UNIVERSIDAD PARA LA COOPERACION INTERNACIONAL
(UCI)

THE CREATION OF A PROJECT MANAGEMENT PLAN FOR THE EXECUTION OF
ROAD ASSET MANAGEMENT SYSTEMS FOR THE COMMONWEALTH OF
DOMINICA

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FINAL GRADUATION PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE
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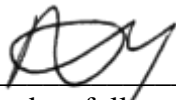Roseau, Commonwealth of Dominica

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This Final Graduation Project was approved by the University as
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DEDICATION

This research paper is sincerely dedicated to my supportive parents Maximilia and Denys both of whom encouraged and inspired me in conducting this study. They have never left my side throughout the process and gave me strength and hope when I thought of giving up.

My sister Esther has provided me with a great sense of enthusiasm and perseverance in my scholastic journey. Without her love and assistance, this research would not have been made possible. Moreover, I dedicate this research paper to my love, Alvin, for cheering me to the finish line. I really did appreciate his words of advice and for continuously giving me moral, emotional, and financial support.

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ABSTRACT

The objective of this research is to develop a Project Management Plan for the Road Asset Management Systems (RAMS) in the Commonwealth of Dominica to successfully manage the execution of the project. There is a need to identify vulnerable road infrastructure assets and prioritize the maintenance needs based on financial constraints of small island developing states. CREAD, (2021) has indicated that there are financing gaps to achieve climate resilience in the Commonwealth of Dominica.

For this project an analysis of the knowledge in project management is carried out within the organization in order to create a guide that helps to standardize, direct and supervise the development of the processes needed for project execution. The research methodologies used are: the analytical, qualitative and quantitative methods, which are guided by the Project Management Institute. The final deliverables of the project correspond to a project management plan which details processes for: project scope, schedule, costs, quality, resources, communications, risks, procurement, stakeholders and regenerative development.

All road assets are geo-reference into a program developed for the island. For the development of the program/software data is collected of all assets, via combination of site surveys as well as video footage from windshield surveys. The collections of pneumatic traffic counts are stored into a program. The program is used by the Ministry's engineers and technicians whom are responsible to populate and retrieve condition reports on road infrastructure bi-annually.

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ABBREVIATIONS AND ACRONYMS

CDB   Caribbean Development Bank

CCRP   Climate Resilience and Recovery Plan

DOT   Department of Transport

FHWA   Federal Highway Administration

GoCD   Government of the Commonwealth of Dominica

ICT   Information and Communication Technology Division

IPC   Interim Payment Certificate

ISO   International Organization of Standards

MoPWPUDE   Ministry of Public Works, Public Utilities and Digital Economy

PIARC   World Road Association

PMBOK GUIDE Project Management Institute

RAMS   Road Asset Management Systems

RBAMS   Risk Based Asset Management Strategy

SAMP   Strategic Asset Management Plan

EXECUTIVE SUMMARY

The road network in the Commonwealth of Dominica consists of approximately 1512km of roadways, which run primarily along the coastline, and along river valley unfavorable climatic conditions. The road infrastructure includes a total of 200 bridges and water crossings across Dominica. The Post -Disaster Needs Assessment Report for Hurricane Maria in 2017 revealed that 33% is deemed to be in good to fair condition and 67% poor to bad condition (GoCD, 2017). Many of these structures are aged, have inadequate hydraulic capacity and lack maintenance. Major damage and losses from Hurricane Maria, estimated at USD$235 million in the road sector, occurred as a result of landslides, edge erosion, embankment and river cross failures from strong flash flooding. This carried substantial bolder debris, deposits of tree and other flooding debris.

The cost of no action to reduce climate vulnerability at the national level would be loss and damage equivalent to 77% of the GDP by 2100. The aim of this project was to reduce the amount spent annually on new construction, rehabilitation and maintenance of road assets to approximately 20% initially and with time increase to 50%.

As a small island developing state, financing road reconstruction, rehabilitation, new construction and maintenance has been a huge task to accomplish, which increases the island's vulnerability as it lacks the capacity to respond to climate change.

The Ministry of Public Works Public Utilities and the Digital Economy (MoPWPUDE), through its Technical Services Division (TSD), is the lead agency within the Government of the Commonwealth of Dominica (GoCD) for the maintenance and management of the road infrastructure. The aforementioned challenges associated with asset management have thus impelled the Government decision towards the development of a Road Asset Management System (RAMS) for the country.

The general objective of this research study was to develop a Road Asset Management System (RAMS) for the Commonwealth of Dominica. The stem collected foundational database of roadway inventory with maintenance needs, condition, and location information for pavement, bridge, geotechnical, drainage and furniture. This was done in an effort to identify remedial activities that maximize system performance while simultaneously minimizing long-term maintenance costs and mitigating risks amidst budget constraints, for GOCD.

For the purpose of this project, the research method which was used is qualitative, where interviews were conducted, meetings were held with key stakeholders, documents reviewed and analyzed. The RAMS system which was developed assisted in making critical decisions, based on a Geographic Information System (GIS) platform that houses all asset information which can be used to generate reports and estimates for rehabilitation works. The specific objective of this research is to map out the processes needed for a successful project execution according to the guidelines established in the PMBOK. The PMBOK provides tools and techniques for project initiating, planning, executing, monitoring, controlling and closing (PMBOK GUIDE, 2017). There are ten knowledge areas identified in the PMBOK. These knowledge areas are the core technical frameworks

required for effective project management planning and correspond to the specific objectives identified above.

 The development of this project management plan is based on the absence of any such plan for project management at the Ministry of Public Works Public Utilities and the Digital Economy (MoPWPUDE). The lack of planning at the Ministry has led to overruns in the schedule and cost of the project, with inconsistencies in quality and required standards. The introduction of a project management plan was critical in ensuring best practices were used for the greatest efficiency and now can be used as a template for future projects being managed by the Ministry. The Project Management Plan has integrated sustainable and regenerative principles in order to effectively carry out project management activities without compromising the needs of the future generation.

 In conclusion the project will create a project charter and management plans for project integration, scope, schedule, cost, quality, resource, communication, risk, procurement and stakeholders. It is imperative that all ten knowledge areas work in tandem to attain Project success. All stakeholders need to understand the significance of the project management plan to ensure that time, quality and cost parameters are maintained throughout execution.

 It is recommended that the project manager and the project team follow the subsidiary plans developed for the project using the relevant project management tools and techniques, prescribe in the project management plan. This is to ensure effective monitoring, supervision and evaluation of the project.

1   INTRODUCTION

The Ministry of Public Works, Public Utilities, and the Digital Economy (MPWPUDE), through its Technical Services Division (TSD), is the lead agency within the Government of the Commonwealth of Dominica (GOCD) for the maintenance and management of the road infrastructure. In 2007, the MPWPUDE developed a 10-Year Road Sector Programme to improve the condition of road network by 2020. However, the rehabilitation programme defined could never be achieved due to the impact of extreme climate events in 2015 and 2017, namely Tropical Storm Erika and Category 5 Hurricane Maria.

Subsequently, in 2019 the GOCD through the MPWPUDE sought to develop an effective asset management planning, identifying activities that maximized system performance while minimizing long-term maintenance costs and mitigating risks amidst budget constraints. Out of this initiative, Risk -Based Asset Management Systems (RBAMS) was developed. The system was populated by means of windshield surveys, served as the baseline for the development of a road asset management decision support system (DSS). RBAMS which predicted future performance under various build and no-build scenarios supported the development of optimal investment strategies.

Aligned with Dominica's Climate Resilience and Recovery Plan (CRRP), MPWPUDE Strategic Plan 2020-2025 and the Ministry's defined objectives, in January 2023 the Road Asset Management System (RAMS) project was launched. RAMS sets out the long-term objectives of the MPWPUDE regarding acceptable conditions and

vulnerability of road assets, accessibility provided by the network, functionality and targeted levels of service, and funding objectives.

The RAMS provides a comprehensive framework to ensure that Dominica's road network is efficiently operated, maintained, renewed, ~~be~~ is resilient in the face of climate events and natural hazards and upgraded to achieve the highest levels of service delivery in the most cost-effective and sustainable manner possible.

1.1. Background

Under the Climate Resilience Act of 2018, Dominica's Climate Resilience and Recovery Plan (CRRP) was developed in 2020, which promotes the development of Dominica as a climate -resilient nation and supports Government Ministries in the implementation of climate-resilient policies and the execution of priority recovery projects.

In line with the CRRP, the MPWPUDE developed its Strategic Plan 2020-2025 and set a priority ~~on~~ for addressing road maintenance and rehabilitation, drafting a Network Master Plan, and establishing a Maintenance Plan for the period identified, as well as strengthening the capacity of MPWPUDE to enhance their capacity in resilient road asset management.

In 2021, the Caribbean Development Bank (CDB) compared the resilience of Dominica's road sector against climate change and disaster risks as fair due to the policies, the legal and institutional frameworks, as well as the available financial conditions at the time (CDB, 2021). Additionally, the assessment highlighted the lack of technical expertise

required for the successful implementation of the road sector related initiatives as planned in the Climate Resilience and Recovery Plan (CRRP) 2020-2030.

Consequently, in 2023 consultants were engaged by GOCD to strengthen the road sector management in Dominica in line with the previous initiatives undertaken during the last five years and to develop a Road Asset Management System, building on the previous RBAMS (2017) and the DSS (2019).

1.2. Statement of the problem

The road network in the Commonwealth of Dominica consists of approximately 955 km of roadways (70% paved), primarily laid out along the coastline and river valleys because of the mountainous nature of the island. There road infrastructure comprises ~~comprise of~~ approximately 174 bridges, 198 main culverts and over 840 earthworks. The percentage of pavement in an acceptable condition (fair to excellent) is 63%, whereas 24% are in fair condition and 37% are in poor or very poor condition. Regarding structures, over 27% of bridges, 7% of critical culverts and 22% of critical earthworks are deemed to be in fair to very poor condition. This is a consequence of the frequent occurrence of natural hazards as well as the poor management or road assets and the limited resources for adequate maintenance, rehabilitation or reconstruction.

The use of a Project Management Plan provides guidelines for a successful project execution. The lack of planning in any project can lead to cost overruns, delays in the schedule, poor quality and severe impact to the environment. The development of a project

management plan is critical as it aims to employ best practices to attain the greatest efficiency.

1.3.   Purpose

The purpose of this study is to develop a Project Management Plan that integrates regenerative principles in order to effectively carry out project management activities for the Road Asset Management in the Commonwealth of Dominica. The Project Management Plan is a comprehensive document that outlines how the RAMS Project will be executed, monitored, controlled and closed. The standards outlined by the Project Management Institute (PMBOK GUIDE) in the PMBOK guide will be utilized. The standards focus on developing the ten (10) knowledge areas; scope, schedule, cost, communication, stakeholder, risk, procurement, integration, quality and resource management.

There are many benefits for the creation of the project management plan, namely (DAN Global 2023):

- It brings all stakeholders together to create the foundations of your project. The project scope is defined as well as limitations and boundaries.

- The project management plan gives clear guidelines on how changes are to be handled and balances both client and team expectations.

- In the plan there are budgets and timelines which are used for schedule development, as the scope is translated into a work breakdown structure (WBS), to ensure all tasks are completed at the right point in the project timeline.

- It establishes the resource requirements for the project, listing out the essential resources that you will need to complete the project successfully. In addition to the number of working hours required, your resource plan should indicate the expertise needed from the project resources at different stages.

- The plan defines what success looks like for the project, there is clarity on a project's objectives also helps reduce wasted resources, which can happen when people start taking the project in the wrong direction due to misunderstandings.

- The project management plan helps you identify risks and decide how to respond to them.

- The plan describes in detail how to report on the project and evaluate its progress.

- It also outlines how project communications will be managed to ensure communication channels are clear from the project planning to closing stage. This includes when, how, and with whom different aspects of the project should be communicated, both internally and externally.

- The plan makes certain that stakeholders are managed efficiently, by outlining how regularly you will engage with your stakeholders, how you will update them on the project's progress, meet their expectations, and analyze their feedback; you can build strong relationships with them throughout the project timeline.

The Road Asset Management System will be GIS Road Data Base; the tool is calibrated and populated with all data from the primary, secondary and tertiary road networks on the island. Trained engineers and technicians from the Ministry will be tasked with collecting asset data from field inspections. The data would include but not limited to asset location, type, material, condition, windshield survey and photos. The road assets comprise of road pavement, drains, bridges, retaining walls and cut slopes. The RAMS supports the calculation of KPIs; that supports the graphic display of information, and provides analysis, planning and costing functionalities. Reports will be easily generated from the system, which provides an asset's vulnerability and financial requirements to determine the level of prioritization for repairs. A user's manual for the use of RAMS will be developed to aid new staff on the systems operations. Road maintenance financing strategy, containing proposals for robust and sustainable long-term financing of road maintenance activities will be provided.

RAMS will effectively control and govern road assets through managing risk and opportunity, in order to achieve the desired balance of cost, risk and performance. The regulatory and legislative environment in which organizations operate is increasingly challenging and the inherent risks that many assets present are constantly evolving. ISO 55000 describes the benefits gained from asset management as the following:

- improved financial performance: improving the return on investments and reducing costs can be achieved, while preserving asset value and without sacrificing the short or long-term realization of the Ministry's objectives;

- informed asset investment decisions: enabling the Ministry to improve its decision making and effectively balance costs, risks, opportunities and performance;

- managed risk: reducing financial losses, improving health and safety, good will and reputation, minimizing environmental and social impact, can result in reduced liabilities such as insurance premiums, fines and penalties;

- improved services and outputs: assuring the performance of assets are resilient and sustainable and can lead to improved services or products that consistently meet or exceed the expectations of customers and stakeholders;

- demonstrated social responsibility and regenerative: improving the Ministry's ability to reduce emissions, conserve resources and adapt to climate change, thus enabling it to demonstrate socially responsible and ethical business practices and stewardship;

- demonstrated compliance: transparently conforming with legal, statutory and regulatory requirements, as well as adhering to asset management standards, policies and processes, can enable demonstration of compliance;

- enhanced reputation: through improved customer satisfaction, stakeholder awareness and confidence;

- improved organizational sustainability: effectively managing short and long-term effects, expenditures and performance, can improve the sustainability of operations and the organization;

- Improved efficiency and effectiveness: reviewing and improving processes, procedures and asset performance can improve efficiency and effectiveness, and the achievement of the Ministry's objectives.

1.4. General objective

To develop a Project Management Plan for the Road Asset Management Systems in the Commonwealth of Dominica to successfully manage the execution of the project.

1.5. Specific objectives

- To create a report that documents the tools and techniques needed for the management of the Road Asset Management System.

- To define project charter to define the key input elements required to develop the project management plan.

- To develop an Integrated Management Plan to coordinate all the elements the project needs to be complete at cost, on schedule and quality.

- To develop Scope Management Plan, to measure the work required and only the work required, completing the project successfully.

- To develop a Schedule Management Plan to define the timeline for the project deliverables to ensure the project's timely completion.

- To develop a Cost Management Plan to plan, estimate, and manage the budget for all project activities, deliverables, and resources.

- To develop a Quality and Safety Management Plan to ensure that all project deliverables meet stakeholders' expectations and universal standards.

- Develop a Resource Management Plan to identify, acquire, and manage all physical and human resources needed to complete the project successfully.

- To develop a Communications Management Plan to ensure effective communication with project stakeholders and record all project communications.

- Develop a Risk Management Plan to increase the probability/impact of positive risks (opportunity) and decrease the probability/impact of negative risks.

- To develop a Procurement Management Plan to develop and administer agreements for products and/or services needed from outside the organization or project team expertise.

- Develop a Stakeholder Management Plan to identify all groups and/or individuals whom may potentially be affected by the project and ensure that their concerns are addressed.

- To measure the RAMS project against regenerative principles and develop a management plan for such.

2   THEORETICAL FRAMEWORK

The theoretical framework of this project is explained in this chapter, which provides relevant information about the Ministry of Public Works, Public Utilities and Digital Economy (MoPWPUDE); its framework, background, mission and vision statements, organizational structure, and products offered. In addition, the chapter provides detail on the Ministry's project management concepts, principles, knowledge areas and the project life cycle. It also explains the relationship between various variables, identifies gaps in existing knowledge, and guides the development of research questions, hypotheses, and methodologies. It also helps to contextualize the research within a broader theoretical perspective and can be used to guide the interpretation of results and the formulation of recommendations (Research Method, 2022).

2.1   Company/Enterprise framework

The Ministry of Public Works, Public Utilities and Digital Economy is a Ministry in the body of the Government of Commonwealth of Dominica. The Ministry is headed by a Minister who is tasked with improving existing policies and developing new policies for the successful management of the Ministry. The Permanent Secretary of the Ministry is the most senior civil servant of a ministry charged with running the Ministry's day-to-day activities. The Permanent Secretary oversees four divisions of the Ministry's organizational framework. The Chief Technical Officer is the lead of the Technical Services Division and is assisted by qualified engineers and technicians.

The Ministry's funding is mainly from allocations from the national budget. There are projects funded by donor agencies and the private sector.

2.1.1   Company/Enterprise background

The Department of Public Works is tasked with the mandate to manage the island's abundant water resource and to implement all physical and digital infrastructure projects. The Department's objectives over the past 10 years have been to improve the road network in Dominica which is consistent with Government's policy (Ministry of Public Works, Public Utilities and Digital Economy, 2023). The National Roads Policy which has the objectives of:

- Providing an accessible road network
- Getting the road network into good condition
- Maintaining the road network in good condition

Nevertheless, despite the efforts made thus far in developing the road infrastructure, Dominica's terrain, coupled with the negative effects of disasters such as the Trough System in December 2013, the Tropical Storm Erika in August 2015 and Hurricane Maria in September 2017 has caused significant setbacks in accomplishing the 10 Year Road Sector Plan.

2.1.2   Mission and vision statements

The mission of the Ministry is to develop resilient physical infrastructure and provide digital services that can withstand and recover quickly from adverse events through improved standards, institutional systems, and regulatory oversight.

The Ministry's vision statement is to build resilient infrastructure with integrated technology (Ministry of Public Works, Public Utilities and Digital Economy, 2023).

The Road Asset Management System project aligns with the Ministry's mission and vision to improve the road network and increase climate resilience.

The Climate Resilience Execution Agency for Dominica (CREAD) was formulated after Hurricane Maria. This statutory body was mandated under the Climate Resilience Act 2018to make the island the most climate- resilient nation in the world.

2.1.3   Organizational structure

The organizational structure of the Ministry allows for the ease of work to flow through an organization and permits groups to work together within their individual functions to manage tasks. This functional hierarchy provides well-defined control lines and communication paths, which makes the operations more efficient and can lead to faster organizational development through the specialization of each department. The Ministry has four main divisions (Ministry of Public Works, Public Utilities and Digital Economy, 2023) which can be seen in Figure 1. These divisions are as follows:

- Electrical Division

- Information and Communication Technology Division,

- Policy Formulation and Administrative Division,

- and Technical Service Division.

Figure 1

Organizational Chart
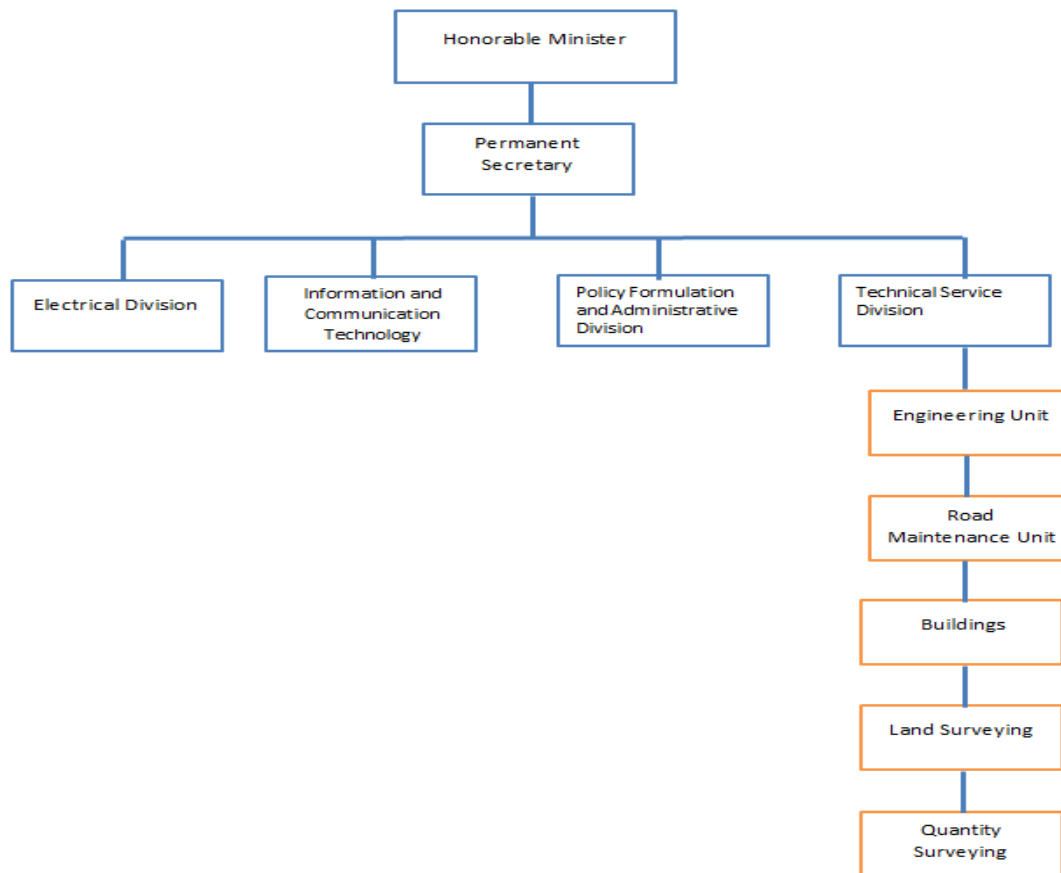
Note. The Organizational Chart of the Ministry of Public Works, Public Utilities and Digital Economy.

2.1.4   Products offered

The services offered by Ministry of Public Works, Public Utilities and Digital

Economy are from the Technical Division, the Electrical Division, the Information and

Communication Technology Division, the Policy Formulation and Administrative Division and the Technical Service Division.

The Electrical Division is charged with carrying out the inspection and certification of all electrical installations before they are connected to the national grid and is done in accordance with international regulations. Their function also includes the maintenance of Government's electrical system and advising Government ministries on electrical needs.

The Information and Communication Technology Division (ICT) is responsible for coordinating policy and service- oriented activities to develop policies for the use of ICTs within Government and to provide a framework for policy implementation, program planning, management and implementation. This will be done in support of the Government's objectives for public service delivery and administrative efficiency, in the context of Public Sector Reform.

The Policy Formulation and Administrative division is responsible for the provision of daily support services for the Ministry which includes financial management, supervision of the implementation of policies, coordination of the human resource management and monitoring and evaluation of the implementation of programs for consistency of policies.

The Technical Services Division has five major units which are namely, the building section, road maintenance, engineering, quantity surveying and land surveying. The Building Section is tasked with developing architectural designs for new and existing Government buildings as well as carrying out condition assessment of Government facilities. This division carries out routine assessments of primary and secondary roads. In

addition, they prepare and implement a road maintenance program, which includes installation of road safety. The quantity surveyor department prepares a detailed bill of quantities and cost estimates for works to be executed by the Ministry as well as financial control and reporting. They are also tasked with the procurement and tendering process for eligible contractors. The Engineering unit develops plans and designs for roads, drainage systems, bridges, river and coastal defenses, and river control compatible to local needs The unit also monitors and implements infrastructural projects as per design standards, codes and construction specifications. The land surveys unit conducts detailed topographic surveys and maps for the development of engineering designs. They also redefine site boundary lines and replaces official boundary markers that are removed. Recommendations are made by this unit to different agencies regarding land acquisition matters.

The MoPWPUDE aims at developing a safe and accessible road network in good condition. The Road Asset Management System (RAMS) will establish principles on which the agency makes decisions associated with the management of and investment in infrastructure. It seeks to link the organizational goals and objectives to the principles for management of the Infrastructure portfolio.

RAMS will articulate how management processes will function in managing infrastructure and delivering services, as well as how the agency will continuously improve their asset management practices over time. The Asset Management Plans developed for individual asset classes (pavements, bridges, ancillary assets), which while being focused on their individual portfolios are also aligned with the overall agency strategy and are customized to the level of management required. The operational plans and work programs

that guide routine activities are in line with the overall agency goals. For this reason the optimum unit to manage RAMS is the Maintenance unit in the Technical Service Department.

2.2 Project Management concepts

Project management concept dates back to the early 1950s in its contemporary form and its roots can be linked back to the latter years of the 19th century (Exceeders, 2020). It was not until the mid-20th century companies realized the advantages of organizing projects for proper execution. Today, the term project management is widely known and many organizations believe that project management is the best means of attaining organizational goals and implementing various business strategies.

The Project Management Plan for Road Assets Managements System will be based on the Project Management Body of Knowledge –Sixth and Seventh Edition as published by the Project Management Institute (PMBOK GUIDE). This section seeks to provide details of the fundamental principles of sound project management planning as detailed by the PMBOK GUIDE. This section summarizes various project management concepts related to the development of a Project Management plan for the project.

2.2.1 Project management principles

Project management principles are not prescriptive in nature and serve as foundational guidelines for strategy, decision making and problem solving. PMBOK GUIDE lists twelve project management principles which will be used to guide the behavior of people involved in the project. These principles are used to guide the

development of the project management plan for the project and are aligned to the PMBOK

GUIDE Code of Ethics and Professional Conduct. PMBOK GUIDE, (2021) twelve

principles without any specific weighting or order are as follows:

- Be a diligent, respectful and caring steward

- Create a collaborative project team environment

- Effectively engage with stakeholders

- Focus on value

- Recognize, evaluate and respond to system interactions

- Demonstrate leadership behaviors

- Tailor based on context

- Build quality into processes and deliverables

- Navigate complexity

- Optimize risk responses

- Embrace adaptability and resiliency

- Enable change to achieve the envisioned future state.

2.2.2   Project management domains

Project management domains are associated with project performance domains

which are a set of skills, activities, and behaviors that contribute to the effective delivery of

project outcomes (PMBOK GUIDE, 2021). These performance domains are interactive,

interrelated and interdependent areas of focus which work in unison to achieve the end

product. PMBOK GUIDE (2021) describes eight performance domains which will be tailored for the execution of this project. They are as follows:

- Stakeholders

The stakeholder performance domain ensures a productive working relationship with stakeholders during project execution. The project objectives must be agreed by all stakeholders and ensures that any stakeholder who opposes the project do not negatively affect or impact project outcomes. Stakeholders on this project include and are not limited to: Government of the Commonwealth of Dominica, Ministry of Public Works, Public Utilities and Digital Economy, other Government agencies, steering committee, the public, funding agencies, end users, project team, etc.

- Team

This domain entails activities and functions associated with the persons who are responsible for deliverables that realize project outcomes. To do this each team member must have a sense of shared ownership, high performance, leadership and interpersonal skills demonstrated by all members. There must be a culture and environment that enable a collection of diverse individuals to evolve into high performance.

- Development approach and life cycle

This performance domain involves establishing the development approach, delivery cadence and project life cycle needed to optimize outcomes. The effective execution of this domain results in the project life cycle, consisting of phases that connect the delivery of project and stakeholders value from the beginning to the end of the project. The delivery

cadence will determine how the project is developed, the timing and frequency of project deliverables.

- Planning

The purpose of this domain is to proactively develop an approach to execute project deliverables. There is a holistic approach to ensure that the project progress is organized, coordinated and deliberated. In this domain time is spent planning prior to project authorization. The project team or project manager progressively elaborates initial project documents such as vision statement, project scope, stakeholders' requirements, project charter, business case to define the path to achieve desired outcomes. A schedule is outlined of project activities, duration and dependencies. Planning also entails estimating work efforts, duration cost, people and physical resources needed for the project.

- Project work

Project works are associated with establishing project processes, managing physical resources and fostering a learning environment. This domain results in efficient and effective project performance. Communication with stakeholders can be through formal and informal means, in addition to verbal and written communication. The flow of existing, new and changed project work is managed by the team ensuring activities run smoothly. Procurement and contract management of contracting professionals or vendors will be managed by the team. This domain allows for knowledge transfer which will increase the professional capacity of the Ministry's staff.

- Delivery

Project delivery focuses on meeting project requirements, scope and quality to produce the expected deliverables that will result in the intended outcome. The project deliverables are aligned to the Ministry's goals and provides a new service to optimize to use of physical resources. At the end all stakeholders are satisfied and generate value to the organization.

- Measurement

The project performance is measured to implement responses to take appropriate actions to maintain optimal performance. The effective executions of these measurement tools and techniques will result in reliable understanding of the project status to facilitate decision- making for resolving problems. This measurement performance domain will allow the project to achieve project targets, milestones and have reliable project performance forecast.

- Uncertainty.

Projects exist in an environment with varying degrees of uncertainty which presents threats and opportunities that the project team can explore, assess, measure and decide how to deal with such uncertainty. The team must have the capacity to anticipate threats from uncertainty which may include: technical, social, political, market and environmental issues which can affect the project.

2.2.3 Predictive, adaptive and hybrid projects

PMBOK GUIDE (2021) outlines the development approach for a project, which can be in three commonly used approaches namely: predictive, hybrid or adaptive. These

development approaches are viewed as a spectrum from predictive approach on one end of the spectrum to adaptive on the other end.

A hybrid development approach is a combination of adaptive and predictive. This approach is used when there is uncertainty or risk around project requirements. For the development of this approach deliverables can be modularized or developed by different project team. The hybrid approach uses an iterative or incremental development approach.

An adaptive approach is used when requirements are subject to high levels of uncertainty and volatility and are likely to change during the project life cycle. This approach is agile, iterative or incremental, however the iterations tend to get shorter and the product is more likely to evolve based on stakeholder's feedback. In an adaptive approach a clear vision is established from the start, however the initial requirements are refined, detailed or replaced in accordance with users' feedback.

The Road Asset Management System project best suits a predictive approach, which is also referred to as the waterfall approach. This approach is used because the project and product is clearly defined and analyzed at the start of the project. The scope, schedule, cost, resource needed and risk are well defined early in the project. There are existing templates from previous projects in the Ministry which will be used to monitor and manage the project. Figure 2 depicts a predictive life cycle where it shows that one phase finishes before the next one begins, which means each phase is only performed once.

Figure 2

Predictive Life Cycle
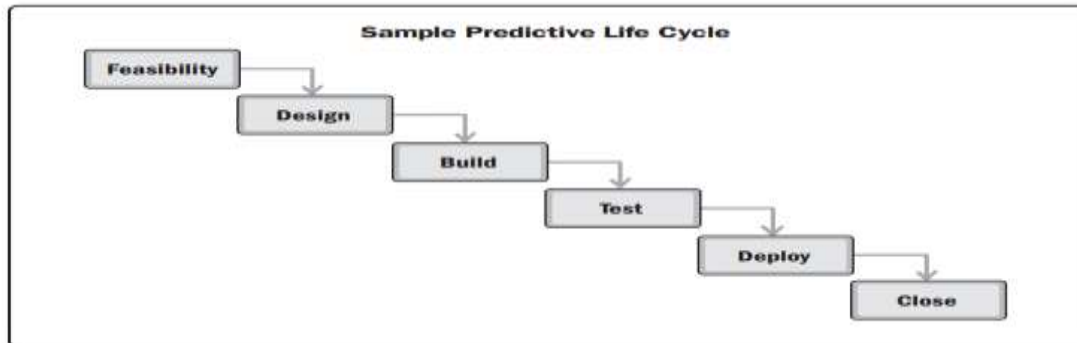
Note. Predictive Life Cycle used for RAMS

2.2.4   Project management

PMBOK GUIDE, (2021) states that project management entails applying knowledge, skills, tools, and techniques to project activities and it acts as a guide in achieving the intended project outcomes. These knowledge, skills, tools, and techniques are essential throughout a project's lifecycle as they assist in planning, monitoring, and controlling all aspects of a project. Project management is accomplished in the project through the appropriate application and integration of project management processes identified for the project (PMBOK GUIDE, 2017).

Lester (2021) provides insight to a project management plan as being a "document which summarizes all of the main features encapsulating the Why, What, When, How, Where, and Who of a project". It is a formal document allowing the project team to direct, execute, monitor, and control project activities. The knowledge, tools, and techniques discussed in the project management plan to design and construct a road assets

management system for the Commonwealth of Dominica as per the knowledge areas, principles, and domains set out in PMBOK GUIDE Project Management Body of Knowledge. It will guide the project team in effectively, efficiently, and sustainably achieving the project deliverables within time, at cost, as per required quality standards.

Poor project management may result in rework, missed deadlines, cost overruns, poor quality, scope creep, loss of good reputation, unsatisfied stakeholders and failure to achieve project objectives.

2.2.5 Project management knowledge areas and processes

The five process groups described by PMBOK GUIDE (2017) to achieve specific project objectives are as follows:

- Initiating - processes performed to define a new project or to conduct a new phase of an existing project by seeking authorization to start the project or phase.
- Planning - processes needed to determine the project's scope, refine the objectives, and define the course of action needed to achieve project objectives.
- Executing - processes required to complete the work defined in the project management plan to satisfy the project requirements.
- Monitoring and Controlling - are the processes that track, review, and regulate the progress and performance of the project. It also involves identifying any areas that require changes to the plan and how to initiate those changes
- Closing - processes performed to formally complete or close a project, phase, or contract.

These processes are linked by specific inputs and outputs, where an outcome of one process is an input for another process in the same process group.

Processes are also categorized as knowledge areas, which are identified area of Project management defined by its knowledge requirements and described in terms of its components processes practices, inputs, outputs, tools and techniques as seen in Table 1 based on PMBOK GUIDE (2017). Table 2 below describes the knowledge areas tailored for the Road Asset Management System Project.

Table 1

PMBOK GUIDE Knowledge Area and Process Groups

Knowledge Areas	Project Management Process Groups				
	Initiating Process Group	Planning Process Group	Executing Process Group	Monitoring and Controlling Process Group	Closing Process Group
4. Project Integration Management	4.1 Develop Project Charter	4.2 Develop Project Management Plan	4.3 Direct and Manage Project Work 4.4 Manage Project Knowledge	4.5 Monitor and Control Project Work 4.6 Perform Integrated Change Control	4.7 Close Project or Phase
5. Project Scope Management		5.1 Plan Scope Management 5.2 Collect Requirements 5.3 Define Scope 5.4 Create WBS		5.5 Validate Scope 5.6 Control Scope	
6. Project Schedule Management		6.1 Plan Schedule Management 6.2 Define Activities 6.3 Sequence Activities 6.4 Estimate Activity Durations 6.5 Develop Schedule		6.6 Control Schedule	
7. Project Cost Management		7.1 Plan Cost Management 7.2 Estimate Costs 7.3 Determine Budget		7.4 Control Costs	
8. Project Quality Management		8.1 Plan Quality Management	8.2 Manage Quality	8.3 Control Quality	
9. Project Resource Management		9.1 Plan Resource Management 9.2 Estimate Activity Resources	9.3 Acquire Resources 9.4 Develop Team 9.5 Manage Team	9.6 Control Resources	
10. Project Communications Management		10.1 Plan Communications Management	10.2 Manage Communications	10.3 Monitor Communications	
11. Project Risk Management		11.1 Plan Risk Management 11.2 Identify Risks 11.3 Perform Qualitative Risk Analysis 11.4 Perform Quantitative Risk Analysis 11.5 Plan Risk Responses	11.6 Implement Risk Responses	11.7 Monitor Risks	
12. Project Procurement Management		12.1 Plan Procurement Management	12.2 Conduct Procurements	12.3 Control Procurements	
13. Project Stakeholder Management	13.1 Identify Stakeholders	13.2 Plan Stakeholder Engagement	13.3 Manage Stakeholder Engagement	13.4 Monitor Stakeholder Engagement	

Note. PMBOK Guide Knowledge areas and process groups which was used as a guide for RAMS.

Table 2

Knowledge Areas for RAMS

No	Knowledge Areas	Description
1	Integration Management	A Project Charter is developed by senior level management at the Ministry which includes: the Minister, Permanent Secretary, Chief Engineer, sponsor (funding agency) and signed off by the Permanent Secretary. This Project Charter defines the scope, activities, risk, stakeholders, assumptions, restrictions and milestones for the project. The Chief Technical Officer assigns a Project Manager to the project, which develops a project management plan for approval.
2	Scope Management	The Project Manager for the Project will be responsible for scope management. The scope for this project is defined by the activities identified in the Scope Statement and Work Breakdown Structure (WBS). Any proposed scope changes may be initiated by the Permanent Secretary, Chief Technical Officer, Project Manager, key stakeholders. During the implementation of the project, the Project Manager will verify interim project deliverables against the original scope as defined in the scope statement and the WBS.
3	Schedule Management	The Project Manager is responsible for the determination and inclusion of all project activities in the project schedule and estimated duration of all activities. The execution of the project activities will form part of the work plan of the project team. Project activities will be planned, reviewed and updated at scheduled team meetings or as determined by the Project Manager. MS Projects will be used as a tool to decompose, track project activities and guide project decisions. Any change to the schedule will follow the change management process.
4	Cost Management	The project is financed through a grant from a donor agency. To ensure the project stays within budget, all variations on a project is approved by the unit before instruction and execution.
5	Quality Management	Quality Control mechanism is managed by the Project Manager throughout the life of the project. A quality

		assurance plan is developed mapping out a "Plan, Do", Check, Act" procedures for the project to ensure objectives are met.
6	Resource Management	The Project Manager identifies all the resources needed for the successful execution of the project which is approved by the Chief Technical Officer. These resources are then managed and controlled by the Project Manager.
7	Communication Management	The accepted means of formal communication within the Ministry's project are letters, emails, minutes from meetings, WhatsApps messages, text messages, facsimiles, site instructions, measurement sheets, daily log books and IPC (Interim Payment Certificates). The project communication process is clearly indicated at the project's inception meeting, where all key personnel provides their contact information on the meeting register sheet. The project also uses the following strategies to disseminate information to stakeholders by using weekly and monthly reports. Public Service Announcements, Press Notification and a Social media strategy to inform the populace and interest groups on the progress and benefits of the project will be handled by the Ministry's Communication Unit.
A ver b 8	Risk Management	A risk assessment plan is developed by the project manager for each project using a risk template and probability and impact matrix. A qualitative assessment will guide the selection of the top ranked risks identified and a watch list to be monitored. The project team will review, update and strategize for project risks and issues at scheduled team meetings or as determined by the Project Manager. The risk response strategies will be included in the project schedule and the communication plan as deemed necessary by the Project Manager.
9	Procurement Management	The method of procurement for the selection of consultants/contractors for a project is guided by procurement procedures for projects financed by Caribbean Development Bank (CDB) which is determined by the donor agency. The Ministry would shortlist prequalified contractors who ~~and~~ are invited to the bidding phase. They will be assessed in four areas namely: eligibility, experience, capacity and resources. International competitive bidding will be used to ensure: 1. Reassurance for prequalified firms 2. Simplified evaluation process for procuring agency.

		3. Better quality bids. 4. Lower risk of non-performance PREQUALIFICATION PHASE Step 1- publish invitation and issue prequalification documents. Step 2- receive application and publicly open application Step 3 – assess application against criteria, prepare report and inform rejected applicants. Step 4 – invite prequalified applicants to the bidding phase BIDDING PHASE Step 1 – organize evaluation team Step 2 – applicant assed using qualifications Step 3 – written clarification if needed Step 4 – evaluate bids Step 5 – evaluation team prepares report Step 6- report is submitted to CDB for no objection The contract is then signed by the contractor and the Permanent Secretary.
10	Stakeholder Management	The Project Manager identifies all stakeholders and develops a stakeholder registry which provides all forms of contact information for individuals, groups and organizations. This register is a list of entities that are impacted or will be impacted by the project. A stakeholder's engagement plan is developed, where groups are formed for separate consultation meetings. Feedbacks from all stakeholders are registered, considered, managed and monitored. The Stakeholders Management Plan is managed throughout the project life cycle.

Note. RAMS knowledge areas used for project implementation.

2.2.6 Project life cycle

The project life cycle is the order of processes and phases used in delivering projects (PMBOK GUIDE, 2021). It describes the high-level workflow or framework of managing a project and the steps you take to make things happen. The type of processes and phases in a project life cycle depends on many factors, including the development approach used. The phases may be sequential, iterative or overlapping and can be mapped to a generic lifecycle as shown in Figure 3.

Figure 3

Generic Project Lifecycle.
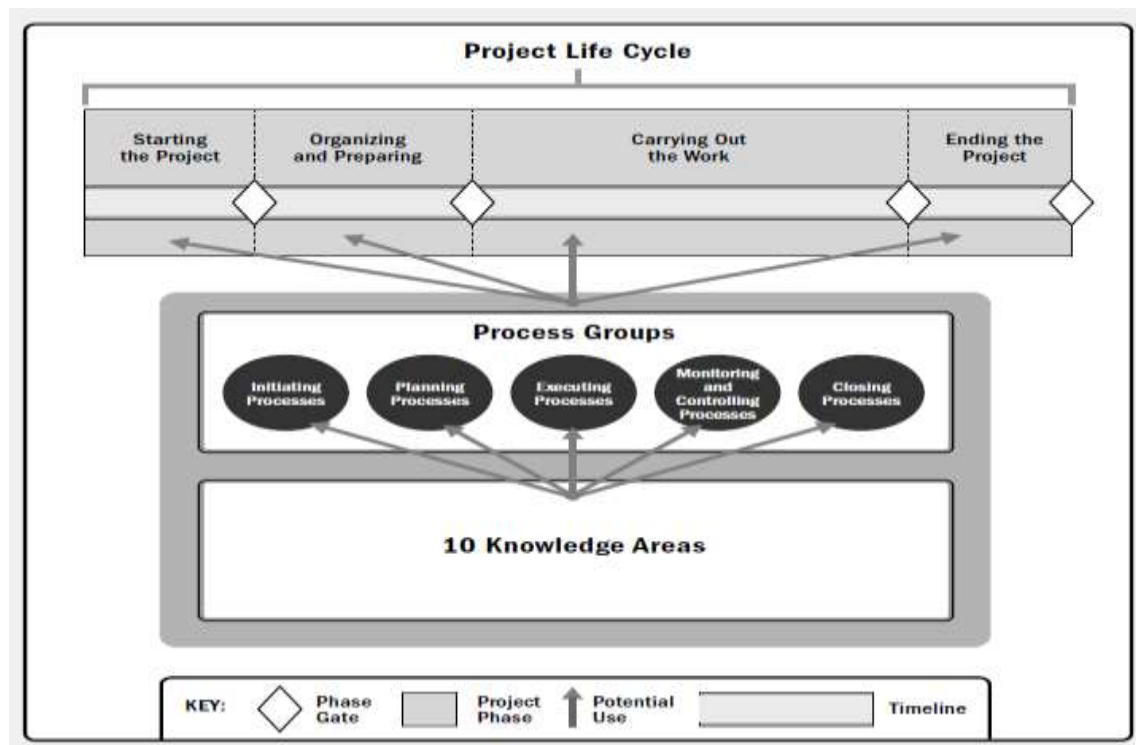
2.2.7 Company strategy, portfolios, programs and projects

Projects are temporary endeavors used to achieve objectives and company's vision by maximizing competitive advantage and minimizing competitive disadvantage (PMBOK GUIDE, 2021). A project can be managed through three separate scenarios namely: stand-alone project, within a program or within a portfolio. Project managers interact with portfolio and program managers when projects are in a program or portfolio (PMBOK GUIDE, 2017).

