KYIV NATIONAL UNIVERSITY OF CONSTRUCTION AND ARCHITECTURE

Faculty of automation and information technologies

Department of Project Management

EXPLANATORY NOTE

TO THE ASSESSMENT WORK FOR OBTAINING THE MASTER'S DEGREE

on the topic:

PROJECT MANAGEMENT OF ROADS INFRASTRUCTURE UTILITIES CONSTRUCTION

KHALAF MOSTAFA

Kyiv 2022

KYIV NATIONAL UNIVERSITY OF CONSTRUCTION AND ARCHITECTURE

Faculty: Automation and information technologies
Department: Project Management
Educational level: Master's degree in the educational and professional program
Branch of knowledge:
Specialty: 073 - Management
Specialization: Project management

APPROVE
Head of Department
Bushuev S. D.
«__»_____2022

TASK
FOR EXECUTION OF CERTIFICATE WORK
TO OBTAIN A MASTER'S DEGREE

_____KHALAF MOSTAFA_____

1.Topic of work:

PROJECT MANAGEMENT OF ROADS INFRASTRUCTURE UTILITIES CONSTRUCTION_____

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2. Supervision:

Oleksandr Valentinovych Bugrov, Candidate of Economic Sciences, Associate Professor of the Department of Project Management_____

3. Deadlines for student submission of work for defense:

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4. Content of the explanatory note (list of issues to be developed):

Project management methodologies and their application in the road industry

Life cycles of infrastructure projects

State regulation in the field of road infrastructure utilities construction

Peculiarities of road infrastructure utilities construction project management

Structuring of project management of the road infrastructure utilities construction

Formation of basic planning decisions and project documents

Project implementation

5. Graphic material by sections:

The work presents 4 tables, 16 figures and 3 appendices.

6. Work schedule:

Types of work and their content	Execution date
Collection of materials of the chosen field of work	
Processing and analysis of work materials	
Introduction	
Chapter 1.	
Chapter 2.	
Chapter 3.	
Conclusions	
Final design of the work	
Checking work for plagiarism	
Preliminary defense of work at the department	
Sending the work for review	

7. Consultants of chapters of the attestation final work

Chapter	Surname, initials and position of the consultant	Checked	
		Date	Signature
Chapter 1.			
Chapter 2.			
Chapter 3.			

8. Date of assignment _____

Head of the dep _____ __Bushuev S. D___

Supervision _____ __Bugrov O. V.___

Student _____ __Khalaf Mostafa_

SUMMARY To the student's graduation thesis			**Khalaf Mostafa**
Institution of higher education	Kyiv National University of Construction and Architecture		
Topic	Project management of roads infrastructure utilities construction		
Educational degree	Master's degree in the educational and professional program		
Faculty	Automation and information technologies		
Department	Project Management		
Specialty	073 Management		
Specialization	Project Management		
Supervision	Bugrov O. V, Candidate of economic sciences, associate Professor of the department of Project Management		
Scope of work:	*Explanatory note, pages*	*Chapters*	*Presentation slides*
	92	*3*	*12*
Chapter 1. Theoretical and methodological aspects of project management of road infrastructure utilities construction	An analysis of project management methodologies and their application in the road industry was carried out. Characteristics of the main project management methodologies are considered. In the field of project management of road infrastructure, there is a large project research methods based on evaluation are of interest economic efficiency, taking into account the stages of the project's life cycle. The concept of the project life cycle is important for research and analysis problems of financing related works and accepting the corresponding ones management decisions during its implementation. The analysis of the road industry of Ukraine shows problematic cases which directly affect the level of development of the entire infrastructure of Ukraine, among them. A detailed study of the basic theoretical aspects of the road infrastructure construction project management process allows a better understanding of the applied aspects that will be applied to the future project.		
Chapter 2.	The field of the road industry has its own specific		

Substantiation of the expediency of project management of road infrastructure utilities construction	characteristics. It is important to take such features into account when developing a road infrastructure construction project. Construction of road infrastructure is a long and painstaking process that requires detailed preparation. We considered the features of human resource management, quality management, monitoring and control over project implementation. Also considered the management of communications during the implementation of the road infrastructure construction project and the planning management of such a project. Risk management is an important factor during project planning and implementation. Therefore, we have characterized the risk that may relate to the construction project of road infrastructure. An important task is to minimize such risks, so we considered one of the ways to reduce the likelihood of risks, namely insurance.
Chapter 3. Applied aspects of management of road infrastructure utilities construction	The main attention is devoted to the structuring of the project, the formation of basic planning solutions and design documents, as well as the implementation of the road infrastructure construction project. The project was completed for a foreign customer. The main goal of the project is the construction of road infrastructure for a new city under construction in the State of Qatar. Defined fixed and call-off scope of work. On the basis of this, an organizational structure for the executed project and a matrix of responsibilities for a clear distribution of work were drawn up. The developed work plan with the use of a special planning program made it possible to calculate the calendar plan and the approximate time of the work. Monitoring and control consists of processes that are used to track, analyze, and coordinate project progress and execution, identifying places that require changes to the plan and initiation corresponding changes.
Work conclusions:	Applied project management methodology for road infrastructure allows you to actively influence production processes in progress implementation of the project. The results of the study make it possible to simplify the process of planning and implementation of projects in the road industry thanks to the application of project management

	methodology based on the PMBOK.
Keywords: project management, road infrastructure , road infrastructure utilities, life cycle,	

Compiler: Khalaf Mostafa

Supervision: Bugrov O.V.

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EXPLANATORY NOTE

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on the topic:

PROJECT MANAGEMENT OF ROADS INFRASTRUCTURE UTILITIES CONSTRUCTION

Performed by a student of the UPM-52 group
Khalaf Mostafa
Specialty 073 – Management
Specialization Project management
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Candidate of economic sciences, associate
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Reviewer

Kyiv 2022

LIST OF ABBREVIATIONS

A – Authorized

CAR – Contractor's All Risks

CMU – Cabinet of Ministers of Ukraine

CR – Controlled Radius

DC – Document Controller

EAR – Erection All Risks

EE – Electronic Equipment

IDI – Inherent Defects Insuranc

IPMA ICB – International Project Management Association International Competence Baseline

ISO – International Organization for Standardization

MBI – Machinery Breakdown Insurance

MOI – Ministry Of Interior

MSF – Microsoft Solutions Framework

PE – Planning Engineer

PM – Project Manager

PMI – Project Management Institute

PMBOK – Project Management Body of Knowledge

PQP – Project Quality Plan

QA/QC – Quality Assurance /Quality Control

QC – Quality Control

QHSE – Quality, Health, Safety, and Environmental

R – Responsible

RUP – Rational Unified Process

SE – System Engineer

SW – Small Works

TPL – Third Party Liabilit

WBS – Work Breakdown Structure

CONTENT

INTRODUCTION

Relevance. It is an obvious fact that the transport sector is one of the leading sectors of the economy

Road and transport infrastructure in the planning structure of a modern city is the basis around which the elements of the urban environment are formed and developed: microdistricts, residential areas, city-wide and district centers, areas where manufacturing enterprises, health care facilities, sports complexes are located, recreational facilities, etc.

The expansion and renewal of infrastructural facilities is of a strategic nature, as it covers road construction, education, health care, housing and communal services, public services, retail trade and public catering, passenger transport, provision of various services to the population, etc. The need to restore and develop the road and transport network, housing and communal facilities, and increase energy efficiency is constantly growing

Currently, the issues of modernization of transport, energy and social infrastructure are considered relevant both for state authorities and for local self-government bodies. The need to increase energy efficiency, restore and develop the road network, housing and communal facilities is constantly growing. At the level of regions and municipal entities, budget constraints become a barrier to the modernization of dilapidated infrastructure. As a rule, the state takes part in the implementation of infrastructure projects, being their initiator and controlling the progress of work within the framework of the projects. That is why such projects are often very sensitive to political changes.

The goal of the work. Justification of feasibility and development of the road infrastructure construction project.

Job tasks. To achieve the set goal, a number of tasks must be completed:

1. Learn the methodology of project management and their application in the road industry;
2. Investigate the life cycles of infrastructure projects;

3. Analyze state regulation in the field of road infrastructure construction;

4. Consider the peculiarities of the management of road infrastructure construction projects;

5. Investigate risks in the management of the road infrastructure construction project; to structure the management of the road infrastructure construction project;

6. form basic planning decisions and project documentation;

7. Investigate the project implementation process.

It is used to solve the problems methods of analysis and synthesis, formal-logical, project, system, comparative legal and statistical.

Object of study. The process of managing the road infrastructure construction project.

Subject of study. Methods and principles of road infrastructure construction project management.

Scientific novelty in the development of a road infrastructure construction project for a foreign customer.

Practical significance. The result of writing the thesis is a developed project for the construction of road infrastructure facilities with features that must be taken into account when implementing a real project.

CHAPTER 1. THEORETICAL AND METHODOLOGICAL ASPECTS OF ROAD INFRASTRUCTURE UTILITIES CONSTRUCTION PROJECT MANAGEMENT

1.1 Project management methodologies and their application in the road industry

Implementation of project management methods in the road industry is a difficult problem, the solution of which should ensure a hight quality, timely execution and minimum cost of works, as well as coordinated work of the road enterprise.

Project management is a methodology of organization, planning, management, coordination of labor, financial and material resources during the project cycle, aimed at the effective achievement of its goals through the use of modern methods, techniques and management technology to achieve certain results regarding the composition and scope of work, cost, time, quality and satisfaction of project participants [1, p.17].

Effective project management includes the application of certain techniques or procedures, a structure of logical and progressive planning and decision-making management, perspective analysis, proper organization, commercial and financial management [2, p 197]

During the existence of project management, many effective approaches, methods and standards have been formed, the use of which ensures the successful implementation of projects. Depending on the field in which project management is carried out, various principles are applied (table 1.1)

Table 1.1

Principles of project management

	Small research and develop-ment	**Small construc-tion**	**Big construc-tion**	**Aviation and space sphere**	**Information management system**	**Engineering**
The importance of organizational structure	insignifi-cant	insignifi-cant	insignifi-cant	insignificant	significant	insignificant
Time management difficulties	small	small	big	big	big	small
Number of meetings	a lot	small	a lot	a lot	many	small
Management of the project manager	mid-level management	high-level management	high-level management	high-level management	mid-level management	mid-level management
Level of conflict	low	low	high	high	high	low
Level of funds control	low	low	high	high	low	low
Planning level	just the key points	just the key points	detailed planning	detailed planning	just the key points	just the key points
The need for interpersonal communication	small	small	big	big	small	small
Presence of a project sponsor	available	not necessarily	available	available	not necessarily	not necessarily

Depending on the type of project, its executors, and the choice of project management, one should choose a project management method – a system of actions applied to achieve the desired result.

Project management methodology is an approach to forming a set of methods that structures a project management system. The methodology determines how project management will be organized and ensures the system integrity of integrated project management.

There are basic project management methodologies and methodologies for a specific organization or industry. Basic methodologies include:

- Project Management Institute (PMI);
- Project Management Body of Knowledge (PMBOK);
- International Project Management Association International Competence Baseline (IPMA ICB);
- Microsoft Solutions Framework (MSF);
- Rational Unified Process (RUP);
- CORE (figure 1.1).

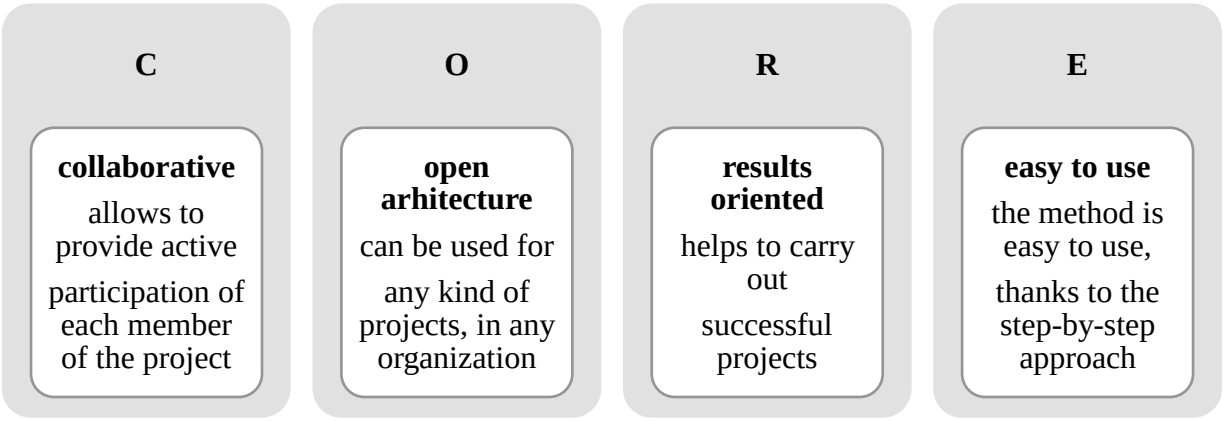

Figure 1.1 – meaning of CORE

Management methodology has become the most widespread by the PMBOK projects of the American Institute of Project Management – PMI. A Guide to the Project Management Body of Knowledge (PMBOK Guide) edition of 2004 is recognized by the United State national standard ANSI/PMI 99-001-2004. International Competence Baseline IPMA based on a managerial approach; ICB IPMA is accepted as an official base in more than 30 countries of the world, and PMBOK is in the associations of about 20 countries.

Quality management in project activity is regulated by the standard ISO 10006 «Quality management systems. Guidelines for quality at project management». Standard requirements for the organization have been implemented management of the entire project requires adaptation to the conditions of

development and implementation specific project. Quite often, ISO 10006 is defined as a separate project management methodology from the point of view of quality, as in the standard requirements for all groups of management processes are listed and formulated projects.

If the organization already has a quality management system in place, then ISO 10006 is the most logical choice for the basic methodology. Standard practically based on PMI PMBOK, but emphasizes on constant improvement of project management processes. If you compare PMI PMBOK and ICB IPMA, then in general they are are quite similar, but differ only in the approach of binding management tasks project to the general cycle [3, p 56]

The application of project management methodologies in the road industry is important, as the effective development of road infrastructure is a task that scientists from all over the world in connection with the development of transport communications is considered as one of the priority fundamental scientific tasks. Due to this, project management in the road industry in Ukraine goes on the same level with such national issues as reduction of construction costs, the need for accelerated renewal fixed assets and reduction of territorial disparities in development road infrastructure [4, p.22].

Scientific research in the road industry has not yet solved the problem formation of theoretical principles, generalization of foreign experience financing and effective project management, analysis of opportunities practical application of project management technologies in the field road construction.

The most characteristic difficulties that arise during implementation projects in the road sector, there is an inefficiency of provision information, the difficulty of controlling the execution of instructions, compliance norms, the complexity of accounting for the unique characteristics of each object construction.

Currently, without the development of modern road infrastructure full implementation of national and international projects is impossible. To solve acute road problems, the industry must move to a new management system built on the principle of projects and programs directed to the result.

In the road industry, project management forms are typical for construction of large highways. Complex ones are also performed works on construction, modernization, repair and maintenance of roads, that is, various projects are being implemented.

In a situation where the need for road infrastructure development is great, a financial resources are limited, the problem of effective traffic management transport complex using modern technologies, which ensure the integrity of roads, save financial costs and sustainable the functioning of socio-economic facilities is quite relevant.

Real practice of road infrastructure management in force lags behind for various reasons of an objective and subjective nature world-class development of information technologies, modern management, project and program management methodologies. Information Technology are gradually becoming a mandatory element of management in the industry. Special role in the implementation of the goals set for the road industry belongs scientific research related to development and implementation modern technical solutions and technologies, theoretical and practical mastering new effective management methodologies [5, p.58].

In project management, it is important to implement a comprehensive approach to all problems of the object of management, considering the development of the road infrastructure as a whole as an adaptive dynamic system.

For optimal project management in the road industry, it is necessary take into account both the features of the life cycle of similar projects and aspects technical and investment design, which leads to the need consider project management from a systemic and simultaneously synergistic perspective point of view.

The system approach provides an opportunity within any subsystem of the road industry to allocate and form a row in the necessary directions structures that combine functionally related elements. Similar structures that are relatively independent components in the hierarchical structure the structure of road construction as a system should contain all signs of such a system.

In the field of project management of road infrastructure, there is a large project research methods based on evaluation are of interest economic efficiency, taking into account the stages of the project's life cycle.

This approach was used by foreign specialists in the field of design management. S. Pipe [6.], J. Rodney Turner [7], G. Webster emphasize, that in project management it is important to consider the life cycle project and the formation of phased plans with control and correction according to the development of construction.

The most accurate representation of the principles of interaction of the main elements in project management gives a systematic project management methodology and programs. The foundations of this methodology were formulated in Europe by International by the Project Management Association (IPMA), in the USA - by the Institute of Management projects (PMI).

Road infrastructure is characterized by a number of features, which must be taken into account for the development of project management methodology. To they include combining assets from different business areas, significant social and social importance for the state, essential role for the development of other spheres business, multi-level nature of management. It is also important to note multifaceted nature of activity, a large number of production units, decentralization of construction, reconstruction, repair and maintenance facilities roads [8, p.32].

Based on the principles of the project approach to management, compliance with ISO international standards, works execution projects in road industry are considered as management processes that are performed for achievement of certain goals and represent a set of interrelated coordinated subprocesses.

The success of the project, its effectiveness as a whole are determined optimal structuring of organizational and technological interaction subprocesses within the structure.

The main directions of the development of scientific methodology project management, in relation to the complex of road works are shown in the figure 1.2.

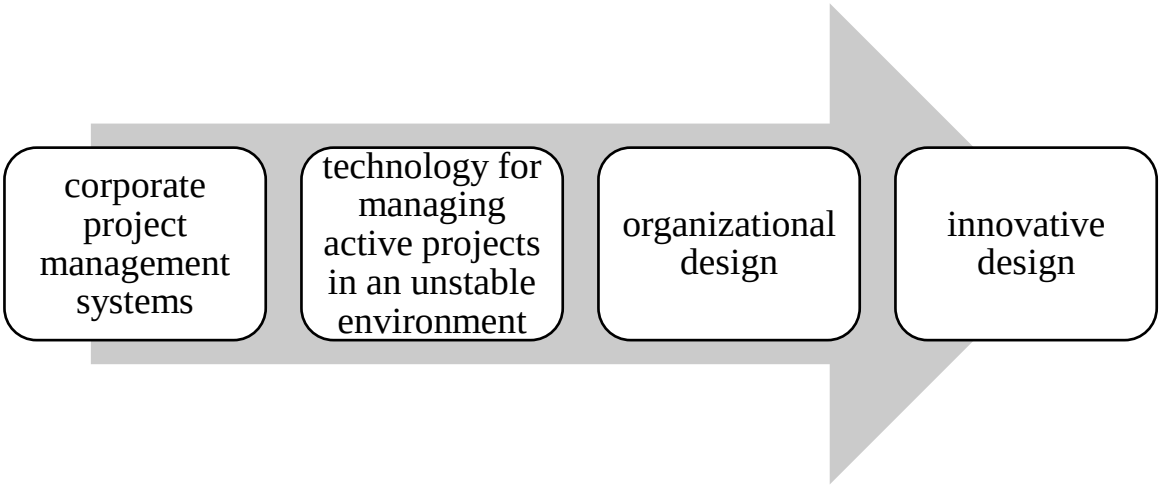

Figure 1.2 - The main directions of the development of methodology project management

An integral part of these structures must to be corporate management of adaptive projects – a system planning, organization, monitoring and control of all aspects of road projects and programs, as well as motivation of all participants to achieve goals project [9, p. 228].

For the successful implementation of the project, it is not so important what the methodology is chosen, and a much bigger role is played by its being appropriate implemented in this way.

1.2 Life cycles of infrastructure projects

Each project has its own life cycle – a set of actions that are interconnected, aimed at achieving a result and that last from the beginning of the project to its completion.

The stages of the project cycle differ depending on the field of activity and accepted work organization system, but each project, as well as the plan, regardless of the complexity and volume of resources required for its implementation necessarily involves two stages: when the project does not exist yet and when it no longer exists.

The life cycle consists of four main phases - separate parts within the project, which require additional control for effective management of the achievement of the main result of the project, shown in Figure 1.3.

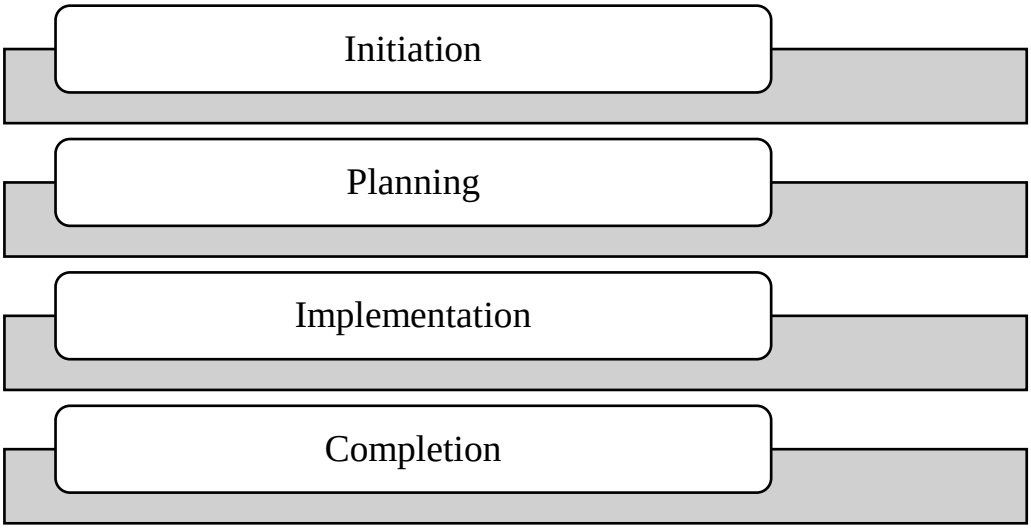

Figure 1.3 – Four main phases of the project life cycle

The moment of birth of an idea is considered the beginning of a project. the completion of the project's existence is the completion of work on its implementation, i.e implementation of the object, the beginning of its operation and use of the results of the project. However, in recent years, the point of view on this the problem has changed in connection with the realization that the total costs

of implementation of the project largely depends on the period of its use results up to the time of its decommissioning [8, p.30].

