INITIAL ENVIRONMENTAL EXAMINATION (IEE) STUDY (TOR)

Terms of Reference
For
Initial Environmental Examination (IEE) Study
for Pilot Bridge Repair and Maintenance Works on 2 Bridges in Vientiane and Savannakhet Provinces

1. Introduction

Many bridges are being damaged and deteriorated in Laos, but only "breakdown-maintenance" is in place, in which repairs are performed only after the damage to the bridge has enlarged and "planned repair" has been absent. There are 3,580 bridges and structures nationwide, including 1,350 on National Roads, of which 35% require regular maintenance and 17% require emergency repairs. In addition, 40% are temporary bridges such as wooden bridges and Bailey bridges, which usually lack durability, and there have been multiple incidents of bridge collapse due to damage to bridges mainly caused by improper bridge repair and maintenance and overloaded vehicles.

Accordingly, JICA provides technical assistance program to the MPWT (Ministry of Public Works and Transport), entitled the Project for Capacity Development on Bridge Maintenance and Management (hereinafter referred to as "JICA-BMM") to establish bridge maintenance cycles (i.e., Inspection-Diagnosis-Planning-Repair) and contributes to the improvement of bridge maintenance capabilities of DOR, PTTI and DPWTs of the MPWT.

As part of the JICA-BMM, JICA and DOR selected the following 2 bridges for pilot repair and maintenance repair works in Vientiane Province and Savannakhet Province. This TOR is prepared to conduct Environment Assessment/IEE in line with the JICA and GOL's environmental and safeguard policy to facilitate implementation of pilot bridge repair and maintenance works on these 2 bridges.

2. Objectives

The main objective of this study is to carry out Initial Environmental Examination (IEE)/ Environment Assessment study as per JICA and GOL (MONRE)'s environmental safeguard policy assessment requirements of the pilot repair works on the following two bridges.

Namone Bridge (Bridge length=46m) KM 142+300, NR-13N, Vientiane Province
Xe Bangnouan Bridge (Bridge length=139m), KM 540+200, NR-13S, Savannakhet Province

This study will facilitate the implementation of these two bridge repair works. More specifically, the consulting firm should perform following task

- Study of relevant potential impacts and risks associated with the proposed project
- Study of compliance of the proposed project against applicable JICA and MONRE's requirements and environmental laws and regulations of the jurisdictions in which the project operates
- Study to incorporate impact avoidance and mitigation measures early into the project design process so that they can be easily accommodated

3.Scope of Work (Activities)

a) Environment Assessment of the previous project literature review and interaction with DOR/DPWT for a good understanding of the assignment.

b)The Consultant has to prepare the Environment Assessment/Initial Environment Examination study in accordance with JICA's Environment and Social Considerations (April 2010) and MONRE's IEE and EIA

guideline.
c)Provide an environmental and social baseline description of the Project;
d)Identify and describe the Project's potential environmental and social impacts;
e)Design mitigation measures to minimize adverse impacts;
f)Describe the Project's public consultation process and Grievance Redress Mechanism;
g)Provide Environmental Management and Monitoring Plans for the overall Project (including defining institutional responsibilities, capacity building and training, and the required budget);
e) Prepare and conduct 2 time in total (one time for each project site) stakeholder consultation meetings at the vicinity of two project sites (maximum of 50 participants per project site and 100 participants in total)

4.Inputs from DOR/DPWT/JICA
DOR/DPWT provides relevant documents /materials and information.
Inputs from JICA are listed below.
JICA Guideline for Environment and Social Considerations (April, 2010)
https://www.jica.go.jp/english/our_work/social_environmental/guideline/pdf/guideline100326.pdf
Environmental Checklist: 7. Roads
https://www.jica.go.jp/english/our_work/social_environmental/guideline/pdf/list7.pdf
General information on 2 bridges for pilot repair and maintenance works (General View, Periodic Inspection Result, Proposed Repair and Maintenance Works, BOQ of repair works)

5.Human Resources Requirement
5.1 Environmental Specialist: (One)
Environmental Specialist shall preferably have a Master's degree in environmental science/environment management/environmental engineering with minimum of 10 years' experience in EIA, IEE study and report preparation.

6.Qualification of Firm
a)Must be working in the field related to EIA, IEE preparation for at least 5 years.
b)Demonstrated Experience in preparation of EIA and IEE reports, preferably in road and bridge construction.

7.Terms of Payment
The payments shall be done as shown below (i) 20% of the contract amount Immediately after contract signing (ii) 40% after submission of draft report Approval from concerned Authority (iii) 20% after submission of final report Approval from concerned Authority, (iv) 20% after submission of IEE application and annex Approval from concerned Authority

8.Deliverables
The consultant will submit the following reports in the timeline stipulated below:
IEE Draft report (English): Within 1.5 months after signing the contract
IEE Final report (English): Within 2 month after signing the contract.
IEE application and annex* (Lao): Within 3 month after signing the contract. * IEE Final report (Lao)

9.Time

The duration of this task shall be 3 months from the date of signing the contract agreement with JICA.

10.Selection/Evaluation Process

The two envelope selection process applied. (1) One (1) CV for candidate Environmental Specialist r will be screened in compliance with the requirement listed in Item 5 and (2) Cost proposal will be evaluated for those firms which passed the first screening.

11.Duties and Taxes

The consultant shall pay all tariffs, duties, other taxes or charges levied by the GOL at any stage during the execution of the work.

12.Documents to be submitted by the Bidder (Eligibility Criteria)

(1) minimum of One (1) CV for candidate Environmental Specialist with signed cover letter

(2) Financial Proposal with signed cover letter including VAT (as per given format)

13.Acceptance of Proposal

All rights are reserved with DOR/DPWT either to approve or disapprove any proposal without giving any reasons whatsoever. If needed, the consultant will be asked for modifications and presentations of the proposal before approval.

14.Force Majeure

Without prejudice to their rights the Government and the service provider shall not be held responsible nor suffer any financial loss should the performance of the contract be delayed or prevented by an event of Force Majeure, which shall include, but not limited to strikes, riots, civil commotion, fire accident or any other incident beyond the control of either party hereto which neither party was aware of or could have foreseen at the time of signing of this contract. In event of an occurrence of the Force Majeure, either party shall notify other of the event or during such event the rights and obligations of either party shall automatically be suspended

Should you have queries on the notice, please forward an email clearly mentioning your queries to Ms. Koud at WhatApp (020-56434542).

Although efforts will be made to respond to such queries as soon as possible, kindly set aside ample time for us to furnish responses to your queries. Proposals must be personally delivered to the address given below by before 8, July, 2022

Financial Proposal
For
Initial Environmental Examination (IEE) Study
for Pilot Bridge Repair and Maintenance Works on 2 Bridges in Vientiane and Savannakhet Provinces

SN	Particulars	Quantity	Unit	Rate (LAK)	Amount (LAK)
A	**Remuneration**				
1	Team leader and environmental Expert	50	MD		
B	**Direct cost**				
1	Stakeholder meeting		LS		
C	**Report writing**		LS		
D	**Travel cost**		LS		
E	**Total**				
	VAT (10%)				
	Grand Total				

INITIAL ENVIRONMENTAL EXAMINATION (IEE) STUDY (NAMONE BRIDGE)

The Project for Capacity Development
on
Bridge Maintenance and Management
Nam Mone Bridge Vangvieng District, Vientiane Province

Initial Environmental Examination
(Draft Version)

Submitted to

Department of Natural Resources and Environment, Vientiane Province

Prepared by

Project Owner	**Environmental Consulting Company**
Department of Road Project Engineer: JICA-BMM (head by: IDCJ) Project Financier: JICA-BMM	Lao Consulting Group Ltd (LCG)

Abbreviations and Acronyms

BMM	Bridge Maintenance and Management
BMS	Bridge Management System
Covid-19	Coronavirus disease 2019
CP	Construction phase
DOE	Department of Environment
DONRE	Department of Natural Resources and Environment in Vientiane Capital/Province.
DOR	Department of Road
DPWT	Department of Public Work and Transport
EIA	Environmental Impact Assessment
EMMP	Environmental Management and Monitoring Plan
GDP	Gross Domestic Product
GoL	Government of Lao PDR
Gov	Government
HH	Household
IDCJ	International Development Center of Japan
IEE	Initial Environmental Examination
JCC	Joint Coordinating Committee
JICA	Japan International Cooperation Agency
MONRE	Ministry of Natural Resources and Environment
NA	National Assembly
NUOL	National University of Laos
OJT	On Job Training
ONRE	Office of Natural Resources and Environment in Districts.
OP	Operation phase
PC-I	Prestress Concrete I Girder
P-CP	Pre-Construction phase
PTI	Public Works and Transport Institute

RC-T	Reinforce Concrete T Girder
RMS	Road Management System
TWG	Technical Working Group
USD	United States Dollar
km	Kilometer
m	Meter
mm	Millimeter
cm	Centimeter
ha	Hectare
km^2	Square Kilometer
m^3	Cubic Meter
m^3/min	Cubic Meter/Minute
m/s	Meter/Second
kg	Kilogram
dB(A)	Decibel

Executive Summary

Regarding to the development of transportation network of the Lao Government since the Independence Day to the current, it indicated that the road network has been developed for connecting within the nation for 56.000 km and the bridge for 3.580 places. As Laos is the landlock country, therefore the road transport is the main option for the logistic and passengers. Thus, the maintenance and quality of transportation as the rehabilitation of road and bridge infrastructure is essential for the industrial development and the economic balance of the nation. In addition, the road and bridge maintenance work was included in the 5 years Economic-Social Development Plan, and the priority ranking on the budget allocation for the road and bridge maintenance is challenged and sensitive as the Lao PDR is a small country with the total population of seven million people and the annual budget for 3.7 billion US dollar. This budget is very limited comparing with one province in Japan. Currently, the spread of Covid 19 in the world has affected to the economy-society not be developed and recessive. For instance, the annually revenue of Lao PDR is decreased for 0.7 billion US dollar in this year (2021). For this reason, the report from the Lao Government through the Ministry of Planning and Investment indicated that the government is considering decreasing the development budget for 50% and the budget for central government for 30% and the budget for local government for 10%. Moreover, there is the potential to decrease the number of Government Officers as well as the bridge maintenance budget. However, regarding to the activities for implementation of the bridge maintenance, it indicated that the bridges have been used for many years which are damaged and broken but there are only the price assessment plans for the maintenance-rehabilitation work. These plans will be implemented once the damage occurred but there is no any maintenance plan. In Laos, there are 3.850 bridges, the national roads for 1.350 roads with 35% required for the regular maintenance and 17% required for the emergency maintenance. In addition, 40% of the bridges are the temporary bridges which were built by wood and steel. These bridges are not strong which have been broken regularly. In the previous, the accidents occurred for many times caused by the inappropriate maintenance and rehabilitation, the bridge damage or the over weight's truck. Most bridges in Laos were financially supported on the construction and maintenance from Japan. However, to ensure the safety traffic and smooth transportation on the road, the planning on bridge maintenance is significant in order to avoid the congestion.

As the result, JICA as the organization which always supported the Lao Government agreed to provide the grant to the Lao Government through the capacity building on the bridge maintenance and management under the project name "The Capacity Building on Bridge Maintenance and Management Project", to be called as "JICA-BMM". This project will define the bridge maintenance cycle including the inspection-analysis-planning and maintenance and the contribution in the capacity building on the bridge maintenance and management for the Department of Road, the Public Works and Transport Institution, Department of Public Work and Transport by the cooperation between the government-private-technical officers and the using of Japanese modern technology for the inspection and damage analysis of the bridge structure. JICA-BMM focuses on the implementation on the infrastructure management and time extension for using modern technology, the establishment of institution, the implementation plan for the maintenance work to cover all roads in Lao PDR.

Therefore, the bridge selection to be the pilot project for the management and maintenance is to survey along the national road by the participation of relevant divisions including the Department of Road and the Provincial of Public Work and Transport Department. The target bridges are located along 13th north and south roads based on the bridge management and maintenance plan of the Department of Road including along 13 north road: Paktang bridge for 80 m length, Houay pong bridge for 23 m length, Nam Bee bridge for 51 m length, Namone bridge for 46 m length, Houay pongsong for 40m length, along 13 south road: Xechampone bridge for 128m length, Xexamsoy bridge for 100 m length, Xebanghieng for 250 m length and Xebangnouan bridge for 140,37 m length. Based on the consideration by the project and relevant divisions, two bridges are selected; one bridge located along 13 north road and one along the 13 south roads as the pilot project for the implementation. The project selected Namone bridge located in the 13 north road which were built since 1991 and located in Km 142+300 from Vientiane Capital and along the 13 south road is Xebangnouan bridge which were built since 1988 and located in Km 540+200 from Vientiane Capital. The project activities are the capacity building for the technical officers on the inspection-analysis-planning and maintenance. Therefore, the pilot bridge maintenance will be one of project activities with the structure maintenance in the top and bottom parts. Based on the survey and analysis by the technical team, the project activities shall be prepared the IEE in accordant with the Lao Law.

- Based on the study on physical environment, the implementation of this proposed maintenance project will not cause the adverse environmental project as it is the maintenance project with no expansion. However, there will be minor and temporary impact from the construction activity such as dust, noise. In addition, Namone bridge is located in the community of Ban Phonesavang but the potential impact is able to control and minimize by the strictly implementation of mitigation measures as described in Chapter 5 and 6 of this report. Moreover, the project also plans and allocates the budget for the Environmental and Social Management and Monitoring Plan for the project implementation throughout the construction phase.
- The impact on surface water quality in Namone will be minor, due to the fact that the work volume and the chemicals caused the contaminated water is less. However, the project also developed the mitigation measures to avoid the damage on the water source by explaining the detail in the management plan to ensure the strictly implementation.
- The forest area is not lost as the project area is located in the existing place with no expansion.
- There is no invasion and resettlement in the project area, even there are houses and repairing shops, but this area was the invasion in the governmental land and conservation area for national roads. However, if it required constructing the bypass, the project will negotiate with the local authorities and there will not be the compensation to the violent people. The implementation on the mitigation measures is described in the impact mitigation plan in the Chapter 5 and 6.
- In term of the safety, the impact from the construction project is moderate as it is the bridge maintenance located in the national road; And the transportation is in high volume. However, this impact mitigation plan is developed for the strictly implementation in order to minimize the impacts from the construction activities in each phase.

It can be concluded the environmental and social impact is minor and temporary comparing with the positive impact. This project will contribute in the human resource development in order to enhance the capacity on the work implementation to be complied with the technical principle and to be sustainable. This is to ensure the long-term use and the traffic flow in order to save the budget for the new construction and also to develop the national economic-social development as mention above.

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Appendix 1 - Photos of the damage on Na Mone bridge

Appendix 2 - Minutes of Meeting on the projected area was encroached (state land), Na Mone Village, Vangvieng District, Vientiane Province on 16/5/2022.

Minutes of Meeting on the projected area was encroached (state land), Phonsavang Village, Vangvieng District, Vientiane Province on (Not yet).

Appendix 3 - The Result of Water Analyses from Phanthamit Laboratory

Appendix 4 - Socio – Economic Questionnaire Form for the Head of Na Mone Village and Phonesavang Village.

