engineers that all possess Bachelors in Engineering or higher. However, most of them lack the principles that are embedded in the PMBOK guide, and many engineers who are PMP qualified, leave to work in the private sector for higher wages.

While SINOHYDRO possesses international experience and has a track record of executing major infrastructural works globally, they lacked the support of the local citizens. Because the company is headquartered in China, many stakeholders felt that since Guyana does not have a great project

management record of accomplishment, the company would abuse the system locally. To ensure better accountability and execution of these major projects, it is imperative that the Ministry and the contractor advance their knowledge and skills in the area of project management. The knowledge and insights that will be gained from the creation of this Project Management Plan will aid in the future development of the country.

### **1.3. Purpose**

The purpose of this project is to develop the capabilities and documents that are in keeping with those recommended by the Project Management Institute through its PMBOK Guide. The result of the study will generate a Project Management Plan that covers all of the knowledge areas suggested by the PMBOK. The creation of this document will allow the Ministry's project management office to be more efficient in their operation and how they oversee the management of all projects. The document will also ensure that the construction company is held accountable for all deliverables and expectations defined in the Project Management Plan. It is anticipated that the plan will improve accountability, transparency and better overall management in the areas of stakeholder management and communication in addition to prudent financial management. The plan will contain all subsidiary plans inclusive of the project's scope, time, cost, quality, human resources, communication, risk, procurement, and Stakeholder Management Plans.

### **1.4. General objective**

To create a Project Management Plan for the construction of the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project in Guyana, South America to improve its transportation network.

### **1.5. Specific objectives**

1. To develop management practices that seek to integrate or fuse all knowledge areas of project management to deliver a successful East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.
2. To create an appropriate Scope Management Plan, that defines the goals and the work breakdown structure of the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.
3. To create a realistic Schedule Management Plan for assigning duration to work packages that can be tracked in the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.
4. To create a realistic Cost Management Plan for assigning cost to work packages for the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.
5. To develop a Quality Management Plan that captures the minimum acceptance criterion as specified by the stakeholder for the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.
6. To create a comprehensive Human Resource Management Plan that manages and assigns the appropriate resources to work packages in a manner that complies with the local labor requirements to execute the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.
7. To develop an effective Communications Management Plan that clearly outlines the project communication goals and strategies for the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.
8. To create a robust Risk Management Plan that identifies all associated risks and their mitigation strategies for the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.
9. To develop an ethical Procurement Management Plan that outlines the process of identifying and assigning of contracts to suppliers who adhere to green business strategies.
10. To develop a comprehensive Stakeholders' Management Plan that identifies key stakeholders, their levels of interest and analyzes how their influence might affect the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.

## **2 THEORETICAL FRAMEWORK**

### **2.1.1 Company/Enterprise framework**

#### **2.1.1.1 Company/Enterprise background**

A Senior Minister and a Junior Minister within the Ministry heads the Ministry of Public Works. The entity is the premier government Ministry that has the responsibility for infrastructural development throughout the country of Guyana. The Ministry has been in existence since the country was a Colony of the British Empire and remains at the helm of the country's rural and urban planning.

The Ministry's day-to-day operations is managed by the Permanent Secretary and has several heads of departments and budget agencies under his/her command. The department and agencies that fall under the purview of the Ministry includes the Maritime Administration Department, the Guyana Civil Aviation Authority, the Cheddi Jagan International Airport, the Demerara Harbour Bridge Company, the Government Electrical Inspectorate, the Canawaima Ferry Services Inc, all Aerodromes, the Transport and Harbour Department, the Work Services Group that serves as its Project Management Office, and all of its support functional departments such as administrative, procurement, and finance. The agency has over 1500 employees that spread across all of its agencies and departments. Its Work Services Group comprises engineers with varying specializations ranging from civil, mechanical and electrical engineering.

The Ministry receives its funding primarily through the approved budget that has been passed in Parliament by way of the Appropriation Bill. These funds come directly from the country's consolidated fund that is managed by the Central Bank. The Ministry also receives additional funding from donor organizations, and multilateral financing institutions by way of grants and loans for specific infrastructural projects.

The engineers attached to the various sections under the Work Services Group, act as Project Managers that oversee the work of private contractors. The private contractors are hired through public tendering and the Ministry also maintains a list of prequalified contractors. SINOHYDRO was selected for the construction of the



East Bank-East Coast (Diamond to Ogle) Highway Linkage Project in Guyana by way of public tendering and has been approved by the National Procurement and Tender Administration Board.

#### **2.1.1.2 Mission and vision statements**

##### **2.1.1.3 The Vision<sup>1</sup>**

The Ministry of Public Works has a vision of becoming the epicenter of the country's engineering and technical excellence. Its key responsibilities include, but are not limited to, the planning creation and maintenance of major public civil works infrastructure throughout Guyana

##### **2.1.1.4 The Mission <sup>2</sup>**

The Ministry of Public Works aims to plan, build and maintain a Main Road Network that is reliable, safe, efficient and cost- effective, as well as a Sea and River Defense system targeted at protecting life and property; supporting the movement of people, goods and services; reducing the cost of transportation; promoting economic growth and quality of life, and protecting and sustaining the environment.

The vision and the mission of the organization indicates a clear intention to become the beacon of infrastructural development in Guyana. The FGP will aid in the process of formalizing these well documented project management practices into the operation of the Works Services Group of the Ministry of Public Works. This will ensure that going forward all projects follow the same methodology that will promote effective and efficient management.

##### **2.1.1.5 Organizational structure**

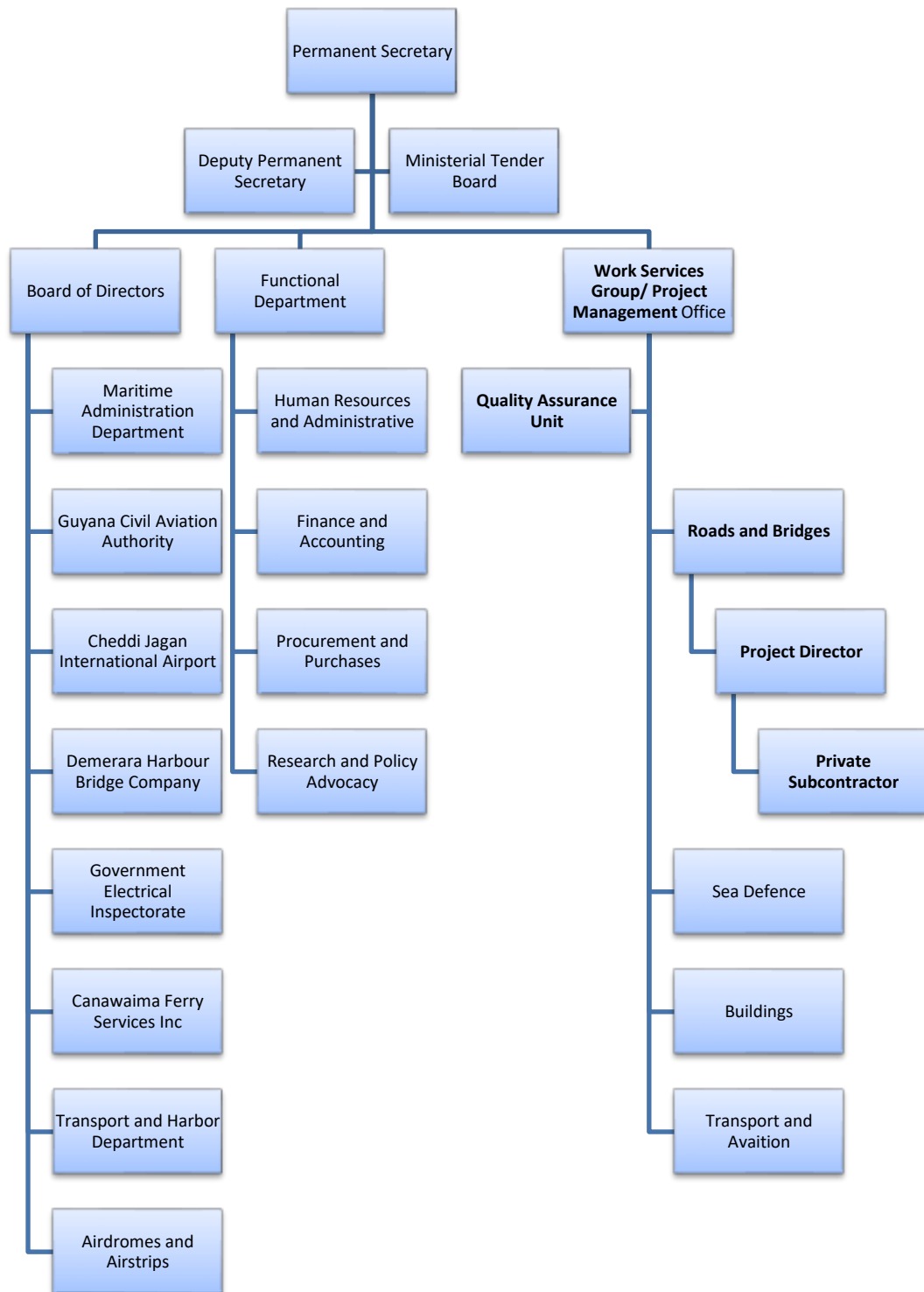
The organizational structure of the Ministry of Public Works outlines all the areas of the Ministry that aids in the development and achievement of the Ministry's Mandate. The

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<sup>1</sup> <https://mopw.gov.gy/about-us>

<sup>2</sup> <https://mopw.gov.gy/about-us>

chart depicts the Permanent Secretary at the head, since the position holder is responsible for the day-to-day operations of the Ministry; the Ministers are just the figureheads.



**Figure 1 Organizational Structure (Source: Compiled by the Author, 2021)**

The Ministry has several agencies and departments that have their individual mandates. These cover a wide range of areas in infrastructural development and service provision. While there are many departments that support the overarching goal of the ministry, one of the most important is the Work Services Group. This unit serves as the Project Management Office of the Ministry.

According to Ministry of Public Works, the **Works Services Group (WSG)** was established in 2002 under donor impetus by merging a series of project implementation units in order to manage donor-funded roads and bridges. The WSG has a quality assurance unit that is responsible for ensuring that all executed projects adhere to the established standards specified in the tender documents. The group is also subdivided into categories according to their areas of responsibilities. These areas include roads and bridges, transportation and aviation, buildings and sea defenses.

The **Sea and River Defences Division (SRDD)** was merged with the WSG during 2008, in order to improve the efficiency of sea defense management, share the regional operational facilities of the WSG, improve staff performance and reduce staff turn-over.

With this merge, the duo is now responsible for the management of cultures, systems and procedures of both departments. Additionally, they have operated de facto similar to a standard public works department by directly employing maintenance teams in the regions.

The SRDD is charged with implementing protective measures to prevent inundation along coastal and riverine areas throughout Guyana.

Owing to the magnitude of works being executed, eight districts have been set up to ensure transparency and accountability throughout all processes. In each district, an engineer oversees the projects.

Below are the district/sub offices for Sea Defense works within all ten administrative regions in Guyana:

1. District 1 – Anna Regina, Essequibo.
2. District 2 – Good Success, Wakenaam.
3. District 3 – Enterprise, Leguan.

4. District 4 – Den Amstel, WCD.
5. District 5 – Paradise, ECD.
6. Districts 6 & 7 - Overwagt WCB.
7. District 8 – Tarlogie, Corentyne Coast

The WSG collaborates with the Regional and Neighborhood Democratic Councils to provide infrastructural works in all other areas except for the sea defense.

#### **2.1.1.6 Products offered**

There are several areas of services for which the Ministry is responsible. These services would fall into the categories of rehabilitation works, expansion works and new constrictions and designs. The areas of work include:

- **Roads and Bridges** - These are central components of the nation's roadway network in the provision of transportation connectivity in order to safely cross features such as waterways, railways, roadways, and other obstacles.
- **Sea Defense** – These projects provide protection against cyclical and local erosion and flooding by the sea of the fertile coastal plains, which lie below sea level.
- **Building and Construction** – The construction and restoration of schools, government offices, wharves and important landmarks throughout the country.
- **Transportation and Aviation** – The development and maintenance of airports, airdromes, airstrips and water ports to provide alternative means of transportation.

#### **2.1.2 Project Management concepts**

Must indicate the main project management concepts, such as project, project management, project life cycle, knowledge areas, project management processes, process groups, and any other applicable project management related concepts.

Must include the relationship of these concepts with the topics to be developed for the FGP, as well as with the company/enterprise context. For example: if the

company has its own project life cycle, it should be presented on this section, after the generic project life cycle definition.

Remember to use APA style cites as needed for every bibliographical source used.

### **2.1.2.1 Project**

According to Verzuh (2015), projects are all the work we do one time or that are temporary in nature, it is fundamental to understand the importance of projects in realizing that each one produces something unique.

The nature of the works carried out by the Ministry of Public Works comes in the form of projects. Each construction activity that the Ministry executes has a finite life and brings about a unique addition to the areas they target. The primary purpose of this Final Graduation Project is to design a Project Management Plan for the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project in Guyana, and the FGP itself is also a project since it has a temporary life.

### **2.1.2.2 Project management**

Project management is a discipline that encompasses a variety of methods, theories, and techniques that have progressed globally to manage the complexities of work that is unique and temporary in nature. Like the business environment that changes constantly, the project management discipline has almost been evolving (Verzuh, 2015). As the evolution continues, the project management practices have still managed to have a proven track record. While there is some semblance of a Project Management Office in the structure of the Work Services Group, it is intended that the FGP will develop the necessary structure that allows the Ministry to better manage all executed projects under its purview.

### **2.1.2.3 Project life cycle**

A project life cycle represents the linear progression of a project, from defining the project through making a plan, executing the work, and closing out the project (Verzuh, 2015). The Project Life Cycle that the Ministry currently utilizes for all projects are outlined below:

### 1. Design

The design is the first stage of a construction project. Once concluded, the bidding process begins. In this stage, the engineers of the Work Services Group first assess the feasibility of the design based on regulations and codes of the building and construction regulations. They then create all necessary design sketches by researching the type of equipment and materials needed and the overall costs.

### 2. Pre-Construction

The bidding process is over and the Work Services Group will choose a contractor. Following this, a contractor is paired with the Project Team from the Work Services Group headed by a lead engineer, then a contract is signed to be officially launched. The team then gets the site ready for construction. A site examination, testing of the soil, and identification any possible unexpected situations, like environmental challenges are all conducted.

### 3. Procurement

During this stage, the team purchases all equipment, materials and labor that are necessary to the completion of the project.

### 4. Construction

The team executes the project in keeping with the terms and conditions of the contract that was signed. The final product must be completed in the defined timeline.

### 5. Commissioning

The commissioning stage commences at the completion of construction. Tests and inspections must be thoroughly conducted by the Project Team to ensure everything is functioning properly before turning over to the Ministry for an official opening.

Training in the operation and maintenance of the systems in the completed project should be provided to the Ministry's personnel.

## 6. Owner Occupancy

Before the project is hand ended over to the Ministry, the quality assurance unit ensures that all the materials, equipment, and building quality meet the expectations outlined in the contract. Once satisfied, the Project is officially handed over to the Ministry Officials and it becomes available for public use.

## 7. Project Closeout

The project closeout allows the team to cement everything by formally completing any remaining contractual obligations to conclude the project. A post-project review is then conducted by the Work Services Group, documentation of lessons learned are completed, project documents are archived, or preparation of a project completion report is done.



**Figure 2 Construction Project Life Cycle (Source: Diana Ramos, 2015)**

### 2.1.2.4 Project management processes

A Project Management Process Group is a logical grouping of arrangement of all project management processes to achieve specific project objectives (Project Management Institute, 2017). There are five (5) processes that are independent of

project phases and are as follows: Initiation, Planning, Executing, Monitoring and Evaluation, and Closing.

The Work Services Group utilizes parts of these processes within its project management practices but not in a structured way. The goal of the FGP is to create a structured approach that encompasses placing all the activities in the project's lifecycle into these process groups.



*Figure 3 Project Management Process Groups (Source: PMBOK, 2017)*

These processes as defined in the PMBOK (2017) are outlined below.

**Project Initiation Process** – This is where the Project Charter is signed after the basic groundwork necessary to create the project and define the guidelines and criteria under which it will operate is specified.

**Project Planning Process** – This is the most important process, since the FGP is built in this process. It is owing to this process that the Project Management Plan can come to fruition. This plan is known as the master plan. It establishes the expectations of stakeholders and outlines how the project will be managed.

**Project Execution Process** – During this phase, project's technical work occurs. The execution of the project requires coordination of human resources, the management of stakeholder expectations, and the effective handling of changes in the project.



**Project Monitoring and Evaluation Process** - The Project Manager must monitor and control the project work to ensure that project deliverables are on time, on budget and of acceptable quality.

**Project Closing Process** – This process marks the completion and closure of contractual obligations, the submission of final details, and the finalization of funding requirements.

#### **2.1.2.5 Project management knowledge areas**

According to the Project Management Institute, (2017) there are forty-nine (49) processes that are grouped into ten (10) knowledge areas. These knowledge areas contain processes that can be used once or at predefined points in the project, processes that are performed routinely as needed, and processes that are performed consistently throughout the project. These knowledge areas are: Integration, Scope, Schedule, Cost, Quality, Resource, Communication, Risk, Procurement and Stakeholder Management,

The purpose of the FGP is to develop a Project Management Plan that details all aspects of these ten (10) knowledge areas to ensure that a proper plan is in place for executing and achieving the strategic goals of the organization.

##### **2.1.2.5.1 Project Integration Management**

This knowledge area ensures that the all-project activities are properly planned, executed, and controlled, including the exercise of formal project change control. This area allows every activity to be coordinated or integrated with every other knowledge area in order to achieve the desired project outcomes (Project Management Institute, 2017). The processes for this knowledge area would include to: develop Project Charter, develop Project Management Plan, direct and manage project work, monitor and control project work, perform integrated change control, and close project or phase.

The FGP will focus on developing the two main areas which are: to develop a Project Charter, and to develop a Project Management Plan.

#### **2.1.2.5.2 Project Scope Management**

Project scope management includes authorizing the work to be conducted, developing a scope statement that will define the extent or range of the project, subdividing the work into manageable components with deliverables, verifying that the amount of work planned has been achieved, and specifying scope change control procedures (Heagney, 2012). It should be noted that changes to project scope are often the factors that cause a project to fail if they are not managed well. The FGP will allow the scope to be clearly defined and managed, thus minimizing any possible scope creep implications.

#### **2.1.2.5.3 Project Schedule Management**

Project schedule management specifically refers to developing a schedule that can be met, then controlling work to ensure that this schedule is realized and the deliverables achieved (Heagney, 2012).

The FGP will ensure that based on the deliverables and the overall goals of the Project to construct an East Bank-East Coast (Diamond to Ogle) Highway Linkage Project in Guyana, an appropriate Project Schedule is created and adhered to.

#### **2.1.2.5.4 Project Cost Management**

In his writing Heagney, (2012) defined the project cost management as estimating the cost of resources, including people, equipment, materials, and such things as travel and other support details. After this is done, costs are budgeted and tracked to keep the project within that budget.

The FGP will aid in the creation of a project budget, which includes all contingencies and reserves that will ensure that the project gets the best quality work for every dollar spent.

#### **2.1.2.5.5 Project Quality Management**

Project quality management includes both quality assurance that allows for developing a plan to meet quality requirements and quality control measure, these are steps taken to monitor results to see if they conform to requirements (Heagney, 2012).

The execution of the FGP will bring forth a robust Quality Management Plan, that will ensure the indented project will deliver the best quality road construction.

#### **2.1.2.5.6 Project Human Resources Management**

This is usually an overlooked aspect in Project Management. The project human resources management involves identifying the people needed to do the job; defining their roles, responsibilities, and reporting relationships; acquiring those people; and then managing them as the project is executed (Heagney, 2012).

The FGP will ensure that there is an effective plan in place that will ensure the best possible and most efficient resources are assigned to the project to ensure its successful execution.

#### **2.1.2.5.7 Project Communications Management**

The project communications management focuses first on developing a strategy to ensure communication is effective for stakeholders. Secondly, it focuses on carrying out the activities necessary to implement the communication strategy (Project Management Institute, 2017). According to Heagney, (2012) the process involves planning, executing, and controlling the acquisition and dissemination of all information relevant to the needs of all project stakeholders. This information might include project status, accomplishments, and events that may affect other stakeholders or projects.

The successful completion of the FGP will ensure that all Project Managers are proficient in speaking and writing, have the ability to lead effective meetings, and can constructively come to a resolution of conflicts on their own.

#### **2.1.2.5.8 Project Risk Management**

Project risk management is one of the most important aspects of modern project management. It can be defined as the systematic process of identifying, quantifying, analyzing, and responding to project risk. It includes maximizing the probability and consequences of positive events and minimizing the probability and consequences of adverse events to project objectives.

The FGP will allow for the creation of a comprehensive risk identification and mitigation strategy, which will allow the overall project objective to be achieved.

#### **2.1.2.5.9 Project Procurement Management**

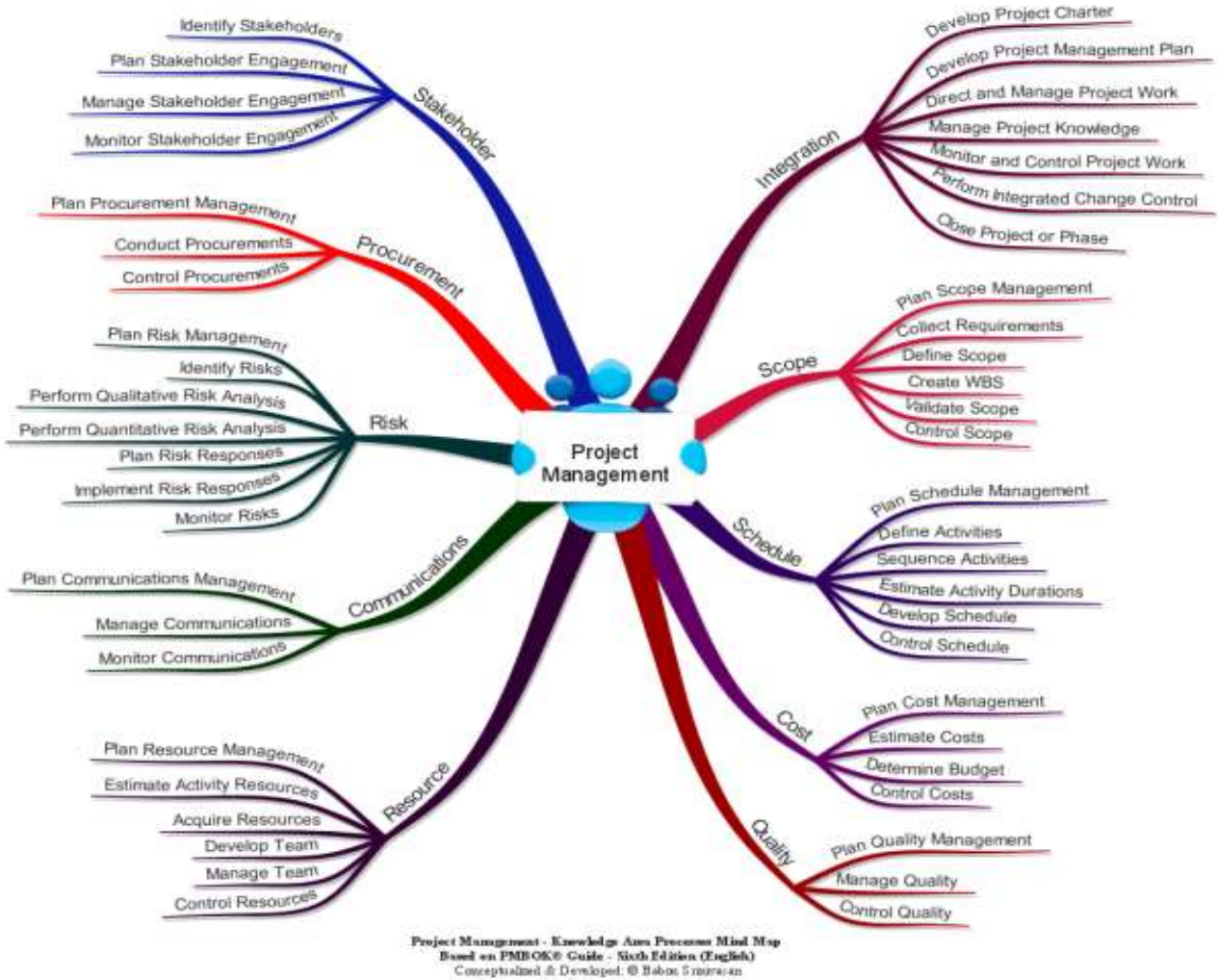
The logistical aspect of managing a job is embedded in the procurement of necessary goods and services for the project. Project procurement management involves deciding what must be procured, issuing requests for bids or quotations, nominating vendors, allocating contracts, and sealing them when the job has concluded.

The FGP will ensure that the Work Services Group has a Procurement Management Plan in place that will ensure it sources the best possible products from ethical suppliers who fit the established criteria.

#### **2.1.2.5.10 Project Stakeholder Management**

This is a crucial plan since without the proper identification and assessment of its key stakeholders and their needs, a project can potentially face major ramifications. Project stakeholder management commences by identifying potential stakeholders to be part of the project. These individuals are categorized as internal and external. The people nominated to be represented in the project can either be customers or executors.

The FGP will ensure that a Stakeholder Identification and Management Plan is sufficient and adequate in managing the needs of all groups that may affect or become affected by the project activities.



**Figure 4 Project Management 10 Knowledge Areas and 49 Processes (Source: Babou Srinivasan adopted from PMBOK,2017)**

### **2.1.3 Other Project Management Practices**

#### **2.1.3.1 Construction Projects**

Construction projects are notably intricate, time-consuming undertakings. The total development of these types of projects normally consists of several phases requiring a unique range of specialized services (Hendrickson, 2008). The progression from project initiation to project completion, then has several phases of interface that include areas such as financial institutions, governmental agencies, engineers, architects, lawyers, insurance companies, contractors, material manufacturers and suppliers, and building tradesmen.

Each construction project is unique. No two jobs are ever the same and as such, each project is tailored to suit its environment. The end product of the FGP will give the Work Services Group of the Ministry the technical know-how moving forward to create these documents to suit each unique project under its execution.

### 3 METHODOLOGICAL FRAMEWORK

#### 3.1.1 Information sources

The origin places where we gather information from are called information sources and these comprise documents, humans, institutions as well as mass media like radio and television.

##### 3.1.1.1 Primary sources

According to NIOS, (2020) primary sources are those sources, which contain original information that has been published, reported or recorded for the first time. Primary sources include raw data, new interpretation of previously known facts or idea, any new observation or experiment, etc. Information tends to be latest and comes out in the form of an article in a periodical, monograph, research report, patent, dissertation, reprint of an article or some other work.

The researcher will use several forms of primary information to complete the FGP.

##### 3.1.1.2 Secondary sources

Secondary sources of information are mostly dependent upon primary sources of information for their existence. They usually present the contents of primary documents in condensed form or list them in a helpful way so that existence of primary documents is known and access to them is made easy (NIOS, 2020).

The FGP will utilize several forms of secondary information, these will be gathered from published information from the Ministry of Public Works, the University of International Cooperation and other online databases.

**Chart 1 Information sources (Source: Compiled by the author, 2021)**

Objectives	Primary Sources	Secondary Sources
To develop management practices that seek to integrate or fuse all knowledge areas of Project Management to deliver a successful	The researcher will conduct interviews, observations, internet communications with the	The researcher will use several sources of secondary information inclusive of the PMBOK

East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.	staff of the Ministry of Public Works, UCI and other stakeholders involved in the FGP.	Guide, other textbooks, and published articles, papers and government reports.
To create an appropriate Scope Management Plan that defines the goals and the work breakdown structure of the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project	The researcher will conduct interviews, observations, internet communications with the staff of the Ministry of Public Works, UCI and other stakeholders involved in the FGP.	The researcher will use several sources of secondary information inclusive of the PMBOK Guide, other textbooks, and published articles, papers and government reports.
To create a realistic Schedule Management Plan for assigning duration to work packages that can be tracked in the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.	The researcher will conduct interviews, observations, internet communications with the staff of the Ministry of Public Works, UCI and other stakeholders involved in the FGP.	The researcher will use several sources of secondary information inclusive of the PMBOK Guide, other textbooks, and published articles, papers and government reports.
To create a realistic Cost Management Plan for assigning cost to work packages for the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.	The researcher will conduct interviews, observations, internet communications with the staff of the Ministry of Public Works, UCI and other stakeholders involved in the FGP.	The researcher will use several sources of secondary information inclusive of the PMBOK Guide, other textbooks, and published articles, papers and government reports.
To develop a Quality Management Plan that captures the minimum acceptance criterion	The researcher will conduct interviews,	The researcher will use several sources of



<p>as specified by the stakeholder for the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.</p>	<p>observations, internet communications with the staff of the Ministry of Public Works, UCI and other stakeholders involved in the FGP.</p>	<p>secondary information inclusive of the PMBOK Guide, other textbooks, and published articles, papers and government reports.</p>
<p>To create a comprehensive Human Resource Management Plan that manages and assigns the appropriate resources to work packages in a manner that complies with the local labor requirements to execute the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.</p>	<p>The researcher will conduct interviews, observations, internet communications with the staff of the Ministry of Public Works, UCI and other stakeholders involved in the FGP.</p>	<p>The researcher will use several sources of secondary information inclusive of the PMBOK Guide, other textbooks, and published articles, papers and government reports.</p>
<p>To develop an effective Communications Management Plan that clearly outlines the project communication goals and strategies for the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.</p>	<p>The researcher will conduct interviews, observations, internet communications with the staff of the Ministry of Public Works, UCI and other stakeholders involved in the FGP.</p>	<p>The researcher will use several sources of secondary information inclusive of the PMBOK Guide, other textbooks, and published articles, papers and government reports.</p>
<p>To create a robust Risk Management Plan that identifies all associated risks and their mitigation strategies for the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.</p>	<p>The researcher will conduct interviews, observations, internet communications with the staff of the Ministry of Public Works, UCI and other stakeholders involved in the FGP.</p>	<p>The researcher will use several sources of secondary information inclusive of the PMBOK Guide, other textbooks, and published articles, papers and government reports.</p>

To develop an ethical Procurement Management Plan that outlines the process of identifying and the assigning of contracts to suppliers who adhere to green business strategies.	The researcher will conduct interviews, observations, internet communications with the staff of the Ministry of Public Works, UCI and other stakeholders involved in the FGP.	The researcher will use several sources of secondary information inclusive of the PMBOK Guide, other textbooks, and published articles, papers and government reports.
To develop a comprehensive Stakeholders' Management Plan that identifies key stakeholders and their levels of interest, and analyses how their influence might affect the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.	The researcher will conduct interviews, observations, internet communications with the staff of the Ministry of Public Works, UCI and other stakeholders involved in the FGP.	The researcher will use several sources of secondary information inclusive of the PMBOK Guide, other textbooks, and published articles, papers and government reports.

### 3.1.2 Research methods

The University of Newcastle Library (2020) defined research methods as the strategies, processes or techniques utilized in the collection of data or evidence for analysis in order to uncover new information or create better understanding of a topic. Research methods encompasses two broad categories, these are: Qualitative and Quantitative.

**Qualitative research** is research that addresses business objectives through techniques that allow the researcher to provide elaborate interpretations of market phenomena without depending on numerical measurement. Its focus is on discovering true inner meanings and new insights. It is more researcher dependent

in that the researcher must extract meaning from unstructured responses, such as text from a recorded interview.

**Quantitative research** can be defined as business research that addresses research objectives by means of empirical assessments using numerical measurement and analysis approaches.

#### **3.1.2.1 Analytical or Explanatory method**

Studies that establish causal relationships between variables may be termed as the explanatory method. The emphasis here is on studying a situation or a problem in order to explain the relationships between variables. It allows us to go ahead and subject the data to statistical tests such as correlation in order to get a clearer view of the relationship. Or alternatively allow us to collect qualitative data to explain the reasons why something has occurred (Saunders, Lewis, & Thornhill, 2007).

#### **3.1.2.2 Exploratory method**

An exploratory study is a valuable means of finding out 'what is happening; to seek new insights; to ask questions and to assess phenomena in a new light' (Robson, 2002). It is particularly useful if you wish to clarify your understanding of a problem, such as if you are unsure of the precise nature of the problem.

The following are three main ways of carrying out exploratory research:

- a search of the literature;
- interviewing 'experts' in the subject;
- conducting focus group interviews.

**Chart 2 Research methods (Source: Compiled by the author, 2021)**

Objectives	Exploratory Method	Analytical or Explanatory Method
To develop management practices that seek to integrate or fuse all knowledge areas of project management to deliver a successful East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.	The method allows for the use of research literature, interviews and discussion to gather data when developing the Project Integration Plan	The analytical method will be employed by using facts or information gathered from the sources identified to drive decision making when determining what factors contribute to the development of the Integration Management Plan.
To create an appropriate Scope Management Plan that defines the goals and the work breakdown structure of the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project	The method allows for the use of research literature, interviews and discussion to gather data when developing the Scope Management Plan	The analytical method will be employed by using facts or information gathered from the sources identified to drive decision making when determining what factors contribute to the development of the Scope Management Plan.
To create a realistic Schedule Management Plan for assigning duration to work packages that can be tracked in the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.	The method allows for the use of research literature, interviews and discussion to gather data when developing the Schedule Management Plan	The analytical method will be employed by using facts or information gathered from the sources identified to drive decision making when determining what factors contribute to the development of the Schedule Management Plan.
To create a realistic Cost Management Plan for assigning cost to work packages for the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.	The method allows for the use of research literature, interviews and discussion to gather data when developing the Cost Management Plan	The analytical method will be employed by using facts or information gathered from the sources identified to drive decision making when determining what factors contribute to the development of the Cost Management Plan.

<p>To develop a Quality Management Plan that captures the minimum acceptance criterion as specified by the stakeholder for the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.</p>	<p>The method allows for the use of research literature, interviews and discussion to gather data when developing the Quality Management Plan</p>	<p>The analytical method will be employed by using facts or information gathered from the sources identified to drive decision making when determining what factors contribute to the development of the Quality Management Plan.</p>
<p>To create a comprehensive Human Resource Management Plan that manages and assigns the appropriate resources to work packages in a manner that complies with the local labor requirements to execute the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.</p>	<p>The method allows for the use of research literature, interviews and discussion to gather data when developing the Human Resource Management Plan</p>	<p>The analytical method will be employed by using facts or information gathered from the sources identified, to drive decision making when determining what factors contribute to the development of the Human Resource Management Plan.</p>
<p>To develop an effective Communications Management Plan that clearly outlines the project communication goals and strategies for the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.</p>	<p>The method allows for the use of research literature, interviews and discussion to gather data when developing the Project Communication Management Plan</p>	<p>The analytical method will be employed by using facts or information gathered from the sources identified to drive decision making when determining what factors contribute to the development of the Communication Management Plan.</p>
<p>To create a robust Risk Management Plan that identifies all associated risks and their mitigation strategies for the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.</p>	<p>The method allows for the use of research literature, interviews and discussion to gather data when developing the Project Risk Management Plan</p>	<p>The analytical method will be employed by using facts or information gathered from the sources identified to drive decision making when determining what factors contribute to the development of the Risk Management Plan.</p>
<p>To develop an ethical Procurement Management Plan that outlines the process of identifying, and the assigning of contracts to suppliers who adhere to green business strategies.</p>	<p>The method allows for the use of research literature, interviews and discussion to gather data when developing the Project Procurement Management Plan</p>	<p>The analytical method will be employed by using facts or information gathered from the sources identified to drive decision making when determining what factors contribute to the development of the Procurement Management Plan.</p>

To develop a comprehensive Stakeholders Management Plan that identifies key stakeholders, their levels of interest, and analyses how their influence might impact the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.	The method allows for the use of research literature, interviews and discussion to gather data when developing the Stakeholder Management Plan	The analytical method will be employed by using facts or information gathered from the sources identified to drive decision making when determining what factors contribute to the development of the Stakeholder Management Plan.
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### 3.1.3 Tools

According to Project Management Institute, (2017) tools can be defined as something “tangible, such as a template or software program, used in performing an activity to produce a product or result.

The FGP will utilize many tools to assist in the deliverable of its identified objectives and overall project goals.

**Chart 3 Tools (Source: PMBOK, 2017)**

Objectives	Tools
To create an appropriate Scope Management Plan that defines the goals and the work breakdown structure of the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project	Interviews, focus groups, facilitated workshops, group creativity techniques, group decision-making techniques, questionnaires and surveys, observations, prototypes, benchmarking, context diagrams and document analysis.
To create a Realistic Schedule Management Plan for assigning duration to work packages that can be tracked in the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.	Gantt Chart, PERT, Critical Path Method and Critical Chain Method.
To create a realistic Cost Management Plan for assigning cost to work packages for the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.	Expert judgment, analogous estimating, parametric estimating, reserve analysis, cost of quality, Project Management Software, Vendor Bid Analysis.