The concept of the project life cycle is important for research and analysis problems of financing related works and accepting the corresponding ones management decisions during its implementation. Implementation of the project requires a certain set of measures related to the assessment of the feasibility of the project, its technical and economic substantiation (TES), development of technical and work project, contract activities, resource planning and directly by working on the project, purchasing materials and equipment, materialization of the project and commissioning of facilities. This list of species project activities shows how diverse they are.

Two large blocks of work can be distinguished in the project: the main activity according to the project and its provision. The main activities of the project include:

- pre-investment studies;
- project planning;
- development of technical, project and budget documentation;
- conducting bidding and concluding contracts;
- materialization project (construction and installation works);
- execution of commissioning works;
- delivery of the project;
- its operation;
- production;
- equipment repair; production development; dismantling of the equipment (closing project).

The provision of the project involves organizational, legal, financial, material and technical, commercial (marketing), personnel and informational activity. This list is not complete, so it should be clearly and unambiguously distributed it is impossible to work in a logical sequence and in time.

The structure of project phases allows you to divide it into logical subgroups for easier management, planning and control. The number of phases, their necessity and degree of control depends on the complexity, duration and potential impact on the project.

Estimated duration of implementation of the main phases the life cycle of the project is given in the table. 1.2.

Table 1.2

Estimated duration of implementation of the main phases of the project life cycle

Type of construction	**Duration of phase realization, years**		
	Conceptual	Contract and operational design	Construction
Large business buildings	1-7	1-3	1,5-2
Residential buildings	1-4	1-3	1-4
Medical institutions	1-5	0,5-4	0,5-5
Educational institutions	1-4	0,5-3	0,5-2,5
Small and medium buildings	0,5-3	0,5-2	0,5-1,5
Roads and harbors	1,5-10	1-4	0,5-3
Industrial facilities	0,5-2	0,5-2,5	0,5-2

At the initial stage, initiation, the project itself is defined. Also at this stage, project boundaries and a comprehensive approach to obtaining the desired result are defined.

At the second stage, everything required to obtain the desired result is planned. The more precisely the project is planned, the fewer errors occur during its execution, and therefore, the greater the probability that the project will be completed on time and without significant risks.

When the project is defined and planned in detail in the first two stages, the project itself is implemented in the implementation stage, and the progress of its implementation is monitored [10, p.14.].

At the stage of completion of the project, various forms of performance reporting are drawn up in order to study what was done and what could be improved in order not to repeat mistakes in the future [11, p.113].

To successfully implement all these four stages, the project manager must simultaneously manage four main elements of the project (figure 1.4).

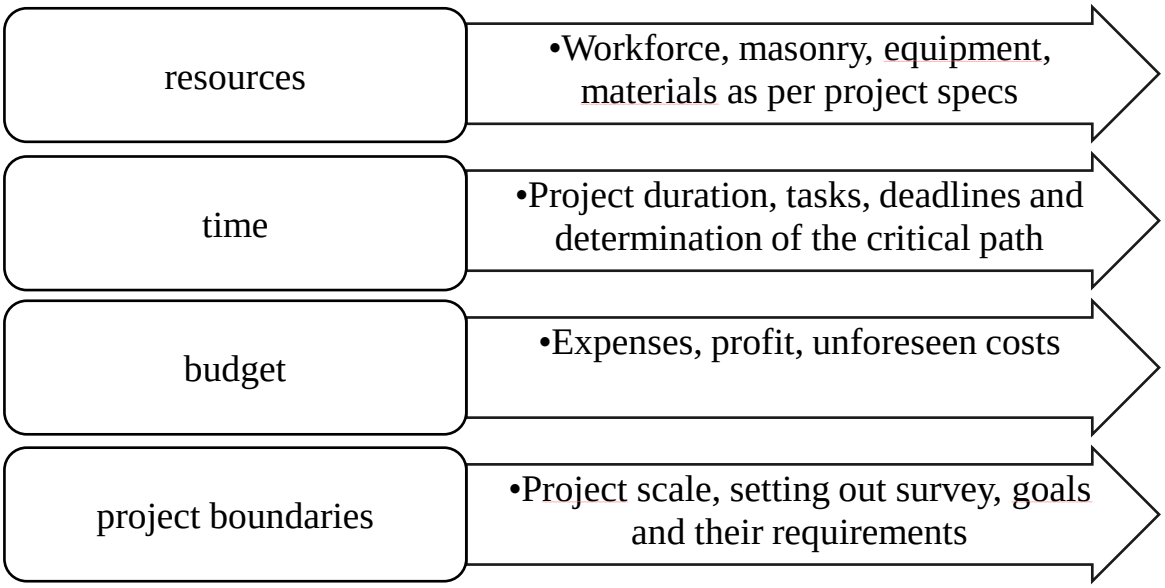

Figure 1.4 – Main elements of the project

Aggregate logically related project operations that are normally completed the achievement of one of the main deliverables is called a project phase. Transition from one phase to another within the project life cycle is carried out in the form of technical transfer or delivery of results phases, and often this is what indicates the transition from phase to phase.

Phase results are checked for completeness, accuracy and require an approval procedure (figure 1.5).

Phases can be hierarchically divided into subphases and further on elements with the required level of detail. There is a project phase element of the project life cycle and is not a group of processes project management. Project phases are most often executed consecutively, but in certain situations may overlap (Appendix 3).

Interrelationships between phases significantly affect requirements management procedure. High-level nature of phases of the project transforms them into elements of the project life cycle.

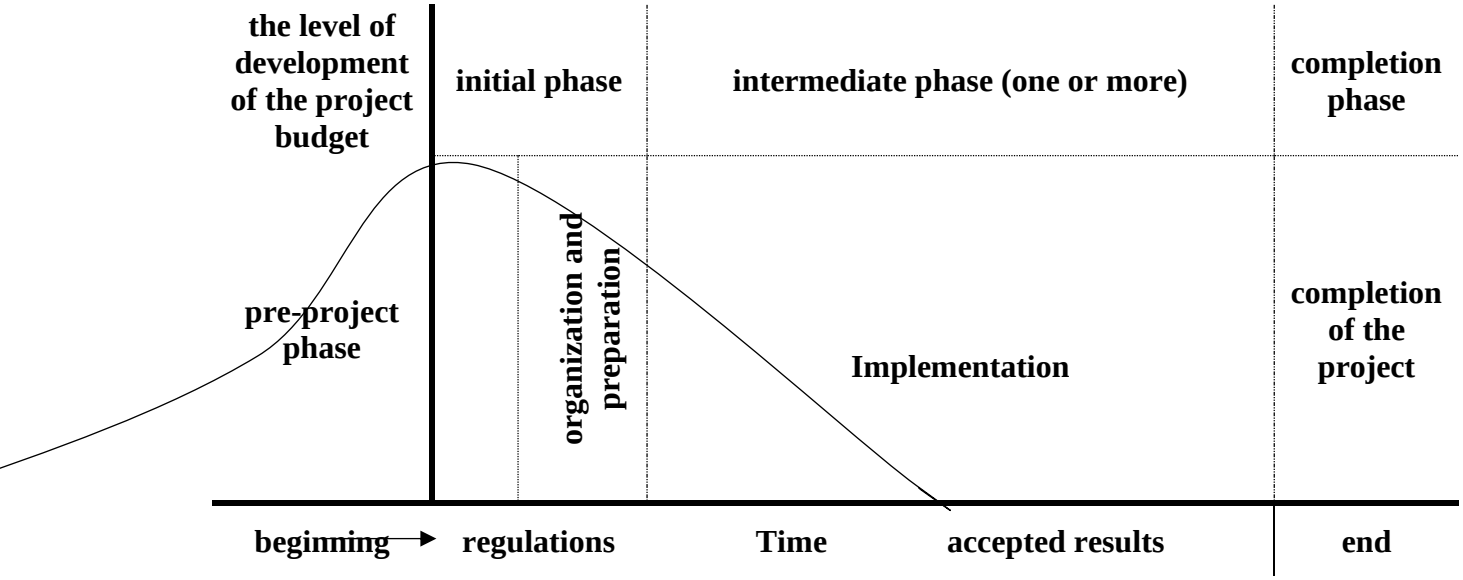

Figure 1.5 – Phases of project

If projects contain a large number of phases, then phases such as rule, is part of a consistent process developed with in order to ensure proper control over the project and obtaining the desired product, service and/or result.

However, there are situations where the project can benefit from using overlapping or overlapping phases in parallel. The following types of relationships between phases are distinguished:

- **sequential (cascade)** – the next phase can to begin only after the completion of the previous phase.
- **parallel** – the next phase begins before completion of the previous phase. Sometimes it can be used in s an example of the schedule compression method. Practice superimposing phases that are performed sequentially is an example application of the schedule compression method, which is called «Fast Tracking» is a special method reducing the duration of the project, which changes its logic by way of simultaneous execution of phases that are usually performed

successively. Overlapping phases can increase the level of risk and lead to repeated execution of work, if the subsequent phase will start before the exact one is obtained information about the results of the previous phase;

- **iterative** – a relationship in which detailed planning for a given period is carried out only for one phase, and the planning of the next one is carried out as it is being carried out works within the current phase and obtaining results. Present approach is useful to a large extent in uncertain, unstable or a changing environment [12, p.93].

The life cycles of the project together with the phases and a detailed description of the works that take place at each stage can be found in figure 1.6.

Figure 1.6 - Project lifecycle management

Accordingly, the following types of project life cycles are distinguished:

- **predictive** (also known as fully managed plan) is a type of project life cycle in which the content project and the duration and cost required for implementation of this content is determined as early as possible stages of the life cycle. Projects go through a series serial or parallel phases, while each phase, as usually focuses on a subset of project work and processes project management.

The work done in each phase is usually differs from the works of the previous and subsequent phases, therefore, the composition and skills required of the project team, may vary from phase to phase;

- **iterative and incremental** are life cycles, with which project phases (iterations) are repeated as the project team begins to understand the product better. Iterability defines product development by execution series of cycles, while incrementality defines sequential increasing the functionality of the product. During such product life cycles are developed both iteratively and Incremental;
- **adaptive** (also known as change-driven or flexible (agile) methods) are aimed at responding to changes high level and require constant involvement of interested parties parties Adaptive methods are also iterative and incremental, but differ in that iterations occur very quickly (the duration is usually 2-4 weeks) and are fixed in duration and cost. In adaptive projects typically run several during each iteration processes, although early iterations may be more focused on the planning of operations. Adaptive methods are generally better at dynamic environment, when the requirements and content that will be delivering value to stakeholders is difficult determine in advance.

In the event that the project or parts of the project decomposed into phases and subphases, such a hierarchy is represented by a hierarchical structure of works (WBS – Work Breakdown Structure).

The infrastructure project is implemented over a long-term period. The level of achievement of the mission value of the infrastructure project is currently being evaluated. At the completion of an infrastructure project, it is determined whether the overall value and strategic objectives have been achieved. The scenario chosen for implementation should provide for an assessment of the impact on the infrastructure project of changes in the environment throughout its entire life cycle. In most cases, the information on the basis of which the evaluation is carried out ages faster than the evaluation process takes place, so the scenario selected for implementation should be based on predictive information [13, p.56]

1.3 State regulation in the field of road infrastructure utilities construction

The legislative base of the field of construction and spatial planning has a rather contradictory appearance - on the one hand, it is sufficiently thorough and branched, and on the other hand, it has significant problems with clarity and unambiguity of norms, consistency of norms both among themselves and norms of adjacent areas of law [14].

To the main legislative acts, the norms of which regulate the construction industry and spatial planning development of territories can be attributed to:

- Law of Ukraine «On Investment Activity» (from September 18, 1991) [15];
- Law of Ukraine «On the Basics of Urban Planning» (from November 16, 1992) [16];
- Law of Ukraine «On Liability for Offenses in the Field of Urban Development» (from 14.10.1994) [17];
- Law of Ukraine «On architectural activity» (from May 20, 1999) [18];
- Law of Ukraine «On the General Planning Scheme of the Territory of Ukraine» (dated February 7, 2002) [19];
- Law of Ukraine «On financial and credit mechanisms and property management during construction housing and real estate transactions» (from June 19, 2003) [20];
- Law of Ukraine «On state registration of property rights to immovable property and their encumbrances» (as of July 1, 2004)[21];
- Law of Ukraine «On comprehensive reconstruction of neighborhoods (micro-districts) of outdated housing of the Foundation» (from December 22, 2006) [22];
- Law of Ukraine «On preventing the influence of the global financial crisis on the development of the construction industry industry and housing construction» (from December 25, 2008) [23];

- Law of Ukraine «On Building Regulations» (from November 5, 2009) [24];
- Law of Ukraine «On Regulation of Urban Planning» (from February 17, 2011) [25];
- Law of Ukraine «On technical regulations and conformity assessment» (from January 15, 2015) [26].

In the system of construction legislation, the specific weight of technical and economic remains significant norms contained in construction norms and rules (state, departmental, regional), state darts (state, departmental), technical conditions:

- State building regulations (SBN) [27];
- Industry building standards (IBS) [28];
- National standards, codes of established practice and technical conditions [29];

The main legal acts that regulate road construction and repair are:

Laws of Ukraine:

- About traffic [30];
- About transport [31];
- About highways [32];
- On sources of financing of the road industry of Ukraine [33];
- On concessions for the construction and operation of highways [34];
- On local self-government of Ukraine [35];
- On construction regulations [36];
- About road transport [22];
- On regulation of urban planning activities [18];
- About the basics of urban planning [16];
- On licensing of economic activities [20];
- About the National Police [14];

- On the ratification of the financial agreement (Ukraine - the project of European roads of Ukraine) between Ukraine and the European Investment Bank [37];
- On the ratification of the financial agreement «European roads of Ukraine || (Project to improve the transport and operational condition of roads on the approaches to Kyiv)» between Ukraine and the European Investment Bank [38].

Resolutions of the Cabinet of Ministers of Ukraine (CMU):

- On the approval of the state target economic program for the development of public highways of state importance for 2018-2022 [39];
- On the approval of the Order of allocation of funds of the state road fund [40];
- Some issues of preparatory and construction works some issues of licensing the construction of facilities that, according to the class of consequences (responsibility), belong to facilities with medium and significant consequences [41];
- On the approval of the Program for the creation and operation of the national network of international transport corridors in Ukraine [42];
- On the approval of the State program for increasing the level of road safety in Ukraine [43];
- On the approval of the Procedure for calculating the fee for operational readiness of a road built under the terms of a concession [44];
- On the approval of the Procedure for state control of road transport [45];
- On the approval of requirements for quality control of works on new construction, reconstruction and capital repair of public roads [36];
- On the approval of the Regulation on the State Agency of Highways of Ukraine [17];
- On the procedure for providing state guarantees for loan funds raised by the State Highway Service [47];

- On the approval of the Technical Regulations of construction products, buildings and structures [28];
- On the approval of the list of paid services provided by units of the Ministry of Internal Affairs, the National Police and the State Migration Service, and the amount of the fee for their provision [16];
- On the approval of the Uniform rules for the repair and maintenance of highways, streets, railway crossings, rules for their use and protection [41];
- About the author's and technical supervision during the construction of an architectural object [39];
- On the approval of the Regulation on the State Agency of Highways of Ukraine [45].

Framework, program documents:

- State targeted economic program for the development of public highways of state importance for 2018-2022 - Decree of the CMU of March 21, 2018 No. 382 [45];
- On the approval of the National Transport Strategy of Ukraine for the period until 2030 - Decree of the CMU dated May 30, 2018 No. 430 [36];
- National transport strategy «Drive Ukraine 2030» [46].

The analysis of the road industry of Ukraine shows problematic cases which directly affect the level of development of the entire infrastructure of Ukraine, among them:

- unsatisfactory condition of roads and low quality of road surface;
- high the level of moral and physical wear and tear of the material and technical base, which is not meets modern requirements;
- imperfect tariff policy, in particular, lack of compensation for the transportation of privileged categories of the population;
- impossibility of updating rolling stock; imperfection of rolling stock;
- unsuitability for serving people with physical disabilities opportunities.

Work on legislation requires extensive consideration and discussion in an expert environment of numerous problems. For example, amending the Law of Ukraine «On Highways»: Article 6 «State policy in the field of highways». The document should provide for the redistribution of responsibility between the customer (the public highway management body) and the executor of the work regarding the quality of the design, construction, reconstruction, repair and maintenance of highways, etc.

In addition, there should be an implementation of international experience in Ukraine regarding the involvement of a consulting engineer for independent control, organizational, technological and operational management of road projects. detailed changes in the legislation will enable Ukraine to participate more effectively in contracts with the involvement of funds from international financial organizations, in projects using modern BIM modeling. The latter provide an opportunity to digitize the entire construction process. This corresponds to the President's global program for digitization of the country.

The main beneficiaries of the recommendations on the implementation of reforms in the field of road infrastructure is the Ministry of Regional Development, of construction and housing and communal services of Ukraine and the Ministry of Infrastructure of Ukraine. Ministry of Regional Development, of construction and housing and communal services of Ukraine is responsible for sectoral reforms (construction and architecture, housing stock, communal economy), and in general for regional development.

Conclusions to chapter 1

In this section was considered theoretical and methodological aspects of road infrastructure construction project management. in particular, we considered what methods are used in project management, what is the life cycle of projects and what laws of Ukraine regulate them.

Therefore, in the first subsection, we studied in detail the principles of project management and ways of their application. It is determined what the basic methodology includes. In the course of the study, the main directions of development of the scientific methodology of project management regarding the complex of road works were determined. It was found that various methodologies can be used in project management, but an important factor is the expediency of its implementation.

In the second subsection, we defined and characterized the main stages of the life cycle of infrastructure objects. The phases that take place between the stages of the cycle have been clarified. We also identified the main elements of the project that have an impact on the life cycle of the infrastructure project. At the end of the second subsection, there is a figure that shows in detail the stages of the project life cycle, its phases and some list of works carried out in the process.

The third subsection contains all the main Laws of Ukraine, Resolutions of the Cabinet of Ministers of Ukraine, Regulations, Program documents, which regulate the processes of road infrastructure construction project management. Knowledge of the legal norms applicable in a certain field positions the project manager as a highly qualified professional, enables construction work to be carried out in accordance with the law, which will not cause problems in the future.

CHAPTER 2. SUBSTANTIATION OF THE EXPEDIENCY OF PROJECT MANAGEMENT OF ROAD INFRASTRUCTURE UTILITIES CONSTRUCTION

2.1 Peculiarities of road infrastructure utilities construction project management

Human activity is provided by elements of social infrastructure – education, health care, law enforcement, etc. Industrial and economic infrastructure can be divided into four main components: transport, telecommunications, fuel and energy, and utilities. Transport infrastructure unites all types of transport: road, rail, air, water. It is worth clearly distinguishing such concepts as transport, transport infrastructure, means of transport (rolling stock).

From this point of view, road infrastructure is considered part of road transport and the whole complex. If road transport is considered from the point of view of production forces, rolling stock is an active part of fixed assets that provide transport services, i.e. the process of moving products to the place of consumption, and road infrastructure is a passive part of fixed assets that provides transport services [47]. It includes roads, transport connections, bus stations, road construction, etc. And the efficiency of providing transport services by road will depend on the extent to which the quality of the road infrastructure will correspond to the level of development of vehicles.

Road infrastructure not only creates consumer value for specific entities and individuals, but also consumer value for everyone who uses the road network. Therefore, roads can be recognized as a public good. Thus, road infrastructure as an economic category reflects the relationship between the state and society regarding the distribution of costs for the creation of a public good and profit from the use of the created public good in the form of a built and equipped road network. Analysis of scientific literature, programs and documents of state and local importance showed that the term «road infrastructure» is often replaced by

the concept of «highway transport network or road», while road infrastructure includes not only engineering structures designed for the movement of vehicles means (motorways and artificial structures), but also roadside service facilities (parking lots, gas stations, maintenance stations, etc.), road facilities (technical means of traffic management, protective structures, small architectural forms and etc.), as well as road services that provide their service [48, p. 159].

Road infrastructure is a set of engineering structures (roads and artificial structures) designed for the movement of vehicles, road service facilities and road construction, as well as road services that provide their maintenance (Figure 2.1) [49, p.7].

Construction of road infrastructure is a long and painstaking process that requires detailed preparation. Therefore, an important element of the project is its participants, because it is they who ensure the implementation of the project idea. As for infrastructure projects, from one to several tens (sometimes hundreds) of organizations participate in their implementation. Each of them has its own functions, degree of participation in the project and degree of responsibility for its fate.

At the same time, all these organizations, depending on the functions performed by them, are usually grouped into absolutely specific groups (categories) of project participants, such as: initiator; customer; investors; Project Manager; project team and functional groups; CEO; subcontractors; designers; consulting and engineering companies; manufacturers of finished products; authorities; land owners; product sellers; competitors; other interested parties.