Appendix -5 Participant list on the public consultation with village level at the Namone village

Chapter 1: Project Overview

1.1 Project's Introduction and Reasons

Laos has developed a 56,000 km road network of and 3,580 bridges in a land locked country where road transport is a dominant transport mode to carry majority of passengers and cargos. Proper maintenance and performance assurance of these road and bridge infrastructures are indispensable for realizing the balanced industrial and economic development across the country as stimulated in the five-year National Socio-economic Development Plan. However, the institutional arrangement for maintaining and managing those road and bridge infrastructure is fragile. Laos is a small country with a population of about 7 million and an annual national budget of 3.7 billion USD, which is comparable to that of a small local government in Japan, and its external demand-led economic and industrial structure represented by the mining industry is easily affected by the global market. In fact, due to the worldwide spread of the new coronavirus and stagnant socio-economic activity, Laos expects a decrease in revenue of 0.7 billion USD this year. Due to this effect, it is reported that the Ministry of Planning and Investment of Laos is considering "50% reduction of development budget", "30% reduction of central government budget", and "10% reduction of local government budget". The risk of human resource reductions and budget cuts for bridge maintenance in Laos is extremely high.

Looking at the practice of the bridge maintenance, many bridges are being damaged and deteriorated, but only "breakdown-maintenance" is in place, in which repairs are performed only after the damage to the bridge has enlarged and "planned repair" has been absent. There are 3,580 bridges and structures nationwide, including 1,350 on National Roads, of which 35% require regular maintenance and 17% require emergency repairs. In addition, 40% are temporary bridges such as wooden bridges and Bailey bridges, which usually lack durability, and there have been multiple incidents of bridge collapse due to damage to bridges mainly caused by improper bridge repair and maintenance and overloaded vehicles. Bridges in Laos have been constructed and maintained with the support of Japan, but in order to ensure safe and smooth traffic on trunk roads, well planned maintenance and repair of bridges is crucial.

Accordingly, JICA provides technical assistance program, entitled the Project for Capacity Development on Bridge Maintenance and Management (hereinafter referred to as "JICA-BMM") to establish bridge maintenance cycles (i.e., Inspection-Diagnosis-Planning-Repair) and contributes to the improvement of bridge maintenance capabilities of DOR, PTI and DPWTs. Notably, Public-Private-Academia collaboration and adaptation of Japanese technologies to the bridge inspection and diagnosis are part of area JICA-BMM emphasizes in order to practice effective infrastructure management and lifetime extending maintenance technology and establish institutional maintenance framework and nationwide robust road network in Laos

1.2 Development Projects

In order to implement the Project for Capacity Development on Bridge Maintenance and Management will implement the inspecting the bridges along

the National Road No. 13 North such as: Pak Thang Bridge (the length is 80 m), Houay Pong Bridge (the length is 23 m), Nam Bee (the length is 51 m), Na Mone Bridge (the length is 46 m), and Houay Pong Song Bridge (the length is 40 m), Xechampone bridge (the length is 128 m), Xexamsoy bridge (the length is 100 m), Xebanghieng bridge (the length is 250 m) Xebangnouan bridge (the length is 140.37 m) which are selected as a model for project's implementation. The project selected Nam Mone Bridge which was built in 1991 and located on NR No. 13 North of Km 142 + 300 far from Vientiane capital and Xebangnouan bridge which was built in 1998 and located on the NR 13 south at Km 540+200 from Vientiane capital. This proposed selection is carried out correctly and in accordance with the policy and laws of Lao PDR, particularly Ministry of Natural Resources and Environment which provides the policies, legislation, regulations and laws to protect the environment from development projects and activities in Lao PDR, such as: the Decree on Environmental Impact Assessment No. 21/GOL, dated 31 January 2019, this decree is for the implementation and expansion of the contents set forth in Articles 21 and 22 of the Law on Environmental Protection (Revised version) No. 29/NA, dated 18 December 2012 and with aim of making all investment projects and activities of state and private sector both domestic and foreign working within the Lao PDR that cause or will cause the environmental and social impact to be unified process throughout the nation within the implementation of the study process on environmental impact assessment from investment projects and activities to be effective and actively contribute to the economic-social development of the nation to be sustainable.

Based on government's development and environmental protection policies will expect to make the proposed project in a sustainable project. Therefore, International Development Center of Japan (IDCJ) is through Department of Roads as the owner project, signed a contract with LCG (Lao Consulting Group Ltd), which is environmental and social consulting company to conduct a study-survey and prepare IEE report of this project. All process of study and survey are carried out in accordance with the regulations and guidelines issued by Ministry, Information dissemination, holding consultation meeting and participation from all parties, which starts from the village consultation meeting where is adjacent the project's area that are expected to be directly and indirectly affected, meetings at different levels respectively.

1.3 Objective and Scope of Study Initial Environmental Examination (IEE)

For the objective and scope of study IEE are focused on the study and assessment of potential impacts which may arise from activities and tasks related to the demolition, maintenance and operation of the project between 2 villages, namely Phonsavang and Na Mone villages, Vangvieng District, Vientiane Province, in IEE study will cover physical, biological, economic and cultural-social within the project and surrounding areas. In order to ensure that this project meets the environmental goals of Laws set by Lao PDR. In addition, IEE study will still provide the appropriate mitigation measures to minimize the potential impacts which may arise from project's activities and tasks. By main objective of this IEE study is:

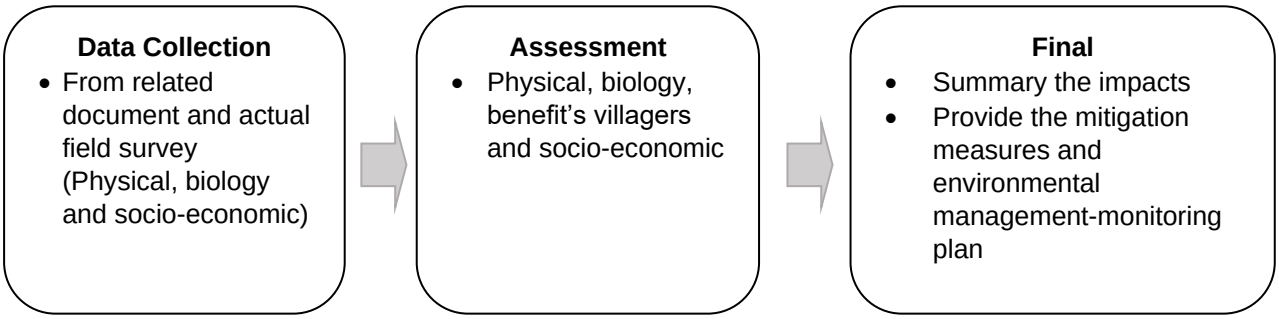
- To study the details of the current environmental area in the project's location and nearby areas before the construction of project.

- To assess the potential impacts both positive and negative due to the project's construction and operation activities.
- To provide the prevention of plan and determine the necessary measures to minimize the potential impacts which may occur by project's activities, including the timing of monitoring measures.

The study will cover various impacts that may be occurred during project's construction and operation activities such as:

- ✓ Generation of dust is from construction activities
- ✓ Noise is caused from construction equipment
- ✓ Solid waste is from construction
- ✓ Vehicular traffic and safety
- ✓ And other potential impacts

Study Methodology



1.4 Details about Project Owner and Environmental Consulting Company which prepares this IEE report

1.4.1 Project Owner (Department of Roads)

Department of Roads is the direct authority of Ministry of Public Works and Transport, and work as a secretary for Minister and Deputy Minister of the Ministry of Public Works and Transport in the micro-management of road-bridge works throughout the country, and according to rights and duties set out in Section 2, Article 3, Article 4 of the Agreement No. 27255/PWT dated 8 December 2017 on DOR's implementation and activities.

E-mail: lamphounk@yahoo.com, https://www.mpwt.gov.la/en/department-of-roads

1.4.2 Environmental Consulting Company

According to the discussion between International Development Center of Japan (IDCJ) and DOR, on behalf on the project owner, agreed to hire the environmental consulting Company as Lao Consulting Group (LCG) will be representative agency to study IEE for Project for Capacity Development on Bridge Maintenance and Management – Na Mone Bridge that located between Phonsavang Village and Namone Village, Vangvieng District, Vientiane Province.

Lao Consulting Group is a business consulting company in many areas such as: structural design, infrastructure, project management consultants

service, environmental consulting service has been registered about environmental and social impact assessment with Ministry of Natural Resources and Environment. According the business license No. 565/MONRE. DOEP, dated 19 June 2021. LCG headquarter is at Building No. 249, Lao – Thai Road, Watnak Village, Sisattanak District, Vientiane Capital, PO Box 3097, Phone number: +85621 313259 and +85621 314627, Fax number: +85621 313258,
E-mail address: lcg@laoconsulting.com , https://www.laoconsulting.com

1.5 The Outline of IEE report

The outline of Initial Environmental Examination Report or (IEE) is prepared on Project for Capacity Development on Bridge Maintenance and Management – Na Mone Bridge that located between Phonsavang Village and Na Mone Village, Vangvieng District, Vientiane Province is according to Decree No. 21/GOL, dated 31 January 2019. Also, according to Technical Guideline on Initial Environmental Examination Writing from Investment Projects and Activities in Lao PDR, No. 29797. 1/MONRE.DESIA.DMM. Vientiane Capital, dated 19 December 2016 is the main version. However, the outline of report may not follow all the steps or topics that defined in table of content of the technical guideline. Because the technical guideline is applied for all types of projects that have studied and there are different types of impact assessment. It depends on process and implementation of that project. This report includes 8 chapters with the following detail and outline are shown below:

Chapter 1 Introduction: There are the brief description of the project's background, objectives, project goals, information of project developer, information of environmental consulting company, and project study plan.

Chapter 2 Relevant Policies and Laws: it is a presentation on regulations, policies, laws, decrees, agreement, guidelines, etc. which are the basic of environmental standard, the relevant of legislations on environmental and social as the reference of the project study.

Chapter 3 Project Description: it is about the details of project which contains the type and size of the project, the importance of the project, service, details of project, construction and operation activity, etc.

Chapter 4 Current of Project Environmental Area: physical elements (Climate/meteorology, topography, soil and erosion, water resource and water quality, air quality, mineral resource, noise and vibration and waste disposal). Biological elements (condition of forest and plant species, wild animals, aquatic animals and aquatic habitats, protected areas). Economic condition (condition of industrial, infrastructure, transportation) and culture and social (land use right, community, population, religion, health, education, culturally important places and etc.,)

Chapter 5 Impact Assessments and Mitigation Measures: is to conduct the assessment of potential impact and mitigation measures (Project's construction and operation phase). In that, IEE will be divided into the following aspects: physical environment, biological environment, economic and cultural – social environment. To provide the mitigation

measures of impacts.

Chapter 6 Environmental and Social Management and Monitoring Plan: is summarized the major impacts and overall mitigation impact of project, details of the monitoring and budget plan is provided for environmental and social monitoring activity.

Chapter 7 Consultation and Public Participation: is to explanation about the implementation of consultation with public, also evaluation and summarizing the villager's opinions and suggestion to project such as there is the community participation in proposed working plan.

Chapter 8 Conclusion and Recommendations: it summarizes the results of study and provides the recommendations for both project implementation and environmental impact management.

1.6 Consultant Team on IEE Study

Technical officers who participate for this study and survey - information gathering for IEE of Project for Capacity Development on Bridge Maintenance and Management – Na Mone Bridge that locates between Phonsavang Village and Na Mone Village, Vangvieng District, Vientiane Province. Most of them are experts and officers from Lao Consulting Group. In addition, LCG also invited local government officer to participate in the survey – data collection and field consultation meeting every time such as: representative unit of Department of Natural Resources and Environment, Vientiane Province, and Office of Natural Resources and Environment, Vangvieng District and other related sectors.

Name List of Consultant Team on IEE

Name List of Consultants	Specialist And Responsibilities
Mr. Bounzou Wangsakoun	Social Specialist/ Project Coordinator
Mr. James Peter Grindey	Water Management and Irrigation Specialist
Mr. Kanda Keosopha	Social Specialist
Mr. Olivier Philaphandeth	GIS and Environmental Sciences Specialist
Mr. Bounpanh Thepphavong	Environmental Engineering Specialist
Mrs. Thipphachanh Souphihalath	Environmental Engineering Specialist
Mr. Phasouk Manivanh	Environmental Science Specialist
Mr. Viengdavanh Phommachanh	Geology Officer
Mr. Xay Lor	GIS and Engineering Officer.

1.7 Project Study Plan

Project study plan will implement for each critical works, it is expected by timing of usage. Timing can be flexible for each works which can depend on the consideration and decision from the relevant divisions, particularly the task of meeting depends on the government sector's levels who can make the decision on it. On this manner, proposed timing can be adaptable any time as below:

Table1. 1: Project IEE Study plan of bridge maintenance

ລດ	ລາຍລະອຽດໜ້າວຽກ	ຊ່ວງເວລາ	2022																				Relevant Authorities
			ເດືອນ ສິງຫາ				ເດືອນກັນຍາ				ເດືອນຕຸລາ				ເດືອນ ພະຈິກ				ເດືອນ ທັນວາ				
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	
1	ກະກຽມທີມງານ, ຕິດຕໍ່ພົວພັນ ເອົາຂໍ້ມູນ ກັບ ພຍທຂ (DPWT), ພຊສ (DONRE), ແລະຫ້ອງການສິ່ງແວດລ້ອມ ແລະລົງເກັບກໍາຂໍ້ມູນພາກສະໜາມ ໂດຍພົວພັນກັບນາຍບ້ານ	1-10 August 2022 VT and SNK																					LCG's team, DPWT, DONRE and Village head
2	ລົງເກັບກໍາຄຸນນະພາບສິ່ງແວດລ້ອມ (ຕົວຢ່າງຂອງນໍ້າ, ອາກາດແລະສຽງ) ແລະສົ່ງໄປຫາຫ້ອງທົດລອງທີ່ໄດ້ຮັບການຢັ້ງຢືນ	10-25 August 2022																					LCG's team, Lab team and DONRE
3	ເກັບກໍາຂໍ້ມູນເພື່ອໃຫ້ໄດ້ຮັບຂອບເຂດ ການສຶກສາ, ເຂດແດນທີ່ຕັ້ງຂອງໂຄງການ, ເພື່ອໃຫ້ໄດ້ຮັບຂໍ້ມູນອຸຕຸນິຍົມ, ຂໍ້ມູນອຸທົກກະສາດແລະຂໍ້ມູນຂ່າວສານສິ່ງແວດລ້ອມອື່ນໆ	7-25 August 2022																					LCG's team, Lab team
4	ວິເຄາະຂໍ້ມູນ ແລະຮ່າງ TOR ບົດລາຍງານ ຂອງບົດ ບສຕສ	10-25 August 2022																					LCG's team, Lab team, Local staff
5	ສົ່ງ TOR ສໍາລັບການສຶກສາ IEE ກັບ DONRE (VT ແລະ SNK)	21-30 Aug, 2022																					DONRE (VT and SNK)
6	ຂັ້ນຕອນການກະກຽມ ຮ່າງລາຍງານ ບສຕສ IEE ແລະ ESMMP	1 Sep-31 Nov, 2022																					DONRE (VT and SNK)
7	ຕິດຕໍ່ພົວພັນກັບອົງການບ້ານ, ເມືອງ ແລະ ແຂວງ ເພື່ອໃຫ້ໄດ້ຮັບຂໍ້ມູນທົ່ວໄປຂອງໂຄງການ ຕື່ມ	15 August-31 Nov, 2022																					Bridge located district
8	ການປຶກສາຫາລືຂັ້ນບ້ານ ແລະ ເມືອງ ເພື່ອສະເໜີຮ່າງ IEE (ຈັດຕັ້ງຢູ່ເມືອງ ຂົວທີ່ຕັ້ງຢູ່)	20-30 October, 2022																					Sub-contractor team, DONRE, local authorities
9	ສົ່ງຮ່າງ IEE ແລະ ESMMP ສະບັບທີ 1 ໃຫ້ DONRE ເພື່ອທົບທວນ	1-5 Nov, 2022																					DONRE
10	ປັບປຸງຮ່າງ IEE ຫຼັງຈາກຄໍາເຫັນຈາກ DORE ແລະການປຶກສາຫາລືທີ່ຜ່ານມາແລະສົ່ງຄືນໃຫ້ DONRE ທົບທວນຄືນ.	20 -30 Nov, 2022																					Sub-contractor team
12	ສົ່ງຮ່າງ IEE ແລະ ESMP ສະບັບສຸດທ້າຍໃຫ້ DORE ເພື່ອທົບທວນ ແລະອະນຸມັດ	1-7 December, 2022																					DONRE
13	ລໍຖ້າການອອກໃບຢັ້ງຢືນສິ່ງແວດລ້ອມ	7-21 December, 2022																					DONRE