Some organization may employ the use of project portfolios to effectively manage multiple programs and projects that are underway at any given time. A portfolio is defined as projects, programs, subsidiary portfolios and operations managed as a group to achieve a strategic objective. Figure 4 illustrates how projects, programs and portfolios are related.

Figure 4

Relationship between projects, programs and portfolios
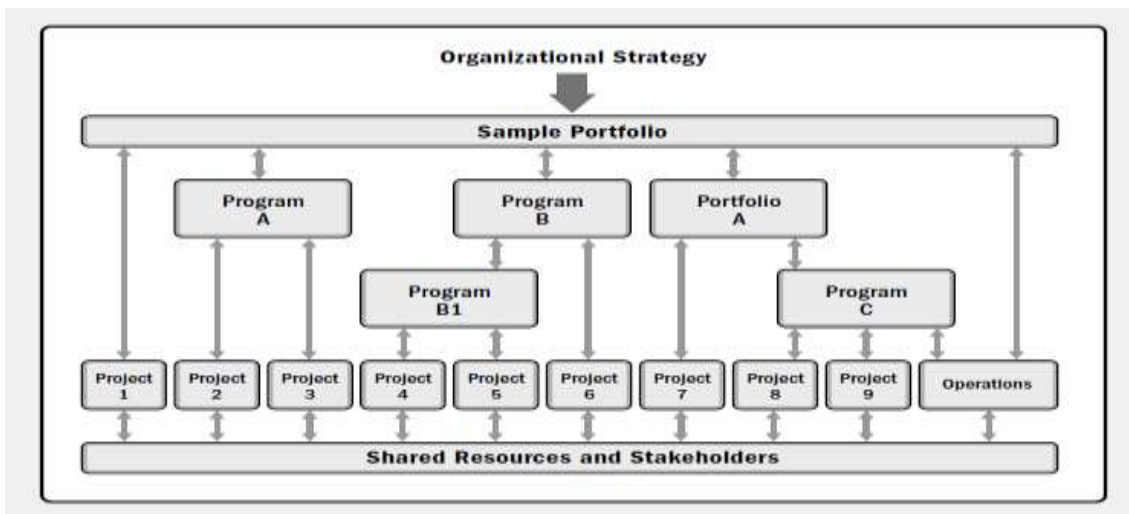
Note. The relationship in the Ministry between projects, programs and portfolios explained.

It is important to note that portfolio management and program management differ with project management, their life cycles, activities, objectives, focus and benefits differ.

At the Ministry, each job is treated as a project with its own project team to manage the activities. The Road Asset Management System currently does not run under a program; however the intention is to integrate it into the Maintenance Unit of the Technical Services Division.

2.3 Other applicable theory/concepts related to the project topic and context

Asset management is defined as the coordinated activity of an organization to realize value from assets (ISO 55000, 2014). In order to do so, asset management must take into account factors such as financial aspects, the operational context, or the organization's needs and expectations, among others. It therefore encompasses several elements of the organization with the aim of improving the lifecycle of tangible assets.

The ISO 55000 makes an overview of asset management and all their elements, beginning with the asset management system. An asset management system is used by the organization to direct, coordinate, and control asset management activities. It can provide improved risk control and gives assurance that the asset management objectives will be achieved on a consistent basis (ISO 55000, 2014).

In Figure 5, ISO 55000 illustrates that an Asset Management System typically consists of the following components: asset portfolio, asset management system, asset management and managing the organization. These components are necessary to efficiently run any asset management system.

Figure 5

Asset Management terms
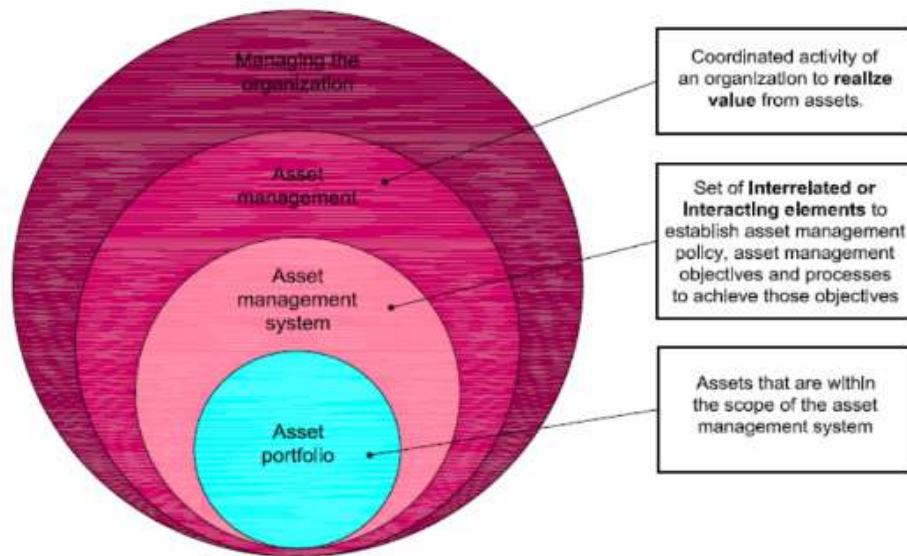
Note. Asset management terms typically used when developing a road asset management system.

The Organizational Strategic Plan sets the overall context, whereas the Asset Management Policy establishes the principles on which the agency makes decisions associated with the management of and investment in infrastructure. It seeks to link the organizational goals and objectives to the principles for management of the infrastructure's portfolio.

The Asset Management Strategy, sometimes termed as the Strategic Asset Management Plan or SAMP, that establishes how the ministry overall will implement asset management and implement the road asset management policies. It articulates how management processes will function in managing infrastructure and delivering services, as

well as how the agency will continuously improve their asset management practices over time.

The Asset Management Plans developed for individual asset classes (pavements, bridges, drainage, ancillary assets), which while being focused on their individual portfolios are also aligned with the overall agency strategy and are customized to the level of management required.

2.3.1 Current situation of the problem or opportunity in study

Data collection and storage is of great concern at the Ministry. There is insufficient staff to run the day-to-day operations. CREAD (2020) indicated that useful data can be extracted for the Commonwealth of Dominica; however, the frequency of data collection is poor. For pavements, 76% of the agencies collected data within 1-3 years, 13% within 4-5 years and 6% and 5% within less than one year or more than six years, respectively. The frequency of data collection on bridges, on the other hand, is 60% over periods of 3 to 6 years, 35% collect data every 1 to 2 years and 5% over periods of more than six years.

The majority of survey respondents (84%) indicated that the decision making for repair and rehabilitation action is based on condition rating (CREAD, 2020). However, it should be noted that the 13% indicated that they perform risk/vulnerability assessment.

Another issue to be addressed is the collection of traffic data. Most of the agencies surveyed collect this type of data either through governmental bodies or through private agencies, only 14 out of 64 (22%) do not collect traffic data. The revised Road Sector Plan

has targeted 50% of the road network to be in good condition by end 2020 and 80% by the end of 2025 (Ministry of Public Works, Public Utilities and Digital Economy, 2023).

The Ministry's goals of the Road Sector Plan are to (Ministry of Public Works, Public Utilities and Digital Economy, 2023):

By 2020 to:

- Increase to 75% the number of main roads in good condition and
- Increase to 40% the number of secondary roads in good condition

By 2025 to:

- Increase to 90% the number of main roads in good condition and
- Increase to 90% the number of secondary roads in good condition

It is alarming to state that the 2020 objectives were not met. To achieve the above objectives, special strategies need to be employed and roads standards need to be revised and adapted to incorporate possible negative impact of climate change. For those approaches, careful attention must be placed in the RAMS implementation strategy, where vulnerable assets are rehabilitated or reconstructed.

2.3.2 Previous research done for the topic in study

The World Road Association - PIARC has developed an online manual for the design of asset management systems, that provide guidance on how asset management principles may be used to support a more efficient approach to maintain road infrastructure assets, and on the implementation and continuous development of road asset management.

The framework developed for RAMS needs to clearly address the following five core questions, which constitute the foundation of road asset management (PIARC, 2023):

1. Current state of assets: type of assets, location, current condition, remaining useful life, remaining economic value).

2. Required level of service/performance level: Stakeholder demand for services, level of fulfillment of regulatory requirements, actual performance.

3. Critical assets to sustained performance: Failure modes, likelihood of failure, consequences of failure, costs of repair, mitigation measures.

4. Operations and investment strategies: alternative management options, most feasible options for road organization.

5. Long-term funding strategy: Current revenues; investment gap to meet asset condition goals; revenue gap to achieve risk goals; optimum mix of preventive maintenance, reactive maintenance, rehabilitation, and replacement.

The asset management strategy provides the basis for the organization to adopt asset management principles to achieve greater efficiency and value for money as well as to improve the organization's overall performance. The strategy also sets out how asset management activities are implemented, measured, and continuously improved, and describes the economic benefits of investing in the maintenance of roads.

In preparing its asset management strategy, the organization should undertake a thorough review of its key documents and plans, identify key statements and objectives such as performance requirements and improvement of road condition, and assess

objectives for work programs to define actions that improve current asset management practices.

The strategy should cover several aspects regarding the planning, delivery, and management of road assets and how these are delivered over the short, medium, and long term and described in a concise manner so that can it be easily understood by all stakeholders. Typically, these aspects may include the following:

• Relevant strategic plans and transport objectives;

• Condition assessment and performance management;

• Current road use needs and forecast on future needs;

• Identification of critical assets and management of risks;

• Decision-making for prioritization of interventions and investment planning;

• Long-term financial needs, including investment requirements and funding sources;

• Legal obligations, particularly regarding safety;

• Future demands for asset management, and stakeholder expectations and needs;

• Initiatives to improve asset management activities.

2.3.3 Other theory related to the topic in study

For such assignment to be successful, the standard ISO 55001 encourages the following:

- Understanding the organization and its context, their needs and expectations and determining the scope of the asset management system.

- Top management shall demonstrate leadership and commitment; they also shall establish an asset management policy and ensure the responsibilities and authorities for relevant roles in the asset management system.

- When planning, the organization shall address risk and opportunities for the asset management system as well as determine objectives and plan how to achieve them.

- In terms of support, the resources, competences, awareness, communication, and information requirements shall be addressed.

The FHWA (Federal Highway Administration) Federal Highway laws, particularly the Federal regulation: 23CFR 515.9 establish the minimum requirements that asset management plans must meet. Among other aspects, the document defines the minimum content for an asset management plan:

1. Asset management objectives.

2. Asset management measures and State DOT (Department of Transportation) targets for asset condition.

3. A summary description of the condition of pavements and bridges.

4. Performance gap identification.

5. Life-cycle planning.

6. Risk management analysis.

7. Financial Plan.

8. Investment strategies.

3   METHODOLOGICAL FRAMEWORK

For the purposes of this study the methodological framework is defined as a structured guide to completing a process or procedure (Research Method, 2022). The

development of the methodological framework involves a series of steps that help to guide

the research process in a systematic and structured manner. Research Method (2022)

provides general steps involved in developing a methodological framework, which is as

follows:

- Define the research problem: in this step the problem or question is clearly defined, which involves identifying the purpose of the research, the research objectives, and the scope of the study.

- Select an appropriate research methodology: This procedure ensures that the research methodology selected should align with the research problem and research question. The most common research methodologies include quantitative, qualitative, mixed-methods, case study, or action research.

- Develop the research design: Once the research methodology is selected, the research design should be developed, which involves identifying the data collection methods, sampling strategy, and data analysis techniques.

- Identify and justify the data collection methods: The data collection methods are selected based on the research methodology and research design.

- Identify and justify the data analysis techniques: The data analysis techniques should also be chosen based on the research methodology and research design.

- Consider ethical considerations: Ethical considerations should be taken into account throughout the research process. This includes obtaining informed consent, ensuring confidentiality and privacy, and protecting the rights of participants.

- Identify potential limitations: It is important to identify potential limitations or biases that may affect the research findings or results. This includes discussing potential sources of error or bias in the research design, data collection methods, or data analysis techniques.

- Consider the significance and implications of the research: The significance and implications of the research findings should be considered, including their potential contributions to theory, practice, or policy.

- Refine the framework: The methodological framework should be refined based on feedback from peers, experts, or other stakeholders. This involves identifying any areas for improvement in the research design, data collection methods, or data analysis techniques.

This chapter will outline the research methods, sources of information, tools, assumptions, constraints, and deliverables relating to the project.

3.1   Information sources

An information source is a source of information that might inform a person about something or provides knowledge to somebody. Information sources may be observations, people's speeches, documents, pictures, organizations (Library and Information Science Network, 2023).

Figure 6, illustrates the various types of information sources which are divided into two broad categories.

A) Documentary Sources: These are generally published or recorded documents of knowledge. Documentary sources may be considered as primary, secondary or tertiary sources of knowledge.

B) Non-Documentary Sources: Non -documentary sources of information form a substantial part of communication especially in science and technology. These sources provide information which other sources do not.

Figure 6

Types of Information Sources
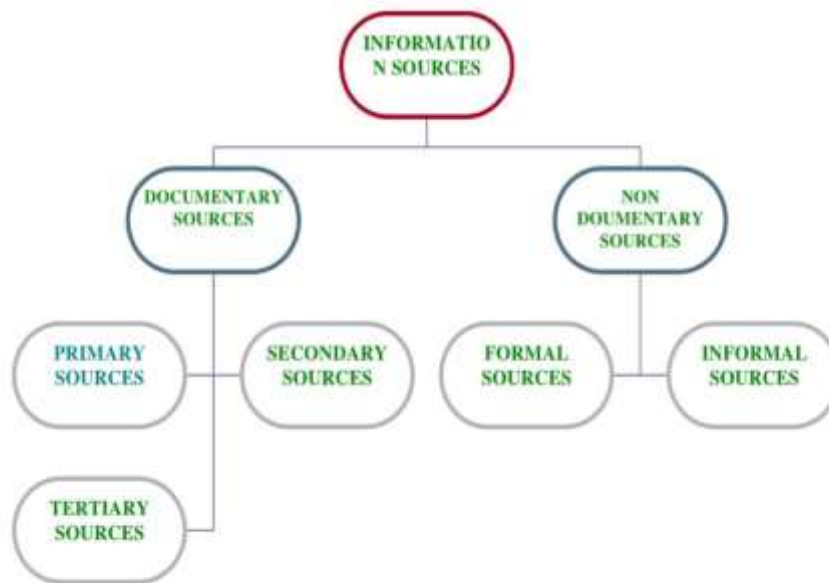
Note. Types of information sources used to develop the project management plan for RAMS.

Leedy and Ormrod (2021) have stated that information is ever-changing and relevance changes with time. Researchers must conduct a thorough literature review to ensure that the information being used is currently relevant to their studies.

3.1.1   Primary sources

Leedy and Ormrod (2021) define primary sources of information as information that emerges directly from the source, a first-hand account. Primary sources of information are first published records of original research and development or description of new application or new interpretation of an old theme or idea. They are original documents representing unfiltered original ideas. Primary source is a term used in a number of disciplines to describe source material that is closest to the person, information, period or idea being studied. Figure 7 provides a list of primary sources of information. The primary sources of information used for this project are research reports, standards, thesis, abstract and trade literature.

Figure 7

Primary Sources of Information
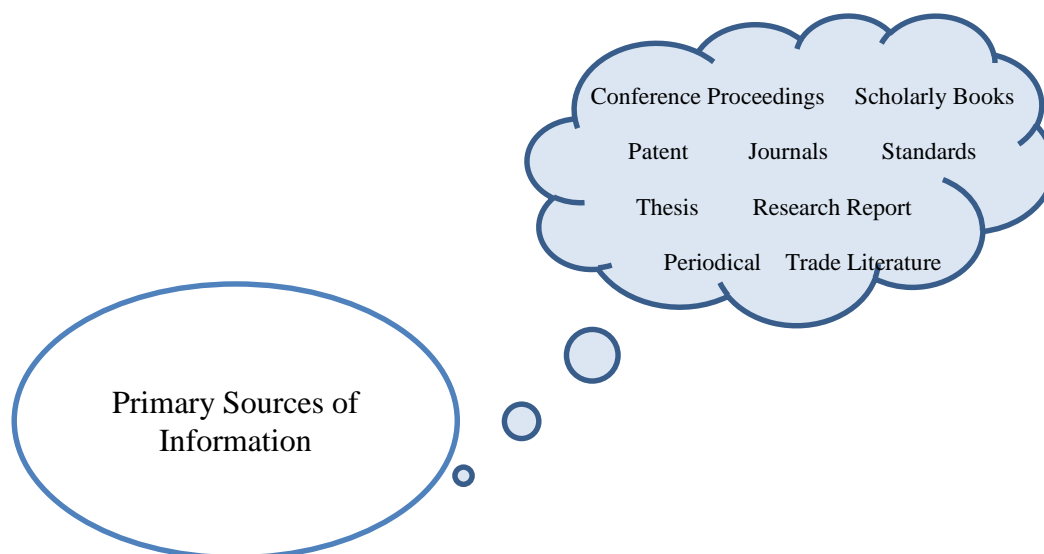
Note. Primary sources of information used to develop the project

3.1.2 Secondary sources

Library and Information Science Network, (2023) describes secondary sources of information are those which are either compiled from or refer to primary sources of information. The original information having been casually modified selected or reorganized so as to serve a definite purpose for group of users. Secondary sources of information contain information arranged and organized on the basis of some definite plan. These contain organized repackaged knowledge rather than new knowledge. Figure 8 provides examples of secondary information sources, which are used to develop information for this project.

Figure 8

Secondary Sources of Information

Secondary Sources of Information

Indexing Services   Treatises
Abstraction Services
Monographs   Text Books
Reference Works
Review of Progress
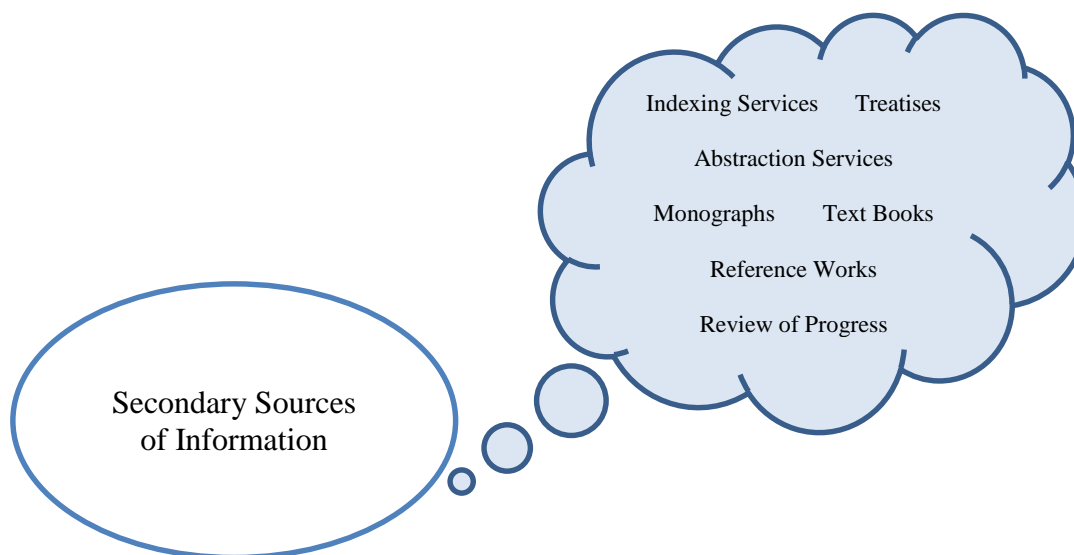
Note. Secondary sources of information used to develop the project

Chart 1 illustrates the primary and secondary information sources for the specific objectives of the project. It provides detail on the information and data retrieved from each information source.

Chart 1

Information sources

Objectives	Information sources	
	Primary	**Secondary**
1. To create a report that documents the tools and techniques needed for the management of the Road Asset Management System.	1. Project appraisal and approval documents (CDB-2019). 2. Interviews with Permanent Secretary and Chief Technical Officer of MoPWPUDE.	1. PMBOK Guide – Project Management Body of Knowledge. Seventh Edition (PMBOK GUIDE, 2021). 2. PMBOK Guide – Project Management Body of Knowledge. Sixth Edition (PMBOK GUIDE, 2017).
2. To define project charter to define the key input elements required to develop the project management plan.	3. Practice of Work Breakdown Structure Third Edition (PMBOK GUIDE, 2019). 4. Project appraisal and approval documents (CDB-2019). 5. Interviews with Permanent Secretary and Chief Technical Officer of MoPWPUDE.	3. Project Risk Management (Warner, 2015) 4. Project Quality Management, Why, What and How (Rose, 2005) 5. Practice Standards for Work Breakdown Structure, Third Edition (PMBOK GUIDE, 2019).
3. To develop an Integrated Management Plan to coordinate all the elements the project needs to be complete at cost,	6. Project appraisal and approval documents (CDB-2019). 7. Interviews with Permanent Secretary and Chief Technical Officer of	6. Practice Standards for Scheduling, Third Edition (PMBOK GUIDE 2019) 7. Books, reference works, websites and journals.

on schedule and quality.	MoPWPUDE.	8. ISO 55000, Asset management−Overview, principles and terminology.
4. To develop Scope Management Plan to measure the work required, and only the work required, completing the project successfully.	8. Meeting with the Minister, Permanent Secretary and Chief Technical Officer to develop a scope management Plan for the project	9. ISO 55001, Asset management−Management systems−Requirements.
5. To develop a Schedule Management Plan to define the timeline for the project deliverables to ensure the project's timely completion.	9. Meeting with the Chief Technical Officer and project team to develop a schedule management plan. 10. Practice Standards for scheduling Third Edition (2019)	10. ISO 55002, Asset management−Management systems−Guidelines for the application. 11. ISO 55001 Innovative Approaches Asset Management. 12. General concept and requirements for asset management training courses (PIARC, 2019).
6. To develop a Cost Management Plan to plan, estimate, and manage the budget for all project activities, deliverables, and resources.	11. Meeting with the Quantity Surveying department and the Financial Analyst of the Ministry to develop a cost management plan for the project	13. AASHTO Transportation Asset Management Guide. 14. Transportation Asset Management Plan (US Transport Department, 2021).
7. To develop a Quality and Safety Management Plan to ensure that all project deliverables meet stakeholders' expectations and universal standards.	12. Meeting with the Chief Technical Officer to determine quality standards and codes to be used for project execution to develop the Quality and Safety Management Plan	15. Puerto Rico Transportation Asset Management Plan (October 2019). 16. Integrating Climate Change into Road Asset Management (World Bank Group, 2017).
8. Develop a Resource	13. Meeting with Human Resource department and IT	17. Procurement Procedures for projects finance by CDB

Management Plan to identify, acquire, and manage all physical and human resources needed to complete the project successfully.	Unit to develop a resource management plan for the project.	(CDB, 2019)
9. To develop a Communications Management Plan to ensure effective communication with project stakeholders and record all project communications.	14. Meeting with the communication lead at the organization to develop communication management plan for public communication. Also meet with project team to develop plans for communication within the team and project execution.	
10. Develop a Risk Management Plan to increase the probability/impact of positive risks (opportunity) and decrease the probability/impact of negative risks.	15. Meeting with project team, sponsor and key stakeholders to develop risk management plan.	
11. To develop a Procurement Management Plan to develop and administer agreements for products and/or services needed from outside the organization or project team expertise.	16. Meeting with the procurement head and contracts manager to develop procurement plan that ensures all procedures are followed and to determine if any expertise or services require outsourcing. Liaise with CDB regarding procurement and tendering procedures established in the grant agreement.	

12. Develop a Stakeholder Management Plan to identify all groups and/or individuals potentially affected by the project and solutions to mitigate impact.	17. Meeting with project team and communication lead at the organization.	
13. To measure the project against regenerative development.	18. Project appraisal and approval documents (CDB-2019). 19. Interviews with Permanent Secretary and Chief Technical Officer of MoPWPUDE.	

Note. Information sources for primary and secondary means explained in detail which was used for the project.

3.2 Research methods

Research methods are the strategies, processes or techniques used for the collection of data or evidence for analysis in order to discover new information or create better understanding of a topic (The University of Newcastle 2023). This research method can also be described as a strategy used to implement that plan. It all depends on your research goal. It can be contingent on what subjects (and who) you want to study. It is important to note that during the research method process that data is only valuable and useful when it is valid, accurate, and reliable. Data is:

- Valid – founded, logical, rigorous, and impartial.

- Accurate – free of errors and including required details.

- Reliable – other people who investigate in the same way can produce similar results.

- Timely – current and collected within an appropriate time frame.

- Complete – includes all the data you need to support your business decisions.

Poor data quality can lead directly to flawed analysis, loss of time, the inability to answer your research questions, inability to validate the results, distorted findings, wasted resources, misleading recommendations and decisions.

Research methods can either be qualitative or quantitative or mixed. A quantitative method examines numerical data and often requires the use of statistical tools to analyze data collected. This allows for the measurement of variables and relationships between them can then be established. This type of data can be represented using graphs and Tables. It answers questions to justify relationships with measurable variables to explain, predict, or control a phenomenon. Types of quantitative methods include:

- Survey research

- Descriptive research

- Correlational research

Qualitative research is a method that collects data using conversational methods, usually open-ended questions. The responses collected are essentially non-numerical and focuses on establishing patterns. This method helps a

researcher understand what participants think and why they think in a particular way. Types of qualitative methods include:

- One-to-one Interview

- Focus Groups (meetings)

- Ethnographic studies

- Text/Document Analysis

- Case Study

A mixed method integrates both qualitative and quantitative research methods. Mixed methods allow for explanation of unexpected results and your research project can benefit from multiple techniques. It provides a holistic approach combining and analyzing the statistical data with deeper contextualized insights. Using mixed methods also enables triangulation, or verification, of the data from two or more sources.

For the purpose of this project, the research method is qualitative where interviews are conducted, meetings held with key stakeholders, documents reviewed and analyzed.

3.2.1 Analytical method

Analytical research paper is an academic piece of writing. In contrast to an argumentative research paper, you don't have to persuade your readers that your personal point of view is correct and others are wrong. The main purpose of the analytical research paper is to present a few different opinions and to draw logical

conclusions. The analytic research method involves critical thinking skills as well as the process of gathering, analyzing, and interpreting information to make inferences and reach conclusions (QuestionPro 2023). Depending on the purpose of the research and the data you have access to; you can conduct analytical research using a variety of methods such as qualitative research which is used for this project. With the use of the analytical research method, facts and information already available will be examined from multiple fronts and used to develop the deliverables as indicated in Chart 2 below. The analytical research method for this project is the use of focus groups, literary research and one-on-one interviews.

Chart 2

Research Methods

Objectives	Research methods		
	One-on-One Interviews	Focus Groups	Literary Research
1. To define project charter to define the key input elements required to develop the project management plan.	1. One-on-one interviews with key stakeholders	1. Through group interaction the project charter is define.	1. This process involves finding information relating to an aspect of a piece of literature related to the project and developing a charter.
2. To develop an Integrated Management Plan to	2. One-on-one interviews with key stakeholders to	2. This group comprises a small number of carefully	2. Guidelines provided by the PMBOK assist in formulating an

coordinate all the elements the project needs to be complete at cost, on schedule and quality.	provide detailed information on how best to integrate the components relating to managing the project. This information was analyzed to develop the integrated management plan.	selected people who discuss the project needs to complete at cost, on schedule and quality.	effective integrated management plan, which accommodates all necessary factors.
3. To develop Scope Management Plan to measure the work required, and only the work required, completing the project successfully.	3. One-on-one interviews were conducted with key/expert players to determine scope needs and requirements.	3. The focus groups are used to identify and explore how people think and behave, and they throw light on why, what and how questions to develop the scope management plan.	A literature review survey of scholarly sources on a scope management plan provides an overview of current knowledge, allowing you to identify relevant theories, methods, and gaps in the existing research that you can later apply to this assignment.
4. To develop a Schedule Management Plan to define the timeline for the project deliverables to ensure the project's timely completion	4. One-on-one interviews were conducted with key/expert players to provided knowledgeable and expert information, which was analyzed and compiled to develop the	4. A group of key stakeholders discussed the scheduled management plan and tools and techniques needed for the management of the plan	5. A review of past projects, resources available for the development of the schedule management plan. A literature review which includes the book Practice Standards for Scheduling, Third Edition (PMBOK GUIDE 2019).

	schedule management plan.		
5. To develop a Cost Management Plan to plan, estimate, and manage the budget for all project activities, deliverables, and resources.	5. One-on-one interviews were conducted with key/expert players to obtained valuable insight to develop costs and create a cost management plan for the project.	6. Through group interaction the cost management plan was developed.	7. A review of in-house and market rates to be reviewed to develop a cost management plan.
6. To develop a Quality and Safety Management Plan to ensure that all project deliverables meet stakeholders' expectations and universal standards	6. One-on-one interviews were conducted with key/expert players to provided knowledgeable and expert information, which was analyzed and compiled to develop the quality and safety management plan.	8. The focus groups are used to identify and explore quality and safety management plans.	3. A desk review of all quality and safety standards nationally and internationally to ensure the project meets project requirements. A literature review of the book Project Quality Management, Why, What and How (Rose, 2005).
7. Develop a Resource Management Plan to identify, acquire, and manage all physical and human resources	7. One-on-one interviews were used to obtain valuable insight to determine the resources needed for the project and to create a cost	9. The focus groups are used to identify and explore the optimum use of resources by the use of a resource management	4. Collecting, interpreting, and analysis of technical reports and guides for developing the resource management plan.

needed to complete the project successfully.	management plan for the project.	plan.	
8. To develop a Communications Management Plan to ensure effective communication with project stakeholders and record all project communications.	8. This method provided knowledgeable and expert information, which was analyzed and compiled to develop the communication management plan.	10. A group of key stakeholders discussed the communication management plan and tools and techniques needed for the management of the plan.	5. A review of technical procedures and protocols for communication in the Ministry to develop a communication managemnt plan.
9. Develop a Risk Management Plan to increase the probability/impact of positive risks (opportunity) and decrease the probability/impact of negative risks.	9. This method provided knowledgeable and expert information, which was analyzed and compiled to develop the risk management plan.	11. The focus groups are used to identify and explore risk management plan for threats and opportunities which may arise on the project.	6. A review of lesson learned on past projects as well as to be examined to develop a risk management plan.
10. To develop a Procurement Management Plan to develop and administer agreements for products and/or services needed from outside the organization or project team expertise.	10. This method provided knowledgeable and expert information, which was analyzed and compiled to develop the procurement management plan.	12. A group of key stakeholders discussed the procurement management plan and tools and techniques needed for the management of the project.	7. A review of documents and lessons learnt from previous procurement procedures.
11. Develop a Stakeholder	11. This method provided	13. A group of key stakeholder	8. Documents were analyzed to assess

Management Plan to identify all groups and/or individuals potentially affected by the project and ensure that their	knowledgeable and expert information, which was analyzed and compiled to develop the stakeholder management plan.	forms the focus group where a stakeholder's management plan is outlined for the project.	the current situation and determine the tools and techniques needed for collecting, interpreting, critical thinking and analysis of information.
12. To measure the project against regenerative development.	12. Provided expert knowledge in conducting the P5 impact analysis as well as understanding the tool.	14. Through group interaction the measures for regenerative development was outlined.	9. A literature review survey of scholarly sources on a regenerative development plan provides an overview of current knowledge, allowing you to identify relevant theories, methods, and gaps in the existing research that you can later apply to this assignment.

Note. Research methods used for the project and the objectives.

3.3 Tools

A tool can be referred to as something tangible, such as a template or software program, used in performing an activity to produce a product or result (PMBOK GUIDE, p. 725, 2017). Greene and Stellman (2018) describe project management's tools and techniques as the process or work to turn project management's inputs into outputs. These tools assist the project team to carry out and organize tasks effectively and efficiently.

This section describes the tools and techniques used in developing the project management plan for the project Road Asset Management Systems (RAMS) which follows

the Project Management Body of Knowledge to meet the proposed deliverables and

objectives. Chart 3 summarizes the tools and techniques used in developing the project

management plan which are based on the PMBOK® Guide Sixth Edition (PMBOK

GUIDE, 2017).

Chart 3

Tools and Techniques

Objectives	Tools
To define project charter to define the key input elements required to develop the project management plan.	1. Expert judgment 2. Data gathering (Brainstorming, focus groups and interviews) 3. Interpersonal and team skills 4. Meetings
To develop an Integrated Management Plan to coordinate all the elements the project needs to be complete at cost, on schedule and quality.	1. Expert judgment 2. Data gathering (Brainstorming, focus groups, checklist and interviews) 3. Interpersonal and team skills 4. Meetings
To develop Scope Management Plan to measure the work required, and only the work required, completing the project successfully.	1. Expert judgment 2. Data analysis (alternatives) 3. Meetings
To develop a Schedule Management Plan to define the timeline for the project deliverables to ensure the project's timely completion.	1. Expert judgment 2. Data analysis (alternatives) 3. Meetings
To develop a Cost Management Plan to plan, estimate, and manage the budget for all project activities, deliverables, and	1. Expert judgment 2. Data analysis (alternatives) 3. Meetings

resources.	
To develop a Quality and Safety Management Plan to ensure that all project deliverables meet stakeholders' expectations and universal standards.	1. Expert judgment 2. Data gathering 3. Data analysis 4. Decision making 5. Data representation 6. Test and Inspection planning 7. Meetings
Develop a Resource Management Plan to identify, acquire, and manage all physical and human resources needed to complete the project successfully.	1. Expert judgment 2. Data representation 3. Organizational theory 4. Meetings
To develop a Communications Management Plan to ensure effective communication with project stakeholders and record all project communications.	1. Expert judgment 2. Communication methods 3. Interpersonal and team skills (political awareness, cultural awareness and communication styles) 4. Data representation 5. Meetings
Develop a Risk Management Plan to increase the probability/impact of positive risks (opportunity) and decrease the probability/impact of negative risks.	1. Expert judgment 2. Data analysis (alternatives) 3. Meetings
To develop a Procurement Management Plan to develop and administer agreements for products and/or services needed from outside the organization or project team expertise.	1. Expert judgment 2. Data gathering (market research) 3. Data analysis 4. Source selection analysis 5. Meetings
Develop a Stakeholder Management Plan to identify all groups and/or individuals potentially affected by the project and ensure that their concerns are addressed.	1. Expert judgment 2. Communication methods 3. Interpersonal and team skills (political awareness, cultural awareness and communication styles) 4. Data representation 5. Meetings
To measure the project against regenerative development	1. Expert judgment 2. Data gathering

	3. Data analysis 4. Meetings

Note. Tools and Techniques used to develop the Project Management Plan for RAMS

3.4   Assumptions and constraints

The PMBOK Guide (2017) defines an assumption as a factor in the planning process that is considered to be true, real, or certain, based on knowledge, experience and information provided by the team, on the other hand, the PMBOK refers to a constraint as a limiting factor that affects the execution of a project, program, portfolio or process. Assumption and constraints analysis is a part of the project management processes. If it is not made properly analyze, it may affect the project's health. The project management plans need to change if assumptions are verified wrong.

A summary of assumptions and constraints used in the Final Graduation Project is shown in Chart 4 below.

Chart 4

Assumptions and constrains

Objectives	Assumptions	Constraints
To define project charter to define the key input elements required to develop the project management plan.	All relevant factors are covered for in the project charter and are achievable.	Limited information to gather all necessary data.
To develop an Integrated Management Plan to coordinate all the elements the	That the integrated management plan is completed without any issues.	Limited information to gather all necessary data.

Objectives	Assumptions	Constraints
project needs to be complete at cost, on schedule and quality		
To develop Scope Management Plan to measure the work required, and only the work required, completing the project successfully.	That the scope management plan covers all requirements for the project.	Unforeseen additional works required to complete the project
To develop a Schedule Management Plan to define the timeline for the project deliverables to ensure the project's timely completion.	That the schedule management plan is realistic and schedule time is achievable.	The time allocated to the execution of the project shall not exceed intended close date.
To develop a Cost Management Plan to plan, estimate, and manage the budget for all project activities, deliverables, and resources.	The budget developed will be a true reflection of the funding required to execute the project	Limited funding limits the full executable scope. A phased approach to the scope is likely.
To develop a Quality and Safety Management Plan to ensure that all project deliverables meet stakeholders' expectations and universal standards.	The quality management plan will detail all the specifications and standards that will guide the quality management process.	Meets project quality standards and specification.
Develop a Resource Management Plan to identify, acquire, and manage all physical and human resources needed to complete the project successfully.	That all resources are readily available for project implementation.	Resources needed for project assignment is not available or does not meet certain qualification and experience criteria.
To develop a Communications Management Plan to ensure effective communication with project stakeholders and record all project communications.	That all stakeholders will be easy to communicate and work with.	Resources for communication needed by project team not available.
Develop a Risk Management Plan to increase the probability/impact of positive risks (opportunity) and decrease the probability/impact of negative risks.	All foreseeable risks will be identified, monitored and managed.	The occurrence of unforeseen risks pushes the project off its scheduled course and exceed project budget.

Objectives	Assumptions	Constraints
To develop a Procurement Management Plan to develop and administer agreements for products and/or services needed from outside the organization or project team expertise.	That the procurement process will be successfully without any retendering.	The funding for the project has an expiry date for spending and the procurement process is unsuccessful.
Develop a Stakeholder Management Plan to identify all groups and/or individuals potentially affected by the project and ensure that their concerns are met.	There are no negative impacts on the project from stakeholders who are not in agreement with the project.	Stakeholders not responding in a timely way to requests.
To measure the project against regenerative development.	That regenerative process can materialize.	No funding to implement regenerative processes/initiatives.

Note. Assumptions and constraints to be considered during the development of the project management plan.

3.5   Deliverables

Project deliverables refers to all the outputs; they may be tangible or intangible in nature, which is submitted within the scope of a project. Project deliverables need to be agreed upon by key stakeholders early during the planning stage. This allows for planning to properly set expectations, allocate resources and documented within a governing project charter so they can be referenced throughout the duration of the Project (Teamwork, 2023). The expected deliverable for each expectation is explained in Chart 5 below.

Chart 5

Deliverable

Objectives	Deliverables
To define project charter to define the key input elements required to develop the project management plan.	A project charter is developed for project planning to outline the key aims and benefits of the RAMS project. It's an at-a-glance guide to why a project is taking place. It's used get buy-in from stakeholders and a reference point to keep the project on track.
To develop an Integrated Management Plan to coordinate all the elements the project needs to be complete at cost, on schedule and quality.	Project integration management plays a critical role in orchestrating the multitude of project activities, processes, and stakeholders. It also involves harmonizing various project elements and aligning them towards a common goal.
To develop Scope Management Plan to measure the work required, and only the work required, completing the project successfully.	The process whereby the outputs, outcomes and benefits are identified defined and controlled. The Scope Management plan is written document to establish the work required, and only the work required, to complete the project successfully.
To develop a Schedule Management Plan to define the timeline for the project deliverables to ensure the project's timely completion.	The Schedule Management Plan defines the timeline for the project deliverables to ensure the project's timely completion. It is a document that details how a project's schedule will be created, managed, and monitored.
To develop a Cost Management Plan to plan, estimate, and manage the budget for all project activities, deliverables, and resources.	The Cost Management plan is a document that helps you map and control a budget. It enables project managers to estimate their direct and indirect costs, allocate resources to the right areas, and control overall spending.
To develop a Quality and Safety Management Plan to ensure that all project deliverables meet stakeholders' expectations and universal standards.	The Quality Management Plan documents the necessary information, specification, and guidelines required to effectively manage project quality from project planning to delivery. It defines a roles, responsibilities and authorities on the project team.

Develop a Resource Management Plan to identify, acquire, and manage all physical and human resources needed to complete the project successfully.	The Resource Management Plan identifies, acquires, and manages all the resources needed to successfully complete the project. It also guides how project resources should be categorized, allocated, and released.
To develop a Communications Management Plan to ensure effective communication with project stakeholders and record all project communications.	This Plan documents how everyone working on a project can communicate best. The plan can define each team member's responsibilities regarding communication and which channels are best.
Develop a Risk Management Plan to increase the probability/impact of positive risks (opportunity) and decrease the probability/impact of negative risks.	Potential risks on the project are documented and the steps the team/individual should take to keep those risks at acceptable levels.
To develop a Procurement Management Plan to develop and administer agreements for products and/or services needed from outside the organization or project team expertise.	This document defines a particular project scheduling requirements and lay down the steps required to get into the final contract stage. The procurement management plan sets out how the procuring organization will acquire the goods and services it needs.
Develop a Stakeholder Management Plan to identify all groups and/or individuals potentially affected by the project and ensure that their concerns are addressed.	A stakeholder management plan is a written document that outlines how your team plans to manage the goals and expectations of key stakeholders during the project lifecycle.
To measure the project against regenerative development.	Regenerative development for this project ensures the management of methods, tools, and techniques to achieve the project's objective while considering the project entire lifecycle to ensure a net positive impact environmental, social, and economic impact.

Note. The project deliverables are outline which will ensure project objectives are meet.

4 RESULTS

In this section, the results are centered on the project management knowledge areas and processes considered as best practices for project management. The project management plan will set measurable results, which will be guide the projections of planning, execution, closing and the incorporation of sustainability and regenerative systems in the road asset management systems. The project management plan will develop systems to manage stakeholders and risks, as well as to monitor and evaluate success.

4.1 Project Integration Management

PMBOK GUIDE (2017) describes Integration Management as the process and activities used to identify, define combine and coordinate the various process and management activities within the project management process groups. Likewise in the project integration management plan for the RAMS project will include the making choices about:

1. Resource allocations

2. Balancing competing demands

3. Examining any alternate approaches

4. Tailoring the process to meet project objectives

5. Managing the interdependencies among the project management knowledge areas.

The project integration management plan will be managed by the Project Manager, whereas the knowledge areas will be managed by specialist and expert. However, the accountability of project integration management cannot be transferred or delegated but lies ultimately on the Project Manager of RAMS.

This project integration management ensures that the deliverables due dates are aligned with project objectives. RAMS project performance and changes will be managed in the project management plan as well as measuring and monitoring project progress. All data collected during project implementation will be analyzed and communicated to relevant stakeholders. All phases of the project will formally be closed and the project as a whole. The transition of the project into the Ministry will be managed to ensure the project continuity and sustainability.

The processes that will be developed under this section are as follows:

a) Project charter

b) Project Management Plan

c) Direct and manage project work

d) Manage Project Knowledge

e) Monitor and control project work

f) Perform integrated change control

g) Close project or phase.

4.1.1   Develop Project Charter

The Project charter developed for this project is a document that formally authorizes the existence of the project and provides the project manager with the authority to organize resources and activities for the project.

To develop the Project charter input were used from business documents, government policies, agreement between different government agencies and enterprise environmental factors. Tools and techniques used for the development of the project charter were expert judgment from the Ministry, data gathering from interviews with the Permanent Secretary and Chief Technical Officer as well as meeting with the Technical Unit of the Ministry. These meetings and interviews with key stakeholders are to identify the project's objectives, success criteria, key deliverables, high-level requirement and summary milestones. The output of this process was the project charter and assumptions log which is detailed in Appendix 1. Appendix 1 provides information on what the research question is, the hypothesis and objectives of the assignment is outlined. Details of the Project justification and benefits to the organization as well as a WBS and FGP Budget. In the Project charter the Project assumptions and constraints are explained. The Project milestones and frameworks are discussed. The project validation in the field of sustainability and regenerative process are included in the Project. The charter also provides an overview of possible risks that may be encountered during the execution of the project and how these risks will impact the project.