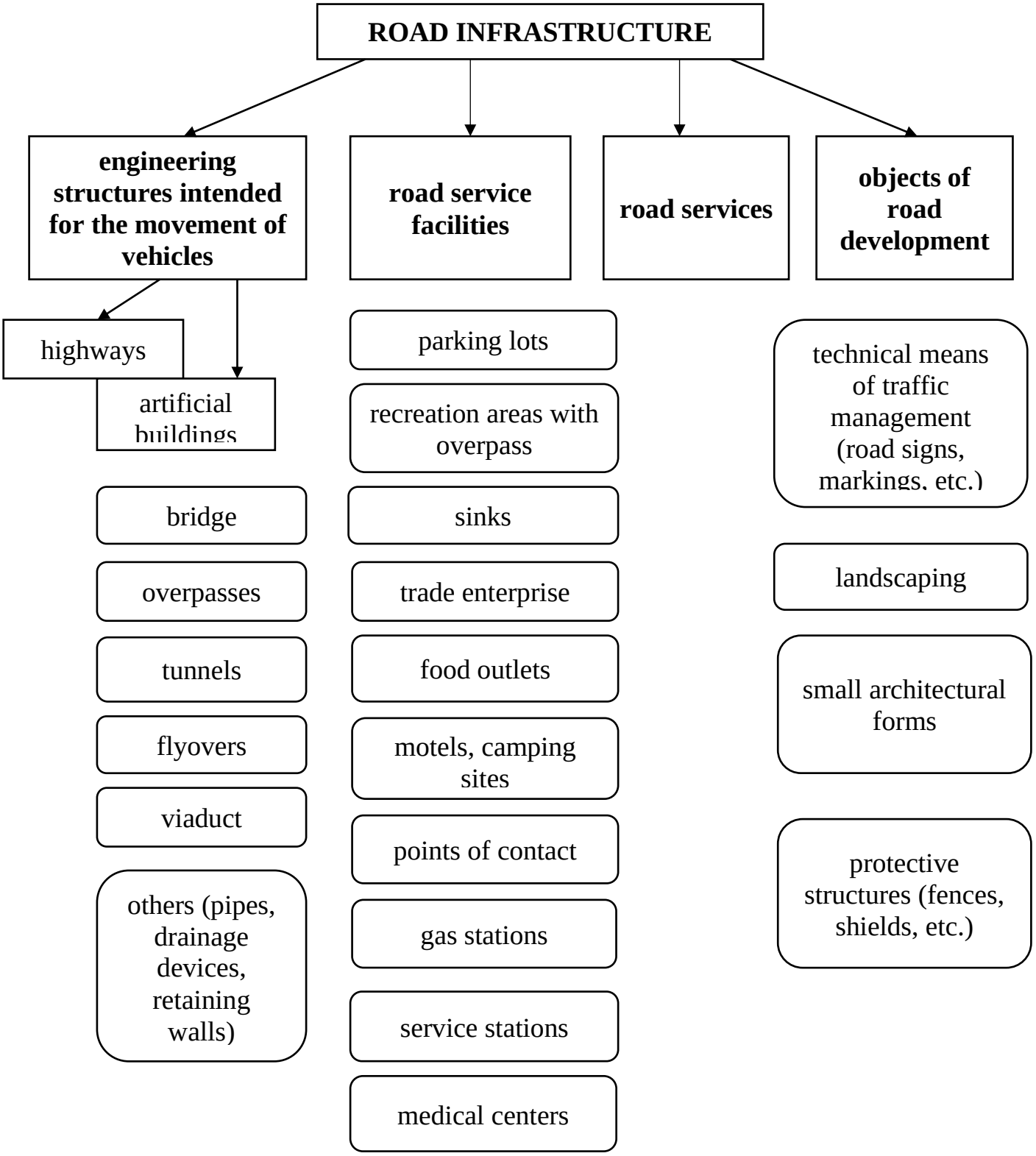

Figure 2.1 – component elements of road infrastructure

Formation of an effective and motivated team focused on the work and goals of the project is one of the tasks of the project manager.

Such human factors as the team's environment, communications between project stakeholders, internal and external rules, cultural differences, organizational characteristics, and others influence project execution. The project team must also be aware of, adhere to, and ensure that all team members adhere to standards of ethical behavior.

Project human resources management includes processes for organizing and managing the project team. The project team consists of people, each of whom is assigned a certain role and responsibility for the implementation of the project. After assigning roles and responsibilities among project team members, they should actively participate in project planning and decision-making. Involving team members in the early stages of the project allows them to use their experience in project planning and strengthens the team's focus on achieving results [50].

The organizational structure of the road infrastructure construction project management is simple: one head (manager) of the project and a functional head to whom the project groups are subordinate. The management of this project will be carried out according to the matrix management structure: the project manager coordinates the implementation of the project, and the functional manager is responsible for the quality of the tasks.

The principles that the project manager must follow to improve the effectiveness of project implementation management:

- the project management cycle must be complete;
- innovation processes and project management processes should be phased;
- when choosing management decisions, there should be a choice from many options;
- the project must have selective management, i.e. it is necessary to choose priority areas of development;

- establishment of connections between the need to create innovations and the possibilities of its implementation;
- all levels of activity are consistent with each other;
- the principle of systematicity is present;
- all activities taking place in the project must have the necessary resources.

In this project, it is important not only to perform the assigned tasks well, but also to use high-quality materials. Therefore, it is necessary to approach the choice of suppliers quite carefully. Quality is one of the key terms of the project. If the project is not on time or over budget, but the product is of poor quality, time or budget mean nothing. Quality is determined by the set of characteristics of an object that determine its ability to satisfy established or anticipated needs. Such an object can be both the project as a whole and the project products, project resources and other components.

To ensure high quality of the project and the integrity of the project team, it is necessary to properly manage communications. Project communications management is aimed at ensuring timely collection, transmission and preservation of information required for successful project implementation. Information is collected, processed and distributed data. For correct decision-making, information must be provided on time and in a convenient form. Communication activities include various aspects:

- internal (within the project) and external (with the customer, other projects, etc.);
- formal (reports, acts of acceptance) and informal (notifications via e-mail);
- vertical (subordinates with superiors) and horizontal (with equals in rank);
- official (annual reports) and unofficial (informal communications);
- oral and written; - verbal and non-verbal (intonation, gestures or facial expressions [51, p 176].

In this project, the main consumers of information include the project manager, customer, functional manager, designers and suppliers. The project manager needs information in order to analyze the discrepancies between the actual performance indicators and the planned and adopted decisions on the project. The customer must be informed about the progress of the project. Designers are notified when changes need to be made to their design documentation, and suppliers are notified when equipment or materials are needed. Also, in accordance with the occurrence of certain changes during the implementation of the project, the functional manager must provide information to the project manager. Thanks to communications management, the communication system between all project participants is supported, management and reporting information is transferred, which ensures the achievement of the project's goal.

Methods to communicate QHSE policy, objectives, instructions, targets and other accomplishments:

- PQP Induction training for all employees
- Tool Box Talks in workplaces
- QC Patrol & Site Inspection
- Providing QHSE handouts to all employees
- Quality induction for Sub-contractors
- Letters/Memos/Bulletin (through notice boards/internal e-mails (Company Website)

Reporting in the project is one of the forms of control, in order to timely see and warn of any deviations from the plan. The performance report, as a formalized communication, provides the manager with raw information for evaluation and analysis. Most often, when managing remote employees, the manager receives feedback practically only through regular work reports [52, p. 82]

For this project, it is important to make daily, weekly, monthly and quarterly reports for the best control of the progress of the project.

Project procurement management is the part of the project management process in which products or services are purchased to complete a task or project.

Procurement management includes the processes of buying or acquiring those required products, services or results that are produced outside the executing organization

In the process of procurement planning, it is necessary to determine which needs of the project can be met by purchasing goods and services from organizations external to the project, and which conditions can be fulfilled by the project team during the implementation process. The process of adjusting the supply of materials should provide for an adaptive system that is able to quickly respond to production needs associated with market changes.

2.2 Risks in the management of the road infrastructure construction project

The centuries-old experience of construction activity has shown the need to control and reduce the risks associated with the creation and operation of real estate objects.

A risk in construction is a possible event, the occurrence of which is likely and random in nature and causes undesirable consequences for the participants of the contract or third parties.

In order to manage risks, it is necessary to create a system of measures of influence on the subjects of activity, which makes it possible to cover possible risks, justify them and reduce the probability of occurrence of negative events and minimize their consequences as much as possible. In order to manage risk factors, it is necessary, first of all, to identify the sources of occurrence, channels, objects and the effect of influence. If the sources of possible risks are properly managed, it will make it possible not only to minimize them, but also to completely neutralize them before they occur [53, p. 91].

The project manager makes decisions about the best way to manage risk. Depending on the type of risk, various measures are being developed to reduce the likelihood of its occurrence. Then the effectiveness of these measures is evaluated and the most optimal ones are chosen. Quite often, project managers develop alternative plans, that is, what measures should be taken by the employee in adverse situations and what consequences should be expected.

We have identified the following risks for project of the road infrastructure utilities construction, shown in figure 2.2.

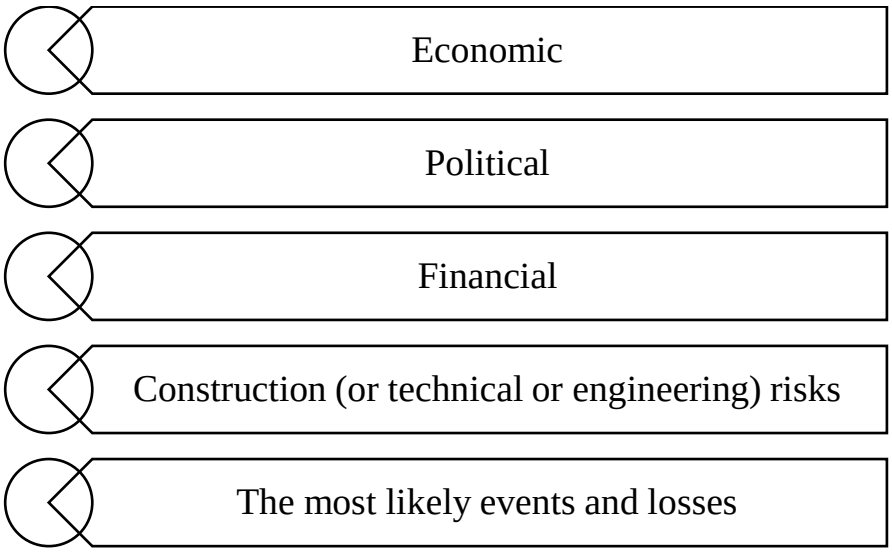

Figure 2.2 – risks for project of the road infrastructure utilities construction

Economic – those related to the threat, the danger of losses in any type of activity related to the production of products, goods, services and their sale, commodity and monetary and financial transactions, commercial activities, the implementation of socio-economic and scientific and technical programs [54, p. 46].

Economic risks include:

- the risk of changes in tax legislation;
- market risk (lack of consumers of goods and services);
- risk of capital investments (inflation);
- the risk of changes in supplier prices;
- the risk of delayed payments for sold products;
- the risk of inadequate management

Political risks are due to the risk of changes in the state system, frequent changes of the government, instability of political power; inadequacy of political decisions;

Financial risk includes:

- risk of violation of the company's liquidity principle;

- unforeseen changes in project valuations as a result of changes in initial management decisions, as well as changes in market and political circumstances;
- as well as the risk of loss of real assets as a result of damage to the property of an unsatisfactory organization;
- cost overruns caused by: disruption of project work plans, low qualification of project developers, errors in drawing up estimates and budgets, ineffective supply and sales strategy, detection of claims from partners, suppliers and consumers.

Construction (or technical or engineering) risks are:

- Fire risks (fire, explosion);
- Risks of natural phenomena (lightning strike; tornado, hurricane, storm, storm, typhoon; flood, downpour, hail; earthquake; snow avalanches; flood, downpour, hail; falling trees, stones; ice, unusual for this areas of frost and heavy snowfall)
- Risks of accidents (water from water supply, sewage, heating and fire protection systems; breakdown of technical systems, including energy supply systems)
- Transport risks (collision of equipment, fall of manned aircraft or its wreckage onto insured property)
- Risks of illegal actions by third parties (hooliganism, theft, robbery)

The most likely events and losses:

- Death or damage to any construction object (building or structure) erected by contract method, construction equipment, machines and construction site equipment, real estate located on the construction site and owned by the developer;
- Death or damage to the construction site as a result of installation errors;
- Damage to property or incurring liability due to poor quality of work, lack of skill, negligence, malicious acts;

- Damage due to short circuit, electric breakdown, high voltage;
- Damage to underground communications and adjacent buildings and structures as a result of foundation subsidence and vibration, as well as the movement of vehicles in the area of the construction site;
- Thefts in the controlled construction area;
- Interruption (suspension) of construction, delay in the start of business operations at the constructed / assembled facility;
- Filing of claims by third parties regarding the infliction of material damage or bodily injuries on them, which arose in connection with the performance of construction and assembly works.

In most countries of the world, there are currently systems for ensuring the safety of construction sites in one form or another.

For road infrastructure projects, specific risks inherent only in this field should be considered and classified according to the phases of the project's life cycle (appendix 3). Risks in the construction of transport infrastructure should be analyzed and identified based on the life cycle of the investment project.

Following the definition of risk and in order to improve the efficiency of their management, it is worth defining the essence and specifying the concept of «risk factor». Risk factors are understood as circumstances that can be causes of risk and lead to risk situations [55, p. 29]

General reasons that can cause risk situations are presented in figure. 2.3.

These reasons can be a catalyst for a whole series of risks, such as a lack of raw materials and materials, lack of payment for work performed or late receipt of payments for products sold, buyer refusal of paid products, non-receipt of loans, investments, etc.

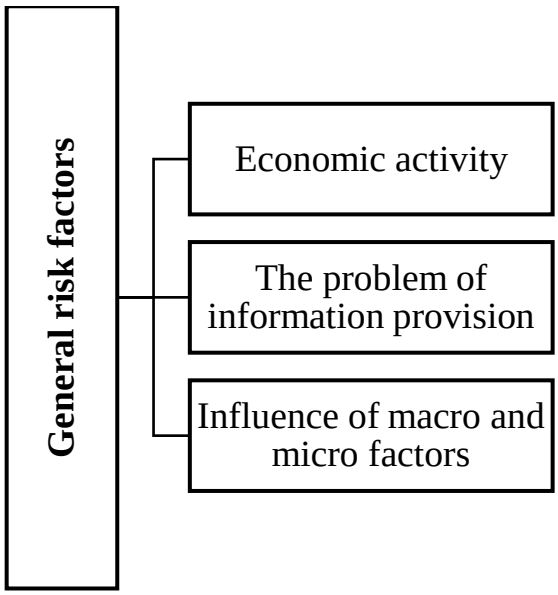

Figure 2.3 – general risk reasons

All sources of risks can be divided into internal and external. Many internal problems of enterprises can be determined by external factors, presented in figure 2.4.

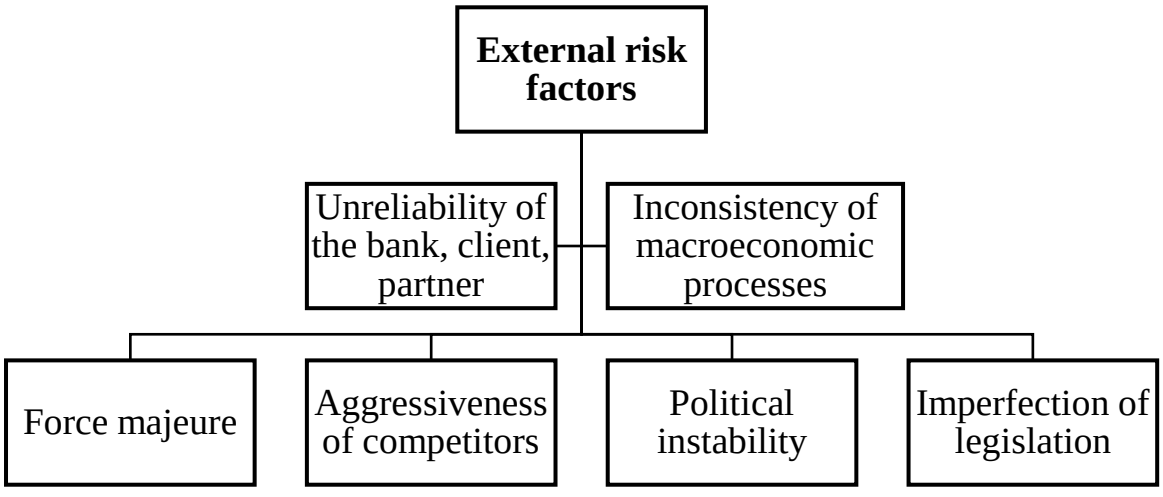

Figure 2.4 – External risk factors

In addition to the above classification, sources of risk can be divided into groups of factors of direct and indirect influence. The first category includes:

- changes and amendments to legislation regulating economic activity;
- unforeseen actions of state authorities, as well as local self-government bodies;
- changes in tax legislation;
- partnership relations.

In turn, the factors of indirect influence are:

- political conditions;
- economic instability;
- force majeure situations;
- economic development of the field of activity [56, p 37].

So, on the basis of the above information, we will compile the risk management road map of the project management of the road infrastructure construction (figure2.5).

In international practice in construction, along with the system of technical control, supervision, evaluation and confirmation of compliance of objects with the requirements of legislation, there is insurance of construction risks, and with them also insurance control and supervision.

Insurance of risks in construction – relations for the protection of property interests of construction participants in the event of insurance cases for monetary funds created at the expense of insurance payments.

Insurance of risks in construction, namely, technical (engineering) risks, has been established in the world for more than two hundred years. In the developed countries of the world, construction and installation risk insurance is a mandatory condition when participating in tenders and concluding construction contracts.

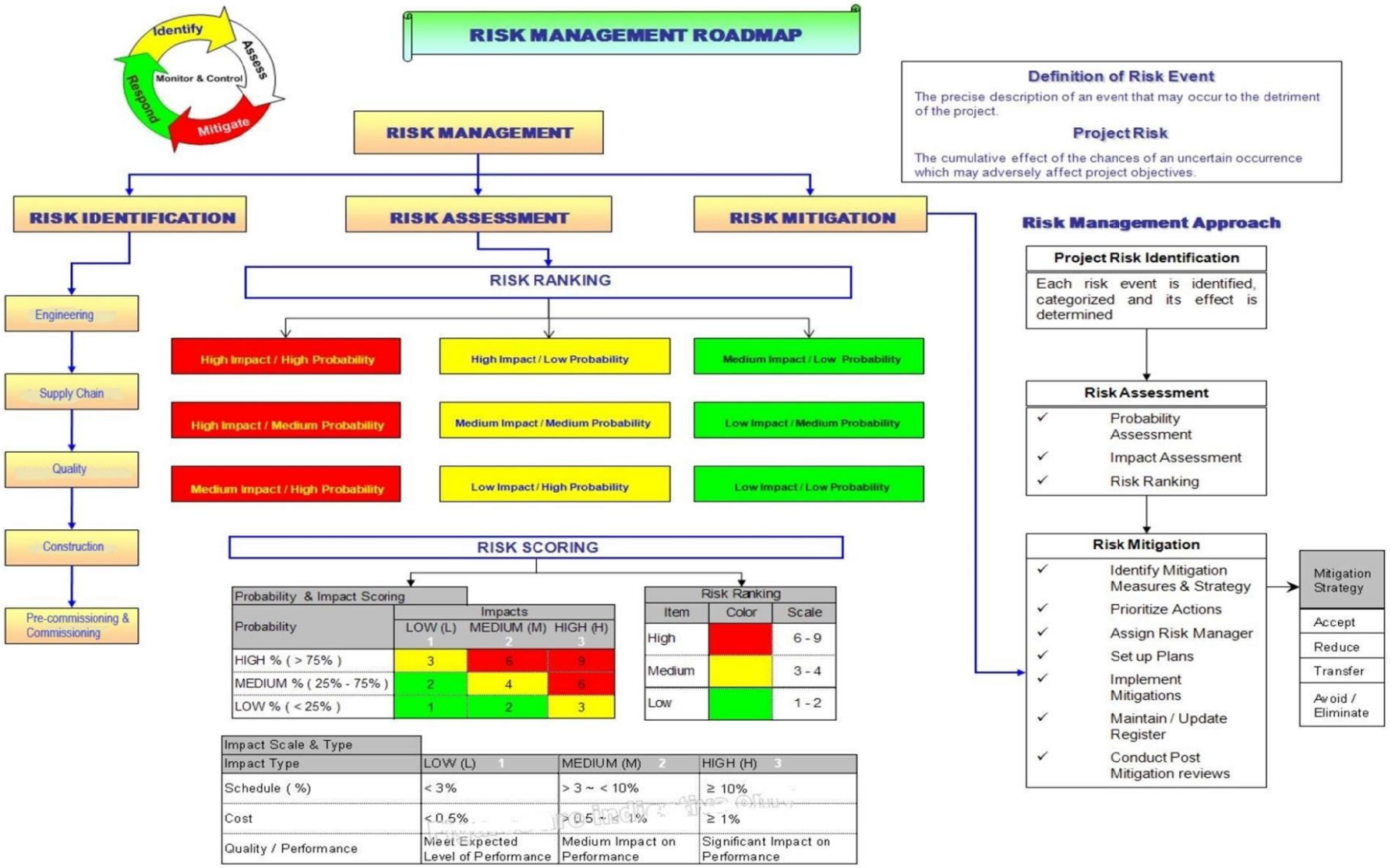

Figure 2.5 – Risk management roadmap

Construction risk insurance contracts (policies):

- CAR (Contractor's All Risks) is a contractor's all risk insurance policy. This insurance covers all contractor risks. It consists of two sections - material damage and third-party liability insurance. This is the insurance of all types of construction objects, within the framework of which insurance protection is provided both against damage caused to the construction object, structures on the construction site and/or construction machines, and against claims of third parties due to material damage or bodily injury, due to related to the construction of the object and guarantees the coverage of all risks of the contractor and is one of the main and most common types of technical risk insurance.
- The insurance amount is set within the full value of the construction object after the completion of construction and installation works, including transportation costs, customs duties, installation costs, other costs determined by the design and estimate documentation.
- EAR (Erection All Risks) – insurance policy for all installation risks; this policy applies if the installation work exceeds the scope of the construction work. This type of insurance is based on the idea of providing the policyholder with the necessary and as complete as possible insurance coverage for all risks that arise during the installation of machines and mechanisms, as well as during the erection of steel structures.
- VE (Boiler Explosion Insurance) – boiler explosion insurance policy;
- CPM (Contractor's Plant and Machinery Insurance) is an insurance policy for construction machines and mechanisms on the construction site, which, as a rule, is quite expensive and the damage of which can bring losses not only to the contractor, but also cause a delay in the work of the entire organization.
- MBI (Machinery Breakdown Insurance) – machinery breakdown insurance policy;
- IDI (Inherent Defects Insurance) – insurance policy for inherent defects;
- EE (Electronic Equipment) – electronic equipment insurance policy;

- TPL (Third Party Liability) is a civil liability insurance policy of construction participants for damage to the life, health and property of third parties (including the state) as a result of construction and assembly works. However, TPL insurance cannot be purchased separately from CAR and EAR policies

At the same time, state regulation in the field of construction insurance is governed by:

- Article 881 of the Civil Code of Ukraine Insurance of the construction object [57];
- Economic Code of Ukraine, Article 318 Clause 5. Contract for capital construction [58];
- Article 39 of the Law of Ukraine «On Regulation of Urban Development Activities» [59];
- Article 140 of the Tax Code of Ukraine [60].

That is, there is some legal basis for insurance of risks in construction. However, there is no voluntary insurance in the field of construction.

The underdevelopment of insurance in the construction sector is explained by several reasons:

1. the regulatory and methodological basis of insurance in the investment and construction sphere has not been developed sufficiently;
2. participants in investment and construction activities are rather poorly informed about the methods, types, order and, most importantly, the benefits of insuring their risks.
3. in the absence of demand for such a product, insurance companies are not engaged in its development and promotion [55, p. 118]

Therefore, it is important to anticipate the risks that may affect the project. The effectiveness of a project implemented in a complex, dynamic and undefined environment depends on understanding the causes and mechanisms of risk action, as well as the development of measures to manage them.