To develop a Quality Management Plan that captures the minimum acceptance criterion as specified by the stakeholder for the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.	Cost Benefit Analysis, Cost of Quality, seven basic quality tools, benchmarking, design of experiments, statistical sampling, additional quality planning tools and meetings.
To create a comprehensive Human Resource Management Plan that manages and assigns the appropriate resources to work packages in a manner that complies with the local labor requirements to execute the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.	Pre-assignment, negotiation, acquisition, virtual teams and multi-criteria analysis.
To develop an effective Communications Management Plan that clearly outlines the project communication goals and strategies for the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.	Communication technology, communication models, communication methods, information management systems, performance reporting.
To create a robust Risk Management Plan that identifies all associated risks and their mitigation strategies for the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.	Risk Management Planning, risk identification, Qualitative Risk Analysis, Quantitative Risk Analysis, Risk response planning, Risk Monitoring and Control, Expert judgment, Documentation reviews, Information gathering techniques, Checklist analysis, Assumptions analysis, Diagramming techniques, SWOT.
To develop an ethical Procurement Management Plan that outlines the process of identifying and the assigning of contracts to suppliers who adhere to green business strategies.	Make-or-buy analysis, expert judgment, market research and meetings.
To develop a comprehensive Stakeholders Management Plan that identifies key stakeholders, their level of interests and analyses how their	Power and interest, power and influence, influence and impact, power, urgency and legitimacy

influence might impact the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.	
To develop management practices that seek to integrate or fuse all knowledge areas of project management to deliver a successful East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.	Expert judgment, data Gathering, facilitation techniques, and meetings.

### 3.1.4 Assumptions and constraints

The PMBOK Guide which was developed by the Project Management Institute (2017) indicates that an **Assumption** is “*An actor in the planning process that is considered to be true, real, or certain, without proof or demonstration*” and **Constraint** as “*A limiting factor that affects the execution of a project or process*”.

**Chart 4 Assumptions and constraints (Source: Compiled by the author, 2021)**

Objectives	Assumptions	Constraints
To develop management practices that seek to integrate or fuse all knowledge areas of project management to deliver a successful East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.	The development of a clear Project Charter that formally authorizes the existence of a project.	The Project Charter may not be developed in accordance with the PMBOK Guide, which may result in miscommunications on the authorities.
To create an appropriate Scope Management Plan that defines the goals and the work breakdown structure of the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project	The project scope and work packages will be clearly defined.	Constant changes will lead to scope creep, if there is no change control in place.
To create a Realistic Schedule Management Plan for assigning duration to work packages that can be tracked in the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.	The time allocated for the completion of the FGP and Project is adequate for all activities.	The time allocation may not be correctly calculated, and the project may go over its scheduled time.



To create a realistic Cost Management Plan for assigning cost to work packages for the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.	The development of an appropriate budget to complete all of the identified project activities.	The budget may not have contingencies in place and costs may over run.
To develop a Quality Management Plan that captures the minimum acceptance criterion as specified by the stakeholder for the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.	The Quality Management Plan will identify all of the stakeholders' quality requirements of the project.	The compromising of quality to save some cost, may result in a defective end-product.
To create a comprehensive Human Resource Management Plan that manages and assigns the appropriate resources to work packages in a manner that complies with the local labor requirements to execute the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.	All critical roles and responsibilities will be identified and suitable personnel will be appointed or assigned to these roles.	The correct human resources may not be available to suit the roles, so mismatches may occur.
To develop an effective Communications Management Plan that clearly outlines the project communication goals and strategies for the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.	The project has the technology and systems in place that is required to effectively address the communication needs of all stakeholders.	Some communication technology may not be available to communicate with all major stakeholders.
To create a robust Risk Management Plan that identifies all associated risks and their mitigation strategies for the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.	A robust Risk Management Plan will be created that addresses all of the risks that could potentially derail the project.	If key and major risks are not identified, the project could be exposed to outside factors that may hinder its completion.
To develop an ethical Procurement Management Plan that outlines the process of identifying and the assigning of contracts to suppliers who adhere to green business strategies.	An appropriate list of resources and suppliers will be created that ensure the procurement process is ethical and transparent.	Some of the identified suppliers may not have the items available locally or the items may go out of stock, causing major delays to the purchasing activities.

To develop a comprehensive Stakeholders Management Plan that identifies key stakeholders, their level of interests and analyses how their influence might impact the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.	All relevant stakeholders will be identified and requirements analyzed.	If key stakeholders are missed and their needs are not addressed, this can cause a project to fail if the stakeholders have high power and influence.
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### 3.1.5 Deliverables

According to the Project Management Institute, (2017) a deliverable can be defined as “any unique and verifiable product, result, or capability to perform a service that is required to be produced to complete a process, phase, or project.”

**Chart 5 Deliverables (Source: Compiled by the author, 2021)**

Objectives	Deliverables
To develop management practices that seek to integrate or fuse all knowledge areas of Project Management to deliver a successful East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.	Project Charter and Project Integration Management Plan
To create an appropriate Scope Management Plan that defines the goals and the work breakdown structure of the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project	Scope Management Plan
To create a realistic Schedule Management Plan for assigning duration to work packages that can be tracked in the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.	Schedule Management Plan
To create a realistic Cost Management Plan for assigning cost to work packages for the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.	Cost Management Plan

<p>To develop a Quality Management Plan that captures the minimum acceptance criterion as specified by the stakeholder for the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.</p>	<p>Quality Management Plan</p>
<p>To create a comprehensive Human Resource Management Plan that manages and assigns the appropriate resources to work packages in a manner that complies with the local labor requirements to execute the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.</p>	<p>Human Resource Management Plan</p>
<p>To develop an effective Communications Management Plan that clearly outlines the project's communication goals and strategies for the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.</p>	<p>Communications Management Plan</p>
<p>To create a robust Risk Management Plan that identifies all associated risks and their mitigation strategies for the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.</p>	<p>Risk Management Plan</p>
<p>To develop an ethical Procurement Management Plan that outlines the process of identifying and the assigning of contracts to suppliers who adhere to green business strategies.</p>	<p>Procurement Management Plan</p>
<p>To develop a comprehensive Stakeholders Management Plan that identifies key stakeholders, their levels of interest, and analyzes how their influence might impact the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.</p>	<p>Stakeholders Management Plan</p>

## **4 RESULTS**

### **4.1 Project Integration Management**

The development of the Project Management Plan for the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project includes the preparation of processes that form part of the Project Integration Management knowledge area. The first process in this knowledge area refers to the creation of the Project Charter. The Charter is a tool used to formally authorize the project, whereby the identified Project Manager has been granted the permission to utilize the resources of the organization for project activities.

The Project Management Plan signifies the second process in the Integration Management knowledge area. This comprises of several subsidiary plans that are to be developed during the Final Graduation Project.

The Project Charter includes some essential focus areas that are deemed necessary for the project's purpose, which includes: the business case and objectives, the project description, stakeholder list, high-level requirements, assumptions and constraints, identification of deliverables, a summary milestone schedule, overall project budget, criteria necessary for project approval, the identification of the Project Manager, and the sponsor's authorization.

Chart 6 Project Charter (Source: Compiled by the author, 2021)

<b>PROJECT CHARTER</b>	
<b>Project Name:</b>	
Project Management Plan for the Construction of the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project in Guyana.	
<b>Knowledge Areas / PM Processes:</b>	<b>Application Area (Sector / Activity):</b>
<b>Knowledge Areas:</b> Integration, Scope, Schedule, Cost, Quality, Human Resources, Communication, Risk, Procurement and Stakeholders <b>PM Processes:</b> Initiation, Planning, Executing, Monitoring and Controlling, Closing	Construction or Public Infrastructure Sector
<b>Project Start Date:</b>	<b>Project Finish date:</b>
01 March 2021	29 February 2024
<b>Business Case:</b>	
<p>The Government of Guyana has embarked on some major infrastructural development projects since being an oil producing State in 2019. Its development plans include the establishment of alternate roads, which would result in the creation of new housing schemes and create better accessibility to farmlands. The demand for the East Bank to East Coast Highway linkage is as a direct result of the growing traffic congestion on both highways when heading into the City of Georgetown, and the development of new housing schemes in the backlands of both the East Bank and East Coast.</p>	
<b>Project Objectives (General and Specific):</b>	
<b>General Objective:</b>	
To create a Project Management Plan for the construction of the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.	
<b>Specific Objectives:</b>	
1. To develop management practices that seek to integrate or fuse all knowledge areas of Project Management to deliver a successful project.	

2. To create a realistic Schedule Management Plan for assigning duration to work packages that can be tracked.
3. To create a realistic Cost Management Plan for assigning cost to work packages.
4. To develop a Quality Management Plan that captures the minimum acceptance criterion as specified by the stakeholder.
5. To create a comprehensive Human Resource Management Plan that manages and assigned the appropriate resources to work packages in a manner that complies with the local labor Requirements.
6. To build an effectively developed Communication Management Plan that clearly outlines the project communication goals and strategies.
7. To create a robust Risk Management Plan that identifies all associated risks and their mitigation strategies.
8. To develop an ethical Procurement Management Plan that outlines the process of identifying and assigning contracts to suppliers who adhere to green business strategies.
9. To develop a comprehensive Stakeholders Management Plan that identifies key stakeholders, their levels of interests, and analyses how their influence might impact the project.
10. To create an appropriate Scope Management Plan, that defines the goals and the work breakdown structure of the project.

#### **Project purpose or justification (merit and expected results):**

The Ministry of Public Works in accordance with its Strategic Plan 2017 – 2021 has outlined that as one of its longer term objectives, this project is one of many that will seek to improve traffic flows, reduce delays as a result of a distressed roadway and defective traffic signals, and reduce accidents and fatalities along this busy roadway corridor. Traffic demand for this roadway is expected to increase for access to both the East Coast of Demerara and East Bank of Demerara, using this main interconnection road link. The construction should involve the following:

1. Rehabilitation of roadway on Sheriff Street and on Mandela Avenue (expanded to 4 lanes). The creation of 15km of new road (4 lanes) where the GuySuCo Punt Dam once ran from Diamond to Ogle.
2. Construction of a Roundabout at the junction of Sheriff Street and David Street / Railway Embankment Road.

3. Construction of sidewalks, cycle lanes and bus laybys.
4. Construction of thirteen (13) concrete bridges, thirty (30) concrete culverts and a steel overhead walkway that connect the eastern and western road sides along the busy EBDPR.
5. Installation of traffic signals and roadway lighting, traffic signs and roadway markings.
6. Construction of a combination of concrete roadside drains and buried concrete pipes to develop and improve the conveyance of rainfall runoff and effluent from properties or businesses along the roadway.

#### **Description of Product or Service to be generated by the Project – Project final deliverables:**

To create a comprehensive Project Management Plan; inclusive of all subsidiary plans for the construction of the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.

#### **Requirements:**

The roads, bridges and supporting infrastructure, has to be designed to withstand any weather conditions. This means that the infrastructure should be built of materials that will allow it to be trafficable in all weather conditions. Oftentimes, excessive rain causes roads to become flooded or swamped to the extent that they become almost impassable to vehicular traffic. Ideally, these roads will be constructed with this knowledge in mind so as to create a free flow of traffic despite inclement weather conditions

#### **Preliminary Scope:**

The project includes the construction of a fifteen (15) kilometer road, the construction of thirteen (13) concrete bridges, thirty (30) concrete culverts and a steel overhead walkway that connect the eastern and western road sides along the busy highway. The Scope of work includes:

- Demolition and removal - see Scope Management Plan for specifications
- Grading and sloping - see Scope Management Plan for specifications
- Prepare the sub base - see Scope Management Plan for specifications
- Proof roll, undercutting and sub base repair - see Scope Management Plan for specifications
- Binder and surface course - see Scope Management Plan for specifications
- Install new asphalt surface - see Scope Management Plan for specifications
- Bridge construction - see Scope Management Plan for specifications
- Culvert construction - see Scope Management Plan for specifications

- Steel overhead walkway constriction - see Scope Management Plan for specifications.

### **Assumptions:**

- Finances

It is assumed that the project is fully funded.

- Workforce

It is assumed that the contractor has the adequate amount of skilled and unskilled workers to successfully execute the project.

- Schedule

It is assumed that thirty-six (36) months is adequate to complete the project and all of its deliverables.

- Budget

It is assumed that the project can be completed given its budget of fifty million (50,000,000) US dollars.

- Project Planning

It is assumed that all the necessary approval and permits will be granted in a timely manner to ensure the project is completed successfully.

- Weather

It is assumed that the road will be constructed for all-weather purposes. Therefore, the correct materials and methods need to be used in the construction of the road to withstand any adverse weather conditions.

### **Constraints:**

- The expenditure associated with the completion of this project should not exceed fifty million (\$50,000,000) US dollars. The project timeline should not exceed thirty-six (36) months; of which twenty-four (24) months are dedicated to the construction of the road and supporting infrastructure and six (6) months each shall be used for preliminary and furnishings, and closing works respectively.

### **Preliminary Risks:**

The project like any other public infrastructure projects in Guyana may be subject to several risks. These include but are not limited to the following:

- **Financial**



1. The underestimation of project costs. This can cause the project to be incomplete or completed by cutting of corners to make budget adequate.
2. The rise in the cost of materials and other resources may pose a potential threat to the successful completion of the project, since there might be budget overruns.
3. Improper storage of materials may lead to damages that may affect the project's financial standings.

- **Health**

1. Worksite accidents due to poor or inadequate HSE practices, can affect the successful completion of the project.
2. The risk of workers contracting the Covid-19 virus could potentially render them hospitalized and cause a delay in the completion of the project.

- **Regulatory**

1. Delays or non-approval of the necessary permits can detain the start and thus the completion of the project.

- **Scheduling**

1. Inclement weather conditions may delay the execution of works, thus deferring the start or end date.
2. Global shipping delays and local logistical issues may affect the project schedule.
3. Delays from subcontractors may also affect the project timeline.

- **Quality**

1. Soil type on the selected route not suitable for road construction.
2. Materials used in the construction process are of inferior quality.

### **Budget:**

<b>Items</b>	<b>Project Costs (\$ USD)</b>
Construction	\$ 40,000,000
Administration and Project Management Operations	\$ 5,000,000
Permits	\$ 1,000,000
Audits	\$ 2,000,000
Contingency (4%)	\$ 2,000,000

<b>Total</b>	<b>\$ 50,000,000</b>	
<b>Milestones and dates:</b>		
<b>Milestone</b>	<b>Start date</b>	<b>End date</b>
Project Start	March 01, 2021	March 01, 2021
Project Initiation/'Kick-off'	March 01, 2021	March 01, 2021
Initial Impact Assessment	March 01, 2021	April 30, 2021
Feasibility Study	May 01, 2021	July 23, 2021
Approval of Project Charter	July 24, 2021	July 31, 2021
Complete Design Documents & Submit to MOW and EPA for Permit	August 01, 2021	August 31, 2021
Mobilization & Demobilization Works	September 01, 2021	September 30, 2021
Field Office and Facilities Set Up	September 01, 2021	October 31, 2021
Management and Traffic Safety Set Up	October 01, 2021	October 31, 2021
Field Technical Review Completion	October 01, 2021	November 15, 2021
Environmental Security Completion	October 01, 2021	November 15, 2021
Relocate Existing Utility Completion	October 01, 2021	November 30, 2021
Soil Testing Completion	October 01, 2021	November 30, 2021
Support Drainage	December 01, 2021	December 31, 2022
Land Clearing Completion	December 01, 2021	June 30, 2022
Excavation Completion	January 01, 2022	January 31, 2023
Piling Completion	February 01, 2022	February 28, 2023
Land Improvement Completion	March 01, 2023	March 31, 2023
Widening Pavement Work Completion	April 01, 2023	May 31, 2023
Roadside Works Completion	April 01, 2023	May 31, 2023
Gilded Pavement Completion	April 01, 2023	May 31, 2023
Concrete Pavement Completion	April 01, 2023	May 31, 2023
Asphalt Mixing Plant (AMP) Completion	May 01, 2023	August 31, 2023
Steel Bridges and Overhead Walkway Construction Completion	April 01, 2023	August 31, 2023

Road Lighting	September 01, 2023	November 30, 2023
Road Marking and Traffic Signals	November 01, 2023	December 31, 2023
Inspection of Works	January 01, 2024	February 14, 2024
Commissioning of New Road	February 15, 2024	February 21, 2024
Handover to the Government of Guyana	February 22, 2024	February 29, 2024
End of Project	February 29, 2024	February 29, 2024

**Relevant historical information:**

On December 11, 2020, a contract was signed between the Ministry of Public Works and Sinohydro Corporation Ltd for the Construction of the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project at a cost of USD50,000,000. With funding, construction works are expected to commence in March, 2021. The funding is provided through the loan LO 2741/BL-GY: Road Network Upgrade & Expansion Program and forms Component 2 (C2) of the reformulated loan programme between the Cooperative Republic of Guyana and the Inter-American Bank (IDB). Component 1 is a housing sector development project to be undertaken by the Ministry of Communities. The contract of the construction works is a measured works contract where the stakeholders, Ministry of Public Works and the Contractor will collaborate to reduce and achieve a cost effective and complete project.

**Stakeholders:**

The stakeholder groups attached to this specific project includes the following list of organizations, groups and individuals:

### **Ministry of Public Works (Sponsor & Owner)**

- Ministers of Public Work
- Permanent Secretary and Heads of Departments
- Work Services Group (In-house Project Directors and Engineers)

### **SINOHYDRO**

- Project Manager
- Senior Pavement and Highway Engineer
- Material Engineer
- Quantity Surveyor
- Bridge and Culvert Engineer
- Survey Engineer or Surveyor
- Health, Environment and Safety Engineer
- Asphalt Foreman
- Operations
- Laborers
- Subcontractors

### **Other Government Agencies**

- Ministry of Local Government and Regional Development
  - *Regional Democratic Councils*
  - *Neighborhood Democratic Councils*
  - *Mayor and City Councils*
- Guyana Power and Light Inc.
- Guyana Lands and Survey Commission.
- Ministry of Housing and Water;
  - *Central Housing and Planning Authority.*
  - *Guyana Water Inc.*
- Environmental Protection Agency.

### **Communities in close proximity to the road construction**

### Project Approval

The approval will be granted once all of the details that were agreed upon in the Scope Statement are achieved. The fifteen (15) Kilometer Road connecting the East Bank of Demerara to the East Coast of Demerara must be delivered by February 29, 2024.

### Project Manager/ Project Director:

The Project Manager for the SINOHYDRO Corporation is Mr. Geoffrey Vaughn, the Project Director from the Ministry of Public Works is Mr. Anthony Flett and his Assistant Director is Mr. Seon Brathwaite, who will act on his behalf in his absence to overlook the works of the contractor.

### Approval:

Project Manager:	Signature:	Date:
Authorized by:	Signature:	Date:

### Direct and manage project work

The Project Team completes all of the assigned work within the prescribed timeline of the project in this step of integration management. This project work may involve the management of all project resources, execution of the activities of the work packages, and making necessary changes. In addition, a review of the project's progression against project goals must be conducted throughout the construction life cycle in order to make necessary changes and keep the project on schedule.

To avoid scope creep dilemma, the project manager and his team must communicate and stay transparent, with every stakeholder that is involved in the project.

### Perform integrated change control

The process of change control should be done throughout the entire lifecycle of the construction project. The Project Management Plan, deliverables and milestones, and scope statement play an integral role in this iterative process. The project's goals must never be jeopardized during the process of a change control, and all corrective actions must be aligned with the project's overall goal.

**Close project or phase**

Once the construction ceases, the project must be evaluated to ensure it reaches the requirements set out in the Project Charter and Project Management Plans. This step involves reviewing various aspects of the project and documenting findings to a reference archive.

**4.2 Project Scope Management**

The Scope Management Plan was created using a modified template taken from an online source. It was created after the Stakeholder Management Plan. The Scope definition process resulted in the development of a Scope Management Plan (SMP) for the project.

The team was able to review all bid documents, and design documents created by the Ministry of Public Works and meeting with specialist engineers and government regulatory agencies to determine the requirements of the project. The SMP included the creation of a scope definition, project scope statement, the Work Breakdown Structure (WBS), WBS dictionary, scope verification and the scope control that will help the contractor, SINOHYDRO Corporation, to successfully execute all defined project work.

The PMBOK® Guide 6th edition was used as a guide to complete this process. The defined Project Charter along with the OPA, organizational policies and procedures, basic past project information, and meetings with sponsors and other stakeholders were used to complete the Scope Management and Requirements Management Plans, which both form output of the plan.

# **SCOPE MANAGEMENT PLAN**

## **CONSTRUCTION OF THE EAST BANK-EAST COAST (DIAMOND TO OGLE) HIGHWAY LINKAGE PROJECT**

SINOHYDRO CORPORATION  
GEORGETOWN  
GUYANA

October 2021

### **Introduction**

The plan provides the framework on how the scope will be developed and managed for the project. It will see the inclusion of the roles and responsibilities of stakeholders as it relates to project scope, scope definition, verification and control measures, scope change control, and the project's work breakdown structure. Project communication as it relates to the Scope should follow the guidelines identified within this plan.

The project forms part of the government's infrastructural development strategy; it includes the construction of an all-weather road, 15 kilometers long, that connects the East Bank to the East Coast Highway and existing roads along the route.

### **Scope Management Approach**

The management of this project will be the responsibility of the Project Manager, with the close supervision of the Project Director assigned by the Work Services Group of the Ministry of Public Works. The scope will be clearly defined via the Scope Statement, Work Breakdown Structure (WBS) and WBS Dictionary.

The deliverable quality checklists and work performance measurements are documents that will be established and approved by the Project Sponsor, Project

Supervisor, the Project Manager and his team along with other stakeholders to measure the project scope.

The stakeholders of the project may formally present requests for scope changes to the Project Manager. Following this, the PM will review the recommended changes to the scope of the project and adjudge, with justification, whether it is granted approval or denial. Further, this information will be presented to the Project Director for his review and approval. Once the Project Director approves the recommendation of the PM, a control meeting will be kept among the Project Team, Project Supervisor and Sponsor where the change will be presented and further reviewed. These individuals will conduct an impact assessment of the change.

### Roles and responsibilities

**Chart 7 Roles and Responsibilities (Source: adopted form C. Walker, 2017)**

Name	Role	Responsibilities
Ministry of Public Works (Government of Guyana)	Project Sponsor	<ul style="list-style-type: none"> <li>a. Approval or denial to scope change requests as appropriate.</li> <li>b. Approve or deny financial disbursement requests as it relates to changes in the Scope.</li> <li>c. Evaluate the need for scope change requests.</li> <li>d. Accept project deliverables.</li> </ul>
Anthony Flett	Project Director (Work Services Group)	<ul style="list-style-type: none"> <li>a. Oversee the PM and the Project Team's work, in accordance with the defined Scope.</li> <li>b. Liaise with the Project Sponsor and the Project Team regarding proposed changes to the Scope.</li> <li>c. Make formal request for changes to the Project Sponsor</li> <li>d. Collaborate with the PM and the Project Sponsor to develop a Project Management Plan.</li> </ul>
Geoffrey Vaughn	Project Manager	<ul style="list-style-type: none"> <li>a. Measure and authenticate project scope.</li> <li>b. Expedite scope change requests.</li> <li>c. Facilitate impact assessments of scope change requests.</li> </ul>



		<ul style="list-style-type: none"> <li>d. Organize and facilitate scheduled change control meetings.</li> <li>e. Convey outcomes of scope change requests.</li> <li>f. Update project documents upon approval of all scope changes.</li> </ul>
Engineers and Members of Contractor Team.	Project Team	<ul style="list-style-type: none"> <li>a. Propose and participate in defining change to the defined Scope.</li> <li>b. Evaluate the proposed scope changes and communicate their suggestions to the Project Manager as needed.</li> </ul>
Subcontractors, Consultants	Stakeholders	<ul style="list-style-type: none"> <li>a. Make proposals and recommendations for scope changes.</li> <li>b. Execute the recommended changes to the scope issued by the Project Manager.</li> </ul>

### **Scope Definition**

The scope of this project was defined using a comprehensive method of requirement collection. These included: the owner's requirements, along with the project contract, previous road contracts and scope, along with meeting minutes. The Project Director from the MPW and the PM were able to develop the Requirements Management Plan, along with the Requirement Traceability Matrix and documentations for the road construction specifications.

The deliverables of the project were generated from subject matter experts, inclusive of civil, structural and asphalt engineers, surveyors, contractors and the government regulatory agencies. The expert opinion provided a pathway to meet the requirements needed for an all-weather durable road that utilizes the resources in the most effective and efficient manner. This will allow the government to open up new housing lands, farm to market roads and ease the traffic congestion on both highways.

### **Project Scope Statement**

The project scope statement provides a detailed description of the project, deliverables, constraints, exclusions, assumptions, and acceptance criteria. These

criteria will allow only the necessary work to be completed, so no resources will be wasted on activities outside of the defined scope.

### **Scope Description, Product Acceptance Criteria and Project Deliverables**

The project includes the construction of an all-weather road that is 15 kilometers long that connect the East Bank to the East Coast Highway and existing roads along the route. The following are the detailed specifications of some critical criteria to be followed:

- **Demolition and Site Clearing**

The clearing area is shown on the construction drawings and consists of forested land inclusive of dense tree cover and underbrush, non-forested grassland, underbrush, scattered trees and saplings. The area may also require the clearing of old abandoned factories, railway lines and old access roads that were previously built along the route.

The clearing area also consists of a 30 meters wide strip to allow for the development of a four-lane highway and corresponding pavements.

The first areas to be cleared shall be Sedimentation Pond 2, and Raw Water line; these will be developed into canals on both sides of the access roads to facilitate proper drainage and irrigation to lands along the proposed road.

Material, including wood chips or shreds, ground or chipped material that are produced in both forested and non-forested areas, may be transported off-site or remain on-site.

Material from trees larger than 4" including logs, branches or chips generated from the trees shall be transported and converted into piles or revetment materials to be used in the construction.



**Figure 5 Map of the Identified Location (Source: Ministry of Public Works, 2020)**

## Excavation, Grading and Sloping

The excavation work includes the removal of any sort of earth or any unsuitable asphalt or any layers to be replaced to reach the level of sub grade. Where existing layer does not meet the requirements for sub grade according to the specifications identified below, excavation must be to the levels of a layer 20 cm below the subgrade for roads designed for heavy traffic.

The sub grade is the layer beneath the base course layer or the sub base course layer. It must not be less than 20 cm thick after compaction. Compaction must not be less than 100% of maximum dry density according to modified proctor.

The required sub grade designed for medium and heavy traffic must also fulfill the following requirements:

- C.B.R 20% minimum
- 12 maximum

- Max. Size=3 (7.5cm)

Sub grade material must be of soils not classified as A6 or A7 according to AASHTO specifications.

In the case of rock excavation, the contractor must excavate to the levels of the bottom of sub grade. Structural excavation must be to the required levels according to drawings or specifications. This includes structural excavation for box culverts, or reinforced pipe culverts, for retaining walls, for PVC ducts, and for gabions.

The contractor must dispose the excess or unsuitable material outside the site to places approved by the Ministry of Public Works or the Mayor and City Councils.

#### Prepare the Sub Base

After preparing the sub grade or the sub base (if necessary) to the required density, finishing the surface to the required levels, and the approval of the Project Director of the Ministry of Public Works, the base course will be delivered to the road bed as uniform mixture after completing the required laboratory tests on the contractor's own expenses.

Base Course must fulfill the following specifications:

- Aggregate material for base course shall consist of crushed limestone, crushed granite or crushed basalt.
- Liquid limit must not exceed 25. (AASHTO-T90)
- Plasticity Index must be 2-6 (AASHTO-T90-T89)
- Base course must be watered and compacted to 100% density according to modified proctor. (AASHTO-T191).
- C.B. R> 80% for maximum dry density of modified proctor (AASHTOT193).
- Abrasion Ratio as per Los Angelo's test using 500 revolutions (AASHTO-96)  
< 40%

- Sand equivalent must be 30% or more (AASHTO-T176)
- Soundness must be 12% maximum tested by sodium sulphate and 18% maximum tested by magnesium sulphate (AASHTO-T 104).
- Finished levels of base course must not be more or less than the designed levels or the levels approved by the engineer by more than 1 cm.

After preparing the sub grade to the required density, finishing the surface to the required levels and approval of the Project Director of the Ministry of Public Works, the sub base course will be delivered to the roadbed as uniform mixture after completing the required laboratory tests on the contractor's own expenses.

Sub base Course must fulfill the following specifications:

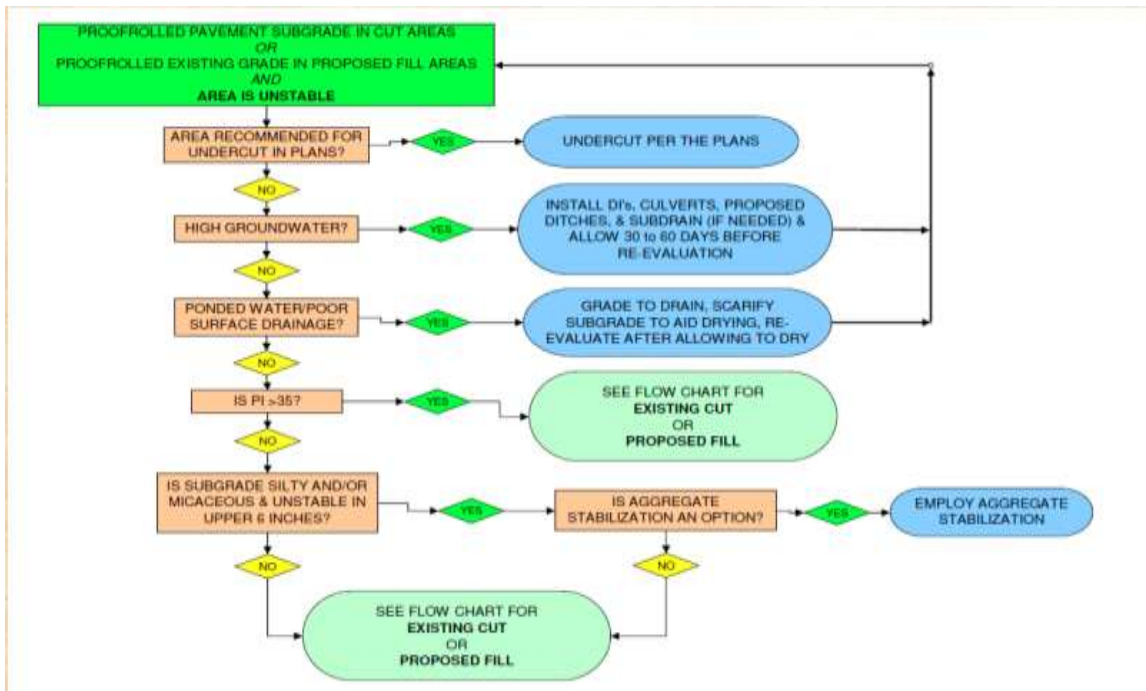
- Aggregate material for sub base course shall consist of crushed limestone, crushed granite or granite basalt; screening of gravel can be used provided it satisfies specification.
- Liquid limit must not exceed 30. (AASHTO-T90).
- Plasticity Index must be 2-8 (AASHTO-T90-T89)
- Sub base must be watered and compacted to 100% density according to modified proctor. (AASHTO-T191)
- C.B.R.> 40% for maximum dry density. (AASHTO-T193)
- Abrasion Ratio as per Los Angelo's test using 500 revolutions (AASHTO96)  
< 40%
- Sand equivalent must be 25% or more (AASHTO-T176)
- Soundness must be 12% maximum tested by sodium sulphate & 18% maximum tested by magnesium sulphate (AASHTO-T 104)

Finished levels of sub-base must not be more than 1cm than the designed levels or the levels approved by the engineer. It can be less than that for more thickness provided it will be compensated by increasing the depth of base course at the contractor's expense.

## Proof Roll, Undercutting and Sub Base Repair

Proof rolling has to be conducted to rapidly determine the strength and stability of the subgrade. Proof rolling is done to the coverage of subgrade to 2 feet outside pavement with the use of rollers with a gross weight of 48 to 50 tons, 4 pneumatic rubber tires and the tire inflation pressure of 68 to 72 psi. In the absence of this roller, the use of rubber-tired construction equipment such as pans, backhoes, motor graders, and dump trucks can be used.

The proposed flow chart below depicts the types of sub base repairs that will be conducted based on the proof roll failures.



**Figure 6 Proof Roll Actions (Source: State of North Carolina, Department of Transportation)**

- Binder and Surface Course

## Rolled Binder and Asphalt Surface Course (Recipe Mix)

The proposed rolled asphalt surface course shall comply with AASHTO for surface course mixtures. The mix designation for the material shall be Type F - 30% 0/14 mm or 35% 0/14 mm.

- Binder

The binder shall be petroleum bitumen of paving grade 40/60 Pen in compliance with AASHTO. The binder content, expressed as percentage by mass of the total mix, shall be in accordance with the requirements.

### **Rolled Asphalt Surface Course (Design Mix)**

Rolled asphalt surface course shall be designed in accordance with the procedures of AASHTO and shall comply with the standards for surface course design mixtures. The design mix material shall be designation Type F - 30% 0/14 mm or 35% 0/14 mm. Prior to the use of the design mixture in the works, the contractor shall notify the employer's representative of intended usage.

- Binder

The binder shall be petroleum bitumen of paving grade 40/60 Pen in compliance with AASHTO.

- Coarse Aggregate

The Coarse aggregate shall be crushed rock in compliance with the specifications above. The resistance to polishing of the coarse aggregate shall be category PSV44 as defined in AASHTO.

- Install New Asphalt Surface

The porous asphalt used on the project shall be laid using an asphalt paving machine, the asphalt should be laid compacted within three hours of being mixed.

The approved thickness for the laid asphalt should be  $45 \pm 5$  mm. Since the highway will contain four lanes, two paving machine should be used simultaneously, this allows the longitudinal joint lines to be rolled while the asphalt is still hot. The approved stagger between the two paving machine should not exceed 20 meters.

The finished surface should not contain longitudinal lines covered in bitumen coating nor should it contain throwback materials to patch lines, in addition there should be no walking or placing of machines on uncompact asphalt. The asphalt should not be laid if there is persistent rainfall or water lodges on the base or subgrade.

Porous asphalt shall be laid within the limits of air temperature and wind speed. Laying shall not be permitted at any temperature if the average wind speed over the preceding hour exceeds 50km/h at 10m height (40km/h at 2m height).

The compaction of the laid asphalt should be done with at least two 6-8 tons, non-vibrating, metal wheel tandem drum rollers for each paving system. The roller drum should be kept clean and wetted before rolling commences, this results in the materials not sticking to the roller during the process.

The use of rubber tire rollers and three- wheeled rollers are prohibited for use on the asphalt surface. The rolling shall commence as specified in the table located in appendix 8.4; which is the highest mat temperature consistent with no shoving. The first roller pass will be on the low edge of the mat, followed by the high edge. Rolling of the rest of the mat shall then proceed from low to high side and shall continue until all curler marks have been eliminated.

- Bridge Constriction

The carriageway width for bridges should be 7.5 m on both sides. The median/central verge is constructed to a width of the median/central verge when provided shall not be less than 1.20 m. For culverts of length 3.0 m and less, the width between the outer most faces of the culvert shall be equal to the full formation width of the road.



The cement shall conform to the requirements of AASHTO M 85 (ASTM C 150) or ASTM C 1157 for the specified type, including the optional requirement for early stiffening. Blended cement shall conform to the requirements of AASHTO M 240 (ASTM C 595) or ASTM C 1157 for the specified type, including the optional requirement for early stiffening. Supplementary cementitious materials not incorporated into the blended cement shall conform to the relevant standards as follows:

Fly ash and natural pozzolans shall conform to the requirements of AASHTO M 295 (ASTM C 618) for the specified class.

Slag cement shall conform to the requirements of AASHTO M 302 (ASTM C 989) for the specified grade.

Silica fume shall conform to the requirements of AASHTO M 307 (ASTM C 1240).

- Culvert Construction

The concrete pipe and box culverts used in this road project should be manufactured to the nationally accepted standard and specifications; these are in accordance with the standards published by the American Society for Testing and Materials (ASTM).

The Precast Reinforced Concrete Box Section used for Culverts, Storm Drains, and Sewers should use the AASHTO M 259 (M 259M) specification. The Precast reinforced Concrete Box sections should be cover under 2 ft. (0.6 m) or more of earth cover for heavy duty loads.

The Concrete Irrigation pipes for drainage should follow the ASTM C 118 (C 118M) specification. Pipes should be sized from CIRCULAR Diameter 6 to 24 in. (150 mm to 600 mm), based on its intended use for the conveyance of irrigation water under low hydrostatic heads. They generally should not exceed 25 ft. (75 kilopascals), and pipes should be in sizes from 4 in. to 24 in. (100 mm to 600 mm) in diameter that are used for heavy duty drainage and standard draining purposes.

- Steel Overhead Walkway Construction

The furnishing and installation of the metal stairs, ladders, and walkways required to complete the overhead walkway are specified below.

#### Aluminum Stairway Connections

- a. The connections that are between each aluminum stairway member shall be aluminum bars, plates, and shapes that are fabricated using stainless steel in accordance with the AISI 304 or AISI 316 specifications.
- b. The connections that exist between aluminum stairway sections and aluminum fabrications, such as landings, walkways, and platforms, shall be aluminum bars, plates that are fabricated using stainless steel in accordance with the AISI 304 or AISI 316 specification.
- c. The connections that exist between aluminum stairway and poured or laid precast concrete shall be fabricated using stainless steel in accordance with the AISI 316 specification.
- d. The connections between each aluminum stairway and steel fabrications, such as landings, walkways, and platforms, shall be fabricated in accordance with the AISI 316 specification.

#### Aluminum Stair Treads

- a. The installed aluminum stair treads shall be same pattern and alloys as aluminum walkway grating.
- b. The installed aluminum stair treads shall be a minimum of 1-1/2 inches thick, unless otherwise indicated by the project sponsor.
- c. The installed aluminum stair treads shall have 1-1/4-inch wide abrasive nosing.

## **Constraints**

The expenditure associated with the completion of this project should not exceed fifty million (\$50,000,000) US Dollars. The project timeline should not exceed thirty-six (36) months; of which twenty-four (24) months are dedicated to the construction of the road and supporting infrastructure and six (6) months each shall be used for preliminary and furnishings and closing works respectively.