4.1.2   Develop Project Management Plan

The benefit of this process is the production of a comprehensive document that defines the basis of the project work and how the work will be performed. All plans are defined, prepared, coordinated and consolidated into a integrate project management plan.

The inputs for this process are the project charter, outputs from other processes, enterprise environmental factors (government policies and mandates) and the organizational process assets of the Ministry. The tools and techniques used are expert judgment, data gathering from interviews and meetings. A detailed project management plan is the output for this process which defines how the project is executed, monitored and controlled and closed. This document will be baseline for project references to the scope, time and cost, so that the project can be measured for performance.

The project management includes: a scope management plan, requirements management plan, schedule management plan, cost management plan, a quality management plan, resource management plan, communication management plan risk management, procurement management plan, stakeholder management plan and sustainability/regenerative management plan. These plans will be subsequently defined in this report.

4.1.3   Direct and Manage Project Work

The overall management of the project is done by the Project Manager and project team. Project managers are responsible for overseeing multiple activities simultaneously,

measuring and monitoring project progress, coordinating the work of various agencies and government entities, and ensuring they meet deadlines. The Project manager is required to lead and motivate team members who often have different skill sets, educational backgrounds, and levels of experience. Project resources which are allocated to the project by the Ministry are efficiently managed.

4.1.4   Manage Project Knowledge

The use of existing organizational knowledge in the Ministry will be used to benefit the project to improve and produce outcomes that support the future operations of project implementation phases.

Knowledge from this project stems from previous project management plans, project documents, project team, lessons learned register and organizational process assets. The tools and techniques used connect people to create new knowledge and integrate knowledge derived from team member skills, expertise and experience. The project will communicate with different focus groups in the Ministry, conduct workshops and training to share knowledge and increase capacity of the technical staff. The information gathered will be managed and stored in the "CLOUD" and the Government database. Access to the information will be limited to authorized personnel. The Project Manager manages political interactions on the project. Identifying and managing those stakeholder interests is an important task as a project manager.

4.1.5   Monitor and Control Project Work

Overall project progress is tracked, reviewed and reported on to ensure progress meets the performance objectives defined in the project management plan. Control mechanisms will be adopted to determine corrective and preventative action or re-planning of activities under the project. The processes under this section entail:

- Comparing the actual project performance against planned activities.

- Check status of individual project risk

- Status reports, progress measurements and furcating of performance

- Forecasting project cost and scheduling information.

- Monitoring approved changes

- Ensuring project stays aligned to business needs, project milestones and project objectives.

- Ensure government standards, regulations are at adhered to.

By monitoring the project in real time, ensures work stays on deadline and on budget. Besides keeping a project on schedule and avoiding overspending, project monitoring is used to manage risk and avoid scope creep. By tracking various metrics, risks are identified early which means earlier mitigation. When changes are requested to the project, control procedures are applied.

4.1.6   Perform Integrate Change Control

All change requests in the project will be reviewed by the project manager, project

team and relevant stakeholders, to which a final decision will be communicated. They

perform integrate change control process is conducted from project start through

completion and is the ultimate responsibility of the project manager (PMBOK GUIDE,

2017). Once the project baselines are established a change request goes through a process.

Changes are recorded in written form and entered into the change management and/or

configuration management systems. All change requests will require information on

estimated schedule impact and cost estimate prior to approval.

        When the change request impacts on the project's baselines, a formal integrated

change control process is required. When the cost estimate is above USD$50,000.00, the

perform integrated change control process includes a change control board (CCB). The

board is charged with reviewing, evaluating, approving, deferring or rejecting changes to

the project and communication the decisions. Appendix 6 provides a sample of change

request form.

4.1.7   Close Project or Phase

        The project manager reviews the entire project before closing it, rating performance

and comparing that to the baseline. The project team will be part of this process, offering

their observations and feedback, which is collected in a lesson's learned document. This

provides guidance for future projects in the organization. The project data and information

are archived, the planned objectives are completed, and organizational team resources are released to pursue new endeavors.

Meetings, such as close-out reporting meetings, customer wrap-up meetings, lessons learned meetings, and celebration meetings are held with stakeholders to confirm that the deliverables have been accepted, to validate that the exit criteria have been met, to formalize the completion of the contracts and to evaluate the satisfaction of the stakeholders.

Activities of the closing phase for the project are namely:

1. All deliverables are up to date and all issues resolved

2. Submission of all final reports

3. Confirm the delivery and formal acceptance of deliverables by the customer

4. Ensure that all cost is charged to the project and finalize all pending claims.

5. Closing project accounts

6. Reassigning personnel from the Ministry

7. Reallocating material, equipment and resources to the Ministry

8. Audit process success or failure

9. Manage knowledge sharing and transfer

10. Identify lessons learned and archive information in the log (see Appendix 6).

11. Measure stakeholder satisfaction

4.2   Scope Management Plan

This scope management plan outlines the processes involved in executing the project and serves as a guideline to keep the project within specific limits to complete the project successfully. As the project manager, managing the project scope is concerned with defining and controlling what is and is not included in the project (PMBOK GUIDE, 2017). PMBOK GUIDE (2017) lists the scope management processes as: plan scope, collect requirements, define scope, create WBS, validate scope, and control scope as seen in Figure 9.

Figure 9

Scope management processes
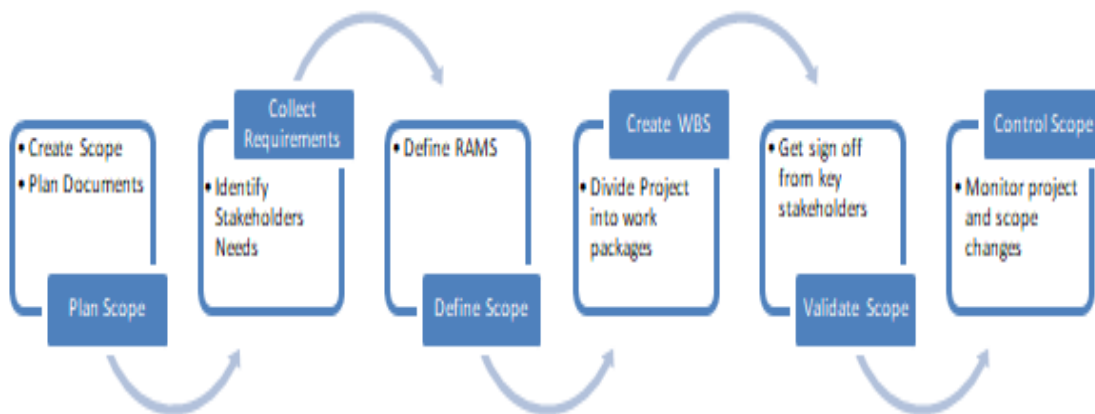
Note. The scope management processes are a guide to ensure the project remains within its specific limits.

The scope management plan assists the project manager to allocate resources in such a manner that the project can finish on time, within budget and with the quality expected by stakeholders.

4.2.1 Plan Scope Management

In this section the project scope plan will be defined, developed, monitored, controlled and validated throughout the project. The data and information in the project charter is analyzed, historical information contained in the ministry's organizational process assets, relevant enterprise environmental factors, as well as latest approved subsidiary plans of project management plan. The output of this section is:

1. Processes for preparing scope statement

2. Processes that enable the creation of a WBS

3. Processes that establish the scope baseline

4. Processes to specify formal acceptance of completed deliverables

4.2.2 Collect Requirements

Collect requirements is the process of determining, documenting and managing stakeholder needs and requirement to meet the project's objectives (PMBOK GUIDE 2017). The requirements may include conditions and skills that should qualify the needs of the project. These requirements are the foundation of the work breakdown structure (WBS).

With the use of expert judgment, research methods such as surveys and stakeholder meetings held weekly during the first month of planning, the requirements of the facility were compiled, analyzed, prioritized and documented by the project management team.

Through these actions, the major requirements that satisfy the main objectives of the project were composed using a requirement traceability matrix seen in Table 3 below.

Table 3.

Traceability Matrix for RAMS Project

Requirements Traceability Matrix								
Project Name	**Road Asset Management Systems**							
Cost Center	**Technical Unit, Ministry of Public Works, Public Utilities and Digital Economy**							
Project Description	**The Road Asset Management System (RAMS) maximizes the value of the road infrastructure from available funds. Physical characteristics on the assets will be collected and stored in a database to analyze each asset's vulnerability to climate change and prioritize interventions for repairs, rehabilitation or reconstruction.**							
ID	WBS ID	**Requirement Description**	**Business Needs, Opportunities, Goals Objectives**	**Project Objectives**	**WBS Deliverables**	**Priority**	**Technical Requirements**	**Verification Criteria**
001	1.3.1	Needs Assessment.	To determine the scope of work required	A needs assessment to be completed to determine the systematic process for determining and addressing needs and gaps between current conditions and desired conditions. Needs assessment is required for planning project scope. It is also used to clarify problems and identify appropriate solutions.	Needs Assessment.	High	Assistance from the Ministry's Management and Technical Unit is required through meetings.	D1-Inception Report
	1.3.1.1	Desk Study	Conduct desk study of relevant documents	To review policies and standards which governed by the ministry. Review existing systems used by the Ministry to manage assets. Review unit rates for maintenance and new construction.	Desk Study	High	Online research and hard copy documents made readily available by Technical Unit.	D1-Inception Report
	1.3.1.2	Review Ministry's framework.	Opportunity to improve the workability of the organization	Review existing organization chart of the Ministry. Review task and responsibilities of technical staff	Review Ministry's framework.	High	Technical Unit to make organizational chart	D1-Inception Report
	1.3.1.3	Review Ministry data storage mechanism	To determine if additional or new form of data storage is needed.	Review the mechanism used to store data.	Review Ministry data storage mechanism	High	Meetings to be held with GIS and DOMINODE.	D1-Inception Report
002	1.3.2	Asset Inventory	Characteristic of asset	All assets will be characterized based on type of material, size, and age.	Asset Inventory	High	Determination of existing inventory at the Ministry (hard or soft copies)	D2-Asset Data Collection
	1.3.2.1	Asset Conditional Assessment	To determine the condition of the assets.	Data collection of all road assets namely: pavement, drainage, culverts, bridges and cut slopes	Asset Conditional Assessment	High	Technical Unit to assist in collecting asset data out onsite.	D2-Asset Data Collection
	1.3.2.2	Road Traffic Count	To determine the value of the road as it relates to the number of drivers usage.	Determine all road counts (AADT)	Road Traffic Count	High	Technical requirement includes Pneumatic counts and technical assistance to install and upload data.	D2-Asset Data Collection
	1.3.2.3	Windshield	To provide a pictorial view	Compile 360^0 views of road profiles	Windshield	High	Requirements include a vehicle	D2-Asset Data Collection

		Survey	of the assets from a driver's perspective.		Survey		where a 360^0 camera can be installed on the top of the vehicle as well as a cellphone on the dashboard.	
	1.3.2.4	GIS mapping of assets	To locate and geo-reference assets easily.	Use of GIS to locate road assets	GIS mapping of assets	High	GIS Officer is needed to input all coordinates for assets.	D2-Asset Data Collection
003	1.3.3	Asset vulnerability	To determine the coping capacity of your assets to climate change	Determine asset scoring for vulnerability (Risk, exposure, coping capacity or sensitivity)	Asset vulnerability	High	Technical Unit to agree on the method of determining level of damage of each type of asset.	D2-Asset Data Collection
004	1.3.4	Project Systems	To develop a system which is easy to learn and use.	The type of program used to develop the website will be explained as well as it different functions	Project Systems	High	Technical unit to provide feedback on what is to be expected on the website.	D3-RAMS Draft Program
	1.3.4.1	Asset rehabilitation Mechanisms	Opportunity to increase asset design life by means of remedial works.	Method to be used for repairs.	Asset rehabilitation	High	Technical unit to agree upon methods of rehabilitation to be undertaken for each level of damage.	D3-RAMS Draft Program
	1.3.4.2	Cost of Repairs	An opportunity to prioritize assets based on budget restraints.	Determine budget cost for repairs	Cost of Repairs	High	Technical unit to provide support on unit rates estimates for repairs.	D3-RAMS Draft Program
005	1.3.5	RAMS	Develop a website where data can be stored and analyzed for asset prioritization.	Determine optimum solution for vulnerable assets.	RAMS	High	Technical requirement may include access to the Government data base, password requirements for different level of staff.	D4-RAMS Program Final
	1.3.5.1	RAMS Program	To store asset data, determine optimum intervention for repairs, and reduce asset performance gaps.	Development of the program	RAMS Program	High	Programmer is needed to develop the RAMS program and website	D4-RAMS Program Final
	1.3.5.2	Capacity Building of the Ministry	An opportunity to increase the technical capacity of your employees.	Train technical staff to use the program and collect data out in the field.	Capacity Building of the Ministry	High	Technical requirements are workshops to engage and interact with the technical staff to ensure that they are knowledgeable about the system developed.	D5-RAMS Training and Manual
	1.3.5.3	RAMS Manual	Opportunity for new staff to easily understand the program or for new consultancy to improve on the program in the future	To develop a manual for ease of operations of RAMS.	RAMS Manual	High	Technical Unit to revise and review RAMS manual and provide feedback to improve the manual.	D5-RAMS Training and Manual

Note. The requirements traceability matrix shows how requirements relate to other artifacts and demonstrates that requirements have been met and prioritized.

4.2.3   Define Scope

This process provides a detailed description of the project and acceptance criteria. The define scope process can be highly iterative. The development and the operationalization of a RAMS will enable the prioritization of public infrastructure spending through an optimized program of periodic maintenance and rehabilitation interventions, supported by the identification of financing mechanisms to ensure the sustainability of the RAMS in the long term. The program should be user friendly and functional at the end of the project.

4.2.3.1   Scope Statement

Road infrastructure is a major investment for the country. The Ministry, must maintain, operate, improve, replace and preserve these assets. The Road Asset Management System (RAMS) maximizes the value of the road infrastructure from available funds. Physical characteristics on the assets will be collected and stored in a data base to analyze each asset's vulnerability to climate change and prioritize interventions for repairs, rehabilitation or reconstruction. RAMS program can integrate assets such as building and utilities; however, for this assignment it is limited to road assets.

4.2.3.2 Create a WBS

This section develops the process to subdivide project deliverables and project work into smaller, more manageable components. A framework of what is to be delivered of the total scope of works. The planned work is contained within the lowest level of the WBS components called work packages, which are grouped into activities where work is scheduled, estimated, monitored and controlled.

This WBS is a visual, hierarchical and deliverable-oriented deconstruction of the project. It is used by the project managers to break down the project scope and visualize all the tasks required to complete their projects. Figure 10 provides a detailed work breakdown structure for the execution of the overall RAMS project. Figure 11, however details all the management plans needed to effectively execute and manage the project.

Figure 10

Work Breakdown Structure (WBS) for RAMS
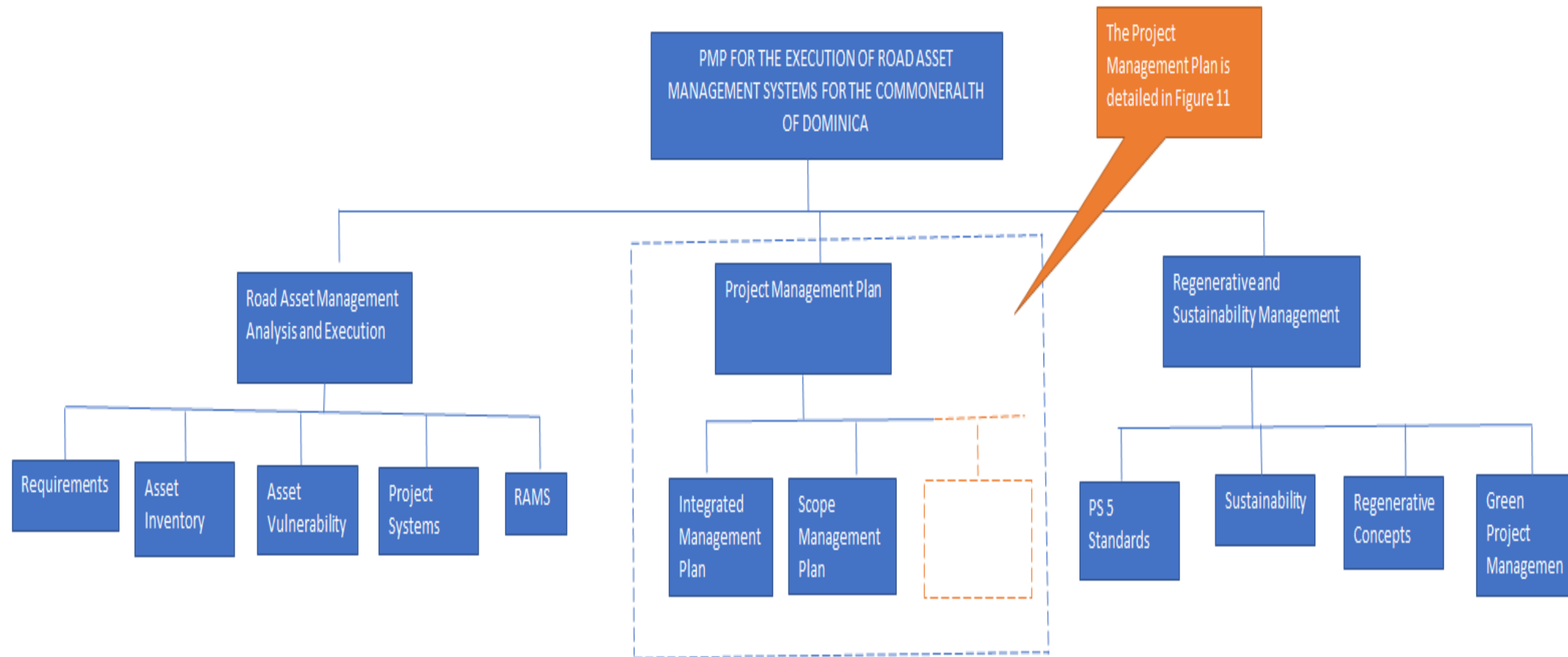
Note. The RAMS WBS breaks work activities into smaller tasks, which is a productivity technique used to make the work more manageable and approachable.

Figure 11

Work Breakdown Structure (WBS) for RAMS Project Management Plan in detail
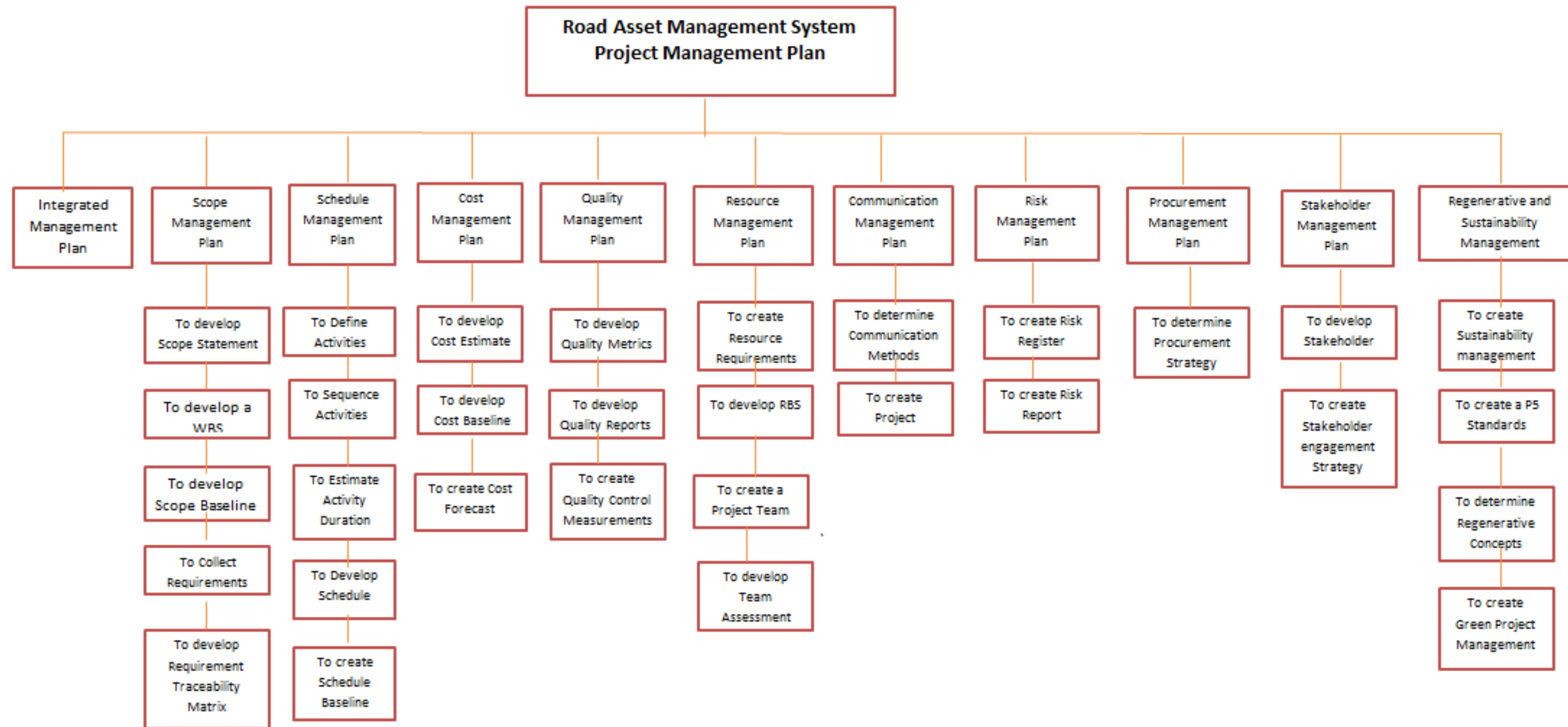
Note. The Project Management Plan for RAMS WBS breaks work clearly demonstrates the relationship between the project deliverables and objectives.

4.2.4   Work Breakdown Structure Dictionary

Work Breakdown Structure Dictionary provides details of the tasks, activities, and deliverables of the work breakdown structure. The content includes whatever milestones are related, the project scope, persons responsible and acceptance criteria. The WBS dictionary is also an essential part of the scope baseline. Table 4 provides detail definitions of each major activity on the project.

Table 4.

Work Breakdown Structure Dictionary - RAMS

WBS Code	Work Packages	Description of Work	Responsibility	Deliverables	Acceptance Criteria	Assigned Resources
1.3.1	Needs Assessment.	The needs or gaps between a current and desired outcome are determined to develop a strategic plan for project successful implementation. This needs assessment pinpoints how you will accomplish your strategic goals.	Project Manager	D1-Inception Report	Sign off/acceptance of inception report, which details project scope	Project Manager Project Team Ministry's Technical Unit
1.3.1.1	Desk Study	A preliminary study is carried out before more detailed physical investigations. This is done to understand the challenges at the Ministry, any existing programs, international standard being used for road asset management systems. The desk study also identifies potential risks , required data for project and methodology for project implementation. report begins introducing the condition of roads in Dominica and their impact on the life and economy of the island's inhabitants. On the legislative framework, there was only two pieces of legislation specifically for the roads sector in Dominica: Roads Ordinance (1961) and Vehicles and Road Traffic Act (1993).	Project Manager	D1-Inception Report	Sign off/acceptance of inception report, which details project scope	Project Manager Project Team Ministry's Technical Unit
1.3.1.2	Review Ministry's framework.	The Ministry's framework is reviewed to understand the operations of the organization. The organizational chart is reviewed to determine if a new unit is needed for the sustainability of RAMS or can it be integrated into the existing framework by assigning individuals additional responsibility to the day-to-day work. The policies and standards of the Government are reviewed to ensure that this project remains with the mission and vision of the Dominica to meet their sustainable development goals.	Project Manager	D1-Inception Report	Sign off/acceptance of inception report, which details project scope	Project Manager Project Team Ministry's Technical Unit

1.3.1.3	Review Ministry data storage mechanism	The review of the existing data storage GIS/DOMINODE to determine the best way to integrate all data collected into the system. The system used should be able to provide access for data/program maintenance and upgrading.	Project Manager	D1-Inception Report	Sign off/acceptance of inception report, which details project scope	DOMINODE GIS Project Team
1.3.2	Asset Inventory	All road assets namely: roads, bridges, culverts, slopes, retaining walls, drainage (box, earthen) will be documented. The size, material, location will be uploaded into the program. IRI data on road rideable condition will also be imputed into the system.	Project Manager	D2-Asset Data Collection	Sign off/acceptance of inception report, which details project scope	Project Manager Project Team Ministry's Technical Unit
1.3.2.1	Asset Conditional Assessment	The condition of all assets will be document to determine maintenance method and prioritize assets.	Project Manager	D2-Asset Data Collection	Sign off/acceptance of inception report, which details project scope	Project Manager Project Team Ministry's Technical Unit
1.3.2.2	Road Traffic Count	Traffic data of all roads will be compiled and used to determine the relevance of the road for prioritizing maintenance.	Project Manager	D2-Asset Data Collection	Sign off/acceptance of inception report, which details project scope	Project Team Ministry's Technical Unit
1.3.2.3	Windshield Survey	A 360^0 view of all roads will be undertaken to provide a pictorial view of the assets.	Project Manager	D2-Asset Data Collection	Sign off/acceptance of inception report, which details project scope	Project Team Ministry's Technical Unit
1.3.2.4	GIS mapping of assets	All assets will be GEO referenced for ease of access to assets.	Project Manager	D2-Asset Data Collection	Sign off/acceptance of inception report, which details project scope	DOMINODE GIS Project Manager Project Team Ministry's Technical Unit
1.3.3	Asset vulnerability	All assets' vulnerability will be rated using different methods namely 1. Roads the use of IRI. 2. AADT 3. Structural assessment 4. Type of structure	Project Manager	D3-RAMS Draft Program	Sign off/acceptance of inception report, which details project scope	Project Manager Project Team Ministry's Technical Unit
1.3.4	Project Systems	Project systems used to determine project criticality is 1. Asset vulnerability 2. Asset rehabilitation method 3. Cost of repairs	Project Manager	D4-RAMS Program Final	Sign off/acceptance of inception report, which details project scope	Project Manager Project Team Ministry's Technical Unit
1.3.4.1	Asset rehabilitation	The process of making capital and maintenance investment decisions that provide the best long-term performance given available resources, considering	Project Manager	D4-RAMS Program Final	Sign off/acceptance of inception report, which details project scope	Project Manager Project Team Ministry's Technical Unit

		trade-offs and competing needs between different assets and investment objectives.				
1.3.4.2	Cost of Repairs	Unit rates for cost of repairs for maintenance, rehabilitation and new construction. This will be aid in providing cost estimates for national budgets. These unit rates are updated every few months.	Project Manager	D4-RAMS Program Final	Sign off/acceptance of inception report, which details project scope	Project Manager Project Team Ministry's Technical Unit Ministry Quantity Survey's Unit
1.3.5	RAMS	RAMS is developed to assess to road infrastructure and determine maintenance alternative to improve asset life cycle.	Project Manager	D5-RAMS Training and Manual	Sign off/acceptance of inception report, which details project scope	Project Manager Project Team Ministry's Technical Unit
1.3.5.1	RAMS Program	Understanding the data required to run HDM-IV models is crucial to assess the feasibility of integrating full HDM into Dominica's RAMS. Using the manuals and a demo access, a list of data required, together with the units and the numerical range acceptable in each field was generated. It has also been checked whether the program accepts blank data fields, due to the difficulties/cost of obtaining some of the data. This has shown that almost all data are required to run the models.	Project Manager	D5-RAMS Training and Manual	Sign off/acceptance of inception report, which details project scope	Project Manager Project Team Ministry's Technical Unit
1.3.5.2	Capacity Building of the Ministry	Training will be provided to the technical staff who will be undertaking the asset surveys namely engineers and technicians. Training will be provided in the Ministry for a total of two weeks. One week will be for the explanation of the program and its use, the second week the team and Ministry staff will conduct joint site visits to physically survey asset and input data into the program.	Project Manager	D5-RAMS Training and Manual	Sign off/acceptance of inception report, which details project scope	Project Manager Project Team Ministry's Technical Unit
1.3.5.3	RAMS Manual	A manual is developed to aid staff with any concerns or issues which may arise after the system has been developed. The manual will also be an aid for new staff member to understand the RAMS system.	Project Manager	D5-RAMS Training and Manual	Sign off/acceptance of inception report, which details project scope	Project Manager Project Team Ministry's Technical Unit

Note. RAMS Work Breakdown Structure Dictionary conveys detailed information about each project component.

4.2.5 Validate Scope

All project scope will be validated to ensure deliverables are accepted by the client/stakeholders. The key benefit of the process is the increased objectivity and likelihood of the success of the final product.

This particular process is necessary for creating different documents like project document updates, work performance information, accepted deliverables, and change requests.

Tools and techniques used for this section are inspection of deliverables by the project team and stakeholders. There will also be workshops where project status will be presented to gain feedback as well as training sessions for technical staff. At major milestones reports are submitted for review and feedback.

4.2.6 Control Scope

When discussing the control scope process, it is important to identify what scope baseline is for the project. Control scope involves monitoring the project's status, scope and changes. The benefit of this process is that it maintains the scope baseline during the entire project lifecycle.

If there is any deviation found through control scope after comparing the current state of the project and the baseline information, the project manager makes corrective or

preventive action. When such corrective action takes place, a change request is often raised and is approved by the change control board.

An approved version of the project scope is known as a scope baseline. The project scope baseline is composed of the project scope statement, requirements documentation, the work breakdown structure (WBS), and the WBS dictionary where all details of your work breakdown structure are collated which have been described previously.

Unexpected project changes can lead to increased project risks like: missed timelines, increased budgets, overwork, or a low-quality end product. There are various reasons why scope creep can occur. Some reasons include (Asana, 2023):

- Unclear project scope

- Unrealistic project objectives

- Too many stakeholders

- Poor scope management

- Poor communication with stakeholders

To avoid scope creep, you need to plan against it, which is where a strong scope management plan comes into play.

4.3   Schedule Management Plan

A schedule management plan outlines the start and end dates of tasks and milestones that must be accomplished for project completion. Developing a schedule management plan is a critical phase in project planning that ensures you start, monitor,

control, and complete projects successfully. The plan should include each activity's

duration; resources needed, and assigned team members' availability. These establish

a solid baseline, which guides the project through its various stages until completion

(Wrike, 2023). PMBOK GUIDE (2017) defines the processes to manage the timely

completion of the project as the following:

- Plan schedule management

- Define activities

- Sequence activities

- Estimate activity duration

- Develop schedule

- Control schedule

4.3.1   Plan Schedule Management

The project management team selects the schedule method critical path, then project

specific data such as dependencies, constraints and resources are considered in the schedule

tool MS Projects. The Schedule Management Plan for RAMS described in Table 5

provides details on scheduled reporting, performed task and any scheduled adjustments.

Table 5

Schedule Management Plan for RAMS

SCHEDULE MANAGEMENT PLAN-RAMS	
Date: January 4th 2024	Project Name: The creation of a Project Management Plan for the Road Asset Management Systems (RAMS) in the Commonwealth of Dominica.
Schedule Methodology	The project manager and project team will create a schedule model for the project using Microsoft Projects (MS Projects). The schedule will be developed using the critical path method (CPM). It will be stored in an open document repository using Google Docs and updated on a weekly basis. The initial schedule will be based on high-level estimates that will be refined at set intervals as requirements are defined for the project. The schedule will be baseline whenever a change request has been approved.
Tools and Techniques	Expert judgment, meetings, decomposition of large activities, analytical techniques.
Level of accuracy	The initial schedule is expected to be accurate by $+/- 10\%$. At the time passes and information on availability of resources are refined the schedule model will be $+/- 3\%$ accurate. The schedule does take into account risk which may be encountered during project implementation.
Units of Measure	Duration is listed in calendar days, weeks or months.
Define Activities	Activities were identified and determine by the following documents: 1. Project Charter 2. Work Breakdown Structure 3. WBS Dictionary 4. Scope Statement 5. Best Practices for Road Asset Management Systems 6. Organizational culture and structure. 7. Historical information and lessons learned repositories 8. Control related policies/procedures/guidelines
Sequence Activities	The project schedule model will follow the organizational outline provided by the WBS and: 1. The sequencing of activities will be based on the codification of each element, top to bottom, and from work packages to activities, respectively. 2. The project's main activities are determined and the relationship and dependencies between activities are shown. 3. Slack is identified as well as the critical paths of the project. 4. MS Projects is used to visualize the activities and dependencies.
Estimate Resources	The type, quantity, and resource duration required for each deliverable is estimated and documented. The project constraints and assumptions for each activity are analyzed. Historical information and project

	records are analyzed for estimating resources.
Estimated Activity Duration	Estimate the duration of human resources required for each activity as well as the quantity of the material and resources needed for each activity.
Rules of Performance measurement	Earned value management rules will be used as the set measurement for performance. EVM techniques for baseline, fixed formula, and percent complete to be employed. To assess magnitude of variation schedule variance (SV) and schedule performance index (SPI) is used.
Develop Schedule	The schedule will be developed based on the estimated resources, activity duration, and the sequencing of activities. The project schedule will be developed using MS Projects. The schedule will indicate the project duration, start and end date.
Schedule Updates	All schedule status reports will follow the format provided in the WBS. Templates will be developed for reporting of project progress. The project schedule is controlled, monitored, and updated via: 1. Daily Works Reports 2.Bi- Weekly, Monthly and quarterly Project Progress Reports 3. Meetings 4. Project Manager will update the project schedule.

Note. The Schedule Management Plan details how a project's schedule will be created, managed, and monitored.

4.3.2   Define Activities

The project team identifies all tasks or activities needed to complete the work packages. These activities are not the deliverables themselves but the individual units of work that must be completed to fulfill the deliverables. Activities are derived from the work package level of the WBS. Activity attributes are the details that are progressively elaborated as the planning process progresses. These attributes show the logical relationship and the resources required to complete the activity. The benefits of this process are: it

breaks down big work packages into smaller activities so that the project manager can estimate, schedule, execute, monitor and control the project work.

The project team members are involved with the decomposition process because they are highly familiar with the tasks, so they know where and how exactly to break them down.

4.3.3   Sequence Activities

Activity sequencing is done after all the project activities have been identified and refers to putting the activities in a logical order by keeping similar types of work together. Identifying and sequencing activities allows the project manager to define estimates and costs and determine the skills needed for the work of the project. Table 6 shows the activity list for the project sequentially.

Table 6

Activity List for RAMS

Sequence of Activities							
Date	**January 4th 2024**						
Project Name	**The creation of a Project Management Plan for the Road Asset Management Systems (RAMS) in the Commonwealth of Dominica.**						
Project Manager	**Naomi Cherry**						
Critical Path ID	**WBS Code**	**Work package**	**Activity**	**Milestone**	**Predecessor**	**Successor**	**Duration**
1	0		Start		**0**	**1**	
	1.3.1	Needs Assessment.			**0**	**2**	
2	1.3.1.1		Desk Study		**1**	**3**	**5 days**
3	1.3.1.2		Review Ministry's framework.		2	**4**	**10 days**
4	1.3.1.3		Review Ministry data storage mechanism		3	**5**	**7 days**
5				D1-Inception Report			**15 days**
	1.3.2	Asset Inventory			4	**6**	
6	1.3.2.1		Asset Conditional Assessment		5	**7**	**40 days**
7	1.3.2.2		Road Traffic Count		6	**8**	**30 days**
8	1.3.2.3		Windshield Survey		7	**9**	**30 days**
9	1.3.2.4		GIS mapping of assets		8	**10**	**10 days**
10				D2-Asset Data Collection			**20 days**
11	1.3.3	Asset vulnerability		Asset vulnerability	9	**11**	**40 days**
	1.3.4	Project Systems			10	**12**	
12	1.3.4.1		Asset rehabilitation		11	**13**	**30 days**
13	1.3.4.2		Cost of Repairs		12	**14**	**20 days**
14				D3-RAMS Draft Program			**30 days**
	1.3.5	RAMS			13	**15**	
15	1.3.5.1		RAMS Program	D4-RAMS Program Final Version	14	**16**	**40 days**
16	1.3.5.2		Capacity Building of the Ministry		15	**17**	**10 days**
17	1.3.5.3		RAMS Manual		16	**18**	**15 days**
18	1.3.5.4			D5-RAMS Closing			**10 days**
19			Finish				

Note. The RAMS Activity List a list of all scheduled activities within the project.

4.3.4   Estimate Activity Duration

Activity duration estimates are approximations of how much time a project task will take. For this project, task is measured in days of work or business periods. The inputs for estimates of duration originate from the project team who is most familiar with the nature of a specific activity. In order to make an expert judgment of duration consideration is given to the scope of the project, the characteristics of its individual activities, the resources accessible to complete the work and historical data from past projects. The length of project activities often depends on the availability and skill sets of team members who can complete them. The duration of each activity is estimated in the Table 6 above.

4.3.5   Develop Schedule

This iterative process analyzes the activity sequences, duration, resources and schedule constraints to create a schedule model for project execution, monitoring and controlling. This develop schedule model is used to determine the planned start and finish dates of each projects activity and milestones based on available information regarding resource availability. The schedule developed is reviewed to ensure duration estimates, resource estimates and schedule reserves are a realistic baseline to track progress. The project team reviews the schedule to guarantee efficiency in the schedule and safeguard from conflicts, overspending, wasted time or failures to meet deadlines.

The tools and techniques used is the critical path method. This method is used to estimate the minimum project duration and determine the amount of schedule flexibility on the logical network paths within the schedule model. The critical path determined for the project is the sequence of activities that represent the longest path through a project, which determines the shortest possible project duration. The critical path diagram is shown below in Figure 12 as well as the duration of the project using PERT Technique in Table 7.

Figure 12

Critical Path for RAMS
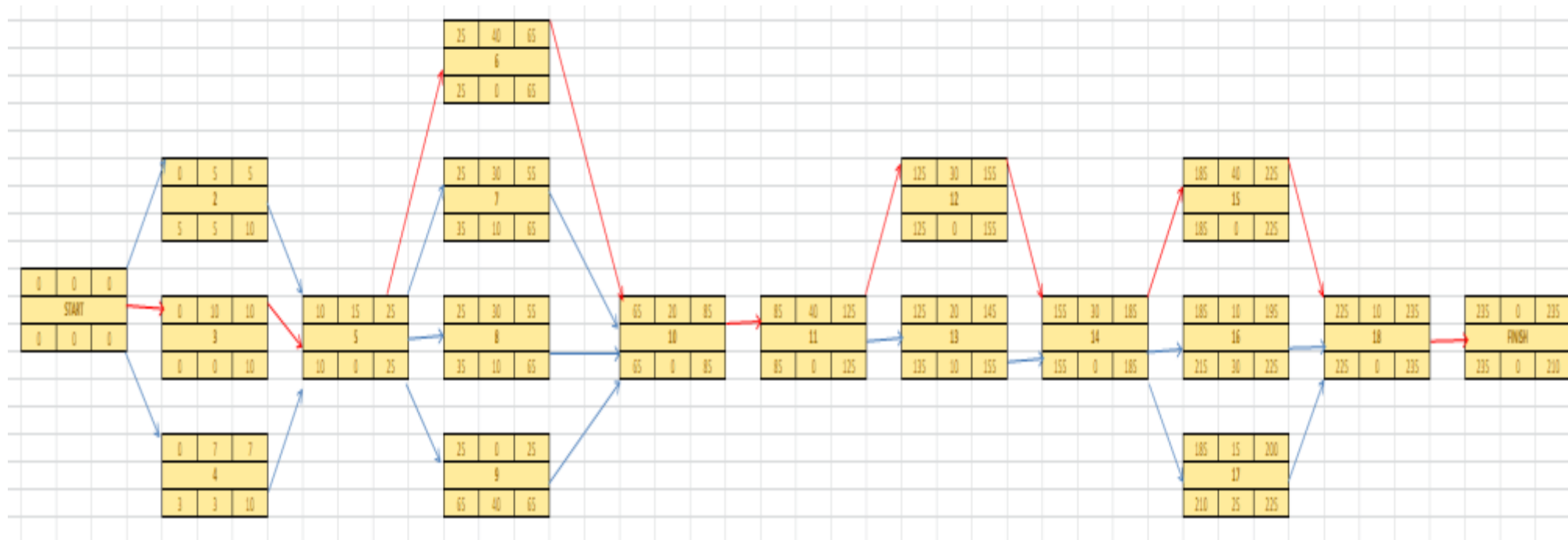
Note. Critical Path is the most extended sequence of tasks that must be accomplished to ensure the completion of the entire project.

Table 7

Project duration using PERT Technique

	Description of Activity	Predecessor	Optimistic Duration (tO)	Most Likely Duration	Pessimistic Duration (tP)	BETA Distribution tE = (tO+4tM+tP)/6	Variance σ2 = ((tP-tO)/6)2	Standard Deviation σ = √σ2	PERT
1	START	NA	0	0	0	0	0		0
2	Desk Study	1	5	7	9	7	0		
3	Review Ministry's framework.	1	10	12	15	12.2	1	1	10
4	Review Ministry data storage mechanism	1	7	9	13	9.3			
5	D1-Inception Report	2,3,4	15	17	19	17	0	1	15
6	Asset Conditional Assessment	5	40	45	47	44.5	1	1	40
7	Road Traffic Count	5	30	35	45	35.8			
8	Windshield Survey	5	30	33	42	34			
9	GIS mapping of assets	5	10	12	17	12.5			
10	D2-Asset Data Collection	6,7,8,9	20	22	27	22.5	1	1	20
11	Asset vulnerability	10	40	43	46	43	1	1	40
12	Asset rehabilitation Mechanisms	11	30	33	39	33.5	2	2	30
13	Cost of Repairs	11	20	23	29	23.5			
14	D3-RAMS Draft Program	12,13	30	35	39	34.8	2	2	30
15	D4-RAMS Program Final Version	14	40	43	49	43.5	2	2	40
16	Capacity Building of the Ministry	14	10	15	21	15.2			
17	RAMS Manual	14	15	17	25	18			
18	D5-RAMS Closing	15,16,17	10	12	15	12.2	1	1	10
19	FINISH						12.75		235

Total Project Duration	235
Sum of Variance square	12.8
Standard Deviation	3.6
Total Project Duration of CPM	DAYS
85% probability	238.6 (12.5months)

Note. The Program Evaluation and Review Technique (PERT) is used for the project to find the estimated time for activities to be completed when there are many unknown factors.

The schedule of the project is developed using MS projects. The schedule model represents the links between activities with planned dates, duration, milestones and resources. Figure 13 provide details of project schedule. The critical path is easily illustrated in red in the figure.