Conclusions to chapter 2

The concept of road infrastructure is often identified with the concept of transport infrastructure. In this section, we clarified the differences between these concepts in order to better distinguish the features of project management of the construction of structures specifically for road infrastructure.

So, in the first subsection, the main components in the management of the road infrastructure construction project are analyzed. We have considered content management, time management, cost management, human resources management, etc. A detailed study of these project management components is important for the further development of the road infrastructure construction project.

The second subsection of this section is devoted to risks in the management of the road infrastructure construction project. The peculiarities of risks for the road industry are analyzed, the risks related to the project are named, the methods of their minimization, in particular, the general characteristics of risk insurance are given.

Thus, managing all areas of knowledge (integration, content, human resources, timing, cost, risks, procurement, communications and quality) allows not only to develop the project in detail, but also to successfully implement it.

CHAPTER 3. APPLIED ASPECTS OF MANAGEMENT OF ROAD INFRASTRUCTURE UTILITIES CONSTRUCTION

3.1 Structuring of project management of the road infrastructure utilities construction

The project charter reflects key information about the project that is being developed during project preparation. The task of this document is to form a single idea about the project among all participants and to formalize the agreements reached. The project charter can be both an internal document and a document that is agreed with the external parties of the project, effectively acting as a contract between the customer and the executor.

Therefore, **the full name** of the road infrastructure construction project is «CP-13F - FIXED & CALL-OFF CONTRACT FOR LUSAIL CITY WORKS».

Contractor: AL BALAGH TRADING & CONTRACTING.

Client: Lusail real Estate Development Company (LREDC).

Project Duration: Fixed scope - 270 Days; Call- Off scope- 3 years.

Site Location: Lusail, city in the State of Qatar.

Contract start date: 08-December-2021

Contract finish date: 06-December-2024

Original Contract value: 55700000,00

Definition of content – breaking down the project into smaller and easily manageable components. To improve management, the project is divided into phases (stages), which must end with a measurable result. At the end of each phase, a decision is made to initiate a new phase or close (conserve) the project. Often the processes of planning and definition of content are combined into one [61].

The scope is considered to be inclusive of all the work items required to provide a fully compliant and functional system, such as but not limited to: preliminaries (unless otherwise specified), supply, installation, testing &

commissioning, quality management, tests witnessing and training, ancillary associated works that fall under the respective scope of work, supply of warranties, remedial of defects, cleaning and reinstating the site to original status, and handing over in a complete successful operating condition to LREDC and respective involved authorities and end users to their full satisfaction, including any authority approvals and permits as required by the job per each respective Call-off order's CR.

The Scope of work is consist with two following parts:

A. Fixed Scope of work

1. SW connection from SW1 Pump Station to the existing culvert wadi area
2. Pump Stations RPS1 and IR4 drain down connection to RPS1 outfall
3. Substations SW-ST2 & SW-ST3 drainage connections
4. Cladding to Generator Exhaust Stacks (6 Nos) in Marina Area

5.Supply and installation of Monorail in bridges Voids at Bridges 3,5,7,8,9.

6.Relocation of the FM200 Cylinders required in Telcom Exchange Building#1

The brief description for the works to be carried out as follows (figure 3.1).The planning of the road infrastructure construction project is done with the help of the Primavera program, which lists all the types of work that have bits done, the time constraints, the terms in which these works must be done, as well as the resources involved in the project and the people responsible for the implementation of the project (Appendix 1).

B. Call-off Scope of work

Category I: Developer Initiated Modifications to Plots (Amalgamation), Infrastructure Utility Connections, Landscape and Driveways (Plot Accesses).

Category II: QD Initiated Changes for upgrade works to infrastructure networks. The following utilities is consist with Category II.

1. Portable water network
2. Foul sewer
3. Storm Water

4. District cooling network

5. Gas network

6. Road works

7. Telecom network

8. MOI Security Systems Department

9. Electric low voltage network

10. Landscape

The main interested parties for AL-Balagh for this project includes LREDC (Client), Sub-Contractors (Engineering, calibration, Manpower supply etc), Suppliers, Board of Directors, Shareholders / Owners, Partners, Neighbouring companies, Sister Concerns, Qatar government, Regulatory bodies, Banks, insurance, Employees and also the society in large. The need and expectations of interested parties are identified and are considered as part of respective procedures. AL-Balagh is always committed to fulfil the needs and expectation of all its interested parties as mentioned below (table 3.1).

Table 3.1

The main interested parties for project

Interested Parties	Need and Expectation of Interested parties
LREDC (Client)	Contractual requirements
Sub-contractors – Design Engineering, Civil Works	To provide required service complying with contractual requirements and Specification, Al-Balagh and LREDC policy, procedure and Controls (PPC's)
Sub-contractors – Others (Manpower, Calibration)	To provide required service complying with contractual requirements and Specification, Al-Balagh and LREDC policy, procedure and Controls (PPC's)
Suppliers	On time supply of material meeting project requirements.
Board of Directors, Shareholders / Owners, Partners	Provide and release adequate budget to complete the project on time
Neighbouring Companies / Contractors	To Maintain safe and quality working environment
Society at Large	Provide good quality services and provide employment for the needy

Qatar Government, Regulatory bodies and QCS	Follow and adhere to Compliance obligation
Banks and Insurance	Financial related matter.

Fixed Scope of work

SW connection from SW1 Pump Station to the existing culvert wadi area	Pump Stations RPS1 and IR4 drain down connection to RPS1 outfall	Substations SW-ST2 & SW-ST3 drainage connections	Cladding to Generator Exhaust Stacks (6 Nos) in Marina Area	Supplyand installation of Monorail in bridges Voids at Bridges 3,5,7,8, and 9	Relocation of the FM200 Cylinders required in Telecom ExchangeBuilding #1
a.design and build the connection between the discharge chamber and the culvert leading to the sea in the current scope of work. b.Abortive works, site clearances, permits and authority approvals for works in proximity of live 66kV cables, etc. are part of the	a. The Control panel will communicate with the LCCC via existing ELV network. b. locate a suitable location for the lift station. c. design and construct the connection from the drain down DN400 gravity pipe	a. Design and build of soakaway and slow down chamber b.Substation floor drain sump to be discharged into the standardAshghal Soakaway (SD6-14-104) via the slowdown chamber. c. make the proposal for the location of soakaway and slow down chamber. d.Abortive works, Site clearances, permits and relevant authority approvals, etc. e.Scope includes pipe connection with all	a.The substation floor drain sump pipe to be connected directly to the foul water manhole as indicated on provided layouts. b.Proposed pipe routing is tentative c.Existing foul water network is running under the carriageway d.Approximate length of pipe for 75mm dia pipe is 60m with all necessary associated fittings and penetration into existing manhole. e.The actual length	a.Develop and install the permanent solution to mitigate generator exhaust For substations 1, 2, 3, 4, 5, and 7 by extending the generator stack 10ft above grade level . b. Develop and install the permanent solution to mitigate	a.Design and construction of Monorails on beam supported to columns for maintenance to shift pipes in and out from the concrete bridge voids for Bridges 3, 5, and 7. b.Design and construction of Monorail with the top steel member of the bridges for maintenance to shift pipes in and out from the Steel bridge voids for Bridges 8 and 9.	The scope of work is related to modification works of FM200 cylinders relocation inside Telephone Exchange Building No. 1.

Contractor scope of work c. Coordination with existing utilities authorities before and during the execution of works are part of the Contractor scope of work d. provide options for cost effective proposal based on actual site condition for QD review and approval	past manhole MH DD1/3 to RPS1 Outfall d. locate a suitable location for the lift station.	required accessories complete as per the drawings. f.Scope of work shall be as per the attached drawings and project specifications. g.provide alternate cost effective proposals based on actual site condition for LREDC review and approval	of pipes and number of fittings to be used shall be verified by actual measurement on site. f.Slow down chamber and soakaway is not required. g.Abortive works, Site clearances, permits and relevant authority approvals, etc h.Scope includes pipe connection with all required accessories	generator exhaust .For substations 6 by re-routing the generator stack out of the carriage way as well as extending it vertically 10ft above grade level.			

Figure 3.1 – Main works for project

Cost management includes activities aimed at determining the required financial result and its achievement. The project budget is usually understood as the structure, composition and meaning of the expenditure items necessary for the implementation of the project and the income item arising as a result of the project. But usually the budget is understood as the structure of costs for the project. In construction and some other projects, a document that reflects the composition, structure and meaning of cost items is called an estimate. Estimates of the cost of a project during its life cycle vary in accuracy. Thus, at the initial stages of the development phase, the cost is estimated with a large margin of error. By the end of this phase, the error in the cost estimate decreases and is no more than 5%. During the implementation of the project, the planned cost is transformed into the actual cost and reflects the real state of affairs.

The cost of the project is determined by the total cost of resources, the cost and time of project work. For construction projects, the construction cost is determined, which is the part of the project cost, which includes the funds needed for capital construction. The estimate of all project costs is equivalent to its total cost.

For this road infrastructure construction project, the budget was calculated in the amount of 55700000.00

3.2 Formation of basic planning decisions and project documents

Human resource management begins with organizational planning. It includes defining project roles, responsibilities, and reporting levels for individuals or groups of individuals. Organizational planning is closely related to staffing and communication planning (figure 3.2)

Allocation of personnel for various disciplines to meet the contractual requirements for the smooth execution of the project is illustrated in the Project Organization Chart&Project QA/QC Organization Chart. The Organization chart also indicates the reporting structure and interaction between Al-Balagh Corporate and Project Execution Team.

The Project Manager and as such the personnel designated by him in association with the Project Execution team develops and implements procedures.

All employees shall be provided with Job Description which shall also reflect the Quality requirements and commitments. All employees are responsible for the quality of their work, as it contributes to the quality of Al-Balagh products & Services provide. Managers and team leaders ensure every team member is appropriately trained, has access to tools and resources, able to implement corrective action when required and opportunities to improve existing processes are sought and taken.

To assign roles and responsibilities, it is advisable to create a matrix of responsibilities. It allows you to present the connection between work and duties. The matrix of responsibility indicates the most important stages of the work of the corresponding project and indicates the key groups of persons interested in the implementation of the project [62, p. 246].

Using a matrix of responsibilities allows you to avoid misunderstandings that occasionally arise between departments and organizations due to unclearly distributed roles and responsibilities. The responsibility matrix provides for those responsible for the process, those who are informed about the execution of the process and those who directly participate in the execution of the process.

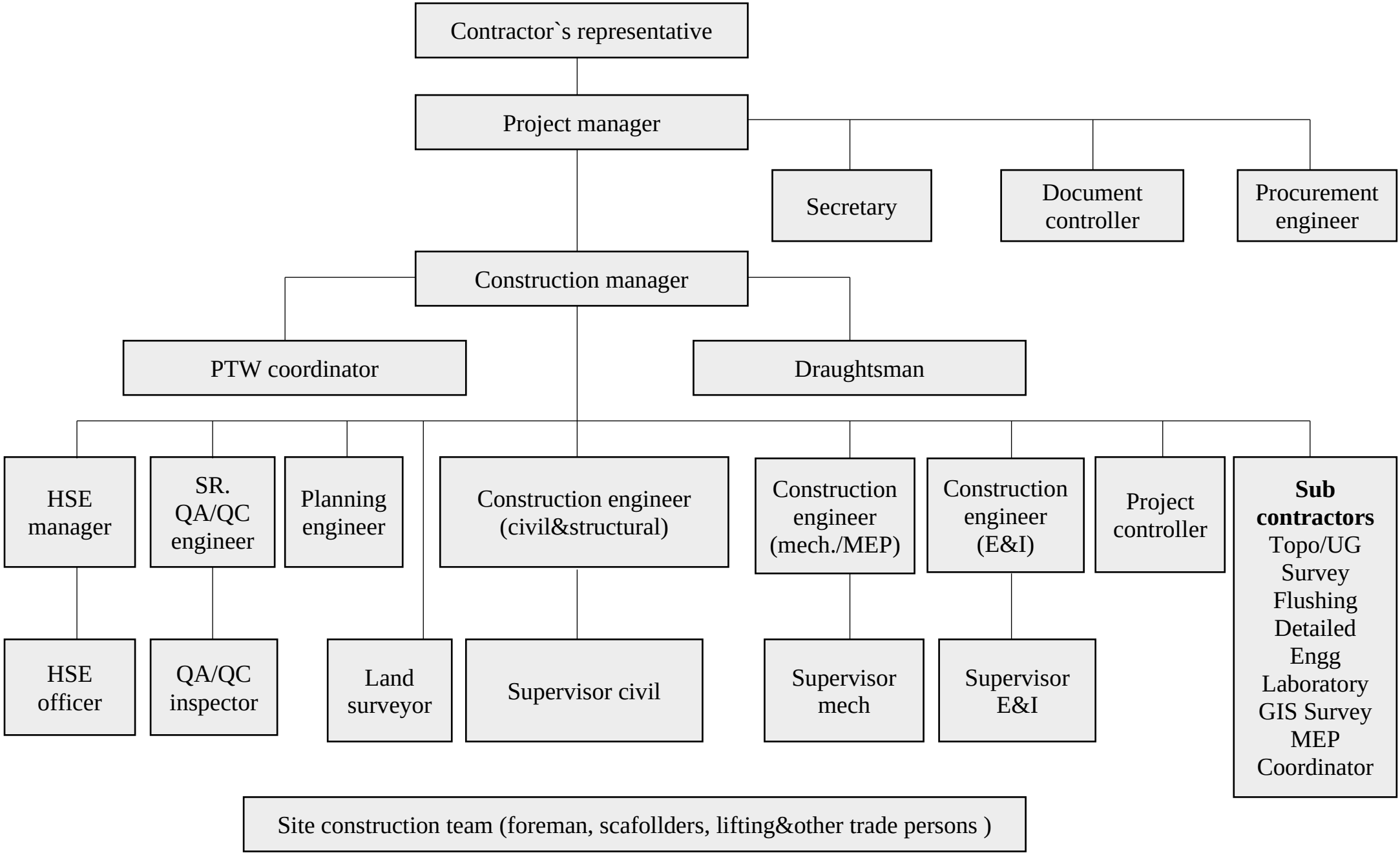

Figure 3.2 – Organisation chart

Contractor representative

- Personnel appointed by Al-Balagh to represent it in all matters under the contract.The contractor representative shall have the authority to commit Al-Balagh to anycourse of action within the rights and obligations of Al-Balagh under the provisionsof the CONTRACT and shall notify the LREDC of all information and decisions of theAl-Balagh under the provisions of the contract
- To provide leadership to the Project management team needs to achieve their goals.
- Responsible to periodically review the competency of all employees.
- To ensure effective handling of situations during emergencies.
- To ensure that all the activities carried out by project management team meeting client requirement, Schedule, Quality & estimated Budget.
- Ensure coordination between various divisions, sections, and disciplines Evaluate & Identify Training needs of the employees and arrange appropriate training with HR department.
- Lead the MRM and contribute for continual improvement of site management process.
- Responsible to provide guidance and support for his subordinates on technical issues related to job.
- Responsible to adhere and follow the implemented Quality, Health, Safety and Environmental Policy, objectives & procedures.

Project Manager

- Responsible for the day to day running of a specific project ensuring that all Divisional manager, Project Engineer, Site Engineers, QA/QC Engineer, Operators, Skilled and Unskilled workers understand their area of responsibilities and carry out their given tasks efficiently and diligently to achieve the objectives of the company.
- To plan, schedule, organize and supervise smooth running of the Project and delegate authorities to Project Engineers and Site Engineers for liaison with Consultants' representatives, proper and effective use of manpower,

equipment and other resources and timely preparation and submission of progress valuations.

- To keep updated the contract files during the project duration and documentation and correspondences are filed and they are readily available at short notice.
- To ensure timely submission of drawings and material, follow up approval, placing orders etc.
- Report to higher management about the progress of the works, requirement on manpower, equipment and other resources, difficulties encountered, specific action required to resolve problems at site.
- Tour the site of works randomly to monitor personally the proper usage of manpower, equipment and materials and study the progress achieved with regard to the plan, discuss with Project engineer on day to day problems and suggest proper solutions.
- Explore cost saving ways and means and suggest to top management especially in the area of sub-Contract work.
- To coordinate with Clients representative and take timely corrective action required as a result of any complaints to ensure cordial relations and to follow up and agree with them on variations and site instructions and execute proper documentation on time.
- Approve and monitor requisitions for materials at site and ensure materials are not wasted.
- To have regular meetings with project engineers/site engineers and supervisor to discuss about program and progress of work and to closely monitor the usage of manpower, equipment and materials to ensure that the job costs do not exceed the budgeted target and the work done is promptly measured included in monthly valuations.
- To ensure safety and welfare of the work force employed at the site and provide proper work environment.

Project Engineer (Civil, Mechanical)

- Reports to Project Manager in Organization & management of all resources and field activities to achieve efficient and effective completion of the contract, within the agreed time and cost.
- Responsible for Construction planning / organizing and successful execution of the Project as per the agreed construction schedule and contract specifications.
- Coordination with Project Engineers, Planning Engineers, Accounts & Admin Organization for smooth operation and effective planning and utilization of resources.
- Implementation of Project Quality Assurance Plan.
- Implementation of Project HSE Plan.
- Responsible for the arrangement of resources as per site requirement for achieving for project schedule.
- Prepare project Method statements which will be reviewed by QA/QC department.
- Ensure that all Project Engineers, Site Engineers and Supervisors understand their area of responsibilities and carry out their given tasks efficiently and diligently to achieve the objectives of the company.
- Ensures timely submission of Contract details and material, follow up approval, placing orders etc.
- Monitors requisitions for materials at site and ensure materials are not wasted.
- Conduct meetings with site engineers and supervisor to implement program and progress of work and to closely monitor the usage of manpower, equipment and materials to ensure that the job costs do not exceed the budgeted target and the work done is promptly measured included in monthly valuations.
- Ensure Safety and welfare of the work force employed at the site and provide proper work environment.

- Ensures that the Quality Objectives, Policies and Procedures are implemented to achieve Customer / Client satisfaction.
- Promotes HSE within the Project and ensure at all time the safety system procedures are followed and continue improvement until effectiveness of the safety Management System is achieved.

HSE Manager

- Develops and monitors the implementation of project HSE Plan and HSE Procedures for the Project.
- Schedules HSE deliverables & prepares material requests for HSE department.
- Ensures all site personnel are safety inducted.
- Sets HSE performance targets for the project and assists the application of the Self-Assessment Tool.
- Preparing HSE Reports in accordance with client /Project requirement and establishing and monitoring tunnel access control in close coordination with tunnel operator.
- Spreads out HSE Culture down to all level staff.
- Ensures Safety Policy Statement is displayed and all employees are made aware of its meaning.
- Monitors and assesses hazardous or unsafe situations and developing measures to improve safety.
- Corrects unsafe acts or conditions through the regular line of authority.
- Investigates and documents all accidents, review and identify actions for improvements and ensure recommendations are implemented.
- Establishes and maintains an up-to-date library on relevant publications, regulations and instructions concerning Safety Standards.

- Sets a high personal standard of HSE compliance at all times and complete any training deemed necessary to remain current with company and industry requirements.
- Accountable for the deployment of project safety staff, coordination, communication and reporting on all HSE matters to higher Management.

QA/QC Engineer

- Understand the QCS, Project Specification and Project QA/QC requirement and follow up.
- Ensure Quality Records are maintained, as required by the Quality System and Customer requirements.
- Co-ordination with Project Engineer for selection of sources of construction materials as per specifications and obtain the approval from concerned authorities.
- Co-ordination with subcontractor site manager for testing of different construction materials for the purpose of routine testing.
- Prepare of activity reports and preservation of all approvals.
- Follow the Inspection request and activity plan as per contract conditions. Liaison with Independent Testing laboratory.
- Conduct required of site- construction activities, material inspections, etc as per project specifications and approved ITPs – fill in relevant check lists.
- Assist QA/QC Manager in collection of data and preparation of quality records.
- Monitor and control documentation at site.
- Prepare all relevant records and maintain the register.
- Coordinate & supervise the safety, security & health and living standard of project staffs, laborers within the site.

QA/QC Inspector

- Witness work activities execution on site.
- Witness field inspections.

- Verifies that materials incorporated are approved.
- Conduct required work activities, material inspections, as per project specifications and approved ITPs - fill in relevant check lists.
- Reports to QA/QC Engineer in case of any non-compliance.
- Assists QA/QC Engineers in collection of data and preparation of quality records.
- **Planning Engineer/Project Control Engineer**
- Work involves project planning and scheduling using MS Project and prepare Pert Chart and Bar Chart, update the charts periodically, study variances and report to Resident Manager/Sr. project Engineer for corrective action and improvement of progress.
- Prepare resources curves and cash flow for the project.
- Visit project sites regularly to study the various constructional activities going on at site whether they are going on as per schedule, the period of delays and reason for delays of various activities and update the progress charts accordingly and report to Management.
- Monitor project costs against budgeted cost and prepare periodical project performance report for Management.
- To attend site progress meetings with Client/Consultant whenever required to explain delays, hold ups etc. in planned progress if any and to suggest remedial measures.

Procurement officer

- Sourcing the suppliers and collecting quotations for products requested by the project.
- Evaluating and selecting new suppliers to secure competitive and proper product supply source and enrolling them on the approved vendor list
- Placing purchase order to one of the approved vendors.
- Expediting the supply and arranging the shipping method/ schedule as required.

- Delivering products to the project with shipping documents, including customs clearance, as required.
- Ensure that purchase order activities are implemented as per the project requirement.
- Ensure that the purchasing documents are adequate to the specification of requirements prior to release.
- Ensure that the purchased product conforms to the purchasing requirements and delivered on the project site with shipping document as required.

Site Engineer

- To assist Sr. Project Engineer / Project Engineer in day to day running of the project in the area specifically allotted to him.
- To ensure that the supervisor, workers and sub-contractors if any, understand their area of responsibilities and carry out their given tasks efficiently and diligently to achieve the objectives of the company.
- To be responsible at site and to monitor personally the proper usage of manpower, equipment and materials and the smooth running of the works as per schedule.
- Plan ahead requirement of manpower, equipment and materials and monitor timely availability of the resources at site with the approval of the Resident Manager so that the work progresses without hindrance.
- To effectively coordinate with the sub-contractors and arrange for site coordination meetings (to be chaired by Resident manager) for ensuring smooth progress of work.
- Raise the inspection request in coordination with the QA/QC Engineer for day to day activities and participate in inspection with Clients.
- Keep good relationship with Clients representative and Consultants at Site and ensure quality work as per specification and keep proper record of variation orders and site instructions.
- Record and submit measurements of work done at site to the Sr. Project Engineer.