Remarks:

IEE = Initial Environmental Examination ບສຕສ

ESMMP = Environmental and Social Monitoring and Management Plan

VT = ແຂວງ ວຽງຈັນ

SNK = ແຂວງ ສະຫວັນນະເຂດ

DONRE= ພະແນກຊັບພະຍາກອນທໍາມະຊາດ ແລະສິ່ງແວດລ້ອມ

DPWT= ພະແນກໂຍທາທິການແລະຂົນສົ່ງ

Vientiane Capital, Dated: 25 July 2022

Chapter 2: Relevant Policies and Laws

This proposed Project for Capacity Development on Bridge Maintenance and Management will be conducted the study of IEE, based on the relevant laws and policies such as: details of laws, decrees, agreement, instructions and regulations. Those are related to environmental and social management that are effective for environmental and social impact assessment. The project's activities shall comply with the requirements that specified in the legislation, the line organizations of government are right to issue the policies and laws which are related to environmental and social impacts. The framework of policies is objective to minimize the potential impacts on community and environment from the project. In expansion, the project's execution is to guarantee the sustainable development and compliance with government – party's socio-economic development policy. The legislation, laws and regulations include:

2.1 Law and Regulation

2.1.1 Environmental Protection Law (No 29/NA, December 18, 2012)

The Environmental Protection Law defines principles, regulations and measures related to environmental management, monitoring of protection, control, preservation and rehabilitation, with quality, of mitigating impacts and pollution created by anthropogenic loads or by nature, aiming to provide balance between social and natural environment, to sustain and to protect natural resources and public health; and contribution into the national socio-economic development and reduction of global warming.

This project is a development project to increase the efficiency of transportation, bridge maintenance and management. Which must concern on the implementation work of demolition and maintenance, traffic within project's area.

According to Part I, Article 6 Principles of Environmental Protection and Article 7 Commitment in Environmental Protection, Part III, Article 12 Importance of Environmental Protection, Article 17 Environmental Prevention Tasks and Article 21 Initial Environmental Examination, Article 25 Limitation of Impacts Derived from Construction Activities and Others. and Part VIII, Article 70 Prohibitions of Operators or Project Developer (new) are applied for the project development shall implement works with environmental protection, it is supervised by Department of natural resources and environment; and district office of natural resources and environment as specified in Article 80 and 81. This proposed project is located near the community, along the main road or national road, it shall implement the impact mitigation strictly (both construction and operation phase) based on the articles that defined in this law.

2.1.2 Law on Construction (No.05/NA, November 8, 2009)

The Construction Law defines the rules, regulations and measures on the management, permission, control, monitoring and inspection of all types of construction as define in Article 5 Construction activity shall ensure It shall be compliance with the national socio-economic development plan, the master development plans of each sector, the quality, the safety, and will

not cause excessive negative impacts on social and environment. It shall not cause any over-limit annoyance to the people living close to the construction site.

Article 34 Safety Measures: In general, the safety measures shall follow the regulations issued out by relevant sectors such as: The danger warning signs, the fence around the construction site, the safety equipment, for laborers (helmets, boots, gauntlet, glasses).

In case the forced majeure such as: Flood, storm, fire, earthquake, landslide or other disasters happens, which affects the construction, the contractor shall immediately take preventive and corrective measures as follows:

1. Provide disaster warning in the construction site;
2. Temporarily stop the construction and take solving measures in time to ensure the safety of laborers and to protect the properties of the construction project;
3. Report any case of the incident to project owner, relevant officers as well as local authority immediately for prompt action.

2.1.3 Land Transportation Law (No. 024/NA, December 12, 2012)

The Land Transport Law has the function of determining the regime for the administration and operation of the domestic, international and cross-border transport of goods and of passengers in order to efficiently and safely expand travel and distribution of goods without environmental and social impacts., increase the contribute to socio-economic development and international cooperation.

Article 5 (new) Principles on Land Transport

1. To ensure relevance to the national socio-economic development plan as well as to ensure socio-economic effectiveness, peace in the country and environment protection;
2. To ensure quality, comfort, rapid service and life's safety, health, asset, right protection and benefit for service provider;
3. To ensure transparency, justice and good manner in service;
4. To ensure economic-technical, modern technology, standard service on land transport.
5. To collaborate with the relevant sectors and local authorities in order to effectively manage, monitor and inspect on land transport sector. The operator's obligations on land transport, they shall follow the law on land transport, security, follow the rule, road protection, environmental and social, employee training as well as fulfill other obligations stipulated in Article 5 regarding to law on land transport. In this Article 33 defines the construction project, road maintenance or other road construction, it shall ensure to minimize the environmental and social impacts as following:

   To ensure the traffic is convenient and follow the rule,

   To ensure the safety by install traffic sign, reflective warning signs that can be seen easily and clearly from a distance install lights and hazard warning lights in night time.

   Project shall ensure the construction or maintenance to complete on working schedule, quickly, on time and get the quality for the traffic.

2.1.4 Land Law (No. 70/NA, June 21, 2019)

Land Use for project development shall ensure the effectiveness of the work aiming and regulation, thus contributing to national socioeconomic development as well as to protect the environmental and social. The related Article with type of this proposed project is belong following articles:

Article 6 Protection of Land and Environment: All individuals and organizations shall have the obligation to protect the land to ensure that it is in a good condition in which there is no soil erosion, land subsidence, and soil degradation and which is suitable to each category of land, and to ensure that the area of each land category is not decreased without due authorization.

2.1.5 Law on Investment Promotion (No. 02/NA, November 17, 2016)

This Law applies to investment of domestic and foreign natural persons and legal entities investing and doing business in the Lao PDR.

In Article 4 Government policies on investment promotion: The Government promotes investment in all sectors, business operations and in areas throughout the country except for the areas and business operations which are detrimental to national security, natural environment, at present and in long-term, public health and fine national cultures.

2.1.6 Labor Law (No.021/NA, December 24, 2013)

This law objective defines for labor protection, labor skills development in order to enhance the quality and productivity of work in society, so as to ensure the transformation to modernization and industrialization aimed at safeguarding the rights of employees and employers, without discrimination as well as the legitimate interests does not allow the use of forced labor in any form if there is recruitment any foreign worker per labor unit, shall give priority to Lao workers first. Day off shall be compliance with government's policy and the continual improvement of their livelihoods, while contributing to the promotion of investment, national socio-economic development, and regional and international links.

The employer must set hours of work and hours of rest for the employee as part of its responsibilities in accordance with the location of the labor unit and real working conditions as mentioned in Article 51 in every labor unit will be no more than six days per week and eight hours per day or no more than forty-eight hours per week and Hours of rest for lunch break shall be no less than sixty minutes per day.

Determination of Salary or Minimum Wage in Article 108: The State promulgates the level of minimum wage or salary at every interval based on the results of consultations with third parties.

2.1.7 Law on Water and Water Resources (No. 115/Pres., May 11, 2017)

This Law determines the necessary principles, regulations, and measures relating to the management, administration, protection, development, use and water resources, prevention of water degradation, rehabilitation of impact areas, to ensure water volume and quality in sustainability as in Article 6 shall be managed and Part IV-Article 26 Protection of Water and Water Resources defines that Individuals, legal entities, or organizations

have the obligations to preserve water and water resources in good, not cause to be polluted to water and water resources.

Article 31 (new) Permission of wastewater discharge: Polluted water that exceeds the discharge standard must first be treated before they may be dumped or discharged into water sources by Individuals, legal entities or organizations. They shall get permission from relevant sectors such as: Department of Natural Resources and Environment, pay the fee and service of wastewater discharge according to the regulation. There are 3 levels of wastewater such as: small, medium, and large based on the volume of wastewater and the concentration of chemicals mixed in the wastewater.

2.1.8 Law on Hygiene, and Health Promotion (No. 73/NA, November 22, 2019)

The construction development shall follow law, regulation and measures in hygiene disease prevention that may arise from the project's implementation. The project developer shall conduct the health promotion in order to maintain the good health, quality of life and increase the awareness of important hygiene, environmental and social protection to focus on reduction of sickness, death and diseases prevention.
Article 20: The employers shall provide safety equipment to workers and shall ensure the hygiene of the work places, mainly, provision of sufficient light and air ventilation, appropriate temperature, humidity, vibration, noise, odor and dust that shall not be over the standards provided by relevant regulations. Employees and business operators, particularly in the sectors of activities which are hazardous to health, shall be protected, received health examinations, treatment and health care in accordance with the laws and regulations

2.2 Decree, Policy, Technical Guideline and Standard

2.2.1 Ministerial Agreement No. 80565/MONRE dated on 17 December 2013

Ministerial Agreement on the Endorsement and Promulgation of List of Investment Projects and Activities Requiring for Conducting the Initial Environmental Examination or Environmental and Social Impact Assessment (No. 8056/MONRE, dated on 17 December 2013) defines that the list of Investment Projects and Activities consists of types and scales of Investment Projects and Activities has categorized into two groups such as: group 1 shall prepare Initial Environmental Examination (IEE) and group 2 shall prepare environmental and social impact assessment (ESIA).

Investment Projects and Activities are classified into 5 sectors such as: (1) Energy Sector, (2) Agriculture and Forestry Sector, (3) Industrial Processing Sector, (4) Infrastructure and Service Sector, and (5) Mining Sector. This proposed project is categorized in No. 4.12 on Rehabilitation of national, provincial, district, rural and special roads.

2.2.2 Decree on Environmental Impact Assessment (No. 21/GOL, dated 31/01/2019)

This Decree provides rules, regulations and measures on management and monitoring implementation of environmental impact assessment

activities to make sure that such activities are proceeded correctly with transparency and in concerted form with purpose to protect environment, mitigate and remedy impacts on environment, ensuring that the compensation is reasonable, relocation and occupational resumption and restoration of livelihood of the affected people is improved more than before, making management and use of the natural resources is efficient, securing the rights and interests of the nation and the people, contributing to the implementation of the National Social and Economic Development Plan in the direction of green and sustainability.

Article 9 Grouping of Investment Projects and Activities: The investment projects and activities that are believed that will cause less or not-severe impacts on social and natural environment will be conducted IEE (This project is project developer's land for the implementation, no new resettlement, compensation and land transformation to be used in the project). Detail of this IEE defines in Group 1 covers Article 11 – Article 18 which has specified the fully process of IEE study.

2.2.3 Decision No. 2797.1/ MONRE. DESIA. DMM, dated on 19 December 2016

Decision on the approval and promulgation of Technical Guideline on IEE report No. 2797.1/ MONRE. DESIA. DMM, dated on 19 December 2016. It has been to guide and assist project developers and environmental consultant service how to prepare IEE from project investments and activities in Lao PDR. The goal is to ensure that the IEE reports include quality, accuracy, adequate project descriptions and being an effective implementation. In addition, to ensure IEE report to follow the process and provisions of the relevant laws, both with the quality of the content and in accordance with the set of standards and international standards.

2.2.4 Decision (No.707/MONRE, dated on 5 Dec 2013)

Decision on the approval and promulgation of Guideline on Public Involvement in the Environmental Impact Assessment process for project's investment (No. 707/MONRE, dated on 5/12/2013. This objective is to ensure the implementation of public involvement to be corrective and compliance with regulation, transparency and participated by affected person from project's investment in the participation process. To help them receive the justice in solving the impacts that caused by investment project in reasonable way.

This goal of decision is to open opportunities for the public involvement in the plaining and decision-making of project's investment, including the resolution of environmental and social impacts. The benefits will be obtained from the project in a fair manner and to avoid or reduce the occurrence of conflicts with the development of project's investment; giving them the opportunity to present their opinion on the implementation of project; At the same time, they can learn and share lessons with relevant sectors in career development, local economy, protection and management of natural resources.

2.2.5 Decision on National Environmental Standards (Amended) No.81/GoL, 2017.

This Decision determines parameters and levels of pollutant concentrations in the national environmental standards as scientific reference in the monitoring of the environmental quality and controlling of pollutions emitted to air, or discharge to soil and water, noise. There are 6 chapters and 18 Articles which has detail about environmental standards, Pollution standard, type of pollution, volume of concentration, parameter and concentration indicator to control the pollution into environment which may arise impacts to life, health of human, animal and ecology system from the development projects.

2.2.6 Decree on Labor Safety and Health (No. 22/GOL, 05 Feb 2019)

This decree defines the principles, regulation and measures on labor safety and health to prevent labor accident and occupation disease that may occur, which aims to protect the rights, benefit of employer and employee, which is related to the content of Article 2 - Labor safety and health: to control the risk assessment of work environment, proper measures to reduce hazards and how to prevent labor accident, prevent occupation diseases and focuses on the safety culture within workplace. All above mentioned details are specified in Article 5 – the principle on safety work and labor's health, Article 8 – Employee's Right, Article 10 – Employer's Right, Article 17 – Measures on the use of Personal Protective Equipment, Article 18 – Sticking of Symbols, Signs and Warning Signs of Danger, Article 19 – Culture Safety and Labor's Health, Article 20 - Prevention of Labor Accident, Article 21 – Occupational Disease and other related disease. Therefore, project shall pay attention to this decree because it is related directly on hiring of staff, labor and worker to work with this project in the future.

2.2.7 Decree on the Origin of Import and Export Goods (No. 228/PM, dated 22 April 2010)

This Decree stipulates the principles and rules on the origin of import and export goods aiming at promoting both domestic and foreign trade and investment, benefiting from trade preferences, protecting the environment, which will contribute to the strengthened development and growth of the national economy and improved livelihoods of the people. This decree will help this proposed project to become a source of origin, warehouse for import and export goods that are modern and increase standard. It shall be based on the conditions or implementation procedures of origin goods that specified in Chapter 4 - Article 11: Issuance of certificates of origin of export goods and Article 12: Customs Declaration and pre-determination of origin of import goods, the project shall comply with this decree in order to high authority regulation has set.