Figure 13

Project duration using MS Projects
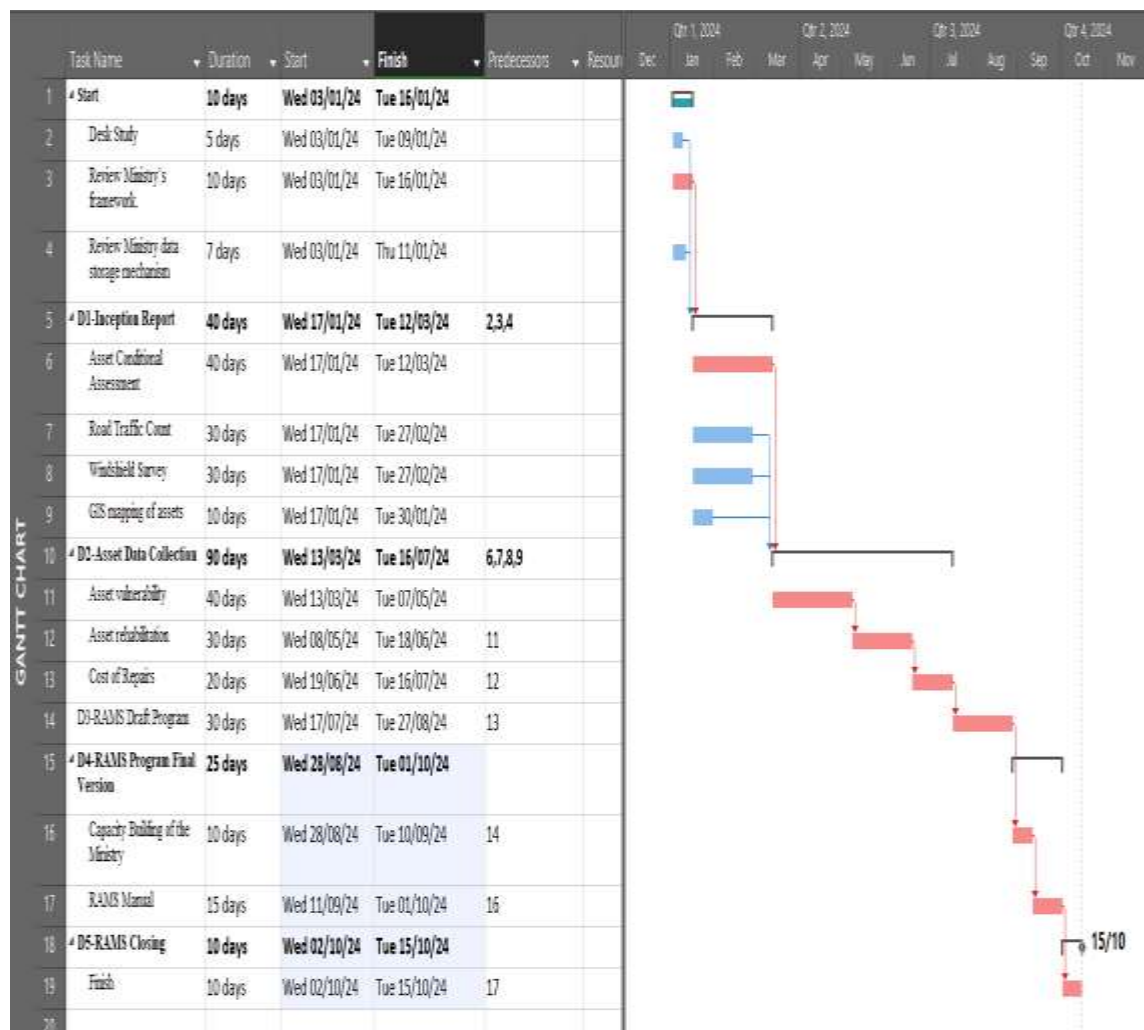
Note. Project duration is used using MS Projects Software.

4.3.6   Control Schedule

The project status is monitored to update the project schedule and manage changes to the schedule baseline. This process is performed throughout the project. The tools and techniques used are the Earned Value Analysis (EVA), Critical Path Method, Leads and Lags, Resource Optimization and Schedule Compression. The project manager is responsible for Control Schedule and it is important that the project manager acts immediately before the changes in the schedule affect or influence the entire project schedule. Another aspect of the control schedule process is that it manages the expectations of the stakeholders by means of giving them advice when work needs to be performed including the type of work, its duration and its impact on the project. The schedule baseline is approved using the Perform Integrated Change Control process. With the control schedule process, it allows project managers to determine the status of the project schedule, conducting reviews, reprioritizing remaining work plan, determining that there is indeed a change of the project schedule and managing actual changes.

There are several steps the project manager needs to take to monitor and control the schedule which includes:

- Review the schedule and schedule baseline regularly.

- Identify variances and take corrective action if needed.

- Monitor the progress of the project and make necessary adjustments.

- Communicate with all stakeholders about the status of the project.

- Keep the project on track and ensure its successful completion.

- Project document updates such as the assumptions log, basis of duration estimates, lessons learned register, project schedule, resource calendar, risk register and schedule data as seen in the appendices.

4.4   Cost Management Plan

PMBOK GUIDE (2017) describes cost management as processes which involve planning, budgeting financing, funding managing, and controlling cost in order to complete the project with budget. The Project cost management processes for this project are:

- Plan cost management
- Estimate cost
- Determine cost
- Control cost.

The cost management plan developed is a document that helps you map and control a budget. It enables the project managers to estimate costs, allocate resources to the right areas, and control overall spending to prevent cost overruns.

4.4.1   Plan Cost Management

Plan cost management is the process of defining how project cost is estimated, budgeted, managed, monitored and controlled throughout the project. Starting with the resource plan, the project manager will use the work breakdown structure to show the

project's composition and its deliverables in a hierarchy from most important to least. This determines where the bulk of the costs will funnel towards, and which components of the project will require the least expenditure. The project manager also determines the resources it requires, which might include certain people, skills, materials, tools, equipment and funds for each subtask in the WBS. By adopting this task-level approach, it becomes possible for the project managers to create an accurate and complete inventory of all resources, which is then fed as an input into the next step of estimating costs.

4.4.2   Estimate Cost

The project manager uses practical estimate that calculates the costs related to the resources needed to complete the project. More specifically, the analogous estimating technique will be used because the estimates are based on comparisons of past similar projects to make projections. There are two key types of costs addressed by the cost estimation process:

- Direct costs: Costs associated with a single area, such as a department or the project itself. Examples of direct costs include fixed labor, materials, and equipment.

- Indirect costs: Costs incurred by the organization at large, such as utilities and quality control.

A cost baseline will be evaluated which reflects the financial resources that the project manager has the power to manage and control. Table 8 provides details on the cost

techniques used to determine project activities, the resources needed and the associated cost

to carry out the activities. It is important to note that the Project Team includes:

- Project Manager

- Civil Engineer

- IT/Program Engineer

- Quantity Surveyor

Table 8.

Technique used to calculate activity cost estimates

	Description of Activity	Cost Techniques	Predecessor	Duration	Resources Needed	Unit Rate	Cost (USD)
2	Desk Study	Expert judgment	1	5	Material: Best practices for road asset management systems, Dominica road laws, programs used internally for asset management systems. Equipment: access to computer and internet. Personnel: Project Manager and Project Team	days	2,500
3	Review Ministry's framework.	Expert judgment	1	10	Material: Copies of Government policies, framework, regulations. Equipment: access to computer and internet. Personnel: Project manager and Project Team	days	3,000
4	Review Ministry data storage mechanism	Analogous estimating	1	7	Material: storage system used previously used for data storage. Equipment: access to computer and internet. Personnel: Project Manager and Project Team	days	2,000
5	D1-Inception Report	Analogous estimating	2,3,4	15	Material: Copies of Government policies, framework, regulations. Equipment: access to computer and internet. Personnel Project Manager and Project Team	sum	15,000
6	Asset Conditional Assessment	Analogous estimating	5	40	Material: Copies of Government policies, framework, regulations. Equipment: access to computer, internet., 2vehicles, 2cameras,4 cell phones, Personnel: Project Manager and Project Team	sum	50,000
7	Road Traffic Count	Expert judgment	5	30	Material: Copies of Government policies, framework, regulations. Equipment: traffic counters, vehicle Personnel: Project Manager and Project Team	km	10,000
8	Windshield Survey	Expert judgment	5	30	Material: Copies of Government policies, framework, regulations. Equipment: access to computer, internet., 2vehicles, 2cameras,4 cell phones, Personnel: Project Manager and Project Team	km	8,0000
9	GIS mapping of assets	Expert judgment	5	10	Material: Copies of Government policies, framework, regulations. Equipment: access to computer, internet., 2vehicles, 2cameras,4 cell phones, Personnel: Project Manager and Project Team	sum	10,000
10	D2-Asset Data Collection	Analogous estimating	6,7,8,9	20	Material: Copies of Government policies, framework, regulations. Equipment: access to computer, internet., 2vehicles, 2cameras,4 cell phones, Personnel: Project Manager and Project Team	sum	25,000
11	Asset vulnerability	Expert judgment	10	40	Material: Copies of Government policies, framework, regulations. Equipment: access to computer, internet., 2vehicles, 2cameras,4 cell phones, Personnel: Project Manager and Project Team	sum	30,000
12	Asset rehabilitation Mechanisms	Expert judgment	11	30	Personnel: Project Manager and Project Team, MOPWPUDE Technical Unit	sum	40,000
13	Cost of Repairs	Expert judgment	11	20	Personnel: Project Manager and Project Team, MOPWPUDE Technical Unit	Sum	20,000
14	D3-RAMS Draft Program	Analogous estimating	12,13	30	Personnel: Project Manager and Project Team, MOPWPUDE Technical Unit	sum	5,000
15	D4-RAMS Program Final Version	Analogous estimating	14	40	Personnel: Project Manager and Project Team, MOPWPUDE Technical Unit	sum	20,000
16	Capacity Building of the Ministry	Expert judgment	14	10	Personnel: Project Manager and Project Team, MOPWPUDE Technical Unit	days	12,000
17	RAMS Manual	Expert judgment	14	15	Personnel: Project Manager and Project Team, MOPWPUDE Technical Unit	sum	10,000
18	D5-RAMS Closing	Analogous estimating	15,16,17	10	Personnel: Project Manager and Project Team, MOPWPUDE Technical Unit	sum	5,000

4.4.3   Determine Cost

The costs of individual activities or work packages are aggregated to establish an authorized cost baseline. This cost baseline is used to monitor against project performance. The project budget includes all funds authorized to execute the project. According to PMBOK (2017), cost estimates include quantitative assessments of the probable costs required to complete project work, as well as contingency amounts to account for identified risks, and management reserve to cover unplanned work. Figure 14 describes the RAMS project budget as the sum of the cost baseline and the management reserve.

Figure 14

Project Budget Components
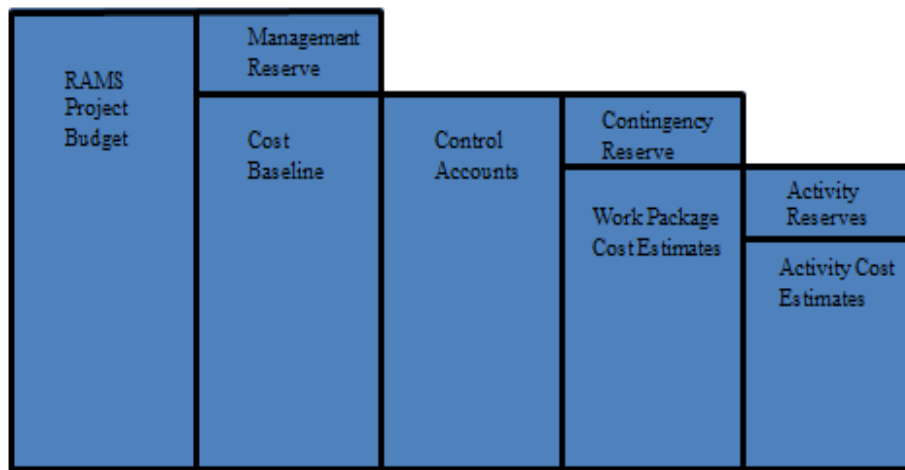
Note. The RAMS project budget is used by determining cost baselines and management reserves.

The project budget cost is determined in detail in Table 9, where the cost baseline is the approved version of the time phased project budget that includes con tangency reserves. The contingency reserve covers design, development, project implementation, inflation and risk associated with the project. The project is part funded by a grant from an NGO along with the Government of Dominica.

The total project budget is determined to be USD$1,080,985.50. Figure 15 demonstrates the cash flow for the project which is dependent on the approval of deliverables from the Ministry of Public Works, Public Utilities and Digital Economy.

Figure 15 also demonstrates an S-Curve graphical analysis, which shows the accumulative project planned value and its last data BAC (budget at completion). The Earned Value Analysis (EVA) is based on planned and actual performance on authorized budget which does not include management reserves as seen in Appendix 7. The analysis indicates the project is ahead of schedule and under planned cost.

Table 9

Project Budget Cost

	Description of Activity	Cost	Contingency Reserve		Total Cost (Cost Baseline)	Management Reserve 5%	Project Budget
			Design, Development and project Implementation 20%	Inflation and risk 3%			
2	Desk Study	10,000.00	2,000.00	300.00	12,300.00	615.00	12,915.00
3	Review Ministry's framework.	12,000.00	2,400.00	360.00	14,760.00	738.00	15,498.00
4	Review Ministry data storage mechanism	15,000.00	3,000.00	450.00	18,450.00	922.50	19,372.50
5	D1-Inception Report	35,000.00	7,000.00	1,050.00	43,050.00	2,152.50	45,202.50
6	Asset Conditional Assessment	160,000.00	32,000.00	4,800.00	196,800.00	9,840.00	206,640.00
7	Road Traffic Count	40,000.00	8,000.00	1,200.00	49,200.00	2,460.00	51,660.00
8	Windshield Survey	80,000.00	16,000.00	2,400.00	98,400.00	4,920.00	103,320.00
9	GIS mapping of assets	60,000.00	12,000.00	1,800.00	73,800.00	3,690.00	77,490.00
10	D2-Asset Data Collection	75,000.00	15,000.00	2,250.00	92,250.00	4,612.50	96,862.50
11	Asset vulnerability	80,000.00	16,000.00	2,400.00	98,400.00	4,920.00	103,320.00
12	Asset rehabilitation Mechanisms	40,000.00	8,000.00	1,200.00	49,200.00	2,460.00	51,660.00
13	Cost of Repairs	20,000.00	4,000.00	600.00	24,600.00	1,230.00	25,830.00
14	D3-RAMS Draft Program	40,000.00	8,000.00	1,200.00	49,200.00	2,460.00	51,660.00
15	D4-RAMS Program Final Version	100,000.00	20,000.00	3,000.00	123,000.00	6,150.00	129,150.00
16	Capacity Building of the Ministry	25,000.00	5,000.00	750.00	30,750.00	1,537.50	32,287.50
17	RAMS Manual	40,000.00	8,000.00	1,200.00	49,200.00	2,460.00	51,660.00
18	D5-RAMS Closing	5,000.00	1,000.00	150.00	6,150.00	307.50	6,457.50
	Totals	$ 837,000.00	$ 167,400.00	$ 25,110.00	$ 1,029,510.00	$ 51,475.50	$ 1,080,985.50

Note. The Project Budget Cost is the estimated cost of completing a project.

Figure 15

Cash Flow Diagram (Source: Compiled by author, 2023)
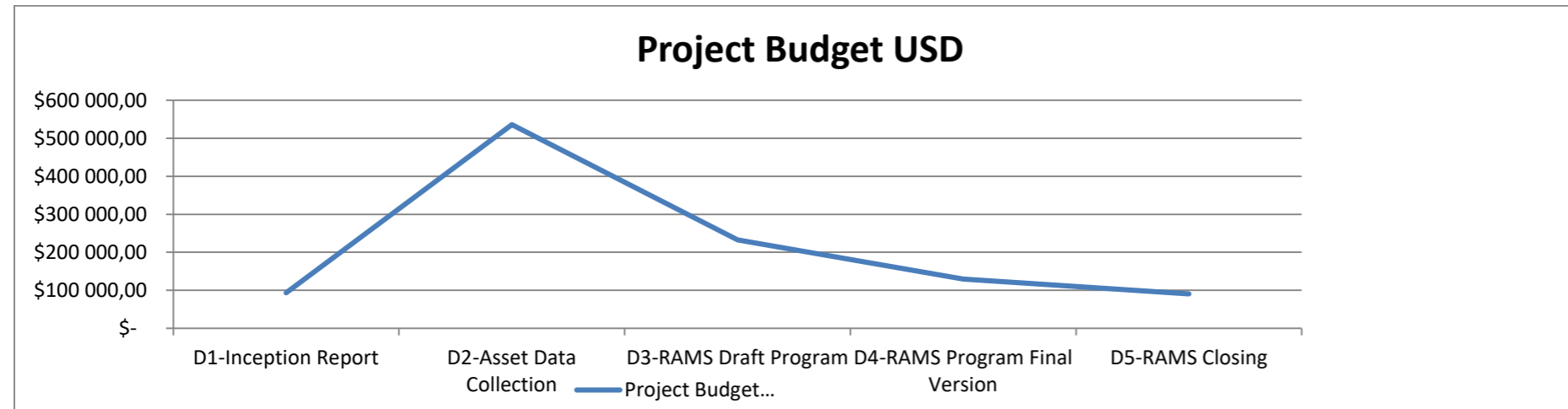
Description of Activity	Project Budget USD
D1-Inception Report	$ 92,988.00
D2-Asset Data Collection	$ 535,972.50
D3-RAMS Draft Program	$ 232,470.00
D4-RAMS Program Final Version	$ 129,150.00
D5-RAMS Closing	$ 90,405.00
Project budget	**$ 1,080,985.50**

	1	2	3	4	5	6	7	8	9	10	11	12
PV Acumulado	$86 250,00	$268 500,0	$427 000,0	$522 000,0	$545 000,0	$601 000,0	$657 000,0	$717 500,0	$806 000,0	$832 000,0	$834 500,0	$837 000,0
AC Acumulado	$90 355,00	$279 298,0	$446 388,0	$554 988,0	$590 488,0	$657 488,0	$718 378,0	$778 128,0	$866 528,0	$887 658,0	$890 858,0	$894 258,0
EV Acumlado	$91 200,00	$284 590,0	$459 590,0	$579 590,0	$612 590,0	$681 590,0	$745 590,0	$810 890,0	$895 790,0	$923 840,0	$927 340,0	$930 795,0
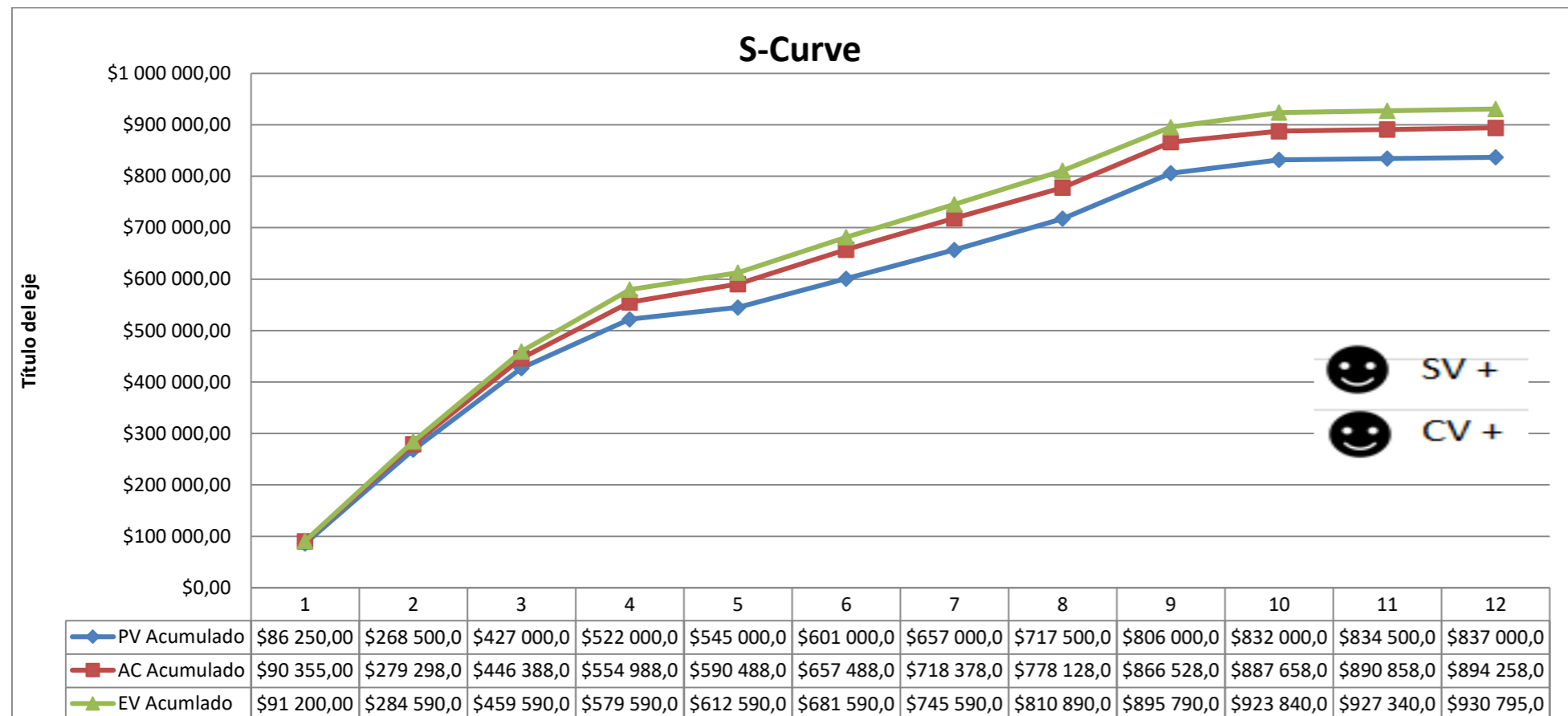
		COMMENTS
$SV = EV - PV$	Positive = Ahead of Schedule Neutral = On schedule Negative = Behind Schedule	SV is positive which indicates its ahead schedule
$SPI = EV / PV$	Greater than 1.0 = Ahead of schedule Exactly 1.0 = On schedule Less than 1.0 = Behind schedule	SPI is above 1 which indicates the project is ahead of schedule
$CV = EV - AC$	Positive = Under planned cost Neutral = On planned cost Negative = Over planned cost	CV is positive which indicates under planned cost
$CPI = EV / AC$	Greater than 1.0 = Under planned cost Exactly 1.0 = On planned cost Less than 1.0 = Over planned cost	CPI is greater than 1 which indicates under planned cost

Note. RAMS Cash flow diagram and S-Curve ensures that the project budget is monitored efficiently.

4.4.4   Control Cost

Wrike (2023) describes cost control is the process of overseeing and managing Project expenses and preparing for potential financial risk. Cost control also involves the task of measuring cost variances from the baseline and taking appropriate action, such as increasing the budget allocated or reducing the scope of work, to correct that gap. Cost control is a continuous process done throughout the project lifecycle.

To successfully manage the project cost, any increase to the authorized budget can only be approved through the Perform Integrated Change Control process. PMBOK GUIDE (2017) provides some guidelines for project control which includes the following:

- Influencing the factors that create changes to the authorized coat baseline

- Ensuring that all change requests are acted on in a timely manner

- Managing the actual changes when and as they occur

- Ensuring that cost expenditures do not exceed the authorized funding by period, by WBS component by activity and in total for the project

- Monitoring cost performance to isolate and understand variances from the approved cost baseline

- Monitoring work performance against funds expended

- Preventing unapproved changes from being included in the reported cost or resources usage

- Informing appropriate stakeholders of all approved changes and associated cost

- Bringing expected cost overruns within acceptable limits

The cost management plan, along with cost baseline and the performance measurement baseline are inputs which will assist in the management of the project's budget. The tools and techniques used for cost management are:

- Data analysis

- Earned value analysis

- Variance analysis

- Earned value analysis

- Trend analysis (Forecasting)

Table 10 below provides a list of formulas which will aid in determining Earned Value analysis for RAMS monitoring. This analysis integrates the scope baseline with the cost baseline and schedule baseline to form the performance measurement baseline. The analysis monitors planned value, earned value and actual cost of the project.

Table 10.

Earned Value Analysis Formulas

Earned Value Analysis Formulas				
Abbreviation	Name	Definition	How Used	Equation
CV	Cost Variance	The amount of budget deficit or surplus at a given point	The difference between the value of work completed to a point	CV= EV-AC
SV	Schedule Variance	The amount by which the RAMS project is ahead or behind the planned delivery date at a given point in time.	The difference between the work completed to a point in time	SV=EV-PV
V AC	Variance at	A projection of	The estimated	VAC=BAC-EAC

	Completion	the amount of budget deficit or surplus, expressed as the difference between the budget at completion and the estimate at completion	difference in cost at the completion of the RAMS project	
CPI	Cost Performance Index	A measure of the cost efficiency of budgeted resources expressed as the ratio of earned value to actual cost	A CPI of 1.0 means the project is on budget, other values shows the percentage of how much cost are over or under the budgeted amount for work accomplished	CPI=EV/AC
SPI	Schedule Performance Index	A measure of schedule efficiency expressed as the ratio of earned value to planned value.	An SPI of 1.0 means that the project is exactly on schedule, that the work actually done so far is exactly the same as the work planned to be done as far. Other values shoe the percentage of how cost are over or under the budgeted amount for work planned.	SPI=EV/PV
EAC	Estimate at Completion	The expected cost to finish all the remaining project work	If the CPI is expected to be the same for the remainder of the project, EAC is determined by using: If future work will be done as planned If the initial plan is no longer valid	EAC=BAC/CPI EAC=AC+BAC-EV EAC=AC+ETC

			If both the CPI and SPI influences the remaining work	EAC=AC+{(BAC-EV)/(CPI X SPI)}
ETC	Estimate to Complete	The expected cost to finish all the remaining project work	Assuming work is proceeding on plan the cost of completing the remaining authorized work is determined:	ETC=EAC-AC
			Re-estimate the remaining work from the bottom up	ETC- Re-estimate
TCPI	To Complete Performance Index	A measure of the cost performance that must be achieved with the remaining resources in order to meet RAMS objectives	The efficiency that must be maintained in order to complete on plan	TCPI=(BAC-EV)/(BAC-AC)
			The efficiency that must be maintained in order to complete the current EAC	TCPI=(BAC-EV)/(EAC-AC)

Note. EVA formulas are used to determine if the project is behind or ahead of schedule as well as if it is on budget.

4.4.5 Change Control

The change control process is focused on identifying, documenting and approving the changes to the project document, deliverables and baseline. The following change management activities will be followed:

1. Identify the changes

2. Document changes into a proper change request form (Appendix 5)

3. Decide on changes (approve, deferred, rejected)

4. Track changes to ensure they are registered, assessed, approved and communicated to stakeholders)

The Change Classification and Authority is as follows:

Classification USD	Authority
Minor – up to EC$50,000.00	Project Manager
Major – $50,000.00 -$100,000.00	Permanent Secretary and /Chief Engineer
Critical – over EC$100,000.00	Change Control Board

*per occurrence not exceeding 1% of project cost

The following persons will form the Change Control Board for this project:

- Permanent Secretary, Department of Infrastructure, Ports and Energy

- Chief Engineer, Department of Infrastructure, Ports and Energy

- Project Manager, RAMS Project

- Financial Analyst at the Department of Infrastructure, Ports and Energy

- Duly appointed representatives from the Department of Economic Development and the Department of Finance.

In the likely event that a change is required in the project, the Project Manager is responsible for the review and recommendation to the CCB for decision-making. When the change has been approved the Project Manager formally accepts the change by signing the project change control document. Upon acceptance of the change by the Change Control Board, the Project Manager will update all project documents and communicate the change to all relevant stakeholders. The Project Manager will keep a record of all change requests.

4.5   Quality Management Plan

To understand quality management, the concept of quality must be understood. PMBOK GUIDE (2017) describes quality as a delivered performance or result, where are ISO 9000 [18] describes quality as the degree to which a set of inherent characteristics fulfill requirement.

The project manager and the project team are responsible for managing project quality using a defined plan. The project quality management plan is the process of continually measuring the quality of all activities and taking corrective action until the team achieves the desired quality requirements to meet stakeholders' objectives. The project quality management processes involves:

- Plan quality management: is concerned with the quality that the work needs to have.

- Manage quality management: this process manages the quality processes throughout the RAMS Project. Quality requirements are identified in this process such as testing of the RAMS program.

- Control quality management: in this process the results of the program is compared with quality requirements to ensure the results are acceptable. Inputted data collected is inspected by the consultant and approved before the program accepts it for analysis. This plan-do-check-act (PDCA) cycle is the basis for continuous quality improvement of the RAMS program.

On the other hand the Juran Trilogy describes three slightly different elements: quality planning, quality control and quality improvement (Rose, 2005). Juran's concept

includes assurance and control activities within quality control. The approach in this project combines the better of these two views to include plan quality, manage quality and quality assurance, control quality and quality improvement.

4.5.1 Plan Quality Management

The benefit of this process is that it provides guidance and direction on how quality will be managed and verified throughout the project. Plan quality steps include:

- Identify customers/users, (both external and internal) in Table 11

    - Government of the Commonwealth of Dominica

    - Users (Technical Unit-Engineers and Technicians)

    - Project Team

    - Motoring Public

Table 11

Customers/Stakeholders identified

Customers		Impact	Interest	Power	Influence
Main	**Examples**				
Government of the Commonwealth of Dominica	Prime Minister, Ministers, Permanent Secretary	High	High	High	High
Users (Technical Unit-Engineers and Technicians)	Chief Technical Officer, Engineers, Technicians	Medium	Medium	High	High
Project Team	Design Consultants Team, Design Supervision Team, Ministry Focal persons on the project	High	High	Medium	Medium
Motoring Public	Motorist and pedestrians	Low	Medium	low	low

Note. Stakeholder are identified and their level of impact, interest, power and influence

The L-shaped Matrix was used to prioritize customers which are described in Table 12.

Table 12.

L-Shaped Matrix Customer Prioritization

Customer Prioritization	GoCoD	Users-Technical Staff	Project Team	Road Users	Row Total	Relative Decimal Value	Priority
GoCoD		1	10	10	21	0.49	**1**
Users-Technical Staff	1		5	10	16	0.37	**2**
Project Team	0.1	0.2		0.2	0.5	0.01	**4**
Road Users	0.1	0.1	5		5.2	0.12	**3**
					42.7		

Key:
10   Much more important
5   More important
1   Equally important
1/5   Less important
1/10   Much less important

Note. Stakeholders are prioritized based on the level of importance.

Not all customers are created equal, if all customers are considered equal; the project team may have an impossible task when applying limited project resources during project implementation. The project team must prioritize customers.

- Determine customer needs/requirements

In this process the project team analyzes the project team and organization to determine their needs and requirements. The contract agreement which is furnished with the terms of reference is the source of the project requirements. The terms of reference would have engaged stakeholders to ensure all requirements are captured. Identifying

requirements includes defining them in such a way that they are useful for the project. The

requirements list is unique and is based on the list of identified customers. The following

requirements are considered:

- User friendly

- Functional

- Reliability

- Regulatory compliant

The requirements identified are measurable (Ross, 2005) and based on the identified

customers. Table 13 demonstrates the rigorous method for prioritizing requirements by the

Full Analytical Criteria Method. This is a three-step process that begins with the L-shaped

matrix developed to prioritize customer requirements, applies the L-shaped matrix to

individual customer requirements, and then combines the results into a single matrix of

project priorities.

Table 13.

Full Analytical Criteria Method

GoCoD	User friendly	Functional	Reliability	Regulatory compliant	Row Total	Relative Decimal Value
User friendly		0.1	0.2	0.2	0.5	0.03
Functional	10		1	1	12	0.62
Reliability	5	1		1	7	0.36

Regulatory compliant	5	1	1		7	0.36
				Grand Total	19.5	

Users-Technical Staff	User friendly	Functional	Reliability	Regulatory compliant	Row Total	Relative Decimal Value
User friendly		10	5	1	16	0.79
Functional	0		1	1	2.1	0.10
Reliability	0.2	1		1	2.2	0.11
Regulatory compliant	1	1	1		3	0.15
				Grand Total	20.3	

Project Team	user friendly	functional	reliability	regulatory compliant	Row Total	Relative Decimal Value
User friendly		0.1	0.2	0.2	0.5	0.02
Functional	10		1	5	16	0.70
Reliability	5	1		0.2	6.2	0.27
Regulatory compliant	5	0.2	5		10.2	0.45
				Grand Total	22.7	

Road Users	User friendly	Functional	Reliability	Regulatory compliant	Row Total	Relative Decimal Value
User friendly		0.2	0.2	0.2	0.6	0.04

				Row Total	Relative Decimal Value
Functional	5		1	1	7	0.51
Reliability	5	1		0.2	6.2	0.45
Regulatory compliant	5	1	5		11	0.80
				Grand Total	13.8	

	GoCoD	Users-Technical Staff	Project Team	Road Users	Row Total	Relative Decimal Value
User friendly	0.01	0.30	0.000	0.01	0.31	0.31
Functional	0.30	0.04	0.008	0.06	0.35	0.35
Reliability	0.18	0.04	0.003	0.05	0.22	0.22
Regulatory compliant	0.00	0.06	0.055	0.10	0.11	0.11
			Grand Total		0.99	

Note. The table demonstrates the rigorous method for prioritizing requirements by the Full Analytical Criteria Method.

The Full Analytical Criteria Method demonstrates that the main concern of the government is that the RAMS software is functional, the User (Technical Staff) are concerned that the program is user friendly, the project's main priority is that the software is functional and road users' main requirement is that it is regulatory compliant.

- The RAMS software use is analyzed to determine the end user. This allows for the software to satisfy customer needs and not just meet specification in a contract. The

analysis identifies hidden customers/stakeholders, those who do not use the software but benefit from the information.

- Analyze the means of production to confirm that all stakeholders are identified.

4.5.2 Manage Quality and Quality Assurance

Manage quality is the work of all involved in the project, the project manager, the project team, project sponsor, the management of the Technical unit, customers and users. In quality management prevention is preferred over inspection (PMBOK GUIDE, 2017). In the RAMS, quality is planned and designed into the system to minimize errors. Manage quality work falls under the conformance work category in the cost of quality framework. The RAMS program uses quality assurance processes to examine and correct the process itself and not just special defects. The cost of preventing mistakes is generally less that the cost of correcting them.

In the RAMS, project prevention and inspection are done continuously throughout the project implementation. The attribute sampling of data is to ensure the results obtained are rated on a continuous scale that measures the degree of conformity. There is also a specified tolerance range of acceptable results and control limit to certify performance.

The project team develops activities that they will do to check project performance against the project plan using specifications as the targets. Developing assurance activities involves more than delegation, but coherent and integrated activities arise from a disciplined process of steps:

- Select the relevant standard or specification.

- Using operational definitions, define an activity that will collect data and compare results to the plan. Develop and apply metrics.

- Define and provide resources.

- Assign responsibility to a specific entity.

- Assemble activities into a quality assurance plan.

The quality assurance plan uses project processes effectively as it involves following and meeting standards to assure stakeholders that the final product will meet their needs, expectation and requirements. Table 14 provides details of the quality assurance plan developed for the project.

Table 14

Quality assurance plan

WBS Ref (Milestones)	Requirement (From the customer)	Specification	Assurance Activity	Schedule submission date	Responsible Entity
5	D1-Inception Report	Report examines government/ministry framework. Conduct desk study on road asset management systems	Feedback and sign off from Technical Unit	12 March 2024	Project Team and Technical Staff
10	D2-Asset Data Collection	Data on all road assets collected. Traffic data collected. Unit cost of construction activities collected Geo referencing of all assets. IRI data collected Windshield 360^0 views collected.	Feedback and sign off on data collected.	18 June 2024	Project Team and Technical Staff
11	Asset vulnerability	Criteria agreed upon by stakeholders to categorize vulnerability of assets.	Sign off on agreed criteria for vulnerability.	9 July 2024	Project Team and Technical Staff
14	D3-RAMS Draft Program	RAMS Pilot Easy access to software	Provide feedback on the program. Sign off on the draft RAMS platform	27 August 2024	Project Team and Technical Staff
15	D4-RAMS Program Final Version	Functional, reliable software Training provided for Ministry's staff RAMS Manual	Running program on the Government System Storage is in GIS/DOMINODE and the cloud Staff is awarded training certificates. Sign off on Manual	1 October 2024	Project Team and Technical Staff
18	D5-RAMS Closing	Financial audit All reports and manual amended with all comments from feedback	Ensure all feedback questions are answered. Ensure all payment are issued Conduct project audit including compilation of lessons learned	15 October 2024	Project Team and Technical Staff

Note. The quality assurance plan is used for RAMS to define the criteria and processes that will ensure and verify that the project meet specific objectives throughout the projects lifecycle

4.5.3   Control Quality

A continuing theme in quality management is that quality is planned in, not inspected in. Quality control tools, when implemented accurately, can provide numerous benefits to enhance productivity and achieve the desired goals. The tools and techniques used for plan quality management are the following:

- Expert judgment from individuals in the field on road asset management whom are diverse in quality assurance techniques, quality control, quality measurements, quality systems and improvements.

- Data gathering from interviews, meetings, brainstorming and benchmarking. They are held by the project team to discuss successful events, what needs improving, what to incorporate in ongoing projects as well as what to add to the organizations' processes to improve quality. The Project Manager has a checklist to manage the control quality activities in a structured manner. Data gathering will ensure that the data collected is useful to fulfill project objectives.

- Meeting with stakeholders to determine their feedback on the RAMS deliverable and software.

- Quality planning is performed parallel to the other planning processes, in order to meet identified quality standards which may require cost or schedule adjustments.

- Data analysis such as cost of quality (prevention cost, appraisal cost, and failure cost). The project manager will not depend on inspection and correction to achieve project quality. Instead, they should use conformance and prevention to achieve quality. The cost of quality associated with the project related to nonconformance of

product, deliverables or services to the needs or expectations of the stakeholders

will have failure cost. This can be seen in Table 15: how the optimum cost of

quality is one that reflects the appropriate balance for investing on the cost of

prevention and appraisal to avoid failure cost.

Table 15

Cost of Conformance and Nonconformance

COST OF CONFORMANCE	COST OF NONCONFORMANCE
Prevention Cost (Build a quality product) a. **Time to do it right**. Create a RAMS pilot before final software submission. This would entail proper planning to prevent later costs that will arise from changes, which go up as the project progresses. b. **Document processes**. Processes will be documented, which includes lesson learned. Audits at every milestone will be conducted to ensure the project is meeting requirements, standards and specifications. The processes used will establish steps to be taken to produce the product. The processes will be monitored and analyzed by the project team to ensure needs are met.	**Internal Failure Cost** a. **Rework.** All rework policies and procedures will be reviewed including a protocol for retesting the reworked product for conformity to specifications. All rework and errors will also be documented. Rework impacts profits negatively; getting it right the first time is necessary. .
Appraisal Cost a. **Destructive testing loss.** Testing the durability of a product will be done, which involves losing the amount spent to produce the product. However, such cost relates to quality assurance and money	**External Failure Cost** a. **Liabilities.** External failures begin with product recalls, return, or exchange of products after the consultant discovers defects in the software which the company will be liable for. These liability costs may result in lawsuits which may run the

invested in activities that identify quality issues before the product goes out to the client. Thus, corrective actions can be taken, and issues can be fixed during the project.	company down. b. **Loss of Business**. Poor quality of the product may cause loss of business with the client as well as future clients. Customer defections are costly because they could lead to a chain of lost opportunities for business.

Note. RAMS cost of conformance and non-conformance is used to ensure cost of quality, which is an integrated concept of the costs to achieve quality and the costs that occur due to quality issues.

- Data representation such as a flow chart indicating systems considered into the program.

- Test and inspection of the RAMS program. A RAMS prototype developed for the client is tested. An investigation of the item to ensure objectives are met and quality of the product is in accordance to requirements. The intent of such detail testing is to find errors, defects, bugs or nonconformance problems. Early testing identifies nonconformance early and reduces cost in fixing the entire product if there is nonconformance. Testing will be done at every milestone of the product and at the end the project. The RAMS program will be tested and daily examination of collected data collected. The cause and effect diagram will be used to find the root cause of the defect. Cause-and-effect diagrams show the relationship between the results of problems and the root cause of these problems. This diagram shows all the primary and secondary causes of a problem and the effect of all the proposed solutions.

Measuring physical characteristics of the RAMS software is essential to ensure quality assurance. The RAMS software is examined for completeness or correct assembly and also tested for performance. Feedback and commenting on the software performance is a way to improve product or reduce deficiencies.

Quality metrics and matrix are a means of measurement to determine the degree of conformance to specifications which are explained in this assignment. Table 16 develops a metrics for quality baseline which is a means of measurement that links requirements, specifications, assurance activities, and the metrics themselves.

Table 16

Metrics and Quality baseline

Quality Objective	Metric	Metric definition	Expected outcome/result	Measurement frequency	Responsible
Quality Assurance	Test and inspections of RAMS	Ensuring the project meets international standards and guidelines.	A quality assurance plan will be developed by the project team. The plan will provide a statement of requirements and specification, assurance activities, schedules, and persons responsible.	During the planning phase, the project team which includes the Project Manager, Project Engineer and Technician determine frequency of quality testing.	Project Manager, Chief Technical Officer and Permanent Secretary, reviews and approves test results and deliverables.
On schedule	Logical data model (Microsoft projects)	Microsoft Project is used to schedule activities against time and resources. This logical data model tool is used to identify where quality issues may arise.	Project to be completed on time	Design consultants determine project schedule performance index (SPI) to determine if the project is on schedule. (for overall project and individual roads)	Design Consults develop schedule and the Project Manager approves the schedule
On Budget	Cost benefit analysis. Cost of quality Cost performance index	Data analysis is used to help the Project Manager determine if the planned quality activities are cost effective. The cost benefit analysis compares the cost of the quality activity to the expected benefit. The cost of quality is also determined to ensure that the cost of an activity reflects the appropriate balance of investing to avoid failure cost associated with rework because of poor quality. The cost performance of the project is determined.	That the project is completed within cost or savings. The project does not generate any cost overruns associated with internal failures (rework/scrap) or external failure (liabilities) CPI determines if the project is overdraft of within cost.	Monthly audits of the Bill of Quantities and project budget to ensure project is within its cost estimate. Revision of payment claims when submitted against deliverables.	Project Manager/Project Engineer
Stakeholders' Satisfaction scores	Meetings	Project Team meetings are held to develop the quality management plan. Meetings	Continuous stakeholders' engagement to keep persons informed and resolves any issues that may be affecting them. A	Complaint will be at a minimum	Project Manager

		will also be held to monitor and manage any issues regarding the project. Progress meetings are held with the design consultants. Management meetings are held with the client (Department heads and Minsters) providing status updates on the projects progress. Stakeholders' consultations are held with the communities and other affected groups.	register will be maintained ensuring complaints are recorded and resolved.		

Note. The RAMS Metrics and Quality Baseline, quantifiable measures the performance, effectiveness, and overall quality of the RAMS product, process, service, software and system.

4.5.4   Quality Improvement

Quality improvement is a deliberate process that uses objective measurement and data (Ross 2005). The basic reason for quality improvement in RAMS project is to improve products or reduce deficiencies. Better products or fewer deficiencies will improve customer satisfaction, improve reputation, and increase competitiveness. Better processes result in more efficient use of time, less waste, or fewer defects.

The plan-do-check-act cycle is a proven, iterative design and management method used in business for the control and continual improvement of processes and products. This cycle was chosen because it is usually used for starting a new improvement project, developing a new or improved design of a process, product, or service, defining a repetitive work process, planning data collection and analysis in order to verify and prioritize problems or root causes, implementing any change and working toward continuous improvement. The American Society for Quality (2023) describes the plan-do-check-act procedure as:

- Plan: Recognize an opportunity and plan a change.

- Do: Test the change. Carry out a small-scale study.

- Check: Review the test, analyze the results, and identify what you've learned.