- Prepare Site measurement of works carried out by sub-contractors and piece workers and submit to the Resident manager.
- Verify and certify supplier's invoices/cash memos for materials received at Site for payment/record in accounts.
- Ensure safety and welfare of the workforce under his control at site and provide proper work environment.

Safety Officer

- Assists the Project Engineer in day-to-day safety requirements.
- Implementation of safety policy at site.
- Coordination with client safety department.
- Coordination with sub contractor's safety officer.
- Be responsible for Health and Safety on the jobsite and provide for correction of deficiencies in these matters.
- Secure the availability of appropriate Personal Protection Equipment (PPE) and provide to employees thereof.
- Make sure proper safety materials and protective devices are available and used.
- Inspect the safe working order of all construction plant and equipment and arrange for the preventative maintaining thereof.
- Inspect Sub-Contractors on their compliance with the tasks, rules, regulations and procedures established in this project plan.
- Instruct the Supervisor on (additional) specific requirements.
- Review accidents and inspect the correction of unsafe practices.
- Inspect the measures for protection of the public from production operations.
- Attempt to ensure safe operation/performance by others on the jobsite, including Owner's representatives, personnel of Consulting Engineers, visitors, the general public and employees of other Contractors.

Surveyor

- Responsible for surrey works in the site as per the project approved drawings.
- Responsible for setting out, formation level marking, etc.
- To set out the grid lines and checking the levels etc.
- To check the plumb / verticality of the structural elements and also for checking the line and level of formwork etc.
- To ensure all surveying equipment's being used are calibrated and their log maintained and recorded.
- To perform internal check on surveying equipment and maintain records.

Lifting / Rigging Supervisor

- Creates the lift plans and ensures that the required controls are in place.
- Ensures that the lifting equipment is inspected and appropriate for use.
- Checks that load integrity and stability is satisfactory.
- Conducting tool box talk to the crew
- Coordinate day to day works to the rigger and assist to them for any rigging /lifting activities.
- Supervise and ensure the safe operation of cranes and forklift machines for the stacking, positioning and turning of loads, weight estimation and special lifts.
- Ensures that people involved are competent for performing their task, aware of the task and procedures to be followed, and aware of their responsibilities
- Briefs people involved in or affected by the lift.
- Supervise the cranes boom, accessories, maintaining the log for Lifting tools and tackles, ensuring erection of barriers and safety sign board in respect to lifting areas. Attending company internal walk thru.
- Ensures the lift is carried out as per the plan. Suspends the lift if changes or conditions (eg, wind) occur that would cause a deviation from the plan

- Monitors the performance of all involved personnel to ensure that adequatestandards of performance are maintained
- Manages any special issues such as language barriers and new/inexperienced staff
- Checks that there is no deviation from standards for routine lifts

Document Controller

- Assures that all correspondence & controlled documents and their status (of production, issuing, approval, and distribution) are properly recorded and updated on the Project's document- data control system (ACONEX).
- Assures that the documents are physically recorded, easily retrievable and maintained in good order.
- Assures (and corrects if necessary) the numbers for the documents according to guidelines defined in relevant procedure, as well as other doc control requirements
- Controls, files and maintains the Quality records in cooperation with QA/QC personnel and physical documents (e.g. inspection and tests, approval requests, review sheets, non-conformance reports, technical queries and instructions, etc.)
- In cooperation with the QA/QC Engineer, keeps site informed about the Project's Library (contractual, administrative, technical documents, pre-formats, standards and specifications).
- Keeps and updates all required logs & submittal registers-lists.

Store Keeper

- Responsible for receipt and delivery of materials at Site stores and to maintain material receipt register and material issue register and report to Project Engineer / Site Engineer.
- To submit material invoices and delivery notes to the Project Engineer / Site Engineer for checking and forwarding to Head Office.
- To maintain Site stores in neat and tidy condition and to store materials according to the manufacturer's recommendation.

The matrix of responsibility can be considered in detail in the table 3.2.

Table 3.2

Responsibility matrix

Activity dicription	PM	PE	QA/QC M-R	HSE M-R	Plan. M-R	QA/QC Eng.	QC Insp.	SE	Dr-man	HSE Off.	DC	SK
General Project Administration	R/A											
Allocate & distribute all correspondences	A	A									R	
Contract matters/commercial matters	R/A										R	
Monthly Valuations	A	A									R	
IFC Design Check	A	R/A										
Shop/as built drawings preparation & submittals	A	R/A							R		R	
Shop/as built drawings Distribution	A	A									R	
Drawing register and Revisions		R/A							R		R	
Cost Control	R/A	R			R							
Construction Planning	R/A	R			R			R				
Monitor Progress	R/A	R			A			R				
Update Construction Programme	A	R			R							
Site Diary	A	R/A	R/A	R/A		R	R	R		R		R
Supervise all Construction Activities	R/A	R/A	R	R		R	R	R		R		
Control Subcontractors Site Works	R/A	R/A	R	R		R	R	R		R		
Prepare Risk Assessments, HSE Plan & HSE Procedures	A	A		R/A						R		
Approve Risk Assessments, HSE Plan & HSE Procedures	A	A		R/A								
Implement HSE Plan & Safety Procedures	R/A	R	R	R/A	R	R	R	R		R		R
Safety Inspections & Registers				R/A						R		
Safety Issues Monitoring		R		R/A						R		
Prepare Project Quality Assurance Plan & Procedures	R/A		R/A			R						
Approve Project Quality Assurance Plan & Procedures	R/A	R/A				R						
Implementation of	R/	R	R/A	R	RR	R	R		R	R	R	R

Quality Management System	A											
Monitor Quality Management SystemImplementation/ Con duct Audits	A		R/A	R		R	R			R		
Issue and monitor closing of internal NCRs		R	R/A	R/A		R	R	R				
Monitor closing of external NCRs	R/ A	R/ A	A	R/A		R	R	R				
Prepare Method Statements	R/ A	R/ A				R		R				
Review Method Statements	R/ A	R/ A	R			R		R				
Approve Method Statements	R/ A		R			R						
Prepare ITP	R/ A	A	R			R						
Review ITP	R/ A	R/ A	R/A			R/A						
Approve ITP	A	A	R			R						
Prepare material submissions, suppliers/subcontractors prequalification	A	A	R			R						
Sign off Material submissions, suppliers/subcontractors prequalifications	R/ A	R/ A	R/A			R						
Material receipt- Handling & Storage	A	R	R/A	R/A				R		R		R
Material Inspections		R/ A	R/A			R	R					
Work Inspections		R/ A				R	R	R		R		
Staff and Employee Training	A	R	R	R								
Liaison with Pubic AuthoritiesStakeholders & Other Subcontractors	A	R					R					
Plant & Equipment management	A	R/ A					R					
In situ & laboratory tests	R/ A					R	R	R				
Quality ObjectivesKPI Monitoring	A		R/A			R	R					
Chair Project Meetings (As Applicable)	A/ R	A/ R										
Attend Project Meetings (As Applicable)	R	R				R	R	R		R	R	

The time limitation of the project requires flexible adaptation and involvement of known technologies and methods for project processes limited by the project's deadlines.

The estimation of the duration of the works can be based on the opinion of an expert, as a rule, it is guided by archival information, an estimation based on analogs, if similar activities have already been performed previously on other projects, or on the basis of situation modeling.

The calendar plan consists of critical points and corresponds to the list of fixed works for this project. The estimated time of fixed works is 270 days and the call off duration is 3 years (figure3.3).

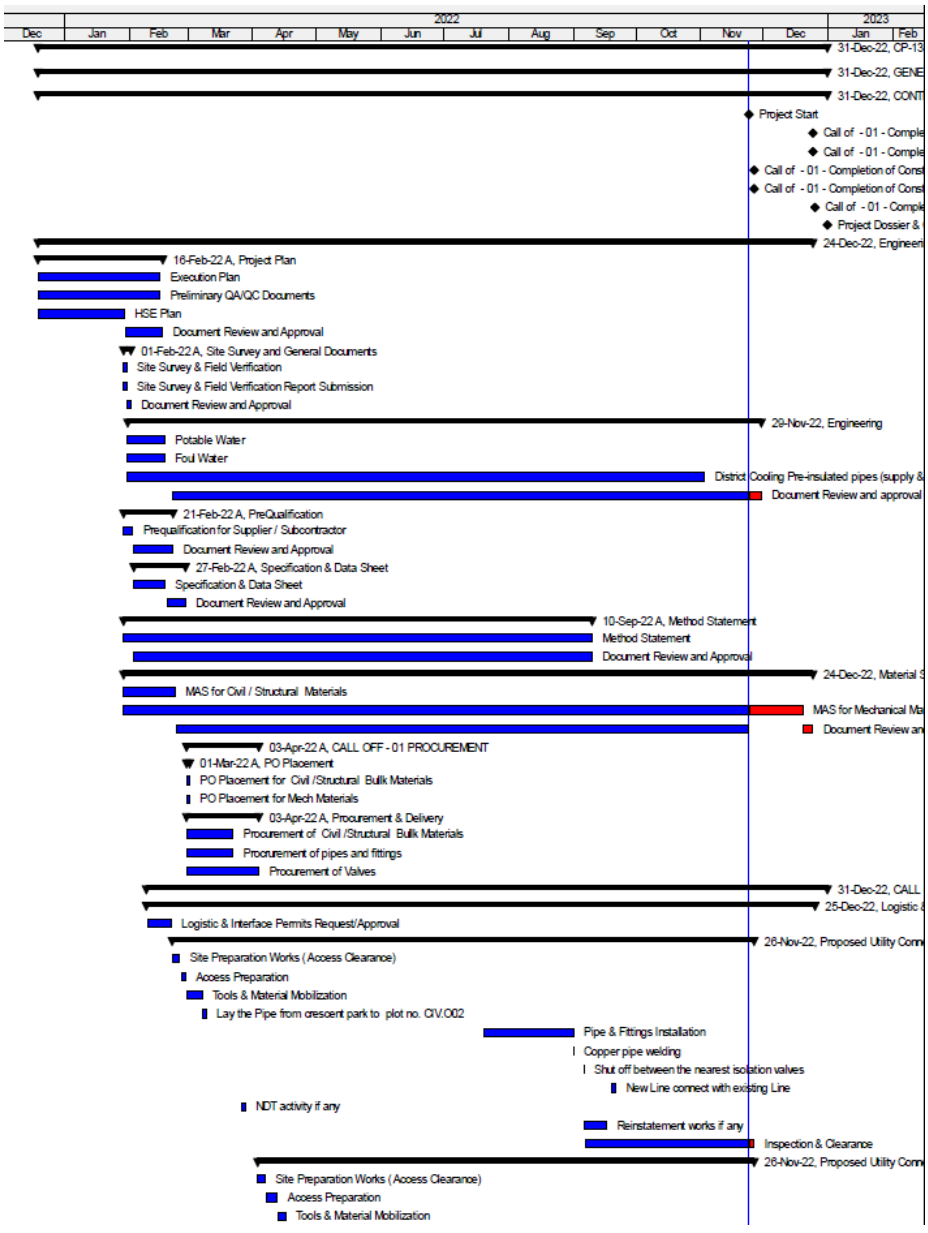

Figure 3.3 – Calendar plan for project

The main task of resource management is to ensure their optimal use to achieve the final goal of project management is the formation of the project result with planned indicators [63].

In the program, we consider labor and material and technical resources. The resource is correlated with certain works performed in the planned sequences, and not with the project as a whole (figure 3.4)..

Supervision staff	Labor Strenght site	Plant&equipment
• Project Engineer Site Engineer Electrical Engineer Mechanical Engineer Surveyor Civil Foreman Electrical Foreman Mechanical Foreman	• mason carpenter steel fixer mechanic asst.mechanic labour painter clerk electrical driver operator storekeeper office boy pipe fitter welder jointer security	• excavators front end loader compactor (large, light) plate compactor grader compressor concrete mixer transmixer site dumper generator waret tanker crane diesel tank tipper truck welding machine bulldozer

Figure 3.4 – Main resource for project

Having a single structure for all projects in the company's portfolio allows you to assess resource needs and better plan the resources of the entire company .

3.3 Project implementation

Monitoring and control consists of processes that are used to track, analyze, and coordinate project progress and execution, identifying places that require changes to the plan and initiation corresponding changes.

One of the main tasks of monitoring and control during the project cycle – identification of risks, determination of residual risks, provision implementation of the risk plan and assessment of its effectiveness, taking into account mitigation risk Indicators of risks associated with the implementation of the conditions for the implementation of the plan, are fixed [64].

The purpose of monitoring and control is to find out whether there was:

- a risk response system was used in accordance with the plan;
- response is effective or changes are needed;
- risk change compared to the previous value;
- onset of exposure to risks;
- necessary measures have been taken;
- the impact of risks is planned or was an accidental result.

During the implementation of the project, monitoring will be carried out in accordance with the following measures:

- daily monitoring of the progress of project implementation by the manager, respectively to the plan;
- daily recording of problematic and unsolvable problems;
- upon completion of works, executors (contracting organizations: construction company, lawyer, advertising agency) report to the project manager.

Responsible person in accordance with the frequency of providing data for monitoring reports the necessary information to the project manager in writing.

Project cost control will be carried out using the method of the mastered volume, which is based on the ratio of actual costs to the volume works that must be completed within a specified time. Constant tracking of the mastered volume

allows you to predict both the success of the project completion and and the risks of going beyond the planned deadlines and budget.

The Management of Al-Balagh is committed to plan the monitoring, measurement, analysis and implements the improvement processes specific to this project. This includes:

1. Demonstrating conformity of the product by identifying what needs to be monitored and measured

2. Ensure conformity of the project Quality Management System by addressing the method and frequency of monitoring and measurement

3. Analyse the results and Continually improve the effectiveness of the project Quality Management System.

This shall include determination of applicable methods, including statistical.

The outputs of the management review shall include decisions and actions related to:

- opportunities for improvement;
- any need for changes to the quality management system;
- resource needs.

The management review meeting shall be attended by the following as minimum:

- ➢ QA/QC
- ➢ Project Manager
- ➢ Project Execution Team members

The QA/QC shall prepare the minutes of meeting with action plans and shall be reviewed by the Project Manager. A copy of the meeting minutes shall be distributed to all the attendees, Divisional Manager, GM for information or further action.

The successful implementation of the project will depend on timely and high-quality development of an operational plan for its implementation.

Operational project management will be carried out by organizing the following forms of control:

- calendar plan of the project;
- project budget;
- construction of a project monitoring system.

Tthe stage of completion/handover of completed works after the end of the project can be graphically represented as follows (figure 3.5).

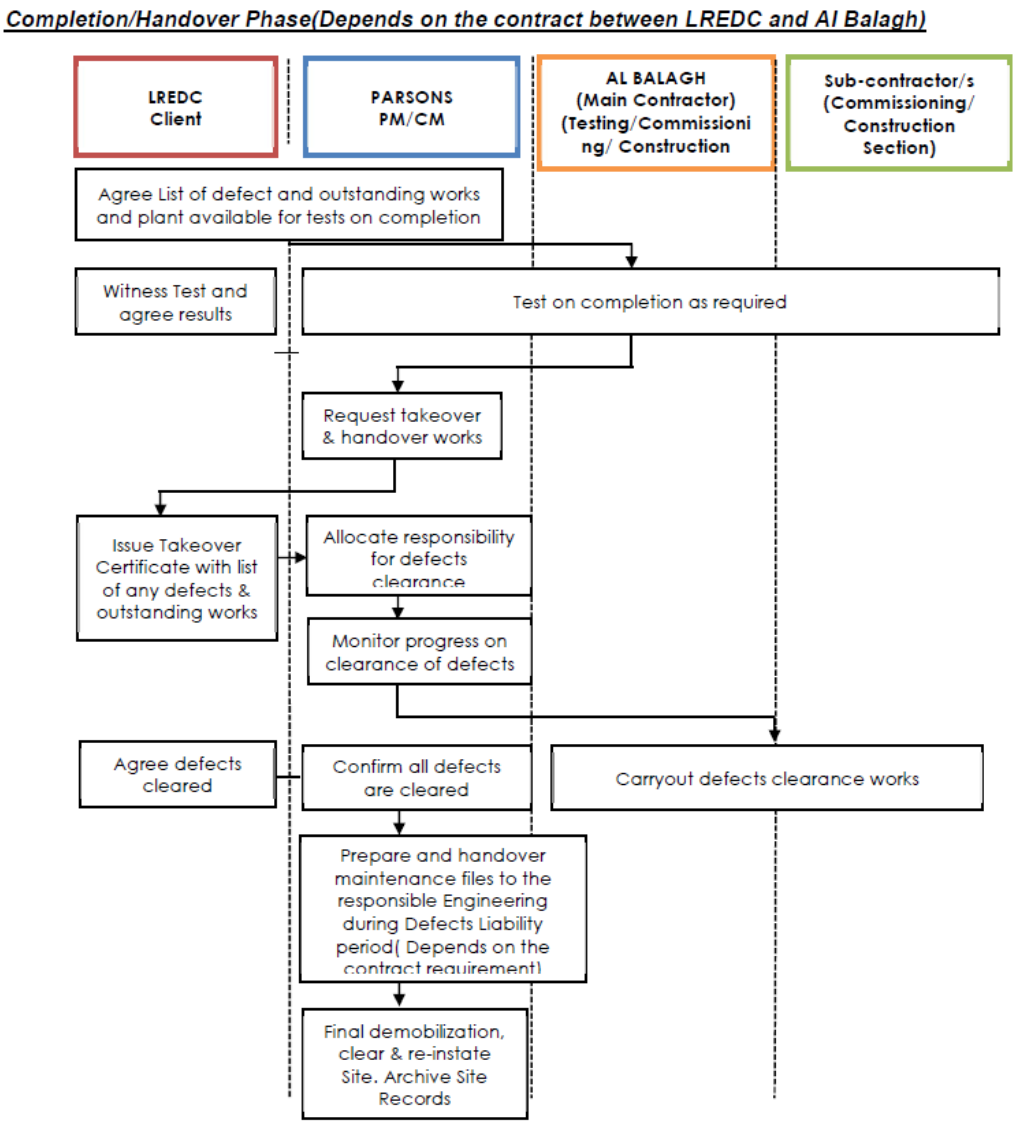

Figure 3.5 – Handover phase of project

In order to meet the project requirements and enhance customer satisfaction, AL-Balagh shall determine and select opportunities for improvement. This may include improving products and services provided, correcting, preventing and

reducing undesired effects, improving the performance and effectiveness of Project Quality Management system.

The need for corrective action is determined on the basis of identified actual non-conformities.

Corrective action requests are typically triggered by such events as a failed inspection, customer complaint, deviation from work instruction/legal requirements/regulations/objectives, nonconforming delivery from a supplier, or a system audit finding.

AL BALAGH will follow Lusail Standardized Non Compliance Procedure for handling corrective actions.

Requirement for corrective actions are documented in a Lusail Standardized Non Compliance Report and/ or Internal Non Conformance Report where the nature of the non-compliance is recorded. The process owner identifies the proposed corrective action and sets reasonable time frames for implementation. After the due date, the Resident manager OR Senior Project Engineer reviews the action taken and evaluates the effectiveness of the corrective action. The purpose of the corrective action is to:

- Review the non-conformities including the customer complaints;
- Determining the root causes of the non-conformity;
- Taking action to eliminate the root causes of the problem to ensure that the non- conformity does not recur;
- Determining and implementing the action needed;
- Record the result of the actions taken;
- Reviewing and recording the effectiveness of the action taken;
- Identifying the need and possibility for preventive actions in areas similar to where the nonconformity was identified (in a proactive manner).

The QA/QC department will maintain records of all the corrective actions initiated analyses and reports trends periodically during Project Review Meetings.

Conclusion to chapter 3

The third section of the diploma project is devoted to the development of the road infrastructure construction project, which is called «CP-13F - FIXED & CALL-OFF CONTRACT FOR LUSAIL CITY WORKS».

The project is developed for Lusail real Estate Development Company (LREDC), located in the State of Qatar.

In the first subsection, the project charter is developed, in which the main points are given. we have developed a work plan for this project, which is divided into fixed and call-off scope of work. on the basis of this, the VBS structure was created.

To understand the purpose of the project, the main stakeholders of the project and their expectations from the project are highlighted.

The second subsection is devoted to the formation of basic planning decisions and design documents. in particular, we created the organizational structure of the project. a responsibility matrix was developed and the duties of each participant involved in the project were described in detail.

We have calculated the approximate time for the project, as well as the resources used for the project.

GENERAL CONCLUSIONS FOR THE WORK

Taking into account the variety of operating conditions of the road network, task of managing construction, repair, maintenance and the arrangement of roads can be solved quite effectively only with using modern methods of project management based on innovative technologies that provide a comprehensive approach to the solution problems of the road industry.

As a result of research in the general system of the project management of road infrastructure is allocated for scientific solutions tasks of the subject area. Methods of solving these tasks have been developed, proposed scientific approaches to the implementation of construction projects and maintenance of the road network. Research results create prerequisites for the implementation of the project management methodology in the road industry.

Applied project management methodology for road infrastructure allows you to actively influence production processes in progress implementation of the project. The set of measures developed for the implementation of the project allows optimize the duration of construction with appointed contractors, take into account the probabilistic parameters of road construction flows, as well as technological and organizational features of road construction, related with the seasonal nature of the work.

The concept of project management in the road industry provides technical and economic diagnosis of organizational and technological innovations using functional-cost analysis, variability implementation of innovations, the choice of progressive technological and organizational ones decisions regarding road construction conditions.

Implementation of project management methodology increases the effectiveness of investments in the construction and repair of the road network, contributes improvement of consumer qualities of road infrastructure with limited resources due to the optimization of organizational and technological solutions.

The possibility of active influence on management processes during implementation projects, taking into account possible positive and negative external influences should become strong arguments in favor of widespread distribution methodologies of project management of road infrastructure.