2.2.8 Road Manual on Maintenance Activity Codes (MAC), August 2020

This is a manual and method about the implementation of road repair, maintenance in the same standard and uniform to apply throughout the country and local level. This manual defines the types of roads, preparation method, maintenance method, how to use mechanical equipment and related components in the implementation of work such as:

the project shall use the code of bridge maintenance which mentioned in the manual. For example: Code No.142 means the bridge cleaning, Code No. 145 means the maintenance of steel bridge surface, AA 003 means the method of maintenance on steel bridge's part, AA 005 means the maintenance of bridge surface pavement with concrete floor, AA 009 means the method of expansion joint is between road and bridge.

2.3 Protocol and International Conventions Related to the Impact of the Project

The government of the Lao PDR has participated as a party to protocols and conventions related to the following projects:

Convention

- United Nations Framework Convention on Climate Change (1992);
- ASEAN Agreement on the Conservation of Nature and Natural Resources in 1985;
- International Plant Protection Convention (IPPC) in 1955
- Kyoto Protocol to reduce greenhouse gas emissions in 2003.

Protocols and standards

- Kyoto Protocol of United Nations Framework Convention on Climate Change, dated on 11 December 1997 and 15 November 2002 was effective on 21 November 1998, and 6 February 2003.
- ISO 14001 and International Finance Corporation (IFC).

Chapter 3: Project Description

3.1 Project Introduction and Concept

From the monitoring and survey of the bridge management in Laos, the previous characteristics are shown below:

- Most of the concrete and steel bridges, including those were supported by the previous Soviet Union in the 1960s and 1970s and large bridges which were for the most part built by foreign donors.
- At the same time, there were temporary bridges such as: Bailey bridge was built by steel. (Remark: deterioration mechanism of bailey bridge was conducted the research by Nagasaki University/National University of Laos)
- 1/6 of number of bridges is on the national road, they have been in utilizing more than 40 years. 1/10 of number of bridges is very urgent for maintenance.
- The request of emergency maintenance is very high increasing. Japan would like to utilize the knowledge and experience on bridge maintenance and management.
- The bridge inspection has not done since 2016 because there was a few changing of responsibility (handover from PWTI to DOR). The previous inspection was conducted by visual inspection without devices of detail inspection. Remark: the lasted of bridge inspection was conducted through the WB-LRSP2 Project in 2020.
- Damage diagnosis was identified by RMS/BMS but is not yet effective. Due to the lack of fully understanding is about the bridge's structure, deterioration mechanism, prioritization and maintenance method.
- The planning of yearly budget was spent for the bridge restoration and maintenance approximately 1 million US dollar in each year (1% of Road Fund Budget), most of budget was spent for emergency works. As the results, it was very difficult to restoration and prevention for medium and long term.
- Maintenance work was only conducted by sub-detail of maintenance in field after the bridge had been deteriorated.

3.1.1 Project's Objectives, Results and Activities

- Before Project for Capacity Development on Bridge Maintenance and Management (JICA-BMM) will implement, it was executed the detailed planning design in February and March 2020. The objective was to identify the project's scope and target by utilizing Matrix PDM, it is an advance standard in engineering to identify of targets, objectives, results and project (JICA-BMM) activities. After that, there was the discussion and agreement on the detailed planning design and implementation with key unit particularly with MPWT of JICA-BMM. The summary was evaluated the project's (JICA-BMM) results and alternative by PDM as following below table:

Table3. 1 Project's Evaluation of Results and Alternative

PDM designed during the Detailed Planning Survey
Overall Goal Bridges in pilot provinces (Vientiane, Savannakhet and Champasak) are properly maintained.
Project Purpose Bridge management capability of DOR and pilot DPWTs is improved.
Output 1. Bridge inspection and diagnosis capability of DOR and pilot DPWTs is improved. 2. Bridge repair and maintenance capability of DOR and pilot DPWTs is improved. 3. Operational and management capability of Bridge Management System (BMS) of DOR and pilot DPWTs is improved. 4. Capability for bridge management planning of DOR and pilot DPWTs is improved.
Activities 1-1. Conduct situation analysis and identify issues for bridge inspection and diagnosis 1-2. Prepare draft Bridge Inspection and Diagnosis Manual, including that for Large-scale bridge(s)1-3. Implement pilot bridge inspection and diagnosis, following the Manual drafted in Item 1-2. 1-4. Review and revise Bridge Inspection and Diagnosis Manual and finalize thru approval by MPWT 1-5. Carry out technical trainings for Bridge Inspection and Diagnosis Manual 2-1. Conduct analysis and identify issues in the condition of bridge for repair and maintenance 2-2. Prepare draft Bridge Repair and Maintenance Manual, including that for Large-scale bridge(s) 2-3. Implement pilot bridge repair and/or maintenance, following the Manual drafted in Item 2-2. 2-4. Review and revise Bridge Repair and Maintenance Manual and finalize through approval by MPWT 2-5. Carry out technical trainings for Bridge Repair and Maintenance Manual 3-1. Conduct situation analysis and identify issues on management of Bridge Inventory 3-2. Development of beta version of BMS that demonstrate how to collect data for damage inspection. 3-3. Carry out data input and analysis utilizing beta version of BMS 3-4. Properly and corrective customize BMS is improved. 3-5. Carry out technical trainings for BMS correctly 4-1. Implement situation analysis on bridge maintenance and management plan, in line with BMS analysis 4-2. Identity priority bridge repair projects and revise bridge maintenance and management plan 4-3. Finalize bridge maintenance and management plan and request the budget 4-4. Carry out planning, monitoring and evaluation of pilot bridge inspection and repair works (Item 1-3 and Item 2-3), following bridge maintenance and management plan 4-5. Carry out technical trainings for BMS based bridge maintenance and management plan

Source: JICA expert team

3.1.2 Scope of the Project Study

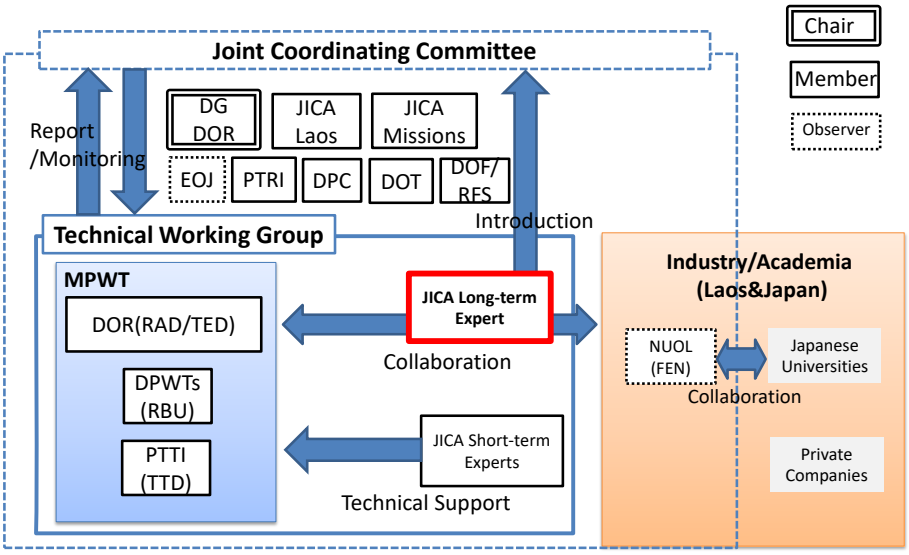
Vientiane, Savannakhet and Champasak provinces are pilot provinces to apply the bridge maintenance and management system (Bridge Inspection and Maintenance) through the on-the-job training (OJT) in project operation phase. It is expected that all the mentioned provinces will participate directly or indirectly, when there are the dissemination of information and practicing on the bridge management system/Technical Manual are developed by JICA-BMM.

3.1.3 Project's Organization Chart

After the establishment of JICA-BMM, there are two groups to implement the project: Joint Coordinating Committee (JCC) and Technical Working Group (TWG). JCC is responsible for monitoring the project's progress,

giving recommendations, and some cases have to be approved the work for TWG to implement the actual work within JICA-BMM. JCC is chaired by Director of DOR and team members from the relevant sectors in MPWT. The work implementation of TWG is composed of experts who will be appointed by JICA such as: technical officers and administrative officers during project's operation.

The JICA-BMM's character is similar with other projects that are supported by JICA, require the cooperation from many divisions such as: private-public-technical officers from the related institutions, appointed experts from JICA. Faculty of Engineering, National University of Lao (NOUL) was selected to participate in JICA-BMM as a partner in this work. It is expected that there will contribute the project's activities for research and consulting services. In addition, it will promote the sustainable development of the project. Appointed JICA's experts will work as the center of cooperation among government – private sectors and technical officer from education institution of Lao – Japan.



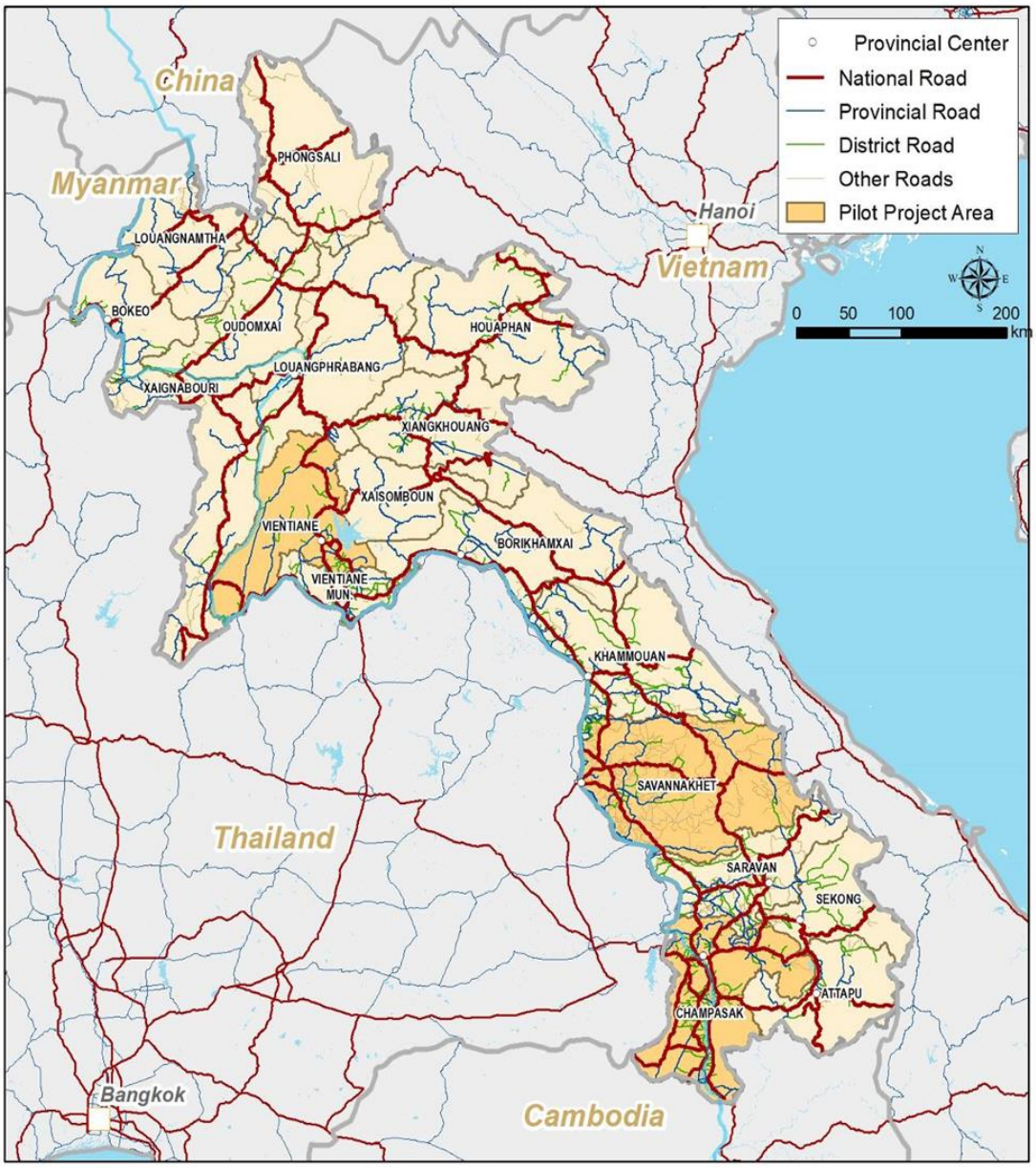
Note: **RFS**: Road Fund Secretariat, **RAD:** Road Administration Division, **TED:** Technical& Environment Division, **RBU:** Road and Bridge Unit, **TTD:** Technical Training Division, **FEN:** Faculty of Engineering

Source: Record of Discussion of JICA-BMM

Figure3. 1 Project's Organization Chart

3.1.4 Project Location

The target project is located in 3 provinces as previously mentioned in topic 3.1.2 within these provinces.



Source: JICA Expert Team

Figure3. 2 Locations of Pilot Project Area in Vientiane province, Savannakhet province and Champasak province

3.2 Project Concept

3.2.1 The Overall of Project Concept

As a result of large-scale and intensive road and bridge infrastructure development in Japan during the period of high economic growth, one out of ten bridges have been in service for more than 50 years, the bridge infrastructure has become aging. Due to the declining birthrate and aging population and lower economic growth, Japan faces difficulty to sustain human resources and secure financial resources for the infrastructure maintenance and management. In the middle of those circumstances, the public sector, private industry and academia worked together to design a system for extending the lifetime of infrastructure, triggered by the "Sasako Tunnel Ceiling Plate Collapse Accident," occurred in 2012, which

was the worst accident in the history of Japan Highway. As a result of this accident, standard guidelines for inspection and diagnosis were developed, technical qualifications for inspection and diagnosis were established and operated, and mandatory regular bridge inspections were regulated once every five years. It also leads to the promotion and operation of the introduction of new technologies related to inspection/ diagnosis and repair of the infrastructure.
Making maximum use of these experiences and know-how obtained in Japan, the Expert Team sets the following four pillars of the project approach, including the response to the on-going COVID-19 epidemic, and provides efforts to maintain and manage bridge infrastructure and extend the service life of those bridges under the constraints of human resources and financial resources in Laos

3.2.2 Project Works item and Activities:
List of Project Works item and Activities:

- Prepare of the work process
- Finalization of Work Process
- Selection of C/P personnel and TWG members
- Set up the Organization of JCC
- Evaluation in collaboration with Road Asset Management Platform
- Preparation of Monitoring Sheet
- Conducting Trainings
- **Implementation of the Pilot Project (Bridge Repair) to do the IEE study**

3.3 Details on the selection of model bridge for the project.

From the results of initial inspection/diagnosis and proposed bridge maintenance which implemented between February and March 2020, including 5 enforced concrete bridges and 4 steel bridges in Vientiane and Salavan provinces. The results are summarized in the below table:

Table3. 2 Inspection Results of Deteriorated Bridges in Vientiane and Savannakhet Provinces.