## **Assumptions**

- Finances

It is assumed that the project is fully funded.

- Workforce

It is assumed that the contractor has the adequate amount of skilled and unskilled workers to successfully execute the project.

- Schedule

It is assumed that thirty-six (36) months is adequate to complete the project and all of its deliverables.

- Budget

It is assumed that the project can be completed given its budget of fifty million (50,000,000) US dollars.

- Project Planning

It is assumed that all the necessary approval and permits will be granted in a timely manner to ensure the project is completed successfully.

- Weather

It is assumed that the road will be constructed for all-weather purposes. Therefore, the correct materials and methods needs to be used in the construction of the road to withstand any adverse weather conditions.

## Work Breakdown Structure

This is a deliverable-oriented hierarchical decomposition of the work to be executed by the Project Team to accomplish the project objectives and create the required deliverables. The WBS allows the Project Team to be efficient and effective in its project planning, execution, controlling, monitoring, and reporting. Further, the breakdown into smaller packets allows the project's scope to be carefully managed and executed given the available resources.

**Chart 8 Work Breakdown Structure (Source: Compiled by the Author, 2021)**

WBS Level	WBS Code	Element Name
1	0	<b>Construction of the East Bank-East Coast (Diamond to Ogle) Highway</b>
2	1	<b>Preparatory Work</b>
3	1.1	<b>Project and Conceptual Design</b>
4	1.1.1	Initial Impact Assessment
4	1.1.2	Feasibility Study
4	1.1.3	Approval of Project Charter
4	1.1.4	Complete Design Documents & Submit to MOPW and EPA for Permits
3	1.2	<b>Mobilization &amp; Demobilization</b>
4	1.2.1	Mobilization Program
4	1.2.2	Demobilization Program
3	1.3	<b>Field Office and Facilities</b>
4	1.3.1	Outfit Office with Service Provider Utilities and Facilities
4	1.3.2	Service Workshop and Warehouse
4	1.3.3	Offices and Accommodations for the Directors
3	1.4	<b>Management and Traffic Safety</b>
4	1.4.1	Management Plan and Traffic Safety
4	1.4.2	Description of Temporary Minimum Road Equipment

WBS Level	WBS Code	Element Name
4	1.4.3	Temporary Road or Bridge Works
4	1.4.4	Maintenance Schedule for Traffic Safety
3	1.5	<b>Field Technical Review</b>
4	1.5.1	Field Survey Work for Design Review
4	1.5.2	Routine Implementation Survey Work
4	1.5.3	Determination of Measurement Point
4	1.5.4	Field Engineering Expert Approval
3	1.6	<b>Environmental Security</b>
4	1.6.1	Environmental Management Efforts
3	1.7	<b>Relocate Existing Utility</b>
4	1.7.1	Utility Relocation Work and Existing Services
3	1.8	<b>Soil Testing</b>
4	1.8.1	Test Characteristics
<b>2</b>	<b>2</b>	<b>Drainage</b>
3	2.1	<b>Support Drainage</b>
4	2.1.1	Excavation of Sewers and Waterways
4	2.1.2	Drainage of Stone & Mortar Pairs
4	2.1.3	Concrete Precast Drainage
4	2.1.4	Concrete Cast Insitu Drainage
4	2.1.5	Porous Drainage
4	2.1.6	Culvert Pipes and Culvert Boxes
<b>2</b>	<b>3</b>	<b>Land Work</b>
3	3.1	<b>Land clearing</b>
4	3.1.1	Cleaning, Peeling and Cutting Trees
3	3.2	<b>Excavation</b>
4	3.2.1	Soil Excavation
4	3.2.2	Stone Excavation
4	3.2.3	Asphalt Pavement Excavation
4	3.2.4	Concrete Pavement Excavation
4	3.2.5	Structure Excavation
3	3.3	<b>Pile / Compaction</b>
4	3.3.1	Dumps Back
4	3.3.2	Heap from the Outside (Borrow Area)
3	3.4	<b>Land Improvement</b>
4	3.4.1	Geotextile Works
4	3.4.2	Vacuum Consolidation Method (VCM) Works
4	3.4.3	Dynamic Compaction (DC)

<b>WBS Level</b>	<b>WBS Code</b>	<b>Element Name</b>
<b>2</b>	<b>4</b>	<b>Widening of Pavement and Roadside</b>
3	4.1	<b>Widening Pavement Work</b>
4	4.1.1	Widening of Asphalt Pavement Works
4	4.1.2	Widening of Concrete Pavement Work
3	4.2	<b>Roadside Works</b>
4	4.2.1	Widening Roadside Works
<b>2</b>	<b>5</b>	<b>Bulking Hardening and Concrete Pavement</b>
3	5.1	<b>Gilded Pavement</b>
4	5.1.1	Aggregate Base
4	5.1.2	Gilded Pavilion Without Asphalt Cover
3	5.2	<b>Concrete Pavement</b>
4	5.2.1	Soil Cement Base
4	5.2.2	Aggregate Cement Foundation Base (CBT dan CTSB)
4	5.2.3	Concrete Pavement Laying
<b>2</b>	<b>6</b>	<b>Asphalt Pavement</b>
3	6.1	<b>Asphalt Mixing Plant (AMP)</b>
4	6.1.1	Basic Asphalt Layer (Prime coat/ Tack coat)
4	6.1.2	Job Mix Testing
4	6.1.3	Upper Asphalt
<b>2</b>	<b>7</b>	<b>Steel Bridges Construction</b>
3	7.1	<b>Lower Structure</b>
4	7.1.1	Wood Piles
4	7.1.2	Precast Concrete Piles
4	7.1.3	Steel Structure Piles
4	7.1.4	Couple Stone with Mortar
4	7.1.5	Pile Caps
3	7.2	<b>Upper Structure</b>
4	7.2.1	Abutment, Columns and Piers
4	7.2.2	Erection of Bridge Girder
4	7.2.3	Floor and Barrier Casting
3	7.3	<b>Bridge Accessories</b>
4	7.3.1	Railing
4	7.3.2	Markings and Fixtures
3	7.4	<b>Steel Overhead Walkway Accessories</b>
4	7.4.1	Roofing
4	7.4.2	Railing
4	7.4.3	Staircases and Elevators

WBS Level	WBS Code	Element Name
2	8	<b>Road Furnishings</b>
3	8.1	<b>Road Lighting</b>
4	8.1.1	Poles
4	8.1.2	Lamps and Bulbs
4	8.1.3	Electrical Works
3	8.2	<b>Road Marking and Traffic Signals</b>
4	8.2.1	Directional Marking
4	8.2.2	Traffic Signs
4	8.2.3	Traffic Lights
2	9	<b>Project Closure</b>
3	9.1	<b>Project Completion and Handover</b>
4	9.1.1	Inspection of Works
4	9.1.2	Commissioning of New Road
4	9.1.3	Handover to the Government of Guyana

The WBS Dictionary was used to define the work that was necessary for the completion of this project. The WBS dictionary includes, the WBS Code, WBS Element, its proposed budget, a description of the activities and the resources assigned to the project activities. The WBS Dictionary will be used as the statement of work for each WBS element.

**Chart 9 WBS Dictionary (Source: Compiled by the Author, 2021)**

WBS	Element Name	Budget	Description of Activities	Resources
1	Preparatory Work	\$ 5,000,000	Works done before the actual construction begins	
1.1	Project and Conceptual Design	\$ 1,000,000	Finalizing Project Charter and design documents	
1.1.1	Initial Impact Assessment	\$ 300,000	Conducting Initial Impact Assessment for project	Laptop, Internet, Printer
1.1.2	Feasibility Study	\$ 350,000	Conducting Initial Impact Assessment for project	Laptop, Internet, Relevant Literature
1.1.3	Approval of Project Charter	\$ 50,000	Approval of Project Charter by sponsor	Laptop, Internet, Relevant Literature
1.1.4	Complete Design Documents & Submit to MOPW and EPA for Permits	\$ 300,000	Finalizing road designs and the completion of application for EPA and building permits	Laptop, Requirements, and Structural Drawings
1.2	Mobilization & Demobilization	\$ 250,000	The determination of procurement needs for equipment for offices,	

<b>WBS</b>	<b>Element Name</b>	<b>Budget</b>	<b>Description of Activities</b>	<b>Resources</b>
			construction, and assembly of Project Team. The determination of what equipment to move from old work site and storage facilities.	
1.2.1	Mobilization Program	\$ 125,000	The development of a plan to acquire resources for the project. Identification of suitable area to house office facilities.	Laptop
1.2.2	Demobilization Program	\$ 125,000	The development of a plan to reuse and reshuffle resources from other worksites and storage facilities.	Laptop
1.3	Field Office and Facilities	\$ 1,250,000	The determination of the office layout and utilities needed for the functioning of the office.	
1.3.1	Outfit Office with Service Provider Utilities and Facilities	\$ 375,000	Assembly of mobile office and the installation of utilities and facilities to make the office functional.	Outside Service Provider
1.3.2	Service Workshop and Warehouse	\$ 437,500	The assembly of mobile workshop and warehouse to maintain and store equipment and machinery.	Trucks, Cranes, Small Tools
1.3.3	Offices and Accommodations for the Directors	\$ 437,500	The equipping of boardroom and office space for senior project contractors and Ministry of Public Works Director.	Trucks, Cranes, Small Tools
1.4	Management and Traffic Safety	\$ 500,000	The development of a plan to reroute traffic, create temporary access roads and temporary signs.	
1.4.1	Management Plan and Traffic Safety	\$ 25,000	Development of the plan to reroute traffic and to create by pass roads and access points.	Laptop, Approved Charter, Concept note
1.4.2	Description of Temporary Minimum Road Equipment	\$ 25,000	Identifying equipment that will be used to create	Laptop, Approved Charter, Concept note



<b>WBS</b>	<b>Element Name</b>	<b>Budget</b>	<b>Description of Activities</b>	<b>Resources</b>
			temporary access roads and access points.	
1.4.3	Temporary Road or Bridge Works	\$ 425,000	The actual construction of temporary roads and bridges to give access to the location.	Excavator, Backhoe, trucks and Wood working tools.
1.4.4	Maintenance Schedule for Traffic Safety	\$ 25,000	The careful identification and marking for temporary access roads and rerouting of traffic.	Laptop, Approved Charter, Concept note
1.5	Field Technical Review	\$ 750,000	The review of the technical requirement for the road construction, area identified for the road construction.	
1.5.1	Field Survey Work for Design Review	\$ 75,000	The develop plan for a cadastral survey to carefully identify the placement of the road and its boundaries.	Laptop, Approved Charter, Concept note
1.5.2	Routine Implementation Survey Work	\$ 225,000	The execution of the cadastral plan according to the prescribed coordinates.	Theodolite, measuring tape, total station, 3D scanners, GPS/GNSS, level and rod
1.5.3	Determination of Measurement Point	\$ 375,000	The careful identification and markings of the coordinates, so that the boundary lines can be cut accurately.	Theodolite, measuring tape, total station, 3D scanners, GPS/GNSS, level and rod
1.5.4	Field Engineering Expert Approval	\$ 75,000	The approved plan of the area identified for the new road, with the accurate coordinates that will be registered with the Lands and Survey Commission.	Laptop, Printer
1.6	Environmental Security	\$ 250,000	The review of the Environmental Plan that will preserve the biodiversity and resources in the identified area.	

WBS	Element Name	Budget	Description of Activities	Resources
1.6.1	Environmental Management Efforts	\$ 250,000	The execution of the Environmental Plan that will preserve the biodiversity and resources in the identified area. Relocating fauna and flora in the areas that may be protected under the Protected Areas Act. The rerouting of steams that may be used for household consumption to avoid contamination.	Laptop, Environmental Consultant Company
1.7	Relocate Existing Utility	\$ 350,000	The execution of the relocation plans for existing utilities and infrastructure to accommodate road construction. This will clear the way for construction in a safe manner.	
1.7.1	Utility Relocation Work and Existing Services	\$ 350,000	The development of a plan to relocate existing utilities and infrastructure to accommodate road construction.	Trucks, Cranes, Small Tools
1.8	Soil Testing	\$ 650,000	The determination whether the soil type is appropriate for road construction.	
1.8.1	Conduct Test Characteristics	\$ 650,000	The collection and testing of samples along the identified area to determine soil type and appropriateness.	Push probes, hammer probes, and bucket augers
2	Drainage	\$ 8,000,000	The development of appropriate channels to allow drainage of lands and liquid waste disposal.	
2.1	Support Drainage Installation	\$ 8,000,000	Development of drainage systems	
2.1.1	Excavation of Sewers and Waterways	\$ 1,600,000	The removal of debris, widening and creation of new trenches to support drainage.	Excavator, Backhoe, Trucks

<b>WBS</b>	<b>Element Name</b>	<b>Budget</b>	<b>Description of Activities</b>	<b>Resources</b>
2.1.2	Laying of Drainage of Stone & Mortar Pairs	\$ 1,200,000	Laying of foundation to support drainage.	Cement Mixing and Concrete Batching Plants, Trucks, Cranes
2.1.3	Installation of Concrete Precast Drainage	\$ 1,200,000	Installation of drainage depending on the terrain and design of drainage area.	Cement Mixing and Concrete Batching Plants, Trucks, Cranes
2.1.4	Installation of Concrete Cast Insitu Drainage	\$ 1,200,000	Installation of drainage depending on the terrain and design of drainage area.	Cement Mixing and Concrete Batching Plants, Trucks, Cranes
2.1.5	Installation of Porous Drainage	\$ 1,200,000	Installation of drainage depending on the terrain and design of drainage area.	Cement Mixing and Concrete Batching Plants, Trucks, Cranes
2.1.6	Installation of Culvert Pipes and Culvert Boxes	\$ 1,600,000	Installation of drainage depending on the terrain and design of drainage area.	Cement Mixing and Concrete Batching Plants, Trucks, Cranes
3	Land Work	\$ 8,000,000	The preparation of the land for construction of new roads	
3.1	Land clearing Execution	\$ 2,800,000	The activities of clearing the land along the dimensions developed in the survey.	
3.1.1	Conducting the Cleaning, Peeling and Cutting Trees	\$ 2,800,000	The commencement of land clearing activities	Bulldozer, Excavator, Chain Saws
3.2	Executing Excavation Activities	\$ 2,800,000	The excavation of debris along the round of the road.	
3.2.1	Conducting Soil Excavation	\$ 560,000	The removal of various type debris, widening of areas to install new road.	Excavator, Backhoe, Trucks
3.2.2	Conducting Stone Excavation	\$ 560,000	The removal of various types of debris, widening of areas to install new road.	Excavator, Backhoe, Trucks
3.2.3	Conducting Asphalt Pavement Excavation	\$ 560,000	The removal of various types of debris, widening of areas to install new road.	Excavator, Backhoe, Trucks

<b>WBS</b>	<b>Element Name</b>	<b>Budget</b>	<b>Description of Activities</b>	<b>Resources</b>
3.2.4	Conducting Concrete Pavement Excavation	\$ 560,000	The removal of various types of debris, widening of areas to install new road.	Excavator, Backhoe, Trucks
3.2.5	Conducting Structure Excavation	\$ 560,000	The removal of various types of debris, widening of areas to install new road.	Excavator, Backhoe, Trucks
3.3	Conducing Piling	\$ 1,600,000	The commencement of the refill and compaction process	
3.3.1	Transporting and Compacting Dumps Back	\$ 800,000	The dumping back of materials that may be used to compact the roads and surrounding areas	Excavator, Backhoe, Trucks, Compactor Roller
3.3.2	Transporting and Compacting of Heap from the Outside (Borrow Area)	\$ 800,000	The dumping back of materials that may be used to compact the roads and surrounding areas	Excavator, Backhoe, Trucks, Compactor Roller
3.4	Conducting Land Improvement	\$ 800,000	Activities to improve land preparation	
3.4.1	Conducting Geotextile Works	\$ 320,000	Reinforcing the soil by adding tensile strength	Fabric installation equipment
3.4.2	Conducting Vacuum Consolidation Method (VCM) Works	\$ 240,000	A soft soil ground improvement method that is typically combined with Prefabricated Vertical Drains and Horizontal Drains (PVD+VCM)	Vacuum Pumps, Pipes
3.4.3	Conducting of Dynamic Compaction (DC)	\$ 240,000	A ground improvement technique that densifies soils and fill materials by using a drop weight.	Compactor Roller
4	Widening of Pavement and Roadside Construction	\$ 4,000,000	Activities that seeks to widen preexisting roads and pavements	
4.1	Executing Widening Pavement Work	\$ 2,000,000	Execution of works to widen existing roads pavements	
4.1.1	Executing Widening of Asphalt Pavement Works	\$ 1,000,000	Widening of pavements made from asphalt	Excavator, Backhoe
4.1.2	Executing Widening of Concrete Pavement Work	\$ 1,000,000	Widening of pavements made from cement.	Excavator, Backhoe
4.2	Conducting Roadside Works	\$ 2,000,000	Execution of works to widen existing roads.	

<b>WBS</b>	<b>Element Name</b>	<b>Budget</b>	<b>Description of Activities</b>	<b>Resources</b>
4.2.1	Executing Widening Roadside Works	\$ 2,000,000	Grading of areas to widen roads.	Excavator, Backhoe
5	Bulking Hardening and Concrete Pavement Construction	\$ 4,000,000	Activities focused on laying subgrade and subbase and pavements	
5.1	Laying Gilded Pavement	\$ 1,400,000	Activities focused on the laying of aggregate for the Gilded Pavement	
5.1.1	Laying of Aggregate Base	\$ 700,000	Laying of aggregate Base (stones)	Dump Trucks, Backhoe
5.1.2	Gilded Pavilion Without Asphalt Cover	\$ 700,000	Laying of Pavilion stones	Dump Trucks, Backhoe
5.2	Pouring of Concrete Pavement	\$ 2,600,000	Activities focused on the pouring of concrete base	
5.2.1	Pouring Soil Cement Base	\$ 520,000	Pouring a highly compacted mixture of soil/aggregate, cement, and water	Cement Mixing and Concrete Batching Plants, Trucks,
5.2.2	Pouring Aggregate Cement Foundation Base (CBT dan CTSB)	\$ 1,040,000	A type of Soil-Cement describing an intimate mixture of native soils and/or manufactured aggregates with measured amounts of Portland cement and water	Cement Mixing and Concrete Batching Plants, Trucks,
5.2.3	Concrete Pavement Laying	\$ 1,040,000	Laying of concrete pavement slabs	Cement Mixing and Concrete Batching Plants, Trucks, Cranes
6	Application of Asphalt Pavement	\$ 10,000,000	Activities involved in the laying of asphalt surface	
6.1	Asphalt Mixing Plant (AMP) Work	\$ 10,000,000		
6.1.1	Application of Basic Asphalt Layer (Prime coat/ Tack coat)	\$ 3,000,000	An application of a low viscosity asphalt to a granular base in preparation for an asphalt surface course	Bitumen Sprayer, Trucks
6.1.2	Conducting of Job Mix Testing	\$ 1,000,000	The asphalt mix test helps to estimate the hot mix (asphalt) tonnage required for the job.	Asphalt Mixture Performance Tester and Analyzer

<b>WBS</b>	<b>Element Name</b>	<b>Budget</b>	<b>Description of Activities</b>	<b>Resources</b>
6.1.3	Application of Upper Asphalt	\$ 6,000,000	Laying asphalt surface to the correct the width, length, and thickness (in inches).	Asphalt Paving Machines, Trucks, Rollers and Compactor Trucks
7	Erection of Steel Bridges and Overhead Walkway	\$ 4,000,000	Activities involved in the building of the bridges and the overhead steel walkway.	
7.1	Establishment of Lower Structure	\$ 1,000,000	Activities to erect the foundation of the bridges.	
7.1.1	Driving of Wood Piles	\$ 250,000	Driving of woodpiles into earth.	Pile Driver, Trucks, Cranes
7.1.2	Driving of Precast Concrete Piles	\$ 250,000	Driving of concrete piles into earth.	Pile Driver, Trucks, Cranes
7.1.3	Driving of Steel Structure Piles	\$ 250,000	Driving of steel plates into earth.	Pile Driver, Trucks, Cranes
7.1.4	Application of Couple Stone with Mortar	\$ 150,000	Plastering of mortar with stones to piles.	Cement Mixer, Concrete Batching Plant
7.1.5	Installation of Pile Caps	\$ 100,000	A thick concrete mat that rests on concrete, timber piles metal sheets.	Cement Mixer, Concrete Batching Plant
7.2	Erection of Upper Structure	\$ 1,000,000	Activities associated with the erection of upper structure of the bridge.	
7.2.1	Erect Abutment, Columns and Piers	\$ 300,000	A substructure, which supports the end of a single span of the extreme end of a multi-span superstructure of the bridge.	Cement Mixer, Concrete Batching Plant, Cranes, Trucks
7.2.2	Erection of Bridge Girder	\$ 350,000	Girder bridges are comprised of deck slabs	Cement Mixer, Concrete Batching Plant, Cranes, Trucks
7.2.3	Installation of Floor and Barrier Casting	\$ 350,000	Application of cement finish to floor and erection of bridge rails columns.	Cement Mixer, Concrete Batching, Plant
7.3	Installation of Bridge Accessories	\$ 1,000,000	Activities surrounding the installation bridge accessories	
7.3.1	Install Railing	\$ 500,000	Attach metal railing to bridges	Trucks, Cranes, Small Tools

<b>WBS</b>	<b>Element Name</b>	<b>Budget</b>	<b>Description of Activities</b>	<b>Resources</b>
7.3.2	Install Markings and Fixtures	\$ 500,000	Paint and install markings on the road.	Trucks, Cranes, Small Tools, Paint Sprayer
7.4	Installation of Steel Overhead Walkway Accessories	\$ 1,000,000	Activities surrounding the installation overhead walkway accessories	Trucks, Cranes, Small Tools
7.4.1	Installation Roofing	\$ 300,000	Installation of roof for overhead walkway.	Trucks, Cranes, Small Tools
7.4.2	Installation Railing	\$ 300,000	Attach metal railing to overhead walkway.	Trucks, Cranes, Small Tools
7.4.3	Installation Staircases and Elevators	\$ 400,000	Installation of mini elevator and staircase on both sides	Trucks, Cranes, Small Tools
8	Complete Road Furnishings	\$ 2,000,000	Activities associated with the application and installation of road finishes.	
8.1	Install Road Lighting	\$ 1,500,000	Installation of street lights	
8.1.1	Install Poles	\$ 600,000	Planting of concrete poles	Trucks, Cranes, Small Tools
8.1.2	Install Lamps and Bulbs	\$ 300,000	Installation of lamps and bulbs on concrete poles	Trucks, Lift and Small Tools
8.1.3	Install Electrical Works	\$ 600,000	Connecting electrical wires to lamps and national grid.	Trucks, Lift and Small Tools
8.2	Install Road Marking and Traffic Signals	\$ 500,000	Activities surrounding the application of road markings and traffic signals	
8.2.1	Install Directional Marking	\$ 75,000	Erecting and installation of directional signs	Trucks, Cranes, Small Tools
8.2.2	Install Traffic Signs	\$ 75,000	Erecting and installation of traffic signs	Trucks, Cranes, Small Tools
8.2.3	Install Traffic Lights	\$ 350,000	Installation of traffic lights	Trucks, Cranes, Small Tools
9.1	Project Completion and Handover		The finalizing and closing of project	
9.1.1	Inspection of Works		An inspection of the road by the Project Sponsor	
9.1.2	Commissioning of New Road		Commissioning of road by Ministers of Public Works	
9.1.3	Handover to the Government of Guyana		The official opening of the road to the public	

## **Scope Verification**

The project supervision team, inclusive of the Project Director of the Work Services Group and the Project Manager of SINOHYDRO Corporation, will be responsible for the scope verification process. This process will see the team reviewing work products, deliverables and results to ensure that all were completed correctly and satisfactorily in keeping with the scope of the project that was initially defined. The Project Director will review all completed deliverables vetted by the Project Manager and his team. Once the Project Director is satisfied with the completed deliverables, the deliverable acceptance document is expected to be presented to the Project Sponsor for formal acceptance. This process will assure that the executed project work was consistent with the defined scope throughout the life of the project.

## **Scope Control**

The Project Manager and his team, with the supervision of the Project Director and his team from the Work Services Group of the MPW, has the responsibility to ensure that the scope of the project is controlled. The scope baseline, inclusive of the project scope statement, work breakdown structure and WBS Dictionary, will be used as the main guide that will allow the teams to maintain the scope baseline throughout the life cycle of the project.

The scope of a project shall be changed providing that the correct procedure has been followed. Any stakeholder can request a change in scope. This must be done by submitting to the Project Manager a project change order form. The Project Manager will then review the suggested change to the scope of the project and determine, with justification, whether it is recommended for approval or denial. This information is then presented to the Project Director for his review and approval. Once the Project Director approves the recommendation of the Project Manager, the changes to the scope will be presented at a change control meeting between the Project Team, Project Supervisor and sponsor to review the change request further and perform an impact assessment of the change. The Project Sponsor can approve or decline the changes to the scope of the project. If accepted, the change order will



be signed and this will allow the Project Manager, with the assistance of the Project Director, to update all project documents and communicate the scope directive to all Project Team members and stakeholders.

### **SPONSOR ACCEPTANCE**

Approved by:

\_\_\_\_\_ Date: \_\_\_\_\_

Government of Guyana

## **REQUIREMENTS MANAGEMENT PLAN**

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## Version history

Version #	Implemented By	Revision Date	Approved By	Approval Date	Reason

## OVERVIEW

The project includes the construction of a fifteen (15) kilometer road, the construction of thirteen (13) concrete bridges, thirty (30) concrete culverts and a steel overhead walkway that connect the eastern and western road sides along the busy highway.

### Purpose

The Requirements Management Plan is used to document the necessary information required to effectively manage project requirements from definition, through traceability to delivery.

The Requirements Management Plan is created during the planning phase of the project. Its intended audience is the Project Manager, Project Team, Project Sponsor and any senior leaders whose support is needed to carry out the plan.

### Scope

The specification of the project was already defined earlier in the Scope Management Plan; to avoid duplication we will refer to that above state specifications.

Activity	Responsible Party
Financier	Government of Guyana (Ministry of Public Works)
Project Supervisions	Work Service Group (Project Director)
Project Management	SINOHYDRO Corporation
Design and Specification	Government of Guyana (Ministry of Public Works)
Permits	Government of Guyana (Ministry of Public Works)
Construction	SINOHYDRO Corporation
Supplies and Materials	Suppliers and Subcontractors

### **Applicability**

The project management team, which includes the contractor, will be most affected by the Requirements Plan as they will have to ensure that all other subsidiary documents, including the Scope Management Plan, the requirements traceability matrix and the project management plan, are coherent and adhere to the processes that guide requirements management.

### **Applicable Documents**

The project Management Plan, inclusive of its Project Charter, the Scope Management Plan, the Requirements Documentation, the Requirements Traceability Matrix, and the approved road construction documents are all applicable to creating the Requirements Management Plan.

### **Changes and Revisions**

The Project Manager of SINOHYDRO Corporation with the supervision of the Project Director of the Ministry of Public Works, is responsible for controlling all proposed changes to the Requirements Management Plan and any other related information in keeping with the requirements.

### **Issue(s)**

The issue that may affect the implementation of the Requirements Management Plan can be a lack of information due to assumptions made by design engineers as it relates to the selection of the geographic location of the road.

## **ROLES AND RESPONSIBILITIES**

### **Organization Overview**

<b>Role</b>	<b>Name</b>	<b>Organization</b>
Project Sponsor	Ministers and Permanent Secretary	Government of Guyana (Ministry of Public Works)
Project Supervisor	Anthony Flett	Work Services Group (MPW)
Project Manager	Geoffrey Vaughn	SINOHYDRO Corporation

Project Team	Team	SINOHYDRO Corporation
Suppliers and Subcontractors	Team	Contracted by SINOHYDRO Corporation

## **Roles and Organization**

### ***Role A***

The Project Sponsor is responsible for providing client requirements, reviewing technical and building requirements and approving requirements.

### ***Role B***

The Project Supervisor is the Work Services Group of the Ministry of Public Works that ensure all project requirements are executed by the Project Team.

### ***Role C***

The Project Manager is responsible for collecting, reviewing and developing project requirements. He is also responsible for enforcing all the approved technical, building and project requirements.

### ***Role D***

The Project Team members are responsible for reviewing requirements to ensure that details are specific and accurate.

### ***Role E***

The sub-consultants are responsible for providing technical requirements and specialty consultation for the project.

## **REQUIREMENTS PROCESSES**

### **Overview**

To identify, develop, maintain, and manage the requirements, the PMBOK® Guide's Project Scope Management processes will be used. Therefore, the following processes will guide requirements management:

#### ***Process 1***

Collect requirements: In this process the stakeholders' needs, industry and regulatory requirements as it relates to the project objectives are determined and documented.

**Process 2**

Define scope: In this process a detailed description of the project is done in keeping with the stakeholders' needs, regulatory requirements, and industry standards.

**Process 3**

Create WBS: In this process the project deliverables are broken down into smaller work packages that are more manageable.

**Process 4**

Validate scope: Within this process the project deliverables that were developed and completed using the requirements are accepted.

**Process 5**

Control scope: Within this process the status of the project is closely monitored and the any proposed changes to the scope is managed closely.

**TOOLS**

**Chart 10 List of Tools (Source: Compiled by the Author, 2021)**

<b>Tool</b>	<b>Version</b>	<b>Use</b>
Stakeholder Management Plan Template (Created in Microsoft Word)	Microsoft Office 2016	Used to create Stakeholder Management Plan
Requirements Documentation Template (Created in Microsoft Word)	Microsoft Office 2016	Used to create Requirements Documentation
Microsoft Project	Microsoft Projects 2016	Used to manage and create WBS elements
Requirements Traceability Matrix (Created in Microsoft Excel)	Microsoft Office 2016	Used to create the Requirements Traceability Matrix

**REQUIREMENTS DOCUMENTATION AND ORGANIZATION****Requirements Documentation****WORK BREAKDOWN STRUCTURES**

This provides a hierarchical breakdown into smaller more manageable packages of the total scope of work to be completed for the project.

**REQUIREMENTS TRACEABILITY MATRIX**

This is a documentation which includes how each requirement will be implemented and evaluated.

**REQUIREMENTS DOCUMENT**

The detailed design, structural and functional requirements for the construction of the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.

**SCOPE MANAGEMENT PLAN**

This plan details how the scope will be developed, managed and maintained throughout the project lifecycle.

**MEASURES**

To measure requirements, the Project Manager will give Work Orders (Directives) to the work team on a weekly basis, preferably Monday mornings before site work begins, to carry out the work based on the schedule.

The Project Manager will be responsible daily for collecting data and compiling a report that will be sent to the Project Management Office (Work Services Group) for the Project Directors and Assistant Project Director to compile and approve a report that will result in the Work Orders (Directives). This will be issued by the Project Manager the following Monday as per the project requirements.

**Requirements Evaluation Checklists**

The determination of whether the requirements meet the criteria must be inputted and the unique ID of the problem requirement(s) must be entered. Explain in remarks the reason if "No" is checked. Attach additional sheets if needed.

Chart 11 Checklist for Requirements (Source: Compiled by the Author, 2021)

Evaluation Criteria	Yes	No	ID	Remarks
<b>Customer/User Needs</b>				
• Ease of Use				
• Connectivity				
• Ease flow of traffic				
• Safety				
<b>Functional Requirements</b>				
• Lane markings and Pedestrian crossing				
• Speed Bumps at specific corners				
• Roundabout connecting roads				
• Proper lighting				
• Proper drainage				
• Adequate space for road side parking				
<b>Technical/Structural Requirements</b>				
• The road construction must adhere to local construction code and standards requirements				
• The roads should be wide enough to accommodate four lane traffic, roadside parking and pavement walkways.				
• The construction components must be built to withstand all weathers, natural disasters and heavy-duty vehicles.				

### Quality Standards

Describe the characteristics of requirements of good quality.

#### Customer or user needs of good quality are:

- Ease of Use: Access points must be easy to find and roads must be wide enough for multiple vehicles at the same time.

- **Connectivity:** The road must have various access and exist points that allows it to connect to other villages and farming lands.
- **Ease flow of traffic:** The road must be able to accommodate the free flow of traffic, clear access to parking and round about to manage traffic flows.
- **Safety:** Access to pavement, pedestrian crossing, traffic lights and overhead walkway to prevent accidents.

#### **Functional requirements;**

- **Lane markings and Pedestrian crossing:** Roads must be clearly marked with road signs and pedestrians crossing.
- **Speed bumps at specific corners:** Speed bumps must be installed on critical corners to reduce speeding.
- **Roundabout connecting roads:** Installation of roundabouts at major intersections to help will traffic flow.
- **Proper lighting:** The installation of street lights along the highway to ensure safety of pedestrians and vehicular traffic.
- **Proper drainage:** The installation of drainage systems to reduce any amount of road flooding.
- **Adequate space for road side parking:** The development of parking lanes on both sides of the highway to reduce congestion dues to accidents or mechanical issues.

#### **Technical/Structural Requirements:**

- **The road construction must adhere to local construction codes and standards requirements:** Roads must be constructed to comply with the local building codes and standards.
- **The roads should be wide enough to accommodate four lane traffic, road side parking and pavement walkways.** Adequate space is needed to ensure the safety of all road users.
- **The construction components must be built to withstand all weathers, natural disasters and heavy duty vehicles.** The materials used and its strength should be able to withstand adverse weather and usage, without faltering.



## **The East Bank to East Coast (Diamond to Ogle) Highway Linkage Project: Requirements Document (1.0)**

Project: The East Bank to East Coast (Diamond to Ogle) Highway

Date(s): October 2021

Prepared by: S. Brathwaite (Assistant Project Director)

Document status:  Draft  Proposed  Validated  Approved

### **1.1. Purpose of This Document**

This document is intended to guide the construction of ***The East Bank to East Coast (Diamond to Ogle) Highway***. It will go through several stages during the course of the project:

- **Draft:** The first version, or draft version is compiled after requirements have been discovered, recorded, classified, and prioritized.
- **Proposed:** The draft document is then proposed as a potential requirements specification for the project. The proposed document should be reviewed by several parties who may comment on any requirements and any priorities, either to agree, to disagree, or to identify missing requirements. Readers include: The Project Manager, Assistant Project Manager, Suppliers, Subcontractors and the Project Sponsor. The document may be amended and re-proposed several times before moving to the next stage.
- **Validated:** Once the various stakeholders have agreed to the requirements in the document, it is considered validated.
- **Approved:** The validated document is accepted by representatives of each party of stakeholders as an appropriate statement of requirements for the project. The Project Manager/contractor will then use the requirements document as a guide to implementation, and to check the progress of the project as it develops.

## 1.2. How to Use This Document

We expect that this document will be used by people with different skill sets. This section explains which parts of this document should be reviewed by various types of readers.

Type of Reader	Most Important to Reader
Project Sponsor	All
Project Supervisor	All
Project Manager	All
Suppliers and Subcontractors	2.2,2.3, 3 & 4

## 1.3 Business Case for the Product

The development plan for the country will see the government executing its development plans to include the establishment of alternate roads, which would result in the creation of new housing schemes and create better accessibility to farmlands. The demand for the East Bank to East Coast Highway linkage is as a direct result of the growing traffic congestion on both highways when heading into the City of Georgetown and the development of new housing schemes in the backlands of both the East Bank and East Coast.

## 2. General Description

This section will give the reader an overview of the project, including why it was conceived, what it will do when complete, and the types of people expected to use it. Constraints faced during development are listed, along with assumptions that were made on how to proceed. The project is being undertaken to construct the East Bank-East Coast (Diamond to Ogle) Highway linkage.

## **2.1 Project Perspective**

The Ministry of Public Works in accordance with its Strategic Plan 2017 – 2021 has outlined as one of its longer -term objectives that this project is one of many that will seek to improve traffic flows, reduce delays as a result of a distressed roadway and defective traffic signals, reduce accidents and fatalities along this busy roadway corridor. Traffic demand for this roadway is expected to increase for access to both the East Coast of Demerara and East Bank of Demerara, using this main interconnection road link.

The primary stakeholders for the project are the Ministry of Public Works and the Government of Guyana (the clients). The project is being developed by SINOHYDRO Corporation, a construction company contracted to build the road. The road specification and the construction supervision will be done by the Works Services Group within the Ministry.

The Citizens of Guyana will be the sole beneficiary of this product. The road will be maintained by the Ministry of Public Works after the completion of this project by the contractor.

### **Technical Background Required**

*Readers must have a level of proficiency that will allow them to understand architectural design, engineering, construction and procurement specifications detailed in the document.*

## **2.2 Building Functions**

The construction of the road should involve the following:

1. Rehabilitation of roadway on Sheriff Street and on Mandela Avenue (expanded to 4 lanes). The creation of 15km of new road (4 lanes) where the GuySuCo Punt Dam once ran from Diamond to Ogle.
2. Construction of a roundabout at the junction of Sheriff Street and David Street / Railway Embankment Road.
3. Construction of sidewalks, cycle lanes and bus laybys.
4. Construction of thirteen (13) concrete bridges, thirty (30) concrete culverts and a steel overhead walkway that connect the eastern and western road sides along the busy EBDPR.
5. Installation of traffic signals and roadway lighting, traffic signs and roadway markings.
6. Construction of a combination of concrete roadside drains and buried HDPE pipes to develop and improve the conveyance of rainfall runoff and effluent from properties or businesses along the roadway.

## **2.3 User Characteristics**

The users of the road way will be drivers and motorists who are licensed under the laws of Guyana to operate the various classes of motor vehicles. Pedestrians will also use the road as part of their daily commute.