- Act: Take action based on what you learned in the study step. If the change did not work, go through the cycle again with a different plan. If you were

successful, incorporate what you learned from the test into wider changes.

Use what you learned to plan new improvements, beginning the cycle again.

A plan-do-check-act cycle was developed for the RAMS project as seen in Figure 16. The 'plan' first identifies and understands the problem or opportunity. It explores the information available in full to generate and screen ideas which help develop a robust implementation plan. The measurable success criteria are established as well as baselines for quality standards, project priorities and set improvement goals.

The 'do' implements actions to ensure quality. The RAMS software is tested with a small-scale pilot project. This will show whether your proposed changes during continuous improvement achieve the desired outcome – with minimal disruption to the rest of your operation if they don't.

'Check' effects of the implementation or 'do' phase. In the check phase the RAMS is monitored and measured where and errors defects are found and fixed. In this process the project team may decide to try out more changes, and repeat the do and check phase. All defects and solutions are documented.

In the 'act' phase solutions are evaluated and implemented. The improved process in the software and it becomes the new baseline, but you continue to look for ways to make it even better. As seen in Figure 17, the plan-do-check-act cycle has improved quality over time and there is continuous improvement in the RAMS product.

Figure 16

RAMS Plan-do-check-act cycle

RAMS Project Time
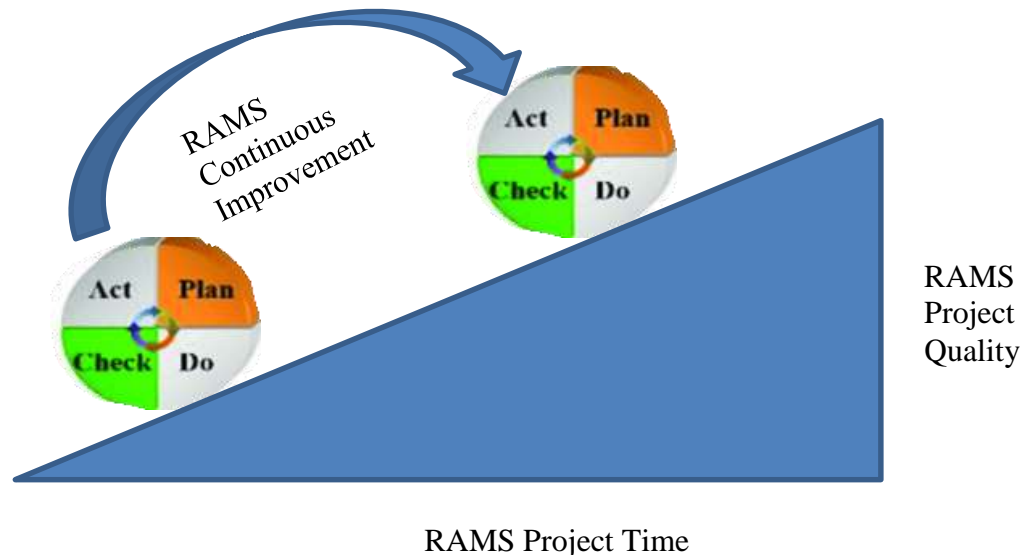
Note. RAMS Plan-do-check-act cycle is an iterative method for continual improvement of processes, products, or services and is a key element of management

A plan-do-check-act cycle was created for RAMS software which is detailed in Table 17. This cycle ensures continuous improvement in the software, that requirements are met and quality of the software improves with time.

Table 17

Plan-do-check-act cycle

	Plan	**Do**	**Check**	**Act**
Define RAMS Model	Stakeholders consultation to determine requirements	Define RAMS Model criteria	Obtain feedback from stakeholders and amend requirements	Roll out requirements for software design.
RAMS Pilot	Plan software creation	Create pilot RAMS	Inspection and test of the pilot and dry run by consultant and Technical staff. Training of the technical staff where defects and errors are noticed.	Amend software to incorporate any improvements which were suggested
RAMS Final	Plan final RAMS submission User manual Maintenance Plan	Create RAMS, user manual and maintenance plan	Inspection and test of final version of RAMS.	Amend software to incorporate any improvements which were suggested.

Note. A Plan-do-check-act cycle for the RAMS software was developed which involves systematically testing possible solutions, assessing the results, and implementing the ones that work.

4.6   Resource Management Plan

This plan includes the processes to identify, acquire and manage the resources needed for the successful completion of the project. The following processes ensure the availability of the resources to the Project Manager and project team at the right time and place:

- Plan resource management

- Estimate activities resources

- Acquire resources

- Develop team

- Manage team

- Control resources.

The resource management plan will get the resources that are needed, turn them into a high-performing project team, and manage them effectively for project success. The resources include anything that is needed for the project - including people, equipment, materials and physical resources.

4.6.1   Plan Resource Management

Runn (2023) describes a resource management plan as a project planning document that details how you will identify, allocate, manage, and release the resources you need for

your project. As with most resource management plan, the ultimate aim is to minimize wastage, maximize resource utilization, and reduce schedule and budget variance.

This resource management plan does this by creating a strategy for how you'll acquire and use your project resources effectively. It's an essential part of effective project resource management, and it can be a standalone document or form part of a larger project management plan (Runn, 2023). Invensis (2023) describes the processes of plan resources management activities as:

- Reviewing Resource Availability: As a project needs relevant and quality resources, it's essential for the project team to consider the availability of the resources as planned during the estimated activity resources process and outsource the required resource.

- Reviewing WBS and Activity List: Since activity resources will be evaluated for the project activities which are a part of the WBS and activity list, WBS and activity list must also be audited.

- Identifying Potentially Available Resources: If it is possible to allot who will complete a specific project activity, these must be recognized during the estimate activity resources process.

- Reviewing Historical Data about Reuse of Resources: If there had been a project that is similar to the one in the organization, that would be extremely valuable for you to check what sort of resources have been utilized.

- Reviewing Organizational Policies on Resource Usage: There may be policies and rules on the best way to ask for a resource, how to assign a

project, how to monitor, and so on. Utilizing relevant tools that help to monitor project phases, assigning activities to project team members, and time reporting are the types of hierarchical approaches to resource usage that must be pursued during the estimate activity resources process.

- Expert Judgment on What Resources are Needed and Available: Based on the activities of the project, what sort of skills and experience must be looked at in the candidates to be a part of the project team can be acquired from subject matter experts. Furthermore, the outputs of the experts will direct you to the most proficient method to form a project team.

- Make or Buy Decisions during the Process: As a project team might need specific resources for a particular project and is not utilized for any other projects within the organization, and then it would be wise to lease the particular resource.

- Breaking Down the Complex Activity to Estimate: Although WBS is made and an activity list is created, a few tasks may be still large to estimate. For this situation, a further breakdown of a task should be possible throughout the whole estimation process.

- Quantify Resource Requirements by Activity: If you are dealing with projects and you realize that you will require analysts, engineers, testers, and so forth. The process will evaluate resource necessities by activity.

- Update Project Documents: As in numerous different processes, activities done in the estimate activity resources process require an update of project archives too.

4.6.2 Estimate activity resources

This process of estimating team resources and the type and quantities of material, equipment, and supplies are necessary to perform project work. For the project managers to decide on the estimated activity resources, the activity list such as schedule management list, resource calendars and hierarchical process resources are scrutinized. Viable estimation of activity resources can prompt the identification of the activity resource prerequisites and resource breakdown structure. The practical usage of activity resource estimates will help guarantee that enough resources are procured without squandering and excessive expenditure.

Expert judgment is used to estimate resources for the project. Experts are considered from the technical staff and project team as to personnel required and if training is necessary this is provided. Reporting requirement is considered based on the organization cultures as well as identifies risk associated with resource acquisitions, retention and release plans from other department or responsibilities.

An organization breakdown structure (OBS) represents the process employed for organizational arrangements and how these arrangements would assist in reporting problems related to the construction project. It is an organizational structure based on the responsibilities of different stakeholders in the project. To indicate the position and

relationship in the unit an organization chart in developed as seen in Figure 17. The

relationship with the consultant is also demonstrated in the organizational chart.

Figure 17

Organization Breakdown Structure
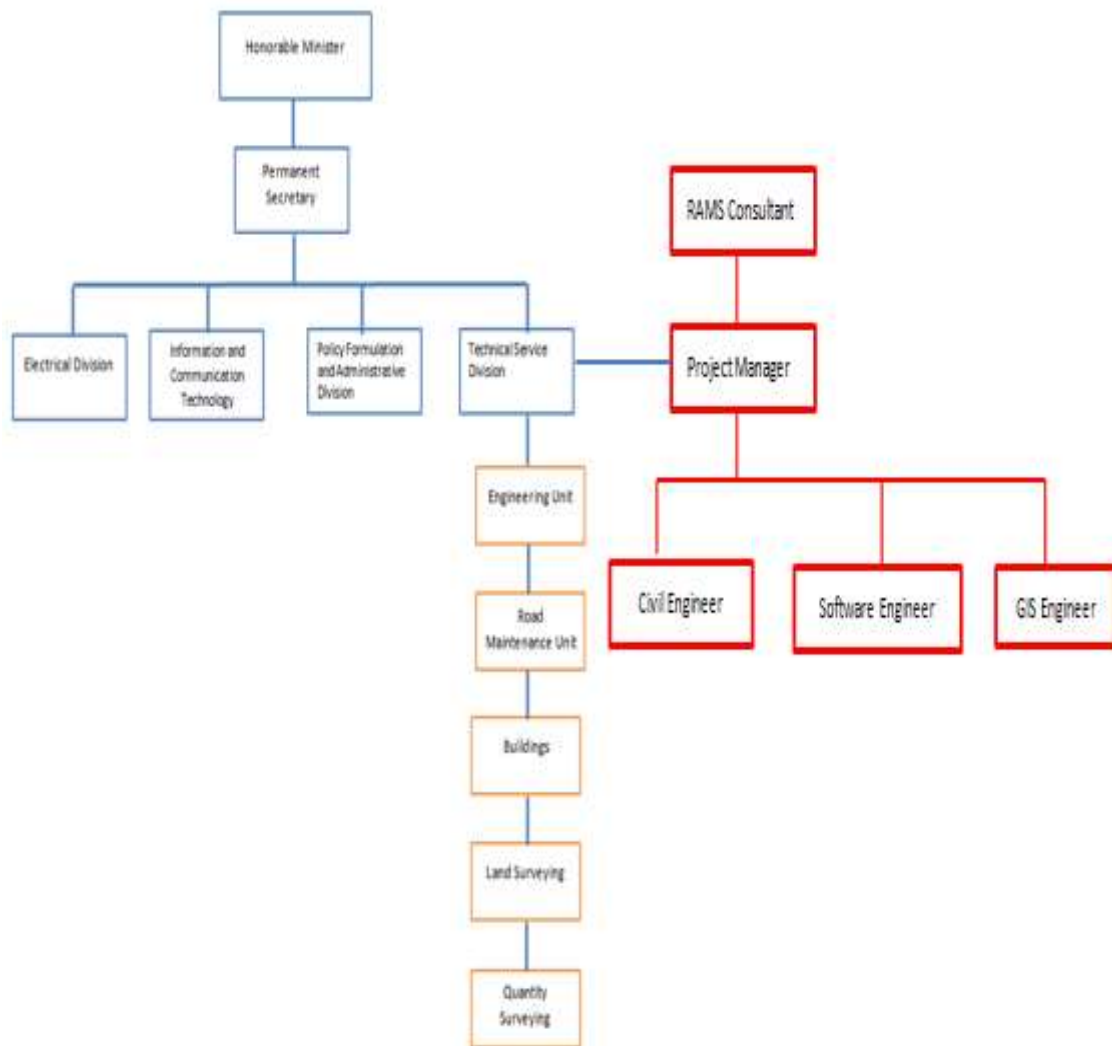
Note. RAMS integration into the Ministry for ease of project implementation

A resource breakdown structure (RBS) was developed for the project and can be seen in

Figure 18. Figure 18 provides a list of the resources that will be required to execute the

project. The resource breakdown structure (RBS) lays out the resources needed to complete

each task in a project plan or work breakdown structure (WBS). It includes all resource

types, including people, time, intangible assets, and tangible assets. Before a project starts,

the RBS helps with planning, organizing, and managing resources; when work is underway,

it helps you track resource utilization.

Figure 18

Resource Breakdown Structure
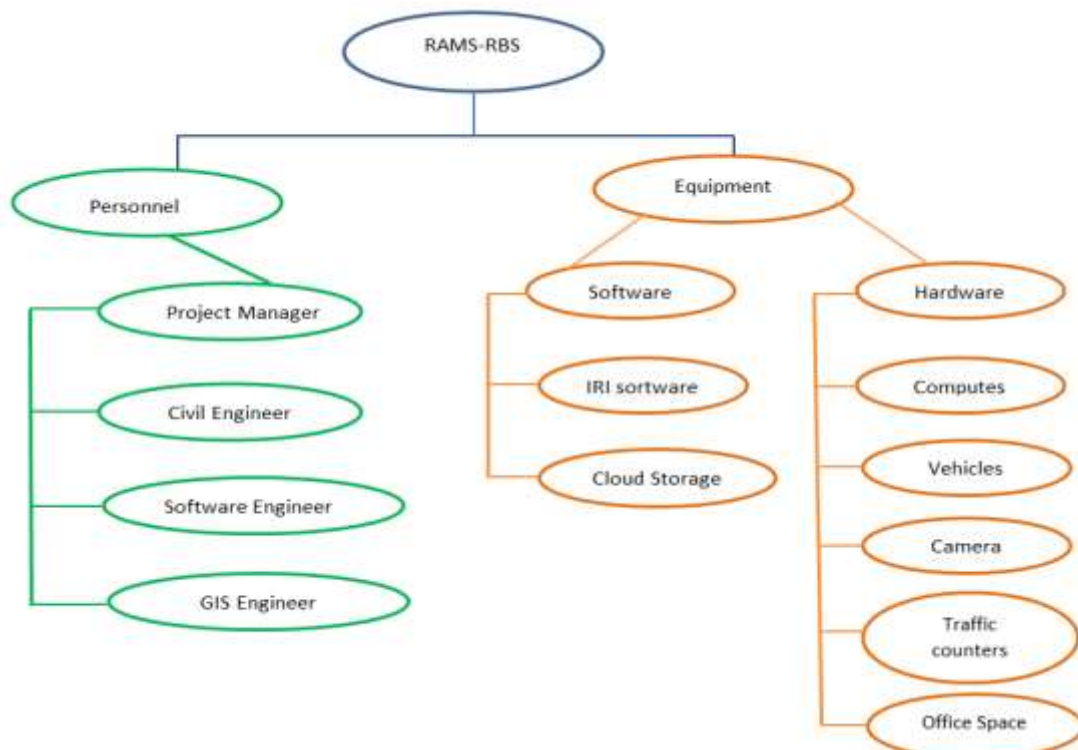
Note. RAMS resource breakdown structure is a list of necessary resources for each task in a project plan.

In Table 18 a RACI matrix was developed for the RAMS project. This matrix is a simple and effective means for defining project roles and responsibilities, providing a comprehensive chart of who is responsible, accountable, consulted, and informed every step of the way. The matrix is created to ensure clear communication and smooth workflows across all parts of a team. RACI matrix helps the project manager guarantee the success of the project before it's even begun. Project managers use RACI matrix to keep track of team roles and relay those responsibilities to the larger team.

Table 18

Quality Matrix –RACI format

WBS Ref (Milestones)	Requirement (From the customer)	Project Manager	Project Team	Technical Staff	Government of Dominica	CDB funding Agency
5	D1-Inception Report	R	A	C	I	I
10	D2-Asset Data Collection	R	A	C	I	I
11	Asset vulnerability	R	A	C	I	I
14	D3-RAMS Draft Program	R	A	C	I	I
15	D4-RAMS Program Final Version	R	A	C	I	I
18	D5-RAMS Closing	R	A	C	I	I

Note. The quality matrix for RAMS identifies the role and responsibility assignment chart that maps out every task, milestone, or key decision involved in completing a project and assigns which roles are Responsible for each action item, which personnel are Accountable, and, where appropriate, who needs to be Consulted or Informed.

RACI Abbreviation Key (PMBOK GUIDE, 2017).

Responsibility - person or role responsible for ensuring that the item is completed

Accountable - person or role responsible for actually doing or completing the item

Consulted - person or role whose subject matter expertise is required to complete the item

Informed - person or role that needs to be kept informed of the status of item completion

4.6.2.1.1 Organizational Theory

The technical unit of the Ministry will oversee the project implementation processes. The Chief Technical officer will liaise with the Consultant when required and put in place any resources needed for the project. The technical unit reviews all deliverables submitted and provide timely feedback. The Permanent Secretary is the one responsible for signing off on all deliverables and approving payments for the consultant. Data collection on the asset is collected alongside the technical staff to increase professional capacity of the unit. Training is conducted by the consultant on how to use the RAMS program and how to train others to use it.

4.6.3 Acquire resources

Acquiring resources is the process of securing team members, equipment, materials or other resources required to deliver the project. The project plan is used to detail what resources are expected to be needed in order to fulfill the delivery of products or for the management of the project. This provides a reasonable estimate of the resources required

for the project and also provides a schedule for when the resources are required and for how long.

The Acquire Resources process is repeated at several stages throughout the project as the need arises. In the early stages of the project, a high-level requirement of resources will be available, but as the plan is refined, further detail is added which leads to more accurate specifications for the resources. The selection criteria for resources include:

- Skills and experience relevant to the assignment

- Availability at the required time of the project plan

- Attitude of the resource with respect to the project objectives

- Identify the sources that can provide the required resources.

- For internal resources, there might be internal processes to acquire them for the project. For hiring resources externally, you might need to float the bids and ask for a quotation from appropriate vendors.

- The process of hiring external resources will include identifying the right vendors and suppliers, getting quotations and comparing their offers, negotiating contracts and ensuring that formalities, including any third-party compliance requirements are fulfilled.

- Train staff in specific skills to use the software.

- Cost of resources.

All external resources needed for this project will be obtained under the contract and the consultant will be responsible to ensure availability. In the Table 19 the project team is identified and quantified. The physical resources needed for the project is detailed in Table

20. The technical unit requires a minimum of 8 engineers or technicians trained in collecting asset data in the field and skilled in using the RAMS software. The Chief Technical Officer will lead the arrangements and meetings to be held with the consultant.

Table 19

Physical Resource Plan

Consultants Project Team-Key Experts			
Designation	Role	Skills	Quantity (No.)
Project Manager	Must be able to manage the project successfully. Skilled in road asset management systems. The manager should have over 10 years of experience in the field of civil engineering and road asset management. The project manager: 1. Ensures that roles and responsibilities are allotted correctly 2. Should ensure proper time management 3. Is responsible for creating and developing budget and financial plans 4. Assists with scheduling 5. Is responsible for effective communication plan among staff and sponsors 6. Ensures that knowledge and information is communicated efficiently 7. Evaluates performance of staff 8. Encourages and promote teamwork for the efficiency of the project's completion. 9. Possesses a Master's degree in Project Management or Civil Engineering.	1. Leadership Skills 2. Communication Skills 3. Critical Thinking Skills 4. Operational Skills 5. Decision- Making Skills 6. Cost Management Skills 7. Budgeting Skills 8. Scheduling Skills 9. Risk- management skills 10. Conflict resolution skills 11. Quality management skills	1
Civil Engineer	The engineer uses his professional knowledge and experience in engineering, and supervises the project. The engineer also liaises with the manager of the project, and Project team to ensure project successful completion. The Civil engineer: 1. Should possess a Master degree in Civil Engineering or relevant field with 8 years of experience. 2. Should be an expert in collecting traffic data, IRI data and analyzing it. 3. Should be diverse in carrying out structural assessment of road infrastructure and charactering defects. 4. Should be trained in vulnerability risk assessment or disaster risk assessment.	1. The engineer must be strong in problem-solving 2. Critical thinking 3. Communication skills: 4. Conduct and manage data collection 5. Conduct on site investigations and analyze data (maps, reports, tests, drawings and other) 6. Assess potential risks, materials and costs 7. Determine cost of maintenance, rehabilitation and reconstruction of assets. 8. Provide advice and resolve creatively any emerging problems/deficiencies 9. Oversee and mentor technical staff and liaise with a variety of stakeholders 10. Monitor progress and compile reports in project status 11. Manage budget and purchase equipment/materials	3
Software Engineer	An expert in developing software for road asset management. BSc degree in Computer Science, Engineering or relevant field with 5 years of experience. The role of the Software Engineer is to build high-quality, innovative and fully performing software that complies with coding standards and technical design.	1. Proven work experience as a Software Engineer or Software Developer 2. Experience designing interactive applications 3. Ability to develop software in programming languages 4. Excellent knowledge of relational databases 5. Experience developing web applications using at least one popular web framework 6. Experience with test-driven development 7. Proficiency in software engineering tools 8. Ability to document requirements and specifications	1
GIS Officer	Is skilled in developing layers to input into software. BSc degree in GIS Engineering or relevant field with 5 years of experience. Layers such as culvert, bridges, roads etc. should be able to geo reference all assets for the software. Build and maintain geographically oriented systems and utility programs. GIS engineers and analysts also contribute to the development of specialized equipment	1. Utilize technical manuals and directives to ensure compliance with codes and company policies 2. Managing users and privileges 3. Database versioning	1

| and components that rely on a geographic positioning system (GPS) | 4. Reconciling and posting changes
5. Designing, building, deploying and maintaining the operational architecture, infrastructure and software stack for our Enterprise GIS Platform
6. Building deployment automation scripts
7. Designing and implementing robust platform monitoring systems, dashboards and solutions
8. Responding to alerts and troubleshooting platform configuration issues.
9. Developing and deploying Enterprise GIS Services and Data Pipelines | |

Note. Physical Resource Plan was quantified to determine project budget.

Table 20

Equipment Resource Plan

Equipment Resource Plan		
Equipment	**Justification**	**Quantity (no.)**
Computer	To develop reports, To create RAMS software, For communication,	5
Cell phones	For communication, To IRI	5
Vehicle	To drive to sites and meetings Fuel for travel	4
Traffic Counter	To obtain traffic counts for the software	2
IRI Software	To obtain IRI – International roughness index.	1
Cloud Space	To store all data collected and RAMS Software	1
Office Space	An area to work on a daily basis Area to conduct meetings	1
360 Camera for vehicle	To obtain 360 views of the roads being assessed.	1
Travel Expenses	Airfare, Per diem allowances, Accommodations	1

Note. The equipment required for RAMS was determined for final project budget.

The cost of the resources are as follows: each time the Acquire Resources process is carried out, the budget for the project is updated to reflect the expected costs for the resources to ensure that the budget remains accurate. The cost of design and project implementation is 20% of the cost of the project which is provided in detail in Table 21. For personnel and equipment needed for project implementation Table 22 provides details. In addition, Table 23 provides a summary of the design and project implementation cost.

Table 21

Cost of Physical Resources

Team	Monthly remuneration rate USD	Time input per month	Cost USD
Project Manager	$ 7,000.00	11	$ 77,000.00
Civil Engineer	$ 4,740.00	8	$ 37,920.00
Software Engineer	$ 4,000.00	6	$ 24,000.00
GIS Officer	$ 3,095.00	4	$ 12,380.00
		Total	$ 151,300.00

Table 22

Cost of Equipment

Equipment	Unit	Quantity	Rate	Cost USD
Vehicle	no	4	$2,000.00	$8,000.00
Traffic Counter	no	1	$ 500.00	$500.00
IRI Software	no	1	$200.00	$200.00
Cloud Space	no	1	$400.00	$400.00
Office Space	lump sum	1	$2,000.00	$2,000.00
360 Camera for vehicle	no	1	$1,000.00	$1,000.00
Travel Expenses	lump sum	1	$4,000.00	$4,000.00
			Total	$16,100.00

Table 23

Design and project implementation cost

Physical Resources	Cost of design and project implementation USD
Personnel	$151,300.00
Equipment	$16,100.00
Total	$167,400.00

Note. RAMS design and project implementation is 20% of the cost of the project

4.6.4   Develop Team

The process of developing project team is an activity that allows improving internal and external interactions of team members, developing their competencies and skills, and optimizing the overall team environment for the purpose of enhancing project performance.

Teamwork management and team building is organized and implemented in the context of clearly and timely stated communication between team members throughout the whole project life-cycle.

The Project Manager takes the lead to develop teams to improve skills and technical competencies of team members to increase the probability of achieving project deliverables in the context of decreasing costs, improving quality and reducing schedules. He or she improves internal agreement and personal recognition among team members to enhance morale, reduce number of conflicts, and improve productivity. The project Manager establishes a dynamic team culture to improve team spirit and cooperation between team members to contribute to better knowledge and expertise sharing.

The project establishes team ground rules, group norms and solid management practices to reduce conflict among team members. Conflict is managed by the Project Manager which increased creativity and better decision making (PMBOK GUIDE 2017). The project manager possesses strong leadership skills, the ability to lead the team and inspire them to do their jobs. The project manager communicates the vision and inspires the project team to achieve high performance.

4.6.5   Manage Team

The project manager tracks the team member performance providing feedback, resolving issues and managing team changes to optimize project performance. Recognition for high performance in challenging assignments is awarded by the project manager to encourage the team members. Workers with low skilled abilities are more intensively supervised than those who have demonstrated ability and experience.

During each deliverable of the project, the progress of each team member is monitored closely by the project manager. Weekly meetings with the project team will be performed and findings documented in minutes with actions from responsible individuals. Work performance reports will be compiled providing detailed assessments of work progress and an evaluation of the team's performance for the month against their delegated tasks. The performance of the project management team will be assessed by the project manager. Kissflow (2023) highlights 10 strategies are to improve team management namely:

- Ensure balance within the team

- Ensure visibility and transparency

- Ensure effective communication within the team

- Foster a culture of collaboration

- Value each suggestion and discuss progress with your team

- Establish success metrics and reward excelling members

- Delegate tasks to groom future leaders

- Manage internal conflicts

- Use all available resources at your disposal to facilitate teamwork

- Take part in regular team building activities and celebrations

4.6.6 Control Resources

This process ensures that the physical resources assigned and allocated to the project are available as planned as well as monitored the planned versus actual utilization of resources and take corrective action as necessary (PMBOK Guide, 2017). The control resources process is done continuously in all project phases at the right time and place to continue without delays. The resources required by a project can be scarce and expensive, so the Control Resources process also needs to ensure resources are not wasted or unused as this will have an adverse impact on the project budget.

4.7   Communication Management Plan

Clear and concise communication requires handling communications in a structured way and choosing the best type of communication for the situation and receiver. Communication is an exchange of information, intended or involuntary through written or non-written form.

In this project the communication management plan is a component which describes how, when and by whom information about the project is disseminated or administered to (Project Management Institute 2021). The plan ensures that all stakeholders are familiar with their role, their purpose or goal, the type of information that needs to be shared with each stakeholder, the methods used to communicate and the frequency that each stakeholder receives information (Lucid Software Inc, 2022).

On many projects, poor communication contributes to project failure, which may cause massive financial loss on a project. At the opposite end of the spectrum, high-performing communication management plan ensure project efficiency (Lucid Software Inc, 2022).

The Communication Management Plan process involves all actions necessary to ensure that information needs of the project and its stakeholders are met. The project manager develops a strategy to ensure communication is effective and implements such strategy efficiently. The processes needed for the project communication management are:

- Plan communication management
- Manage communication

- Monitor communication.

A communication plan defines the information that is disseminated to the project team and stakeholders as well as when the information will be transmitted. The plan indicated the channel to which information should be delivered and whom the communication is targeting. Notwithstanding that project communication is the exchange of project-specific information with the emphasis on creating understanding between the sender and the receiver. Effective communication is one of the most important factors contributing to the success of a project.

Communications Management ensures timely and appropriate generation, collection, distribution, storage retrieval, and even ultimate disposal of project information for security reasons. The communication management plan involves the inclusion of internal and external stakeholders in project reviews, project meetings and social networking.

For this project the communication management plan will keep the project on track, will create written documentation that the team can reference in the future, increases stakeholders' visibility into the project and its status, provides the opportunity for stakeholders to give feedback, which can help the team detect issues early on.

4.7.1 Plan Communication Management

There are several key objectives of Plan Communications Management process which is to include the smooth flow of information between the stakeholders and the

project management team, to define the strategies that will be used for communicating and to identify the key actions and tactics to be undertaken in the implementation of the plan. During project initiation, the efforts would begin to identify stakeholders and their communication requirements. Keeping all relevant stakeholders, especially the public, and those directly affected by the RAMS in the know, is of critical importance not only in fostering cooperation and buy-in but also in terms of promoting the overall project.

In planning the construction project's communications, important consideration should be given to the contract agreement and reporting requirement. A project management communication plan will keep your project on track. The plan, creates a written documentation that the team can reference

- Sets expectations of when stakeholders will receive updates

- Increases stakeholders' visibility into the project and its status

- Provides the opportunity for stakeholders to give feedback, which can help the team detect issues early on and reduce wasted work

- Increases productivity during meetings or eliminates them altogether (Lucid Software Inc, 2022).

Plan communication management is the process of developing an appropriate approach and plan communication activities based on stakeholders information needs. The plan is reviewed and modified, when necessary, when the stakeholders community changes or at the start of a new phase. The following step assist in planning a communication management plan:

Choose a format, the project manager creates a communication plan using

Microsoft excel spreadsheet.

- Set communication goals, such as keeping stakeholders updated on

  project status, weekly monthly and quarterly and annually.

- Identify stakeholders and their levels of interest and influence on the

  project. The project manager updates the stakeholders' register.

- Identify methods of communication and how different stakeholders are

  communicated to. The following methods of communication are

  considered depending on what the stakeholders are most likely to see or

  attend:

  - Weekly check-ins

  - Meetings and presentations, whether in person, over the phone, or

    through video conferencing

  - Meeting summaries-minutes

  - Status reports

  - To-do lists

  - Collaboration apps or social media

- Determine frequency of communication

- Determine who provides communication updates to stakeholders. This

  task will fall on the project manager, but if not, the owner of a specific

  update needs to be clearly identified in your communications plan.

Table 24 details the communication directory developed for the RAMS project which provides key stakeholders name, contact information, designation and stakeholders ID.

Table 24

Communication Directory-List of Stakeholders

Stakeholder ID	Stakeholder	Institution	Designation	Email	Telephone	Comment
	Internal					
S001	Mr. Alvin Nickson	MoPWPUDE	Permanent Secretary	anickson@gmail.com	1767-122-3476	
S002	Mr. Albert Hall	MoPWPUDE	Chief Technical Officer	ahall@gmail.com	1767-890-7654	
S003	Ms. Jane Camps	MoPWPUDE	Civil Engineer	jcamps@gmail.com	1767- 345-8761	
S004	Mr. Ralph Jackson	MoPWPUDE	Civil Engineer	rjackson@gmail.com	1767-235-0986	
S005	Mr. Lewis John	MoPWPUDE	Civil Engineer	ljohn@gmail.com	1767-567-8760	
S006	Ms. Jill Mayers	MoPWPUDE	Civil Engineer	jmayers@gmail.com	1767-354-1290	
S007	Mr. Sam Lane	MoPWPUDE	Technician			
S008	Mr. Frank Paul	MoPWPUDE	Technician	fpaul@gmail.com	1767-578-1672	
S009	Mr. Carl Mark	MoPWPUDE	Technician	cmark@gmail.com	1767-678-5609	
S010	Ms. Lane Clark	GIS/DOMINODE	GIS specialist	lclark@gmail.com	1767-890-5673	
S011	Mr. Dan Bates	GIS/DOMINODE	IT Officer	dbates@gmail.com	1767-456-3987	
S012	Mr. Sherlock Smith	CDB	Project Coordinator	ssmith@gmail.com	1767-569-4531	
S013	Mr. Lawrence Louis	CDB	Project Supervisor	llouis@gmail.com	1767-356-3675	
S014	Consultant Team	TBD	TBD	TBD	TBD	
S015	Project Manager	TBD	TBD	TBD	TBD	
S016	Project Team	TBD	TBD	TBD	TBD	
S020	Government of Dominica	MoPWPUDE	Minister	TBD	TBD	
	External					
S017	Steering committee change control board	TBD				
S018	Representatives from the Ministry of Finance	TBD				
S019	Public and motorist	TBD	Media			

Note . RAMS stakeholder directory are kept updated to ensure communication when required.

4.7.1.1.1 Communication Methods

The method of communication in the project is dependent on the stakeholder. PMBOK GUIDE (2017) outlines three types of communication methods that are essential to know as a project manager:

- Interactive communication

- Pull communication

- Push communication

The project manager uses each communication method at the right time and in the right context which will help ensure you achieve the desired result of a strong team and a good working relationship. Interactive communication is effective in conveying sensitive and important information in a way that can be best understood and acted upon immediately. Interactive communication to be implemented includes: face to face meetings, phone conversations or video conferencing through platforms such as Zoom and Teams.

Push communication entails sending information to the recipient while not expecting a response immediately through: emails, project newsletters and project documentation.

Push communication is used by the project team when you need to convey information to others that is not time-sensitive or urgent such as project updates or reports. The project manager uses pull communication to allow stakeholders to access information at their leisure.

4.7.1.1.2   Classification of Stakeholders

In the RAMS Project, the internal stakeholders, also called primary stakeholders, are entities with a direct interest or influence in the Ministry, as all the processes and results of the Ministry's operations also affect them. External stakeholders, also called secondary stakeholders, have an interest in the company but have no direct influence on its decisions and are not directly affected by its performance.

Some stakeholders may have vested interests in the outcome of the project. The decisions they make can directly impact the outcome of the project. When working together on a project, it is essential to practice efficient stakeholder management and keep communication channels available.

Table 25 defines who internal and external stakeholders are and also classifies stakeholders by position, power and interest.

4.7.1.1.3   Stakeholders Mapping of Data

The project manager uses a stakeholder map as a visual for the information gathered during stakeholder analysis. It shows the level of impact and interest for each stakeholder depending on where they land on the map. The project manager uses the stakeholder map as a way of managing expectations.

Table 25

Stakeholder Classification

Stakeholder ID	Stakeholder	Institution	Designation	Stakeholder Classification		
				Position	Power	Interest
	Internal					
S001	Mr. Alvin Nickson	MoPWPUDE	Permanent Secretary	+	H	H
S002	Mr. Albert Hall	MoPWPUDE	Chief Technical Officer	+	H	H
S003	Ms. Jane Camps	MoPWPUDE	Civil Engineer	+	M	H
S004	Mr. Ralph Jackson	MoPWPUDE	Civil Engineer	+	M	H
S005	Mr. Lewis John	MoPWPUDE	Civil Engineer	+	M	H
S006	Ms. Jill Mayers	MoPWPUDE	Civil Engineer	+	M	H
S007	Mr. Sam Lane	MoPWPUDE	Technician	+	L	M
S008	Mr. Frank Paul	MoPWPUDE	Technician	+	L	M
S009	Mr. Carl Mark	MoPWPUDE	Technician	+	L	M
S010	Ms. Lane Clark	GIS/DOMINODE	GIS specialist	+	L	M
S011	Mr. Dan Bates	GIS/DOMINODE	IT Officer	+	L	M
S012	Mr. Sherlock Smith	CDB	Project Coordinator	+	H	H
S013	Mr. Lawrence Louis	CDB	Project Supervisor	+	H	H
S014	Consultant Team	TBD	TBD	+	M	H
S015	Project Manager	TBD	TBD	+	M	H
S016	Project Team	TBD	TBD	+	M	H
S020	Government of Dominica	MoPWPUDE	Minister	+	H	H
	External			+		
S017	Steering committee change control board	TBD		+	H	H
S018	Representatives from the Ministry of Finance	TBD		+	M	M
S019	Public and motorist	TBD	Media	+	L	L

Power: High (H), Medium (M), Low (L)   **Interest:** High (H), Medium (M), Low (L)   **Position:** + In favor, . . .   - Against

Note. Stakeholders are classified by means of power, position and interest.

Without mapping stakeholders in relation to their influence and interest in the project, it is difficult to communicate with them and keep them happy.

The stakeholder maps use four ways to manage communication with stakeholders based on the power interest matrix: manage them closely, keep them satisfied, keep them informed or simply monitor them. Figure 19 maps out the RAMS stakeholders, who are managed closely, kept informed, monitored and kept satisfied.

These four categories are described below as:

- Manage Closely: this is for category high-power and high interest stakeholders. There is consistent communication with these stakeholders and they must be satisfied that the project goals are met.

- Keep Satisfied: this category is for high-power and low-interest stakeholders. Communication with these stakeholders but closely managed.

- Keep informed: this category is for low-power and high-interest stakeholders. These stakeholders have advice and guidance for the project as well as advance notice on emerging issues; occasional contact with these stakeholders is encouraged.

- Monitor: this category is for low-power and low-interest stakeholders. These stakeholders are of the lowest priority and not much time is spent communicating with them.

Figure 19

Stakeholder Mapping
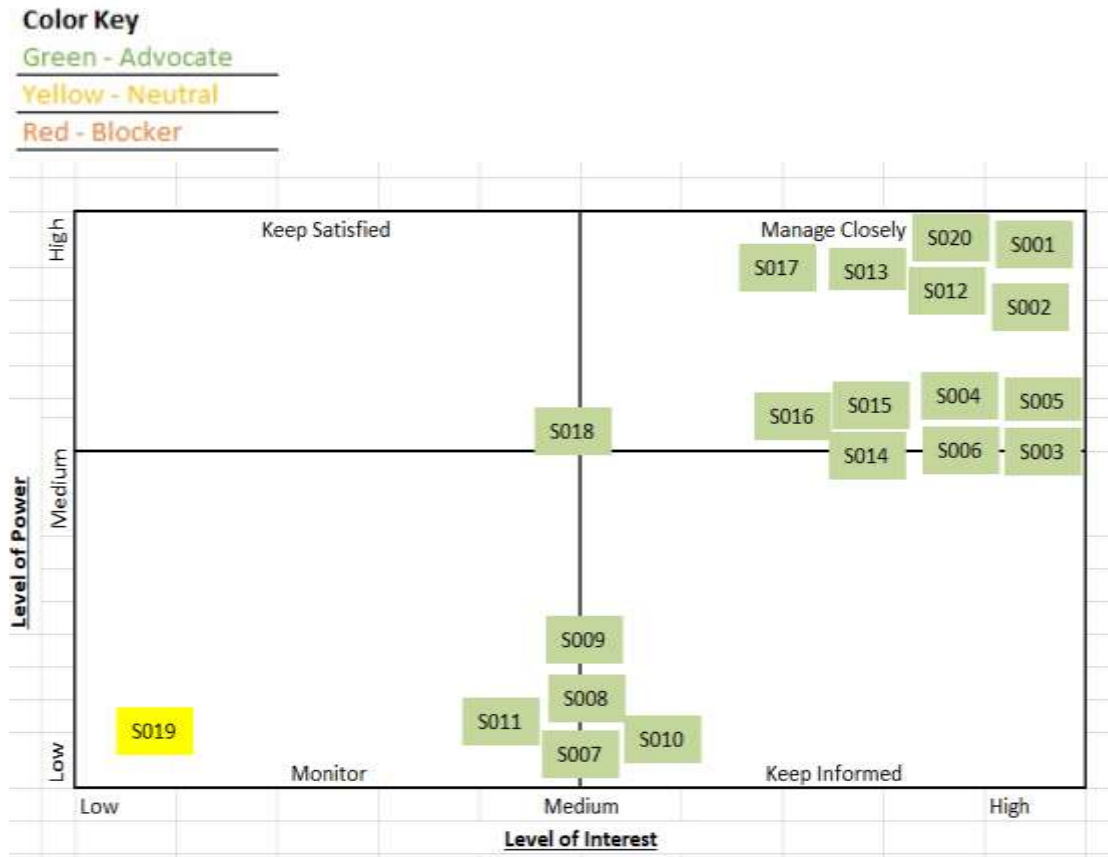
Note. RAMS stakeholders are mapped to determine who are managed closely, kept informed, monitored and kept satisfied.

Grouping stakeholders through mapping allows for their questions, concerns and needs to be anticipated so that effective messages and good decision making. This Stakeholder's map provides various stakeholders and groups them according to their level of interest and level of power. It also indicates the level of support that the stakeholder may have for the project.

4.7.2   Define Strategy

To maintain communication the interests of stakeholders are defined as well as the strategies to be used to keep them informed. The project manager develops a strategy that will assist the project effectively communicate specifically targeted information to stakeholders. This can include building support for a particular initiative, shaping public opinion, or managing a crisis.

Not only do effective strategic communications make messages visible to specific audiences, but they also build and sustain strong relationships with customers, promoting reliability, responsibility and accountability. This way, focus remains on the project's objectives, progress is monitored and valuable feedback is evaluated. Developing a strategy and plan lays the groundwork for fulfilling a purpose and allocating resources towards the greater goals. Table 26 provides detail on stakeholder interest and the intended strategy for communication management.

Table 27 describes a communication matrix that was developed to provide details of the type of communication to be used as well as the owner to deliver the information and the audience of such information.

Table 26

Stakeholder Communication Strategy

Stakeholder ID	Stakeholder	Interest	Strategy
	Internal		
S020	Minister(Government of Dominica)	The citizens will have much more confidence in them. They will have much support in future elections.	To show transparency in the project progress and status.
S001	Permanent Secretary	The Government can use the outcome of this project in to make sound decisions on which road assets to maintain, rehabilitate and reconstruct.	To ensure that the Permanent Secretary is updated on the project and any issues that may affect project delays.
S002	Chief Technical Officer		
S003	Civil Engineer	Technical capacity of professional will increase.	To be informed on project daily status
S004	Civil Engineer		
S005	Civil Engineer		
S006	Civil Engineer		
S007	Technician		
S008	Technician		
S009	Technician		
S010	GIS specialist	That data collected on national assets are stored for future use and that grant funds are used appropriately.	To be informed on project requirement from their individual ministries.
S011	IT Officer		
S018	Representatives from the Ministry of Finance		
S012	CDB Project Coordinator	To ensure project reaches its targets	
S013	CDB Project Supervisor		
S014	Consultant Team	For business profit.	To be informed on all project issues
S015	Project Manager	For business profit, increase business profile and complete Project successfully.	To show transparency in the project management, and to invite them visiting the project sites
S016	Project Team		
	External		
S017	Steering Committee Change Control Board	That the Project objectives are meet and the Project stays within budget, on schedule and required standard. The aim is also to ensure that sustainability and regenerative goals are achieved.	Updates on project status and issues that may affect meeting project objectives to assist in reducing risk for project failure.
S019	Public and motorist	To have safe roads and uninterrupted flow of traffic.	To provide information on the progress of the project.

Table 27

RAMS Communication Matrix

Communication Type	Audience	Delivery Method	Frequency	Owner
Reports	Minister, Permanent Secretary, Chief Technical Officer, Civil Engineers, Technicians	Meetings Emails	Bi-weekly, Monthly, Quarterly and annually	Project Manager, Consultant, Chief Technical Officer
Presentations	Minister, Permanent Secretary, Chief Technical Officer, Civil Engineers, Technicians	Meetings Emails Web-conference Telephone calls Media	Quarterly	Project Manager, Consultant, Chief Technical Officer
Announcements	Minister, Permanent Secretary, Chief Technical Officer, Civil Engineers, Technicians, Project Team, CDB Officers, RAMS Design Consultants, other GoCD Ministries, Public and Motorist	Meetings Emails Web-conference Telephone calls Media	When needed	Minister, Project Manager, Consultant, Chief Technical Officer
Meetings	Minister, Permanent Secretary, Chief Technical Officer, Civil Engineers, Technicians	Meetings, Web-conference	Weekly, Bi-weekly, Monthly, Quarterly and annually	Project Manager, Consultant, Chief Technical Officer
Team Building Activities	Chief Technical Officer, Civil Engineers, Technicians, Project Team, CDB Officers and RAMS Design Consultants	Meetings, Excursions, Lunches	Annually.	Project Manager, Consultant, Chief Technical Officer

Note. The communication strategy for RAMS are used to determine the frequency that information needs to be disseminated.