Name of Bridge	Location of Bridge	Superstructure Work type	Element							
			Superstructure			Substructure	Bridge accessories			
			Main girder	Cross girder	Deck slab		Bearing	Column	flexibility	Drainage
1. Houay Som Sa Nuk	Vientiane Province	PC-I	C	B	D	A	B	D	D	D
2. Houay Ngam		PC-I	B	-	D	B	-	D	B	B
3. Nam Mone		PC-T	C	B	D	A	B	D	C	B
4. Nam Pong		PC-I	C	A	D	B	B	D	C	B
5. Houay Ta Bong Phet	Savannakhet Province	RC-T	C	B	C	B	C	C	D	C
6. Xe Cham Phone		Steel-I	A	A	B	B	B	B	C	C
7. Xe Xam Xoy		Steel-I	B	B	C	B	B	C	D	C
8. Xe Bang Hieng		Steel-I	B	B	C	B	C	B	D	C
9. Xe Bang Nouan		Steel-I	B	A	C	B	D	B	D	C

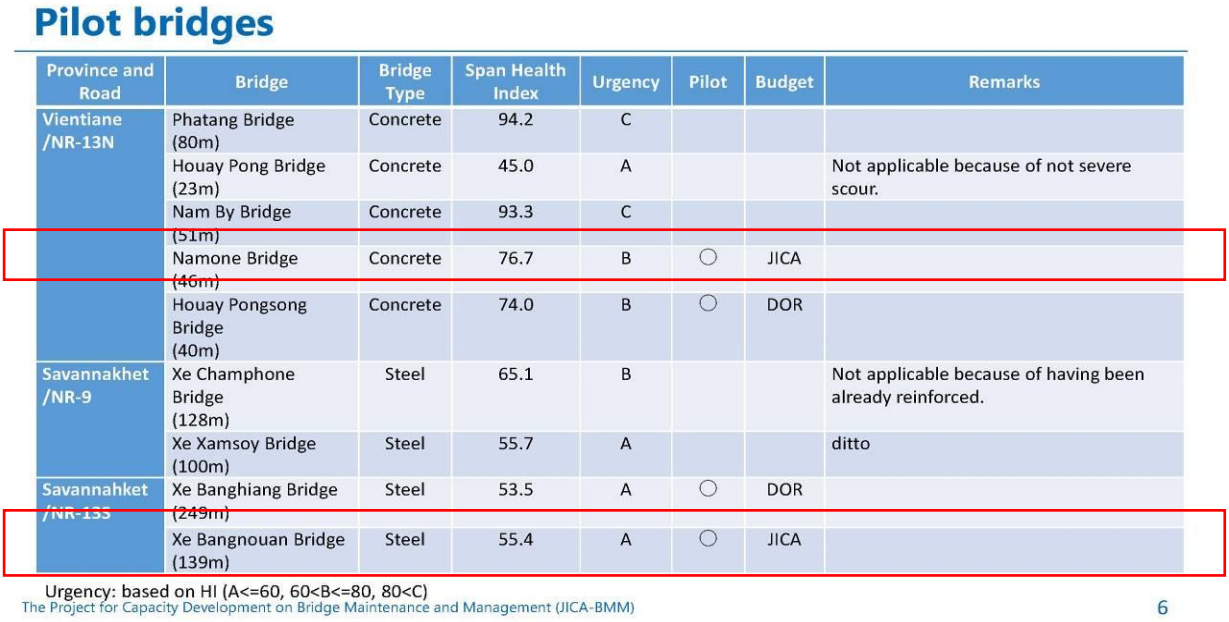
Remark:

Table3. 3 Level-Status of Damage, Requirement of Repair Duration

Level of Damage	Status of Damage	Requirement of Repair Duration
Level A	No damage	-
Level B	Little damage	It is required to repair when available.
Level C	Medium damage	It is required for urgency repair.
Level D	High damage	It is required for the most urgency repair.
Level E	Very high damage	The structural part is collapse and require to build new one.

After the detailed inspection was reviewed by project's specialists, DOR and relevant sectors. The selection of the pilot bridge is Na Mone Bridge and Xe Bung Nuan Bridge.

The criteria were considered for the selection of the pilot bridge summarized in the meeting on 22/8/2022 as following figure:



Pilot bridges

Province and Road	Bridge	Bridge Type	Span Health Index	Urgency	Pilot	Budget	Remarks
Vientiane /NR-13N	Phatang Bridge (80m)	Concrete	94.2	C			
	Houay Pong Bridge (23m)	Concrete	45.0	A			Not applicable because of not severe scour.
	Nam By Bridge (51m)	Concrete	93.3	C			
	Namone Bridge (46m)	Concrete	76.7	B	○	JICA	
	Houay Pongsong Bridge (40m)	Concrete	74.0	B	○	DOR	
Savannakhet /NR-9	Xe Champhone Bridge (128m)	Steel	65.1	B			Not applicable because of having been already reinforced.
	Xe Xamsoy Bridge (100m)	Steel	55.7	A			ditto
Savannahket /NR-13S	Xe Banghiang Bridge (249m)	Steel	53.5	A	○	DOR	
	Xe Bangnouan Bridge (139m)	Steel	55.4	A	○	JICA	

Urgency: based on HI (A<=60, 60<B<=80, 80<C)

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Figure3. 3 Detailed the Selection of the Pilot Bridge and Maintenance Budget

3.4 Detailed the Pilot Na Mone Bridge

Na Mone Bridge was built in 1991, along National Road No. 13 North, Km 142+300 from Vientiane capital to Vientiane province. This bridge is located between Na Mone and Phonsavang Villages which is the reinforced concrete bridge. There are 2 spans and 4 main beams in each span. The length beam is reinforced concrete for 22 m. The total of length bridge is 46,08 m and the width of bridge surface is 7,30 m as shown in the below figures:

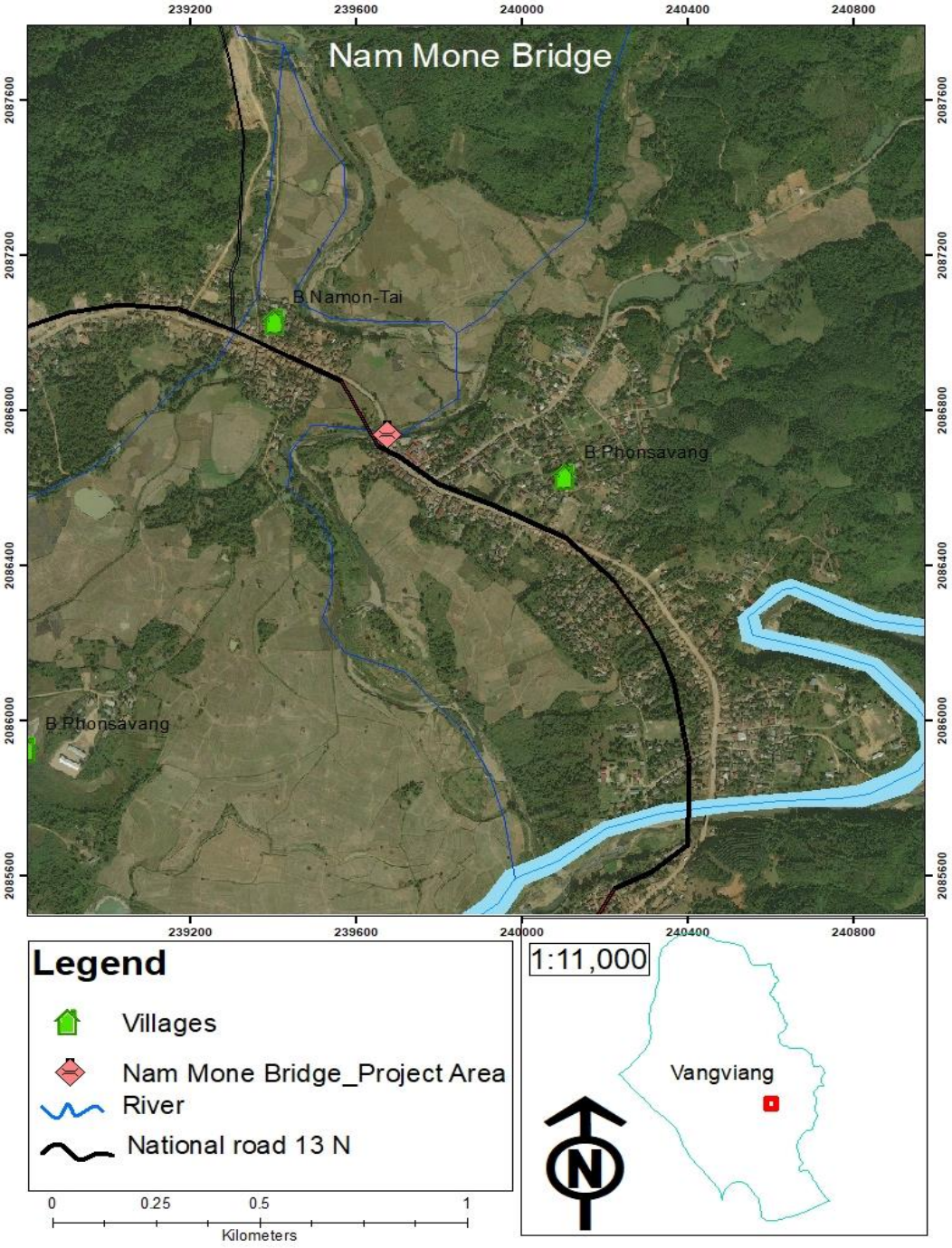

Figure3. 4 Location Map of Nam Mone Bridge

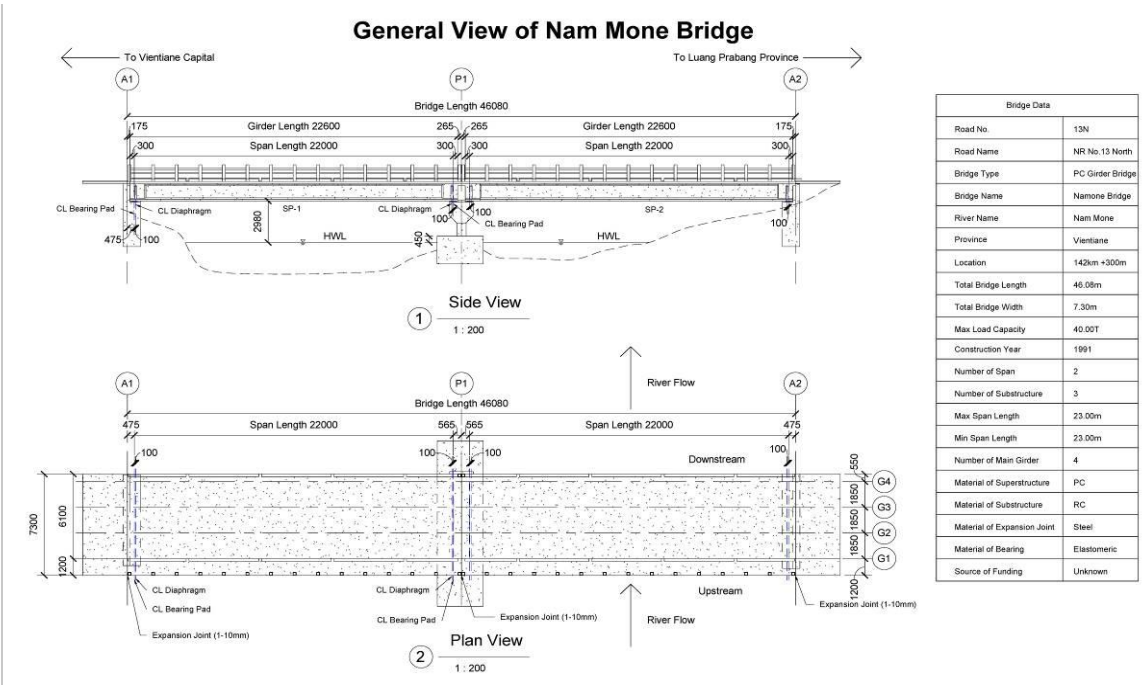

Figure3. 5 General View of Nam Mone Bridge

Figure3. 6 The View of Entrance the bridge to Vientiane

Figure3. 7 The View of Entrance the bridge to Luangprabang

Bridge General View

Road No.	13N	Bridge location (Chainage)	142 Km + 300 m
Road name	NR No.13 North	Bridge location (Province)	Vientiane
Bridge ID/No.	Unknown	Coordinates (Latitude)	18° 51' 22.67"
Bridge name	Namone	Coordinates (Longitudu)	102° 31' 45.14"

Side Views

Plan Views

Figure3. 8 General View of Na Mone Bridge

3.4.1 The Characterizes of Damage on Na Mone Bridge

Based on the damage survey report of Nam Mone Bridge is summarized as the following table:

Table3. 4 Summary the Damage Element of Nam Mone Bridge

Photo no.	Element name	Damage grade	Damage type	Component	Photo no.	Element name	Damage grade	Damage type	Component
001	Main structure-Girder	C	07	Superstructure	063	Railing	C	01	Superstructure
002	Main structure-Girder	C	07	Superstructure	064	Railing	C	01	Superstructure
003	Deck slab	C	07	Superstructure	065	Railing	C	01	Superstructure
004	Deck slab Deck slab	C	07	Superstructure	066	Railing	C	01	Superstructure
005	Deck slab Deck slab	C	07	Superstructure	067	Railing column	E	04	Superstructure
006	Main structure-Girder	C	07	Superstructure	068	Railing column	E	04	Superstructure
007	Deck slab	C	07	Superstructure	069	Railing column	E	04	Superstructure
008	Deck slab	C	07	Superstructure	070	Railing column	E	04	Superstructure
009	Main girder and cross girder	C	07	Superstructure	071	Railing column	E	04	Superstructure
010	Deck slab	C	07	Superstructure	072	Railing column	E	04	Superstructure
011	Main girder and cross girder	D	06	Superstructure	073	Railing	E	04	Superstructure
012	Main girder and cross girder	D	06	Superstructure	074	Railing	E	04	Superstructure
013	Main girder and cross girder	D	06	Superstructure	075	Railing	E	04	Superstructure
014	Main girder and cross girder	C	06	Superstructure	076	Railing	E	04	Superstructure
015	Main girder and cross girder	C	06	Superstructure	077	Railing	E	04	Superstructure
016	Main girder and cross girder	C	06	Superstructure	078	Railing	E	04	Superstructure
017	Main girder and cross girder	C	06	Superstructure	079	Railing column	E	06	Superstructure
018	Main girder and cross girder	D	06	Superstructure	080	Railing column	E	06	Superstructure
019	Deck slab	E	20	Superstructure	081	Railing column	E	06	Superstructure
020	Slab and side bridge	E	13	Superstructure	082	Railing column	E	06	Superstructure
021	Deck slab	D	07	Superstructure	083	Railing column	E	06	Superstructure
022	Deck slab	C	11	Superstructure	084	Wheel guard	E	06	Superstructure
023	Deck slab	C	11	Superstructure	085	Railing column	E	07	Superstructure
024	Deck slab	C	11	Superstructure	086	Railing column	E	07	Superstructure
025	Deck slab	C	11	Superstructure	087	Railing column	E	07	Superstructure
026	Deck slab	C	11	Superstructure	088	Railing column	E	07	Superstructure