## **2.4 General Constraints**

The expenditure associated with the completion of this project should not exceed fifty million (\$50,000,000) US dollars. The project timeline should not exceed thirty-six (36) months; of which twenty-four (24) months are dedicated to the Construction of the road and supporting infrastructure and six (6) months each shall be used for preliminary and furnishings, and closing works respectively.

### 3. Specific Requirements

This section of the document lists specific requirements for *The East Bank to East Coast (Diamond to Ogle) Highway*. Requirements are divided into the following sections:

- Customers' needs. These are requirements written from the point of view of end users.
- Functional requirements. These are detailed specifications describing the features or functions available on the completed road.
- Technical/structural requirements. These are requirements about the build specification and requirements of the road.

#### **Customer/User Needs:**

- Ease of Use
- Connectivity
- Ease flow of traffic
- Safety

#### **Functional Requirements:**

- Lane markings and Pedestrian crossing
- Speed bumps at specific corners
- Roundabout connecting roads
- Proper lighting
- Proper drainage
- Adequate space for road side parking

#### **Technical/Structural Requirements:**

- The road construction must adhere to local construction codes and standards requirements.
- The roads should be wide enough to accommodate four lane traffic, roadside parking, and pavement walkways.
- The construction components must be built to withstand all weathers, natural disasters, and heavy-duty vehicles.

#### **4. High-Level Technology**

The installation of smart traffic lights or intelligent traffic lights. These are a vehicle traffic control system that combines traditional traffic lights with an array of sensors and artificial intelligence to intelligently route vehicle and pedestrian traffic. The traffic lights will also include the installation of CCTV cameras to monitor all the activities from the Central Command Station of the Guyana Police Force.

## Requirements Traceability Matrix

Chart 12 Requirements Traceability Matrix (Source: Compiled by the Author, 2021)

ID	WBS ID	Customer Needs	Functional Requirements	Technical Assumption(s) Technical Requirements	Verification	Design Document	Priority	Additional Comments
1	2.1.1	Safety	Proper Drainage	The road construction must adhere to local construction code and standards requirements			High	
2	2.1.2	Safety	Proper Drainage	The road construction must adhere to local construction code and standards requirements			High	
3	2.1.3	Safety	Proper Drainage	The road construction must adhere to local construction code and standards requirements			High	
4	2.1.4	Safety	Proper Drainage	The road construction must adhere to local construction code and standards requirements			High	
5	2.1.5	Safety	Proper Drainage	The road construction must adhere to local construction code and standards requirements			High	
6	2.1.6	Safety	Proper Drainage	The road construction must adhere to local construction code and standards requirements			High	
7	3.1.1	Safety	Adequate Space for Road Side Parking	The road construction must adhere to local construction code and standards requirements. The roads should be wide enough to accommodate four lane traffic, roadside parking and pavement walkways, and the construction components must be built to withstand all weathers, natural disasters and heavy-duty vehicles.			High	
8	3.2.1	Safety	Adequate Space for Road Side Parking	The road construction must adhere to local construction code and standards requirements. The roads should be wide enough to accommodate four lane traffic, roadside parking and pavement walkways, and the construction components must be built to withstand all weathers, natural disasters and heavy-duty vehicles.			High	
9	3.2.2	Safety	Adequate Space for Road Side Parking	The road construction must adhere to local construction code and standards requirements. The roads should be			High	

ID	WBS ID	Customer Needs	Functional Requirements	Technical Assumption(s) Technical Requirements	Verification	Design Document	Priority	Additional Comments
				wide enough to accommodate four lane traffic, roadside parking and pavement walkways, and the construction components must be built to withstand all weathers, natural disasters and heavy-duty vehicles.				
10	3.2.3	Safety	Adequate Space for Road Side Parking	The road construction must adhere to local construction code and standards requirements. The roads should be wide enough to accommodate four lane traffic, roadside parking and pavement walkways, and the construction components must be built to withstand all weathers, natural disasters and heavy-duty vehicles.			High	
11	3.2.4	Safety	Adequate Space for Road Side Parking	The road construction must adhere to local construction code and standards requirements. The roads should be wide enough to accommodate four lane traffic, roadside parking and pavement walkways, and the construction components must be built to withstand all weathers, natural disasters and heavy-duty vehicles.			High	
12	3.2.5	Safety	Adequate Space for Road Side Parking	The road construction must adhere to local construction code and standards requirements. The roads should be wide enough to accommodate four lane traffic, roadside parking and pavement walkways, and the construction components must be built to withstand all weathers, natural disasters and heavy-duty vehicles.			High	
13	3.3.1	Safety	Adequate Space for Road Side Parking	The road construction must adhere to local construction code and standards requirements. The roads should be wide enough to accommodate four lane traffic, roadside parking and pavement walkways, and the construction components must be built to withstand all weathers, natural disasters and heavy-duty vehicles.			High	
14	3.3.2	Safety	Adequate Space for Road Side Parking	The road construction must adhere to local construction code and standards requirements. The roads should be wide enough to accommodate four lane traffic, roadside parking and pavement walkways, and the construction components must be built to withstand all weathers, natural disasters and heavy-duty vehicles.			High	



ID	WBS ID	Customer Needs	Functional Requirements	Technical Assumption(s) Technical Requirements	Verification	Design Document	Priority	Additional Comments
15	3.4.1	Safety	Adequate Space for Road Side Parking	The road construction must adhere to local construction code and standards requirements. The roads should be wide enough to accommodate four lane traffic, roadside parking and pavement walkways, and the construction components must be built to withstand all weathers, natural disasters and heavy-duty vehicles.			High	
16	3.4.2	Safety	Adequate Space for Road Side Parking	The road construction must adhere to local construction code and standards requirements. The roads should be wide enough to accommodate four lane traffic, roadside parking and pavement walkways, and the construction components must be built to withstand all weathers, natural disasters and heavy-duty vehicles.			High	
17	3.4.3	Safety	Adequate Space for Road Side Parking	The road construction must adhere to local construction code and standards requirements. The roads should be wide enough to accommodate four lane traffic, roadside parking and pavement walkways, and the construction components must be built to withstand all weathers, natural disasters and heavy-duty vehicles.			High	
18	4.1.1	Ease of Use & Ease of Traffic Flow	Adequate Space for Road Side Parking	The roads should be wide enough to accommodate four lane traffic, roadside parking and pavement walkways			High	
19	4.1.2	Ease of Use & Ease of Traffic Flow	Adequate Space for Road Side Parking	The roads should be wide enough to accommodate four lane traffic, roadside parking and pavement walkways			High	
20	4.2.1	Ease of Use & Ease of Traffic Flow	Adequate Space for Road Side Parking	The roads should be wide enough to accommodate four lane traffic, roadside parking and pavement walkways			High	
21	5.1.1	Ease of Use & Safety	Adequate Space for Road Side Parking & Roundabout Connecting Roads	The road construction must adhere to local construction code and standards requirements. The roads should be wide enough to accommodate four lane traffic, roadside parking and pavement walkways, and the construction components must be built to withstand all weathers, natural disasters and heavy-duty vehicles.			High	

ID	WBS ID	Customer Needs	Functional Requirements	Technical Assumption(s) Technical Requirements	Verification	Design Document	Priority	Additional Comments
22	5.1.2	Ease of Use & Safety	Adequate Space for Road Side Parking & Roundabout Connecting Roads	The road construction must adhere to local construction code and standards requirements. The roads should be wide enough to accommodate four lane traffic, roadside parking and pavement walkways, and the construction components must be built to withstand all weathers, natural disasters and heavy-duty vehicles.			High	
23	5.2.1	Ease of Use & Safety	Adequate Space for Road Side Parking & Roundabout Connecting Roads	The road construction must adhere to local construction code and standards requirements. The roads should be wide enough to accommodate four lane traffic, roadside parking and pavement walkways, and the construction components must be built to withstand all weathers, natural disasters and heavy-duty vehicles.			High	
24	5.2.2	Ease of Use & Safety	Adequate Space for Road Side Parking & Roundabout Connecting Roads	The road construction must adhere to local construction code and standards requirements. The roads should be wide enough to accommodate four lane traffic, roadside parking and pavement walkways, and the construction components must be built to withstand all weathers, natural disasters and heavy-duty vehicles.			High	
25	5.2.3	Ease of Use & Safety	Adequate Space for Road Side Parking & Roundabout Connecting Roads	The road construction must adhere to local construction code and standards requirements. The roads should be wide enough to accommodate four lane traffic, roadside parking and pavement walkways, and the construction components must be built to withstand all weathers, natural disasters and heavy-duty vehicles.			High	
26	6.1.1	Ease of Use & Safety	Adequate Space for Road Side Parking, Roundabout Connecting Roads & Speed Bumps at Specific Corners	The road construction must adhere to local construction code and standards requirements. The roads should be wide enough to accommodate four lane traffic, roadside parking and pavement walkways, and the construction components must be built to withstand all weathers, natural disasters and heavy-duty vehicles.			High	
27	6.1.2	Ease of Use & Safety	Adequate Space for Road Side Parking, Roundabout Connecting Roads &	The road construction must adhere to local construction code and standards requirements. The roads should be wide enough to accommodate four lane traffic, roadside parking and pavement walkways, and the construction			High	

ID	WBS ID	Customer Needs	Functional Requirements	Technical Assumption(s) Technical Requirements	Verification	Design Document	Priority	Additional Comments
			Speed Bumps at Specific Corners	components must be built to withstand all weathers, natural disasters and heavy-duty vehicles.				
28	6.1.3	Ease of Use & Safety	Adequate Space for Road Side Parking, Roundabout Connecting Roads & Speed Bumps at Specific Corners	The road construction must adhere to local construction code and standards requirements. The roads should be wide enough to accommodate four lane traffic, roadside parking and pavement walkways, and the construction components must be built to withstand all weathers, natural disasters and heavy-duty vehicles.			High	
29	6.2.1	Ease of Use & Safety	Adequate Space for Road Side Parking, Roundabout Connecting Roads & Speed Bumps at Specific Corners	The road construction must adhere to local construction code and standards requirements. The roads should be wide enough to accommodate four lane traffic, roadside parking and pavement walkways, and the construction components must be built to withstand all weathers, natural disasters and heavy-duty vehicles.			High	
30	6.2.2	Ease of Use & Safety	Adequate Space for Road Side Parking, Roundabout Connecting Roads & Speed Bumps at Specific Corners	The road construction must adhere to local construction code and standards requirements. The roads should be wide enough to accommodate four lane traffic, roadside parking and pavement walkways, and the construction components must be built to withstand all weathers, natural disasters and heavy-duty vehicles.			High	
31	6.2.3	Ease of Use & Safety	Adequate Space for Road Side Parking, Roundabout Connecting Roads & Speed Bumps at Specific Corners	The road construction must adhere to local construction code and standards requirements. The roads should be wide enough to accommodate four lane traffic, roadside parking and pavement walkways, and the construction components must be built to withstand all weathers, natural disasters and heavy-duty vehicles.			High	
32	7.1.1	Ease of Use, Easy flow of traffic & Safety	Lane Markings and Pedestrian Crossing & Speed Bumps at Specific Corners	The road construction must adhere to local construction code and standards requirements			High	
33	7.1.2	Ease of Use, Easy flow of traffic & Safety	Lane Markings and Pedestrian Crossing & Speed Bumps at Specific Corners	The road construction must adhere to local construction code and standards requirements			High	

ID	WBS ID	Customer Needs	Functional Requirements	Technical Assumption(s) Technical Requirements	Verification	Design Document	Priority	Additional Comments
34	7.1.3	Ease of Use, Easy flow of traffic & Safety	Lane Markings and Pedestrian Crossing & Speed Bumps at Specific Corners	The road construction must adhere to local construction code and standards requirements			High	
35	7.1.4	Ease of Use, Easy flow of traffic & Safety	Lane Markings and Pedestrian Crossing & Speed Bumps at Specific Corners	The road construction must adhere to local construction code and standards requirements			High	
36	7.1.5	Ease of Use, Easy flow of traffic & Safety	Lane Markings and Pedestrian Crossing & Speed Bumps at Specific Corners	The road construction must adhere to local construction code and standards requirements			High	
37	7.2.1	Ease of Use, Easy flow of traffic & Safety	Lane Markings and Pedestrian Crossing & Speed Bumps at Specific Corners	The road construction must adhere to local construction code and standards requirements			High	
38	7.2.2	Ease of Use, Easy flow of traffic & Safety	Lane Markings and Pedestrian Crossing & Speed Bumps at Specific Corners	The road construction must adhere to local construction code and standards requirements			High	
39	7.2.3	Ease of Use, Easy flow of traffic & Safety	Lane Markings and Pedestrian Crossing & Speed Bumps at Specific Corners	The road construction must adhere to local construction code and standards requirements			High	
40	7.3.1	Ease of Use, Easy flow of traffic & Safety	Lane Markings and Pedestrian Crossing & Speed Bumps at Specific Corners	The road construction must adhere to local construction code and standards requirements			High	
41	7.3.2	Ease of Use, Easy flow of traffic & Safety	Lane Markings and Pedestrian Crossing & Speed Bumps at Specific Corners	The road construction must adhere to local construction code and standards requirements			High	

ID	WBS ID	Customer Needs	Functional Requirements	Technical Assumption(s) Technical Requirements	Verification	Design Document	Priority	Additional Comments
42	7.4.1	Ease of Use, Easy flow of traffic & Safety	Lane Markings and Pedestrian Crossing & Speed Bumps at Specific Corners	The road construction must adhere to local construction code and standards requirements			High	
43	7.4.2	Ease of Use, Easy flow of traffic & Safety	Lane Markings and Pedestrian Crossing & Speed Bumps at Specific Corners	The road construction must adhere to local construction code and standards requirements			High	
44	7.4.3	Ease of Use, Easy flow of traffic & Safety	Lane Markings and Pedestrian Crossing & Speed Bumps at Specific Corners	The road construction must adhere to local construction code and standards requirements			High	
45	8.1.1	Ease of Use, Easy flow of traffic & Safety	Proper Lighting, Lane Markings & Pedestrian	The roads should be wide enough to accommodate four lane traffic, roadside parking and pavement walkways.			Medium	
46	8.1.2	Ease of Use, Easy flow of traffic & Safety	Proper Lighting, Lane Markings & Pedestrian	The roads should be wide enough to accommodate four lane traffic, roadside parking and pavement walkways.			Medium	
47	8.1.3	Ease of Use, Easy flow of traffic & Safety	Proper Lighting, Lane Markings & Pedestrian	The roads should be wide enough to accommodate four lane traffic, roadside parking and pavement walkways.			Medium	
48	8.2.1	Ease of Use, Easy flow of traffic & Safety	Proper Lighting, Lane Markings & Pedestrian	The roads should be wide enough to accommodate four lane traffic, roadside parking and pavement walkways.			Medium	
49	8.2.2	Ease of Use, Easy flow of traffic & Safety	Proper Lighting, Lane Markings & Pedestrian	The roads should be wide enough to accommodate four lane traffic, roadside parking and pavement walkways.			Medium	
50	8.2.3	Ease of Use, Easy flow of traffic & Safety	Proper Lighting, Lane Markings & Pedestrian	The roads should be wide enough to accommodate four lane traffic, roadside parking and pavement walkways.			Medium	

### **4.3 Project Schedule Management**

The first process in project schedule management involved developing the Schedule Management Plan that would be used to guide the lifecycle of the construction process. The Project Charter and the Scope Management Plan were critical inputs used in the creation of the Schedule Management Plan. These inputs were supported with the use of tools and techniques such as expert judgement, analytical techniques, and meetings.

## **SCHEDULE MANAGEMENT PLAN**

### CONSTRUCTION OF THE EAST BANK-EAST COAST (DIAMOND TO OGLE) HIGHWAY LINKAGE PROJECT

SINOHYDRO CORPORATION  
GEORGETOWN  
GUYANA

October 2021

### **Introduction**

The Project Schedule provides the stakeholders of the project with a roadmap on how all project activities will be executed. The schedule allows the stakeholders of the project to track in real-time the progress or status of each project activity at any point in time. The plan specifies how the approved baseline will be monitored by the Project Team and how changes to the schedule may be initiated and formalized.

### **Schedule Management Approach**

The Project Schedule will be created using Microsoft Projects 2016. The WBS will be used to determine the project deliverables and work packages. To determine the work packages needed to complete each deliverable, the activity definition process will be conducted. The order of the work packages and the relationships that exist will be created

using the activity sequencing process. The duration estimation process for work each work package will be completed to determine the work periods for each. Finally, in order to complete the schedule in a timely manner the resources estimation process will be conducted.

The preliminary project schedule will be reviewed by all assigned resources for conformity to the proposed work package assignments, durations, and schedule. Once this is completed, the Project Director will review, then forward the schedule to the sponsor for approval. Following this, the Project Manager will commence the baselining process for the project activities.

The Project Milestones were defined in the Project Scope Management Plan

### **Roles and Responsibilities**

The assistant Project Director, with guidance from the Project Director, the Project Manager and senior members of the Project Team will be responsible for facilitating work package definition, sequencing, estimating duration, and resources. The APD will use MS Projects 2016 to create the schedule and this will be validated by all stakeholders. Once validated the schedule will be presented to the Project Sponsor for approval, then subsequently baselined by the Project Manager.

The Project Team has the responsibility for reviewing the schedule and executing all assigned work packages once the schedule is approved.

The Project Sponsor has the responsibility to participate in reviewing the proposed schedule and approving the final schedule before it is baselined. All change requests will subsequently be reviewed and approved by the sponsor.

### **Schedule Control**

The schedule of the project can be reviewed as the need arises to add or remove new or obsolete information. The schedule will display information relating to the start dates, finish dates, the sequence, and human resources attached to each work package in the WBS and their completion status.

The Project Manager has the overall responsibility to host meetings to review the schedule. The Project Director, with the supporting justifications, must review these proposed changes. If accepted by the Project Director, it will then be forwarded to the Project Sponsor for approval. The communication relating to the dissemination of the project schedule information must be done in accordance with the project Communications Plan.

The Project Team is expected to participate in all scheduled review meetings to propose any schedule changes, and also shoulders the responsibility to report any delays or acceleration in the project commencement and conclusion to the Project Manager.

### **Schedule Changes and Thresholds**

The Project Manager or the Project Director may determine that it is essential to make modifications to the project schedule. The PM would then be responsible for organizing a review meeting with the Project Team to assess the potential risks or hindrances that may occur as a result of the proposed changes. It is essential that the meeting determines the likely activities that will be impacted and the possible variances that may occur as a result of these proposed changes, or any suggested alternatives that may be utilized to minimize these impacts.

The Project Manager shall present a schedule change request to the Project Director if the variances exceed the approved threshold established by the Ministry of Public Works. This established threshold is:

Whether there is a reduction of 5% or an increase of 10% in the duration of an individual work package or overall baseline schedule.

Once the Project Director agrees with the suggested changes to the project schedule, it is forwarded to the Project Sponsor for approval, after which the Project Manager will be responsible for communicating all approved changes and their impact to all relevant stakeholders.



## Scope Change

If there was, any changes made previously to the project's scope by the Project Sponsor, the Project Manager and Project Team are responsible for reviewing these changes to determine if they would have any impact on the project schedule baselines. If there are proposed changes, the Project Manager is responsible for initiating a change request to facilitate the rebasing of the project schedule.

## SPONSOR ACCEPTANCE

Approved by:

\_\_\_\_\_ Date: \_\_\_\_\_

Government of Guyana

In the second process of the Schedule Management Plan, the activity definition was generated. The inputs used in this process included the WBS, project deliverables, constraints and assumptions supported by tools such as the expert judgment and Microsoft Projects 2016. This resulted in the Chart 13 being developed.

The activity list was created in accordance with the PMBOK Guide, which indicated that the list included what is termed an activity identifier, and a scope of work description for the activities that are sufficient to allow each member of the Project Team to understand what work is required to be completed. The activity attribute can be seen in the Resource Assignment and Activity Duration Schedule in figure (7), where the predecessor activities, successor activities, logical relationships, leads and lags were determined using Microsoft Projects 2016.

**Chart 13 Project Activity List (Source: Compiled by the Author, 2021)**

Activity ID	Task Name	Definition	Resource Names
1	Preparatory Work		
1.1	Project and Conceptual Design	The activities that will conceptualize the project. An initial assessment of the risks is considered, followed by an in-depth feasibility study and the creation of the Project Charter. The project design is then finalized and all necessary permits and approvals are acquired before the construction commences.	Project Directors, Project Manager, Quantity Surveyors Engineer, Sponsor
1.1.1	Initial Impact Assessment		
1.1.2	Feasibility Study		
1.1.3	Approval of Project Charter		
1.1.4	Complete Design Documents & Submit to MOPW and EPA for Permits		
1.2	Mobilization & Demobilization	The activities involved in the determination of procurement needs of equipment for offices, construction, assembly of Project Team. The determination of what equipment to move from old work site and storage facilities.	Finance and Procurement Specialist, Project Manager, Project Directors
1.2.1	Mobilization Program		
1.2.2	Demobilization Program		
1.3	Field Office and Facilities	The activities that will see the mobile office and warehouses being set up, in addition to a furnished office space for the Project Team.	Finance and Procurement specialist, Project Manager, Project Directors
1.3.1	Outfit Office with Service Provider utilities and Facilities		
1.3.2	Service Workshop and Warehouse		
1.3.3	Offices and Accommodations for the Directors		
1.4	Management and Traffic Safety	The activities involved in the creation of alternate and temporary access roads and bridges to access work site and to divert any traffic that may be affected by the project activities.	Project Manager, Project Directors, Pavement and Highway Engineer, Bridge and Culvert Engineer, Laborers & Junior Workers (Project Team), Operators, Quantity surveyor, Asphalt and Cement Foreman, HSE Engineer
1.4.1	Management Plan and Traffic Safety		
1.4.2	Description of Temporary Minimum Road Equipment		
1.4.3	Temporary Road or Bridge Works		
1.4.4	Maintenance Schedule for Traffic Safety		
1.5	Field Technical Review		Asphalt and Cement Foreman, Bridge and Culvert Engineers, HSE Engineer, Land Surveyor,
1.5.1	Field Survey Work for Design Review		

Activity ID	Task Name	Definition	Resource Names
1.5.2	Routine Implementation Survey Work	The review of the coordinates for the proposed road, the determination of the measurement points and cutting of the initial line for the route of the road.	Materials, Engineer, Operators, Pavement and Highway Engineer, Project Directors, Project Manager, Quality Assurance Officer, Quantity surveyor
1.5.3	Determination of Measurement Point		
1.5.4	Field Engineering Expert Approval		
1.6	Environmental Security	The activities that will see the deliverable being achieved: to ensure all the environmental hazards are avoided, relocation of animals, plants and consideration for drinking water contamination.	HSE Engineer, Project Directors, Project Manager, Land Surveyor, Quality Assurance Officer
1.6.1	Environmental Management Efforts		
1.7	Relocate Existing Utility	The activities that will see the deliverable being achieved: all existing utilities that are in the route will be removed or relocated to allow the easy execution of project activities.	HSE Engineer, Operators, Project Directors, Project Manager
1.7.1	Utility Relocation Work and Existing Services		
1.8	Soil Testing	The activities necessary for the achievement of the project deliverables. It involves collecting of soil samples and testing for its strength and quality.	HSE Engineer, Materials Engineer, Operators, Project Directors, Project Manager, Quality Assurance Officer
1.8.1	Conduct Test Characteristics		
2	Drainage	The activities are all the necessary actions that will be taken to achieve the delivery of Support Drainage Installation. The trenches will be excavated and the various drainage system and water ways will be installed depending on the terrain and intended use.	Asphalt and Cement Foreman, Bridge and Culvert Engineer, HSE Engineer, Laborers & Junior Workers (Project Team), Materials Engineer, Operators, Pavement and Highway Engineer, Project Directors, Project Manager, Quality Assurance Officer, Suppliers
2.1	Support Drainage Installation		
2.1.1	Excavation of Sewers and Waterways		
2.1.2	Laying of Drainage of Stone & Mortar Pairs		
2.1.3	Installation of Concrete Precast Drainage		
2.1.4	Installation of Concrete Cast Insitu Drainage		
2.1.5	Installation of Porous Drainage		
2.1.6	Installation of Culvert Pipes and Culvert Boxes		
3	Land Work	The activities are all the actions needed to complete the deliverable of land clearing. This is critical to establish the boundaries that need to be excavated that will be the route of the road.	HSE Engineer, Laborers & Junior Workers (Project Team), Land Surveyor, Operators, Project Directors, Project Manager, Quality Assurance Officer, Asphalt and Cement Foreman, Bridge and Culvert Engineer, Materials Engineer, Pavement and Highway Engineer
3.1	Land clearing Execution		
3.1.1	Conducting the Cleaning, Peeling and Cutting Trees		
3.2	Executing Excavation Activities		

Activity ID	Task Name	Definition	Resource Names
3.2.1	Conducting Soil Excavation	The activities are all the actions needed to complete the deliverable of executing the excavation activities. The team will excavate all debris inclusive of the soil, any stones, old road and structures that are along the route of the road.	Bridge and Culvert Engineer, Laborers & Junior Workers (Project Team), Materials Engineer, Operators, Pavement and Highway Engineer, Project Manager, Quality Assurance Officer
3.2.2	Conducting Stone Excavation		
3.2.3	Conducting Asphalt Pavement Excavation		
3.2.4	Conducting Concrete Pavement Excavation		
3.2.5	Conducting Structure Excavation		
3.3	Conducting Piling	The activities associated with the management of the excavated materials that has been piled up, some materials will be used for the compacting of the excavated area to strengthen its geotextile composition of the base.	Bridge and Culvert Engineer, HSE Engineer, Laborers & Junior Workers (Project Team), Materials Engineer, Operators, Pavement and Highway Engineer, Project Manager, Quality Assurance Officer
3.3.1	Transporting and Compacting Dumps Back		
3.3.2	Transporting and Compacting of Heap from the Outside (Borrow Area)		
3.4	Conducting Land Improvement	The activities that will be conducted to ensure the achievement of the deliverable. It will involve all the necessary works to correct any issues with the land preparation for the road, to ensure it is in accordance with the defined standards.	Bridge and Culvert Engineer, Laborers & Junior Workers (Project Team), Operators, Pavement and Highway Engineer, Project Manager, Quality Assurance Officer, HSE Engineer, Materials Engineer
3.4.1	Conducting Geotextile Works		
3.4.2	Conducting Vacuum Consolidation Method (VCM) Works		
3.4.3	Conducting of Dynamic Compaction (DC)		
4	Widening of Pavement and Roadside Construction	The activities that will ensure that some of the existing roads and connecting streets are connected to the newly built road in the correct manner to accommodate the traffic flow in the future.	Asphalt and Cement Foreman, Bridge and Culvert Engineer, HSE Engineer, Laborers & Junior Workers (Project Team), Materials Engineer, Operators, Pavement and Highway Engineer, Project Manager, Quality Assurance Officer, Suppliers
4.1	Executing Widening Pavement Work		
4.1.1	Executing Widening of Asphalt Pavement Works		
4.1.2	Executing Widening of Concrete Pavement Work		
4.2	Conducting Roadside Works		
4.2.1	Executing Widening Roadside Works		
5	Bulking Hardening and Concrete Pavement Construction	The activities that will aid in the achievement of the project deliverable. It includes activities that will involve the preliminary laying of concrete aggregate base and all	Asphalt and Cement Foreman, Bridge and Culvert Engineer, HSE Engineer, Laborers & Junior Workers (Project Team), Materials Engineer, Operators, Pavement and Highway Engineer,
5.1	Laying Gilded Pavement		
5.1.1	Laying of Aggregate Base		

Activity ID	Task Name	Definition	Resource Names
5.1.2	Gilded Pavilion Without Asphalt Cover	concrete works that will ensure the road is structurally sound and solid	Project Manager, Quality Assurance Officer, Suppliers
5.2	Pouring of Concrete Pavement		
5.2.1	Pouring Soil Cement Base		
5.2.2	Pouring Aggregate Cement Foundation Base (CBT dan CTSB)		
5.2.3	Concrete Pavement Laying		
6	Application of Asphalt Pavement	The activities involved in achieving the deliverables associated with the laying of asphalt to complete the road surface.	Asphalt and Cement Foreman, Bridge and Culvert Engineer, HSE Engineer, Laborers & Junior Workers (Project Team), Materials Engineer, Operators, Pavement and Highway Engineer, Project Manager, Quality Assurance Officer
6.1	Asphalt Mixing Plant (AMP) Work		
6.1.1	Application of Basic Asphalt Layer (Prime coat/ Tack coat)		
6.1.2	Conducting of Job Mix Testing		
6.1.3	Application of Upper Asphalt		
7	Erection of Steel Bridges and Overhead Walkway	These activities are a part of the works that will help us to achieve our deliverable associated with the erection of the steel bridges and overhead walkway on the newly constructed roads. It will involve ground works, works above the surface and the installation of the accessories that goes along with these structures.	Asphalt and Cement Foreman, Bridge and Culvert Engineer, HSE Engineer, Laborers & Junior Workers (Project Team), Materials Engineer, Operators, Pavement and Highway Engineer, Project Manager, Quality Assurance Officer
7.1	Establishment of Lower Structure		
7.1.1	Driving of Wood Piles		Asphalt and Cement Foreman, Bridge and Culvert Engineer, HSE Engineer, Laborers & Junior Workers (Project Team), Materials Engineer, Operators, Pavement and Highway Engineer, Project Manager, Quality Assurance Officer, Suppliers
7.1.2	Driving of Precast Concrete Piles		
7.1.3	Driving of Steel Structure Piles		
7.1.4	Application of Couple Stone with Mortar		
7.1.5	Installation of Pile Caps		
7.2	Erection of Upper Structure		Asphalt and Cement Foreman, Bridge and Culvert Engineer, HSE Engineer, Laborers & Junior Workers (Project Team), Materials Engineer, Operators, Pavement and Highway Engineer, Project Manager, Quality Assurance Officer, Suppliers
7.2.1	Erect Abutment, Columns and Piers		
7.2.2	Erection of Bridge Girder		
7.2.3	Installation of Floor and Barrier Casting		
7.3	Installation of Bridge Accessories		

Activity ID	Task Name	Definition	Resource Names
7.3.1	Install Railing		Asphalt and Cement Foreman, Bridge and Culvert Engineer, HSE Engineer, Laborers & Junior Workers (Project Team), Materials Engineer, Operators, Pavement and Highway Engineer, Project Manager, Quality Assurance Officer, Suppliers, Subcontractors
7.3.2	Install Markings and Fixtures		
7.4	Installation of Steel Overhead Walkway Accessories		Asphalt and Cement Foreman, Bridge and Culvert Engineer, HSE Engineer, Laborers & Junior Workers (Project Team), Materials Engineer, Operators, Pavement and Highway Engineer, Project Manager, Quality Assurance Officer, Suppliers, Subcontractors
7.4.1	Installation Roofing		
7.4.2	Installation Railing		
7.4.3	Installation Staircases and Elevators		
8	Complete Road Furnishings	The activities that will allow the Project Team to achieve the deliverable of installing road marking, traffics lights and streetlights along the newly constructed roadway.	HSE Engineer, Operators, Project Manager, Subcontractors, Suppliers, Laborers & Junior Workers (Project Team)
8.1	Install Road Lighting		
8.1.1	Install Poles		
8.1.2	Install Lamps and Bulbs		HSE Engineer, Operators, Project Manager, Subcontractors, Suppliers
8.1.3	Install Electrical Works		
8.2	Install Road Marking and Traffic Signals		
8.2.1	Install Directional Marking		
8.2.2	Install Traffic Signs		
8.2.3	Install Traffic Lights		
9	Project Closure	The activities that are involved in the inspection of the completed project works, the acceptance of these works and the official handing over and commissioning of the newly built roadway.	Finance and Procurement Specialist, Project Directors, Project Manager, Sponsor
9.1	Project Completion and Handover		Finance and Procurement Specialist, Project Directors, Project Manager, Sponsor
9.1.1	Inspection of Works		Finance and Procurement Specialist, Project Directors, Project Manager, Sponsor
9.1.2	Commissioning of New Road		Project Directors, Project Manager, Sponsor
9.1.3	Handover to the Government of Guyana		Project Directors, Project Manager, Sponsor



## Sequence Activities

The third process involves the sequencing of activities; it involves the “identifying and documenting relationships between project activities” (Project Management Institute, 2017). The inputs used in this process included the activity list, milestone list and the Project Scope Statement. Microsoft Projects 2016 was used to create the Network Diagram using the precedence diagramming method, dependency determination and leads and lags. The table showing the predecessor and lags are displayed below.

**Chart 14 Activity Sequencing (Source: Compiled by the Author, 2021)**

Task Name	Predecessors
<b>1. Construction of the East Bank-East Coast (Diamond to Ogle) Highway</b>	
<b>2. Preparatory Work</b>	
<b>3. Project and Conceptual Design</b>	
4. Initial Impact Assessment	
5. Feasibility Study	4
6. Approval of Project Charter	5
7. Complete Design Documents & Submit to MOPW and EPA for Permits	6
<b>8. Mobilization &amp; Demobilization</b>	<b>7</b>
9. Mobilization Program	7
10. Demobilization Program	9
<b>11. Field Office and Facilities</b>	<b>7</b>
12. Outfit Office with Service Provider Utilities and Facilities	7
13. Service Workshop and Warehouse	7
14. Offices and Accommodations for the Directors	12
<b>15. Management and Traffic Safety</b>	<b>10</b>
16. Management Plan and Traffic Safety	10
17. Description of Temporary Minimum Road Equipment	16
18. Temporary Road or Bridge Works	17
19. Maintenance Schedule for Traffic Safety	17
<b>20. Field Technical Review</b>	<b>10</b>
21. Field Survey Work for Design Review	10
22. Routine Implementation Survey Work	21
23. Determination of Measurement Point	22
24. Field Engineering Expert Approval	23,18,19



<b>Task Name</b>	<b>Predecessors</b>
25. <b>Environmental Security</b>	<b>10</b>
26. Environmental Management Efforts	10
27. <b>Relocate Existing Utility</b>	<b>10</b>
28. Utility Relocation Work and Existing Services	10
29. <b>Soil Testing</b>	<b>10</b>
30. Test Characteristics	10
31. <b>Drainage</b>	<b>28,30,26,24,14,13</b>
32. <b>Support Drainage</b>	<b>28,30,26,24,14,13</b>
33. Excavation of Sewers and Waterways	28,30,26,24,14,13
34. Drainage of Stone & Mortar Pairs	33
35. Concrete Precast Drainage	33
36. Concrete Cast Insitu Drainage	33
37. Porous Drainage	33
38. Culvert Pipes and Culvert Boxes	33
39. <b>Land Work</b>	28,30,26,24,14,13
40. <b>Land clearing</b>	<b>28,30,26,24,14,13</b>
41. Cleaning, Peeling and Cutting Trees	28,30,26,24,14,13
42. <b>Excavation</b>	<b>31SS+4 wks</b>
43. Soil Excavation	31SS+4 wks
44. Stone Excavation	31SS+4 wks
45. Asphalt Pavement Excavation	31SS+4 wks
46. Concrete Pavement Excavation	31SS+4 wks
47. Structure Excavation	31SS+4 wks
48. <b>Pile</b>	<b>42SS+4 wks</b>
49. Dumps Back	42SS+4 wks
50. Heap from the Outside (Borrow Area)	42SS+4 wks
51. <b>Land Improvement</b>	<b>50,42,43,44,45,47,48,49,33,34,35,36,37,38</b>
52. Geotextile Works	50,42,43,44,45,47,48,49,33,34,35,36,37,38
53. Vacuum Consolidation Method (VCM) Works	52
54. Dynamic Compaction (DC)	50,42,43,44,45,47,48,49,33,34,35,36,37,38
55. <b>Widening of Pavement and Roadside</b>	<b>50,42,43,44,45,47,48,49,33,34,35,36,37,38</b>
56. <b>Widening Pavement Work</b>	<b>54,53</b>
57. Widening of Asphalt Pavement Works	54,53
58. Widening of Concrete Pavement Work	57
59. <b>Roadside Works</b>	<b>54,53</b>
60. Widening Roadside Works	54,53
61. <b>Bulking Hardening and Concrete Pavement</b>	<b>54,53</b>
62. <b>Gilded Pavement</b>	<b>54,53</b>
63. Aggregate Base	54,53

<b>Task Name</b>	<b>Predecessors</b>
64. Gilded Pavilion Without Asphalt Cover	63SS+2 wks
<b>65. Concrete Pavement</b>	<b>64,57</b>
66. Soil Cement Base	64,57
67. Aggregate Cement Foundation Base (CBT dan CTSB)	64,57
68. Concrete Pavement Laying	64,57
<b>69. Asphalt Pavement</b>	<b>64,57</b>
<b>70. Asphalt Mixing Plant (AMP)</b>	<b>64,57</b>
71. Basic Asphalt Layer (Prime coat/ Tack coat)	64,57
72. Job Mix Testing	71,58,66SF-3 wks,67SF-3 wks,68SF-3 wks
73. Upper Asphalt	72
<b>74. Steel Bridges Construction</b>	<b>54,53</b>
<b>75. Lower Structure</b>	<b>54,53</b>
76. Wood Piles	54,53
77. Precast Concrete Piles	54,53
78. Steel Structure Piles	54,53
79. Couple Stone with Mortar	76,77,78
80. Pile Caps	76,77,78
<b>81. Upper Structure</b>	<b>79,80</b>
82. Abutment, Columns and Piers	79,80
83. Erection of Bridge Girder	82SS+2 wks
84. Floor and Barrier Casting	82
<b>85. Bridge Accessories</b>	<b>84</b>
86. Railing	84
87. Markings and Fixtures	86SS+2 wks
<b>88. Steel Overhead Walkway Accessories</b>	<b>84</b>
89. Roofing	84
90. Railing	84
91. Staircases and Elevators	84
<b>92. Road Furnishings</b>	<b>89,90,91,73,87</b>
<b>93. Road Lighting</b>	<b>89,90,91,73</b>
94. Poles	89,90,91,73
95. Lamps and Bulbs	94
96. Electrical Works	95
<b>97. Road Marking and Traffic Signals</b>	<b>96</b>
98. Directional Marking	96
99. Traffic Signs	98SS+2 wks
100. Traffic Lights	96
<b>101. Project Closure</b>	<b>100,99</b>
<b>102. Project Completion and Handover</b>	<b>100,99</b>

Task Name	Predecessors
103.Inspection of Works	100
104.Commissioning of New Road	103
105.Handover to the Government of Guyana	104

### Estimate Activity Durations

In this process, the timeline for each activity was estimated using the Bottom-up estimating technique. This involves breaking the project down into individual activities and then having a subject matter expert and the Project Team suggest and estimate timelines for each activity. The resources calendar, activity and milestone list were used as input in the process. The Chart (15) illustrates the duration estimates for the project.