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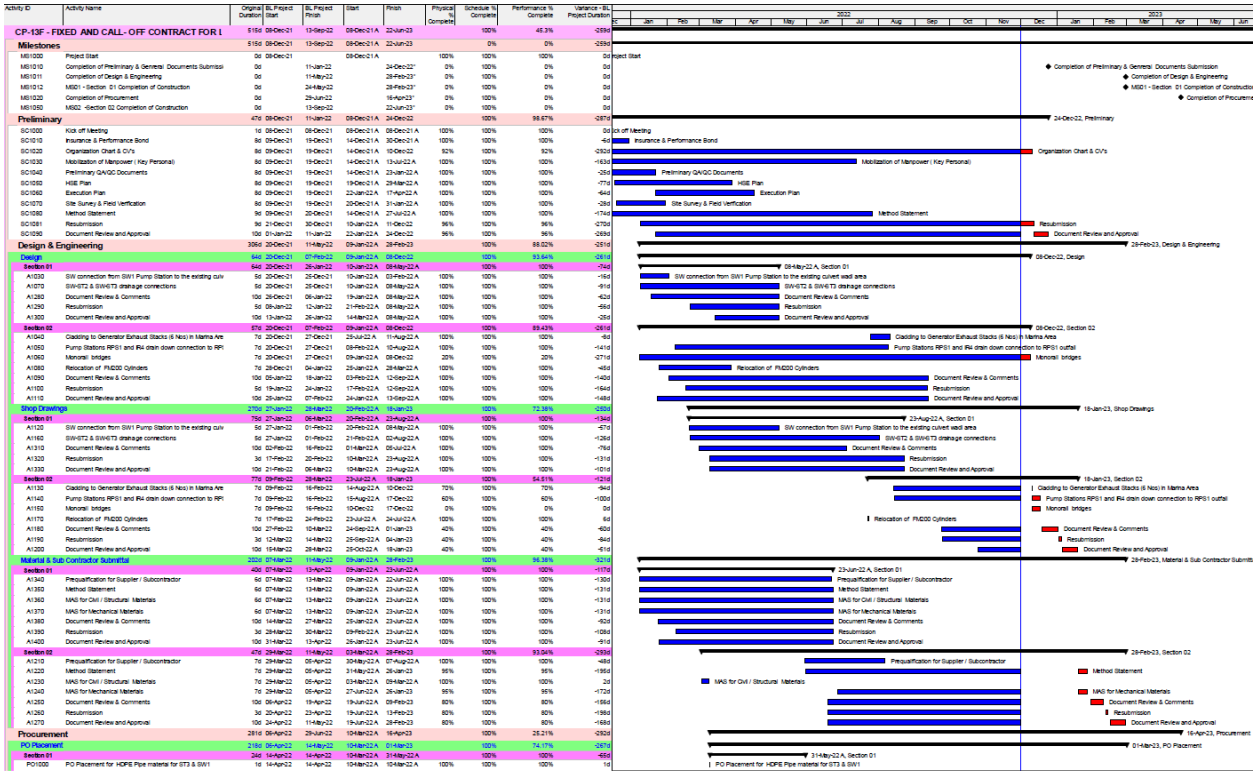
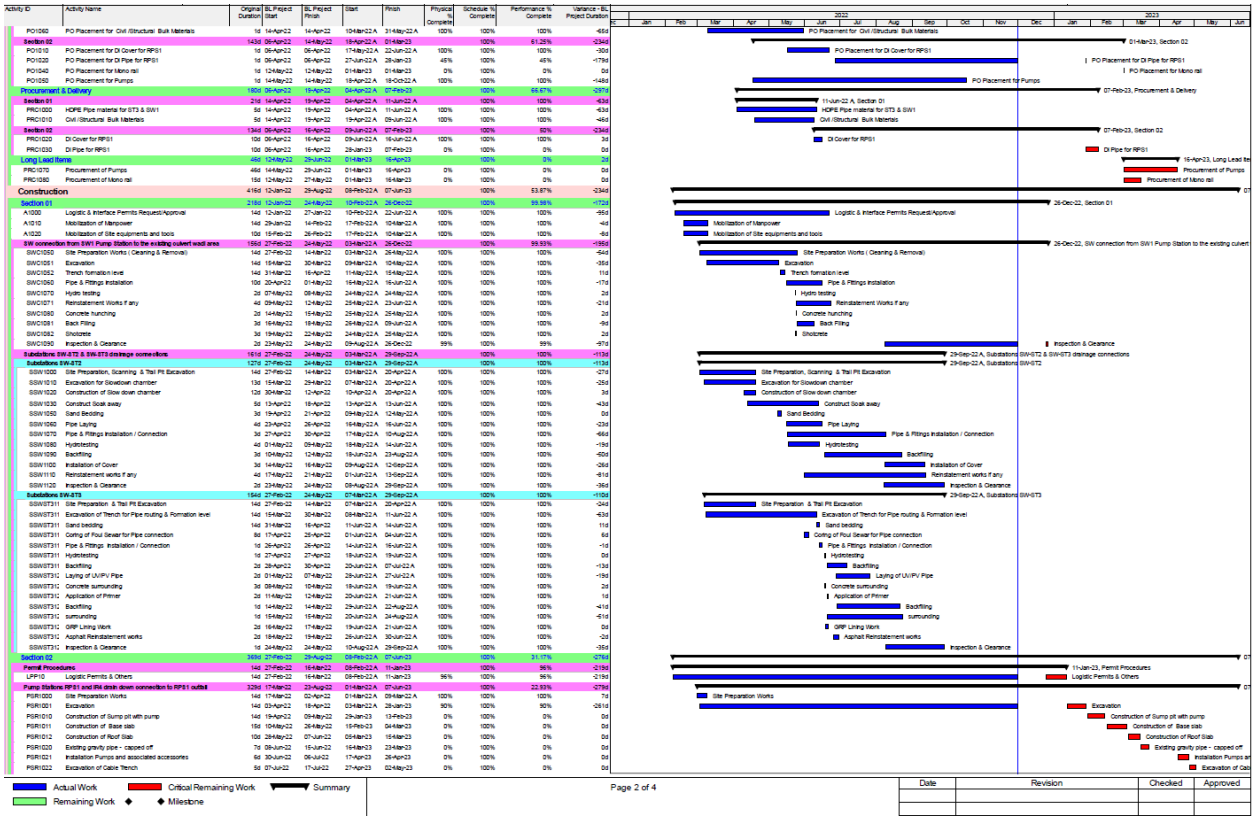
APPENDIX 1



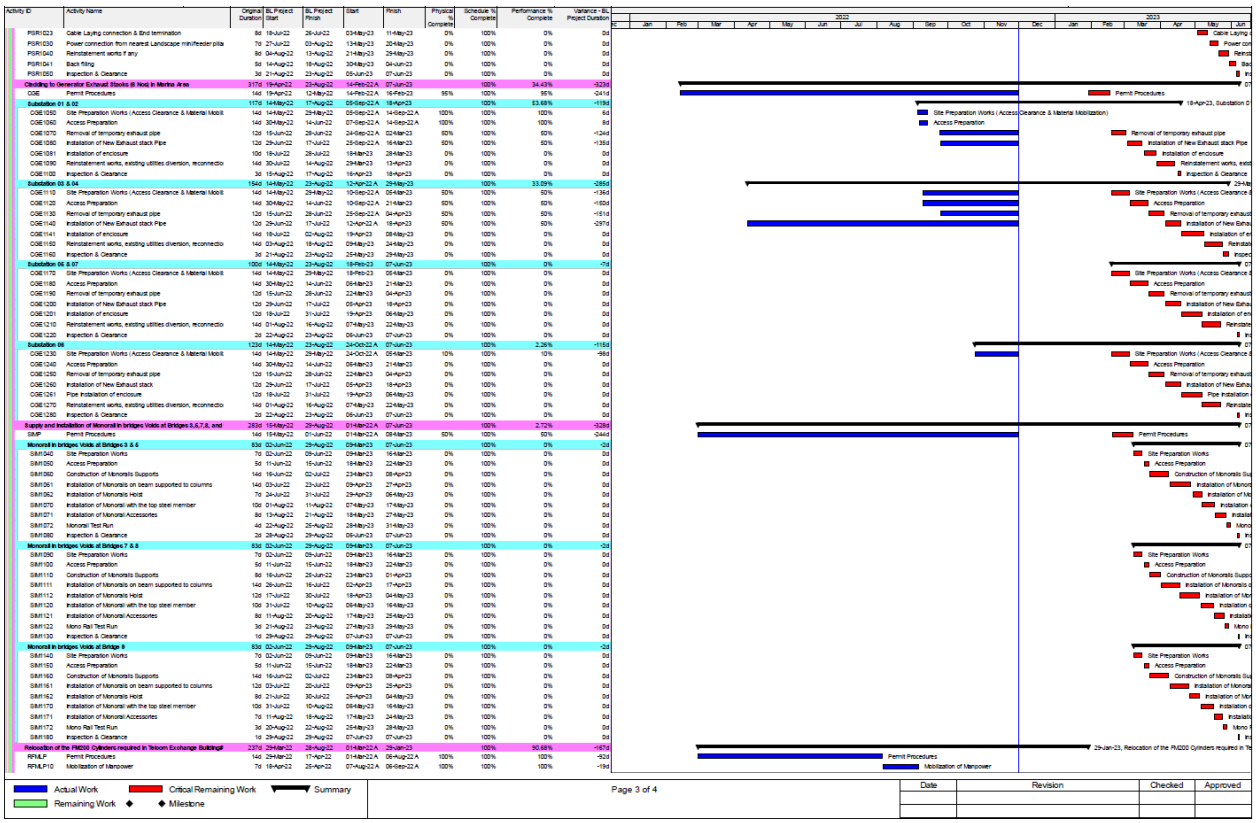
Activity ID	Activity Name	Original Duration	BL Project Start	BL Project Finish	Start	Finish	Physical % Complete	Schedule % Complete	Performance % Complete	Variance - BL Project Duration
CP-13F - FIXED AND CALL- OFF CONTRACT FOR I		515d	09-Dec-21	13-Sep-22	09-Dec-21A	22-Jun-23		100%	46.3%	-259d
Milestones		515d	09-Dec-21	13-Sep-22	09-Dec-21A	22-Jun-23		0%	0%	-259d
MS1000	Project Start	0d	09-Dec-21		09-Dec-21A		100%	100%	100%	0d
MS1010	Completion of Preliminary & General Documents Submissi	0d		11-Jan-22		24-Dec-22*	0%	100%	0%	0d
MS1011	Completion of Design & Engineering	0d		11-May-22		28-Feb-23*	0%	100%	0%	0d
MS1012	MS01 - Section 01 Completion of Construction	0d		24-May-22		28-Feb-23*	0%	100%	0%	0d
MS1020	Completion of Procurement	0d		29-Jun-22		16-Apr-23*	0%	100%	0%	0d
MS1050	MS02 -Section 02 Completion of Construction	0d		13-Sep-22		22-Jun-23*	0%	100%	0%	0d
Preliminary		47d	09-Dec-21	11-Jan-22	09-Dec-21A	24-Dec-22		100%	98.67%	-287d
SC1000	Kick off Meeting	1d	09-Dec-21	09-Dec-21	09-Dec-21A	09-Dec-21A	100%	100%	100%	0d
SC1010	Insurance & Performance Bond	8d	09-Dec-21	19-Dec-21	14-Dec-21A	30-Dec-21A	100%	100%	100%	-46d
SC1020	Organization Chart & CV's	8d	09-Dec-21	19-Dec-21	14-Dec-21A	10-Dec-22	92%	100%	92%	-282d
SC1030	Mobilization of Manpower (Key Personal)	8d	09-Dec-21	19-Dec-21	14-Dec-21A	13-Jul-22 A	100%	100%	100%	-163d
SC1040	Preliminary QA/QC Documents	8d	09-Dec-21	19-Dec-21	14-Dec-21A	23-Jan-22 A	100%	100%	100%	-26d
SC1050	HSE Plan	8d	09-Dec-21	19-Dec-21	15-Dec-21A	29-Mar-22 A	100%	100%	100%	-77d
SC1060	Execution Plan	8d	09-Dec-21	19-Dec-21	22-Jan-22 A	17-Apr-22 A	100%	100%	100%	-64d
SC1070	Site Survey & Field Verification	8d	09-Dec-21	19-Dec-21	20-Dec-21A	31-Jan-22 A	100%	100%	100%	-28d
SC1080	Method Statement	8d	09-Dec-21	19-Dec-21	14-Dec-21A	27-Jul-22 A	100%	100%	100%	-174d
SC1081	Resubmission	9d	21-Dec-21	30-Dec-21	10-Jan-22 A	11-Dec-22	96%	100%	96%	-270d
SC1090	Document Review and Approval	10d	01-Jan-22	11-Jan-22	22-Jan-22 A	24-Dec-22	96%	100%	96%	-269d
Design & Engineering		306d	20-Dec-21	11-May-22	09-Jan-22 A	28-Feb-23		100%	98.02%	-261d
Design		64d	20-Dec-21	07-Feb-22	09-Jan-22 A	08-Dec-22		100%	93.64%	-261d
Section 01		64d	20-Dec-21	07-Feb-22	09-Jan-22 A	08-May-22 A		100%	100%	-76d
A1030	SW connection from SW1 Pump Station to the existing culv	5d	20-Dec-21	26-Dec-21	10-Jan-22 A	03-Feb-22 A	100%	100%	100%	-16d
A1070	SW-ST2 & SW-ST3 drainage connections	5d	20-Dec-21	26-Dec-21	10-Jan-22 A	08-May-22 A	100%	100%	100%	-91d
A1300	Document Review & Comments	10d	20-Dec-21	06-Jan-22	19-Jan-22 A	08-May-22 A	100%	100%	100%	-62d
A1290	Resubmission	5d	08-Jan-22	12-Jan-22	21-Feb-22 A	08-May-22 A	100%	100%	100%	-66d
A1300	Document Review and Approval	10d	13-Jan-22	26-Jan-22	14-Mar-22 A	08-May-22 A	100%	100%	100%	-29d
Section 02		57d	20-Dec-21	07-Feb-22	09-Jan-22 A	08-Dec-22		100%	89.43%	-261d
A1040	Cladding to Generator Exhaust Stacks (6 Nos) in Marina Are	7d	20-Dec-21	27-Dec-21	25-Jul-22 A	11-Aug-22 A	100%	100%	100%	-6d
A1050	Pump Stations RPS1 and IR4 drain down connection to RPS	7d	20-Dec-21	27-Dec-21	08-Feb-22 A	10-Aug-22 A	100%	100%	100%	-141d
A1060	Monorail bridges	7d	20-Dec-21	27-Dec-21	09-Jan-22 A	08-Dec-22	20%	100%	20%	-271d
A1080	Relocation of FM200 Cylinders	7d	20-Dec-21	27-Dec-21	04-Jan-22 A	29-Jun-22 A	100%	100%	100%	-40d
A1090	Document Review & Comments	10d	05-Jan-22	18-Jan-22	03-Feb-22 A	12-Sep-22 A	100%	100%	100%	-148d
A1100	Resubmission	5d	19-Jan-22	24-Jan-22	17-Feb-22 A	12-Sep-22 A	100%	100%	100%	-164d
A1110	Document Review and Approval	10d	25-Jan-22	07-Feb-22	24-Jan-22 A	13-Sep-22 A	100%	100%	100%	-148d
Shop Drawings		210d	21-Jan-22	22-Feb-23	23-Feb-22 A	18-Jun-23		100%	52.38%	-258d
Section 01		75d	21-Jan-22	06-Apr-22	23-Feb-22 A	23-Aug-22 A		100%	100%	-134d
A1120	SW connection from SW1 Pump Station to the existing culv	5d	21-Jan-22	01-Feb-22	20-Feb-22 A	08-May-22 A	100%	100%	100%	-67d
A1160	SW-ST2 & SW-ST3 drainage connections	5d	21-Jan-22	01-Feb-22	21-Feb-22 A	02-Aug-22 A	100%	100%	100%	-126d
A1310	Document Review & Comments	10d	02-Feb-22	16-Feb-22	01-Mar-22 A	08-Jul-22 A	100%	100%	100%	-76d
A1320	Resubmission	3d	17-Feb-22	20-Feb-22	10-Mar-22 A	23-Aug-22 A	100%	100%	100%	-131d
A1330	Document Review and Approval	10d	21-Feb-22	06-Mar-22	10-Mar-22 A	23-Aug-22 A	100%	100%	100%	-101d
Section 02		77d	21-Jan-22	06-Apr-22	23-Jul-22 A	18-Jun-23		100%	64.51%	-121d
A1130	Cladding to Generator Exhaust Stacks (6 Nos) in Marina Are	7d	09-Feb-22	16-Feb-22	14-Aug-22 A	10-Dec-22	70%	100%	70%	-94d
A1140	Pump Stations RPS1 and IR4 drain down connection to RPS	7d	09-Feb-22	16-Feb-22	15-Aug-22 A	17-Dec-22	60%	100%	60%	-109d
A1150	Monorail bridges	7d	09-Feb-22	16-Feb-22	10-Dec-22	17-Dec-22	0%	100%	0%	0d
A1170	Relocation of FM200 Cylinders	7d	17-Feb-22	24-Feb-22	23-Jul-22 A	24-Jul-22 A	100%	100%	100%	6d
A1180	Document Review & Comments	10d	27-Feb-22	10-Mar-22	24-Sep-22 A	01-Jan-23	40%	100%	40%	-60d
A1190	Resubmission	3d	12-Mar-22	14-Mar-22	26-Sep-22 A	04-Jan-23	40%	100%	40%	-64d
A1200	Document Review and Approval	10d	15-Mar-22	28-Mar-22	29-Oct-22 A	18-Jan-23	40%	100%	40%	-61d
Material & Sub Contractor Submittal		202d	07-Mar-22	11-May-22	09-Jan-22 A	28-Feb-23		100%	96.36%	-521d
Section 01		40d	07-Mar-22	13-Apr-22	09-Jan-22 A	23-Jun-22 A		100%	100%	-117d
A1340	Prequalification for Supplier / Subcontractor	6d	07-Mar-22	13-Mar-22	09-Jan-22 A	22-Jun-22 A	100%	100%	100%	-130d
A1350	Method Statement	6d	07-Mar-22	13-Mar-22	09-Jan-22 A	23-Jun-22 A	100%	100%	100%	-131d
A1360	MAS for Civil / Structural Materials	6d	07-Mar-22	13-Mar-22	09-Jan-22 A	23-Jun-22 A	100%	100%	100%	-131d
A1370	MAS for Mechanical Materials	6d	07-Mar-22	13-Mar-22	09-Jan-22 A	23-Jun-22 A	100%	100%	100%	-131d
A1380	Document Review & Comments	10d	14-Mar-22	27-Mar-22	28-Jan-22 A	23-Jun-22 A	100%	100%	100%	-92d
A1390	Resubmission	3d	28-Mar-22	30-Mar-22	09-Feb-22 A	23-Jun-22 A	100%	100%	100%	-93d
A1400	Document Review and Approval	10d	31-Mar-22	13-Apr-22	26-Jan-22 A	23-Jun-22 A	100%	100%	100%	-91d
Section 02		47d	29-Mar-22	11-May-22	03-Mar-22 A	28-Feb-23		100%	93.04%	-293d
A1210	Prequalification for Supplier / Subcontractor	7d	29-Mar-22	05-Apr-22	03-Mar-22 A	07-Aug-22 A	100%	100%	100%	-46d
A1220	Method Statement	7d	29-Mar-22	05-Apr-22	31-May-22 A	26-Jan-23	95%	100%	95%	-195d
A1230	MAS for Civil / Structural Materials	7d	29-Mar-22	05-Apr-22	03-Mar-22 A	09-Mar-22 A	100%	100%	100%	2d
A1240	MAS for Mechanical Materials	7d	29-Mar-22	05-Apr-22	27-Jun-22 A	26-Jan-23	95%	100%	95%	-172d
A1250	Document Review & Comments	10d	06-Apr-22	19-Apr-22	19-Jun-22 A	09-Feb-23	80%	100%	80%	-164d
A1260	Resubmission	3d	20-Apr-22	23-Apr-22	19-Jun-22 A	13-Feb-23	80%	100%	80%	-198d
A1270	Document Review and Approval	10d	24-Apr-22	11-May-22	19-Jun-22 A	28-Feb-23	80%	100%	80%	-168d
Procurement		281d	09-Apr-22	29-Jun-23	10-Mar-22 A	16-Apr-23		100%	26.21%	-282d
PO Placement		216d	09-Apr-22	14-Mar-23	10-Mar-22 A	01-Mar-23		100%	74.17%	-267d
Section 01		24d	14-Apr-22	14-Apr-22	10-Mar-22 A	31-May-22 A		100%	100%	-65d
PO1000	PO Placement for HDPE Pipe material for ST3 & SW1	1d	14-Apr-22	14-Apr-22	10-Mar-22 A	10-Mar-22 A	100%	100%	100%	1d