027	Deck slab	E	11	Superstructure	089	Railing column	E	07	Superstructure
028	Deck slab	D	11	Superstructure	090	Railing column	E	07	Superstructure
029	Deck slab	C	11	Superstructure	091	Wheel guard	C	07	Superstructure
030	Deck slab	C	11	Superstructure	092	Wheel guard	C	07	Superstructure
031	Deck slab	E	11	Superstructure	093	Wheel guard	C	07	Superstructure
032	Deck slab	D	11	Superstructure	094	Wheel guard	C	07	Superstructure
033	Deck slab	D	11	Superstructure	095	Wheel guard	C	07	Superstructure
034	Deck slab	D	11	Superstructure	096	Wheel guard	C	07	Superstructure
035	Deck slab	D	11	Superstructure	097	Railing	C	23	Superstructure
036	Deck slab	D	11	Superstructure	098	Railing	C	23	Superstructure
037	Deck slab	D	11	Superstructure	099	Railing	E	23	Superstructure
038	Deck slab	E	11	Superstructure	100	Railing	E	23	Superstructure
039	Deck slab	E	11	Superstructure	101	Pavement	C	14	Superstructure
040	Deck slab	D	11	Superstructure	102	Pavement	C	14	Superstructure
041	Deck slab	D	11	Superstructure	103	Pavement	C	14	Superstructure
042	Deck slab	E	11	Superstructure	104	Pavement	C	14	Superstructure
043	Deck slab	E	11	Superstructure	105	Pavement	C	14	Superstructure
044	Deck slab	D	11	Superstructure	106	Pavement	C	14	Superstructure
045	Deck slab	D	11	Superstructure	107	Pavement	C	15	Superstructure
046	Deck slab	D	11	Superstructure	108	Pavement	C	15	Superstructure
047	Deck slab	D	11	Superstructure	109	Pavement	C	15	Superstructure
048	Deck slab	D	11	Superstructure	110	Pavement	C	15	Superstructure
049	Deck slab	D	11	Superstructure	111	Pavement	E	15	Superstructure
050	Deck slab	E	11	Superstructure	112	Pavement	E	15	Superstructure
051	Deck slab	D	06	Superstructure	113	Expansion Joint	E	17	Superstructure
052	Deck slab	E	11	Superstructure	114	Expansion Joint	E	17	Superstructure
053	Deck slab	E	11	Superstructure	115	Expansion Joint	E	17	Superstructure
054	Column A1	E	20	Superstructure	116	Expansion Joint	E	17	Superstructure
055	Column A1	E	24	Superstructure	117	Expansion Joint	E	17	Superstructure
056	Pier cap P1	E	06	Superstructure	118	Expansion Joint	E	17	Superstructure
057	Construction joint between stop block and P1 pier cap	C	07	Superstructure	119	Sediment clogging (Drainage problem)	E	24	Superstructure
058	Top of column P1	E	24	Superstructure	120	Sediment clogging (Drainage problem)	E	24	Superstructure
059	Abutment A2	E	20	Sub structure	121	Sediment clogging (Drainage problem)	E	24	Superstructure

060	Abutment A2	E	24	Sub structure	122	Sediment clogging (Drainage problem)	E	24	Superstructure
061	Railing	C	01	Superstructure	123	Sediment clogging (Drainage problem)	E	24	Superstructure
062	Railing	C	01	Superstructure	124	Sediment clogging (Drainage problem)	E	24	Superstructure

Remark: See the details in appendix 1

3.4.2 Service Management System

After the maintenance is completed, it will be handover to DPWT of Vientiane province as Management Unit of Utilize and Maintenance, to ensure the National Road No.13 North is comfort and quick particularly the bridge is between Phonsavang and Namone villages.

3.4.3 The Maintenance Fund

The fund of proposed bridge maintenance is assisted by Japan government through JICA as a main administrative unit. The entire of cost is approximately 260.000,00 US Dollar, but not include the finalized cost because it is under the project bidding at the moment.

3.4.4 Project Implementation Plan

The total duration of project construction is 36 months or 3 years, project will commence on 11/2020 and expect to complete within 11/2023. However, the implementation bridge repair plan will be spent only 12 months in the whole plan and it will start 11/2022 to 11/2023. Project implementation plan includes each imperative sub-tasks which is evaluated the implementation phase, it can be adaptable in accordance with other social condition for the actual implementation. In the manner, the duration can change any time. The detail of project implementation plan is summarized below:

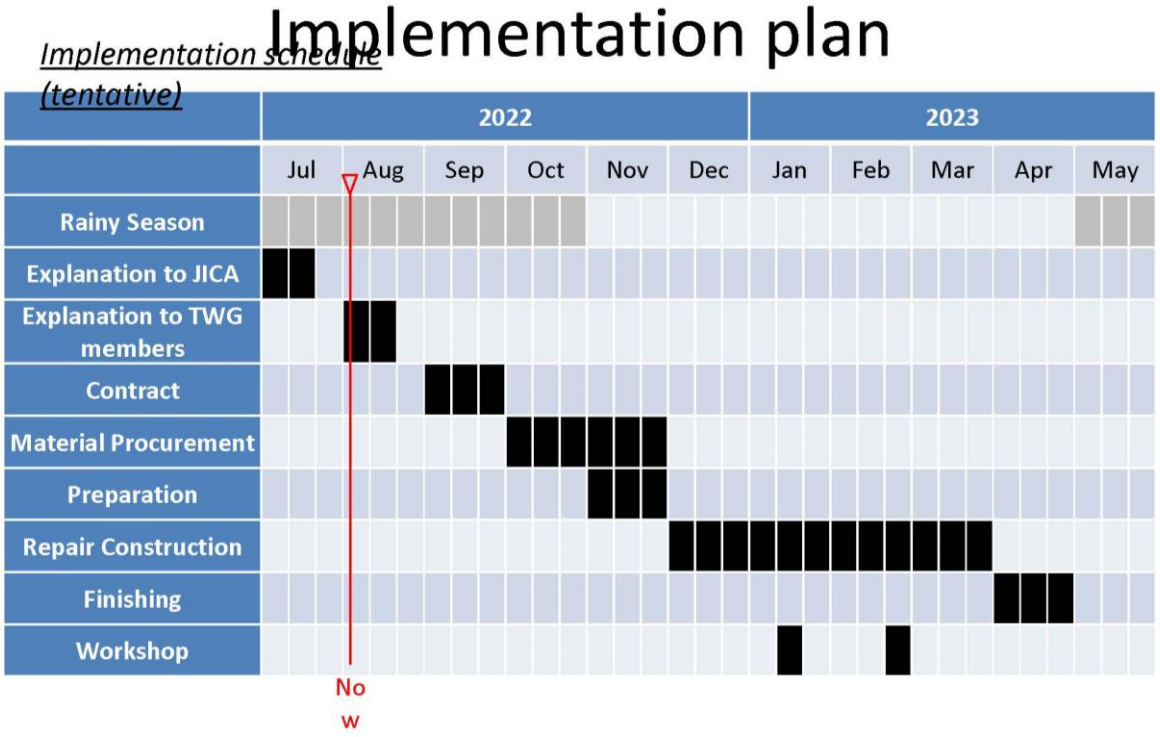

Figure3. 9 Project Implementation Plan

3.5 Detailed Design and Method of Maintenance

3.5.1 Maintenance on the Bottom of Bridge

Maintenance on the bottom of bridge consists the top of columns for both Abutment A1 and Abutment A2.

3.5.2 Maintenance on Superstructure

Consist the top of column, bridge surface, pavement material of bridge surface, Joint part between bridge-road, Railing, wheel guard as following above Table 3.3;

3.5.3 Method of Maintenance

Bridge maintenance will be implemented in dry season and spent about 12 months by temporary blocking of traffic. The traffic will block only one lane or all lanes in few periods, but there will provide the detour in the dry season to allow traffic at all times. However, the detailed designs on method of maintenance will define again in the implementation phase of technical practice. But there is not any impact on villagers or property adjacent.

If it is necessary to block two lanes, project will provide a detour through Nam Mone by utilizing the box convert which is suitable for drainage and a safety traffic. The location of detour is near the bridge which is the state land, it will be utilize to travel on this way. There are 2 households who built a repairing shop and extended their house in this area such as: Mr. Thidbounta and Mr. Xeingthongbai, but the local authority of village and district levels have already discussed with them by making the minute of meeting as the future reference. Both of them agreed to relocate without the compensation cost when project implements the work and inquires for this zone; Mr. Khamseng encroached the state land in Na Mone village by filling some land, after DPWT of Vangvieng District and Village Office have suggested with him and stopped filling some land by making the minute of meeting on 16/5/2022 (Appendix 2).

After the previous methods were reviewed and discussed about new technology utilizing into the maintenance many times. Project can summary the methods of maintenance as the following below table:

Table3. 5: Previous and Revised Repair Methods (Nam Mone Bridge)

Type	Element	1st proposal (Nov/2021)	2nd proposal (May/2022)	Final proposal (Aug/2022)
Bridge Repair and Reinforcement	Main Girder / Crossbeam	Sectional Repair	Sectional Repair	Sectional Repair
		Protective Coating	Caulking	Caulking
		CFP Bonding	-	
		CFS Bonding	-	
	RC Deck Slab	Caulking	All replacement	Crack Repair (Injection / Caulkng)
		Sectional Repair	-	Sectional Repair
		Protective Coating	-	Concrete Pavement with Increasing slab depth
	Abutment	Cleaning on Bearing Seat	Cleaning on Bearing Seat	Cleaning on Bearing Seat
	Pier	Cleaning on Bearing Seat	Cleaning on Bearing Seat	Cleaning on Bearing Seat
		-	Sectional Repair	Sectional Repair
	Pavement	Replacement	Replacement	Concrete Pavement
	Expansion Joint	Replacement	Replacement	Replacement
	Railing	Replacement	Replacement	Replacement
	Wheel guard	Replacement	Replacement	No repair because replacement was for all replacement of deck slab

Red : New reviewed Items for pilot project

As keeping safety of bridge and road condition, following items are to be done;
Road marking / Installment of lighting / Installment of safety sign board / Installment of guide post

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Chapter 4: Environmental and Social Descriptions

4.1 Scope of the Study

The Initial Environmental Examination is for the Namone Bridge Maintenance and Management Project, crossing between Ban Namone Tai and Ban Phonesavang, Vangvieng District Vientiane Province. The detailed study includes the physical, biological and economic-social components, the cultural and visual components in the current project area. In additions, the study on each component is complied with the Technical Guideline on Establishment of Initial Environmental Examination Report for the Investment Projects and Activities in Lao PDR, No.2797/ MoNRE/DESIA/DRM, Vientiane Capital, and Dated on 19 December 2016. However, the recent environmental study for this project might not follow all steps or topics as described in the table of content due to the fact that this guideline is applied for all types of projects with different environmental studies and impacts.

4.2 Physical Component

4.2.1 Climate/Meteorology and Air Quality

Vangvieng district is located in the central part, which slanting nearly to the North. The climate/meteorology is divided in two seasons including the dry season starting from November to April, as this district is covered by the high hills therefore the weather in this season is cold and windy. And the other reason is its landscape. Moreover, the rainy season starting from June to October, the weather in this season is hot. Based on the meteorological information in 2021, the average temperature is 19.5-34°c. The water level of Song River is 0.56-6.024 m, with the precipitation of 322.8 mm.

<table>
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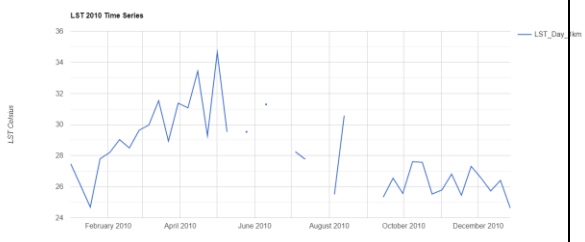
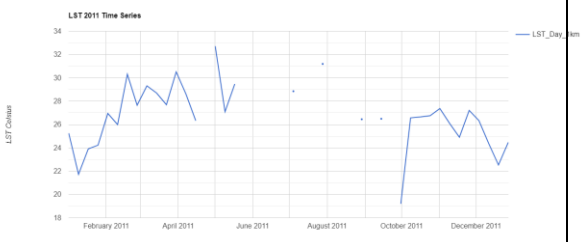
  </td><td>Annual average temperature in 2011
  </td></tr>
<tr><td>Annual average temperature in 2012
  </td><td>Annual average temperature in 2013
  </td></tr>
<tr><td>Annual average temperature in 2014</td><td>Annual average temperature in 2015</td></tr>
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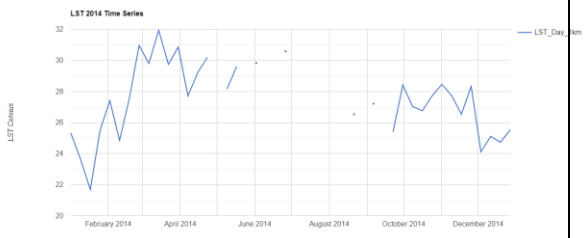
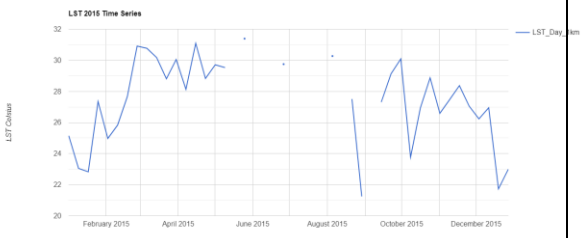
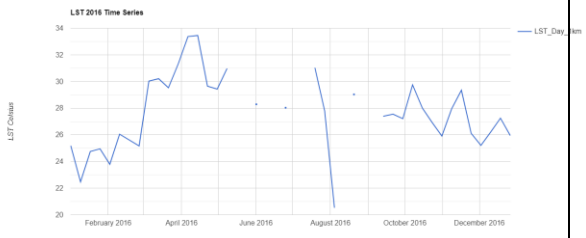
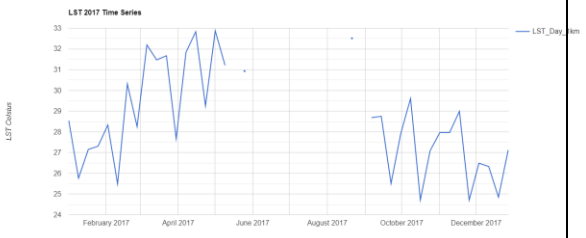