**Chart 15 Activity Duration (Source: Compiled by the Author, 2021)**

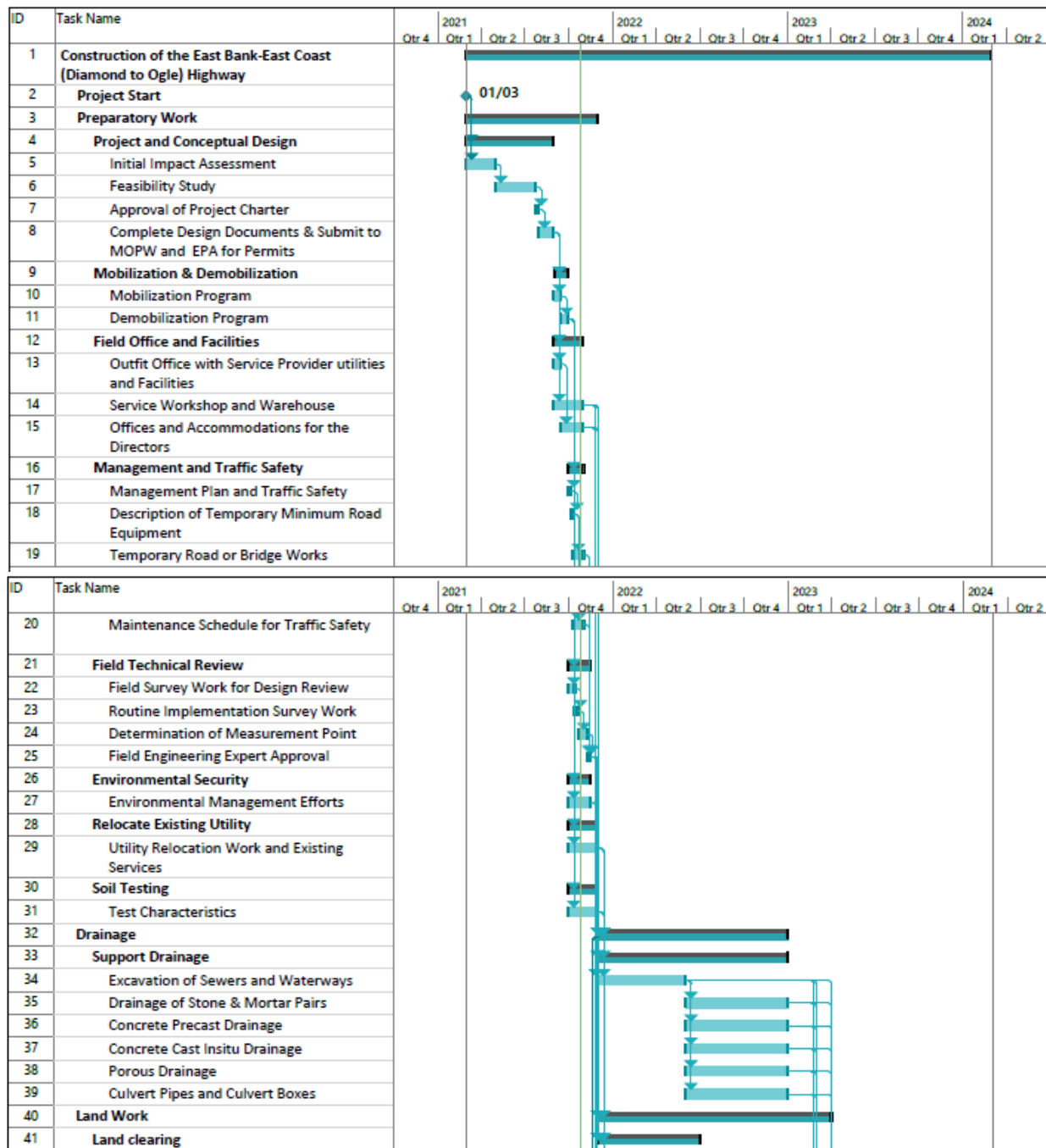
Task Name	Duration	Start	Finish
<b>Construction of the East Bank-East Coast (Diamond to Ogle) Highway</b>	<b>156.57 wks</b>	<b>Mar 01, '21</b>	<b>Feb 29, '24</b>
<b>Preparatory Work</b>	<b>39.29 wks</b>	<b>Mar 01, '21</b>	<b>Nov 30, '21</b>
<b>Project and Conceptual Design</b>	<b>26.14 wks</b>	<b>Mar 01, '21</b>	<b>Aug 31, '21</b>
Initial Impact Assessment	8.71 wks	Mar 01, '21	Apr 30, '21
Feasibility Study	12 wks	May 01, '21	Jul 23, '21
Approval of Project Charter	1 wk	Jul 24, '21	Jul 30, '21
Complete Design Documents & Submit to MOPW and EPA for Permits	4.43 wks	Jul 31, '21	Aug 30, '21
<b>Mobilization &amp; Demobilization</b>	<b>4.29 wks</b>	<b>Sep 01, '21</b>	<b>Sep 30, '21</b>
Mobilization Program	2.14 wks	Aug 31, '21	Sep 14, '21
Demobilization Program	2.14 wks	Sep 15, '21	Sep 29, '21
<b>Field Office and Facilities</b>	<b>8.71 wks</b>	<b>Sep 01, '21</b>	<b>Oct 31, '21</b>
Outfit Office with Service Provider utilities and Facilities	2.14 wks	Aug 31, '21	Sep 14, '21
Service Workshop and Warehouse	8.71 wks	Aug 31, '21	Oct 30, '21
Offices and Accommodations for the Directors	6.57 wks	Sep 15, '21	Oct 30, '21
<b>Management and Traffic Safety</b>	<b>4.43 wks</b>	<b>Oct 01, '21</b>	<b>31 Oct '21</b>
Management Plan and Traffic Safety	1 wk	Sep 30, '21	Oct 06, '21
Description of Temporary Minimum Road Equipment	0.43 wks	Oct 07, '21	Oct 09, '21
Temporary Road or Bridge Works	3.14 wks	Oct 10, '21	Oct 31, '21
Maintenance Schedule for Traffic Safety	3.14 wks	Oct 10, '21	Oct 31, '21
<b>Field Technical Review</b>	<b>6.57 wks</b>	<b>Oct 01, '21</b>	<b>Nov 15, '21</b>
Field Survey Work for Design Review	2 wks	Sep 30, '21	Oct 13, '21

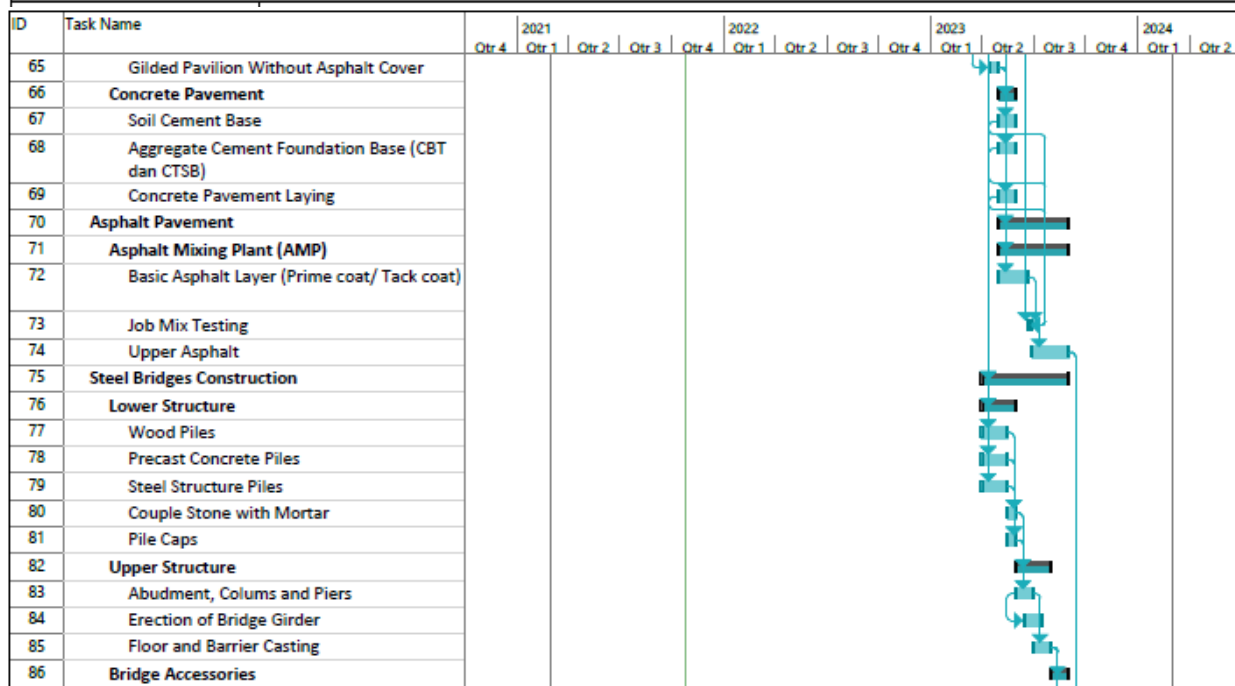
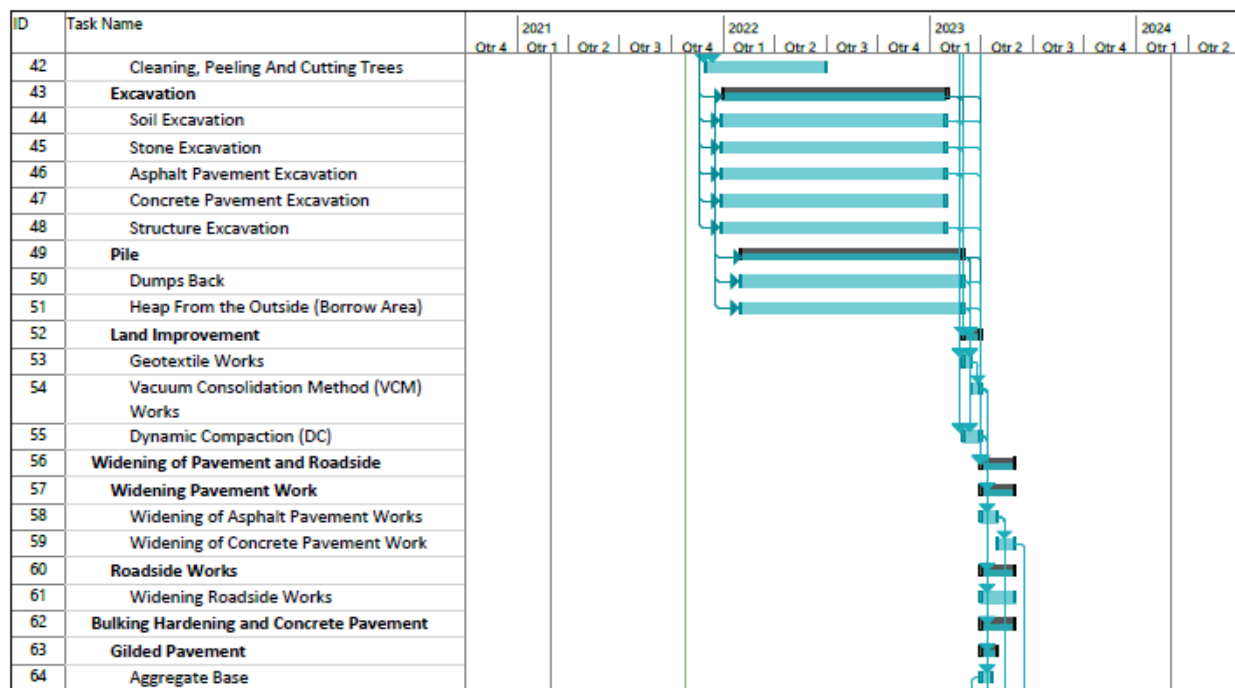
<b>Task Name</b>	<b>Duration</b>	<b>Start</b>	<b>Finish</b>
Routine Implementation Survey Work	1 wk	Oct 14, '21	Oct 20, '21
Determination of Measurement Point	2.57 wks	Oct 21, '21	Nov 07, '21
Field Engineering Expert Approval	1.14 wks	Nov 08, '21	Nov 15, '21
<b>Environmental Security</b>	<b>6.57 wks</b>	<b>Oct 01, '21</b>	<b>Nov 15, '21</b>
Environmental Management Efforts	6.57 wks	Sep 30, '21	Nov 14, '21
<b>Relocate Existing Utility</b>	<b>8.71 wks</b>	<b>Oct 01, '21</b>	<b>Nov 30, '21</b>
Utility Relocation Work and Existing Services	8.86 wks	Sep 30, '21	Nov 30, '21
<b>Soil Testing</b>	<b>8.71 wks</b>	<b>Oct 01, '21</b>	<b>Nov 30, '21</b>
Test Characteristics	8.86 wks	Sep 30, '21	Nov 30, '21
<b>Drainage</b>	<b>56.57 wks</b>	<b>Dec 01, '21</b>	<b>Dec 31, '22</b>
<b>Support Drainage</b>	<b>56.57 wks</b>	<b>Dec 01, '21</b>	<b>Dec 31, '22</b>
Excavation of Sewers and Waterways	26 wks	Dec 01, '21	May 31, '22
Drainage of Stone & Mortar Pairs	30.57 wks	Jun 01, '22	Dec 31, '22
Concrete Precast Drainage	30.57 wks	Jun 01, '22	Dec 31, '22
Concrete Cast Insitu Drainage	30.57 wks	Jun 01, '22	Dec 31, '22
Porous Drainage	30.57 wks	Jun 01, '22	Dec 31, '22
Culvert Pipes and Culvert Boxes	30.57 wks	Jun 01, '22	Dec 31, '22
<b>Land Work</b>	<b>69.43 wks</b>	<b>Dec 01, '21</b>	<b>Mar 31, '23</b>
<b>Land clearing</b>	<b>30.29 wks</b>	<b>Dec 01, '21</b>	<b>Jun 30, '22</b>
Cleaning, Peeling and Cutting Trees	30.29 wks	Dec 01, '21	Jun 30, '22
<b>Excavation</b>	<b>56.57 wks</b>	<b>Jan 01, '22</b>	<b>Jan 31, '23</b>
Soil Excavation	56.57 wks	Jan 01, '22	Jan 31, '23
Stone Excavation	56.57 wks	Jan 01, '22	Jan 31, '23
Asphalt Pavement Excavation	56.57 wks	Jan 01, '22	Jan 31, '23
Concrete Pavement Excavation	56.57 wks	Jan 01, '22	Jan 31, '23
Structure Excavation	56.57 wks	Jan 01, '22	Jan 31, '23
<b>Pile</b>	<b>56.14 wks</b>	<b>Feb 01, '22</b>	<b>Feb 28, '23</b>
Dumps Back	56.14 wks	Feb 01, '22	Feb 28, '23
Heap from the Outside (Borrow Area)	56.14 wks	Feb 01, '22	Feb 28, '23
<b>Land Improvement</b>	<b>4.43 wks</b>	<b>Mar 01, '23</b>	<b>Mar 31, '23</b>
Geotextile Works	2 wks	Mar 01, '23	Mar 14, '23
Vacuum Consolidation Method (VCM) Works	2.43 wks	Mar 15, '23	Mar 31, '23
Dynamic Compaction (DC)	4.43 wks	Mar 01, '23	Mar 31, '23
<b>Widening of Pavement and Roadside</b>	<b>8.71 wks</b>	<b>Apr 01, '23</b>	<b>May 31, '23</b>
<b>Widening Pavement Work</b>	<b>8.71 wks</b>	<b>Apr 01, '23</b>	<b>May 31, '23</b>
Widening of Asphalt Pavement Works	4.29 wks	Apr 01, '23	Apr 30, '23
Widening of Concrete Pavement Work	4.43 wks	May 01, '23	May 31, '23
<b>Roadside Works</b>	<b>8.71 wks</b>	<b>Apr 01, '23</b>	<b>May 31, '23</b>
Widening Roadside Works	8.71 wks	Apr 01, '23	May 31, '23
<b>Bulking Hardening and Concrete Pavement</b>	<b>8.71 wks</b>	<b>Apr 01, '23</b>	<b>May 31, '23</b>
<b>Gilded Pavement</b>	<b>4.29 wks</b>	<b>Apr 01, '23</b>	<b>Apr 30, '23</b>
Aggregate Base	3 wks	Apr 01, '23	Apr 21, '23

<b>Task Name</b>	<b>Duration</b>	<b>Start</b>	<b>Finish</b>
Gilded Pavilion Without Asphalt Cover	2.29 wks	Apr 15, '23	Apr 30, '23
<b>Concrete Pavement</b>	<b>4.43 wks</b>	<b>May 01, '23</b>	<b>May 31, '23</b>
Soil Cement Base	4.43 wks	May 01, '23	May 31, '23
Aggregate Cement Foundation Base (CBT dan CTSB)	4.43 wks	May 01, '23	May 31, '23
Concrete Pavement Laying	4.43 wks	May 01, '23	May 31, '23
<b>Asphalt Pavement</b>	<b>17.57 wks</b>	<b>May 01, '23</b>	<b>Aug 31, '23</b>
<b>Asphalt Mixing Plant (AMP)</b>	<b>17.57 wks</b>	<b>May 01, '23</b>	<b>Aug 31, '23</b>
Basic Asphalt Layer (Prime coat/ Tack coat)	7.43 wks	May 01, '23	Jun 21, '23
Job Mix Testing	1 wk	Jun 22, '23	Jun 28, '23
Upper Asphalt	9.14 wks	Jun 29, '23	Aug 31, '23
<b>Steel Bridges Construction</b>	<b>21.86 wks</b>	<b>Apr 01, '23</b>	<b>Aug 31, '23</b>
<b>Lower Structure</b>	<b>8.71 wks</b>	<b>Apr 01, '23</b>	<b>May 31, '23</b>
Wood Piles	6.43 wks	Apr 01, '23	May 15, '23
Precast Concrete Piles	6.43 wks	Apr 01, '23	May 15, '23
Steel Structure Piles	6.43 wks	Apr 01, '23	May 15, '23
Couple Stone with Mortar	2.29 wks	May 16, '23	May 31, '23
Pile Caps	2.29 wks	May 16, '23	May 31, '23
<b>Upper Structure</b>	<b>8.71 wks</b>	<b>Jun 01, '23</b>	<b>Jul 31, '23</b>
Abutment, Columns and Piers	4.29 wks	Jun 01, '23	Jun 30, '23
Erection of Bridge Girder	4.43 wks	Jun 15, '23	Jul 15, '23
Floor and Barrier Casting	4.43 wks	Jul 01, '23	Jul 31, '23
<b>Bridge Accessories</b>	<b>4.43 wks</b>	<b>Aug 01, '23</b>	<b>Aug 31, '23</b>
Railing	3 wks	Aug 01, '23	Aug 21, '23
Markings and Fixtures	2.43 wks	Aug 15, '23	Aug 31, '23
<b>Steel Overhead Walkway Accessories</b>	<b>4.43 wks</b>	<b>Aug 01, '23</b>	<b>Aug 31, '23</b>
Roofing	4.43 wks	Aug 01, '23	Aug 31, '23
Railing	4.43 wks	Aug 01, '23	Aug 31, '23
Staircases and Elevators	4.43 wks	Aug 01, '23	Aug 31, '23
<b>Road Furnishings</b>	<b>17.43 wks</b>	<b>Sep 01, '23</b>	<b>Dec 31, '23</b>
<b>Road Lighting</b>	<b>13 wks</b>	<b>Sep 01, '23</b>	<b>Nov 30, '23</b>
Poles	6.29 wks	Sep 01, '23	Oct 14, '23
Lamps and Bulbs	2.43 wks	Oct 15, '23	Oct 31, '23
Electrical Works	4.29 wks	Nov 01, '23	Nov 30, '23
<b>Road Marking and Traffic Signals</b>	<b>4.43 wks</b>	<b>Dec 01, '23</b>	<b>Dec 31, '23</b>
Directional Marking	3 wks	Dec 01, '23	Dec 21, '23
Traffic Signs	2.43 wks	Dec 15, '23	Dec 31, '23
Traffic Lights	4.43 wks	Dec 01, '23	Dec 31, '23
<b>Project Closure</b>	<b>8.57 wks</b>	<b>Jan 01, '24</b>	<b>Feb 29, '24</b>
<b>Project Completion and Handover</b>	<b>8.57 wks</b>	<b>Jan 01, '24</b>	<b>Feb 29, '24</b>
Inspection of Works	6.43 wks	Jan 01, '24	Feb 14, '24
Commissioning of New Road	1 wk	Feb 15, '24	Feb 21, '24
Handover to the Government of Guyana	1.14 wks	Feb 22, '24	Feb 29, '24

## Develop Schedule

The inputs used in this process are the Schedule Development included the Activity List, Project Schedule Network Diagram, Activity Resource Requirements, Resource Calendar, Activity Durations, Project Scope Statement, Risk Register, and Resource Requirements. The tool used for developing the project schedule was Microsoft Project 2016. The figure (7) illustrates the duration estimates for the project.





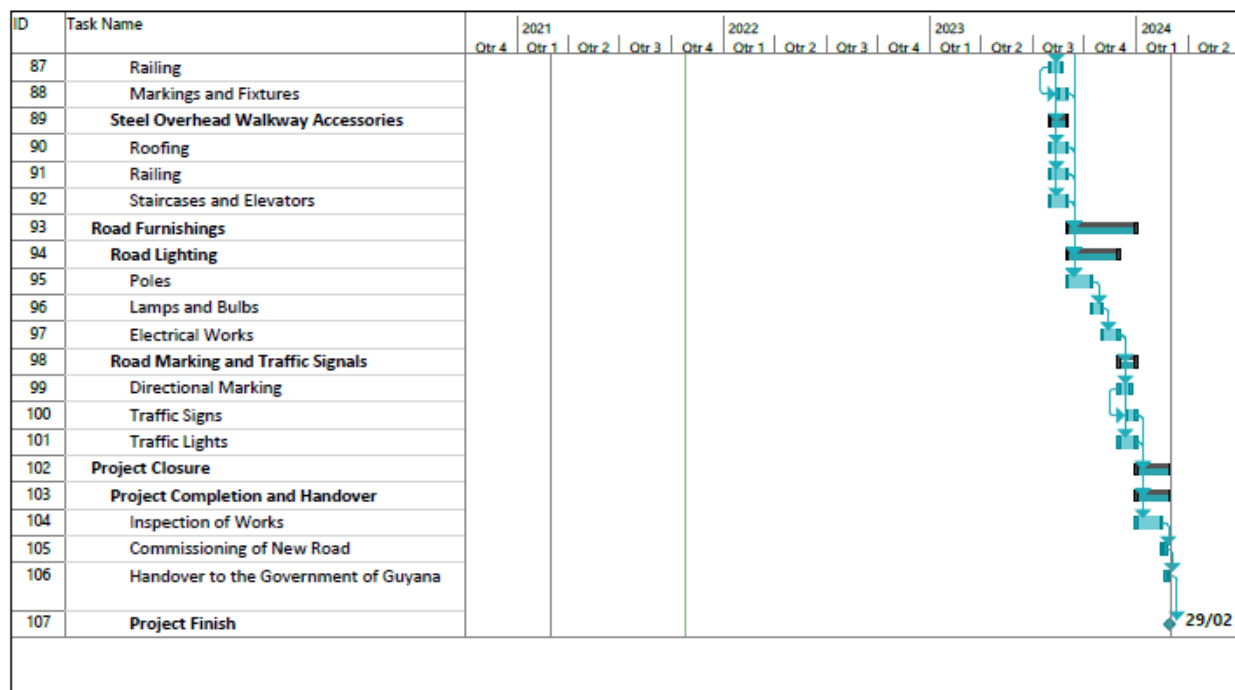


Figure 7 Project Schedule (Source: Compiled by Author in MSP 16, 2021)



#### **4.4 Project Cost Management**

The first process in the Project Cost Management is the development of the Cost Management Plan. The inputs used in the creation of this plan included the Project Charter and the Schedule and Risk Management Plan. These were supported with the use of expert judgement, data analysis and meetings. This process was guided by the PMBOK Guide which outlines how the Cost Management Plan should be structured.

## **COST MANAGEMENT PLAN**

### **CONSTRUCTION OF THE EAST BANK-EAST COAST (DIAMOND TO OGLE) HIGHWAY LINKAGE PROJECT**

**SINOHYDRO CORPORATION  
GEORGETOWN  
GUYANA**

**October 2021**

#### **Introduction**

The Cost Management Plan dictates the mechanics that will be acclimated to define how the project costs will be monitored and controlled during the construction process. It includes the mechanism and baseline for quantification of all the project costs, their reporting, and monitoring. It additionally includes the following:

- Identification of the ascendancy for cost management
- Nomination of the ascendancy for approbation of transmutations in costs
- Procedure for quantification of cost performance and its reporting formats for reports, their frequency, and to whom it is distributed.

The Project Manager is assigned the overall responsibility for the management and control of the project cost during the construction process. The PM is expected to conduct weekly meetings with the Finance and Procurement Specialist to discuss the project's cost performance, with measures adopted for its control. The PM is held accountable for any variances that may occur in the project cost, and is expected to make

recommendations of alternatives for realigning the project within the planned budget allocation. Once reviewed by the Project Director, the Project Sponsor will authorize cost changes that exceed the project budget, if necessary.

### **Cost Management Approach**

The approach that will be utilized in the management of cost has been documented in this component of the Cost Management Plan. The project will see the use of Cost Accounts engendered at the fourth level of the Work Breakdown Structure. The company's accounting software will be utilized to manage the cost control and monitoring process of the finances. The Project Manager will utilize the earned value calculations to measure and manage the financial performance of the project.

The project allows for a variance of +/-0.05 of both the schedule and the cost, using the Schedule Performance Index (SPI) and Cost Performance Index (CPI) as a tracker. Once the variances pass +/- 0.10, the Project Manager is alerted and presents this information to the Project Director where the appropriate remedial measures are discussed and recommended. The Project Sponsor should approve any corrective actions that are suggested, through the initiation of a change request.

### **Project Costs Measurement**

The performance of the project will be measured and analyzed using the Earned Value Management Approach. To conduct the EVM approach the Project Manager will utilize the following:

- Cost Variance (CV)
- Cost Performance Index (CPI)
- Schedule Variance (SV)
- Schedule Performance Index (SPI)

Once the analysis is conducted and the variance for the Cost Performance Index (CPI) or Schedule Performance Index (SPI) is between 0.05 and 0.1, the Project Manager has

the responsibility to report the reasons for this variance, which includes any recommendations for improvement to the Project Director. Once satisfied, the Project Director will forward this information to the Project Sponsor to approve any necessary change requests.

<b>Performance Measurement</b>	<b>Red</b>	<b>Yellow</b>
Cost Performance Index (CPI)	Less than 0.9 or Greater than 1.1	Between 0.90 and 0.95 or Between 1.05 and 1.1
Schedule Performance Index (SPI)	Less than 0.9 or Greater than 1.1	Between 0.90 and 0.95 or Between 1.05 and 1.1

### **Format for Reporting**

The reports that are presented to the Project Director and the Project Sponsor with regards to the project's cost performance will be included in the project's monthly and quarterly status reports. Any variances in relation to the cost that exceeded the predefined limits will be presented to the sponsor, where remedial courses of actions can be initiated by way of a change request. All previously approved changes for remedial purposes are also given a status update.

### **Cost Variance Response Process**

The established threshold that dictates when a variance should be escalated will be a CPI or SPI of less than 0.9 or greater than 1.1. If the Project Manager determines that the variances pass one of the established thresholds, a Cost Variance Corrective Action Plan is required. The Project Manager must first analyze and recommend necessary changes to the Project Director. When satisfied with the recommended actions, the Project Director presents it to the Project Sponsor with options for corrective actions within one week from when the cost variance was first reported. The project's sponsor is tasked with selecting a corrective action option within three days, and, upon acceptance, the plan will become a part of the project plan and the project will be updated by the Project Manager to reflect the corrective actions.

### Cost Change Control Process

The change control process for the project cost, will follow the established change order process established by the Ministry of Public Works. All proposed changes to the project budget/cost must be reviewed by the Project Director before being forwarded to the Project Sponsor for approval.

### Project Budget

Item	Project Costs (\$ USD)
Construction	\$ 40,000,000
Administration and Project Management Operations	\$ 5,000,000
Permits	\$ 1,000,000
Audits	\$ 2,000,000
Contingency (4%)	\$ 2,000,000
<b>Total</b>	<b>\$ 50,000,000</b>

### SPONSOR ACCEPTANCE

Approved by:

\_\_\_\_\_ Date: \_\_\_\_\_

Government of Guyana

The costs for the project were estimated after the conclusion of the project schedule. The inputs used in the cost estimation includes the Cost Management Plan and Resource Management Plan. Additionally, it includes the scope baseline, cost estimates and project schedule.

The tools and techniques used were: expert judgement, cost of quality factors, a bottom-up, analogous, and parametric estimating, reserve analysis, and cost aggregation and historical information review to summate the cost of each work package and ultimately the cost of the entire project. The budget for the project included the cost estimate in addition to a contingency reserve calculated at 4%. Expert judgement and the Ministry's

standard for large capital projects were used to identify the percentage allocated for the contingency reserve. The Funding Limit Conciliation was used throughout the entire process to ensure that the planned expenditure did not exceed the funds committed to the project by the Project Sponsor.

The project requires that funds will be disbursed at intervals. Funds are scheduled to be disbursed every six (6) months. The Disbursement Schedule below displays the amount of funds disbursed based on its requirements at various intervals during the project's life cycle. The Disbursement Schedule was also supported by the S-Curve in figure 8, which showed the cumulative cost of the project over the intervals highlighted in the disbursement schedule.

## Project Cost Baseline and Disbursement Schedule

Chart 16 Project Cost Baseline (Source: Compiled by the Author, 2021)

WBS	Descriptions of Cost Accounts	Total Cost	Labor Cost	Materials Cost
	<b>Administration and Project Management Operations</b>			
<b>1</b>	<b>Preparatory Work</b>	<b>\$ 5,000,000</b>	<b>\$ 750,000</b>	<b>\$ 4,250,000</b>
<b>1.1</b>	<b>Project and Conceptual Design</b>	<b>\$ 1,000,000</b>	<b>\$ 805,000</b>	<b>\$ 195,000</b>
1.1.1	Initial Impact Assessment	\$ 300,000	\$ 240,000	\$ 60,000
1.1.2	Feasibility Study	\$ 350,000	\$ 280,000	\$ 70,000
1.1.3	Approval of Project Charter	\$ 50,000	\$ 45,000	\$ 5,000
1.1.4	Complete Design Documents & Submit to MOPW and EPA for Permits	\$ 300,000	\$ 240,000	\$ 60,000
<b>1.2</b>	<b>Mobilization &amp; Demobilization</b>	<b>\$ 250,000</b>	<b>\$ 200,000</b>	<b>\$ 50,000</b>
1.2.1	Mobilization Program	\$ 125,000	\$ 100,000	\$ 25,000
1.2.2	Demobilization Program	\$ 125,000	\$ 100,000	\$ 25,000
<b>1.3</b>	<b>Field Office and Facilities</b>	<b>\$ 1,250,000</b>	<b>\$ 700,000</b>	<b>\$ 550,000</b>
1.3.1	Outfit Office with Service Provider Utilities and Facilities	\$ 375,000	\$ 262,500	\$ 112,500
1.3.2	Service Workshop and Warehouse	\$ 437,500	\$ 218,750	\$ 218,750
1.3.3	Offices and Accommodations for the Directors	\$ 437,500	\$ 218,750	\$ 218,750
<b>1.4</b>	<b>Management and Traffic Safety</b>	<b>\$ 500,000</b>	<b>\$ 138,750</b>	<b>\$ 361,250</b>
1.4.1	Management Plan and Traffic Safety	\$ 25,000	\$ 25,000	

<b>WBS</b>	<b>Descriptions of Cost Accounts</b>	<b>Total Cost</b>	<b>Labor Cost</b>	<b>Materials Cost</b>
1.4.2	Description of Temporary Minimum Road Equipment	\$ 25,000	\$ 25,000	
1.4.3	Temporary Road or Bridge Works	\$ 425,000	\$ 63,750	\$ 361,250
1.4.4	Maintenance Schedule for Traffic Safety	\$ 25,000	\$ 25,000	
<b>1.5</b>	<b>Field Technical Review</b>	<b>\$ 750,000</b>	<b>\$ 112,500</b>	<b>\$ 637,500</b>
1.5.1	Field Survey Work for Design Review	\$ 75,000	\$ 71,250	\$ 3,750
1.5.2	Routine Implementation Survey Work	\$ 225,000	\$ 213,750	\$ 11,250
1.5.3	Determination of Measurement Point	\$ 375,000	\$ 262,500	\$ 112,500
1.5.4	Field Engineering Expert Approval	\$ 75,000	\$ 67,500	\$ 7,500
<b>1.6</b>	<b>Environmental Security</b>	<b>\$ 250,000</b>	<b>\$ 150,000</b>	<b>\$ 100,000</b>
1.6.1	Environmental Management Efforts	\$ 250,000	\$ 150,000	\$ 100,000
<b>1.7</b>	<b>Relocate Existing Utility</b>	<b>\$ 350,000</b>	<b>\$ 297,500</b>	<b>\$ 52,500</b>
1.7.1	Utility Relocation Work and Existing Services	\$ 350,000	\$ 297,500	\$ 52,500
<b>1.8</b>	<b>Soil Testing</b>	<b>\$ 650,000</b>	<b>\$ 552,500</b>	<b>\$ 97,500</b>
1.8.1	Conduct Test Characteristics	\$ 650,000	\$ 552,500	\$ 97,500
<b>N/A</b>	<b>Total Administration and Project Management Operations</b>	<b>\$ 5,000,000</b>	<b>\$ 2,956,250</b>	<b>\$ 2,043,750</b>
	<b>Construction Costs</b>			
<b>2</b>	<b>Drainage</b>	<b>\$ 8,000,000</b>	<b>\$ 1,200,000</b>	<b>\$ 6,800,000</b>
<b>2.1</b>	<b>Support Drainage Installation</b>	<b>\$ 8,000,000</b>	<b>\$ 1,200,000</b>	<b>\$ 6,800,000</b>
2.1.1	Excavation of Sewers and Waterways	\$ 1,600,000	\$ 240,000	\$ 1,360,000
2.1.2	Laying of Drainage of Stone & Mortar Pairs	\$ 1,200,000	\$ 180,000	\$ 1,020,000
2.1.3	Installation of Concrete Precast Drainage	\$ 1,200,000	\$ 180,000	\$ 1,020,000
2.1.4	Installation of Concrete Cast Insitu Drainage	\$ 1,200,000	\$ 180,000	\$ 1,020,000
2.1.5	Installation of Porous Drainage	\$ 1,200,000	\$ 180,000	\$ 1,020,000
2.1.6	Installation of Culvert Pipes and Culvert Boxes	\$ 1,600,000	\$ 240,000	\$ 1,360,000
<b>3</b>	<b>Land Work</b>	<b>\$ 8,000,000</b>	<b>\$ 1,200,000</b>	<b>\$ 6,800,000</b>
<b>3.1</b>	<b>Land Clearing Execution</b>	<b>\$ 2,800,000</b>	<b>\$ 420,000</b>	<b>\$ 2,380,000</b>
3.1.1	Conducting the Cleaning, Peeling and Cutting Trees	\$ 2,800,000	\$ 420,000	\$ 2,380,000
<b>3.2</b>	<b>Executing Excavation Activities</b>	<b>\$ 2,800,000</b>	<b>\$ 420,000</b>	<b>\$ 2,380,000</b>
3.2.1	Conducting Soil Excavation	\$ 560,000	\$ 84,000	\$ 476,000
3.2.2	Conducting Stone Excavation	\$ 560,000	\$ 84,000	\$ 476,000
3.2.3	Conducting Asphalt Pavement Excavation	\$ 560,000	\$ 84,000	\$ 476,000
3.2.4	Conducting Concrete Pavement Excavation	\$ 560,000	\$ 84,000	\$ 476,000