Date	Revision	Checked	Approved



Activity ID	Activity Name	Original Duration	BL Project Start	BL Project Finish	Start	Finish	Physical % Complete	Schedule % Complete	Performance % Complete	Variance - BL Project Duration
PO1060	PO Placement for Civil /Structural Bulk Materials	1d	14-Apr-22	14-Apr-22	10-Mar-22 A	31-May-22 A	100%	100%	100%	-44d
Section 02		145d	06-Apr-22	14-Apr-22	18-Jun-22 A	01-Mar-23		100%	61.25%	-234d
PO1010	PO Placement for DI Cover for RPS1	1d	06-Apr-22	06-Apr-22	17-May-22 A	22-Jun-22 A	100%	100%	100%	-30d
PO1020	PO Placement for DI Pipe for RPS1	1d	06-Apr-22	06-Apr-22	27-Jun-22 A	28-Jan-23	45%	100%	45%	-178d
PO1040	PO Placement for Mono rail	1d	12-Apr-22	12-Apr-22	01-Mar-23	01-Mar-23	0%	100%	0%	0d
PO1050	PO Placement for Pumps	1d	14-Mar-22	14-Apr-22	18-Apr-22 A	18-Oct-22 A	100%	100%	100%	-148d
Procurement & Delivery		180d	06-Apr-22	19-Apr-22	04-Apr-22 A	07-Feb-23		100%	64.67%	-297d
Section 01		21d	14-Apr-22	19-Apr-22	04-Apr-22 A	11-Jun-22 A		100%	100%	-43d
PRC1000	HDPE Pipe material for ST3 & SW1	5d	14-Apr-22	19-Apr-22	04-Apr-22 A	11-Jun-22 A	100%	100%	100%	-43d
PRC1010	Civil /Structural Bulk Materials	5d	14-Apr-22	19-Apr-22	09-Jun-22 A	09-Jun-22 A	100%	100%	100%	-46d
Section 02		134d	06-Apr-22	16-Apr-22	09-Jun-22 A	07-Feb-23		100%	52%	-234d
PRC1020	DI Cover for RPS1	10d	06-Apr-22	16-Apr-22	09-Jun-22 A	16-Jun-22 A	100%	100%	100%	3d
PRC1030	DI Pipe for RPS1	10d	06-Apr-22	16-Apr-22	28-Jun-23	07-Feb-23	0%	100%	0%	0d
Long Lead Items		46d	12-Apr-22	28-Jun-22	01-Mar-23	16-Apr-23		100%	0%	29d
PRC1070	Procurement of Pumps	46d	14-Mar-22	29-Jun-22	01-Mar-23	16-Apr-23	0%	100%	0%	0d
PRC1080	Procurement of Mono rail	15d	12-Apr-22	27-Apr-22	01-Mar-23	16-Mar-23	0%	100%	0%	0d
Construction		416d	12-Jan-22	29-Aug-22	08-Feb-22 A	07-Jun-23		100%	53.67%	-234d
Section 01		218d	12-Jan-22	24-May-22	10-Feb-22 A	26-Dec-22		100%	99.58%	-172d
A1000	Logistic & Interface Permits Request/Approval	14d	12-Jan-22	27-Jan-22	10-Feb-22 A	22-Jun-22 A	100%	100%	100%	-95d
A1010	Mobilization of Manpower	14d	29-Jan-22	14-Feb-22	17-Feb-22 A	10-Aug-22 A	100%	100%	100%	-4d
A1020	Mobilization of Site equipments and tools	10d	15-Feb-22	26-Feb-22	17-Feb-22 A	10-Aug-22 A	100%	100%	100%	-8d
SW connection from SW1 Pump Station to the existing culvert wadi area		155d	27-Feb-22	24-May-22	03-Mar-22 A	26-Dec-22		100%	99.93%	-155d
SWC1050	Site Preparation Works (Cleaning & Removal)	14d	27-Feb-22	14-Apr-22	03-Mar-22 A	25-Aug-22 A	100%	100%	100%	-64d
SWC1051	Excavation	14d	16-Mar-22	30-Mar-22	09-Mar-22 A	10-May-22 A	100%	100%	100%	-35d
SWC1052	Trench formation level	14d	31-Mar-22	16-Apr-22	11-May-22 A	15-May-22 A	100%	100%	100%	11d
SWC1060	Pipe & Fittings installation	10d	20-Apr-22	01-May-22	16-May-22 A	16-Jun-22 A	100%	100%	100%	-17d
SWC1070	Hydro testing	2d	27-May-22	28-May-22	24-May-22 A	24-May-22 A	100%	100%	100%	2d
SWC1071	Reinstatement Works if any	4d	09-May-22	12-May-22	25-May-22 A	23-Jun-22 A	100%	100%	100%	-21d
SWC1080	Concrete hunching	2d	14-May-22	15-May-22	25-May-22 A	25-May-22 A	100%	100%	100%	2d
SWC1081	Back Filling	3d	16-May-22	18-May-22	26-May-22 A	09-Jun-22 A	100%	100%	100%	-9d
SWC1082	Shotcrete	3d	19-May-22	22-May-22	24-May-22 A	26-May-22 A	100%	100%	100%	2d
SWC1090	Inspection & Clearance	2d	23-May-22	24-May-22	09-Aug-22 A	26-Dec-22	99%	100%	99%	-97d
Substations SW-ST2 & SW-ST3 drainage connections		161d	27-Feb-22	24-May-22	03-Mar-22 A	29-Sep-22 A		100%	100%	-113d
Substations SW-ST2		127d	27-Feb-22	24-May-22	03-Mar-22 A	29-Sep-22 A		100%	100%	-113d
SSW1000	Site Preparation, Scanning & Trial Pit Excavation	14d	27-Feb-22	14-Mar-22	03-Mar-22 A	20-Apr-22 A	100%	100%	100%	-27d
SSW1010	Excavation for Slowdown chamber	13d	15-Mar-22	29-Mar-22	07-Mar-22 A	20-Apr-22 A	100%	100%	100%	-26d
SSW1020	Construction of Slow down chamber	12d	30-Mar-22	12-Apr-22	10-Apr-22 A	20-Apr-22 A	100%	100%	100%	3d
SSW1030	Construct Soak away	5d	13-Apr-22	18-Apr-22	13-Jun-22 A	13-Jun-22 A	100%	100%	100%	-43d
SSW1050	Sand Bedding	3d	19-Apr-22	21-Apr-22	09-May-22 A	12-May-22 A	100%	100%	100%	0d
SSW1060	Pipe Laying	4d	23-Apr-22	26-Apr-22	16-May-22 A	16-Jun-22 A	100%	100%	100%	-23d
SSW1070	Pipe & Fittings installation / Connection	3d	27-Apr-22	30-Apr-22	17-May-22 A	15-Jun-22 A	100%	100%	100%	-46d
SSW1080	Hydrotesting	4d	01-May-22	05-May-22	18-May-22 A	14-Jun-22 A	100%	100%	100%	-19d
SSW1090	Backfilling	3d	10-May-22	12-May-22	19-Jun-22 A	23-Aug-22 A	100%	100%	100%	-62d
SSW1100	Installation of Cover	3d	14-May-22	16-May-22	09-Aug-22 A	12-Sep-22 A	100%	100%	100%	-26d
SSW1110	Reinstatement works if any	4d	17-May-22	20-May-22	17-Jun-22 A	13-Sep-22 A	100%	100%	100%	-61d
SSW1120	Inspection & Clearance	2d	23-May-22	24-May-22	08-Aug-22 A	29-Sep-22 A	100%	100%	100%	-36d
Substations SW-ST3		154d	27-Feb-22	24-May-22	07-Mar-22 A	29-Sep-22 A		100%	100%	-113d
SSWST311	Site Preparation & Trial Pit Excavation	14d	27-Feb-22	14-Mar-22	07-Mar-22 A	20-Apr-22 A	100%	100%	100%	-24d
SSWST311	Excavation of Trench for Pipe routing & Formation level	14d	16-Mar-22	30-Mar-22	08-Mar-22 A	11-Jun-22 A	100%	100%	100%	-53d
SSWST311	Sand bedding	14d	31-Mar-22	16-Apr-22	11-Jun-22 A	14-Jun-22 A	100%	100%	100%	11d
SSWST311	Coring of Foul Sewer for Pipe connection	8d	17-Apr-22	26-Apr-22	01-Jun-22 A	04-Jun-22 A	100%	100%	100%	6d
SSWST311	Pipe & Fittings installation / Connection	1d	26-Apr-22	26-Apr-22	14-Jun-22 A	16-Jun-22 A	100%	100%	100%	-1d
SSWST311	Hydrotesting	1d	27-Apr-22	27-Apr-22	18-Jun-22 A	19-Jun-22 A	100%	100%	100%	0d
SSWST311	Backfilling	2d	28-Apr-22	30-Apr-22	20-Jun-22 A	07-Jul-22 A	100%	100%	100%	-13d
SSWST31(	Laying of UU/PV Pipe	2d	01-May-22	07-May-22	26-Jul-22 A	27-Jul-22 A	100%	100%	100%	-15d
SSWST31(	Concrete surrounding	3d	08-May-22	10-May-22	19-Jun-22 A	19-Jun-22 A	100%	100%	100%	2d
SSWST31(	Application of Primer	2d	11-May-22	12-May-22	20-Jun-22 A	21-Jun-22 A	100%	100%	100%	1d
SSWST31(	Backfilling	1d	14-May-22	14-May-22	29-Jun-22 A	22-Aug-22 A	100%	100%	100%	-41d
SSWST31(	surrounding	1d	15-May-22	15-May-22	20-Jun-22 A	24-Aug-22 A	100%	100%	100%	-41d
SSWST31(	GRP Lining Work	2d	16-May-22	17-May-22	19-Jun-22 A	21-Jun-22 A	100%	100%	100%	0d
SSWST31(	Asphalt Reinstatement works	2d	18-May-22	19-May-22	29-Jun-22 A	30-Jun-22 A	100%	100%	100%	-2d
SSWST31(	Inspection & Clearance	1d	24-May-22	24-May-22	10-Aug-22 A	29-Sep-22 A	100%	100%	100%	-36d
Section 02		369d	27-Feb-22	29-Aug-22	08-Feb-22 A	07-Jun-23		100%	51.17%	-279d
Permit Procedures		14d	27-Feb-22	16-Mar-22	08-Feb-22 A	11-Jan-23		100%	96%	-219d
LPP10	Logistic Permits & Others	14d	27-Feb-22	16-Mar-22	08-Feb-22 A	11-Jan-23	96%	100%	96%	-219d
Pump Stations RPS1 and IR4 drain down connection to RPS1 outfall		329d	17-Mar-22	23-Aug-22	01-Mar-23	07-Jun-23		100%	22.93%	-279d
PSR1000	Site Preparation Works	14d	17-Mar-22	02-Apr-22	01-Mar-23	09-Mar-22 A	100%	100%	100%	7d
PSR1001	Excavation	14d	03-Apr-22	18-Apr-22	03-Mar-22 A	28-Jun-23	90%	100%	90%	-261d
PSR1010	Construction of Sump pit with pump	14d	19-Apr-22	09-May-22	29-Jun-23	13-Feb-23	0%	100%	0%	0d
PSR1011	Construction of Base slab	15d	10-May-22	26-May-22	15-Feb-23	04-Mar-23	0%	100%	0%	0d
PSR1012	Construction of Roof Slab	10d	28-May-22	07-Jun-22	06-Mar-23	16-Mar-23	0%	100%	0%	0d
PSR1020	Existing gravity pipe - capped off	7d	08-Jun-22	15-Jun-22	16-Mar-23	23-Mar-23	0%	100%	0%	0d
PSR1021	Installation Pumps and associated accessories	6d	30-Jun-22	06-Jul-22	17-Apr-23	24-Apr-23	0%	100%	0%	0d
PSR1022	Excavation of Cable Trench	5d	07-Jul-22	17-Jul-22	27-Apr-23	02-May-23	0%	100%	0%	0d

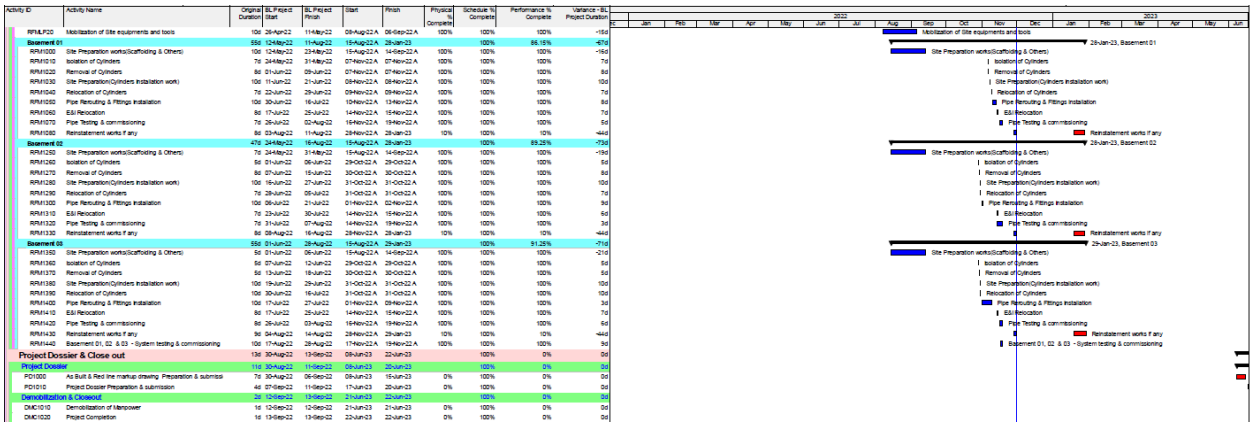
Date	Revision	Checked	Approved



Activity ID	Activity Name	Original Duration	BL Project Start	BL Project Finish	Start	Finish	Physical % Complete	Schedule % Complete	Performance % Complete	Variance - BL Project Duration
PSRI1023	Cable Laying connection & End termination	8d	18-Jul-22	26-Jul-22	03-May-23	11-May-23	0%	100%	0%	0d
PSRI1030	Power connection from nearest Landscape minifeeder pillar	7d	27-Jul-22	03-Aug-22	13-May-23	20-May-23	0%	100%	0%	0d
PSRI1040	Reinstatement works if any	8d	04-Aug-22	13-Aug-22	21-May-23	29-May-23	0%	100%	0%	0d
PSRI1041	Back filling	5d	14-Aug-22	18-Aug-22	30-May-23	04-Jun-23	0%	100%	0%	0d
PSRI1050	Inspection & Clearance	3d	21-Aug-22	23-Aug-22	05-Jun-23	07-Jun-23	0%	100%	0%	0d
Cladding to Generator Exhaust Stacks @ Nos) in Marina Area		317d	19-Apr-22	23-Aug-22	14-Feb-22A	07-Jun-23		100%	34.43%	-323d
CGE	Permit Procedures	14d	19-Apr-22	12-May-22	14-Feb-22A	16-Feb-23	95%	100%	95%	-241d
Substation 01 & 02		117d	14-May-22	17-Aug-22	08-Sep-22A	19-Apr-23		100%	53.68%	-119d
CGE1050	Site Preparation Works (Access Clearance & Material Mobili	14d	14-May-22	29-May-22	05-Sep-22A	14-Sep-22A	100%	100%	100%	6d
CGE1060	Access Preparation	14d	30-May-22	14-Jun-22	07-Sep-22A	14-Sep-22A	100%	100%	100%	8d
CGE1070	Removal of temporary exhaust pipe	12d	16-Jun-22	28-Jun-22	24-Sep-22A	02-Mar-23	50%	100%	50%	-124d
CGE1080	Installation of New Exhaust stack Pipe	12d	29-Jun-22	17-Jul-22	26-Sep-22A	16-Mar-23	50%	100%	50%	-135d
CGE1081	Installation of enclosure	10d	18-Jul-22	28-Jul-22	18-Mar-23	28-Mar-23	0%	100%	0%	0d
CGE1090	Reinstatement works, existing utilities diversion, reconnectio	14d	30-Jun-22	14-Aug-22	29-Mar-23	13-Apr-23	0%	100%	0%	0d
CGE1100	Inspection & Clearance	3d	18-Aug-22	17-Aug-22	16-Apr-23	18-Apr-23	0%	100%	0%	0d
Substation 03 & 04		154d	14-May-22	23-Aug-22	12-Apr-22A	29-May-23		100%	33.09%	-285d
CGE1110	Site Preparation Works (Access Clearance & Material Mobili	14d	14-May-22	29-May-22	10-Sep-22A	06-Mar-23	50%	100%	50%	-136d
CGE1120	Access Preparation	14d	30-May-22	14-Jun-22	10-Sep-22A	21-Mar-23	50%	100%	50%	-182d
CGE1130	Removal of temporary exhaust pipe	12d	15-Jun-22	28-Jun-22	25-Sep-22A	04-Apr-23	50%	100%	50%	-151d
CGE1140	Installation of New Exhaust stack Pipe	12d	29-Jun-22	17-Jul-22	12-Apr-22A	18-Apr-23	50%	100%	50%	-297d
CGE1141	Installation of enclosure	14d	18-Jul-22	02-Aug-22	19-Apr-23	08-May-23	0%	100%	0%	0d
CGE1150	Reinstatement works, existing utilities diversion, reconnectio	14d	03-Aug-22	18-Aug-22	09-May-23	24-May-23	0%	100%	0%	0d
CGE1160	Inspection & Clearance	3d	21-Aug-22	23-Aug-22	25-May-23	29-May-23	0%	100%	0%	0d
Substation 06 & 07		100d	14-May-22	23-Aug-22	18-Feb-23	07-Jun-23		100%	0%	-74d
CGE1170	Site Preparation Works (Access Clearance & Material Mobili	14d	14-May-22	29-May-22	18-Feb-23	08-Mar-23	0%	100%	0%	0d
CGE1180	Access Preparation	14d	30-May-22	14-Jun-22	06-Mar-23	21-Mar-23	0%	100%	0%	0d
CGE1190	Removal of temporary exhaust pipe	12d	15-Jun-22	28-Jun-22	22-Mar-23	04-Apr-23	0%	100%	0%	0d
CGE1200	Installation of New Exhaust stack Pipe	12d	29-Jun-22	17-Jul-22	05-Apr-23	18-Apr-23	0%	100%	0%	0d
CGE1201	Installation of enclosure	12d	18-Jul-22	31-Jul-22	19-Apr-23	06-May-23	0%	100%	0%	0d
CGE1210	Reinstatement works, existing utilities diversion, reconnectio	14d	01-Aug-22	16-Aug-22	07-May-23	22-May-23	0%	100%	0%	0d
CGE1220	Inspection & Clearance	3d	22-Aug-22	23-Aug-22	06-Jun-23	07-Jun-23	0%	100%	0%	0d
Substation 08		123d	14-May-22	23-Aug-22	24-Oct-22A	07-Jun-23		100%	2.26%	-118d
CGE1230	Site Preparation Works (Access Clearance & Material Mobili	14d	14-May-22	29-May-22	24-Oct-22A	05-Mar-23	10%	100%	10%	-95d
CGE1240	Access Preparation	14d	30-May-22	14-Jun-22	06-Mar-23	21-Mar-23	0%	100%	0%	0d
CGE1250	Removal of temporary exhaust pipe	12d	15-Jun-22	28-Jun-22	22-Mar-23	04-Apr-23	0%	100%	0%	0d
CGE1260	Installation of New Exhaust stack	12d	29-Jun-22	17-Jul-22	05-Apr-23	18-Apr-23	0%	100%	0%	0d
CGE1261	Pipe installation of enclosure	12d	18-Jul-22	31-Jul-22	19-Apr-23	06-May-23	0%	100%	0%	0d
CGE1270	Reinstatement works, existing utilities diversion, reconnectio	14d	01-Aug-22	16-Aug-22	07-May-23	22-May-23	0%	100%	0%	0d
CGE1280	Inspection & Clearance	3d	22-Aug-22	23-Aug-22	06-Jun-23	07-Jun-23	0%	100%	0%	0d
Supply and installation of Monorail in bridges Voids at Bridges 5,6,7,8, and		265d	14-May-22	29-Aug-22	01-Mar-22A	07-Jun-23		100%	2.72%	-328d
SMP	Permit Procedures	14d	14-May-22	01-Jun-22	01-Mar-22A	08-Mar-23	50%	100%	50%	-244d
Monorail in bridges Voids at Bridges 3 & 4		83d	02-Jun-22	29-Aug-22	09-Mar-23	07-Jun-23		100%	0%	-0d
SMI1040	Site Preparation Works	7d	02-Jun-22	09-Jun-22	09-Mar-23	16-Mar-23	0%	100%	0%	0d
SMI1050	Access Preparation	5d	11-Jun-22	15-Jun-22	18-Mar-23	22-Mar-23	0%	100%	0%	0d
SMI1060	Construction of Monorails Supports	14d	16-Jun-22	02-Jul-22	23-Mar-23	08-Apr-23	0%	100%	0%	0d
SMI1061	Installation of Monorails on beam supported to columns	14d	03-Jun-22	23-Jun-22	09-Apr-23	27-Apr-23	0%	100%	0%	0d
SMI1062	Installation of Monorails Hoist	7d	24-Jun-22	31-Jun-22	28-Apr-23	06-May-23	0%	100%	0%	0d
SMI1070	Installation of Monorail with the top steel member	10d	01-Aug-22	11-Aug-22	07-May-23	17-May-23	0%	100%	0%	0d
SMI1071	Installation of Monorail Accessories	8d	13-Aug-22	21-Aug-22	18-May-23	27-May-23	0%	100%	0%	0d
SMI1072	Monorail Test Run	4d	22-Aug-22	26-Aug-22	28-May-23	31-May-23	0%	100%	0%	0d
SMI1080	Inspection & Clearance	2d	28-Aug-22	29-Aug-22	06-Jun-23	07-Jun-23	0%	100%	0%	0d
Monorail in bridges Voids at Bridges 7 & 8		83d	02-Jun-22	29-Aug-22	09-Mar-23	07-Jun-23		100%	0%	-0d
SMI1090	Site Preparation Works	7d	02-Jun-22	09-Jun-22	09-Mar-23	16-Mar-23	0%	100%	0%	0d
SMI1100	Access Preparation	5d	11-Jun-22	15-Jun-22	18-Mar-23	22-Mar-23	0%	100%	0%	0d
SMI1110	Construction of Monorails Supports	8d	16-Jun-22	28-Jun-22	23-Mar-23	01-Apr-23	0%	100%	0%	0d
SMI1111	Installation of Monorails on beam supported to columns	14d	29-Jun-22	18-Jul-22	02-Apr-23	17-Apr-23	0%	100%	0%	0d
SMI1112	Installation of Monorails Hoist	12d	17-Jul-22	30-Jul-22	18-Apr-23	04-May-23	0%	100%	0%	0d
SMI1120	Installation of Monorail with the top steel member	10d	31-Jul-22	10-Aug-22	06-May-23	16-May-23	0%	100%	0%	0d
SMI1121	Installation of Monorail Accessories	8d	11-Aug-22	20-Aug-22	17-May-23	26-May-23	0%	100%	0%	0d
SMI1122	Mono Rail Test Run	3d	21-Aug-22	23-Aug-22	27-May-23	29-May-23	0%	100%	0%	0d
SMI1130	Inspection & Clearance	1d	29-Aug-22	29-Aug-22	07-Jun-23	07-Jun-23	0%	100%	0%	0d
Monorail in bridges Voids at Bridge 9		83d	02-Jun-22	29-Aug-22	09-Mar-23	07-Jun-23		100%	0%	-0d
SMI1140	Site Preparation Works	7d	02-Jun-22	09-Jun-22	09-Mar-23	16-Mar-23	0%	100%	0%	0d
SMI1150	Access Preparation	5d	11-Jun-22	15-Jun-22	18-Mar-23	22-Mar-23	0%	100%	0%	0d
SMI1160	Construction of Monorails Supports	14d	16-Jun-22	02-Jul-22	23-Mar-23	08-Apr-23	0%	100%	0%	0d
SMI1161	Installation of Monorails on beam supported to columns	12d	03-Jul-22	20-Jul-22	09-Apr-23	25-Apr-23	0%	100%	0%	0d
SMI1162	Installation of Monorails Hoist	8d	21-Jul-22	30-Jul-22	26-Apr-23	04-May-23	0%	100%	0%	0d
SMI1170	Installation of Monorail with the top steel member	10d	31-Jul-22	10-Aug-22	06-May-23	16-May-23	0%	100%	0%	0d
SMI1171	Installation of Monorail Accessories	7d	11-Aug-22	18-Aug-22	17-May-23	24-May-23	0%	100%	0%	0d
SMI1172	Mono Rail Test Run	3d	20-Aug-22	22-Aug-22	25-May-23	28-May-23	0%	100%	0%	0d
SMI1180	Inspection & Clearance	1d	29-Aug-22	29-Aug-22	07-Jun-23	07-Jun-23	0%	100%	0%	0d
Relocation of the RM200 Cylinders required in Tricom Exchange Building#		235d	28-Mar-22	28-Aug-22	01-Mar-22A	29-Jun-23		100%	50.68%	-167d
RFMLP	Permit Procedures	14d	28-Mar-22	17-Apr-22	01-Mar-22A	06-Aug-22A	100%	100%	100%	-92d
RFMLP10	Mobilization of Manpower	7d	19-Apr-22	26-Apr-22	07-Aug-22A	06-Sep-22A	100%	100%	100%	-19d