4.7.3 Manage Communication

The Project Manager distributes the communication management plan to all relevant stakeholders and project team members. To manage communication involves the processes of ensuring timely and appropriate collection, creation distribution storage, retrial, management, monitoring and disposition of project information (PMBOK Guide, 2017).

There may be times when the project manager has information which could be a security risk. Plan for this possible scenario when crafting your communication plan. The Project Manager crafts the flowchart in Figure 20 that shows how to share sensitive information.

Figure 20

Sensitive Information Matrix
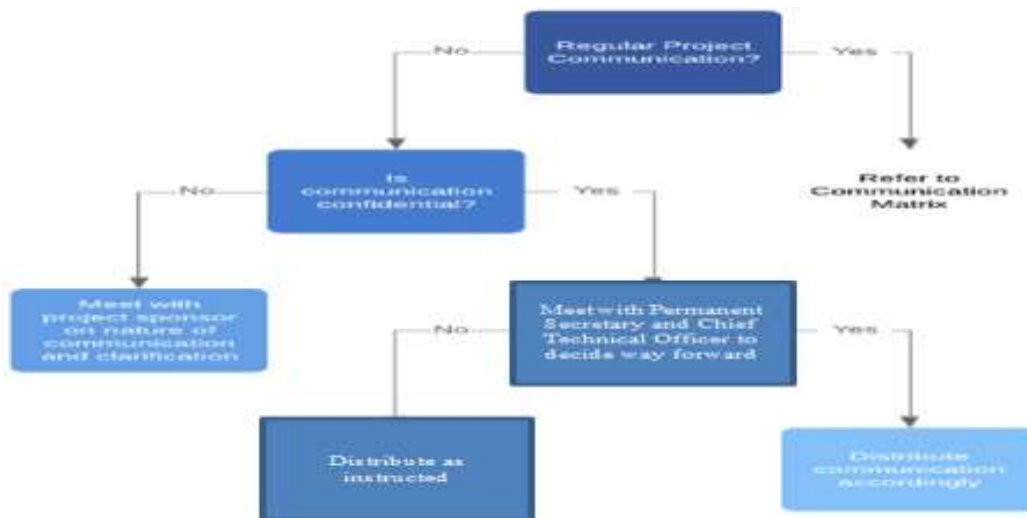
Note. The Sensitive Information Matrix is a tool used to determine how to handle information which is confidential

4.7.4   Monitor Communication

The Project Manager will monitor communication by monitoring and controlling communications throughout the entire project life cycle to ensure the information needs of the project stakeholders are met. The project manager needs to control the flow of communication and the information shared.

Meetings held have a time limit, and the project manager keeps to it. Recurring meetings should be scheduled in advance. Meeting with the team should be regular (however, need not be often). Each meeting should have a specific purpose and agenda. The agenda should be distributed to the meeting attendees before the meeting and the team should stick to the agenda during the meeting. Team members and meeting attendees should know their role in meetings beforehand. Minutes are documented and published for relevant stakeholders' review and feedback by using a minutes of meeting form (as seen in Appendix 9.)

Project reporting is the act of collecting and distributing project information. These reports are shared with the stakeholders identified and include project information according to their requirements. Table 28 demonstrates the type of reporting which will be implanted under the RAMS implementation.

Table 28

Project Reporting

Report Type	Frequency	Format
Annual Performance Reports	Annually	Word document describing the performance of the project for the given year. Describes if KPIs were met, issues, delay, risk, budget and quality.
Quarterly Performance Reports	Quarterly	Word document describing the performance of the project for the given month. The project objectives, scope, budget status and allocations, and project plan for next quarter will be described in this document. Conclusion and recommendations along with progress photos are presented in the report.
Progress Status Report	Monthly	Project Manager will provide progress report on progress of the project, timeline, resources, delays, risks or issues in the project.
Budget Management Report	Monthly	Excel file tracking budget expenses, purchase orders, invoices, payment dates and monthly forecast of expenses.
Lessons Learnt Log	Monthly	In Table format the lessons will be recorded by ID number, date identified, entered by, description of lesson, impact on the project and recommendation/comments.
Project Manager Bi-weekly Progress Report	Bi-Weekly	Table report format describing the progress of the project, any variation from contract, problems, delays and challenges,

		recommendations, remarks and include progress photographs.
Minutes of Meetings	Bi-Weekly	Progress Meetings will be held biweekly, and minutes prepared accordingly.
Issues Management Log	Bi-Weekly	Log recording of resource constraints, scope modifications, implementation schedule, project compliance, Contractor/Supplier performance, Project design and any other issue requiring immediate action, actively being resolved status or resolution of issue.
Design Consultant Report and Supervisory Consultants Report	Monthly	Tracking sheet of consultants progress related to project objectives.
Daily Logs	Daily	To be prepared by the Project Manager Team. The log describes the daily works in progress.
Public Complaint Register	Monthly	This report to be prepared in Table format will capture the name of complaint, location, date and time, complaint/concern and signature of complainant and parties involved.

Note. Project reporting for RAMS for each deliverable ensures that all stakeholders are adequately informed.

4.8   Risk Management Plan

Wanner (2013) explains that projects are afflicted with risk by nature and a risk is a threat and an opportunity at once. A risk is not an assumption. Warner (2003) defines project assumptions as an educated guess or opinion. A project assumption that is proven

to be false often becomes a constraint and can cause significant setbacks or limitations in a project. Relying on assumptions in a project can generate risk on the project. The Project Manager periodically checks the stability of the assumptions, and is monitored continuously.

Understanding a risk and the risk management process entails understanding the underlying factors that contribute to project risks. Risk can impact the project's timeline, performance or budget. Project risk management is the process of identifying, analyzing and responding to any risk that arises over the life cycle of a project to help the project remain on track and meet its goal. Risk management also examines the relationship between risks and the cascading impact they could have on an organization's strategic goals. Risk management isn't reactive only; it should be part of the planning process to figure out the risk that might happen in the project and how to control and mitigate that risk if it in fact occurs. Risk project management processes are:

- Plan risk management

- Identify risk

- Perform qualitative risk analysis

- Perform quantitative risk analysis

- Plan risk responses

- Implement risk responses

- Monitor risk.

Project Risk Management aims, identify and manage risks that are not addressed by the other project management processes (PMBOK Guide, 2017). The project ensures risks

are managed, for unmanaged risk has the potential to cause the project to deviate from the plan and fail to achieve the defined project objectives. This risk management plan addresses individual project risks which are uncertain events which affect one or more project objectives or overall project risk, which are uncertainty on the project as a whole and which may cause variations in project outcomes.

To ensure efficient management of risk, the project manager explains to the project team the level of risk exposure which is acceptable in pursuit of the project objectives. This is defined by measurable risk thresholds that reflect the risk appetite, risk tolerance and risk threshold of the stakeholders. Risk management is a very important part of project management because it can exponentially increase the chances of a project's successful outcome.

4.8.1 Plan Risk Management

Plan risk management commences when the project is conceived, revised during the project life cycle, is done when the project scope changes significantly and when new risks are constantly emerging. The aim is not to eliminate all risk but to preserve and add to enterprise value by making smart risk decisions. The risk management plan describes how risk management is structured in the project and how it is carried out.

The Risk Manager is responsible for the Risk Management Plan, its effective implementation throughout the project life cycle. The Risk Manager is also responsible for creating and maintaining the Risk Register (or Log).

4.8.1.1.1 Risk Strategy

The risk management strategy for this Project is a structured approach to addressing risks, risk exposures, and risk events. It is a continuous process in which new and ongoing risks are continually identified, assessed, managed, and monitored. This provides a way to update and review assessments as new developments occur and then to take steps to protect the organization, people, and assets. The risk management strategy used depends on the risk. The project team and manager need to fully understand each risk the project faces so that the appropriate strategy can be chosen to treat them. There are four main risk management strategies, or risk treatment options namely:

- Risk Acceptance

A risk is accepted with no action taken to mitigate it is the definition of risk acceptance (Ideagen, 2023). The cost of eliminating risks goes higher than the original cost of risk. In some instances accepting the risk is the optimum solution.

- Risk Transference

With this approach, the responsibility of managing risk is given to another party. This does not imply that the risk is eliminated, but

it will be handled by another organization. Insurance requirement in the contract agreement with consultants comes under this type of risk management.

- Risk Avoidance

In the project any risk which can be avoided or eliminated will be done, however, opportunities for growth will be taken up. Risk avoidance will be reserved for risks that would have a major impact on the project or ministry if they were to occur.

- Risk Reduction

The Project Manager develops approaches to mitigating risks through proper actions to prevent them or minimize their impact. This is a standard method of treating risk. With this approach, you can adopt measures and tactics to help you manage risks more effectively.

4.8.1.1.2   Methodology

The methodology to be employed to plan risk management defines the specific approaches, tools and data sources that will be used to perform risk management on the project. Define the tools and approaches that will be used to perform risk management activities such as risk assessment, risk analysis and risk mitigation strategies.

The risk management plan is tailored for the size of the project, already know risk and project importance. Tools and techniques to be used in this process by the project manages is expert judgment, stakeholder analysis and meetings.

The project manager must be familiar with Ministry's approach to managing risk. Meetings are held by the project manager with the project team, key stakeholders and consultant who are responsible to manage risk on the project. The following risk management processes that help with the implementation of the project:

- Identify project risks, forecast, and evaluate risks on the project.

- Analyze and determine their effect on your business goals, objectives, operations, finances, customers and employees, brand, stakeholders.

- Identify an action plan to have a risk response and eliminate or reduce those effects.

4.8.1.1.3   Roles and Responsibilities

The roles and responsibilities in the plan risk process defines the lead, support and risk management team members for each activity described in the risk management plan and clarifies their responsibilities. Figure 21 illustrates the role and responsibilities of individuals as it relates to risk management.

Figure 21

Roles and responsibilities

Note. Roles and responsibilities of the Project Manage and the team is outlined as it relates to risk management.

This RAMS project is small in nature and not complex, for this reason a risk officer is not needed as well as a sub-project manager. These roles and responsibilities will be

handled by the Project Manager. Risk management training is provided by the project manager to all project team members. Team members include stakeholders, project sponsors, government and consultants.

4.8.1.1.4 Funding

This process identifies the funds needed to perform activities related to project risk management (PMBOK Guide 2017). It establishes protocols for application of funds in contingency and management reserves. The application would be made to the Change Control Board by the Project Manager and rejection or approval is granted.

4.8.1.1.5 Timing

The timing of when and how often the risk management processes will be performed is established in the plan and is included in the project scheduled plan.

4.8.1.1.6 Risk Categories

The Project Manager groups individual risk, by creating a risk breakdown structure (RBS). It represents a hierarchical representation of potential sources of risk. The Project Manager uses RBS to brainstorm and document risks. It also helps to mitigate against likely and unlikely risks. In this project, seven broad categories of risks were identified as seen in Figure 22. While there could have been further categorization, limiting it to seven helped to give a more ordered and complete view of the risks. It also helped in promoting understanding of how the risks were related to the project, at its various phases.

Figure 22

Risk Breakdown Structure
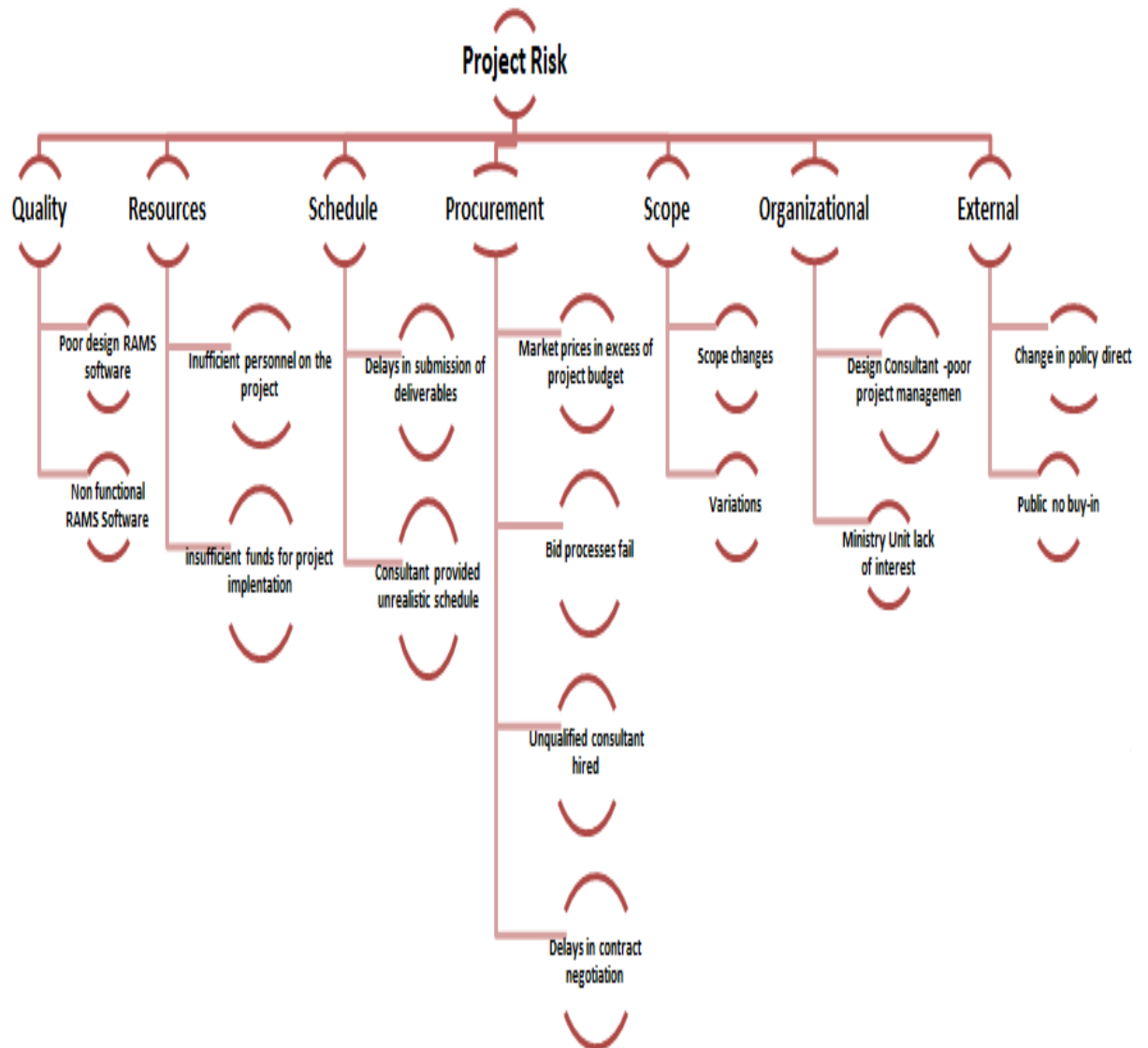
Note Risk Breakdown Structure for RAMS is a hierarchical chart that breaks down project

risks starting with higher-level categories and continuing down into sub-levels of risk.

4.8.1.1.7   Stakeholder Risk Appetite

Risk appetite is a classification of how much risk are specific stakeholders or the overall organization, willing to accept while pursuing project objectives. The following factors affect the risk appetite of an organization: organizational culture, risk attitude of stakeholders, competition, the organization's financial condition and the capability of the organization to handle the risk.

The Project Manager developed a risk appetite statement as seen in Figure 23 which defines what they consider as acceptable risk. This statement guides project managers in every decision related to risk management, such as identifying risks, assessing them, and developing a risk response plans.

Figure 23

Risk Appetite Statement

Note. Risk Appetite statement determines if risks need to be managed and gives us hints about how they are to be managed.

A risk appetite statement helps management understand risks and make informed decisions. In addition, it provides transparency to stakeholders, and they can assign resources for risk management. A risk appetite statement communicates the corporate value (willingness to take or avoid risks), strategy, and capacity to absorb the risks.

4.8.1.1.8 Risk Probability and impacts

The Project Manager develops definitions of risk probability and impact levels for the project context and reflects the risk appetite and thresholds of the organization and stakeholders. The probability addressing how likely the risk event or condition is to occur (the uncertainty dimension), and impact detailing the extent of what would happen if the risk materialized (the effect dimension). Table 29 illustrates the definition of risk probability and impact levels for the RAMS project. The project objectives will also evaluate opportunities from positive impacts such as moving ahead of schedule, cost reductions and policy adjustments and negative impacts such as delays, cost overruns, poor quality and impact on the environment.

Table 29

Definition of risk probability and impact levels

Scale	Probability	+/-Impact on Projects Objectives			
		Time	Cost	Environment	Quality
Very High	>70%	>6 months	>$501k	Very High	Very Significant impact on overall function
High	51-70%	3-6 months	$251-$500k	High	Significant impact on overall function
Medium	31-50%	1-3 months	$101-$250k	Medium	Some impact in key functional areas
Low	11-30%	1-4 weeks	$51-$100k	Low	Minor impact on the overall functionality
Very Low	1-10%	1 week	< $50k	Very Low	Minor impact on secondary functions
Nil	<1%	No change	No change	Nil	No change in functionality

Note. Risk probability and impact level for RAMS are describes from a scale of nil to very high.

4.8.1.1.9 Probability and Impact Matrix

The Project Manager uses a Probability and Impact Matrix to assess and prioritize risks within a project. It helps stakeholders evaluate the potential consequences (impact) of a risk and the likelihood (probability) of that risk occurring. Figure 24 illustrates the probability vs. Impact Matrix graph which describes what can be found in the probability and impact assessment.

Figure 24

Probability and impact matrix for RAMS

		Threats					Opportunities				
	0.90	0.05	0.09	0.18	0.36	0.72	0.72	0.36	0.18	0.09	0.05
Probability	0.70	0.04	0.07	0.14	0.28	0.56	0.56	0.28	0.14	0.07	0.04
	0.50	0.03	0.05	0.10	0.20	0.40	0.40	0.20	0.10	0.05	0.03
	0.30	0.02	0.03	0.06	0.12	0.24	0.24	0.12	0.06	0.03	0.02
	0.10	0.01	0.01	0.02	0.04	0.08	0.08	0.04	0.02	0.01	0.01
		0.05	0.10	0.20	0.40	0.80	0.80	0.40	0.20	0.10	0.05
						Impact					

4.8.1.1.10 Identify Risk

Participants in the identify risk process activities are the Project manager, project team members, consultants, Ministries' staff members, representatives from the donor agency, end users of the software and other stakeholders. The Project Manager ensures that all stakeholders are involve to foster ownership of risk identified, responsibility of the risk and associated risk response actions. Identifying risk is iterative, since new risk emerges as the project progresses. The level of the risk will also change during the project life cycle.

Tools and techniques to be used to identify risk are expert judgment, meetings, data analysis and data gathering from brainstorming and interviews. As you begin identifying your project's risks, place them into one of the following three categories:

- Known risks: these are risks that are readily identified by you and your project team members.

- Unknown risks: unknown risks are those that are not as obvious and not easily identified by you or your team members. However, upper-level management

and project stakeholders often have insight into these potential risks. Seeking their input to discover these risks is a major part of developing your risk management plan.

- Unknowable risks: these are risks that simply cannot be foreseen, such as an illness, accident, or system failure.

4.8.1.1.11 Risk Register

The Project Manager develops a risk register which captures details of individual project risk. It also includes information about the priority of the risk and the likelihood of it happening. A project risk register should not only identify and analyze risks, but also provide tangible mitigation measures. This way, if the risk becomes a larger threat, your team is prepared with solutions and empowered to solve the issues.

The Project Manager ensures that risks are tracked in a central location and reviewed regularly, to reduce the event that something may be missed or forgotten. Everyone on the project team and potentially impacted by the project's success helps identify and assess risks. The risk register developed in Table 30 contains:

- Risk identification. This could include a name or an identification number to identify the risk.

- Risk description. Providing a brief description of the risk helps determine why the risk is a potential threat. The risk description is short, concise, and provides a high-level overview.

- Risk category. Each risk is assigned to a category such as quality, schedule or scope. This is done by categorizing and evaluating where the risk derives from and determining remediation.

- Risk probability. This involves deciding how likely each risk may occur by using the PMBOK Guide (2017) risk matrix guide

- Risk analysis. Analyzing the potential effect that each risk might have on the project or ministry can help support the severity of the risk.

- Risk responses. Also known as a risk response plan, a risk mitigation plan should include a step-by-step solution intended to reduce or eliminate the risk, a brief description of the anticipated outcome, and how the risk mitigation plan will affect the impact of the risk.

- Risk priority. Establish the priority of the risk, typically by combining the probability of the risk and the risk analysis. One way to do this is to document priority using a simple numerical scale, such as 1 (green), 2 (yellow), or 3 (red).

- Risk owner. Each risk to an organization should have an owner assigned to it, to assure that the risk is mitigated according to plan. Risk ownership should include the person who is assigned to oversee the risk mitigation plan, plus any additional team members as necessary.

- Risk Status. The status of each risk can let people know whether a risk has been successfully mitigated or not. A risk status can be marked as "open," "in progress," or "closed".

Table 30

Risk Register and Qualitative Risk Analysis

Risk ID	Risk	Risk Category	Strategic Response Type	Risk Responses	Probability (P)	Impact (I)	Risk Score (PxI)	Risk Priority	Risk Owner	Risk Status
	Threats									
R001	Change in Policy direction	Threat	Escalate	Communicate project goals and benefits to government cabinet	0.7	0.8	0.72	1	Minister and Permanent Secretary	Open
R002	Public against to project	Threat	Mitigate	Keep the public informed	0.1	0.1	0.01	3	Minister	Open
R003	Poor project management by the Design Consultant of RAMS	Threat	Mitigate	Develop a project management plan and implement processes	0.5	0.2	0.10	2	Project Manager and Ministry	Open
R004	Ministry lack interest in the project	Threat	Mitigate	Communicate goals to the project management team	0.3	0.2	0.06	2	Ministry	Open
R005	Variation	Threat	Avoid	Ensure project management tools are used for project success	0.7	0.4	0.28	1	Project Manager and Ministry	Open
R006	Scope Changes	Threat	Mitigate	Ensure all requirements from stakeholders are before project implementation	0.5	0.8	0.40	1	Project Manager and Ministry	Open
R007	Market prices in excess of project budget	Threat	Accept	Activate contingencies	0.5	0.4	0.2	1	Project Manager and Ministry	Open
R008	Bid process fail	Threat	Accept	Retender at the minimum possible turnover time	0.3	0.4	0.12	2	Project Manager and Ministry	Open
R009	Unqualified consultants hired	Threat	Mitigate	Ensure TOR requirement employ qualified personnel	0.5	0.8	0.4	1	Project Manager and Ministry	Open
R010	Delays in contract negotiation	Threat	Mitigate	Set deadlines for bidders and the client for responses.	0.1	0.1	0.01	3	Project Manager and Ministry	Open
R011	Delays in submission of deliverables	Threat	Mitigate	Set deadline for submissions and feedback as well as penalties.	0.3	0.4	0.12		Project Manager and Ministry	Open
R012	Consultants provided unrealistic project schedule	Threat	Mitigate	Provide detail feedback to improve project schedule	0.5	0.8	0.4	1	Project Manager and Ministry	Open
R013	Insufficient personnel on the project	Threat	Mitigate	Ensure TOR has all project requirement	0.3	0.4	0.12	2	Project Manager and Ministry	Open
R014	Poor design of RAMS	Threat	Mitigate	Ensure that the TOR	0.7	0.8	0.56	1	Project Manager and Ministry	Open

				provide requirements for a functional RAMS software.						
	software									
R015	Nonfunctional RAMS software	Threat	Mitigate	Ensure project software pilot is functional	0.5	0.8	0.4	1	Project Manager and Ministry	Open
R016	Insufficient funds for project implementation	Threat	Transfer	Alert project sponsors at the soonest	0.9	0.8	0.72	1	Project Manager and Ministry	Open
	Opportunities									
R017	Design consultants to work of government build asset management systems	Opportunity	Transfer	Government to determine if additional services are required from the consultant	-0.5	-0.2	-0.1	2	Project Manager and Ministry	Open
R018	Government to use RAMS scientific data to gain funding for maintenance, rehabilitation and reconstruction of road assets.	Opportunity	Transfer	Government to take the opportunity to source funding for maintenance projects	-0.7	-0.4	-0.28	1	Project Manager and Ministry	Open

Note. Qualitative risk analysis identifies all threats (or opportunities), how likely they are to happen, and the potential impacts if they do.

4.8.1.1.12 Risk Report

A risk report identifies risks tied to potentially impacting an organization's business processes. This project risk presents information on sources of overall project risk, together with summary information on identified individual project risk, which is then submitted to key stakeholders. The report is developed progressively throughout the project risk management processes. PMBOK Guide (2017) indicates that the results from the perform qualitative risk analysis, perform quantitative risk analysis, plan risk response, implement risk responses and monitor risk are included in the risk report.

The report allows the Project Manager to be preemptive and considering risks before they occur, which can save money, time and reputations. This risk reports are important because it helps the project managers, project owners and end users of the software to better understand various risks the ministry is taking while working on a project. The report brings to the forefront an accurate interpretation of the issues that may impact the project.

4.8.1.1.13 Perform Qualitative Risk Analysis

The Project Manager uses qualitative risk analysis for identifying, analyzing and evaluating risks in an organization. It is used because qualitative risk analysis uses subjective judgment to determine the probability of a risk occurring and its impact on an organization. The outcome of this process is a list of risks with their corresponding probabilities and impacts which is found in detail in Table 30.Qualitative risk analysis is an

essential step when conducting risk management that helps the Project Manager to manage the project and maintain its schedule. The analysis helps avoid potentially costly delays or mistakes, which helps ensure the project succeeds (Indeed, 2023). The following are steps used to perform the qualitative risk analysis:

- Identify the projects risks

- Asses the project risk

- Prepare risk report

- Implement and monitor risk response plans

- Monitor and control the risk

4.8.1.1.14 Perform Quantitative Risk Analysis

The Project Manager conducts a quantitative risk analysis which focuses on numerical values of the risks present. The quantitative risk analysis allows the determination of potential risk on the project. This analysis help you decide if a risk is worth pursuing. It also is useful in the development of project management plans, as understanding the risks present allows you to reduce the likelihood of certain risks and to prepare for others that you cannot fully eliminate.

The quantitative risk analysis used for this project was the 'three-point risk analysis. This method determines the expected cost of a risk on the project. To calculate a three point assessment, the Project Manager and team determines:

- the most likely cost of a risk,

- the most optimistic cost of a risk

- and the most pessimistic cost of the risk.

Table 31 demonstrates the three cost risk which are added, divided by three and multiplied by the probability to determine the cost of the risk. In this project the risk cost incorporates impact on the project's time, quality, budget and environment. Risk responses will be developed for risk with probability percentages above 10%. Table 31 indicates that total risk cost is US$3 800 556.03 and total time wasted because of risk can be 335 days. The steps to perform a quantitative risk analysis:

- Identify the projects risks

- Asses the cost of project risk

- Determine the probability of each risk occurring

- Calculate cost of each risk

Table 31

Quantitative Risk analysis

`	Risk	Probability (%)	Most likely cost ($USD)	Most optimistic cost ($USD)	Most pessimistic cost($USD)	Average cost of Risk($USD)	Most likely schedule impact (days)	Most optimistic schedule impact (days)	Most pessimistic schedule impact (days)	Average schedule impact (days)	Plan risk response
	Threats										
R001	Change in Policy direction	50%	1080985.50	1080985.50	1080985.50	$ 540,492.75	90	54.00	108.00	42	yes
R002	Public against project	10%	0	0	1080985.50	$ 36,032.85	20	12.00	24.00	2	no
R003	Poor project management by the Design Consultant of RAMS	30%	200000.00	100000.00	3000000.00	$ 330,000.00	60	36.00	72.00	17	yes
R004	Ministry lacks interest in the project	10%	500000.00	200000.00	800000.00	$ 50,000.00	45	27.00	54.00	4	no
R005	Variation	60%	100000.00	50000.00	200000.00	$ 70,000.00	30	18.00	36.00	17	yes
R006	Scope Changes	50%	150000.00	10000.00	200000.00	$ 60,000.00	45	27.00	54.00	21	yes
R007	Market prices in excess of project budget	60%	2000000.00	1000000.00	2500000.00	$ 1,100,000.00	60	36.00	72.00	34	yes
R008	Bid process fail	45%	3000.00	2000.00	5000.00	$ 1,500.00	90	54.00	108.00	38	yes
R009	Unqualified consultants hired	40%	2000000.00	1500000.00	2500000.00	$ 800,000.00	70	42.00	84.00	26	yes
R010	Delays in contract negotiation	30%	20000.00	10000.00	40000.00	$ 7,000.00	30	18.00	36.00	8	yes
R011	Delays in submission of deliverables	50%	200000.00	100000.00	300000.00	$ 100,000.00	60	36.00	72.00	28	yes
R012	Consultants provided unrealistic project schedule	60%	80000.00	50000.00	10000.00	$ 28,000.00	50	30.00	60.00	28	yes
R013	Insufficient personnel on the project	30%	50000.00	20000.00	60000.00	$ 13,000.00	30	18.00	36.00	8	yes
R014	Poor design of RAMS software	60%	1080985.50	1200000.00	1500000.00	$ 756,197.10	45	27.00	54.00	25	yes
R015	Nonfunctional RAMS software	45%	300000.00	200000.00	500000.00	$ 150,000.00	80	48.00	96.00	34	yes
R016	Insufficient funds for project implementation	50%	400000.00	200000.00	600000.00	$ 200,000.00	90	54.00	108.00	42	yes
	Opportunities										
R017	Design consultants to work of government build asset management systems	10%	-3500000.00	-2000000.00	-1500000.00	-$ 233,333.33	-120	-72.00	-144.00	-11	no
R018	Government to use RAMS scientific data to gain funding for maintenance.	10%	-3000000.00	-1750000.00	-1500000.00	-$ 208,333.33	-100	-60.00	-120.00	-9	no
						$ 3,800,556.03				353	

Note. Quantitative risk analysis focus on numerical values of the risks identified for the RAMS project.

4.8.1.1.15 Plan Risk Responses

Good risk response starts with good risk identification by the Project Manager, project team and stakeholders. The Project Manager also look at lessons learned from previous projects to identify risk, talking to your experienced project team members about what they think could happen and reaching out to stakeholders and mentors.

A sound risk response strategy is vital as it allows the project team to address risks by priority and ensures adequate resources and budget has been assigned. The Project Manager develops the risk response plan to determine ways to reduce or eliminate any threats to the project, and also takes advantage of the opportunities to increase their impact on the project.

The Project Manager is also responsible to decrease the probability and impact of threats and increase the probability and impact of opportunities. For the threats that cannot be mitigated, the Project Manager has a robust contingency plan and also a response plan if contingencies do not work. It is not required to eliminate all the risks of the project due to resource and time constraints. The Project Manager reviews the risk register throughout the project. Planning for risks is iterative and risk response planning does not end once you begin work on the project. Risk responses strategies for threats may include:

- AVOID: Focus on eliminating the cause and thus, eliminating the threat.

- MITIGATE: There are certain risks that cannot be eliminated. However, their impact can be reduced. This is termed as mitigation of risks.

- TRANSFER: Transfer the risk to some other party- for example, insurance purchases, warranties or guarantees.

The choices of response strategies for OPPORTUNITIES include:

- EXPLOIT: eliminate the uncertainty associated with the risk to ensure it occurs.

- ENHANCE: Increase the probability and positive impact of risk events

- SHARE: Allocate ownership of opportunity to a third-party

  A response strategy for BOTH threats and opportunities:

- ACCEPT: Passive acceptance leaves action to be determined as needed, in case of a

  risk event. Active acceptance may involve contingency plans to be implemented if

  risk occurs and allocation of time and cost reserves to the project. A decision to

  accept risk must be communicated to stakeholders.

- ESCALATE: Risks which cannot be monitored and handled by the project are

  escalated to the upper level-for example, to project sponsor or client.

Table 31 describes the risk response for the RAMS project as well as its triggers. Some

risks are not going to be resolved. The risk response is also a way to put a contingency

plan into action when they do occur.

Table 32

Plan Risk Responses

Risk ID	Risk	Plan risk response	Trigger	Category	Strategic Response Type	Response
	Threats					
R001	Change in Policy direction	yes	Elections which caused change in government	threat	accept	Ensure that there is buy- in from the public and permanent secretary
R003	Poor project management by the Design Consultant of RAMS	yes	Delayed submission of deliverables	threat	avoid	Effective monitoring by supervisory consultant
R005	Variation	yes	Increase in scope	threat	avoid	Ensure TOR captures all project requirements
R006	Scope Changes	yes	Increase in project requirements	threat	avoid	Ensure TOR captures all project requirements
R007	Market prices in excess of project budget	yes	Unsuccessful bid process	threat	accept	Ensure project budget reflects market conditions
R008	Bid process fail	yes	No bid submission	threat	avoid	Retender
R009	Unqualified consultants hired	yes	Ensure TOR qualification requirements are above standards	threat	avoid	Ensure TOR captures all qualification requirements
R010	Delays in contract negotiation	yes	Delayed negotiations	threat	avoid	Set deadlines
R011	Delays in submission of deliverables	yes	Delayed submission of deliverables	threat	avoid	Set deadlines
R012	Consultants provided unrealistic project schedule	yes	Delayed submission of deliverables	threat	avoid	Detail review of project schedule
R013	Insufficient personnel on the project	yes	Poor project deliverables	threat	avoid	Review consultants project team
R014	Poor design of RAMS software	yes	Not user friendly, difficult to navigate	threat	avoid	Ensure software is user friendly and manual is provided
R015	Nonfunctional RAMS software	yes	Submission of nonfunctional software	threat	avoid	Ensure consultant submits functional pilot software for approval.
R016	Insufficient funds for project implementation	yes	Project budget is insufficient	threat	escalate	Ensure all requirements are reflected in the TOR and cost is reflective of market prices.

Note. Plan risk response for RAMS determined ways to reduce or eliminate any threats to the project, and also the opportunities to increase their impact.

4.8.1.1.16 Implement Risk Responses

The Implement Risk Responses process is where the Project Manager takes the

response plans and actually does the work to make them happen. The execution of risk

response plans is important because you can't always rely on talking about a potential

problem as enough to get it remedied.

The purpose of this process is to ensure that each of the identified risks on the Risk

Register has appropriate actions or plans to mitigate or avoid a risk before it happens or to

provide a response when a risk occurs and turns into a project issue. The idea is to reduce

the exposure to risks in the project and minimize threats to the delivery in terms of time,

cost or quality.

4.8.1.1.17 Monitor Risk

The Project Manager and team will continuously monitor closely the occurrence of

possible risks whether calculated or unexpected and will activate the risk management plan

when necessary. Risk assessment data will be collected every week and data will be

compiled in a report for further analysis.

The Project Manager tracks and measures the performance and outcomes of the risk

responses, and reports any issues or changes to the risk owners. The manager also updates

the risk register and the risk matrix regularly, and identifies any new or emerging risks that

may arise.

Risks and their triggers and responses are reported at every progress meeting and progress report. Constant monitoring of the risk register allows the project team to identify secondary or residual risks and react promptly. The Project Manager uses the contingency and management reserves as a means to mitigate certain risks that the project may encounter. The project team will use various data analysis techniques to monitor risks, including reserve analysis, performance analysis, project audits, and weekly progress meetings. Risk monitoring will be a continuous process throughout the life of this project.

4.9   Procurement Management Plan

Procurement management refers to all the actions and strategies related to the cycle of identifying, evaluating, selecting suppliers or services needed from outside the project team. Procurement management is responsible for ensuring that the projects get the required goods and services at the right time, at the right price, and with the right specifications. The Project Manager administers control processes required to develop and administer agreements such as contracts, purchase orders, testing quality, memoranda of agreement, or internal services level agreements. Creating the procurement management plan includes any other activity that is needed to control how purchases are made, governed by the contract and ministry's policies. The process for project procurement management is:

- Plan procurement management
- Conduct procurement management

- Control procurement management

The Project Manager's main responsibility during the procurement process is to help co-ordinate information to the procurement team and anything they may need to push a contract forward into the next stage. If the procurement team needs specific information regarding the needs of the project, the Project Manager can help gather and share that information. Xebrio (2023) explains that project procurement management can benefit a project in the following ways:

- It identifies the essential goods and services that have to be necessarily procured for the successful completion of a project.

- It helps populate a Purchase Order list and the corresponding list of vendors.

- It outlines a delivery time frame and methodology.

- It helps with the review and procurement of goods and services from vendors.

- It validates supplier contract milestones and approves the settlement of dues.

- It serves as a reference for reviewing vendor performance against terms mentioned in the contract.

- It supports the identification and resolution of vendor performance issues.

- It doubles as a communication channel that apprises the upper management on the project status.

4.9.1 Plan Procurement Management

The Project Manager develops the processes for plan procurement management. The plans includes documents that define a particular project, scheduling requirements and lay down the steps required to get into the final contract. The plan sets out how the procuring organization will acquire the goods and services. The procurement management plan, like all other management plans, becomes a subsidiary of the project management plan. The goal of a procurement plan is to increase the efficiency, effectiveness and transparency of the procurement process for all stakeholders.

CDB (2021) procurement procedures for projects financed by CDB guidelines will be used to procure services for the consultancy services for the RAMS Project. Quality and Cost-Based Selection (QCBS) is the selection method for Consulting Firms. When selecting a firm, competition among qualified short-listed firms will be used. A firm is selected based on the quality of the proposal and on the cost of the services to be provided.

The Project Manager issues to shortlisted firms a request for proposal (RFP), which includes a Letter of Invitation, TOR and form of contract, to submit proposals. In response to the RFP, Proposers shall prepare Technical and Financial Proposals, which shall be submitted at the same time in two (2) separate sealed envelopes and opened in accordance to CDB guidelines. The weight for cost shall normally be twenty (20) points and technical proposal eighty (80) out of a total score of hundred (100).

The total score shall be obtained by weighting the quality and cost scores and adding them. The firm obtaining the highest total score shall be invited for negotiations.

The publication of the Award of Contract shall be in accordance with CDB and FIDIC 1999 red book form of contract is to be used.

A lump sum form of contract is used because the assignments in which the scope and the duration of the services and the required output of the Consultants are clearly defined. Payments are linked to outputs (deliverables) such as reports and software submission. The contract shall include a fixed price for the activities to be carried out by the Consultant and shall not be subject to any price adjustment.

Procurement Statement of Work

The aim of this consultancy includes the development and operationalizes a RAMS for the road network in the Commonwealth of Dominica. The consultancy will recommend financing mechanisms to ensure the sustainability of RAMS and to draft any related legislation required. The Consultant will provide the programming and budgeting of periodic maintenance and rehabilitation of road infrastructure using economic efficiency criteria to reduce the economic challenges posed by natural disasters and climate change by using Risk Assessment Data to prioritize public infrastructure spending. Training and capacity building will be provided as a means of ensuring the project's sustainability.

4.9.2 Conduct Procurement Management

In this process the Project Manager obtains bidders responses, selects a bidder and awards a contract. The timeline for procurement activities are outlined in Table 33. This

process allows for competitive bidding and transparency. This process is performed once throughout the project's lifecycle. The Procurement Management Plan provides a comprehensive framework for managing procurement activities and ensuring that they are aligned with the project's goals and objectives.

Table 33

Procurement activities

Date	Milestones	Responsibilities
15 September 2023	Draft of TOR complete	Project Manager and Project Team
29 September 2023	TOR requirement reviewed and approved	MoPWPUDE, CDB Officers, Project Manager and Project Team
2 October 2023	Draft RFP reviewed	MoPWPUDE, CDB Officers, Project Manager and Project Team
10 October 2023	RFP published	MoPWPUDE, CDB Officers, Project Manager and Project Team
10 November 2023	RFP Submissions deadlines	Bidders
20 November 2023	Evaluation Complete	MoPWPUDE, CDB Officers, Project Manager and Project Team

1December 2023	Approval of the evaluation	CDB Officers
11 December 2023	Negotiations for firm	Project Manager
18 December 2023	Award of Contract	Project Manager
1 January 2024	Issue commencement letter	Project Manager

Note. The procurement activities for RAMS are dated with respective milestones and

personnel responsibly for each activity.

The roles and responsibilities of the people involved in procurement, including how

much money is spent is important for a smooth procurement process. Table 34 provides the

responsibilities of all parties involved in the procurement process.

Table 34

Roles and responsibilities in procurement management

No	Responsibility	Designation
1	Funding/budget	CDB
2	Contract signing	Permanent Secretary and consultant
3	Procurement management	Project Manager
4	Claim/invoices approval	Project Manager, Permanent Secretary, CDB
5	Contract administration	Project Manager

Note. The roles and responsibilities in procurement management are outline to ensure the process follow CDB and Government guidelines

4.9.3 Control Procurement Management

The Project Manager manages procurement relationships, monitoring contract performance and making changes and correction as appropriate and closing out contracts. This process ensures that both the client and the consultant performance meet the project's requirements according to the legal agreements (PMBOK Guide, 2017).

The Project Manager's administrative activities under the contract include:

- Collection of project deliverables and granting approvals;

- Managing project records

- Measuring project performance to facilitate payments of invoices

- Refinement of procurement plans and schedules due to scope changes or variations.

Tools and techniques to be used for control procurement management by the project manager are:

- Expert judgment

The Project Manager must be diverse in relevant functional areas such as finance, engineering design RAMS, contract administration, project management processes and claims administration.

- Claim administration

Then the Project Manager and consultant cannot reach an agreement on compensation become disputes and as per the contract will be resolved by a dispute arbitration board (DAB).

- Data analysis

The data analysis technique that is used by the Project Manager to monitor and control performance is:

i. Performance review: of the contract requirements as well as work packages that are ahead or behind schedule, below standard quality, procurement issues and over or under budget.

ii. Earned value analysis (EVA): schedule and cost variance along with schedule and cost performance indexes are calculated to determine the degree of variance from target.

iii. Trend analysis: develop a forecast estimate at completion for cost performance to see if performance is improving or deteriorating.

- Inspection

The Project Manager reviews all work performed by the consultant. They include reviews of project deliverables, reports, and RAMS software (pilot and final version).

- Audits

A structure review of the procurement process is done by the Project Manager. Rights and obligations are detailed in the audit as described in the procurement contract. Results of the audits are brought to the attention of the consultant for adjustments to the project where necessary.

A contract administration matrix is used to address the important details and processes surrounding the contract. It is used by the Project Manager to centralize the contract lifecycle, ensure the timely realization of contract obligations and promote key date awareness among stakeholders. The matrix also promotes accountability, reveals consultants' performance, reconcile financials and budgets. Appendix 10 provides the template to be used.

4.10 Stakeholder Management Plan

Stakeholder management is about strategically managing your stakeholder relationships. This ongoing process typically includes identifying stakeholders, analyzing them, interacting with them, monitoring them, and reporting on the outcomes. Stakeholder management can achieve a number of objectives, such as greater mutual understanding, increased trust, stronger relationships, better risk identification and management, meeting legal obligations and increased support.