<b>WBS</b>	<b>Descriptions of Cost Accounts</b>	<b>Total Cost</b>	<b>Labor Cost</b>	<b>Materials Cost</b>
3.2.5	Conducting Structure Excavation	\$ 560,000	\$ 84,000	\$ 476,000
<b>3.3</b>	<b>Conducing Piling</b>	<b>\$ 1,600,000</b>	<b>\$ 240,000</b>	<b>\$ 1,360,000</b>
3.3.1	Transporting and Compacting Dumps Back	\$ 800,000	\$ 120,000	\$ 680,000
3.3.2	Transporting and Compacting of Heap from the Outside (Borrow Area)	\$ 800,000	\$ 120,000	\$ 680,000
<b>3.4</b>	<b>Conducting Land Improvement</b>	<b>\$ 800,000</b>	<b>\$ 120,000</b>	<b>\$ 680,000</b>
3.4.1	Conducting Geotextile Works	\$ 320,000	\$ 48,000	\$ 272,000
3.4.2	Conducting Vacuum Consolidation Method (VCM) Works	\$ 240,000	\$ 36,000	\$ 204,000
3.4.3	Conducting of Dynamic Compaction (DC)	\$ 240,000	\$ 36,000	\$ 204,000
<b>4</b>	<b>Widening of Pavement and Roadside Construction</b>	<b>\$ 4,000,000</b>	<b>\$ 600,000</b>	<b>\$ 3,400,000</b>
<b>4.1</b>	<b>Executing Widening Pavement Work</b>	<b>\$ 2,000,000</b>	<b>\$ 300,000</b>	<b>\$ 1,700,000</b>
4.1.1	Executing Widening of Asphalt Pavement Works	\$ 1,000,000	\$ 150,000	\$ 850,000
4.1.2	Executing Widening of Concrete Pavement Work	\$ 1,000,000	\$ 150,000	\$ 850,000
<b>4.2</b>	<b>Conducting Roadside Works</b>	<b>\$ 2,000,000</b>	<b>\$ 300,000</b>	<b>\$ 1,700,000</b>
4.2.1	Executing Widening Roadside Works	\$ 2,000,000	\$ 300,000	\$ 1,700,000
<b>5</b>	<b>Bulking Hardening and Concrete Pavement Construction</b>	<b>\$ 4,000,000</b>	<b>\$ 600,000</b>	<b>\$ 3,400,000</b>
<b>5.1</b>	<b>Laying Gilded Pavement</b>	<b>\$ 1,400,000</b>	<b>\$ 210,000</b>	<b>\$ 1,190,000</b>
5.1.1	Laying of Aggregate Base	\$ 700,000	\$ 105,000	\$ 595,000
5.1.2	Gilded Pavilion Without Asphalt Cover	\$ 700,000	\$ 105,000	\$ 595,000
<b>5.2</b>	<b>Pouring of Concrete Pavement</b>	<b>\$ 2,600,000</b>	<b>\$ 390,000</b>	<b>\$ 2,210,000</b>
5.2.1	Pouring Soil Cement Base	\$ 520,000	\$ 78,000	\$ 442,000
5.2.2	Pouring Aggregate Cement Foundation Base (CBT dan CTSB)	\$ 1,040,000	\$ 156,000	\$ 884,000
5.2.3	Concrete Pavement Laying	\$ 1,040,000	\$ 156,000	\$ 884,000
<b>6</b>	<b>Application of Asphalt Pavement</b>	<b>\$ 10,000,000</b>	<b>\$ 1,500,000</b>	<b>\$ 8,500,000</b>
<b>6.1</b>	<b>Asphalt Mixing Plant (AMP) Work</b>	<b>\$ 10,000,000</b>	<b>\$ 1,500,000</b>	<b>\$ 8,500,000</b>
6.1.1	Application of Basic Asphalt Layer (Prime coat/ Tack coat)	\$ 3,000,000	\$ 450,000	\$ 2,550,000
6.1.2	Conducting of Job Mix Testing	\$ 1,000,000	\$ 150,000	\$ 850,000
6.1.3	Application of Upper Asphalt	\$ 6,000,000	\$ 900,000	\$ 5,100,000
<b>7</b>	<b>Erection of Steel Bridges and Overhead Walkway</b>	<b>\$ 4,000,000</b>	<b>\$ 600,000</b>	<b>\$ 3,400,000</b>
<b>7.1</b>	<b>Establishment of Lower Structure</b>	<b>\$ 1,000,000</b>	<b>\$ 150,000</b>	<b>\$ 850,000</b>

<b>WBS</b>	<b>Descriptions of Cost Accounts</b>	<b>Total Cost</b>	<b>Labor Cost</b>	<b>Materials Cost</b>
7.1.1	Driving of Wood Piles	\$ 250,000	\$ 37,500	\$ 212,500
7.1.2	Driving of Precast Concrete Piles	\$ 250,000	\$ 37,500	\$ 212,500
7.1.3	Driving of Steel Structure Piles	\$ 250,000	\$ 37,500	\$ 212,500
7.1.4	Application of Couple Stone with Mortar	\$ 150,000	\$ 22,500	\$ 127,500
7.1.5	Installation of Pile Caps	\$ 100,000	\$ 15,000	\$ 85,000
<b>7.2</b>	<b>Erection of Upper Structure</b>	<b>\$ 1,000,000</b>	<b>\$ 150,000</b>	<b>\$ 850,000</b>
7.2.1	Erect Abutment, Columns and Piers	\$ 300,000	\$ 45,000	\$ 255,000
7.2.2	Erection of Bridge Girder	\$ 350,000	\$ 52,500	\$ 297,500
7.2.3	Installation of Floor and Barrier Casting	\$ 350,000	\$ 52,500	\$ 297,500
<b>7.3</b>	<b>Installation of Bridge Accessories</b>	<b>\$ 1,000,000</b>	<b>\$ 150,000</b>	<b>\$ 850,000</b>
7.3.1	Install Railing	\$ 500,000	\$ 75,000	\$ 425,000
7.3.2	Install Markings and Fixtures	\$ 500,000	\$ 75,000	\$ 425,000
<b>7.4</b>	<b>Installation of Steel Overhead Walkway Accessories</b>	<b>\$ 1,000,000</b>	<b>\$ 150,000</b>	<b>\$ 850,000</b>
7.4.1	Install Roofing	\$ 300,000	\$ 45,000	\$ 255,000
7.4.2	Install Railing	\$ 300,000	\$ 45,000	\$ 255,000
7.4.3	Installation of Staircases and Elevators	\$ 400,000	\$ 60,000	\$ 340,000
<b>8</b>	<b>Complete Road Furnishings</b>	<b>\$ 2,000,000</b>	\$ 300,000	\$ 1,700,000
<b>8.1</b>	<b>Install Road Lighting</b>	<b>\$ 1,500,000</b>	\$ 225,000	\$ 1,275,000
8.1.1	Install Poles	\$ 600,000	\$ 90,000	\$ 510,000
8.1.2	Install Lamps and Bulbs	\$ 300,000	\$ 45,000	\$ 255,000
8.1.3	Install Electrical Works	\$ 600,000	\$ 90,000	\$ 510,000
<b>8.2</b>	<b>Install Road Marking and Traffic Signals</b>	<b>\$ 500,000</b>	<b>\$ 75,000</b>	<b>\$ 425,000</b>
8.2.1	Install Directional Marking	\$ 75,000	\$ 11,250	\$ 63,750
8.2.2	Install Traffic Signs	\$ 75,000	\$ 11,250	\$ 63,750
8.2.3	Install Traffic Lights	\$ 350,000	\$ 52,500	\$ 297,500
	<b>Total Construction Costs</b>	<b>\$ 40,000,000</b>	<b>\$ 6,000,000</b>	<b>\$ 34,000,000</b>
<b>N/A</b>	<b>Environmental &amp; Building Permits</b>	<b>\$ 1,000,000</b>		
<b>N/A</b>	<b>Audit Fees</b>	<b>\$ 2,000,000</b>		
<b>N/A</b>	<b>Contingency Costs</b>	<b>\$ 2,000,000</b>		
	<b>Total Project Overall Costs</b>	<b>\$ 50,000,000</b>	<b>\$ 8,956,250</b>	<b>\$ 36,043,750</b>



**Planned Disbursement Schedule and S-Curve of the Project Budget**  
**Chart 17 Disbursement Schedule (Source: Compiled by the Author, 2021)**

Descriptions of Cost Accounts	Mar 21 - Aug 21	Sept 21 -Feb 22	Mar 22- Aug 22	Sept 22 -Feb 23	Mar 23 - Aug 23	Sept 23 -Feb 24	Totals
<b>Administration and Project Management Operations</b>							
<b>Preparatory Work</b>							
<b>Project and Conceptual Design</b>							
Initial Impact Assessment	300,000						300,000
Feasibility Study	350,000						350,000
Approval of Project Charter	50,000						50,000
Complete Design Documents & Submit to MOPW and EPA for Permits	300,000						300,000
<b>Mobilization &amp; Demobilization</b>		250,000					250,000
Mobilization Program							
Demobilization Program							
<b>Field Office and Facilities</b>		1,250,000					1,250,000
Outfit Office with Service Provider utilities and Facilities							
Service Workshop and Warehouse							
Offices and Accommodations for the Directors							
<b>Management and Traffic Safety</b>		500,000					500,000
Management Plan and Traffic Safety							
Description of Temporary Minimum Road Equipment							
Temporary Road or Bridge Works							
Maintenance Schedule for Traffic Safety							
<b>Field Technical Review</b>		750,000					750,000
Field Survey Work for Design Review							
Routine Implementation Survey Work							
Determination of Measurement Point							
Field Engineering Expert Approval							
<b>Environmental Security</b>		250,000					250,000
Environmental Management Efforts							
<b>Relocate Existing Utility</b>		350,000					350,000

Descriptions of Cost Accounts	Mar 21 - Aug 21	Sept 21 -Feb 22	Mar 22- Aug 22	Sept 22 -Feb 23	Mar 23 - Aug 23	Sept 23 -Feb 24	Totals
Utility Relocation Work and Existing Services							
<b>Soil Testing</b>		650,000					650,000
Conduct Test Characteristics							
<b>Total Administration and Project Management Operations</b>	1,000,000	4,000,000	-	-	-	-	5,000,000
<b>Construction Costs</b>							
<b>Drainage</b>							
<b>Support Drainage Installation</b>							
Excavation of Sewers and Waterways		800,000	800,000				1,600,000
Laying of Drainage of Stone & Mortar Pairs			514,286	685,714			1,200,000
Installation of Concrete Precast Drainage			514,286	685,714			1,200,000
Installation of Concrete Cast Insitu Drainage			514,286	685,714			1,200,000
Installation of Porous Drainage			514,286	685,714			1,200,000
Installation of Culvert Pipes and Culvert Boxes			685,714	914,286			1,600,000
<b>Land Work</b>							
<b>Land clearing Execution</b>							
Conducting the Cleaning, Peeling and Cutting Trees		1,200,000	1,600,000				2,800,000
<b>Executing Excavation Activities</b>							
Conducting Soil Excavation		86,154	258,462	215,385			560,000
Conducting Stone Excavation		86,154	258,462	215,385			560,000
Conducting Asphalt Pavement Excavation		86,154	258,462	215,385			560,000
Conducting Concrete Pavement Excavation		86,154	258,462	215,385			560,000
Conducting Structure Excavation		86,154	258,462	215,385			560,000
<b>Conducting Piling</b>							
Transporting and Compacting Dumps Back		61,538	369,231	369,231			800,000
Transporting and Compacting of Heap from the Outside (Borrow Area)		61,538	369,231	369,231			800,000
<b>Conducting Land Improvement</b>							
Conducting Geotextile Works					320,000		320,000
Conducting Vacuum Consolidation Method (VCM) Works					240,000		240,000
Conducting of Dynamic Compaction (DC)					240,000		240,000

Descriptions of Cost Accounts	Mar 21 - Aug 21	Sept 21 -Feb 22	Mar 22- Aug 22	Sept 22 -Feb 23	Mar 23 - Aug 23	Sept 23 -Feb 24	Totals
<b>Widening of Pavement and Roadside Construction</b>							
<b>Executing Widening Pavement Work</b>							
Executing Widening of Asphalt Pavement Works					1,000,000		1,000,000
Executing Widening of Concrete Pavement Work					1,000,000		1,000,000
<b>Conducting Roadside Works</b>							
Executing Widening Roadside Works					2,000,000		2,000,000
<b>Bulking Hardening and Concrete Pavement Construction</b>							
<b>Laying Gilded Pavement</b>							
Laying of Aggregate Base					700,000		700,000
Gilded Pavilion Without Asphalt Cover					700,000		700,000
<b>Pouring of Concrete Pavement</b>							
Pouring Soil Cement Base					520,000		520,000
Pouring Aggregate Cement Foundation Base (CBT dan CTSB)					1,040,000		1,040,000
Concrete Pavement Laying					1,040,000		1,040,000
<b>Application of Asphalt Pavement</b>							
<b>Asphalt Mixing Plant (AMP) Work</b>							
Application of Basic Asphalt Layer (Prime coat/ Tack coat)					3,000,000		3,000,000
Conducting of Job Mix Testing					1,000,000		1,000,000
Application of Upper Asphalt					6,000,000		6,000,000
<b>Erection of Steel Bridges and Overhead Walkway</b>							
<b>Establishment of Lower Structure</b>							
Driving of Wood Piles					250,000		250,000
Driving of Precast Concrete Piles					250,000		250,000
Driving of Steel Structure Piles					250,000		250,000
Application of Couple Stone with Mortar					150,000		150,000
Installation of Pile Caps					100,000		100,000
<b>Erection of Upper Structure</b>							
Erect Abutment, Columns and Piers					300,000		300,000
Erection of Bridge Girder					350,000		350,000
Installation of Floor and Barrier Casting					350,000		350,000

Descriptions of Cost Accounts	Mar 21 - Aug 21	Sept 21 -Feb 22	Mar 22- Aug 22	Sept 22 -Feb 23	Mar 23 - Aug 23	Sept 23 -Feb 24	Totals
<b>Installation of Bridge Accessories</b>							
Install Railing					500,000		500,000
Install Markings and Fixtures					500,000		500,000
<b>Installation of Steel Overhead Walkway Accessories</b>							
Install Roofing					300,000		300,000
Install Railing					300,000		300,000
Installation of Staircases and Elevators					400,000		400,000
<b>Complete Road Furnishings</b>							
<b>Install Road Lighting</b>							
Install Poles						600,000	600,000
Install Lamps and Bulbs						300,000	300,000
Install Electrical Works						600,000	600,000
<b>Install Road Marking and Traffic Signals</b>							
Install Directional Marking						75,000	75,000
Install Traffic Signs						75,000	75,000
Install Traffic Lights						350,000	350,000
<b>Total Construction Costs</b>	-	2,553,846	7,173,626	5,472,527	22,800,000	2,000,000	40,000,000
<b>Environmental &amp; Building Permits</b>	<b>1,000,000</b>						1,000,000
<b>Audit Fees</b>		<b>666,667</b>		<b>666,667</b>		<b>666,667</b>	2,000,000
<b>Contingency Costs</b>	<b>333,333</b>	<b>333,333</b>	<b>333,333</b>	<b>333,333</b>	<b>333,333</b>	<b>333,333</b>	2,000,000
<b>Total Project Overall Costs</b>	<b>2,333,333</b>	<b>7,553,846</b>	<b>7,506,960</b>	<b>6,472,527</b>	<b>23,133,333</b>	<b>3,000,000</b>	50,000,000

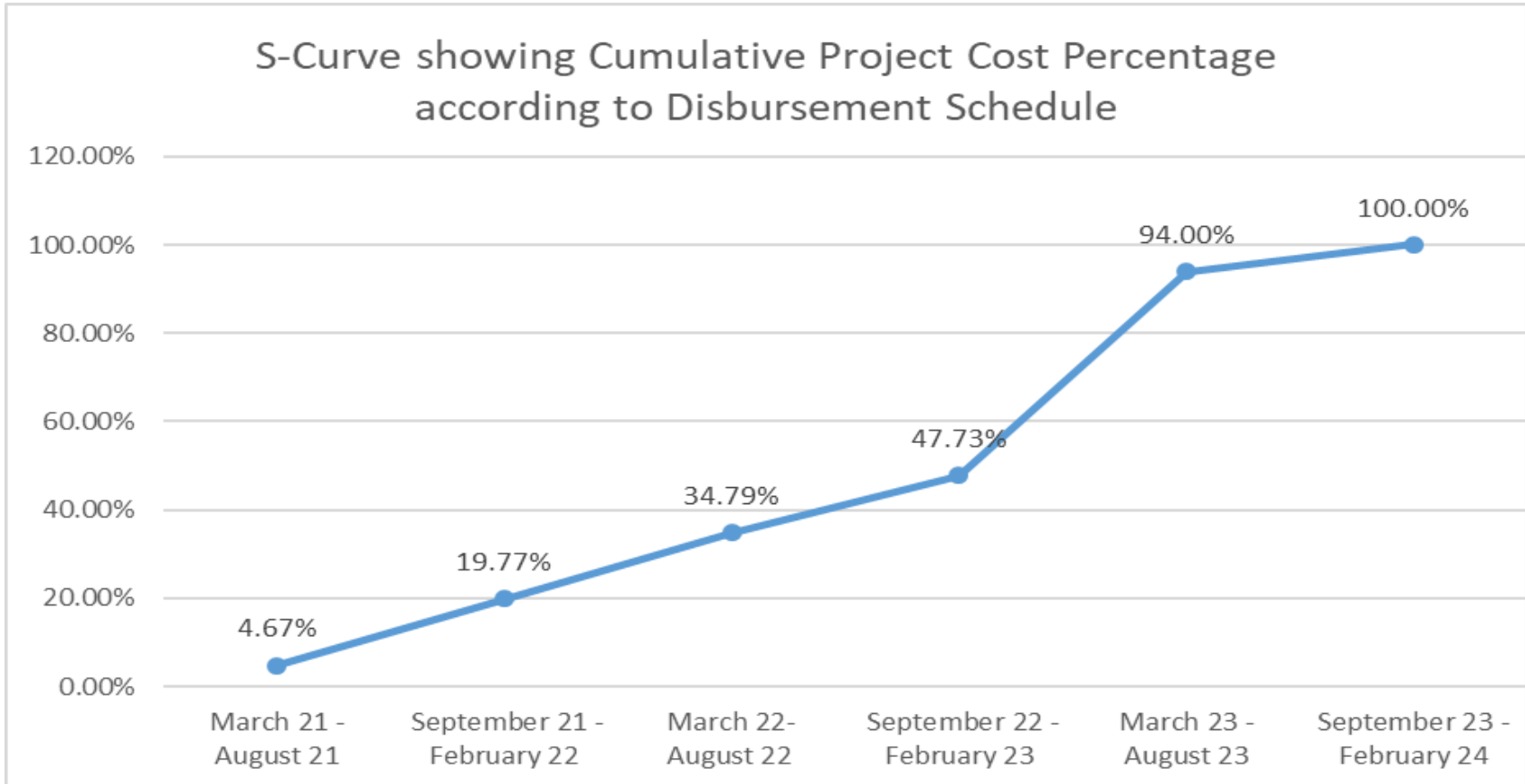


Figure 8 S-Curve (Source: Compiled by Author, 2021)

#### **4.5 Project Quality Management**

The Project's Quality Management Plan was created after the Procurement Management Plan. This assures all stakeholders that the quality consideration was made in relation to the project's materials and processes. Since the focus area for this project is planning, only the Plan Project Management process was considered during its development.

The PMBOK® Guide was used to determine the input of the Quality Management Plan. These inputs include: The Stakeholder Register, the Risk Register and the Requirements Documents. It also included the Requirements Management Plan which contained the quality requirement. This proved to be very useful. The techniques and tools utilized in the development of the plan were meetings and brainstorming sessions.

Given that the government has major infrastructural works planned for the next decade, the importance of quality cannot be overemphasized. Further, the Minister of Public works indicated that poor quality work may result in the company being blacklisted from further contracts with the government. Thus, the Quality Management Plan was used as a guide to ensure that the design, processes used, materials and construction of the road met, and in most cases exceeded the industry's standards, in an effort to satisfy the quality requirements of the project.

## **QUALITY MANAGEMENT PLAN**

**CONSTRUCTION OF THE EAST BANK-EAST COAST (DIAMOND TO OGLE)  
HIGHWAY LINKAGE PROJECT**

**SINOHYDRO CORPORATION  
GEORGETOWN  
GUYANA**

October 2021

**Introduction**

The Quality Management Plan for the road construction project is aimed at streamlining all activities, processes and procedures which will ensure that the final deliverable product at the end of the project is satisfactory.

**Quality Management Approach**

The approach to quality management taken by the road construction team will ensure that both the processes and products are within the parameters of the approved standards. The team will take a Total Quality Management Approach to its quality journey where it will continuously improve by measuring and monitoring and looking at ways to improve its standards.

The product quality will be defined by the specification enshrined in the design and bid documents, these are in keeping with the approved standards adopted by the Ministry of Public Works. The focus is on assuring the project deliverables attains the client's quality requirements.

The process quality will be subject to the procedures and policies that are enshrined in the Standard Operating Procedures of the Ministry. These procedures were developed based on the adopted standards from more developed economies. The execution of these procedures and processes will ensure that the deliverables attain the prescribed quality requirements.

The sponsor and Project Director of the Work Services Group, with input from the Quality Assurance Officer and Project Manager, will develop the project's Quality Plan with all organizational and project specific quality standards for both product and processes.

The materials used in the road construction process will require certain specifications. These will be closely monitored over the life cycle of the project. This will ensure that the project achieves and possibly surpasses its quality targets.

## Roles and Responsibilities

**Chart 18 Quality Roles and Responsibilities (Source: Compiled by the Author, 2021)**

Name	Role	Responsibilities
Ministry of Public Works (Government of Guyana)	Project Sponsor	<ul style="list-style-type: none"> <li>a. Determining the parameters governing the overall quality of the project</li> </ul>
Anthony Flett	Project Director (Work Services Group)	<ul style="list-style-type: none"> <li>a. Identify, report, review and/or analyze project deliverables and/or work products, focusing on quality characteristics such as completeness, consistency, fitness of use, etc.</li> <li>b. Provide Project Sponsor with independent oversight of quality issues and areas of nonconformance Participate in necessary quality audits and quality reviews.</li> </ul>
Geoffrey Vaughn	Project Manager	<ul style="list-style-type: none"> <li>a. Relate quality (risks and issues) to internal and external stakeholders.</li> <li>b. Liaise with project staff regularly to channel project activities and stay updated on project quality status.</li> <li>c. Liaise with EMT to relate any quality related issues.</li> <li>d. Engage in the establishment and oversight of the project's QM effort.</li> <li>e. Develop and sustain project management plans.</li> <li>f. Surveil milestones, activities, timelines, resources, budgets and critical path</li> <li>g. Develop and track project metrics.</li> <li>h. Preside over contractor activities.</li> <li>i. Examine contractor deliverables</li> </ul>



Quality Assurance Officer	Project Team	<ul style="list-style-type: none"> <li>a. Identify and escalate any critical project issues to the Project Manager and/or Project Director.</li> <li>b. Identify quality standards and metrics.</li> <li>c. Provide QA inputs for developing project work products and ensuring that quality targets are defined for each deliverable and process.</li> <li>d. Implement QA techniques to ensure the quality of the deliverables to be produced by the project.</li> <li>e. Implement QC techniques to control the quality of the deliverables</li> </ul>
Engineers and Contractors	Project Team	<ul style="list-style-type: none"> <li>a. Identify and escalate any critical project issues to the Project Manager.</li> <li>b. Relate project status, quality (risks and issues) to the quality Officer, PM, PD</li> </ul>
Suppliers		<ul style="list-style-type: none"> <li>a. Ensure that the materials provided are of an approved standard.</li> </ul>

## Quality Requirements / Standards

### ***Product Quality:***

The raw materials and finished products used in the construction of the East Bank-East Coast (Diamond to Ogle) Highway linkage project must adhere to the locally adopted standard, since Guyana does not have its own standards for certain materials. The Ministry of Public Works has enshrined in its organization's documents and policies, the accepted standards that will be used in road construction projects.

The Ministry of Public Works uses the standards that were developed by the American Association of State Highway and Transportation Officials (AASHTO) and the American Society for Testing and Materials (ASTM). These standards ensure that materials are of a quality that is acceptable in more developed economies and thus will provide lasting benefits to the local economy. The Project Manager must ensure that these approved standards are communicated to all stakeholders.

***Process Quality:***

The Work Services Group of the Ministry of Public Works has an approved manual that details the practices and procedures of its construction process. This Procedure Manual provides a guide to the correct construction practices and procedures for use on road contracts by the Department. This document is not intended to be comprehensive and therefore does not provide information on all construction activities. It refers to the Standard Technical Specification; however, it does not replace any aspect of that document. If there is any conflict, the Specification takes precedence. These procedures and practices must be communicated to all stakeholders by the Project Manager.

**Quality Assurance**

The Quality Assurance Plan associated with the construction of the road is conducted to ensure that defects and miscalculations in its raw materials and manufactured products are addressed. Several tests will be conducted throughout the lifecycle of the project to ensure that quality requirements will be fulfilled.

These tests will be conducted by the Quality Assurance Officer and the Project Team at intervals throughout the project to ensure all processes are being correctly implemented and executed. The table below outlines the various tests that the Quality Assurance Officer and team must conduct at intervals:

**Chart 19 Test by QA Engineer (Source: Compiled by the Author, 2021)**

Test	Reason to Conduct
Moisture Condition Value (MCV)	This is where the soil is tested for its moisture content. It is rammed to test the

	level of compaction. As a general guide, MCV of 8.5 is recommended.
Cast-in-place Cylinders	Molds are placed in the location of the pour. Fresh concrete is poured into these molds which remain in the slab. Once hardened, these specimens are removed and compressed for strength.
Disc Shaped Compact Tension (DCT)	This uses low-temperature fracture test to determine the cracking resistance of asphalt mixtures.
Charpy V-notch Test	The test measures the material's ability to absorb energy, or impact within a given temperature range.

Any discrepancies or irregularities unearthed when conducting these tests must be reported immediately to the PM, who will have the responsibility of communicating same to the PD. A meeting will then be held with the Project Team and or the subcontractors to resolve these issues.

#### Quality Control

This process needs to be systematic and effectively executed by the road construction contractor, SINOHYDRO Corporation. These processes are reliably monitored and audited by the PD since this, provides a win-win outcome for both contractors and road agency clients.

Effective quality control will enable the contractor to minimize rework and the associated cost and time over-runs. A transparent QA process with auditable evidence of compliance will enable the Work Services Group to satisfy itself that what is built complies with specified requirements and can therefore be expected to achieve its intended life and performance at the expected life span.

## Quality Control Measurements

### Quality Assurance Log

The QA Log contains a list of assurance activities and tests that are carried out to ensure that the products or processes adhere to all the specifications.

ID #	Review Date	Product/ Process Reviewed	Required Findings	Actual Findings	Resolution	Personnel Responsible	Date Resolved

### Quality Control Log

The QC log involves verification of output conformance to the desired quality levels and includes all operational techniques and activities used to fulfill requirements for quality. These techniques and activities are aligned with the customers and/or stakeholders before project work is commenced.

ID #	Review Date	Product/ Process Reviewed	Required Findings	Actual Findings	Resolution	Personnel Responsible	Date Resolved

## SPONSOR ACCEPTANCE

Approved by:

\_\_\_\_\_ Date: \_\_\_\_\_

Government of Guyana

#### **4.6 Project Human Resources Management**

The Human Resources Management Plan's creation followed the completion of the Communications Plan. The inputs used in the creation of this Human Resources Management Plan includes: The Resources Requirement defined in the WBS Dictionary and the Stake Holder Register that was created in the Scope and Stakeholder Management Plans respectively. The tools and techniques utilized in this process included: conducting meetings and interviews with industry experts to gain a better understanding of the resource requirements for the project given its needs.

Since this project only covers the Plan, the Human Resources Management process will be the sole focus for this document. The other three processes will be conducted during the project execution phase.

## **HUMAN RESOURCE MANAGEMENT PLAN**

**CONSTRUCTION OF THE EAST BANK-EAST COAST (DIAMOND TO OGLE)  
HIGHWAY LINKAGE PROJECT**

**SINOHYDRO CORPORATION  
GEORGETOWN  
GUYANA**

October 2021

## **Introduction**

The Human Resources Management Plan is one of the most important components of the Project Management Plan. It aids the management of the project in applying the correct resources for the efficient and effective execution of all project activities. The plan includes: roles and responsibilities, timeline for the roles, training, and rewards system.

## **Roles and Responsibilities**

The roles and responsibilities of the Project Team is critical for its success. The Project Team must comprise of a skillset that will allow the project deliverables to be achieved in an effective and efficient manner. It is imperative that each member of the team has a firm and thorough understanding of their roles and responsibilities that will contribute to the success of the project. The road construction project will see the following roles and responsibilities being established:

**Project Director (1 Employee)** – this individual is responsible for providing oversight to the Project Team by reviewing all the work submitted by the Project Manager and all requests for disbursement of finances. The PD is also tasked with preparing the Project Management Plans with the support of the assistant Project Director and the Project Manager.

**Assistant Project Director (1 Employee)** – This individual is responsible for assisting the PD in the oversight of the project and leads the way in the preparation of all project management plans.

**Project Manager (1 Employee)** – This individual is responsible for the day- to- day management of the project. The overall success of the project depends heavily on the ability of the PM to achieve all deliverables in an effective and efficient manner.

The PM must prepare all requests for disbursement from the sponsor. He must authorize and approve all project expenditures after receiving all disbursements. The PM is also responsible for communicating with all stakeholders the project's status and for managing the human and other resources of the project.

**Finance and Procurement Specialist (1 Employee)** – This individual has the responsibility of preparing and keeping track of all project finances, liaising with suppliers for the purpose of producing the necessary resources and reporting the status of the project finances to the PM.

**Land Surveyor (1 Employee)** – This individual has the responsibility of providing the coordinates and measurements of where the road should be located, as well as tracking the road building process to ensure the correct location is being used.

**Quantity surveyor (1 Employee)** – This individual has the responsibility of quantifying all materials and costs in unit, along with the cost that is needed to successfully complete the project.

**Quality Assurance Officer (1 Employee)** – This individual has the responsibility to partake in the creation of the Quality Management Plan and to conduct all test and quality assurance and control measures to ensure that the project materials and processes adhere to the established standards and specifications.

**Material Engineer (1 Employee)** – This individual has the responsibility to work alongside the QA to ensure that laboratory and field testing of construction materials for highways, bridges, aggregates, cement, steel, bitumen and other materials such as sand, soil, and bricks are carried out.

**Senior Pavement and Highway Engineer (2 Employees)** – These individuals have the responsibility for the structural integrity of the roads and pavement by ensuring

that all processes and procedures are executed in accordance with the requirements and specifications of mixtures and applications.

**Bridge and Culvert Engineer (1 Employee)** – This individual has the responsibility for the structural integrity of all bridges, drains and culverts by ensuring that all are designed in keeping with the prescribed specification and engineering.

**Health, Environmental and Safety Engineer (1 Employee)** – This individual has the responsibility of ensuring that all established safety and health standards are executed on work site. This contributes to the successful completion of the project since it helps to reduce worksite accidents.

**Asphalt and Cementing Foreman (2 Employee)** – This individual is expected to liaise with the other engineers to organize the asphalt laying and cementing process and directly supervise and coordinate daily activities of the paving crew.

**Operators (10 Employees)** – These individuals are the operators of the heavy machineries and equipment used in the road construction process. These machines include: excavators, backhoes, trucks, mixing trucks, pavers etc.

**Laborers (40 Employees)** – These individuals are the crew members who are responsible for completing the daily activities on the project site. They support the specialist engineers by helping to oversee the execution of the road construction.

**Subcontractor Electrical Engineering** – This company will be responsible for the installation of traffic lights and street lights and all its electrical connectivity to the national grid and the command center.



## Project Organizational Charts - RACI Chart

Chart 20 Project RACI Chart (Source: Compiled by the Author, 2021)

	Project Director	Project Manager	Finance and Procurement Specialist	Land Surveyor	Quantity surveyor	Quality Assurance Officer	Material Engineer	Pavement and Highway Engineer	Bridge and Culvert Engineer	HES Engineer	Asphalt & Cement foreman	Operators	Sponsor	Subcontractor
Project and Conceptual Design	R												A	
Initial Impact Assessment	A	R												
Feasibility Study	A	R								I				
Approval of Project Charter	C	C											R	
Complete Design Documents & Submit to MOW and EPA for Permit	A	R			C					C				
Mobilization & Demobilization Works	C	A	R											
Field Office and Facilities Set Up	C	A	R											
Management and Traffic Safety Set Up	C	A	I	I	C	I	I	R	C	C	C	I	I	
Field Technical Review Complete	A	R	C	C	C	C	C	C	C	C	C	I	I	
Environmental Security	C	A	I	C	I	C	I	I	I	R	I	I	I	
Relocate Existing Utility	C	R	I	I	I	I	I	I	I	C	I	I	I	
Soil Testing	C	A	I	C	I	R	C	I	I	I	I	I	I	
Drainage	C	A	I	C	I	C	C	C	R	I	C	I	I	
Land Work	C	A	I	C	I	C	C	R	C	I	I	I	I	
Widening of Pavement and Roadside	C	A	I	C	I	C	C	R	C	I	C	I	I	

Bulking Hardening and Concrete Pavement	C	A	I	C	I	C	C	C	C	I	R	I	I	
Asphalt Pavement	C	A	I	C	I	C	C	C	C	I	R	I	I	
Steel Bridges Construction	C	A	I	C	I	C	C	C	R	I	C	C	I	
Road Furnishings	C	A	I	I	I	C	C	R	R	I	C	I	I	R
Project Communications	A	R	I	I	I	I	I	I	I	I	I	I	I	
Stakeholder Management	A	R												
Accounting and Procurement	C	A	R											
Status Reports	I	R	C	C		C	C	C	C	C	C	C	I	
Manage Laborers & Junior Employees		A	C	R	R	R	R	R	R	R	R	R		

**Responsible:** The person who does the work to achieve the task. They have the responsibility for getting the work done or making decisions.

**Accountable:** The person who is accountable for the correct and thorough completion of the task.

**Consulted:** The people who provide information for the project with whom there is two-way communication.

**Informed:** The people kept informed of progress with whom there is one-way communication.

## Staffing Management

### **Staff Acquisition:**

The human resources of the project will consist of mainly employees of the SINOHYDRO Corporation. The Works Services Group, who has direct supervision over the project, will assign a Project Director, an assistant Project Director and any other staff that they may deem necessary for the supervision of the project. The contractor will also acquire the services of subcontractors and suppliers to assist them in the execution of the project activities.

All employees and subcontractors of the project must sign a contract with the SINOHYDRO Corporation before they partake in any of the project's activities. The

mobile office on site will house the employees and their subcontractors temporarily. The PD and team will have a temporary space at the project site, but will not be there on a daily basis.

**Resource Calendars:**

The construction of the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project is expected to last 156.5 weeks in totality. The Project Manager of SINOHYDRO Corporation and the directors from the Works Services Group are expected to be a part from the inception date. The environmental officer and quantity surveyor will join the group to finalize the feasibility study, cost and unit estimation before the actual construction commences. The full Project Team will be hired once the Charter has been approved and permits are secured.



**Figure 9 Human Resources Calendar (Source: Compiled by the Author, 2021)**

***Training:***

All employees will be trained with regards to their respective roles, and in roles similar to theirs, should a switch in designation be deemed necessary. All employees and subcontractors must go through a mandatory HSE training that will be conducted by the HSE engineer; all operators must have formal training with specified hours of operating simulators before being allowed to operate the machines.

Training in the HSE will be ongoing; however, other types of training will be conducted on a needs basis so that the project activities are not hampered frequently.

***Performance Reviews:***

The Project Manager is responsible for overall management of the human capital of the project. The PM reviews the work of all his senior team members on a weekly basis via reports they submit to him. The head engineers in the various sections, have the responsibility to review all their subordinates' performance. This performance evaluation is done every three months according to the SOP of the company. However, new employees are evaluated on a weekly basis to determine where they are a good fit for the organization. After the review is conducted, discussions are held with the engineers and subordinates in the presence of the PM to discuss the outcome of the review. These discussions are documented, and the management agrees upon proposed actions.

***Recognition and Rewards:***

While the life of the project is limited, employees are recognized and celebrated in the morning 'kick-start' meetings for their exemplary work on the project as the need arises. If they save costs, at the end of the project they are also paid bonuses for their satisfactory work.

**SPONSOR ACCEPTANCE**

Approved by:

\_\_\_\_\_ Date: \_\_\_\_\_

Government of Guyana.

## **4.7 Project Communication Management**

The dissemination of information to relevant stakeholders on the project progress and deliverable hinges on a well thought out Communications Plan. This plan was developed with the PMBOK Guide as a framework. The plan dictates with whom communications should be kept, the frequency of such communication, the purpose of the communication, and the mode and format in which the presentation will take place. This is one of the most important plans, since poor communications can lead an unsuccessful project.

The Assistant Project Director held discussions with both the Project Director and the Project Manager, to determine the most suitable communication means. They also examined information from communication in similar projects completed prior to garner adequate information to prepare the plan.

# **Communications Management Plan**

CONSTRUCTION OF THE EAST BANK-EAST COAST (DIAMOND TO OGLE)  
HIGHWAY LINKAGE PROJECT

October 2021

**Project Manager: Geoffrey Vaughn**

**Project Objective: To Construct Highway**

**Project Sponsor: Government of Guyana**

**Prepared by: S. Brathwaite**

**Submitted to: Project Sponsor and Project Director (Government of Guyana)**

## **Introduction**

The Communications Plan will serve as a guide that will keep all relevant stakeholders involved and abreast with all development in the construction of the East Bank- East Coast (Diamond to Ogle) Highway Linkage Project. The Communication Matrix below is the most important depiction in the Communications Plan. It shows what should be communicated, how and when it should be done, and the target audience for the type of communication.

## **Target Audiences**

The target audience for communications on the project's activities includes the following stakeholders:

Project Sponsor (Ministers of Public Works, Permanent Secretaries, and other Heads of Departments)

Project Supervisor (the Project Directors of the Works Services Group)

Project Manager

Quality Assurance Officer

Financial and Procurement Specialist

Project Team

Subcontractors and Suppliers

Government Regulatory Agencies

## **Communication Delivery Methods and Technologies**

The primary mediums used to communicate and disseminate information to the project stakeholders include: face-to-face meetings, emails, video conferencing (Skype, Zoom, and Google Meetings) and telephone conversations. The reporting will take the form of PowerPoint presentations, reports and oral presentations.