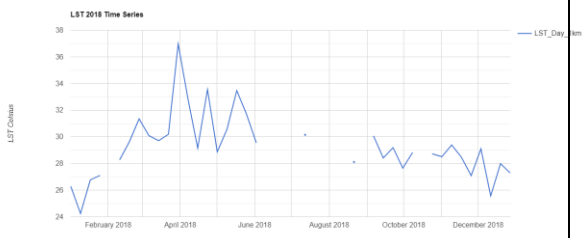
Annual average temperature in 2016



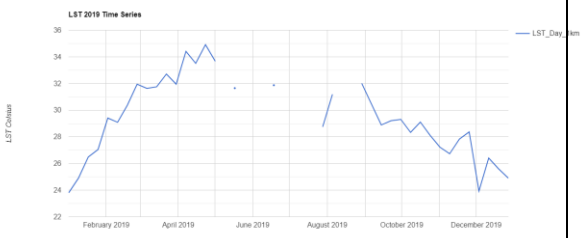
Annual average temperature in 2017



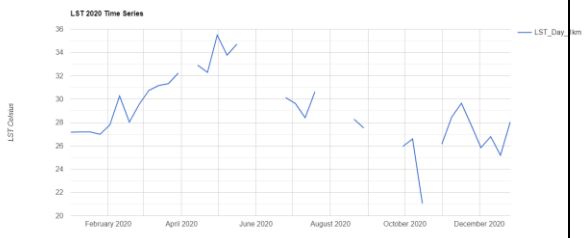
Annual average temperature in 2018



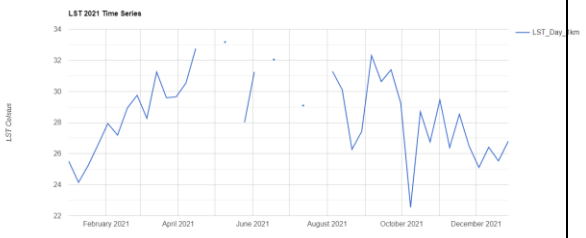
Annual average temperature in 2019



Annual average temperature in 2020



Annual average temperature in 2021



Annual average temperature in2012

Temperature measurement location area

Source: Land surface Temperature MODIS

Figure4. 1 Annual average temperature graph from year 2010 to 7/2022

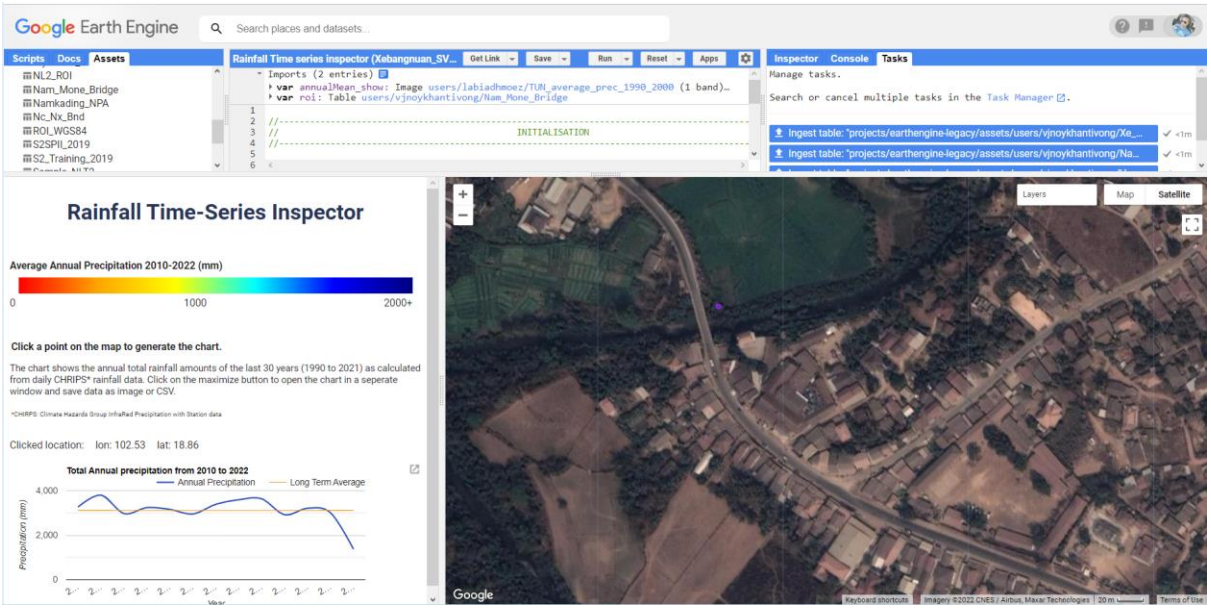
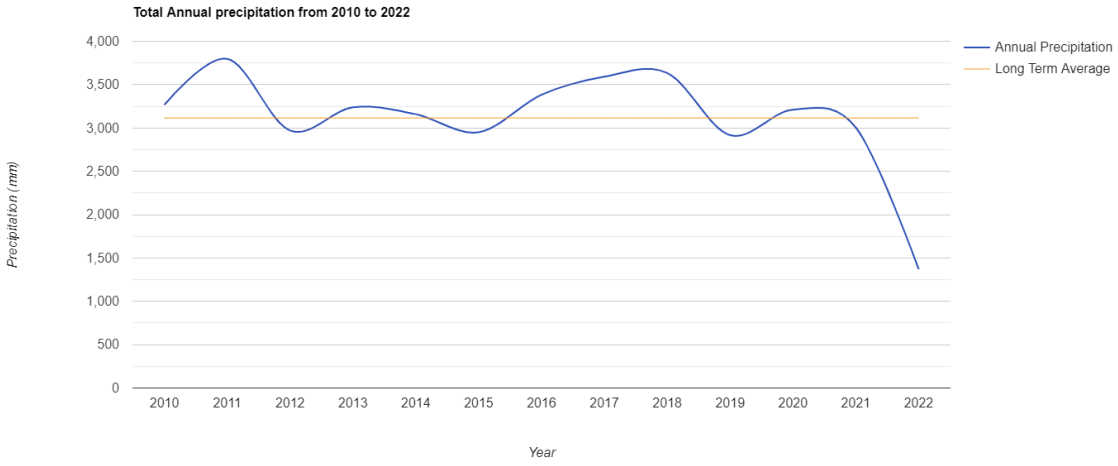


Figure4. 2 Land surface rainfall from MODIS



Source: Google earth engine - MODIS Satellite image

Figure4. 3 Annual average precipitation graph from 2010 to 2022

❖ National environment standards

Table4. 1 General air quality standards.

Parameter	Symbol	Average	Standard Less than	Unit
Carbon monoxide	CO	1 hour	30	ppm
		8 hours	9	ppm
Nitrogen dioxide	NO_2	1 hour	0.11	ppm
		1 year	0.02	ppm
Sulfadiazine	SO_2	1 hour	0.13	ppm
		24 hours	0.05	ppm
Total suspended particulate<100	TSP	24 hours	0.33	mg/m^3
		1 year	0.10	mg/m^3
Particulate matter <10	PM-10	24 hours	0.12	mg/m^3

		1 year	0.05	mg/m^3
Particulate matter <2.5	PM-2.5	24 hours	0.05	mg/m^3
		1 year	0.015	mg/m^3
Ozone	O_3	1 hour	0.20	mg/m^3
		8 hours	0.14	mg/m^3
Lead	Pb	1 year	0.00015	mg/m^3

Source: National Environment standard, article 5, table5, page 3/38

4.2.2 Landscape

Vangvieng district is the mountainous area, located from the municipality to the north for 96 km crossing the 13th North Road. The total area is approximately 1,679.28 km2, bordering with various districts including Kasi and Phoukhoun districts to the north, Keooudom district to the south, Longjeang and Anouvong districts, Xaysomboun province to the West and Feung and Hin Herb districts to the west.

The area of Ban Namone Tai and Ban Phonesavang is located in the project area with the distance from Vangvieng district for 12 Km along the 13th North Road. The village areas are surrounded by the mountains. However, the agricultural area is flat area along the road to Vangvieng district.

4.2.3 Geology and Soil

The geology and soil in Vangvieng district are outstanding as the limestone hill area, which is surrounded by the abundant forests. The soil characteristic is based on the areal condition; the agricultural area is quite limited as it is the limestone hill with the rock soil. The soil structure is in the hard soil layer with the integrated limestone, therefore the soil layer along the mountainous area is the hard clay soil. However, Vangvieng district could provide the agricultural area as it can be seen along the mountain valley. In addition, the flat area is the sandy clay with richness minerals occurred by the erosion from the high to lower place. This caused the soil layer is abundant.

4.2.4 Erosion and Sediment

The erosion and sediment are consisting of two patterns occurred by the natural and human activities. Most area with the natural erosion will be occurred in the rainy season. The heavy rain caused the flood in the downstream along the river, the river banks and the downstream in some mountain valleys near the steep hill. However, the erosion and sediment are caused by the heavy rain. Most of erosion and sediment occurred by the human activities are including: agricultural activity, construction for business operation, construction of infrastructure and projects; for instance, the earth excavation caused to the erosion and sediment

4.2.5 Hydrology/Water source and Water Quality

The hydrology in Vangvieng district is consisting of various significant rivers particularly Song River playing an important role as the main tourist place which contributes in the economic-social development and activities in the river. This river has good scenery as surrounding by the forest and limestone hill. The river flow direction is from the north toward the south, conjoining with Nam Lik near Hin Herb district.

The main water source in the project area is Namone along the 13th north road. This river is a significant river as a tributary of Song River. Namone

is curved by the landscape with different widths. The width is 10-20 m. People living along the river for fishing, the local fishery as well as the income source of some families.

Regarding to this Initial Environmental Examination Report, the water quality was tested from the water source at the bridge including Namone. There are two water sampling points including the upstream which is 50 m far from the bridge and the downstream is about 50m. On 2 Aug 2022 is a day for the data collection and water sampling. The weather on this day was changed immediately. In the morning, it was sunny but the weather in the evening was suddenly changed which caused the difficulties for water sampling. The detail on water sampling is as following

Table4. 2 Data and samples at the site

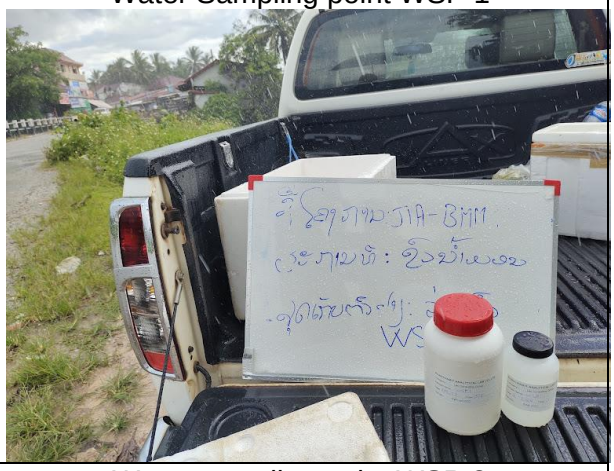
No	Name of Sample	Time	Sampling Point	Temperature of water	Depth of River	Depth of Sampling	Weather
1	WSP1 Upstream	14:06	48 Q 239724.83 m E, 2086744.03 m N	25.7 c	0.6 m	0.15 m	After raining
2	WSP2 Downstream	13:46	48 Q 239631.18 m E, 2086732.29 m N	26.1 ◦ c	0.45 m	0.1 m	Will be raining

Source: Google Earth Professional

Figure4. 4 Location sampling map of the surface water – Nam Mone River

Water Sampling point WSP 1

Water Sampling point WSP 1



Water sampling point WSP 2

Water sampling point WSP 2

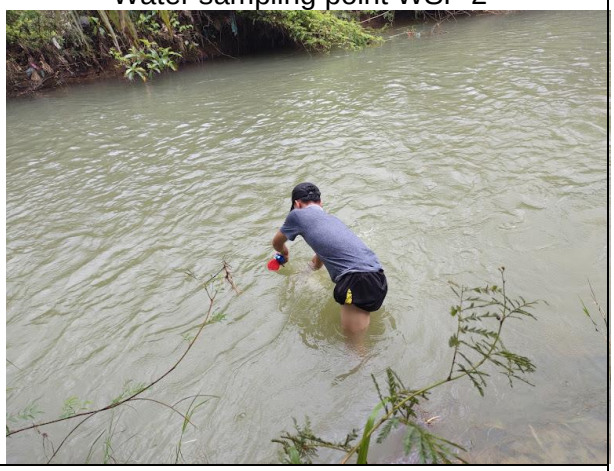


Figure4. 5 Water Sampling Collection

Table4. 3 General surface water quality standards

Parameter	Symbol	Standards					Unit	Analysis method
		1	2	3	4	5		

Color, Order and Taste	NA	n	n'	n'	n'	NA	Not defined	Not defined
Temperature	t °c	n	n'	n'	n'	Not defined	°c	Thermometer
Potential of hydrogen	pH	6-8	6-8	5-9	5-9	Not defined	Not defined	Electrometric pH meter
Dissolved Oxygen	DO	> 7	6.0	4.0	2.0	< 2	mg/L	Azide Modification meter
Electro conductivity	EC	< 500	≤ 1000	≤ 2000	≤ 4000	> 4000	µS/cm	Ec meter
Chemical Oxygen demand	COD	n	5-7	7-10	10-12	> 12	mg/L	Potassium Dichromate Digestion; Open reflux or Close reflux
Total coliform bacteria	Not defined	n	5000	20000	not defined	Not defined	MPN/100ml	Multiple tube Fermentation Technique
Fecal coliform bacteria	Not defined		1000	4000	not defined	Not defined	mg/L	Multiple tube Fermentation Technique
Total suspended solid	TSS	< 10	≤ 25	≤ 40	≤ 60	> 60	mg/L	Glass fiber filter Disc
Phosphate	PO_4	< 0.1	0.5	1	2	> 2	mg/L	Ascorbic Acid
Ammonium ion	NH_4^+	< 0.5	≤ 1.5	≤ 3	≤ 4	> 4	mg/L	Kjeldahl
Nitrate Nitrogen	NO_3-N	n	5.0	5.0	5.0	Not defined	mg/L	Cadmium reduction
Ammonia Nitrogen	NH_3-N	n	0.5	0.5	0.5	Not defined	mg/L	Distillation Nesslerization
Phenol	C_6H_5OH	n	0.005	0.005	0.005	Not defined	mg/L	Distillation-4Amino antipyrene

Remarks:

n= Natural water resource

n' = Natural water resource, but temperature precision ± 3 °C

Source: National Environment standard, article 9, table10, page 15-16/38

Remarks:

Category 1: A good quality natural water source, without through the production process, mixing with chemicals and free from dirty water from all kinds of activities

Category 2: Consumption and drinking water source but must be sterilize, this category is suitable for conservation of aquatic life, fishery, water sport, and etc.

Category 3: Consumption and drinking water source but must be sterilize, this category is suitable for agriculture, raise animals and etc.

Category 4: Consumption and drinking water source but must be sterilize, this category is suitable for industry, and it is a wetland source for treatment water from urban or community

Category 5: A natural water source for communication, transportation, and it is a wetland source for treatment water from urban or community

The current water sampling is to test the water quality in order to find the parameter of contaminated water as following:

Table4. 4 The analysis result of surface water quality

No.	parameter	Unit	Results)		Standard[1]
			WSP1	WSP2	
1	Color	Pt-Co	less turbidity	less turbidity	
2	Odor		NA	NA	
3	Temperature	°C	25.7	26.1	-
4	pH		7.7	7.6	5.0 - 9.0
5	Chemical Oxygen Demand (COD)	mg/L	14.7	-	10 - 12
6	Biological oxygen demand (BOD5)	mg/L	0.5	0.40	-

Source: The laboratory result from Phanthamit Lab Limited

The laboratory result is in the Appendix 3

Based on the result of water quality testing, the COD is over the national standards, it's meant the water is quite dirty because of water sampling on the rain season and it's raining, according to the field survey, however if compare to wastewater treatment from toilet standard, both of them are minor. According to field survey, the category was selected is B by BOD_5 <30 mg/L, COD<125 mg/L

there is no mining or agriculture farm on the upstream of the Xebangnouan Bridge, so the heavy metal was not monitoring in this phase.