The Project Manager is charged with executing all the processes involved in the stakeholders' management plan. The processes consist of identifying the people, groups, and organizations that could impact the project positively or negatively. It also includes the analysis of stakeholders' expectations and to develop appropriate management strategies for effectively engaging stakeholders in project decisions and execution.
The project stakeholder management processes are:

- Identify stakeholder

- Plan stakeholder engagement

- Manage stakeholder engagement

- Monitor stakeholder engagement

Stakeholder engagement is listen to, collaborate with, or inform (or a combination of all three) their existing stakeholders. Stakeholder engagement helps organizations to proactively consider the needs and desires of anyone who has a stake in the project. With time the Project Manager and project team foster connections, trust, confidence, and buy-in with stakeholders. Stakeholder engagement is used by the team to mitigate potential risks and conflicts with stakeholder groups, including uncertainty, dissatisfaction, misalignment, disengagement, and resistance to change.

4.10.1.1.1 Identify stakeholders

To ensure project success the stakeholder identification commences as soon as possible after the project charter is approved; The Project Manager is assigned and team begins to form. The team correctly identifies and engages all stakeholders in an appropriate way to ensure project success. There is a significant and continuous interaction with your stakeholders throughout the project lifecycle.

The Project Manager identifies those who are directly impacted by the RAMS project who are called internal stakeholders and those who may be indirectly affected are external stakeholders as seen in Figure 25. Examples of directly impacted stakeholders are the project team members or a customer who the project is being done for. Those indirectly affected may include an adjacent organization or members of the local community. Directly

affected stakeholders will usually have greater influence and impact of a project than those indirectly affected.

During the first iteration of identify stakeholders there will be no change request. Identifying stakeholders continues throughout the project, new stakeholder are registered and information on stakeholders are updated which may result in a change request to the project management plan or documents. This request is done through perform integrated change control processes.

Figure 25

RAMS internal and external stakeholder

Note. RAMS means of identifying internal and external stakeholders.

4.10.1.1.2 Stakeholder Register

An outcome of identifying stakeholders should be a project stakeholder register. The Project Manager develops a stakeholder register, which collects information about any person that will be impacted or can impact the project. This process helps the team to identify all your stakeholders for a stakeholder analysis.

Table 35 is where the project team captures the names, contact information, titles, organizations, and other pertinent information of all stakeholders. This is a necessary tool during Stakeholder Management and will provide significant value for the project team to communicate with stakeholders in an organized manner.

4.10.1.1.3 Stakeholder Analysis

The Project Manager uses the stakeholder analysis to identify and understand the needs and expectations of major interests inside and outside the project environment.

Understanding the attributes, interrelationships, interfaces among and between project advocates and opponents, assists the team in strategically planning the project.

To gain early alignment among all stakeholders on goals and plans, the stakeholder analysis will help ensure everyone starts the project with a clear understanding of what success will look like and how they can contribute to that successful outcome. The analysis also helps the Project Manager identify and address conflicts early on.

The analysis indicates key persons associated with the project that do not see the value of your initiative, or would prefer to redeploy some of your resources to other projects. The Project Manager creates a stakeholder analysis seen in Table 36 where stakeholders' expectations and requirements are detailed.

Table 35

Stakeholders' Register

Stakeholder ID	Stakeholder	Institution	Designation	Email	Telephone	Comment
	Internal					
S001	Mr. Alvin Nickson	MoPWPUDE	Permanent Secretary	anickson@gmail.com	1767-122-3476	
S002	Mr. Albert Hall	MoPWPUDE	Chief Technical Officer	ahall@gmail.com	1767-890-7654	
S003	Ms. Jane Camps	MoPWPUDE	Civil Engineer	jcamps@gmail.com	1767- 345-8761	
S004	Mr. Ralph Jackson	MoPWPUDE	Civil Engineer	rjackson@gmail.com	1767-235-0986	
S005	Mr. Lewis John	MoPWPUDE	Civil Engineer	ljohn@gmail.com	1767-567-8760	
S006	Ms. Jill Mayers	MoPWPUDE	Civil Engineer	jmayers@gmail.com	1767-354-1290	
S007	Mr. Sam Lane	MoPWPUDE	Technician	slane@Qgmail.com	1767-890-9807	
S008	Mr. Frank Paul	MoPWPUDE	Technician	fpaul@gmail.com	1767-578-1672	
S009	Mr. Carl Mark	MoPWPUDE	Technician	cmark@gmail.com	1767-678-5609	
S010	Ms. Lane Clark	GIS/DOMINODE	GIS specialist	lclark@gmail.com	1767-890-5673	
S011	Mr. Dan Bates	GIS/DOMINODE	IT Officer	dbates@gmail.com	1767-456-3987	
S012	Mr. Sherlock Smith	CDB	Project Coordinator	ssmith@gmail.com	1767-569-4531	
S013	Mr. Lawrence Louis	CDB	Project Supervisor	llouis@gmail.com	1767-356-3675	
S014	Consultant Team	TBD	TBD	TBD	TBD	
S015	Project Manager	TBD	TBD	TBD	TBD	
S016	Project Team	TBD	TBD	TBD	TBD	
S020	Government of Dominica	MoPWPUDE	Minister	TBD	TBD	
S017	Steering committee change control board	TBD				
	External					
S018	Representatives from the Ministry of Finance	TBD				
S019	Public and motorist	TBD	Media			

Note. RAMS Stakeholders register is a list of all stakeholders and their contact information for ease of communication.

Table 36

Stakeholder Analysis

Project Name	The creation of a Project Management Plan for the Road Asset Management Systems (RAMS) in the Commonwealth of Dominica	RAMS - Stakeholder Analysis					
Main Sponsor	Caribbean Development Bank						
ID	Internal Stakeholders	Functional Area	Roles - Responsibilities	Main Expectations	Major Requirements	Influence/Impact (Low-Medium-High)	Communication Strategy
	Internal						
S001	Mr. Alvin Nickson	MoPWPUDE	Permanent Secretary	Project successful completion	RAMS to be functional and be a source of data for road project prioritization.	High	Meetings Emails
S002	Mr. Albert Hall	MoPWPUDE	Chief Technical Officer	Project successful implementation	RAMS to be functional and be a source of data for road project prioritization.	High	Meetings Emails Web-conference Telephone calls Media
S003	Ms. Jane Camps	MoPWPUDE	Civil Engineer	Increase professional capacity	RAMS to be functional and be a source of data for road project prioritization.	Medium	Meetings Emails Web-conference Telephone calls Media, surveys, questionnaires
S004	Mr. Ralph Jackson	MoPWPUDE	Civil Engineer	Increase professional capacity	RAMS to be functional and be a source of data for road project prioritization.	Medium	Meetings Emails Web-conference Telephone calls Media surveys, questionnaires
S005	Mr. Lewis John	MoPWPUDE	Civil Engineer	Increase professional capacity	RAMS to be functional and be a source of data for road project prioritization.	Medium	Meetings Emails Web-conference Telephone calls Media surveys,

						questionnaires
S006	Ms. Jill Mayers	MoPWPUDE	Civil Engineer	Increase professional capacity	RAMS to be functional and be a source of data for road project prioritization.	Medium	Meetings Emails Web-conference Telephone calls Media surveys, questionnaires
S007	Mr. Sam Lane	MoPWPUDE	Technician	Increase professional capacity	RAMS to be functional and be a source of data collection of road assets	Medium	Meetings Emails Web-conference Telephone calls Media surveys, questionnaires
S008	Mr. Frank Paul	MoPWPUDE	Technician	Increase professional capacity	RAMS to be functional and be a source of data collection of road assets	Medium	Meetings Emails Web-conference Telephone calls Media surveys, questionnaires
S009	Mr. Carl Mark	MoPWPUDE	Technician	Increase professional capacity	RAMS to be functional and be a source of data collection of road assets	Medium	Meetings Emails Web-conference Telephone calls Media, surveys, questionnaires
S010	Ms. Lane Clark	GIS/DOMINODE	GIS specialist	Increase in data input into GIS and DOMINODE	A source of data collection of road assets	Low	Meetings Emails Web-conference Telephone calls Media
S011	Mr. Dan Bates	GIS/DOMINODE	IT Officer	Increase in data input into GIS and DOMINODE	A source of data collection of road assets	Low	Meetings Emails Web-conference Telephone calls Media
S012	Mr. Sherlock Smith	CDB	Project Coordinator	Project remains within budget, on schedule and achieves requirements laid in the TOR	RAMS to be functional and be a source of data for road project prioritization.	High	Meetings Emails Web-conference Telephone calls Media
S013	Mr. Lawrence Louis	CDB	Project Supervisor	Project remains within budget, on schedule and achieves requirements	RAMS to be functional and be a source of data for road	High	Meetings Emails

				laid in the TOR	project prioritization.		Web-conference Telephone calls Media
S014	Design Consultant Team for RAMS	TBD	TBD	Completes project as required	RAMS to be functional and user friendly	High	Meetings Emails Web-conference Telephone calls Media
S015	Project Manager	TBD	TBD	Manage all stakeholders expectation and delivers project successfully	RAMS to be functional and meets stakeholders expectations	High	Meetings Emails Web-conference Telephone calls Media
S016	Project Team	TBD	TBD	Work in collaboration with the project management team to achieve project objectives	RAMS to be functional and meets stakeholders' expectations.	High	Meetings Emails Web-conference Telephone calls Media
S020	Government of Dominica	MoPWPUDE	Minister	Increase the efficiency of working at the Ministry	RAMS to be functional and be a source of data for road project prioritization.	High	Meetings Emails Web-conference Telephone calls
S017	Steering committee change control board	TBD		Project remains within budget, on schedule and achieves requirements laid in the TOR	RAMS to be functional and be a source of data for road project prioritization.	High	Meetings Emails Web-conference Telephone calls
	External						
S018	Representatives from the Ministry of Finance	TBD		Project remains within budget, on schedule and achieves requirements laid in the TOR	RAMS is useful and monies are spent efficiently.	Low	Meetings Emails Web-conference Telephone calls Media
S019	Public and motorist	TBD	Media	The project to benefit motorist	RAMS prioritizes road construction based on needs not political power.	Medium	Group meeting, conferences, media, press releases

Note. Stakeholders are analyzed to determine their impact and strategies to ensure proper communication.

4.10.1.1.4 Stakeholder Mapping

Data representation is used by the Project Manager as a technique for stakeholder mapping. Stakeholder mapping categorizes stakeholders using power/interest, power/influence and impact/influence grid. A stakeholder map is a visual representation of individuals or groups with a vested interest in a project. Stakeholder mapping helps you identify these key stakeholders, understand their influence, and develop a strategy for stakeholder management. The Project Manager uses stakeholder mapping to manage expectations.

By identifying potential areas of concern, resistance, or opposition early on, you can anticipate and address potential challenges proactively, before they become project risk. By the use of the maps the project manager understand which stakeholders are most critical, and can allocate resources, time, money, and effort more effectively to keep them satisfied.

The Project Manager engages the right stakeholders at the right time, to increase support for the project and pave the way for smoother implementation. The stakeholder map establishes channels for regular feedback, allowing you to address emerging concerns or changing conditions promptly as not to cause project delays.

By mapping out your stakeholders, you know how they stand in regard to the project. Therefore, as the project is executed, the Project Manager can incrementally deal with those expectations, bringing them in line with the project so everyone is happy with the deliverables. Table 37 and figure 26 categorize the stakeholders and map them in relation to their power, interest and influence.

Table 37

Stakeholder categorizing

ID	Stakeholder	Power/Interest	Power/Influence	Impact/Influence
S001	Permanent Secretary	High -High	High -High	High -High
S002	Chief Technical Officer	High -High	High -High	High -High
S003	Civil Engineer	Medium/High	Medium/Medium	High/High
S007	Technician	Low/Medium	Low/Low	Low/Medium
S010	GIS specialist	Low/Low	Low/Low	Low/Low
S011	IT Officer	Low/Low	Low/Low	Low/Low
S012	Project Coordinator-CDB	High-High	High-High	High-High
S014	Design Consultant Team for RAMS	Medium-High	Medium-High	High-High
S015	Project Manager	Medium-High	Medium-High	High-High
S016	Project Team	Medium- High	Medium- Medium	Medium- High
S020	Government of Dominica	High-High	High-High	High-High
S017	Steering committee change control board	High-High	High-High	High-High
S018	Representatives from the Ministry of Finance	Low-High	Low-Low	Low-High
S019	Public and motorist	Low-Low	Low-Low	Low-Low

Note. Stakeholder's power, interest, influence and impact is categorized and mapped.

Figure 26

Stakeholder Mapping

Power/Influence Map

Impact/Influence

Power/Interest Map

4.10.2 Plan Stakeholders Engagement

Effective stakeholder management is critical to a project's success. Key stakeholders often have control over project resources, such as project funds, employees, materials, or knowledge critical to its success.

The Project Manager creates the stakeholder management plan of action which ensures that all stakeholders' interests, needs, impact and expectations are understood so that you can properly manage them. The plan enables the manager to articulate to a project team how communication will work, including who will be told what and when. The plan is a formal document that establishes who the stakeholders of a project are and how each stakeholder engages with the project. Going through the process of creating the plan also helps analyze your stakeholders and better understand them. This can help you better anticipate their needs and proactively address any concerns.

The stakeholder engagement plan is updated regularly by the Project Manager. The tools and techniques used to create the plan includes: expert judgment, meetings, data gathering, data analysis, decision- making techniques and data representation.

An assessment of the stakeholder was conducted as seen in Table 38 using a stakeholder engagement assessment matrix. The matrix defines the current level of engagement; the matrix is used to inform a discussion about the desired engagement level of each stakeholder or stakeholder group. In the PMBOK Guide (2017) stakeholders can be categorized in 5 different ways:

- Unaware (U). Stakeholders are unaware of the project and any potential impacts may have on them.

- Resistant (R). Stakeholders in this category are aware of the project and are resistant to the change.

- Neutral (N). Neutral stakeholders are aware of the project but are neither resistant to nor supportive of it.

- Supportive (S). These stakeholders are aware of the project and its potential impact and are supportive of the change.

- Leading (L). Stakeholders in this category are aware of the project and are actively working to ensure its success. These stakeholders may be termed 'change champions.'

Table 38

Stakeholder engagement assessment matrix

ID	Stakeholder	Unaware	Resistant	Neutral	Supportive	Leading
S001	Permanent Secretary				Current	Current
S002	Chief Technical Officer				Current	Current
S003	Civil Engineer				Current	
S007	Technician				Current	
S010	GIS specialist			Current	Desired	
S011	IT Officer			Current	Desired	
S012	Project Coordinator-CDB				Current	
S014	Design Consultant Team for RAMS				Current	
S015	Project Manager				Current	

S016	Project Team				Current	
S020	Government of Dominica				Current	Current
S017	Steering committee change control board				Current	Current
S018	Representatives from the Ministry of Finance			Current	Desired	
S019	Public and motorist		Current		Desired	

Note. RAMS Stakeholder engagement is identified as being desired or current for each stakeholder.

4.10.3 Stakeholder Engagement Plan

The stakeholder engagement plan developed by the Project Manager identifies the strategies and actions required to promote productive involvement of stakeholders in decision making and execution. The key steps used by the Project Manager in creating an effective stakeholder management plan are (Cinergix Pty Ltd, 2023):

- Identify and Prioritize Stakeholders: Identify all relevant stakeholders and categorize them based on their level of influence, interest, and impact on the project. Prioritize stakeholders based on their significance and the potential impact they can have on the project's success which is detailed in Table 35 and Table 36.

- Understand Stakeholder Needs and Expectations: Conduct thorough research and analysis to understand the needs, expectations, and concerns of each stakeholder group. This is achieved through surveys, interviews and focus groups. Document their interests, concerns, and desired outcomes.

- Define Stakeholder Engagement Strategies: Develop strategies to effectively engage with stakeholders throughout the project life cycle. Determine the best communication channels, frequency of interactions, and methods for gathering feedback which is detailed in Table 36. Tailor the engagement strategies to meet the specific needs and preferences of each stakeholder group.

- Establish Communication Protocols: Define clear communication protocols that outline how the information will be shared with stakeholders. Specify the frequency and format of communication, as well as the responsible parties for delivering the messages. Ensure two-way communication channels are established to encourage stakeholder feedback and participation.

- Assign Responsibilities: Identify and assign roles and responsibilities for stakeholder management. Designate individuals or teams responsible for engaging with specific stakeholder groups. Communicate their roles and expectations to ensure effective stakeholder management across the project team.

- Develop a Risk Mitigation Plan: Identify potential risks and challenges associated with stakeholder engagement and develop a plan to mitigate them. Anticipate and address potential conflicts or resistance from stakeholders and develop strategies to handle them effectively.

- Monitor and Evaluate Stakeholder Engagement: Regularly monitor and evaluate the effectiveness of stakeholder engagement activities. Collect feedback, measure stakeholder satisfaction, and assess the impact of engagement strategies. Use this information to make necessary adjustments and improvements to the stakeholder management plan.

- Continuously Update and Improve the Plan: Stakeholder dynamics and project requirements may change over time. Regularly review and update the stakeholder management plan to ensure its relevance and effectiveness. Incorporate lessons learned and feedback from stakeholders to improve future engagement efforts.

4.10.4 Manage Stakeholder Engagement

The Project Manager provides leadership and guidance, as well as act as the link between stakeholders' expectations and the project management team's ability to meet them. The Project Manager utilizes the Communication Plan and strategies identified above to communicate project- related information to key stakeholders in a proactive and timely manner. Managing stakeholder engagement helps the Project Manager to increase the probability of project success by ensuring that stakeholders clearly understand the project goals, objectives, benefits, and risks.

The project team will be actively listening and soliciting input and feedback to make sure communications are being received and understood, and also to capture important information to help make adjustments and to respond to problem areas.

Other project artifacts will factor into Stakeholder Management as well, including the list of project charter and the Change Control process, both of which consider the impact on stakeholders. The project's Issues Log is another tool to collect, document, and address concerns raised by stakeholders and stakeholder management risks that have materialized into issues that must be managed.

The stakeholders' management plan will be used to inform the different levels of stakeholders and mechanism to be used to be communicated.

4.10.5 Monitor Stakeholder Engagement

Monitor Stakeholder Engagement is the process of monitoring overall project stakeholder relationships and adjusting strategies and plans for engaging stakeholders. Monitor Stakeholder Engagement involves assessing the level of engagement and using insights from the data collection to adjust strategies and tactics for engaging effectively with stakeholders. With the use of the data collected and recorded during progress meetings, informal discussions via telephone and face- to- face interaction, the project team assesses the effectiveness of their interactions using engagement criteria. The Project Manager will then determine areas in need of improvement and make the necessary adjustments to the project's communication plan.

Individual stakeholders will be encouraged to participate and to voice questions and concerns, with the most serious issues and concerns that are raised addressed in a formal, rigorous process through the Issues and Risk logs.

Stakeholders are recognized as being critical players to the project's success. The project team has planned for and will work to involve, engage and listen to all key stakeholders throughout the project life cycle.

5   CONCLUSIONS

The Commonwealth of Dominica is a small, fertile island in the eastern Caribbean Sea. As a small island developing state, climate change has a very tangible impact on island. Hurricanes Harvey, Irma, Maria, and Nate turned the 2017 tropical cyclone season into one of the deadliest and most devastating of all time- destroying communications, energy and transport infrastructure, homes, health facilities and schools. These challenges are compounded by limited institutional capacity, scarce financial resources and a high degree of vulnerability to systemic shocks.

The Government of Dominica recognized the need to manage their resources wisely, for this reason the road asset management system (RAMS) project was initiated. The objective of road asset management is to optimize the economic benefits by minimizing the sum of maintenance costs and rebuilding by effectively implementing road asset management processes.

Road asset management can help determine the optimal funding levels that help minimize these total road transport costs for a country, and can demonstrate how available funding can best be allocated to specific roads or road sections, and to specific types of maintenance and repair. In doing so, it does not look at short-term impacts on the road network, but rather at medium- or long-term impacts (generally a time frame of at least 20 years is used).

To effectively realize the benefits of this RAMS project a robust Project Management Plan was developed to successfully manage the execution of the project. The project management plan is a documented report of the tools and techniques needed for project implementation.

The information compiled is in alignment with the ten (10) specific objectives required to complete the project management plan which is guided by PMBOK Guide (2017) knowledge areas. The project charter, the knowledge areas and regenerative concerns developed for the RAMS project management plan is outlined below:

1. The project charter developed is a formal document delineating the project's purpose, description, scope statement, milestones, project budget, risks, stakeholders, assumptions and constraints. This document guides all subsequent decisions and actions undertaken in the project. The charter communicates what the project is about, who's involved, and how it will be done. The charter acts as a compiled summary of the project integrated into a simplified table format.

2. Included in the plan is the creation of an Integrated Management Plan which coordinates all the elements the project needs to be complete at cost, on schedule and quality. The Integrated Management Plan requires a holistic approach to ensure successful project outcomes, which involves harmonizing various project elements and aligning them towards a common goal.

3. To develop Scope Management Plan is a process that helps determine and document the list of all the project goals, tasks, milestones, deliverables, deadlines, and budgets as a part of the planning process. The Project Manager's managing the expectations of the stakeholders and clients is one of the most challenging tasks. With a definite project scope, the Project Manager can easily stay on track and ensure that all the deadlines are being followed throughout the project life cycle.

4. The Schedule Management Plan defines the timeline for the project deliverables to ensure the project's timely completion. All key stakeholders understand what is expected to be complete and keeps everyone involved on track. The plan also outlines the most critical path for the project and indicating the longest path that may be pursued while utilizing the shortest time span.

5. The Cost Management Plan created consists of the process of estimating, budgeting and controlling costs throughout the project life cycle, with the objective of keeping expenditures within the approved budget.

6. To develop a Quality and Safety Management Plan to Project Manager ensure that all project deliverables meet stakeholders' expectations and universal standards.

7. Details of how the project will acquire, develop, use, manage, control, and release the resources you need for a particular project is detailed in the Resource Management Plan developed.

8. The Communication Management Plans created are an integral part of the project planning and project management plan. This document details how everyone working on a project can communicate best. It specifies what information will be shared at specific intervals with stakeholders. The plan can define each team member's responsibilities regarding communication and which channels are to be used.

9. The Risk Management Plan defines potential risks which may be a threat or opportunity and ways to mitigate or take advantage of them. The risk identification process runs parallel to the project from the very beginning to the end. It's a continuous procedure where risks grow in complexity and number as the project's parameters become more tangible; for these reasons methods are outlined on how risks are monitored.

10. Develop a procurement management plan which explains in detail how services are going to procured and type of contract agreement to be used based on the source of funding.

11. To develop a Stakeholder Management Plan is to identify all groups and/or individuals potentially affected by the project and ensure that they are satisfied. In this project the stakeholders are those with an interest in your project's outcome. They are members of a project team, the project managers, government officials, project sponsors, the public and end users.

12. The Project Management Plan also highlighted ways to measure the project against regenerative and sustainable development. This is to ensure that the assignment meets the challenges of our climate crisis. The regenerative and sustainable concepts for RAMS mean that the road infrastructure is improved and maintained at acceptable levels or standards of service, including services, operations, safety, and impact on the environment.

6 RECOMMENDATIONS

The following recommendations have been highlighted for the successful completion of the project;

1. The MoPWPUDE should employ formal PMBOK guidelines based on Project Management strategies to increase the likelihood of project success.

2. The Project Manager and project team should knowledgeable about PMBOK Project Management processes to ensure project.

3. The Project Manager, project team and stakeholders should recognize the project charter as the formal document delineating the project's purpose, scope, stakeholders, objectives, and comprehensive plan. This document should guide all subsequent decisions and actions in the project's life cycle.

4. The project implementing team must understand that project integrate management is a complex discipline that requires a holistic approach to ensure successful

outcomes. This process harmonizes various project elements and aligning them towards a common goal.

5. The scope management plan outlines the processes involved in executing your project and serves as a guideline to keep the project within specific limits. As a project manager, it's your responsibility to guide your team through the project life cycle.

6. Project manager need to have the ability to allocate time and resources efficiently to manage costs and keep the project on its tracks.

7. The quality of the final product is a major determinant of whether a project is considered successful or not. As a result, it is necessary for the project team to maintain quality standards throughout the project to guarantee success.

8. Poor project management has a direct correlation with poorly skilled and inefficient team. Therefore, the Project Manager and team ensure that the RAMS design consultants are capable of delivery projects success.

9. Communication is key in any project. Therefore, it is important that the project management team keeps an open line of communication with all relevant stakeholders to guarantee their satisfaction throughout the project.

10. Risks are inevitable in a temporary endeavor such as the RAMS project. It is important for the project management team to closely monitor the project, so that in the event of any risk triggers arise, the risk response plan can be activated in a timely manner and the project's progress can remain on track.

11. It is import that the project team liaise with the CDB officer throughout the procurement of services to avoid any mishaps during tendering.

12. All stakeholders are identified, the project team must ensure that everyone is heard, understood, contented and there is continuous contact throughout the project.

13. The MoPWPUDE should create a unit to ensure the sustainability of RAMS in the department.

14. The MoPWPUDE should include in the national budget funding for RAMS software maintenance.

15. The MoPWPUDE should use the reports generated from RAMS to source funding from the national budget.

16. The MoPWPUDE should use data collected to source funding from NGOs and donor agencies for asset maintenance, rehabilitation and reconstruction and new construction to increase climate resilience.

17. Develop standard project management initiation and planning documents prior to the execution of civil engineering projects.

18. MoPWPUDE should pursue PMP certification of all its engineers. PMP certification could also be considered as a requirement for employment of engineers in the future.

19. GoCD should invest in creating an asset management systems for government owned building namely hospitals, schools, health clinics, resource centers, hurricane shelters, police stations, fire stations, air and sea ports.

7 VALIDATION OF THE FGP IN THE FIELD OF REGENERATIVE AND SUSTAINABLE DEVELOPMENT

Road infrastructure is an essential feature in a community, town, city or county. They connect people to their destinations to get educated, in entertainment, or make a livelihood. They also provide access to emergency services, such as police and fire departments.

However, the construction of roads can have negative impacts on the environment and society including pollution, impact on indigenous people and the depletion of natural resources for construction. To reduce the negative impacts while still supplying all the benefits that roads provide, RAMS places emphasis on how to make roads more sustainable and resilient.

Projects and project management take place in an environment that is broader than that of the project itself. The RAMS project is temporary in nature; but it's a new way of managing road assets is an efficient way of ensuring sustainability for the long game. In addition RAMS supports good governance in the Ministry, realizing its long-term objectives for sustainability and regenerative efforts.

In a project, the stakeholders and in particular the Project Manager must balance economic factors of cost, schedule, and scope. At times some trade-offs must also be made between the economic, social, and environmental factors surrounding a sustainable project management move. Achieving sustainability in project management requires an active role

of all people involved in the project, programs, and portfolios (Institute of Project Management, 2023).

Projects are an opportunity to make change happen, to deliver new products and services, take unique new challenges, and thus shape our society. Sustainability and regenerative management shouldn't just be an afterthought in projects but should be one of the specific objectives for project delivery in the project management plan.

7.1   Sustainability in RAMS

A sustainable road is a road that is built to reduce the environmental impact of transportation. As urban populations continue to grow, there is an increasing demand to repair damaged roads, putting further pressure on depleting resources.

The lack of appropriate and planned maintenance increases the cost of future treatments and vehicle operating costs with negative impact on the environment in terms of use of natural resources, GHG emission and energy consumption (Cafiso et al., 2016).

To increase road sustainability, the RAMS will ensure that innovative ways are incorporated into building road infrastructure that is resilient and sustainable. The management of road assets' primary objective is to increase assets life cycle without compromising its structural integrity.

7.2 P5 Standards and RAMS

As natural resources deplete, change is needed, and projects are how we implement change. In a study by GPM (2019) , it was found that among the over one thousand executives surveyed, 96% believe that projects and project management are integral to sustainable development. 100% of these same executives believe that project managers should understand how important sustainability is to their project.

Among project managers, 71% reported that the P5 Standard improved sustainability in their projects. Of the project managers who actively use P5 in projects, 95% were able to realize increased sustainability benefit.

The P5 Standard is based on a combination of the UN Global Compact Ten Principles and the UN's Global Reporting Initiative (GRI) G4 Reporting Framework. P5 primary drivers are the Sustainable Development Goals (SDGs) documented in the 2030 Agenda for Sustainable Development (GPM, 2019).

For these reason RAMS will be using P5 to identify potential impacts to sustainability, both positive and negative, that can be analyzed and presented to management to support informed decisions and effective resource allocation.

P5 ontology is a set of concepts and categories in a subject area that shows their properties and the relationships among them. The top level of the Table expands on the triple bottom line of People, Planet, and Prosperity by adding consideration of Product and

Processes impacts. Hence P5 stands for Product, Process, People, Planet, and Prosperity.

Figure 27 details the P5 sustainable considerations under each main topic.

Figure 27

P5 Ontology

PROJECT										
Product Impacts				**Process (Project Management) Impacts**						
Lifespan of Product		Servicing of Product		Effectiveness of Project Processes		Efficiency of Project Processes		Fairness of Project Processes		
People (Social) Impacts				**Planet (Environmental) Impacts**				**Prosperity (Economic) Impacts**		
Labor Practices and Decent Work	Society and Customers	Human Rights	Ethical Behavior	Transport	Energy	Land, Air, and Water	Consumption	Business Case Analysis	Business Agility	Economic Stimulation
Employment and Staffing	Community Support	Non-discrimination	Procurement Practices	Local Procurement	Energy Consumption	Biological Diversity	Recycling and Reuse	Modeling and Simulation	Flexibility/Optionality	Local Economic Impact
Labor/Management Relations	Public Policy/Compliance	Age-Appropriate Labor	Anti-Corruption	Digital Communication	CO2 Emissions	Water and Air Quality	Disposal	Present Value	Business Flexibility	Indirect Benefits
Project Health and Safety	Protection for Indigenous & Tribal Peoples	Voluntary Labor	Fair Competition	Traveling and Commuting	Clean Energy Return	Water Consumption	Contamination and Pollution	Direct Financial Benefits		
Training and Education	Customer Health and Safety			Logistics	Renewable Energy	Sanitary Water Displacement	Waste Generation	Return on Investment		
Organizational Learning	Product and Service Labeling							Benefit-Cost Ratio		
Diversity and Equal Opportunity	Mkt. Comm. and Advertising							Internal Rate of Return		
Local Competence Development	Customer Privacy									

Note. P5 ontology is a set of project impacts and processes impacts that may affect the society, environment and ecomonics.

RAMS will use this standard to provide guidance on what to measure and how to integrate P5 into project activities and reporting. Not only will it be used to identify and respond to potential impact, but ensure proper visibility/transparency to all stakeholders.

7.3   Regenerative Concept and RAMS

Regenerative projects are paradigm of change; they are raising the bar and helping to shift an entire industry in a positive direction. By including regenerative development in the RAMS project, there is an opportunity of shifting the construction industry in a positive direction. The regenerative concept incorporated into the built environment can be a source of co-evolution for the natural and human communities (Industry Dive, 2023).

Muller (1982) describes regenerative development as the way forward to saving our civilization, based on a holistic approach that integrates six layers depicted in figure 28

1) Environment: Regeneration of functional landscapes, where we produce and conserve, maximizing ecosystem function;

2) Social: strengthening by community organization and development, to cope with adaptation to climate change and reduce sumptuous consumption patterns;

3) Economy: a new paradigm for economic development where people matter more than markets and money, measured according to the well-being of humans and all life forms;

4) Political: conservation and valuation of living culture which is the necessary bond for community life, where local knowledge, values and traditions are shared within family, friends and the community as a whole, giving meaning to these terms;

5) Cultural: rethinking and redesigning current political structures so they reflect true participatory democracy without the influence of money and power and especially fostering long term vision and actions that seek increased livelihoods and happiness and not only gross income, and most importantly;

6) Spiritual: fostering deep spiritual and value structures based on ethics, transparency and global well-being to allow humanity to live in peace with itself and Mother Earth.

Figure 28

Six layers of regenerative
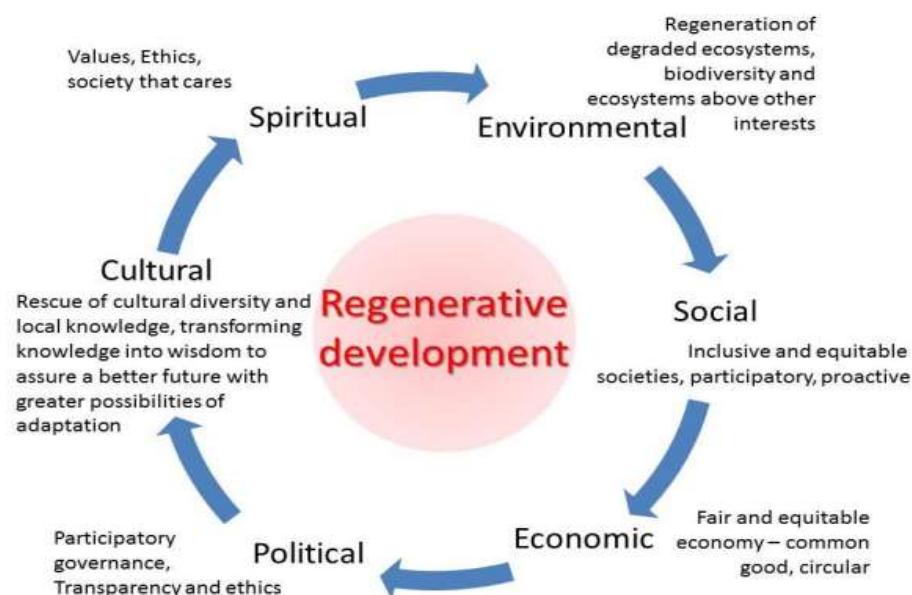
Note. The model of regenerative development encapsulates 6 areas namely: culture, politics, spirituality, economy, and society which signifies the role and responsibility of mankind to mother earth.

These regenerative developments six layers are integrate into the RAMS project. The project is can be characterized as long term perspective and approach that builds our capacity for qualitative growth. It values and needs input from all stakeholders; is transparent, highlighting risk and opportunities. It also focuses on the vision, mission and goals of the Ministry of what is desired, not what is expedient (Gabel, 2015). RAMS project encourages asset maintenance rather that reconstruct when necessary. RAMS ensures that the country financial resources are used efficiently.

7.4   Green Project Management and RAMS

Green Project Management or Sustainable Project Management is the application of methods, tools, and techniques to achieve project objective while considering the entire lifecycle to ensure a net positive environmental, social, and economic impact (GPM Global 2022).

Green project management is now moving beyond its traditional focus on time, cost, and scope to place the emphasis on delivering the objectives in the business case or charter while maintaining an asset lifecycle focus. Projects are now being measured against evolutionary processes where sustainability and regenerative ethos is adopted in projects to ensure they do not come at the expense of the planet and its limited resources. For this

reason the Project Management Plan makes an effort to address social and environmental impacts so that the world we live in and that we are borrowing from future generations can regenerated and be sustained.

In this assignment regenerative management is a specific object which ensures that the project manager keeps the projects regenerative and sustainable goals in mind from the beginning of the project to closure. A regenerative and sustainable project should adhere to GPM's six principles for sustainable projects as seen in figure 29.

Figure 29

GPM's six principles for sustainable projects

Note. GPM's six principles for sustainable projects is a means of ensuring that projects

operate in ways that, at a minimum, meet fundamental responsibilities in the areas of

human rights, labor, environment and anti-corruption.

BIBLIOGRAPHY

American Society for Quality. (2023). What is plan do check cycle. https://asq.org/quality-resources/pdca-cycle

Cinergix Pty Ltd. (2023) Stakeholder Management Plan Templates https://creately.com/guides/stakeholder-management-plan-templates/

Gabel, M. (2015). Regenerative Development-Going beyond sustainability https://www.kosmosjournal.org/article/regenerative-development-going-beyond-sustainability/

GPM. 2019. The GPM P5™ Standard for Sustainability in Project Management GPM Global Version 2.0 https://mosaicprojects.com.au/PDF-Gen/The-GPM-P5-Standard-for-Sustainability-in-Project-Management-v2.0.pdf

GPM Global. (2022). Sustainable and Regenerative Development. https://greenprojectmanagement.org/about/what-is-sustainable-project-management

Government of Dominica. (2023). Asset Management System for Roads and Bridges under Development. Government Information Service. http://news.gov.dm/news/3921-asset-management-system-for-roads-and-bridges-under-development

Greene, J., & Stellman, A. (2018). Head first PMP (4th ed.). O'Reilly Media.

Ideagen, (2023). What is a risk management strategy? https://www.ideagen.com/thought-leadership/blog/what-is-a-risk-management-strategy

International Bank for Reconstruction and Development / International Development Association or The World Bank, 2017. Integrating Climate Change into Road Asset Management.

Institute of Project Management. (2023) Sustainability in Project Management. https://www.projectmanagement.ie/blog/sustainability-in-project-management/#:~:text=Sustainable%20Project%20Management%20is%20the,social%20aspects%20of%20such%20projects

Indeed (2023). What is a risk report? https://www.indeed.com/career-advice/career-development/risk-report

Industry Dive. (2023). What is regenerative development –really? https://www.smartcitiesdive.com/ex/sustainablecitiescollective/what-regenerative-development%E2%80%94really/8055/

Invensis (2023). Estimate Activity Resources Process in Project Management. https://www.invensislearning.com/blog/estimate-activity-resources/

ISO 55000. (2014) Asset management standard.

Japan International Cooperation Agency. (2023). Road Asset Management Platform. https://www.jica.go.jp/english/activities/issues/transport/ramp/index.html

Kissflow (2023) 10 Dynamic Strategies for Managing a Project Team https://kissflow.com/project/project-team-management/

Leedy, P., & Omrod, J. (2021). Practical research: Planning and design (12th ed.). Pearson Education Limited.

Leslie Sylvester Sherman, "Project Management Plan for the Learning Management Systems Development Project," UCI BIBLIOTECA, accessed September 1, 2023, https://omeka.campusuci2.com/biblioteca/items/show/805.

Lester, A. (2021). Project management, planning and control: Managing engineering, construction, and manufacturing projects to PMBOK GUIDE, APM, and BSI Standards (8th ed.). Elsevier Ltd.

Library and Information Science Network. (2023). Sources of Information. https://www.lisedunetwork.com/sources-of-information/

Lucid Software Inc. (2022). How to Create a Project Management Communication Plan. https://www.lucidchart.com/blog/project-management-communication-plan#:~:text=A%20project%20management%20communication%20plan%20identifies%20how%20important%20information%20will,expect%20to%20receive%20that%20information.

Ministry of Public works, Public Utilities and Digital Economy. 2023. Our Mission. https://publicworks.gov.dm/

Muller E. 1982 Regenerative development, the way forward to saving our civilization. https://www.ucipfg.com/Repositorio/GSPM/manuales/Regenerative_development_EM.pdf

PMC. (2023). Road Asset Management System. Road Department. https://www.pmc.gov.in/en/road-asset-management-system-rams

PIARC. (2023). Innovative Approaches Asset Management-Technical Report

Pitchnhire. (2023). Everything you need to know about Analytical Research. https://www.pitchnhire.com/blog/analytical-research

PMBOK Guide. (2021). A Guide to the Project Management Body of Knowledge, (PMBOK® Guide) - Seventh Edition, Project Management Institute, Inc., 2021.

PMBOK Guide. (2017). A Guide to the Project Management Body of Knowledge: PMBOK Guide Sixth Edition. Project Management Institute, Inc., 2017.

QuestionPro (2023) Analytical Research: What is it, Importance and Examples? https://www.questionpro.com/blog/analytical-research

ResearchGate GmbH (2023) https://www.researchgate.net/figure/Plan-Do-Check-Act-cycle-the-wheel-of-continuous-improvement_fig2_322854136)

Ross (2005). Project Quality Management Why, What and How.

Runn. (2023). How to Create a Resource Management Plan. https://www.runn.io/blog/resource-management-plan

Wanner (2013) Project Risk Management

Wrike. (2023). A complete guide to schedule management plan. https://www.wrike.com/blog/schedule-management-plans-guide/

Xebrio 2023, What is project procurement management. https://xebrio.com/project-management-guide/faq/what-is-project-procurement-management/

APPENDICES

Appendix 1:

FGP Charter

CHARTER OF THE PROPOSED
FINAL GRADUATION PROJECT (FGP)

1. Student name

NAOMI CHERRY

2. FGP name

The creation of a Project Management Plan for the execution of Road Asset Management Systems for the Commonwealth of Dominica.

3. Application Area (Sector or activity)

Construction/Finance/Geographical Information Systems (GIS)
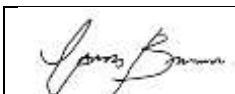
4. Student signature

5. Name of the Graduation Seminar facilitator

CARLOS BRENES MENA

6. Signature of the facilitator

7. Date of charter approval

8. Project start and finish date

29ᵗʰ August 2023	16ᵗʰ October 2023

9. Research question

What procedures are needed to guide a Project Manager for the successful execution of a Road Asset Management Systems project for the Commonwealth of Dominica?

10. Research hypothesis

Can a Project Management Plan be developed for the execution of a Road Asset Management System for the Commonwealth of Dominica?

11. General objective

To develop a Project Management Plan for the Road Asset Management Systems in the Commonwealth of Dominica to successfully manage the execution of the project.

12. Specific objectives

1. To define project charter to define the key input elements required to develop the project management plan.
2. To develop an Integrated Management Plan to coordinate all the elements the project needs to be complete at cost, on schedule and quality.
3. To develop Scope Management Plan to measure the work required, and only the work required, completing the project successfully.
4. To develop a Schedule Management Plan to define the timeline for the project deliverables to ensure the project's timely completion.
5. To develop a Cost Management Plan to plan, estimate, and manage the budget for all project activities, deliverables, and resources.
6. To develop a Quality and Safety Management Plan to ensure that all project deliverables meet stakeholders' expectations and universal standards.
7. Develop a Resource Management Plan to identify, acquire, and manage all physical and human resources needed to complete the project successfully.
8. To develop a Communications Management Plan to ensure effective communication with project stakeholders and record all project communications.
9. Develop a Risk Management Plan to increase the probability/impact of positive risks (opportunity) and decrease the probability/impact of negative risks.
10. To develop a Procurement Management Plan to develop and administer agreements for products and/or services needed from outside the organization or project team expertise.

11. Develop a Stakeholder Management Plan to identify all groups and/or individuals potentially affected by the project and ensure that they are satisfied.
12. To measure the project against regenerative development.

13. FGP purpose or justification

The International Monetary Fund (IMF) ranked the Commonwealth of Dominica as the country that suffered the worst natural disasters between 1980 to 2017 which was Hurricane Maria in 2017 (CREAD, 2021).

In light of this, a 2020-2025 Climate Resilience and Recovery Plan (CCRP) for the island was developed. The Plan set a priority on addressing road maintenance and rehabilitation, as well as on strengthening the capacity of Ministry of Public Works to enhance their capacity in resilient road asset management.

The Project Management Plan for Road Asset Management System (RAMS) will provide the basis for the Ministry of Public Works, by extension the country, to adopt asset management principles, to achieve greater efficiency and value for money, as well as improve the organization's overall performance. The project will define several aspects regarding the planning, delivery, and management of road infrastructure assets and set recommendations on road maintenance practices (routine, periodic and rehabilitation).