## Communications Matrix

Chart 21 Project Communication Matrix (Source: Compiled by the Author, 2021)

Communication	Deliverable	Delivery Method	Frequency	Goal	Owner	Audience
Project Sponsor Briefing	Sponsor Report	Face to Face and Video Conferencing	Quarterly	To brief the Project Sponsor on all the details of the project's executing activities, as well as the progress report from the Director's observations, and reports received from the Project Manager. Regulatory Issues	Project Director	Project Sponsor (Ministers, PS, HODS) Heads of Government Regulatory Bodies.
Project Status Updates	Project Updates	Emails, Telephone Calls, Video Conferencing and Face to Face Conversations	As the Need arises for other stakeholders, (Monthly for Project Sponsors & Weekly for Project Director)	A review of project updates and discussions on delays and potential issues. Change request and other project related issues.	Project Manager	Project Sponsor, Project Director, Project Team, Supplier and Subcontractors.
Team Briefing Meeting	'Kickoff' Meetings	Face to Face, Video Conferencing	Daily	A briefing on the previous week's work, the project work for the new week, and any potential project blockages. In addition to having staff recognition and rewards.	Project Manager	Project Director, Project Team, Suppliers and Subcontractors.
Project Review	Milestone Update	Emails, Video Conferencing and Face to Face Conversations	At Each Milestone	A presentation on the project deliverables achieved, hindrances and next steps for the achievement of unmet deliverables and milestones.	Project Manager	Project Director, Project Team, Suppliers and Subcontractors.
Quality Review	Quality Status	Emails, Presentations, Video Conferencing and Face to Face Conversations	Monthly	To brief the Project Team on the quality issues faced during the previous month, solutions implemented and the outstanding issues.	Project Manager and Quality Assurance Officer	Project Director, Project Team, Suppliers and Subcontractors.

Financial Management and Analysis Review	Financial Status	Emails, Presentations, Video Conferencing and Face to Face Conversations	Quarterly	A comprehensive review of the project's financial management, cost overruns, procurements issues and the variance analysis.	Project Manager and Financial and Procurement Specialist	Project Sponsor and Project Directors
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### **Communication Standards**

The Ministry of Public Works as part of its SOPs, mandates that all meetings and communications be documented for future reference, transparency and accountability.



#### **4.8. Project Risk Management**

The PMBOK Guide, with the previously developed subsidiary Project Management Plans were used as inputs, along with the Stakeholder Register and the Project Charter, which guided the risk management process. The tools used to complete this process included: expert opinions, meets and external research. This combined with the inputs identified earlier resulted in the creation of the project's Risk Management Plan, which is detailed below.

## **RISK MANAGEMENT PLAN**

### **CONSTRUCTION OF THE EAST BANK-EAST COAST (DIAMOND TO OGLE) HIGHWAY LINKAGE PROJECT**

**SINOHYDRO CORPORATION  
GEORGETOWN  
GUYANA**

October 2021

#### **Purpose and Objectives**

The Risk Management Plan involves the systematic process of identifying, analyzing, and responding to project risks. It includes analyzing the probability and consequences of positive events and minimizing the probability and consequences of adverse events to the project's overall objectives. The plan will also define how mitigation of identified risks can be done using different strategies.

## Roles and Responsibilities

**Chart 22 Risk Roles and Responsibilities (Source: Compiled by the Author, 2021)**

Project Manager	<ul style="list-style-type: none"> <li>● Maintaining this Risk Management Plan.</li> <li>● Maintaining the risk management data base and distributing updates.</li> <li>● Providing feedback to the team on the status of risks.</li> <li>● Tracking efforts in the reduction of moderate and high risk to acceptable levels.</li> <li>● Facilitating risk management training.</li> <li>● Providing risk assessments.</li> <li>● Creating risk briefings, reports, and documents required for project reviews.</li> </ul>
Project Team	<ul style="list-style-type: none"> <li>● Quarterly, or as directed, participate in the update to project risk assessments made during the previous review period.</li> <li>● Examine and suggest any changes to the risk assessments made and the risk mitigation plans proposed.</li> <li>● Report new risks to the Project Manager.</li> <li>● Ensure that risk is a topic discussed at each project meeting.</li> </ul>
Project Director	<ul style="list-style-type: none"> <li>● Examine and suggest to the Project Manager changes on the overall risk management approach.</li> <li>● Quarterly, or as directed, participate in the update to program risk assessments made during the previous quarter.</li> <li>● Examine and suggest any changes to the risk assessments made and the risk mitigation plans proposed.</li> </ul>

## The Risk Breakdown Structure

The Ministry of Public Works has established a Risk Breakdown Structure (RBS) that it uses for all public road construction projects. It is a hierarchical representation of potential sources of risk that may affect the project adversely. The table below depicts a representation of the RBS used in the construction of the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.

**Chart 23 Risk Breakdown Structure (Source: Adopted from the Ministry of Public Works, 2021)**

RBS Level 0	RBS Level 1	RBS Level 2
Sources of risk	Structures & Geotechnical	Structure Design Change– bridge superstructure, retaining walls
		Geotechnical Design Change– foundations, ground improvements, unsuitable materials
		Structural Design Criteria Change– seismic, hydraulic, geometric, building codes
		Geotechnical Design Criteria Change– soil stabilization, hydraulic, codes
	Management /Funding	Project Management Issues– change in managers / other key leadership
		Delay– indecision, submittal review
		Funding– availability, cash flow restrictions
		Lack of adequate storage facilities
	Contracting & Procurement	Contract Procurement Process Issues
		Market Conditions– non-competitive bidding environment, lack of qualified bidders, bids exceed upset price or budget.

		Contractor Performance Issues - productivity, quality
		Schedule Uncertainty - timing of award of contracts
	Construction	Construction Permitting– work restrictions
		Schedule Uncertainty(general)
		Constructability– site access, staging / material handling, differ
		Adjacent Projects– coordination among contractors, limited staging, sequencing
		Inadequate Quality of works
	Environmental/ Health and Safety	Construction Impacts– water quality for neighboring communities
		Lack of HSE Policy and Practices on work site
		Environmental Permits– delays, appeals, unanticipated conditions
		Global Health Crisis that affects the quality of employment force
	Technical risk	4.1 Technical specifications
		4.2 Technical process
		4.3 Design

## Definition of Probability and Impact

The definition of the probability and impacts is an important part of the risk management process. According to the Project Management Institute Inc., (2017) the probability and impact levels are specific to the project context and reflect the risk appetite and thresholds of the organization and key stakeholders. The threshold that was approved for this project by the Ministry of Public Works is defined below in the table. This will be used in conjunction with the probability and impact matrix defined further down in the Risk Management Plan to determine the probability of the risks that were identified.

**Chart 24 Definition of Probability and Impact (Source: Adopted from the Ministry of Public Works, 2021)**

Scale	Probability	+/- Impact on project objectives		
		Time	Cost	Quality
Very high	>70%	> 1 year	>\$5,500,000	Very significant in the project objective, (for instance a monetary change or lack of a procurement law can stop the project)
High	51-70%	>6 months	\$1,500,001- \$5,500,000	Significant impact in the quality
Medium	31-50%	3 to 6 months	\$500,001- \$1,500,000	Relative impact in the quality, can be resolved
Low	11-30%	1 to 2 months	\$200,001- \$500,000	Low impact on quality
Very Low	0-10%	< 1 month	< \$200,000	Minor impact in the quality
Null	< 1%	No change	No change	No change in the project



**Risk Register**

The Risk Register was created using the risks identified when the team examined all the subsidiary Project Management Plans. The register contains the person (s) responsible for addressing the risk, the causes and effects of the risk, the triggers, consequences, and the level of risks associated with each identified risk. The probability, impact and level of risk were calculated using the organization’s definition of risk and impact and its Probability and Impact Matrix. The level of risks will be captured using information that combines its probability of occurrence and impact, which are both aspects of Qualitative Risk Analysis. Once the level of risk was assessed, the team developed a risk response strategy for each identified risk.

**Chart 26 Risk Register (Source: Compiled by the Author, 2021)**

RISK & RBS CODE	OWNER OF THE RISK	CAUSE/ REASON	TRIGGER	CONSEQUENCE/ EFFECT	PROBABILITY	IMPACT	LEVEL OF RISK	RISK RESPONSE STRATEGY
2.3 Underestimating of Project/ materials Cost	Project Manager & Quantity Surveyor	The underestimation of project costs can cause the project to be incomplete or completed by cutting of corners to make the budget adequate	Lack of Industry and Market Knowledge	The budget may be overrun. If there are no available funds, the scope of the work may have to reduce, thus the overall quality may be lacking	High (0.75)	High (0.7)	High (0.525)	There should be an independent analysis of the Quantity Surveying Process to ensure that estimates are a true reflection of the prevailing costs on the market.

RISK & RBS CODE	OWNER OF THE RISK	CAUSE/ REASON	TRIGGER	CONSEQUENCE/ EFFECT	PROBABILITY	IMPACT	LEVEL OF RISK	RISK RESPONSE STRATEGY
3.2 Market Conditions– non-competitive bidding environment, lack of qualified bidders; bids exceed upset price or budget.	Project Manager	The rise in the cost of materials and other resources may pose a potential threat to the successful completion of the project, since there may be budget overruns.	Inflation & Economic Crisis	This may lead to budget overruns or having to settle for a cheaper inferior product.	Very High (0.95)	Very High (0.9)	Very High (0.855)	The Project Manager should implement the use of a Forward Contract Clause in all Agreements with suppliers. This guarantees that prices will remain the same in the future, regardless of market conditions.
2.5 Lack of Adequate Storage facilities	Project Manager & Materials Engineer	Improper storage of materials may lead to damages that may affect the project's financial standings.	Poor Planning and Foresight	This results in wastage that will drive the cost of the project up, leading to budget overruns	Medium (0.55)	High (0.7)	Medium (0.385)	The Project Manager, Quality Assurance Officer and Materials Engineer should ensure that storage facilities and warehouses can adequately store materials that can be damaged e.g. cement.
5.2 Lack of HSE Policy and Practices on work site	HSE Engineer	Worksite accidents due to poor or inadequate HSE practices, can affect the successful completion of the project.	Not adhere to safety standards to hasten project completion.	This can lead to worksite death and lawsuits for the company	Medium (0.55)	Very High (0.9)	Medium (0.495)	The Project Manager should ensure that its HSE Policy is updated and in keeping with the local laws and regulations. The HSE Engineer should ensure that



RISK & RBS CODE	OWNER OF THE RISK	CAUSE/ REASON	TRIGGER	CONSEQUENCE/ EFFECT	PROBABILITY	IMPACT	LEVEL OF RISK	RISK RESPONSE STRATEGY
								all employees adhere to the policy and are equipped with the necessary PPE before going on worksite.
5.4 Global Health Crisis that affects the quality of employment force	Project Manager	The Risk of workers contracting the Covid-19 virus could potentially render them hospitalized and cause a delay in the completion of the project.	A global outbreak in diseases and viruses	This can lead to death and a reduction in the quality of workers or their productivity.	Very High (0.95)	Very High (0.9)	Very High (0.855)	The Project Manager should ensure that there are adequate vitamins, masks, sanitizers and other items that can eliminate germs and protect its employees. They also need to ensure that all tools and workstations are properly cleaned and sanitized on a daily basis.
4.1 Construction Permitting– work restrictions	Project Director & Project Manager	Delays or non-approval of the necessary permits can delay the start and thus the completion of the project.	May be triggered by environmental issues.	They may cause a delay in the commencement or the cancellation of the project.	Low (0.15)	Very High (0.9)	Low (0.135)	The Project Director and Manager should ensure that all the necessary requirements are fulfilled so that permits can be approved.
4.2 Schedule Uncertainty(general)	Project Manager & Finance and	Inclement weather conditions may delay the execution	The unpredictable	This may cause a delay to the project	High (0.75)	Medium (0.50)	Medium (0.375)	The Project Manager should ensure that there

RISK & RBS CODE	OWNER OF THE RISK	CAUSE/ REASON	TRIGGER	CONSEQUENCE/ EFFECT	PROBABILITY	IMPACT	LEVEL OF RISK	RISK RESPONSE STRATEGY
	Procurement Specialist	of works, thus delaying the start or end date.	nature of the weather.	due to flooding and possible erosion				are pumps on standby to assist in case of a flood and have machines readily available to clear blocked drainage.
3.4 Schedule Uncertainty - timing of award of contracts, shipment delays	Project Manager & Finance and Procurement Specialist	Global shipping delays and local logistical issues may affect the project schedule.	The global pandemic has triggered a spike in shipping cost.	This will affect the project's completion date. The milestone would need to be adjusted because works cannot be executed	High (0.75)	Medium (0.50)	Medium (0.375)	The Project Manager should ensure that it sources the services of companies that produces the items locally.
3.1 Contract Procurement Process Issues	Project Manager & Finance and Procurement Specialist	Delays from subcontractors may also affect the project timeline	Failure to adhere to specific start dates, and penalties in contracts	The delay in the work of the subcontractor will affect the overall project schedule.	Low (0.15)	Medium (0.50)	Very Low (0.075)	The Project Manager should have the legal officer from the Ministry review all contracts to ensure that all requirements, clauses and penalties are in place to ensure that there is no misunderstanding
1.2 Geotechnical Issues– foundations, ground improvements, unsuitable soil types	Project Manager & Quality Assurance Officer	Soil Type on the selected route not suitable for road construction.	The soil type may differ in the various terrains; some areas may have clay soil type.	The soil type may result in the roads eroding and not being able to facilitate constant	Low (0.15)	Very High (0.9)	Low (0.135)	The Project Manager should request information on soil types from the Lands and Survey

RISK & RBS CODE	OWNER OF THE RISK	CAUSE/ REASON	TRIGGER	CONSEQUENCE/ EFFECT	PROBABILITY	IMPACT	LEVEL OF RISK	RISK RESPONSE STRATEGY
				traffic flows after completion.				Commission and conduct its soil analysis at different areas to ensure all soils types are planned for and factored into the construction process.
4.4 Inadequate Quality of works	Project Manager & Quality Assurance Officer	Materials used in the construction process are of inferior quality.	Lack of enforcement of quality standards.	This may result in injuries to the users of the road and even employees on the work site.	High (0.75)	High (0.7)	High (0.525)	The Project Manager and the Quality Assurance Officer should ensure that all quality check and audits are done in a comprehensive and thorough manner.

#### **4.9. Project Procurement Plan**

The Project Procurement Plan is an essential plan that will aid in the successful completion of the project. This plan has been developed with a focus on the first process known as the Plan Procurement Management. The inputs used in the process included: The Project Charter, Scope and Quality Management Plans, the WBS, Requirements documents, Risk Register and the formal procurement policies, procedures, and guidelines of the Ministry. The tools used to analyze the information were expert opinions. No make or buy analysis was conducted in depth but the decision to make items was determined based on the equipment owned by the company.

The output from this process resulted in the development of a Procurement Management Plan for the road construction project. The plan is detailed below and will provide all information related to acquisition of resources.

## **PROCUREMENT MANAGEMENT PLAN**

CONSTRUCTION OF THE EAST BANK-EAST COAST (DIAMOND TO OGLE)  
HIGHWAY LINKAGE PROJECT

SINOHYDRO CORPORATION

GEORGETOWN

GUYANA

October 2021

## **Introduction**

The purpose of the Procurement Management Plan is to define the procurement requirements for the construction of the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project. The plan also determines how the process will be managed, and the procurement documentation that will be used to request bids right through to the contract closure after products and services have been delivered. This plan identifies and defines the items to be procured by purchase or lease and what will be made on site, the types of contracts that will be utilized in the procurement process, the contract approval process and evaluation, and qualification decision criteria. The plan also includes the risk associated with the procurement process and suggests mitigation strategies. In addition to how costs will be determined, the standard procurement documentation will be used and procurement constraints associated with the project.

## **Procurement Management Approach**

The Project Manager is responsible for the management of the procurement process and all the activities related to it. The company's Finance and Procurement Specialist will lend support to the Project Manager to develop the list of items that will be procured to ensure the project achieves its deliverables. The specialist engineering along with the Project Manager and Procurement Specialist will discuss the procurement plans before the list is finalized. The Project Manager will then review the procurement list prior to purchasing which will be done by the Assistant Project Manager. The Project Manager, along with the Project Directors, will make a final review of the list to determine whether they will forge ahead with the procurement process, which involves tendering, vendor selection, purchasing and contracting.

## **Make, Buy or Rent Decision**

The Project Team had to make a decision on what items would be made and what items would be procured through purchase or rental agreements. The list below

displays the items that will be purchased. Most of the items that will be outsourced via a purchase agreement are those that cannot simply be manufactured by the company internally or that are raw materials to make a product the company can manufacture. The contractor has several large equipment that it owns like the concrete batching and precast plants, mixers and wood working tool. Hence, it would be easier to make products such a concrete, precast and blocks using the raw materials procured. The contractor also owns a large fleet of heavy duty machinery and equipment for road works, however, the company will be renting some additional items so that it has enough available to work simultaneously on different sections of the road.

**Chart 27 Make, Buy or Rent List (Source: Compiled by the Author, 2021)**

<b>Make</b>	<b>Buy</b>	<b>Rent</b>
Blocks	Sand	Excavators
Concrete	Stone	Rollers
Cement Mortar	Aggregate	Backhoes
Pre Cast Concrete Drain Structure	Bulk Cement	Cranes
Shoring	Wood	
	Reinforced steel rods and ties	
	Concrete Piles	
	Wood Piles	
	Steel Beams	
	Mini Elevator for Overhead Walkway	
	Metal and Aluminum Sheets	
	Asphalt	
	Bitumen	
	Tar	
	Concrete Light Poles	
	Lamps and Bulbs	
	Electrical Wires and Fittings	
	Directional Markings and Signboards	
	Traffic Signboards	
	Traffic Lights	
	Paint	
	Bolts and Nuts	

### Procurement Definition (Statement of Work)

The list of items detailed below has been determined by the Project Team to be essential for the successful execution of all project activities. The table specifies the items that should be procured externally, a description of its use, the specified quality standard and the timeline for the scheduled delivery to commence. This list is subject to be reviewed frequently by the Project Manager and the Project Director.

**Chart 28 Procurement Delivery Dates (Source: Compiled by the Author, 2021)**

Item/ Service	Description	Quality Standard	Delivery Start Date
Excavators	Items to be rented or leased for use in the project's excavation and construction activities.	Specified in the MPW Standards	Dec 01, 21
Rollers	Items to be rented or leased for use in the project's excavation and construction activities	Specified in the MPW Standards	Dec 01, 21
Backhoes	Items to be rented or leased for use in the project's excavation and construction activities	Specified in the MPW Standards	Dec 01, 21
Cranes	Items to be rented or leased for use in the project's excavation and construction activities	Specified in the MPW Standards	Dec 01, 21
Sand	Items are needed to create concrete and mortar mixtures	Specified in the MPW Standards in accordance with AASHTO & ASTM	Dec 01, 21
Stone	Items are needed to create concrete and mortar mixtures and to be used as a base when compacting	Specified in the MPW Standards in accordance with AASHTO & ASTM	Dec 01, 21
Aggregate	Items are needed to create concrete and mortar mixtures and to be used as a base when compacting	Specified in the MPW Standards in accordance with AASHTO & ASTM	Dec 01, 21
Bulk Cement	Items are needed to create concrete and mortar mixtures	Specified in the MPW Standards in accordance with AASHTO & ASTM	Dec 01, 21

Item/ Service	Description	Quality Standard	Delivery Start Date
Wood	Items to be used to make shorings and any other mechanisms needed on the work site.	Specified in the MPW Standards in accordance with AASHTO & ASTM	Oct 10, 21
Reinforced steel rods and ties	Items to reinforce all concrete wall, precast, steel bridges and walkways	Specified in the MPW Standards in accordance with AASHTO & ASTM	Dec 01, 21
Concrete Piles	Items used to support offshore structures such as bridges, culverts and overhead walk way	Specified in the MPW Standards in accordance with AASHTO & ASTM	Apr 01, 23
Wood Piles	Items used to support offshore structures such as bridges, culverts and overhead walk way	Specified in the MPW Standards in accordance with AASHTO & ASTM	Apr 01, 23
Steel Beams	To be used on bridges that use girders as the means of supporting its deck.	Specified in the MPW Standards in accordance with AASHTO & ASTM	Apr 01, 23
Mini Elevator for Overhead walkway	To be installed on the metal overhead walkway.	Specified in the MPW Standards in accordance with AASHTO & ASTM	Apr 01, 23
Metal Sheets	To be laid on bridges and walkway before concrete is poured	Specified in the MPW Standards in accordance with AASHTO & ASTM	Apr 01, 23
Asphalt	To be added to the mixture that is laid on road surface	Specified in the MPW Standards in accordance with AASHTO & ASTM	May 01, 23
Bitumen	To be added to the mixture that is laid on road surface	Specified in the MPW Standards in accordance with AASHTO & ASTM	May 01, 23
Tar	To be added to the mixture that is laid on road surface	Specified in the MPW Standards in accordance with AASHTO & ASTM	May 01, 23



Item/ Service	Description	Quality Standard	Delivery Start Date
Subcontractor	The services need to be procured to carry out the work of installing the street lights along the roadway.	Specified in the MPW Standards	Sep 01, 23
Concrete Light Poles	To be planted 30 ft. apart along the side and median of the road way	Specified in the MPW Standards	Sep 01, 23
Lamps and Bulbs	To be installed on concrete light poles	Specified in the MPW Standards	Oct 15, 23
Electrical Wires and Fittings	To be used to connect the street light to each other and to the national grid	Specified in the MPW Standards	Nov 01, 23
Directional Signboards	Marking To be planted around turns and intersections and road painted to improve visibility	Specified in the MPW Standards	Dec 01, 23
Traffic Signboards	To be installed at strategic points determined by the Guyana Police Force to inform commuters of road usage	Specified in the MPW Standards	Dec 15, 23
Traffic Lights	To be installed at all major intersections outside of the roundabout, to have better traffic management.	Specified in the MPW Standards	Dec 01, 23
Paint	To be used to make markings such as pedestrian crossings, and lines along the roadway.	Specified in the MPW Standards	Dec 01, 23
Bolts and Nuts	To be used as fasteners to keep metal works and wood in place.	Specified in the MPW Standards	Oct 10, 21

### **Type of Contract to be used**

The construction project will see the utilization of several types of contracts incorporated in its procurement process. The first and mainly utilized contract type is the Unit Price Contract. Under this type of contract, a supplier is paid for the actual quantity of each line item delivered to the worksite during construction. Each unit price includes all labor, materials, equipment, overheads, and profits attributable to

the making of the product that was delivered. This contract will be used to purchase all raw materials and other materials used in the construction process.

The second contract utilized in the project is the Time and Materials Contract. This type of contract is used to reimburse a subcontractor for the costs of the materials needed to complete a job, along with a predetermined hourly wage and other fees related to the service being provided. It will be utilized to hire the subcontractor who will execute all electrical works related to installation and operationalizing of street lights and traffic lights. The large materials used in this process would be purchased directly by the company using a unit price contract, however, the T&M contract will be used for the services of installing it and any other smaller materials that will be utilized in the process.

The final contract that will be used on this project is the Lease to Purchase Contract. In this contract, the equipment is leased for a specified number of hours with options to purchase at the end of the lease term. The contract will specify that the monies already paid in rental fees will be deducted from the cost price of the equipment should the company activate the purchase clause of the contract. This contract will be used to lease the heavy duty equipment needed to complement its current fleet of machinery and equipment.

### **Procurement Risks and Mitigation Strategies**

All project activities may be subject to some risk. While the overall project risks were identified in the Risks Register, this particular section deals with the risks specifically to procurement activities. These risks that the Project Team should be wary of in relation to its procurement process and how they can be mitigated includes the following:

**Inadequate needs analysis** – The determination of the budgets or materials needed for the successful completion of the project may be understated or overstated in the quantity surveying and materials determination process. To avoid this issue, the list should be reviewed in its entirety by the specialist engineers assigned to the project and also an external group of engineers that have industry experience.

**Poor supply chain management** – In this process the contractor fails to manage its supply chain effectively. From the inception, a poor vendor evaluation method is practiced. Owing to this, some vendors may not have the capacity to manufacture materials in the specified time or the contracts may be ambiguous, allowing the supplier to take advantage of loopholes. These issues can be avoided by having the supplier evaluation process as stringent and as transparent as possible, as well as having the legal officer of the Ministry of Public Works review all contracts before signing with the suppliers.

**Poor Quality of Items Procured** – In this process the items that were manufactured and delivered by the supplier are of a poor quality. This can have an adverse effect on the project's success and also exposes the users of the road to hazards. To avoid these issues the team must ensure that the suppliers manufacture products to the specified requirements by conducting its quality assurance process as frequently as possible. This will result in items that are not up to standard being rejected by the Project Manager.

### **Cost Determination**

In the Quantity Surveying Process, the cost of materials and services associated with the project activities is known as the Engineer's Estimate. The contractor will use a Request for Proposals; a document posted by an organization to attract bids from potential vendors for a product or service. These RFP will require suppliers to submit their costs to supply the specified products and services needed, the quality specifications, delivery dates and requirements, as well as their capacity requirements, which will be compared to a breakdown of the engineer's estimate. The selection process will require all submitted RFP to adhere to all requirements. Failure to supply all information will result in the proposal being disregarded.

## **Standardized Procurement Documentation**

The Ministry of Public Works has a standard template that it uses for its Request for Proposals. All projects that fall under its purview must utilize this document when subcontracting or procuring the services from outside parties.

The following standard documents will be used for project procurement activities:

- Request for Proposals (RFP)
- Instruction to Supplier
- Proposal Data Sheet (PDS)
- General Conditions of Contract (GCC)
- Special Conditions of Contract (SCC)
- Delivery Schedule
- Technical Specifications
- Suppliers Bid
- Price Schedule
- Contract
- Bid Securing Declaration
- Bid Security
- Performance Security
- Letter of Acceptance
- Authorization for Signing the Bid
- Evaluation and Qualification criteria
- Litigation Form

## **Procurement Constraints**

There are numerous constraints that should always be considered to aid in the project's Procurement Management Plan. These constraints may hinder the selection of certain vendors or the procurement of certain type of materials.

**Schedule** – The timeline for the project is rigid thus any delays in the procurement process will affect the project completion date. The procurement process must be aligned with the project schedule to aid the timely completion of the project.

**Cost** – The project has a predetermined budget and its reserves are limited to factors resulting from the change in the project's scope. Thus, the procurement process may have to utilize a lengthy time finding a supplier who adheres to its pre-approved budget allocation to avoid any shortage of materials or service provision.

**Quality** – The established quality specification for the materials used in the project may hinder the procurement process, the Project Team may have to search for suppliers that can adhere to its standard specifications.

### **Contract Approval Process**

Once the engineers estimate has been determined via the quantity surveying process, and the make or buy criteria is applied for the materials needed is conducted, the Finance and Procurement Specialist prepares the Request for Proposals for the various items needed externally. The RFP are reviewed by the Project Manager and the Project Director before it is advertised. Once the deadline for proposal closes, the Project Manager along with the Project Director review all submitted proposals and only those that have submitted all requested information will be considered.

The final proposals are selected for contract awards based on the established selection criteria. Proposals that are under 10,000 USD in total can be approved by the Project Director or the Assistant. If the contract sum is above the prescribed 10,000 USD, it will require the approval of the Project Sponsor.

## Evaluation and Qualification Criteria

The criteria for the selection and award of procurement contracts under this project will be based on the following evaluation and qualification criteria:

- Submission of a valid business registration or certificate of incorporation that is clearly legible. Incorporated companies must submit a list of directors.
- Submission of a valid NIS compliance certificate in the name of the business as per business registration. Document must be clearly legible.
- Submission of a valid GRA compliance certificate in the name of the business as per business registration. Document must be clearly legible.
- Completed and signed supplier's bid page.
- Completed and signed price schedule must be submitted.
- Completed and signed delivery schedule on page or statement of agreement to supply goods/services within the period specified in the delivery schedule.
- Provision of documentation detailing the technical specifications for the items listed in the Schedule of Requirements page or evidence to show that the goods comply with the Technical Specifications.
- Demonstrate experience and technical capacity by providing documentary evidence that shows the supply of goods/services similar to the items in the Requirements Schedule page. Bidders must provide copies of contracts with previous clients, or copies of valid invoices showing items supplied to clients.
- Evidence of financial capacity, in the name of the bidder, representing 30% of the bid price. Financial capacity must be evidenced in the form of a bank statement or line of credit from a bank or insurance company licensed by the Bank of Guyana. The line of credit must state a figure. The document must be dated within one month of the bid opening date and be clearly legible.

- Bidder must provide a Letter of Authorization for the procuring entity to seek reference from the bidder's bank relating to the financial capacity evidence supplied. The document must be dated within one month of the bid opening date and be clearly legible.
- Written confirmation of authorizing signatory must be provided. This must be in the form of an Affidavit of authorization and endorsed by a Commissioner of Oaths or Justice of Peace.

The contract will be awarded to the Bidder who is substantially responsive to the bid document and who has offered the lowest bid price.

### **Vendor Management**

The Project Manager with the assistance of the Project Director will be responsible for the vendor management process. Weekly meetings will be held with the various suppliers to discuss, plan delivery schedules, identify potential and current hindrances that may occur, and quality issues. This communication can be done in person and via video conferencing. It is expected that this weekly meeting will develop good working relations with the suppliers, and may reduce any potential disputes and misunderstanding with the parties involved.

### **Performance Metrics for Procurement Activities**

The following metrics are established for supplier and subcontractor performance for this project's procurement activities. Each metric is rated on a 1-3 scale (1 - Unsatisfactory, 2 – Acceptable, 3 – Exceptional) as indicated in the table below:

Vendor	Product Quality	On Time Delivery	Documentation Quality	Development Costs	Development Time	Cost per Unit	Transactional Efficiency
Vendor #1							
Vendor #2							

The Project Manager along with the Materials Engineer and Quality Assurance Officer has the responsibility to review all items that were procured by the company. Once the quality is acceptable, the PM signs the delivery note, otherwise the shipment of products may be rejected.

### **SPONSOR ACCEPTANCE**

Approved by:

\_\_\_\_\_ Date: \_\_\_\_\_

**Government of Guyana**



#### 4.10. Project Stakeholder Plan

The Stakeholder Management Plan involves the identification of all the stakeholders who are involved in the construction of the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project. This is the first process in the project Stakeholder Plan, which includes indicating the project stakeholders on a regular basis, and inspecting and documenting necessary information in terms of their interests, involvement, interdependencies, influence, and potential impact on project success. The Project Charter and the agreement with the subcontractors were used as inputs in the process. The tools and techniques used in the process included: meetings held with the Project Sponsor, Supervisors, and Project Manager, and the completion of the stakeholder's register template with the relevant information regarding roles, departments, interests, expectations, and influence levels.

#### Stakeholder Register

Chart 29 Stakeholder Register (Source: Compiled by the Author, 2021)

Name	Role	Stakeholder Types	Contact Information	Communication Type	Expectation	Interest	Influence	Classification
Mr. Juan Edghill	Project Sponsor	Internal (Owner)	<a href="mailto:minister@mpw.gov.gy">minister@mpw.gov.gy</a>	E-Mail, Telephone, Face to Face & Video Conferencing	Moderate Project Involvement	High	High	Important
Mr. Deodatt Sharma	Project Sponsor	Internal (Owner)	<a href="mailto:minister@mpw.gov.gy">minister@mpw.gov.gy</a>	E-Mail, Telephone, Face to Face & Video Conferencing	High Project Involvement	High	High	Important
Mr. Anthony Flett	Project Director	Internal (Supervisor)	<a href="mailto:pd.wsg@mpw.gov.gy">pd.wsg@mpw.gov.gy</a>	E-Mail, Telephone, Face to Face &	High Project Involvement	High	High	Important

Name	Role	Stakeholder Types	Contact Information	Communication Type	Expectation	Interest	Influence	Classification
				Video Conferencing				
Mr. Seon Brathwaite	Assistant Project Director	Internal (Supervisor)	<a href="mailto:apd.wsg@mpw.gov.gy">apd.wsg@mpw.gov.gy</a>	E-Mail, Telephone, Face to Face & Video Conferencing	High Project Involvement	High	High	Important
Mr. Geoffrey Vaughn	Project Manager	Internal	<a href="mailto:pm.wsg@Sinohydro.com">pm.wsg@Sinohydro.com</a>	E-Mail, Telephone, Face to Face & Video Conferencing	High Project Involvement	High	High	Important
Finance and Procurement Specialist	Project Team	Internal	<a href="mailto:fps.guy@Sinohydro.com">fps.guy@Sinohydro.com</a>	E-Mail, Telephone, Face to Face & Video Conferencing	High Project Involvement	Medium	Medium	Semi- Important
Land Surveyor	Project Team	Internal	<a href="mailto:ls.guy@Sinohydro.com">ls.guy@Sinohydro.com</a>	E-Mail, Telephone, Face to Face & Video Conferencing	High Project Involvement	Medium	Medium	Semi- Important
Quantity Surveyor	Project Team	Internal	<a href="mailto:qs.guy@Sinohydro.com">qs.guy@Sinohydro.com</a>	E-Mail, Telephone, Face to Face & Video Conferencing	High Project Involvement	Medium	Medium	Semi- Important
Quality Assurance Officer	Project Team	Internal	<a href="mailto:gao.guy@Sinohydro.com">gao.guy@Sinohydro.com</a>	E-Mail, Telephone, Face to Face & Video Conferencing	High Project Involvement	Medium	Medium	Semi- Important
Material Engineer	Project Team	Internal	<a href="mailto:me.guy@Sinohydro.com">me.guy@Sinohydro.com</a>	E-Mail, Telephone, Face to Face & Video Conferencing	High Project Involvement	Medium	Medium	Semi- Important

Name	Role	Stakeholder Types	Contact Information	Communication Type	Expectation	Interest	Influence	Classification
Pavement and Highway Engineer	Project Team	Internal	<a href="mailto:phe.guy@Sinohydro.com">phe.guy@Sinohydro.com</a>	E-Mail, Telephone, Face to Face & Video Conferencing	High Project Involvement	Medium	Medium	Semi- Important
Bridge and Culvert Engineer	Project Team	Internal	<a href="mailto:bce.guy@Sinohydro.com">bce.guy@Sinohydro.com</a>	E-Mail, Telephone, Face to Face & Video Conferencing	High Project Involvement	Medium	Medium	Semi- Important
HSE Engineer	Project Team	Internal	<a href="mailto:hese.guy@Sinohydro.com">hese.guy@Sinohydro.com</a>	E-Mail, Telephone, Face to Face & Video Conferencing	High Project Involvement	Medium	Medium	Semi- Important
Asphalt & Cement foreman	Project Team	Internal	<a href="mailto:ac.guy@Sinohydro.com">ac.guy@Sinohydro.com</a>	E-Mail, Telephone, Face to Face & Video Conferencing	High Project Involvement	Medium	Medium	Semi- Important
Operators	Project Team	Internal	<a href="mailto:opts.guy@Sinohydro.com">opts.guy@Sinohydro.com</a>	E-Mail, Telephone, Face to Face & Video Conferencing	High Project Involvement	Medium	Low	Semi- Important
Site Workers & Junior Workers	Project Team	Internal	<a href="mailto:team.guy@Sinohydro.com">team.guy@Sinohydro.com</a>	E-Mail, Telephone, Face to Face & Video Conferencing	High Project Involvement	Medium	Low	Semi- Important
Subcontractors	Works Subcontractors	External	<a href="#">To Be Determined</a>	E-Mail, Telephone, Face to Face	Moderate Project Involvement	Medium	Low	Semi- Important
Suppliers	Materials Supplier	External	To Be Determined	E-Mail, Telephone, Face to Face	Moderate Project Involvement	Low	Low	Not Important

Name	Role	Stakeholder Types	Contact Information	Communication Type	Expectation	Interest	Influence	Classification
Central Housing and Planning Authority.	Government Regulatory Body	External	<a href="mailto:info@chpa.gov.gy">info@chpa.gov.gy</a>	E-Mail, Telephone, Face to Face & Video Conferencing	Moderate Project Involvement	High	High	Semi- Important
Guyana Water Inc.	Government Regulatory Body	External	<a href="mailto:info@gwi.gov.gy">info@gwi.gov.gy</a>	E-Mail, Telephone, Face to Face & Video Conferencing	Moderate Project Involvement	High	High	Semi- Important
Guyana Power and Light Inc.	Government Regulatory Body	External	<a href="mailto:info@gpli.gov.gy">info@gpli.gov.gy</a>	E-Mail, Telephone, Face to Face & Video Conferencing	Moderate Project Involvement	High	High	Semi- Important
Guyana Lands and Survey Commission	Government Regulatory Body	External	<a href="mailto:info@glsc.gov.gy">info@glsc.gov.gy</a>	E-Mail, Telephone, Face to Face & Video Conferencing	Moderate Project Involvement	High	High	Semi- Important
Ministry of Local Government and Regional Development	Government Regulatory Body	External	<a href="mailto:info@mlgrd.gov.gy">info@mlgrd.gov.gy</a>	E-Mail, Telephone, Face to Face & Video Conferencing	Moderate Project Involvement	High	High	Semi- Important
Environmental Protection Agency	Government Regulatory Body	External	<a href="mailto:info@epa.gov.gy">info@epa.gov.gy</a>	E-Mail, Telephone, Face to Face & Video Conferencing	Moderate Project Involvement	High	High	Semi- Important
Local Communities	Citizens/ Potential Road Users	External	Local Media Houses	Public Hearings and Traditional News Outlets	Low Project Involvement	High	Medium	Important

## Plan Stakeholder Engagement

The second process directs developing the Stakeholder Management Plan which is governed by the stakeholder management knowledge area. In this process, the team developed various approaches to meet the needs, expectations, interests, and potential impact on the project for the project stakeholders. The inputs used included: The Stakeholder Register, the Communications Plan, the Risk Management Plan and the Project Charter. For the compilation of the Stakeholder Engagement Plan, meetings were held and research was done to create the Stakeholder Engagement Assessment Matrix seen in the figure below.