Actual Work | Critical Remaining Work | Summary | Remaining Work | Milestone

Date	Revision	Checked	Approved



Activity ID	Activity Name	Original Duration	BL Project Start	BL Project Finish	Start	Finish	Physical % Complete	Schedule % Complete	Performance % Complete	Variance - BL Project Duration
RFMLP20	Mobilization of Site equipments and tools	10d	26-Apr-22	11-May-22	08-Aug-22A	06-Sep-22A	100%	100%	100%	-16d
Basement 01		55d	12-May-22	11-Aug-22	15-Aug-22A	28-Jan-23		100%	86.15%	-67d
RFM1000	Site Preparation works(Scaffolding & Others)	10d	12-May-22	23-May-22	15-Aug-22A	14-Sep-22A	100%	100%	100%	-16d
RFM1010	Isolation of Cylinders	7d	24-May-22	31-May-22	07-Nov-22A	07-Nov-22A	100%	100%	100%	7d
RFM1020	Removal of Cylinders	8d	01-Jun-22	09-Jun-22	07-Nov-22A	07-Nov-22A	100%	100%	100%	8d
RFM1030	Site Preparation(Cylinders installation work)	10d	11-Jun-22	21-Jun-22	08-Nov-22A	08-Nov-22A	100%	100%	100%	10d
RFM1040	Relocation of Cylinders	7d	22-Jun-22	29-Jun-22	09-Nov-22A	09-Nov-22A	100%	100%	100%	7d
RFM1050	Pipe Rerouting & Fittings installation	10d	30-Jun-22	11-Jul-22	10-Nov-22A	13-Nov-22A	100%	100%	100%	8d
RFM1060	E&I Relocation	8d	17-Jul-22	25-Jul-22	14-Nov-22A	15-Nov-22A	100%	100%	100%	7d
RFM1070	Pipe Testing & commissioning	7d	26-Jul-22	02-Aug-22	16-Nov-22A	19-Nov-22A	100%	100%	100%	5d
RFM1080	Reinstatement works if any	8d	03-Aug-22	11-Aug-22	28-Nov-22A	28-Jan-23	10%	100%	10%	-44d
Basement 02		47d	24-Mar-22	16-Aug-22	15-Aug-22A	29-Jan-23		100%	89.25%	-73d
RFM1250	Site Preparation works(Scaffolding & Others)	7d	24-Mar-22	31-May-22	15-Aug-22A	14-Sep-22A	100%	100%	100%	-19d
RFM1260	Isolation of Cylinders	6d	01-Jun-22	08-Jun-22	29-Oct-22A	29-Oct-22A	100%	100%	100%	6d
RFM1270	Removal of Cylinders	8d	07-Jun-22	15-Jun-22	30-Oct-22A	30-Oct-22A	100%	100%	100%	8d
RFM1280	Site Preparation(Cylinders installation work)	10d	16-Jun-22	27-Jun-22	31-Oct-22A	31-Oct-22A	100%	100%	100%	10d
RFM1290	Relocation of Cylinders	7d	28-Jun-22	06-Jul-22	31-Oct-22A	31-Oct-22A	100%	100%	100%	7d
RFM1300	Pipe Rerouting & Fittings installation	10d	08-Jun-22	21-Jun-22	01-Nov-22A	02-Nov-22A	100%	100%	100%	9d
RFM1310	E&I Relocation	7d	22-Jun-22	30-Jun-22	02-Nov-22A	03-Nov-22A	100%	100%	100%	6d
RFM1320	Pipe Testing & commissioning	7d	31-Jul-22	07-Aug-22	14-Nov-22A	19-Nov-22A	100%	100%	100%	3d
RFM1330	Reinstatement works if any	8d	08-Aug-22	16-Aug-22	28-Nov-22A	28-Jan-23	10%	100%	10%	-44d
Basement 03		55d	01-Jun-22	25-Aug-22	15-Aug-22A	29-Jan-23		100%	91.25%	-71d
RFM1350	Site Preparation works(Scaffolding & Others)	5d	01-Jun-22	08-Jun-22	15-Aug-22A	14-Sep-22A	100%	100%	100%	-21d
RFM1360	Isolation of Cylinders	6d	07-Jun-22	12-Jun-22	29-Oct-22A	29-Oct-22A	100%	100%	100%	6d
RFM1370	Removal of Cylinders	5d	13-Jun-22	18-Jun-22	30-Oct-22A	30-Oct-22A	100%	100%	100%	5d
RFM1380	Site Preparation(Cylinders installation work)	10d	19-Jun-22	30-Jun-22	31-Oct-22A	31-Oct-22A	100%	100%	100%	10d
RFM1390	Relocation of Cylinders	10d	30-Jun-22	14-Jul-22	31-Oct-22A	31-Oct-22A	100%	100%	100%	10d
RFM1400	Pipe Rerouting & Fittings installation	10d	17-Jun-22	27-Jun-22	01-Nov-22A	09-Nov-22A	100%	100%	100%	3d
RFM1410	E&I Relocation	8d	27-Jun-22	07-Jul-22	14-Nov-22A	15-Nov-22A	100%	100%	100%	7d
RFM1420	Pipe Testing & commissioning	8d	26-Jul-22	03-Aug-22	16-Nov-22A	19-Nov-22A	100%	100%	100%	6d
RFM1430	Reinstatement works if any	9d	04-Aug-22	14-Aug-22	28-Nov-22A	29-Jan-23	10%	100%	10%	-44d
RFM1440	Basement 01, 02 & 03 - System testing & commissioning	10d	17-Aug-22	28-Aug-22	17-Nov-22A	19-Nov-22A	100%	100%	100%	9d
Project Dossier & Close out		13d	30-Aug-22	13-Sep-22	08-Jun-23	22-Jun-23		100%	0%	0d
Project Dossier		11d	30-Aug-22	11-Sep-22	08-Jun-23	20-Jun-23		100%	0%	0d
PD1000	As Built & Red line markup drawing Preparation & submissi	7d	30-Aug-22	06-Sep-22	08-Jun-23	15-Jun-23	0%	100%	0%	0d
PD1010	Project Dossier Preparation & submission	4d	07-Sep-22	11-Sep-22	17-Jun-23	20-Jun-23	0%	100%	0%	0d
Demobilization & Closeout		2d	12-Sep-22	13-Sep-22	21-Jun-23	22-Jun-23		100%	0%	0d
DMO1010	Demobilization of Manpower	1d	12-Sep-22	12-Sep-22	21-Jun-23	21-Jun-23	0%	100%	0%	0d
DMO1020	Project Completion	1d	13-Sep-22	13-Sep-22	22-Jun-23	22-Jun-23	0%	100%	0%	0d

APPENDIX 2

PROJECT MANAGEMENT OF ROADS INFRASTRUCTURE UTILITIES CONSTRUCTION

Diploma project of a 6th year student

Faculty of Automation and Information Technologies

Department of project management

Specialty 073 – Management

KHALAF MOSTAFA

INTRODUCTION

The goal of the work.

Justification of feasibility and development of the road infrastructure construction project

Object of study.

The process of managing the road infrastructure construction project

Subject of study.

Methods and principles of road infrastructure construction project management.

Scientific novelty in the development of a road infrastructure construction project for a foreign customer.

Practical significance.

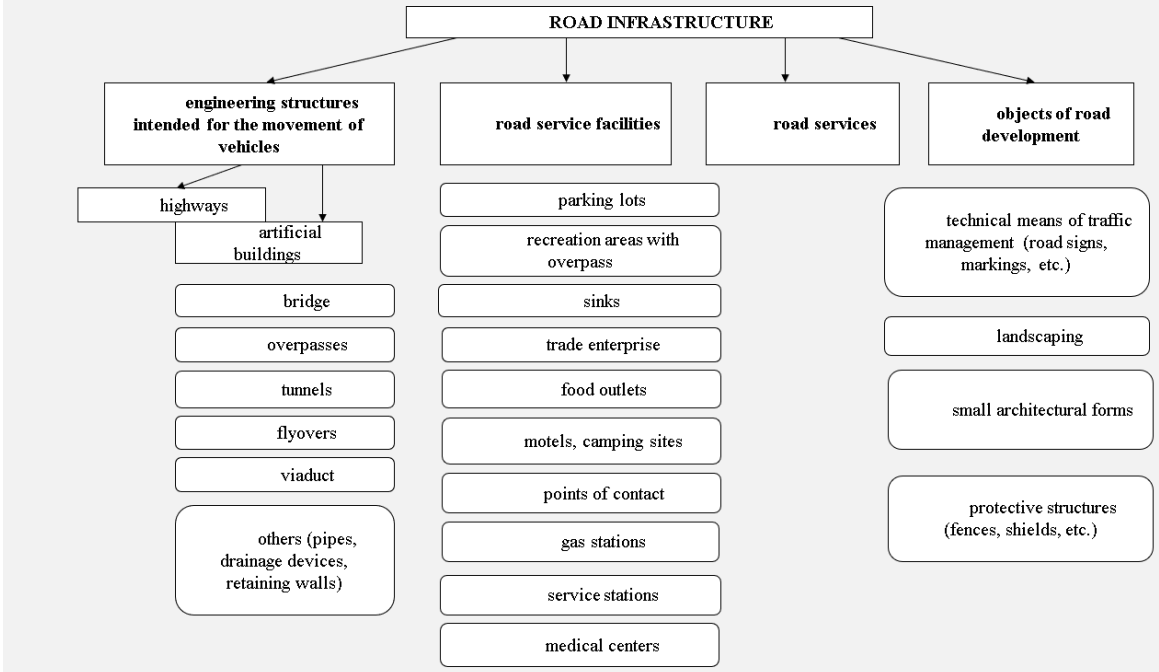
The result of writing the thesis is a developed project for the construction of road infrastructure facilities with features that must be taken into account when implementing a real project.

LIFE CYCLES OF INFRASTRUCTURE PROJECTS

- Initiation
- Planning
- Implementation
- Completion

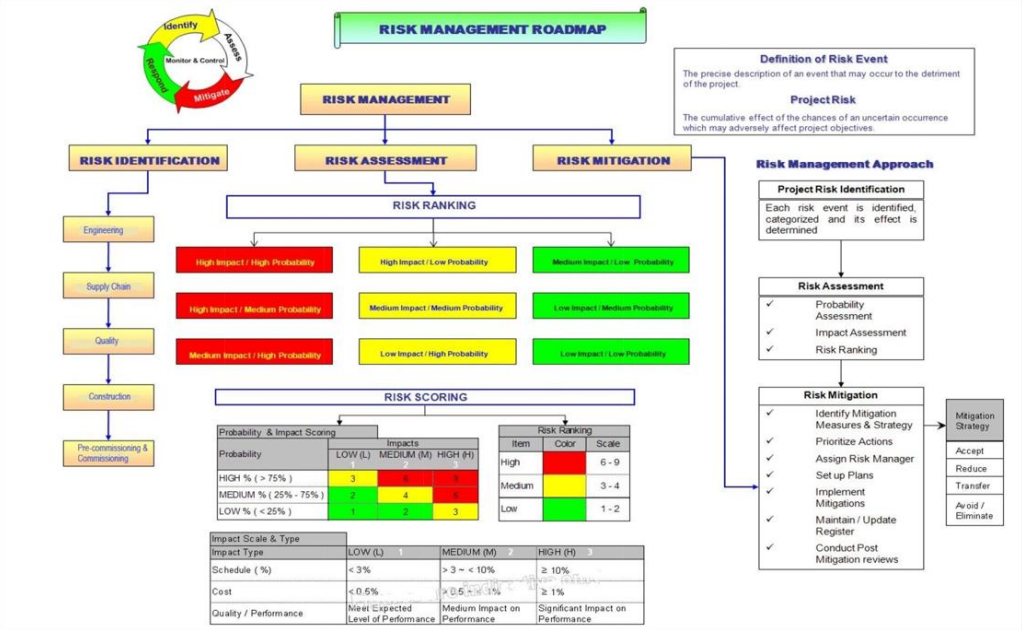
To successfully implement all these four stages, the project manager must simultaneously manage four main elements of the project

resources	•people, equipment, materials
time	•project duration, tasks, determination of the critical path
budget	•expenses, profit, unforeseen costs
project boundaries	•project size, goals and their requirements



RISKS

- Economic
- Political
- Financial
- Construction (or technical or engineering) risks
- The most likely events and losses



STRUCTURING OF PROJECT

The full name of the road infrastructure construction project is «CP-13F - FIXED & CALL-OFF CONTRACT FOR LUSAIL CITY WORKS».

Contractor: AL BALAGH TRADING & CONTRACTING.

Client: Lusail Real Estate Development Company (LREDC).

Project Duration: Fixed scope-270 Days; Call-Off scope-3 years

Site Location: Lusail, city in the State of Qatar.

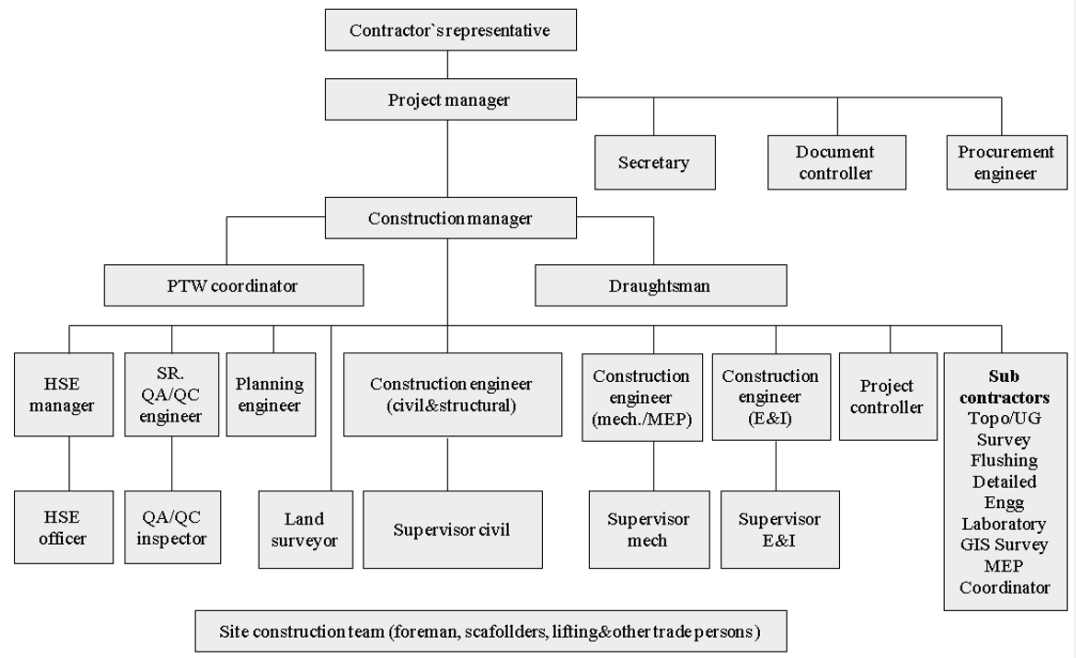
Contract start date: 08-December-2021

Contract finish date: 06-December-2024

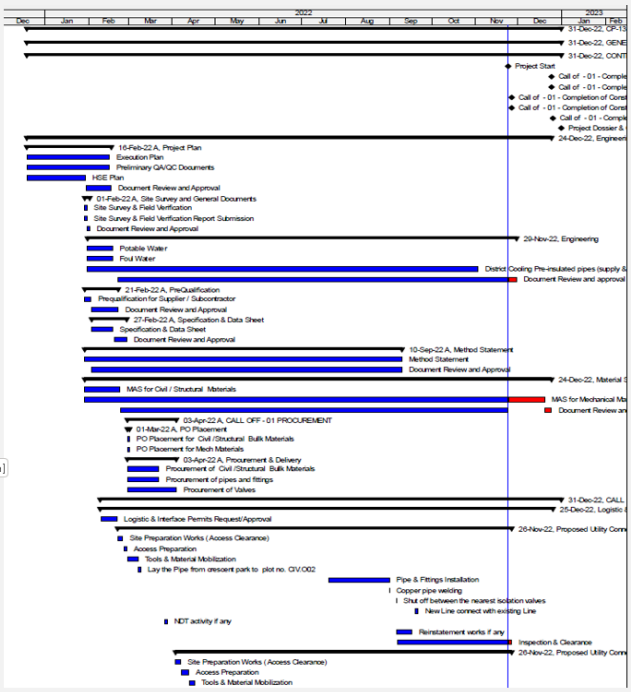
Original Contract value: 55700000,00

FIXED SCOPE OF WORK

- SW connection from SW1 Pump Station to the existing culvert wadi area
- Pump Stations RPS1 and IR4 drain down connection to RPS1 outfall
- Substations SW-ST2 & SW-ST3 drainage connections
- Cladding to Generator Exhaust Stacks (6 Nos) in Marina Area
- Supply and installation of Monorail in bridges Voids at Bridges 3,5,7,8,9.
- Relocation of the FM200 Cylinders required in Telcom Exchange Building#1



The calendar plan consists of critical points and corresponds to the list of fixed works for this project. The estimated time of fixed works is 270 days and the call off duration is 3 years



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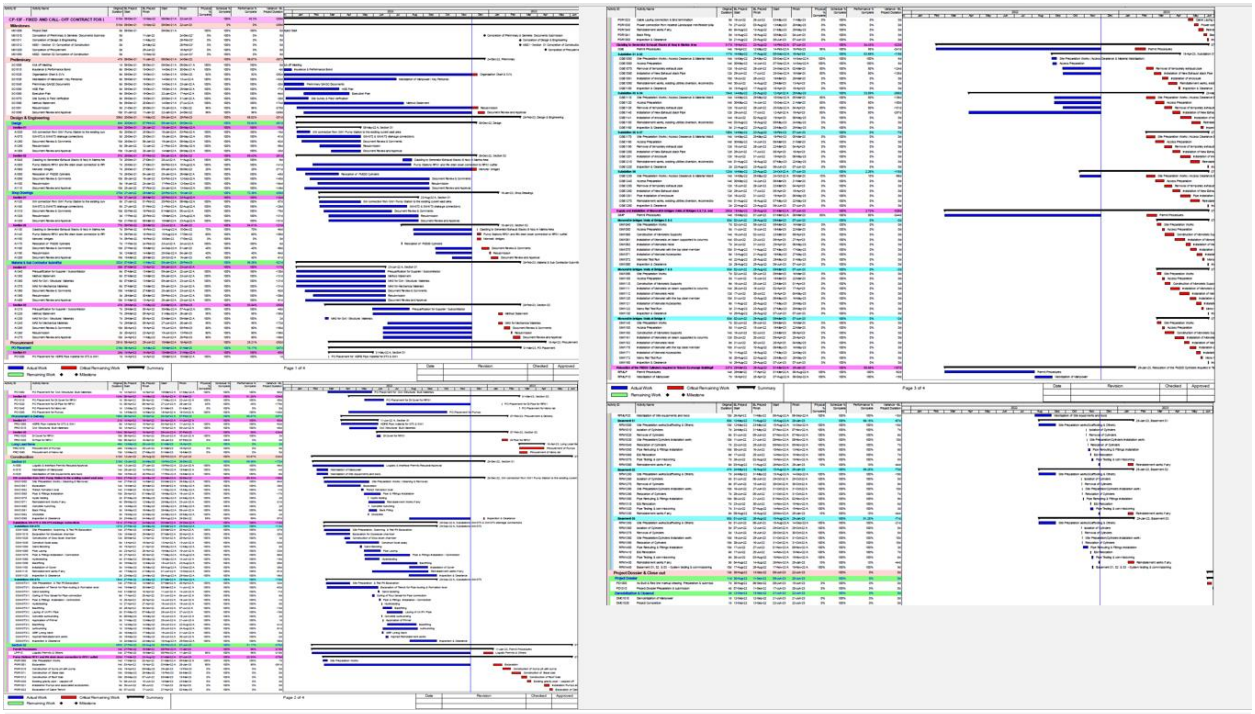

THANK YOU FOR YOUR ATTENTION!

APPENDIX 3

Classification of risks during the implementation of the road infrastructure construction project

Phase of life cycle	Types of risks	Possible risk options
Pre-investment phase	Incorrectly determined volume of transportation	Underestimation of the volume of transportation Revaluation of the volume of transportation
	Project risks	The risk of receiving a negative conclusion of examinations Insufficient level of competence of developers of the technical task Insufficient level of competence of project documentation developers
	The risk of insufficient regulatory and legal support	Lack of relevant legal acts Inconsistency of norms and rules of ukrainian and international legislation The risk of underestimating the
	The risk of non-systematics	Presence of «bottlenecks» Anticipatory growth of residential construction volumes
	Risks when agreeing on Areas for construction	The risk of a negative attitude of the population Archaeological risks The risk of choosing a suboptimal option in the investigation of the opposition of the owners of construction land plots
Investment phase	Financial risks	Risk of underfunding The risk of increased costs during the construction period Risk of bankruptcy of project participants
	Construction risks	The risk of a decrease in the quality of the work performed The risk of an increase in the duration of work on the project The risk of non-implementation of project decisions Logistic risks
	Political risks	The risk of foreign partners withdrawing from the project Emergence of protest measures The risk of foreign partners refusing to supply materials and equipment
Operational phase	The risk of a shortage of qualified personnel	The risk of errors in forecasting the need for qualified personnel The risk of inefficient use of qualified personnel Revaluation of personnel potential
	Environmental risks	The risk of man-made emergency situations The risk of deterioration of the environment
	Operational risks	Decrease in transport potential Wear and tear or lack of operational fleet