The RAMS will identify vulnerable assets and prioritize the maintenance needs, on the planning and budgeting of interventions for this small island state where finance is a challenge. CREAD, (2021) indicated that there is a financing gap of USD$90-130 Million to achieve climate resilience in the Commonwealth of Dominica. The cost of no action to reduce climate vulnerability at the national level would be loss and damage equivalent to 77% of the GDP by 2100. The aim of this project is to reduce the amount spent on the annual budget for road infrastructure to about 20% initially and with time increase.

14. Work Breakdown Structure (WBS). In Table form, describing the main deliverable as well as
    secondary, products or services to be created by the FGP.

The Creation of a Project Management Plan for the Execution of Road Asset Management System for the Commonwealth of Dominica

1. Graduation Seminar
   1.1. FGP Deliverable 1
      1.1.1. Appendix 1 FGP Charter (Item 1 to 10)
      1.1.2. Appendix 4 Preliminary Bibliography Research
   1.2. FGP Deliverable 2
      1.2.1. Appendix 1 FGP Charter (Item 11 to 12)
      1.2.2. WBS
   1.3. FGP Deliverable 3
      1.3.1. Corrections to document
      1.3.2. Appendix 1 FGP Charter (Item 13 to 19)
   1.4. FGP Deliverable 4
      1.4.1. Corrections to document
      1.4.2. Theoretical framework
      1.4.3. Appendix 1 FGP Charter (Item 20)
   1.5. FGP Deliverable 5
      1.5.1. Corrections to document
      1.5.2. Methodological framework
      1.5.3. Appendix 1 FGP Charter (Item 21)
   1.6. FGP Deliverable 6
      1.6.1. Corrections to document
      1.6.2. Introduction
      1.6.3. Project Validation in regenerative and sustainable development
      1.6.4. Appendix 1 FGP Charter (Item 22)
      1.6.5. FGP Schedule
   1.7. FGP Deliverable 1
      1.7.1. Corrections to document
      1.7.2. Executive Summary
      1.7.3. Abstract
      1.7.4. Bibliography references and indices
      1.7.5. Signed FGP Charter
2. Tutoring Process
   2.1. Tutor
      2.1.1. Tutor Assignment
      2.1.2. Communication
   2.2. Adjustment of previous chapters
   2.3. Background and Research on Assignment
   2.4. Chapter IV. Development of Project Management Plan
      2.4.1. Integration Management Plan
      2.4.2. Scope Management Plan
      2.4.3. Schedule Management Plan
      2.4.4. Cost Management Plan
      2.4.5. Quality Management Plan

           2.4.6. Resource Management Plan
           2.4.7. Communication Management Plan
           2.4.8. Risk Management Plan
           2.4.9. Procurement Management Plan
           2.4.10. Stakeholders Management Plan
    2.5. Chapter V. Conclusion
    2.6. Chapter VI. Recommendation
    2.7. Chapter VII. Incorporation of Regenerative Development
3. Reading by Reviewers
    3.1. Reviewers Assignment Request
           3.1.1. Assignment of Two Reviewers
           3.1.2. Communication
           3.1.3. FGP Submission to Reviewers
    3.2. Reviewers Work
           3.2.1. Reviewer 1
               3.2.1.1.   FGP Reading
               3.2.1.2.   Reader 1 Report
           3.2.2. Reviewer 2
               3.2.2.1.   FGP Reading
               3.2.2.2.   Reader 1 Report
4. Adjustments
    4.1. Report for Reviewers
    4.2. FGP Update
    4.3. Second Review by Reviewer

5. Presentation to Board of Examiners
    5.1. Final Grade by Board
    5.2. FGP Grade Report

15. FGP budget

Detail the budged that you estimate is necessary to develop your FGP document (relevant costs).

Activity	Estimate Budget (USD$)
Student Time (10hrs/per week)	840.00
Communication	100.00
Photocopying and printing	50.00
Document Binding	120.00
Shipping document to UCI	200.00
TOTAL	$1310.00

16. FGP planning and development assumptions

1. Information regarding road asset management in the country is organized and available.
2. Access to information on road assets is easily available and will be non-restricted, and there will not be limitations to their use for academic purposes.
3. Researcher time for the FGP will be at least 10 hours per week during the FGP development process.
4. The estimated budget will be sufficient to carry out the study and create the project management plan.
5. The Project Management plan will be successfully completed in time stipulated by UCI.
6. All information and guidelines needed to develop the PMP are accessible.

17. FGP constraints

1. Time: Short time frame for undertaking the FGP.
2. Resource: Limited human resources, one person (Project Manager) available to undertake the assignment.
3. Scope: Scope is quite large for the given time frame.

18. FGP development risks

1. COVID-19 is currently on the rise again which may cause shut down and limit access to non-electronic files at the Ministry and in-person interviews and affect the delivery time of the FGP.
2. No electronic data is stored by the Ministry, which may cause delays in retrieving the data manually from stored away boxes.
3. A natural disaster (hurricane) might delay site visits and field data, which could delay the development of the deliverables.
4. Failure to meet milestone dates may lead to delay and hence late delivery of project.
5. Lack of support by supervisor or tutor can result in poor submissions or late delivery of project components.

19. FGP main milestones

Milestones are related to deliverables on the second level (deliverables) and third level (control accounts) of the WBS of section 14 of this Charter. At the same time the deliverables are related to the specific objectives (in the case of the FGP please include the times for the tutorship reviews as well as for the readership).

Deliverable	Finish estimated date
2 Tutoring Process	
2.1 Tutor	20.10.2023
2.2 Adjustments of Previous Chapters (as needed)	25.10.2023
2.3 Background & Good Practices Research	27.11.2023
2.4 Chapter IV: Project Management Plan	27.11.2023
2.5 Chapter V: Conclusion	24.11.2023
2.6 Chapter VI: Recommendations	28.11.2023
2.7 Chapter VII: Incorporation of Regenerative Development	28.11.2023
3 Readers' Review	
3.1 Reviewers' Assignment request	05.12.2023
3.2 Reviewers' Work	19.12.2023

20. Theoretical framework

20.1 Estate of the "matter"

The MPWPUDE, in 2019 sought to develop effective asset management planning, identifying activities that maximized system performance while minimizing long-term maintenance costs and mitigating risks amidst budget constraints. The database developed under the risk based asset management strategy (RBAMS), populated by means of windshield surveys, served as the baseline for the development of a road asset management decision support system, which predicted future performance under various build and no-build scenarios and supported the development of optimal investment strategies.

RAMS, on the other hand, conducts a combination of site survey, windshield surveys and the collection of pneumatic traffic counts, which will be stored into a program. This program will be used by engineers and technicians to populate and retrieve condition reports on road infrastructure. It will also monitor assets for planning maintenance activities (routine/periodic), rehabilitation interventions or adaptation of assets to climate change. In addition, it proposes the reorganization of MPWPUDE resources to conduct all the necessary tasks and activities within asset management and provides clear responsibilities to each division for the implementation of road asset management within the ministry. Finally, it defines the framework for monitoring the implementation of the RAMS strategy itself within the organization.

In 2021, the resilience of Dominica's road sector against climate change and

disaster risks was assessed as fair when compared to the specification requirements, policies, the legal and institutional frameworks, as well as the available financial conditions at the time (CDB, 2021). Additionally, the assessment highlighted the lack of technical capacity and technology required for the successful implementation of the road sector related initiatives planned in the Climate Resilience and Recovery Plan (CRRP) 2020-2030.

This Road Asset Management System provides a comprehensive framework to ensure that Dominica's road network is efficiently operated, maintained, renewed, be resilient in the face of climate events and natural hazards and upgraded to achieve the highest levels of service delivery in the most cost-effective and sustainable manner possible.

Aligned with Dominica's CRRP, MPWPUDE Strategic Plan 2020-2025 and the ministry's defined objectives, RAMS sets out the long-term objectives of the MPWPUDE regarding accepTable condition and vulnerability of road assets, accessibility provided by the network, functionality and targeted levels of service, and funding objectives.

20.2 Basic conceptual framework

Asset Management Plan- a plan which specifies the activities, resources and timescales required for an individual asset, or grouping of assets, to achieve the organization's asset management objectives based on specification (ISO 55000).

Asset Management Systems- is a set of interrelated or interaction elements of an organization to establish policies and objectives for asset management (ISO55000).

Adaptation to Climate Change- is the adjustment within natural or human systems in response to actual or projected climatic stimuli or their effects, which aims to moderate harm or exploit beneficial opportunities (PIARC).

Climate Change – is the variation in the state of the climate, which can be detected by changes in the mean and / or variability of its properties and which persists for a long period, usually for decades or more. Climate change can be due to natural internal processes or external forcing, including modulations of solar cycles, volcanic eruptions, or persistent anthropogenic changes in the composition of the atmosphere or in land use (IPCC).

Life Cycle Planning- is the process to estimate the cost of managing an asset class, or asset sub-group over its whole life with consideration for minimizing cost while

preserving or improving the condition (FWHA).

Project Management - is the application of knowledge, skills, tools, and techniques to initiate, plan, execute, and close project activities to achieve project requirements (PMBOK GUIDE).

Resilience – is the capability to anticipate, prepare for, respond to, and recover from threats with minimum damage to social well-being, the economy, and the environment (PIARC).

Strategic Asset Management Plan (SAMP)- Documented information that specifies how organizational objectives are to be converted into asset management objectives, the approach for developing asset management plans, and the role of the asset management system in supporting achievement of the asset management objectives (ISO 55000).

1. Methodological framework

Objective	Name of deliverable	Information sources	Research method	Tools	Restrictions
To define project charter to define the key input elements required to develop the project management plan.	**Project Charter**	**Primary Sources** Project appraisal and approval documents (CDB-2019).	One-on-one interviews with key stakeholders to provide detailed information for the management of the Road Asset Management System.	Expert judgment from CDB and Chief Technical Officer of the MoPWPUDE. Expert judgment is also estimation methodology for project planning that relies on the expert's opinion to estimate quantitative project details, such as timelines and potential resources	Limited information to gather all necessary data. Unforeseen additional works required to complete the project.
To develop an Integrated Management Plan to coordinate all the elements the project needs to be complete at cost, on schedule and quality.	**Integrated Management Plan**	Interviews with Permanent Secretary and Chief Technical Officer of MoPWPUDE.			
To develop Scope Management Plan to measure the work required, and only the work required, completing the project successfully.	**Scope Management Plan**	Project appraisal and approval documents (CDB-2019). Interviews with Permanent Secretary and Chief Technical Officer of MoPWPUDE.	A group of key stakeholder forms the focus group. The group meeting is used collect data needed for the management of the project.	Data gathering (Brainstorming, focus groups, checklist and interviews) from the GIS unit, Technical Decision and CREAD.	The occurrence of unforeseen risks pushes the project off its scheduled course and exceed project budget. The funding for the project has an expiry date for spending and the procurement process is unsuccessful.
To develop a Schedule Management Plan to define the timeline for the project deliverables to ensure the project's timely completion.	**Schedule Management Plan**	**Secondary Sources**	Guidelines provided by the PMBOK and literature review (desk study) assist in formulating an effective integrated	Interpersonal and team skills from CDB, CREAD and MoPWPUDE. Meetings with key stakeholders from GIS,	Limited funding limits the full executable scope. A phased approach to the scope is likely.
To develop a Cost	**Cost Management**	PMBOK Guide – Project			

Management Plan to plan, estimate, and manage the budget for all project activities, deliverables, and resources.	**Plan**	Management Body of Knowledge. Seventh Edition (PMBOK GUIDE, 2021).	management plan, which accommodates all necessary factors.	CDB, MoPWPUDE and CREAD	The time allocated to the execution of the project shall not exceed intended close date.
To develop a Quality and Safety Management Plan to ensure that all project deliverables meet stakeholders' expectations and universal standards.	**Quality and Safety Management Plan**	PMBOK Guide – Project Management Body of Knowledge. Sixth Edition (PMBOK GUIDE, 2017). Project Risk Management (Warner, 2015)		Data analysis from data collected from stakeholders and desk research. Data analysis also includes evaluating risks associated with budgeting, project scheduling, and sticking to deadlines from the idea stage through the project's life cycle.	
Develop a Resource Management Plan to identify, acquire, and manage all physical and human resources needed to complete the project successfully.	**Resource Management Plan**	Project Quality Management, Why, What and How (Rose, 2005) Practice Standards for Work Breakdown Structure, Third Edition (PMBOK GUIDE, 2019).		Decision making culture based on financial constraints.	
To develop a Communications Management Plan to ensure effective communication with project stakeholders and record all project communications.	**Communication Management Plan**	Practice Standards for Scheduling, Third Edition (PMBOK GUIDE 2019) Books, reference works, websites and journals.		Data representation requirements and limitations of MoPWPUDE. Test and Inspection planning of road assets and the needed capacity to collect data.	

| Develop a Risk Management Plan to increase the probability/impact of positive risks (opportunity) and decrease the probability/impact of negative risks. | **Risk Management Plan** | ISO 55000, Asset management− Overview, principles and terminology.

ISO 55001, Asset management− Management systems− Requirements. | | Communication Methods used as per CDB and Government protocols. The PMBOK(2017) outlines three types of communication methods that will be used:
- Interactive communication

Which can be face to face meetings, phone conversations or video conferencing through platforms, such as Zoom and Teams. | |
|---|---|---|---|---|---|
| To develop a Procurement Management Plan to develop and administer agreements for products and/or services needed from outside the organization or project team expertise. | **Procurement Management Plan** | ISO 55002, Asset management− Management systems− Guidelines for the application. | | | |
| Develop a Stakeholder Management Plan to identify all groups and/or individuals potentially affected by the project and ensure that their. | **Stakeholder Management Plan** | ISO 55001 Innovative Approaches Asset Management.

General concept and requirements for asset management training courses (PIARC, 2019). | | - Pull communication

Which can be communication through emails, project reports and project documentation. | |
| To measure the project against regenerative development. | **Regenerative Management Plan** | AASHTO Transportation Asset Management Guide. | | - Push communication | |

		Transportation Asset Management Plan (US Transport Department, 2021). Puerto Rico Transportation Asset Management Plan (October 2019). Integrating Climate Change into Road Asset Management (World Bank Group, 2017). Procurement Procedures for projects finance by CDB (CDB, 2019)		This can be through government website or project management software. Using each communication method at the right time and in the right context will help ensure you achieve the desired result of a strong team and a good working relationship with the varying stakeholders to your project.	

2. Validation of the work in the field of the regenerative and sustainable development.

Sustainability has historically been the goal of eco-friendly movements, but now there is a new found effort on the need for regenerative efforts as well. One of the FGP specific objectives is to develop regenerative- sustainable principles the project will be guided by. RAMS regenerative-sustainable indicators will be measured against the P5 Impact analysis Version 5.0.1 which considers the project's impact on people, plant and prosperity. Some areas of measurement as follows for the:
People :
1. protection for indigenous people,
2. customer privacy and data protection
3. harassment and discrimination,
4. equal opportunity,
5. customer health and safety
Planet
1. local procurement
2. digital communication
3. biological diversity
4. renewable energy
5. energy consumption
Prosperity
1. business case analysis
2. modeling and simulation
3. social return on investment
4. indirect benefits
5. local economic impact.

P5 Impact analysis is increasingly important as project managers and shareholders are concern with evaluating the effects of their project on the environment. The P5 Impact analysis is aligned with the United Nations' Sustainable Development Goals (SDGs) which is idle for any project with regenerative-sustainable goals.

The project will be assessed for regenerative concepts against Muller (1982) holistic approach, which integrates six layers namely: the environment, society, the economy, politics, cultural and spiritual considerations. Theses six layers of concern will ensure the conservation of the ecosystem, as well as the adaptation to climate change and reduce consumption patterns. RAMS will also safeguard lives rather than money/market aspiration. The conservation of living cultures which is the necessary bond for community life will be part of RAMS regenerative objective. The RAMS project will foster deep spiritual values, structured based on ethics, culture and ethnicity.

Appendix 2:

FGP WBS

The Creation of a Project Management Plan for the Execution of Road Asset Management System for the Commonwealth of Dominica

1. Graduation Seminar
- 1.1 FGP Deliverable 1
  - 1.1.1 Appendix 1 FGP Charter (items 1 to 10)
  - 1.1.2 Appendix 4 Bibliographical
- 1.2 FGP Deliverable 2
  - 1.2.1 Appendix 1 FGP Charter (Items 11 to 12)
  - 1.2.2 WBS
- 1.3 FGP Deliverable 3
  - 1.3.1 Corrections to document
  - 1.3.2 Appendix 1 FGP Charter (items 13 to 19)
- 1.4 FGP Deliverable 4
  - 1.4.1 Corrections to document
  - 1.4.2 Theoretical framework
  - 1.4.3 Appendix 1 Charter (Item 20)
- 1.5 FGP Deliverable 5
  - 1.5.1. Corrections to document
  - 1.5.2 Methodological Framework
  - 1.5.3 Appendix 1 Charter (Item 21)
- 1.6 FGP Deliverable 6
  - 1.6.1. Corrections to document
  - 1.6.2. Introduction
  - 1.6.3 Project Validation in regenerative and sustainable development
  - 1.6.4 Appendix 1 Charter (Item 22)
  - 1.6.5 FGP Schedule
- 1.7 FGP Final Deliverable
  - 1.7.1 Corrections to Document
  - 1.7.2 Executive Summary
  - 1.7.3 Abstract
  - 1.7.4 Bibliographical references index
  - 1.7.5 Signed FGP Charter

2. Tutoring Process
- 2.1 Tutor
  - 2.1.1 Tutor
  - 2.1.2 Communication
- 2.2 Adjustment of previous chapters
- 2.3 Background and Research on Assignment
- 2.4 Chapter IV. Development of Project Management Plan
  - 2.4.1 Integration Management Plan
  - 2.4.2 Scope Management Plan
  - 2.4.3 Schedule Management Plan
  - 2.4.4 Cost Management Plan
  - 2.4.5 Quality Management Plan
  - 2.4.6 Resource Management Plan
  - 2.4.7 Communication Management Plan
  - 2.4.8 Risk Management Plan
  - 2.4.9 Procurement Management Plan
  - 2.4.10 Procurement Management Plan
- 2.5 Chapter V. Conclusion
- 2.6 Chapter VI. Recommendation
- 2.7 Chapter VII. Incorporation of Regenerative Development

3. Reading by Reviewers
- 3.1 Reviewers Assignment Request
  - 3.1.1. Assignment of Two Reviewers
  - 3.1.2 Communication
  - 3.1.3 FGP Submission to
- 3.2. Reviewers Work
  - 3.2.1 Reviewer 1
    - 3.2.1.1 FGP Reading
    - 3.2.1.2 Reader 1 Report
  - 3.2.2. Reviewer 2
    - 3.2.2.1 FGP Reading
    - 3.2.2.2 Reader 2 Report

4. Adjustments
- 4.1 Report for Reviewers
- 4.2 FGP Update
- 4.3 Second Review by Reviewers

5. Presentation to Board of Examiners
- 5.1 Final Grade by Board
- 5.2 FGP Grade Report

Appendix 3:

FGP Schedule

ID	Task Name	Duration	Start	Finish
1	**Final Graduation Project Schedule**	84 days	Tue 29/08/23	Wed 20/12/23
2	FGP START	1 day	Tue 29/08/23	Tue 29/08/23
3	1 Graduation Seminar	36 days	Tue 29/08/23	Tue 17/10/23
4	1.1 FGP Deliverable 1	6 days	Tue 29/08/23	Tue 05/09/23
5	1.1.1 Appendix 1 FGP Charter (Item 1 to 10)	3 days	Tue 29/08/23	Thu 31/08/23
6	1.1.2 Appendix 4 Preliminary Bibliography Research	5 days	Wed 30/08/23	Tue 05/09/23
7	1.2 FGP Deliverable 2	6 days	Tue 05/09/23	Tue 12/09/23
8	1.2.1 Appendix 1 FGP Charter (Item 11 to 12)	3 days	Fri 01/09/23	Tue 05/09/23
9	1.2.2 WBS	3 days	Fri 08/09/23	Tue 12/09/23
10	1.3 FGP Deliverable 3	6 days	Tue 12/09/23	Tue 19/09/23
11	1.3.1 Corrections to document	2 days	Wed 13/09/23	Thu 14/09/23
12	1.3.2 Appendix 1 FGP Charter (Item 13 to 19)	5 days	Wed 06/09/23	Tue 12/09/23
13	1.4 FGP Deliverable 4	6 days	Tue 19/09/23	Tue 26/09/23
14	1.4.1 Corrections to document	1 day	Wed 13/09/23	Wed 13/09/23
15	1.4.2 Theoretical framework	6 days	Tue 19/09/23	Tue 26/09/23
16	1.4.3 Appendix 1 FGP Charter (Item 20)	3 days	Wed 13/09/23	Fri 15/09/23
17	1.5 FGP Deliverable 5	5 days	Tue 26/09/23	Mon 02/10/23
18	1.5.1 Corrections to document	1 day	Mon 18/09/23	Mon 18/09/23
19	1.5.2 Methodological framewo	4 days	Wed 27/09/23	Mon 02/10/23
20	1.5.3 Appendix 1 FGP Charter (Item 21)	4 days	Mon 18/09/23	Thu 21/09/23
21	1.6 FGP Deliverable 6	6 days	Tue 03/10/23	Tue 10/10/23
22	1.6.1 Corrections to document	1 day	Fri 22/09/23	Fri 22/09/23
23	1.6.2 Introduction	4 days	Tue 03/10/23	Fri 06/10/23
24	1.6.3 Chapter VII Project Validation in regenerative and sustainable development	5 days	Mon 18/09/23	Fri 22/09/23
25	1.6.4 Appendix 1 FGP Charter (Item 22)	2 days	Fri 22/09/23	Mon 25/09/23
26	1.6.5 FGP Schedule	5 days	Tue 26/09/23	Mon 02/10/23
27	1.7 FGP Deliverable 7	11 days	Tue 03/10/23	Tue 17/10/23
28	1.7.1 Corrections to document	1 day	Tue 03/10/23	Tue 03/10/23
29	1.7.2 Executive Summary	3 days	Wed 04/10/23	Fri 06/10/23
30	1.7.3 Abstract	2 days	Mon 09/10/23	Tue 10/10/23

Project: FGP schedule
Date: Sun 08/10/23

Task	Project Summary
Split	Inactive Task
Milestone	Inactive Milestone
Summary	Inactive Summary
Manual Task	Start-only
Duration-only	Finish-only
Manual Summary Rollup	External Tasks
Manual Summary	External Milestone
Deadline	
Progress	
Manual Progress	

ID		Task Name	Duration	Start	Finish
31		1.7.4 Bibliography references and indices	4 days	Wed 11/10/23	Mon 16/10/23
32		1.7.5 Signed FGP Charter	1 day	Tue 17/10/23	Tue 17/10/23
33		2. Tutoring Process	33 days	Tue 17/10/23	Tue 28/11/23
34		2.1 Tutor	4 days	Tue 17/10/23	Fri 20/10/23
35		2.1.1 Tutor Assignment	2 days	Tue 17/10/23	Wed 18/10/23
36		2.1.2 Communication	2 days	Thu 19/10/23	Fri 20/10/23
37		2.2 Adjustment of previous chapters	3 days	Mon 23/10/23	Wed 25/10/23
38		2.3 Background and Research on Assignment	2 days	Thu 26/10/23	Fri 27/10/23
39		2.4 Chapter IV. Development of Project Management Plan	23 days	Mon 30/10/23	Mon 27/11/23
40		2.4.1 Integration Management Plan	3 days	Mon 30/10/23	Wed 01/11/23
41		2.4.2 Scope Management Pla	3 days	Mon 30/10/23	Wed 01/11/23
42		2.4.3 Schedule Management Plan	2 days	Fri 03/11/23	Sun 05/11/23
43		2.4.4 Cost Management Plan	3 days	Thu 02/11/23	Sun 05/11/23
44		2.4.5 Quality Management P	3 days	Thu 09/11/23	Sat 11/11/23
45		2.4.6 Resource Management Plan	3 days	Mon 13/11/23	Wed 15/11/23
46		2.4.7 Communication Management Plan	3 days	Thu 16/11/23	Mon 20/11/23
47		2.4.8 Risk Management Plan	3 days	Tue 21/11/23	Thu 23/11/23
48		2.4.9 Procurement Management Plan	2 days	Fri 24/11/23	Mon 27/11/23
49		2.4.10 Stakeholders Management Plan	2 days	Tue 21/11/23	Wed 22/11/23
50		2.5 Chapter V. Conclusion	2 days	Thu 23/11/23	Fri 24/11/23
51		2.6 Chapter VI. Recommendati	2 days	Mon 27/11/23	Tue 28/11/23
52		2.7 Chapter VII. Incorporation of Regenerative Development	4 days	Thu 23/11/23	Tue 28/11/23
53		3. Reading by Reviewers	15 days	Wed 29/11/23	Tue 19/12/23
54		3.1 Reviewers Assignment Request	5 days	Wed 29/11/23	Tue 05/12/23
55		3.1.1 Assignment of Two Reviewers	2 days	Wed 29/11/23	Thu 30/11/23
56		3.1.2 Communication	2 days	Fri 01/12/23	Mon 04/12/23
57		3.1.3 FGP Submission to Reviewers	1 day	Tue 05/12/23	Tue 05/12/23

Project: FGP schedule
Date: Sun 08/10/23

Task		Project Summary	
Split		Inactive Task	
Milestone	◆	Inactive Milestone	◇
Summary		Inactive Summary	
Manual Task		Start-only	⊏
Duration-only		Finish-only	⊐
Manual Summary Rollup		External Tasks	
Manual Summary		External Milestone	◇
Start-only	⊏	Deadline	⬇
Finish-only	⊐	Progress	
External Tasks		Manual Progress	
External Milestone	◇		

ID		Task Name	Duration	Start	Finish
58		3.2 Reviewers Work	10 days	Wed 06/12/23	Tue 19/12/23
59		3.2.1 Reviewer 1	10 days	Wed 06/12/23	Tue 19/12/23
60		3.2.1.1 FGP Reading	9 days	Wed 06/12/23	Mon 18/12/23
61		3.2.1.2 Reader 1 Report	1 day	Tue 19/12/23	Tue 19/12/23
62		3.2.2 Reviewer 2	10 days	Wed 06/12/23	Tue 19/12/23
63		3.2.2.1 FGP Reading	9 days	Wed 06/12/23	Mon 18/12/23
64		3.2.2.2 Reader 1 Report	1 day	Tue 19/12/23	Tue 19/12/23
65		4. Adjustments	20 days	Wed 20/12/23	Tue 16/01/24
66		4.1 Report for Reviewers	9 days	Wed 20/12/23	Mon 01/01/24
67		4.2 FGP Update	1 day	Tue 02/01/24	Tue 02/01/24
68		4.3 Second Review by Reviewers	10 days	Wed 03/01/24	Tue 16/01/24
69		5. Presentation to Board of Examiners	6 days	Wed 17/01/24	Wed 24/01/24
70		5.1 Final Grade by Board	2 days	Wed 17/01/24	Thu 18/01/24
71		5.2 FGP Grade Report	3 days	Fri 19/01/24	Tue 23/01/24
72		FGP END	1 day	Wed 24/01/24	Wed 24/01/24

Project: FGP schedule
Date: Sun 08/10/23

Task		Project Summary	
Split		Inactive Task	
Milestone	◆	Inactive Milestone	◇
Summary		Inactive Summary	

Manual Task		Start-only
Duration-only		Finish-only
Manual Summary Rollup		External Tasks
Manual Summary		External Milestone

Deadline	↓
Progress	
Manual Progress	

Page 3

Appendix 4:

Preliminary bibliographical research

Asana. (2023) Scope Management plan: what it is and how to create one. https://asana.com/resources/scope-management-plan

Asian Development Bank. (2018). Compendium of Best Practices in Road Asset Management. https://www.adb.org/sites/default/files/publication/396126/best-practices-road-asset-management-carec.pdf

Justification: Best practices for road assets management.

Cafiso, S & Capace B. (2016) Road Asset Management for Sustainable Development. https://www.worldscientific.com/doi/epdf/10.1142/9789814723039_0044

Justification: Explains benefits road asset management with regards to sustainable development.

Chevaugn Odain Walker, "Project Management Plan for the Expansion of the Generation Asset Management Group Workspace," UCI BIBLIOTECA, accessed September 1, 2023, https://omeka.campusuci2.com/biblioteca/items/show/1272.

Justification: An example of a project management plan for asset management group workspace.

CDB. (2021). Project Planning for the Integration of Climate Resilience in the Road Transport Sector in the Borrowing Member Countries of the Caribbean Development Bank. https://www.caribank.org/package-guidance-resources-planning-integration-climate-resilience-road-transport-sector-caribbean

Justification: indicates challenges the road infrastructure of the Commonwealth of Dominica has faced.

CREAD. (2021). Annex Climate Resilience and Recovery Plan: Disaster Resilience Strategy. https://dominica.gov.dm/images/documents/disaster_resilience_strategy_annex_crrpkm1.pdf

Justification: Indicates the strategies for Dominica climate resilience and recovery plan.

CREAD. (2021). Dominica Climate Resilience and Recovery Plan 2020-2030. https://dominica.gov.dm/images/documents/CRRP-Final-042020.pdf

Justification: Provides details of Dominica climate resilience and recovery plan which demonstrates plans to in provide road infrastructure on the island

Dwight Thomas Kent Gary, "Project Management Plan for a Road Maintenance Management System," UCI BIBLIOTECA, accessed September 1, 2023, https://omeka.campusuci2.com/biblioteca/items/show/305.

Justification: An example of a project management plan for road maintenance management system.

Exceeders. (2020). Introduction to Project Management-Key Concepts. https://www.exceeders.com/blog/introduction-to-project-management-key-concepts

Justification: Key concepts of Project Management.

Research Method. (2022). Theoretical Framework Types, Examples and Writing Guide. https://researchmethod.net/theoretical-framework/

Justification: Provide insight on reach methods

ROADSCANNERS. (2023). Improving productivity of paved road asset management. https://www.roadscanners.com/services/road-asset-management/

Justification: is an example of improving productivity with asset management.

Salish Mohan, "The Project Management Plan for the Asset Management Platform Project," UCI BIBLIOTECA, accessed September 1, 2023, https://omeka.campusuci2.com/biblioteca/items/show/1471.

Justification: Is an example of a project management plan for asset management platform.

Teamwork. (2023). What are project deliverables. https://www.teamwork.com/blog/project-deliverables/

Justification: Information on project deliverables.

Vaisala. (2023). Road Asset Management. https://www.vaisala.com/en/products/road-asset-management.

Justification: Is an example of a road asset management plan.

Appendix 5:

Change Request Form

EXECUTION OF ROAD ASSET MANAGEMENT SYSTEMS FOR THE COMMONWEALTH OF DOMINICA

Client: Government of the Commonwealth of Dominica
Beneficiary: Ministry of Public Works Public Utilities and Digital Economy
Funded: Grant-Caribbean Development Bank
Consultant: TBD
Supervisory Consultant (Project Manager):TBD

Project Start Date:_____
Project Duration:_____
Project End Date:_____

Requested By		Change Number		
Presented To		Date of Request		
Change Name				
Description of Change:				
Reason for Change:				
Effect on Deliverables (including a list of any affected deliverables):				
Effect on Organization:				
Effect on Schedule (including Estimated Completion Date for this change):				
Effect on Project Cost:				
Item Description	Hours		Dollars	
	Reduction	Increase	Reduction	Increase
Analysis		0		$ 0.00
		0		$ 0.00
Total Net Change in Cost:			$ 0.00	

Assessment of Impact	
	Effect of NOT Approving this Change:
	Reason for Rejection (if applicable):

Change Control Board

☐ Approved   Signature:

☐ Rejected   Title: Date:

                    Signature   Date:

                    Title:

                    Signature

Appendix 6.

Lessons Learned Log

EXECUTION OF ROAD ASSET MANAGEMENT SYSTEMS FOR THE COMMONWEALTH OF DOMINICA

Client: Government of the Commonwealth of Dominica
Beneficiary: Ministry of Public Works Public Utilities and Digital Economy
Funded: Grant-Caribbean Development Bank
Consultant: TBD
Supervisory Consultant (Project Manager):TBD

Project Start Date:_____
Project Duration:_____
Project End Date:_____

LESSONS LEARNED LOG

ID	Date Identified	Entered by	Description	Impact on project	Recommendation/Comment

Appendix 7

S-Curve Calculation

ID	WORK PACKAGE	BUDGET	PV, AC, EV	MONTH 1	MONTH 2	MONTH 3	MONTH 4	MONTH 5	MONTH 6	MONTH 7	MONTH 8	MONTH 9	MONTH 10	MONTH 11	MONTH 12
2	Desk Study	$10,000.00	PV	10,000.00											
			AC	8,000.00											
			EV	9,000.00											
3	Review Ministry's framework.	$12,000.00	PV	12,000.00											
			AC	10,500.00	2,500.00										
			EV	11,000.00	3,000.00										
4	Review Ministry data storage mechanism	$15,000.00	PV	4,500.00	10,500.00										
			AC	5,400.00	8,000.00										
			EV	6,700.00	10,500.00										
5	D1-Inception Report	$35,000.00	PV	15,750.00	15,750.00	3,500.00									
			AC	15,555.00	15,555.00	3,000.00									
			EV	16,000.00	16,000.00	4,500.00									
6	Asset Conditional Assessment	$160,000.00	PV		40,000.00	80,000.00	40,000.00								
			AC		45,000.00	95,090.00	40,600.00								
			EV		44,000.00	81,000.00	45,000.00								
7	Road Traffic Count	$40,000.00	PV	32,000.00	8,000.00										
			AC	38,900.00	9,000.00										
			EV	35,000.00	9,000.00										
8	Windshield Survey	$80,000.00	PV		60,000.00	20,000.00									
			AC		58,888.00	22,000.00									
			EV		61,890.00	21,000.00									
9	GIS mapping of assets	$60,000.00	PV	12,000.00	48,000.00										
			AC	12,000.00	50,000.00										
			EV	13,500.00	49,000.00										
10	D2-Asset Data Collection	$75,000.00	PV			15,000.00	15,000.00	15,000.00	15,000.00	15,000.00					
			AC			12,000.00	13,000.00	25,000.00	20,000.00	17,890.00					
			EV			17,500.00	19,000.00	21,000.00	23,000.00	17,000.00					
11	Asset vulnerability	$80,000.00	PV			40,000.00	40,000.00	-							
			AC			35,000.00	55,000.00								
			EV			51,000.00	56,000.00								
12	Asset rehabilitation Mechanisms	$40,000.00	PV					8,000.00	32,000.00						
			AC					10,500.00	35,000.00						
			EV					12,000.00	36,000.00						
13	Cost of Repairs	$20,000.00	PV						9,000.00	11,000.00					
			AC						12,000.00	12,000.00					
			EV						10,000.00	15,000.00					
14	D3-RAMS Draft Program	$40,000.00	PV							30,000.00	10,000.00				
			AC							31,000.00	13,000.00				
			EV							32,000.00	12,000.00				
15	D4-RAMS Program Final Version	$100,000.00	PV								30,000.00	60,000.00	10,000.00		
			AC								23,780.00	59,500.00	9,000.00		
			EV								31,900.00	57,000.00	12,050.00		
16	Capacity Building of the Ministry	$25,000.00	PV								12,500.00	12,500.00			
			AC								11,000.00	11,000.00			
			EV								11,500.00	12,900.00			
17	RAMS Manual	$40,000.00	PV								8,000.00	16,000.00	16,000.00		
			AC								11,970.00	17,900.00	12,130.00		
			EV								9,900.00	15,000.00	16,000.00		
18	D5-RAMS Closing	$5,000.00	PV											2,500.00	2,500.00
			AC											3,200.00	3,400.00
			EV											3,500.00	3,455.00

				MONTH 1	MONTH 2	MONTH 3	MONTH 4	MONTH 5	MONTH 6	MONTH 7	MONTH 8	MONTH 9	MONTH 10	MONTH 11	MONTH 12
			PV Total	$86,250.00	$182,250.00	$158,500.00	$95,000.00	$23,000.00	$56,000.00	$56,000.00	$60,500.00	$88,500.00	$26,000.00	$2,500.00	$2,500.00
			PV Acumulado	$86,250.00	$268,500.00	$427,000.00	$522,000.00	$545,000.00	$601,000.00	$657,000.00	$717,500.00	$806,000.00	$832,000.00	$834,500.00	$837,000.00
			AC Total	$90,355.00	$188,943.00	$167,090.00	$108,600.00	$35,500.00	$67,000.00	$60,890.00	$59,750.00	$88,400.00	$21,130.00	$3,200.00	$3,400.00
			AC Acumulado	$90,355.00	$279,298.00	$446,388.00	$554,988.00	$590,488.00	$657,488.00	$718,378.00	$778,128.00	$866,528.00	$887,658.00	$890,858.00	$894,258.00
			EV Total	$91,200.00	$193,390.00	$175,000.00	$120,000.00	$33,000.00	$69,000.00	$64,000.00	$65,300.00	$84,900.00	$28,050.00	$3,500.00	$3,455.00
			EV Acumulado	$91,200.00	$284,590.00	$459,590.00	$579,590.00	$612,590.00	$681,590.00	$745,590.00	$810,890.00	$895,790.00	$923,840.00	$927,340.00	$930,795.00
			SV	$4,950.00	$16,090.00	$32,590.00	$57,590.00	$67,590.00	$80,590.00	$88,590.00	$93,390.00	$89,790.00	$91,840.00	$92,840.00	$93,795.00
			SPI	1.06	1.06	1.08	1.11	1.12	1.13	1.13	1.13	1.11	1.11	1.11	1.11
			CV	$845.00	$5,292.00	$13,202.00	$24,602.00	$22,102.00	$24,102.00	$27,212.00	$32,762.00	$29,262.00	$36,182.00	$36,482.00	$36,537.00
			CPI	1.01	1.02	1.03	1.04	1.04	1.04	1.04	1.04	1.03	1.04	1.04	1.04

Appendix 8

Minutes of Meeting

EXECUTION OF ROAD ASSET MANAGEMENT SYSTEMS FOR THE COMMONWEALTH OF DOMINICA

Client: Government of the Commonwealth of Dominica
Beneficiary: Ministry of Public Works Public Utilities and Digital Economy
Funded: Grant-Caribbean Development Bank
Consultant: TBD
Supervisory Consultant (Project Manager):TBD

Project Start Date:_____
Project Duration:_____
Project End Date:_____

Minutes of Meeting

Current Meeting

Meeting Description:	
Document Number:	MoM-0001
Date:	Click or tap to enter a date.
Time:	
Location:	
Meeting Moderator:	
Minutes By:	

Meeting History

	Previous Meeting	Next Meeting
Document Number:	N/A	MoM-0002

MoM Date:	Click or tap to enter a date.	Click or tap to enter a date.
Time:		
Location:		
Minutes By:		

Attendees:

Name	☐ Yes ☐ No ☐ N/A	Name	☐ Yes ☐ No ☐ N/A
	☐ Yes ☐ No ☐ N/A		☐ Yes ☐ No ☐ N/A
	☐ Yes ☐ No ☐ N/A		☐ Yes ☐ No ☐ N/A
	☐ Yes ☐ No ☐ N/A		☐ Yes ☐ No ☐ N/A
	☐ Yes ☐ No ☐ N/A		☐ Yes ☐ No ☐ N/A
	☐ Yes ☐ No ☐ N/A		☐ Yes ☐ No ☐ N/A

Highlighted Action Items:

Action Item Number	Open Date	Requested By	Description	Priority	Status	Responsible Party	Target Due Date	Actual Closed Date	Current Status / Notes
AI-0001									

Action Item Number	Open Date	Requested By	Description	Priority	Status	Responsible Party	Target Due Date	Actual Closed Date	Current Status / Notes
AI-0002									
AI-0003									

Agenda:

1.

2.

3.

Meeting Items:

1.

2.

3.

Questions & Decisions:

1.

2.

3.

Other Notes:

1.

2.

3.

Attachments:

1.

2.

Appendix 9

Issues Management Log

EXECUTION OF ROAD ASSET MANAGEMENT SYSTEMS FOR THE COMMONWEALTH OF DOMINICA

Client: Government of the Commonwealth of Dominica
Beneficiary: Ministry of Public Works Public Utilities and Digital Economy
Funded: Grant-Caribbean Development Bank
Consultant: TBD
Supervisory Consultant (Project Manager):TBD

Project Start Date:_____
Project Duration:_____
Project End Date:_____

Issues Management Log

Category	Description	Corrective Action	Assessment	Person Responsible

Category

- ➤ Resource Constraints
- ➤ Scope modifications
- ➤ Implementation Schedule
- ➤ Project Compliance
- ➤ Contractor/supplier performance
- ➤ Project Design
- ➤ other

Assessment

| 3 – immediate action required |
| 2 – actively being resolved |
| 1 – issue Resolved |

Appendix 10

Contract Administration Matrix

CONTRACT ADMINISTRATION MATRIX				
Project:			**Contract:**	
Contract Manager:				
Contact:				
Technical Group:				
Validity of the Contract:				
Start Date:		**Closing Date:**		
ACTIVITIES	**DATE**	**REQUIRES VALIDATION?**	**VALIDATED BY**	**OTHER ASPECTS**
REVIEWS / VISITS				
PAYMENTS / AMOUNTS				
VERIFICATION OF GUARANTEES				
SUBCONTRACTOR CONTROL				
CLOSING CONTRACT				
OBSERVATIONS: Breaches, actions taken, endorsements, fines applied, acknowledgments, temporary receptions, etc.				
Approved by:				
Signature and date:				

Janelle St. Louis
Certified Teacher

January 5th, 2024

Academic Advisor
Master's Degree In Project Management (MPM)
Universidad para la Cooperacion Internacional (UCI)

Dear Academic Advisor,

RE: Thorough Review Proof Reading of Final Graduation Project submitted by Naomi Cherry in partial fulfillment of the requirements for the Master's in Project Management (MPM) Degree.

I hereby confirm that I, Janelle St. Louis, have made all the corrections to the Final Graduation Project document as I have advised. Based on my revision of the project, the document does now meet the literary and linguistic standards expected of a student for a degree at the Master's level.

Yours respectfully,

Janelle St. Louis

**University of
South Wales
Prifysgol
De Cymru**

It is hereby certified that | Hyn sydd i dystio bod

JANELLE ENDA ST. LOUIS

has been awarded | wedi derbyn dyfarniad

MASTER OF ARTS
MEISTR YN Y CELFYDDYDAU

in EDUCATION (INNOVATION IN LEARNING AND TEACHING)
mewn ADDYSG (ARLOESEDD MEWN DYSGU AC ADDYSGU)

MERIT
TEILYNGDOD

Award Date / Dyddiad y Dyfarniad : 17/04/2019
Date of Issue / Dyddiad Cyhoeddi : 23/01/2020
Enrolment Number / Rhif Cofrestu : 74101877

An award of the University of South Wales
Dyfarniad Prifysgol De Cymru

Academic Registrar
Cofrestrydd Academaidd

Vice-Chancellor
Is-Ganghellor

THE UNIVERSITY OF THE WEST INDIES

Janelle Enda St Louis

having completed the Course of Study approved by the University and having satisfied the Examiners, has this day been admitted by the Senate to the Degree of

BACHELOR OF EDUCATION
LANGUAGE EDUCATION
(LITERACY STUDIES)

with
Second Class Honours (Upper Division)

July 1, 2015

DATE

VICE-CHANCELLOR

UNIVERSITY REGISTRAR

This Document is not valid unless it bears the University's seal