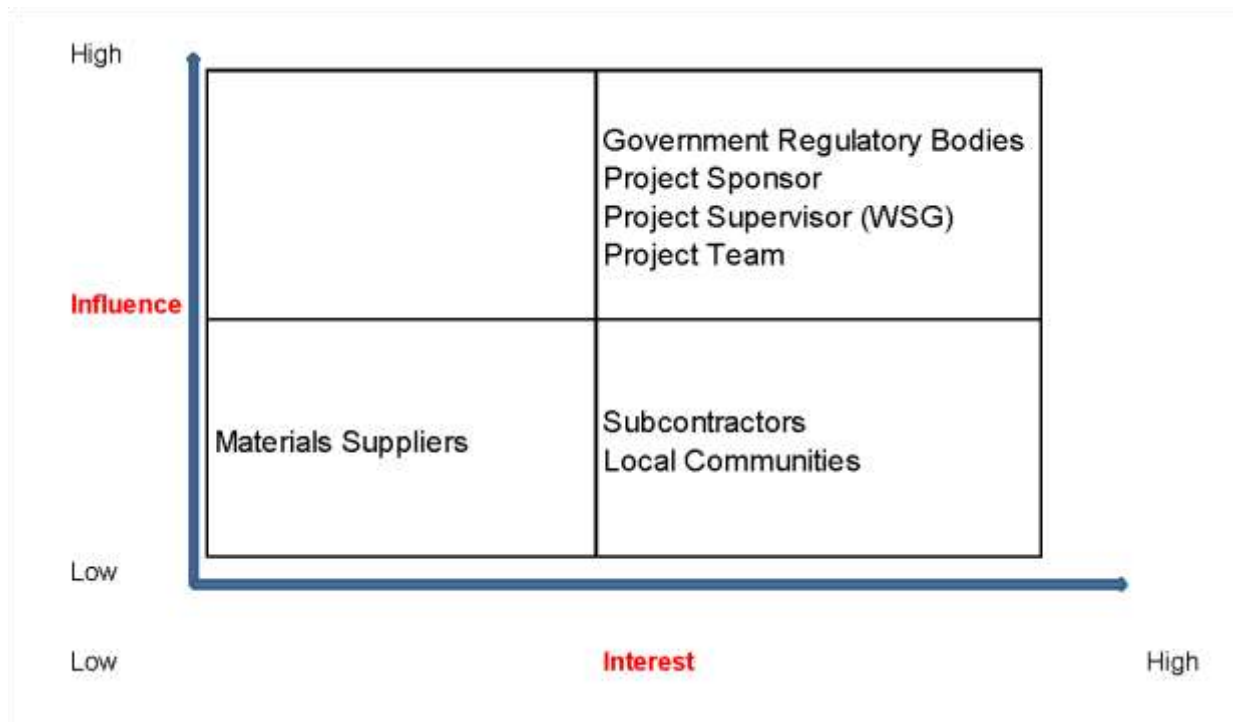
## Stakeholder Engagement Plan

The matrix helps to track the desired level of engagement that is needed from each stakeholder group for the specific project. This matrix will also be used during the execution of project activities. The project stakeholders were previously identified and detailed in the stakeholder register. These stakeholders were grouped into categories listed below indicating their roles in the project to make the process less cumbersome. The table below displays the desired status based on level of support for the project.

**Chart 30 Stakeholder Engagement Assessment Matrix (Source: Compiled by the Author, 2021)**

Stakeholders	Unaware	Resistant	Neutral	Supportive	Leading
Project Sponsor					D
Project Director					D
Project Manager					D
Project Team				D	
Works Subcontractors				D	
Materials Supplier			D		
Government Regulatory Body				D	
Local Communities				D	

The Interest Influence Matrix has been created to determine the strategies that will be used for engaging the stakeholders of the project. The Matrix depicts the Stakeholder Engagement Plan that the project will utilize to ensure its success. While some stakeholders identified in the Stakeholder's Register had their influence and interest rated at medium, for the purpose of the Influence Interest Matrix, those medium ratings would be classified as high for internal stakeholders and low for external stakeholders



*Figure 10 Influence Interest Matrix (Source: Compiled by the Author, 2021)*

### **Stakeholder Engagement Strategies:**

The stakeholder groups that fall into the High- Influence, High Interest groups, are the most important stakeholders to the project and they should be monitored closely to ensure all their requirements are being met and that they are consulted before any decisions are made.

The group of stakeholders that were placed into the Low-Influence, High Interest quadrant, are those stakeholder groups that should be kept informed on how the

project activities and deliverables are progressing. Since they have a high interest in the successful completion of the project, keeping them informed helps to remove any doubts they may have about the success of the project or any potential roadblocks that may arise.

The stakeholder groups placed into the Low-Influence, Low Interest quadrants need to be monitored because these groups can become dominant and subsequently affect the project activities. In the case of the road construction project, the material suppliers can decide they want more profit and increase the cost of the items, thus adversely affecting the success rate of the project.

### **Manage Stakeholder Engagement**

This process of managing the Stakeholder Engagement Process involves communicating and working to ensure that stakeholder's requirements, and expectations, address issues, and foster appropriate stakeholder involvement. The process allows the Project Manager to mitigate any issues that may arise with the stakeholder and to increase support to them.

The effective management of the Stakeholder Engagement Process requires the Project Managers to utilize the project's Communications Plan that was created and the strategies identified above to ensure that stakeholders are engaged in a prudent and effective manner.

The Project Manager must possess certain qualities to be an effective communicator; he must be culturally aware, and possess great negotiation and conflict management skills and other soft skills. These will be applied during meetings with the stakeholders and may result in changes to the project management plans and project documents.

## **Monitor Stakeholder Engagement**

This is the process where the stakeholder engagement strategies are closely observed and evaluated by the Project Manager. This process may be monitored using the Stakeholder Engagement Assessment Matrix that was created; this allows the Project Manager to classify each stakeholder into their current status as against their desired status.

The results from the updated Stakeholder Engagement Assessment Matrix may result in the Project Manager initiating a change request, and may include corrective and preventive actions to improve the current level of stakeholder engagement. These changes may be applied to the project management plans such as the Communication Plan and Stakeholder's Engagement Plans, in addition to project documents like the Stakeholder Register.



## 5 CONCLUSIONS

The preparation of the Project Management Plan followed the guidance of the sixth edition of the PMBOK Guide, supported by analytical and exploratory research. The Project Management Plan surrounded the construction of the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.

1. The first plan focused on the authorization of the project while the other plans will be integrated under one umbrella. The research concluded with the creation of the Project Charter; which is a high-level document that provides the Project Manager with the authority to execute the project. The Charter also specifies the initial roles, members of the Project Team, and the established goals and project deliverables.
2. The second subsidiary plan focused on the development of the Scope of the project. This object resulted in the creation of the Scope Management Plan for the project. Additionally, the WBS, WBS Dictionary, Requirements Management Plan and Requirements Traceability Matrix were created for the project. These were created on templates discovered during the research process and with the Guidance of the PMBOK Guide.
3. The third subsidiary plan focused on the scheduling of the project activities. The Schedule Management Plan was created because of this objective along with the Resource Assignment, and Activity Duration Schedule, the Network Diagram (Activity Sequencing), the Activity Duration and Project Schedule, and Gantt Charts. The designed plan and schedules helped in the creation of an estimate for each activity that fits into the project constraint known as time.
4. The fourth subsidiary plan focused on the cost associated with the project. This objective led to the creation of a Cost Management Plan for the project. Additionally, the project cost for the work packages were determined, which was kept within the established overall budget, and a disbursement schedule

was created to ensure that the project finances are well managed and disbursed according to its requirements.

5. The fifth subsidiary plan focused on the area of quality. The Quality Management Plan was created as a result of this objective. The plan included the roles and responsibilities of persons as it relates to quality management, the quality management approach, quality requirements/standards, quality assurance, quality control, and the quality control measures that will govern the activities of the project.
6. The sixth subsidiary plan focused on the human resources needed to successfully complete the project. The objective resulted in the creation of the Human Resources Management Plan. It included a comprehensive list of persons who will be assigned to the project, their roles and responsibilities, a RACI chart, the resources calendar and the Staff Management Plan. This combination allowed for a better understanding of the human resources needs that will contribute to the success of the project.
7. The seventh subsidiary plan dealt with the communications aspect of the project. This objective resulted in the Communications Plan that the Project Manager will use to ensure that all stakeholders are well managed and informed. The plan includes what is known as the Communication Matrix; it specifies what should be created, who should handle the communication, the frequency, the intended audience, and the mode of communication. Without a proper Communication Plan, the Project Manager might fail to meet the requirements of all stakeholders of the project.
8. The eight subsidiary plans cover the risk management component of the project. The objectives lead to the creation of the Risk Management Plan. The plan included the identification of the roles and responsibilities associated with the Project Team, a risk breakdown structure, definition of probability and

impact, Probability and Impact Matrix and the Risk Register. The register identified all risks that may affect the completion of the project and the proposed strategy for its mitigation. This component was critical since it places the Project Team in a state of preparedness for any hindrances that may occur. No quantitative analysis was done, since the tools were not readily available to conduct these.

9. The ninth subsidiary plan dealt with the procurement activities of the project, the objective resulted in the creation of the Procurement Management Plan. The plan was comprehensive in nature. It contained the procurement management approach, the make, buy or rent decision, the procurement schedule, contract types, procurement constraints, evaluation criteria etc. This plan will ensure the correct materials are made, bought or rented while expectations and requirements are realistic and can be completed in the proposed project schedule.
10. The final subsidiary plan involved the management of the project's stakeholders. The objective resulted in the creation of a Stakeholder Management Plan. The plan includes the stakeholder register, where contact information, level of interest and influence was established. It also included an Engagement Plan and an Interest-Influence Matrix to categorize stakeholder groups and to determine appropriate engagement strategies. This plan is critical for the project's success since the stakeholder can make or break a project if they are not managed correctly.

The holistic Project Management Plan seeks to bring a cohesive and coherent way to manage the successful completion of the construction of the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project. The PMBOK Guide provided valuable information that has proven to be useful in the successful management of the proposed project and any other project that may be on the horizon.

## 6 RECOMMENDATIONS

The Project Management Plan that was created has a history of bringing success to the management of any type of project. The Ministry of Public Works through its Work Services Group has the mandate for the majority of major infrastructural development projects planned for Guyana. It is recommended that the following are implemented with immediate effect:

- The Ministry adopts the use of a Project Management Plan for all of its future projects, which can be tailored to suit the individual needs of the project.
- The Ministry should encourage all of its engineers and technical staff to pursue studies in the field of project management to widen the repository within the agency.
- The Ministry should ensure that it purchases all the necessary tools such as Microsoft Projects and Project Software to assist its engineers with the planning and management of all projects.
- The Ministry, through its Work Services Group, should ensure that all of its subcontractors utilize the Project Management Plans when executing project works for the Ministry whether large or small.

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## 8 APPENDICES

### 8.1 Appendix 1: FGP Charter

<b>PROJECT CHARTER</b>	
(Formalizes the project start and confers the Project Manager with the authority to assign company resources to the project activities. Benefits: it provides a clear start and well defined project boundaries)	
<b>Date:</b>	<b>Project Name:</b>
10 May 2021	Project Management Plan for the Construction of the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.
<b>Knowledge Areas / PM Processes:</b>	<b>Application Area (Sector / Activity):</b>
<b>Knowledge Areas:</b> Integration, Scope, Schedule, Cost, Quality, Human Resources, Communication, Risk, Procurement and Stakeholders <b>PM Processes:</b> Initiation, Planning, Executing, Monitoring and Controlling, Closing	Construction or Public Infrastructure Sector
<b>Project Start Date:</b>	<b>Project Finish date:</b>
10 May 2021	26 November 2021
<b>Project Objectives (General and Specific):</b>	
<b>General Objective:</b> To create a Project Management Plan for the construction of the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.	
<b>Specific Objectives:</b> <ol style="list-style-type: none"> <li>1. To create an appropriate Scope Management Plan, that defines the goals and the work breakdown structure of the project.</li> <li>2. To create a realistic Schedule Management Plan for assigning duration to work packages that can be tracked.</li> <li>3. To create a realistic Cost Management Plan for assigning cost to work packages.</li> <li>4. To develop a Quality Management Plan that captures the minimum acceptance criterion as specified by the stakeholder.</li> <li>5. To create a comprehensive Human Resource Management Plan that manages and assigned the appropriate resources to work packages in a manner that complies with the local labor Requirements.</li> <li>6. To build an effectively developed Communication Management Plan that clearly outlines the project communication goals and strategies.</li> <li>7. To create a robust Risk Management Plan that identifies all associated risks and their mitigation strategies.</li> <li>8. To develop an ethical Procurement Management Plan that outlines the process of identifying and assigning contracts to suppliers who adhere to green business strategies.</li> </ol>	

9. To develop a comprehensive Stakeholders Management Plan that identifies key stakeholders, their levels of interests, and analyses how their influence might impact the project.

10. To develop management practices that seek to integrate or fuse all knowledge areas of Project Management to deliver a successful project.

#### **Project purpose or justification (merit and expected results):**

The long-term objective of this project is to improve traffic flows, reduce delays as a result of a distressed roadway and defective traffic signals, reduce accidents and fatalities along this busy roadway corridor. Traffic demand for this roadway is only expected to increase for access to both the East Coast of Demerara and East Bank of Demerara, using this main interconnection road link. The construction should involve the following:

1. Rehabilitation of roadway on Sheriff Street and on Mandela Avenue (expanded to 4 lanes). The creation of 13km of new road (4 lanes) where the GuySuCo Punt Dam once ran from Diamond to Ogle.
2. Construction of a Roundabout at the junction of Sheriff Street and David Street / Railway Embankment Road.
3. Construction of sidewalks, cycle lanes and bus laybys.
4. Construction of thirteen (13) concrete bridges, thirty (30) concrete culverts and a steel overhead walkway that connect the eastern and western road sides along the busy EBDPR.
5. Installation of traffic signals and roadway lighting, traffic signs and roadway markings.
6. Construction of a combination of concrete roadside drains and buried HDPE pipes to develop and improved the conveyance of rainfall runoff and effluent from properties/businesses along the roadway

#### **Description of Product or Service to be generated by the Project – Project final deliverables:**

To create a comprehensive Project Management Plan; inclusive of all subsidiary plans for the construction of the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project.

#### **Assumptions:**

- The Project can be completed in the allotted timeline granted by the university.
- The assigned single project staff can get the work done.
- The knowledge gained in the MPM program is sufficient to complete the project deliverables.

#### **Constraints:**

- The availability of data and information due to some government office closures, may delay the completion of the project within the timeline stipulated by UCI.
- Work life balance and poor planning may affect the sole project member in completing task in a timely manner.

#### **Preliminary Risks:**

- The risk of not having access to information from the Ministry of Public Works, will cause significant delay or cancellation of the project. This will result in time loss due to having to find another project.
- The Risk of contracting the Covid-19 virus, this could potentially render me hospitalized and cause a delay in the completion of the project.

#### **Budget:**



The cost of this project has not yet been ascertained. The likely cost would include the administrative cost of printing project documents and traveling to Government Agencies for the initial information if not available in soft copies.

#### **Milestones and dates:**

<b>Milestone</b>	<b>Start date</b>	<b>End date</b>
Submission of Project Charter	10 May 2021	16 May 2021
Submission of WBS	10 May 2021	16 May 2021
Submission of Introduction Chapter	17 May 2021	23 May 2021
Submission of FGP Schedule	17 May 2021	23 May 2021
Submission of Theoretical Framework	24 May 2021	30 May 2021
Submission of Methodological Framework	31 May 2021	6 June 2021
Submission of Executive Summary	7 June 2021	13 June 2021
Submission of Bibliography, Indexes	7 June 2021	13 June 2021
Signing of Project Charter	7 June 2021	13 June 2021
Tutor Process	26 July 2021	15 October 2021
Reading by Reviewers	16 October 2021	25 October 2021
Adjustments	26 October 2021	4 November 2021
Presentation to Board of Examiners	5 November 2021	10 November 2021

#### **Relevant historical information:**

On December 11, 2020, a contract was signed between the Ministry of Public Works and Sinohydro Corporation Ltd for the Construction of the East Bank-East Coast (Diamond to Ogle) Highway Linkage Project at a cost of USD50,000,000. With funding, construction works are expected to commence in March, 2021. The funding is provided through the loan LO 2741/BL-GY: Road Network Upgrade & Expansion Program and forms Component 2 (C2) of the reformulated loan programme between the Cooperative Republic of Guyana and the Inter-American Bank (IDB). Component 1 is a housing sector development project to be undertaken by the Ministry of Communities. The contract of the construction works is a measured works contract where the stakeholders, Ministry of Public Works and the Contractor will collaborate to reduce and achieve a cost effective and complete project.

#### **Stakeholders:**

##### **Direct stakeholders:**

The University of International Cooperation  
 Course Lecturers and Tutors  
 Reviewers  
 Board of Examiners  
 Seon Brathwaite (Project Manager)

##### **Indirect stakeholders:**

The Ministry of Public Works  
 The Government of Guyana

The Citizens of Guyana

**Approval:**

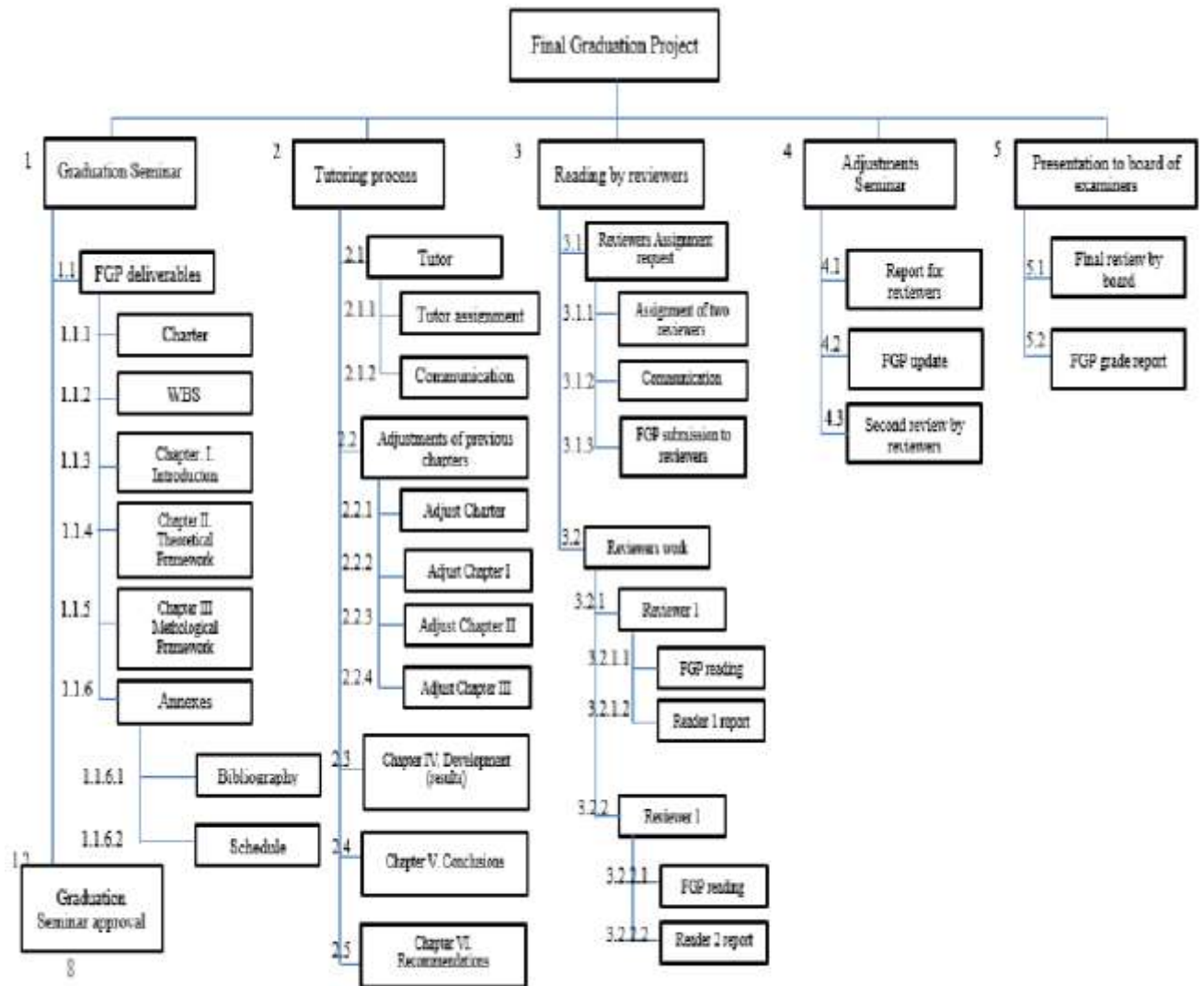
Project Manager: Seon Brathwaite

Signature:

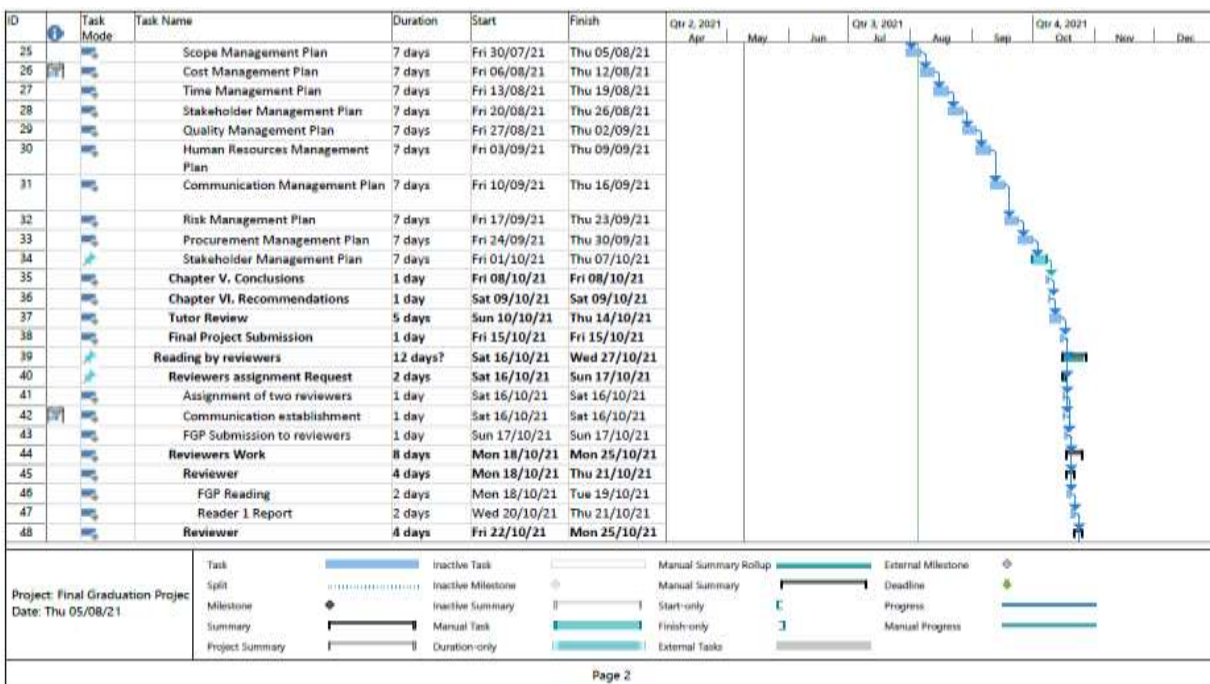
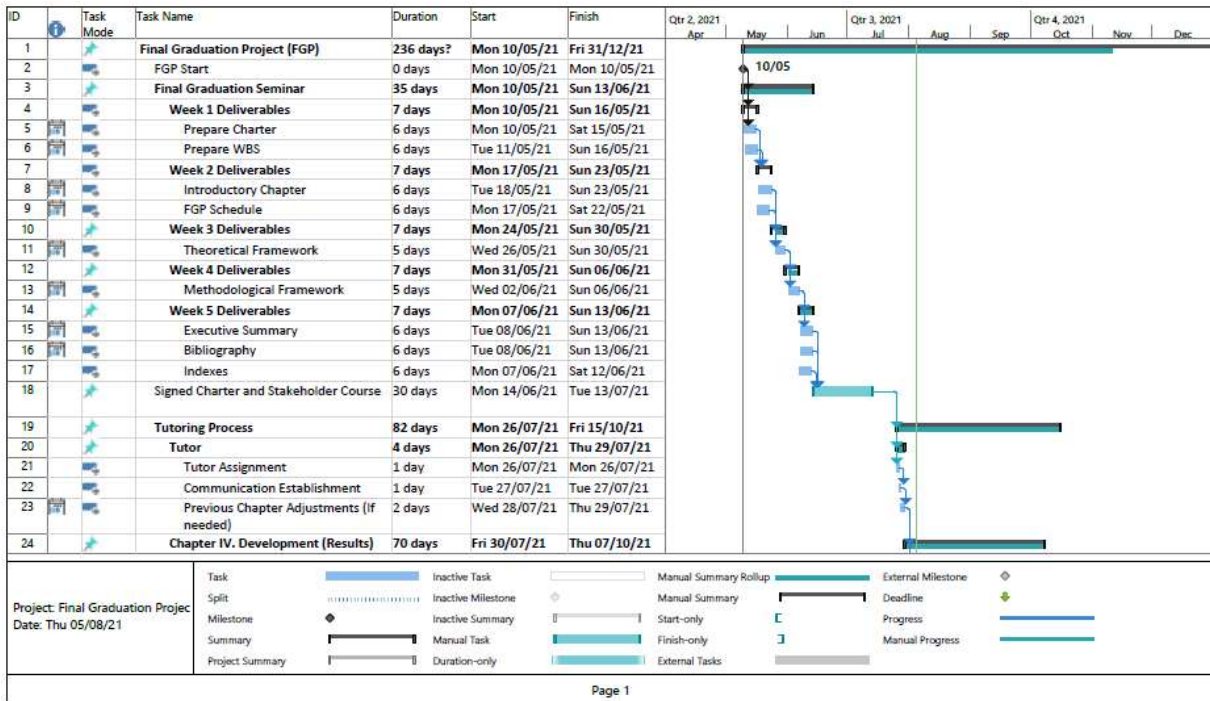
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### 8.2 Appendix 2: FGP WBS



### 8.3 Appendix 3: FGP Schedule



ID	Task Mode	Task Name	Duration	Start	Finish	Qtr 2, 2021			Qtr 3, 2021			Qtr 4, 2021		
						Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
49		FGP Reading	2 days	Fri 22/10/21	Sat 23/10/21									
50		Reader 2 Report	2 days	Sun 24/10/21	Mon 25/10/21									
51		Adjustments	10 days	Tue 26/10/21	Thu 04/11/21									
52		Report for reviewers	4 days	Tue 26/10/21	Fri 29/10/21									
53		FGP Update	3 days	Sat 30/10/21	Mon 01/11/21									
54		Second Review by Reviewers	3 days	Tue 02/11/21	Thu 04/11/21									
55		Presentation to Board of Examiners	5 days	Sat 06/11/21	Wed 10/11/21									
56		Final Review Board Meetin	3 days	Sat 06/11/21	Mon 08/11/21									
57		Loading of FGP Grade Report	2 days	Tue 09/11/21	Wed 10/11/21									
58		FGP End	0 days	Wed 10/11/21	Wed 10/11/21									◆ 10/11

Project: Final Graduation Project Date: Thu 05/08/21	Task	Inactive Task	Manual Summary Rollup	External Milestone	◆
	Split	Inactive Milestone	Manual Summary	Deadline	↓
	Milestone	Inactive Summary	Start-only	Progress	Manual Progress
	Summary	Manual Task	Finish-only	Manual Progress	Manual Progress
	Project Summary	Duration-only	External Tasks	Manual Progress	Manual Progress

## 8.4 Appendix 4: Other relevant information

## Composition of Base and Binder Course mixes

Clause	903	906	930	932	933	934
Description	Dense Macadam Base	Dense Macadam Binder Course	Heavy Duty Macadam Base with grade-40/60 Pen Binder (HDM50)	Dense Macadam Base with grade 40/60 Pen Binder (DBM50)	Heavy Duty Macadam Binder Course with grade-40/60 Pen Binder (HDM50)	Dense Macadam Binder Course with grade-40/60 Pen Binder (DBM50)
Nominal Size	0/32 mm	0/20 mm	0/32 mm	0/32 mm	0/20 mm	0/20 mm
Nominal Layer Thickness (mm)	70 – 150	50 – 100	70 – 150	70 – 150	50 – 100	50 – 100
Min. Thickness at any one point (mm)	55	40	55	55	40	40
Aggregate Grading (% by mass passing)						
40 mm	100		100	100		
31.5 mm	90 – 100	100	90 – 100	90 – 100	100	100
20 mm	71 – 95	95 – 100	71 – 95	71 – 95	95 – 100	95 – 100
14 mm	58 – 82	65 – 85	58 – 82	58 – 82	65 – 85	65 – 85
10 mm	-----	52 – 72	-----	-----	52 – 72	52 – 72
6.3 mm	44 – 60	39 – 55	44 – 60	44 – 60	39 – 55	39 – 55
2 mm	24 – 36	24 – 36	24 – 36	24 – 36	24 – 36	24 – 36
250 µm	6 – 20	7 – 21	6 – 20	6 – 20	7 – 21	7 – 21
63 µm	2 – 9*	2 – 9*	7 – 11*	2 – 9*	7 – 11*	2 – 9*
Binder Content (% by mass of total mixture)						
Crushed Rock Aggregate	4.0 % ± 0.6	4.7 % ± 0.6	4.0 % ± 0.6	4.0 % ± 0.6	4.7 % ± 0.6	4.7 % ± 0.6
Crushed Gravel Aggregate	4.5 % ± 0.6	5.0 % ± 0.6	4.5 % ± 0.6	4.5 % ± 0.6	5.0 % ± 0.6	5.0 % ± 0.6
Binder Grade	70/100 Pen	40/60 Pen				
Range of Temperatures						
Max. Mixing Temperature (°C)	180	185				
Min. Rolling Temperature (°C)	85	105				
* When gravel other than limestone gravel is the aggregate, the material passing the 63 µm test sieve shall include Portland cement or hydrated lime to the amount of 2 per cent by mass of the total aggregate.						

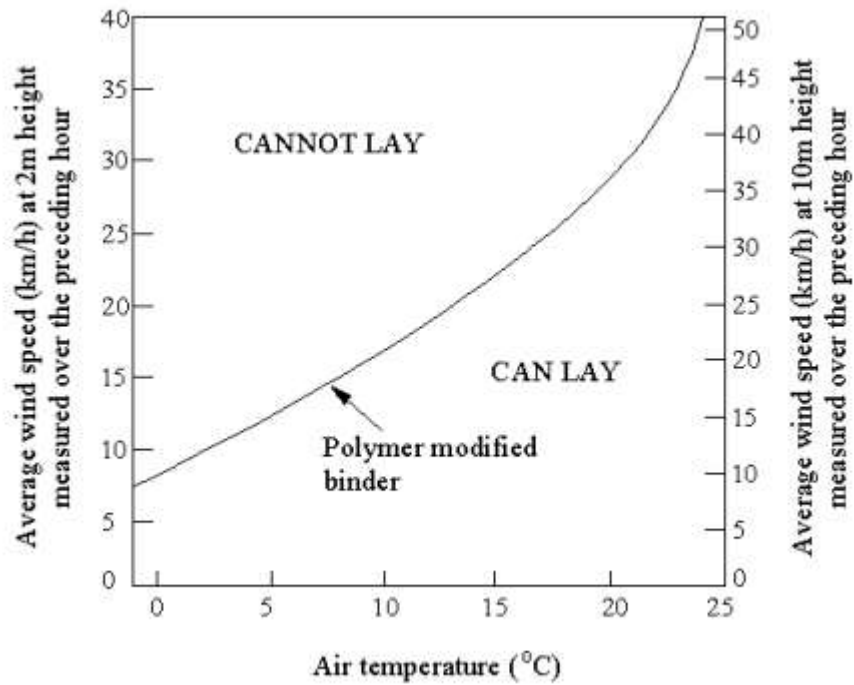
### Composition of Surface Course Mixes

Clause	910	911	915	912	909	916
Description	Rolled Asphalt Surface Course (Recipe Mix)	Rolled Asphalt Surface Course (Design Mix)	Coated Chippings For Rolled Asphalt Surface Course	Close Graded Macadam Surface Course	Dense Macadam Surface Course	Open Graded Macadam Surface Course
Designation <sup>1</sup>	30% 0/14 3.5% 0/14	30% 0/14 3.5% 0/14	14/20 G, 85/20	0/14 mm	0/6 mm	0/10 mm
Nominal Layer Thickness (mm)	40	40	N/A	40-55	20-30	30-35
Min. Thickness at any one point (mm)	-----	-----	N/A	35	15	25
Aggregate Grading (% by mass passing)						
40 mm	-----	-----	100	-----	-----	-----
31.5 mm	100	100	98-100	-----	-----	-----
20 mm	100	100	85-99	100	-----	100
14 mm	85-100	85-100	0-20	95-100	100	85-100
10 mm	60-90	60-90	0-5	70-90	90-100	30-60
6.3 mm	-----	-----	-----	45-65	36-52 <sup>b</sup>	10-18
2 mm	59-71	59-71	-----	19-33 <sup>b</sup>	20-50	-----
1 mm	-----	-----	-----	15-30	-----	-----
500 µm	44-71	44-71	-----	-----	-----	-----
250 µm	18-62	18-62	-----	-----	7-23	-----
63 µm	7-11	7-11	0-2	3-8	2-10	2-7
Max. % Aggregate passing 2 mm and Retained on the 500 µm test sieves	15	15	-----	-----	-----	-----
Binder Content (% by mass of total mixture)						
Crushed Rock Aggregate	7.8% ± 0.6	6.5% Min, 6.4% Min.	1.5% ± 0.3	-----	-----	-----
Crushed Gravel Aggregate	7.5% ± 0.6	6.5% Min, 6.4% Min.	-----	-----	-----	-----
Crushed Rock Aggregate (excluding limestone)	-----	-----	-----	5.1% ± 0.5	6.3% ± 0.5	5.3% ± 0.5
Crushed Rock Aggregate (limestone)	-----	-----	-----	4.9% ± 0.5	6.0% ± 0.5	5.1% ± 0.5
Binder Grade	40/60 Pen	40/60 Pen	40/60 Pen	70/100 Pen or 160/220 Pen	160/220 Pen	160/220 Pen
Range of Temperatures						
Max. Mixing Temperature (°C)	190	190	170	180	155	145
Min. Rolling Temperature (°C)	105	105	-----	85	60	80

<sup>1</sup> The mixture designation numbers (e.g. 30% 0/14) refer to the nominal coarse aggregate content of the mixture and nominal size of the coarse aggregate in the mixture respectively.

<sup>2</sup> May be increased to 38 in Clause 912 mixes and 60 in Clause 909 mix when sand fine aggregate is used.

### Limiting weather conditions for laying porous asphalt



### Mixing and Handling Temperatures

Binder Type	Mixing Temperature Range (°C)	Delivery Temperature Range (°C)	Minimum Compacting Temperature (°C)	
			Start	Finish
Polymer modified	In accordance with manufacturers requirements	145 - 170	140	115



## 8.5 Appendix 5: Dictum and Proof of Philological Corrections

26 Middle Street

Buxton

East Coast Demerara

Guyana

October 18, 2021

### TO WHOM IT MAY CONCERN

I am a trained English Language teacher employed with the Government of Guyana since 2012. I have a Bachelor's Degree in Education (English) from the University of Guyana, and currently serve as the English Head of Department at a local secondary school.

This document verifies that I have vetted Mr. Seon Brathwaite's Final Graduation Project. Some corrections made included: changes to sentence structure to create a more natural flow, editing of minor grammatical and typographical errors, and selection of more appropriate diction for increased readability. With these necessary changes, I have no qualms that the quality content of Mr. Brathwaite's Final Graduation Project is worthy of consideration and approval.

Please find attached copies of the necessary certificates for your perusal.

Sincerely,



Jessica Goodchild (jezz22gchild@gmail.com)

## University Degree Certificate

2016 1014963

UNIVERSITY OF GUYANA



**Jessica Andrea Goodchild**


having completed the course of study approved by  
the University and passed the prescribed examinations  
has this day been admitted by the Academic Board  
to the General Degree of  
**Bachelor of Education  
(ENGLISH)  
PASS WITH CREDIT**

dated this Third day of October 2016

[Signature]  
Chancellor

[Signature]  
Vice-Chancellor and Principal

[Signature]  
Registrar



### Teaching College Certificate



# GUYANA MINISTRY OF EDUCATION

## TRAINED TEACHER CERTIFICATE

This is to certify that **Jessica Goodchild** has satisfactorily completed a programme in  
**(Secondary Academic) Education from 2009 to 2012** and is hereby awarded this **Grade 1**  
**Class 1 Trained Teacher's Certificate** in accordance with the provision of the Education Act.

*M.R. Jackson*  
.....  
Chief Education Officer

*[Signature]*  
.....  
Principal  
Cyril Potter College of Education

1<sup>st</sup> August, 2012