Table4. 5 The water pollution from toilet control standard

Parameter	Symbol	Standards	Unit	Analysis method
Potential of Hydrogen	pH	6-9	Not defined	pH meter
Biological Oxygen Demand 5 days	BOD_5	30	mg/L	Azide modification at 20°C, 5 days
Chemical Oxygen Demand	COD	125	mg/L	Potassium dichromate Digestion; Open reflux or Close reflux
Total Suspended Solid	TSS	50	mg/L	Grass fiber filter Disc
Total Nitrogen	TKN	10	mg/L	Kjeldahl
Phenol	C_6H_5OH	2	mg/L	Distillation-Aminoantipyine Method 4
Fat, Oil and Grease	FOG	5.0	mg/L	Solvent Extrractionby

[1] National Environmental Standards No.81/Gov, February 21, 2017

				weight
Total dissolve solid	TDS	400	MPN/mL	Dry Evaporation 103-105° c, 1 hour

Source: Environment National Standard Article 14 Table 14.4 Page 30/38

Table4. 6 The water pollution control from building standard

Building type	Building size				
	A	B	C	D	E
Condominium	A≥ 500 rooms	100≤B≤500 rooms	C≤ 100 rooms	Not defined	Not defined
Hotel	A≥ 200 rooms	600≤B<200 rooms	C≤ 600 rooms	Not defined	Not defined
Dormitory	Not defined	> 250 rooms	50≤C<250 rooms	10≤D<50 rooms	Not defined
Massage (Equivalent to bed)	Not Defined	> 5000 m^2	1000≤C<5000 m^2	Not defined	Not defined
Hospital	A≥ 30 beds	10≤B<30 beds	Not defined	Not defined	Not defined
School, Academy or Institute	A≥ 25000 m^2	5000≤B<25000 m^2	Not defined	Not defined	Not defined
Office or Department	A≥ 55000 m^2	10000≤B<55000 m^2	5000≤C<10000 m^2	Not defined	Not defined
Mega trade center / Super market	A≥ 25000 m^2	5000≤B<25000 m^2	Not defined	Not defined	Not defined
Fresh Market	A≥ 2500 m^2	1500≤B<2500 m^2	1000≤C<1500 m^2	500≤D<1000 m^2	Not defined
Food center / Restaurant	A≥ 2500 m^2	500≤B<2500 m^2	250≤C<500 m^2	100≤D<250 m^2	E<100 m^2

Parameter	Symbol	Maximum value Standards					Unit	Analysis method
		A	B	C	D	E		
Potential of hydrogen	pH	5.5-8.5	5.5-8.5	5.5-8.5	5.5-8.5	Not defined	Not defined	pH meter
Biological Oxygen Demand 5 days	BOD_5	20	30	40	50	60	mg/L	Azide modification at 20°C, 5 days
Total suspended solid	TSS	30	40	50	50	60	mg/L	Glass fiber filter Disc
Dissolved Oxygen	DO	> 7	6.0	4.0	2.0	< 2	mg/L	Azide Modification meter
Sediment solid	SS	0.5	0.5	0.5	0.5	Not defined	mg/L	Imhoff cone 1000 cm^3 1 hour
Total dissolved solid	TDS	500	500	500	500	Not defined	mg/L	Dry evaporation 103-105 °C, 1 hour
Sulfide	S^{2-}	1	1	3	4	Not defined	mg/L	Titration

Nitrogen	TKN	35	35	40	40	Not defined	mg/L	Kjeldahor color metic
Fat, Oil and Grease	FOG	20	20	20	20	100	mg/L	Solvent Extraction by weight

Source: Environment National Standard Article 14 Table 14.1 Page 28-29/38

4.2.6 Mineral Resource

Regarding to the natural resource in the Annual Report in 2021, the district consists of various minerals including iron, zinc, barite which were operated by various companies. This indicated that the mineral resources are still abundant in current and this also enhances the revenue in term of the country development Noise and Vibration

4.2.7 Noise and vibration

Noise and vibration are one of the social and environmental impacts, especially the sensitive places like: hospital-healthcare center, school, temple, according to the scientific definition if the noise source exceeded 70 dB(A) is considered to be an affected place. These components are sensitive for noise and vibration impacts; However, this proposed project will cause the noise and vibration impact therefore, it is necessary to define the suitable prevention and mitigation measure in the nearby community due to the fact that the noise will be occurred by the bridge construction, the land clearance activities, the transportation of construction materials and other activities. In additions, the noise occurred by the traffic along the 13th north road as well as the community activities.

The National Environmental standard no. 81/GOV, February 21, has mention vibration control only the mining and crusher source only

Table4. 7 General noise quality standards.

Standards	Measurement method
Maximum noise (L_{max}) less than 115dB (A)	Measurement noise level (L_{eq}) while noise level is changing
Average noise level 24 hours ($L_{eq}24$) less than 70 dB(A)	Continues measurement (L_{eq})

Source: National Environment standard, article 15, table15, page 34/38

4.3 Biological Component

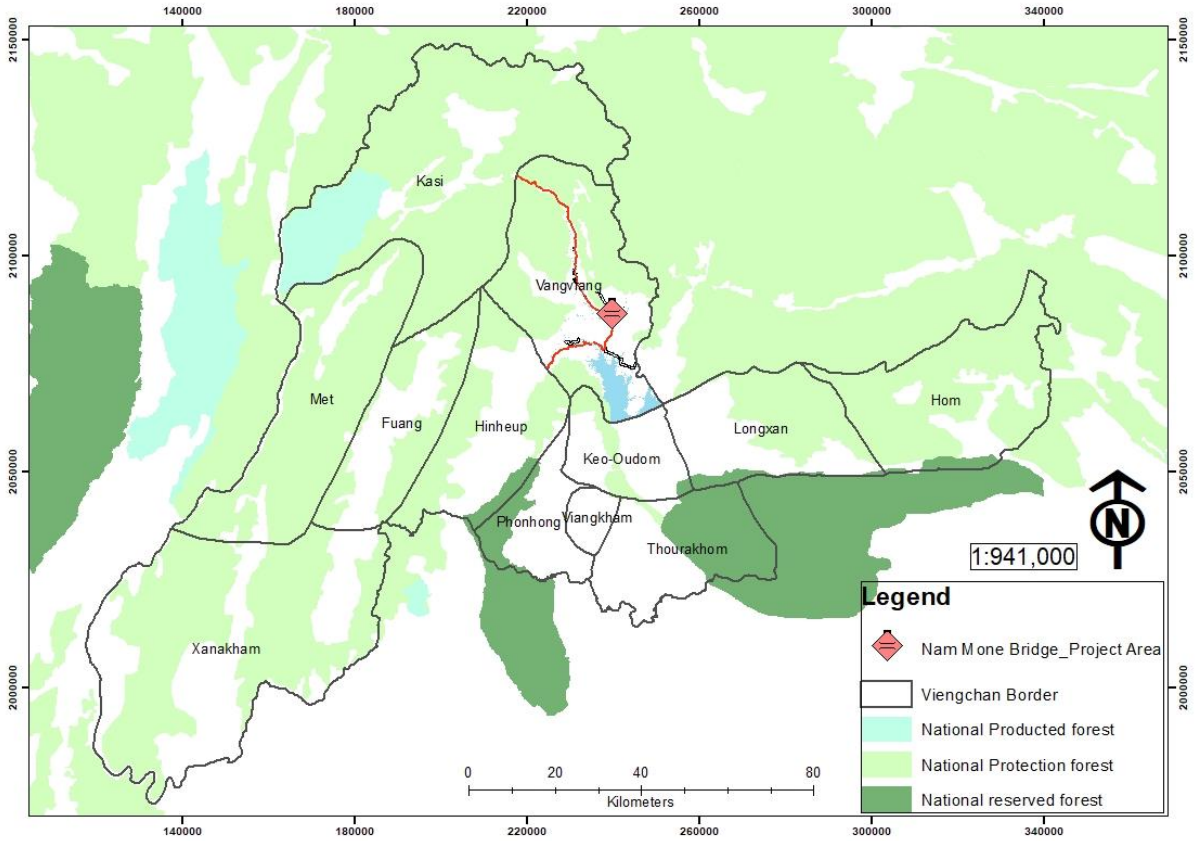
4.3.1 Terrestrial Ecology and Wildlife

Regarding to the areal condition and the comparison on project type, the project activities indicated that there is no impact on wildlife due to the fact that the project activities are not related to the clearance of forest area or wildlife habitat. The activities are to maintain the bridge and to minimize the environmental and social impact.

4.3.2 Forest and Vegetation

The district is covered by the forest for 114.19 ha, which equivalent of 67.94%. Regarding to the regulation, Vangvieng district has prohibited the shifting cultivation. In addition, the forest area with vegetation is along the mountainous area which is difficult to access including the high hill,

prohibited forest area, remote area and the district protection forest nearby the village. In addition, the forest area is covered by various trees but people can access only in some areas in order collect the NTFPs for their living.



Source: The forest data on 2015

Figure4. 6 Forest map in Vientiane province area

4.3.3 Aquatic Fauna and Aquatic habitat

The proposed Nam Mone Maintenance Bridge Project, Vangvieng District, Vientiane Province located cross the Nam Mone River through on 13th north road. Namone plays an important role for people living along the river as being the food source, fishing for food as well as the aquatic habitat particularly the upstream is the forest area with natural abundance.

4.3.4 Conservation-Protection Forests and Wetland

The forest area surrounding the project area consists of the protection forest of Vangvieng district; the mountainous area on the right side of 13th North Road to Vangvieng is the district protection forest. The regulation of the Lao Government is to protect the forest and not to illegal conduct logging and not to destroy the forest for the production. However, the forestry resource is being the wildlife habitat which has the abundant natural resources. In additions, there is the mixed forest which the local people use as the production forest. Although, the forest area nearby the project area is the mountainous area which is difficult to access.

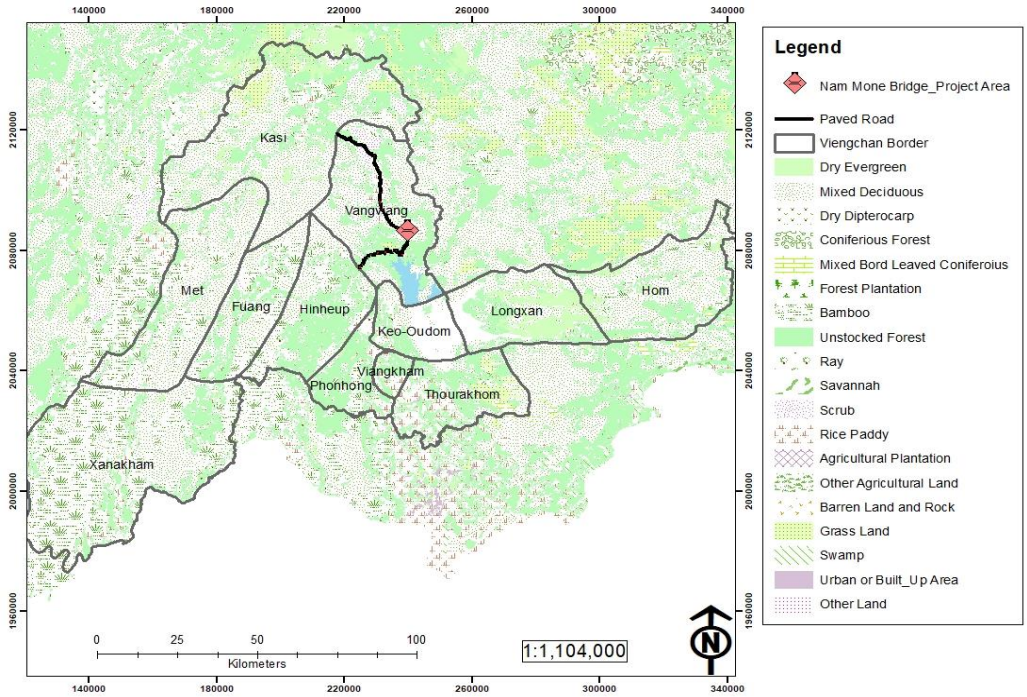
4.4 Economic-social Component

4.4.1 Administration and Limitation

The organization structure of the Lao Government consists of the central, provincial, district, local and village authorities. However, each level of authorities has the detailed responsibilities under the same law of Lao PDR.

4.4.2 Land Use (Land Use Map)

The land use in the project area is divided by the village management consisting of construction land, paddy field, garden, other agricultural land area as well as cemetery. In additions, there are forest area and river regarding to the allocation by the village, district and province.



Source: The Land use data on 2015

Figure4. 7 Land use in Vientiane province area

4.4.3 Social Information

4.4.3.1 Community and Population

The villages in the project area consist of two villages including Na mone and Phonesavang villages. The total population is 2417 people with1156 females. In additions, Lao Loum is covered 85%, Mong for 14% and Khmer for 1%. The occupation of local people is the government officers, workers, business owners and farmers. In addition, the community's infrastructure includes national roads, schools, temples, restaurants, repairing shop and supermarkets.

4.4.3.2 Ethnic and Religion

The information on ethic and religion in the project studied area indicated that the villages in the project area are distant from Vangvieng district for 12 km which is not far from the city. Therefore, the population of Lao Loum is the most population living in this area which covers 85%. In additions, Hmong covers 14% and Khmer for 1%.

However, the ethnics are different in term of language and traditions. Moreover, religions in these two villages are Buddhist (85%), spiritual (13%) and Christian (2%). Despite of the different traditions, the living conditions are a bit different.


Figure4. 8 Xaymoungkounvanaram temple at Phonesavang village

4.4.3.3 Education

Regarding to the educational situation in the studied area, the field survey indicated that there are some schools in two villages in the project area particularly Ban Phonesavang, there are kindergarten up to high schools and Ban Namone there are kindergarten up to primary schools. Thus, students have to study their high school in Ban Phonesavang. Based on the details on the interview in two villages in Aug 2022 are as following:

Table4. 8 Summary on the number of students in two villages

No	Name of Village	student in nursery school	Students in primary school	Students in secondary school	Students in high school
1	Namone Tai	62	100	-	-
2	Phonesavang	73	194	899	566

Figure4. 9 Xaymoungkounvanaram temple at Phonesavang village

4.4.3.4 Poverty Family[2] and Risk Group

Regarding to the poor families and risk group, currently based on the interview, Ban Phonesavang consists of 275 houses, 251 families and the total population of 1397 people with 702 females. The vulnerable

[2] Laos' poverty line is constructed on an absolute basis, comprising a food poverty line (based on 2,100 kcal per day), a non-food poverty line (30% of total consumption), not enough clothes, and non-permanent residents, no ability to pay for medicine and basic education, and cannot access to the basic public service network

families with female head of family consist of 10 families. However, the economic-social changing caused the development of these families later than others. In additions, Ban Namone consists of 218 families; the total population of 1020 people with 454 females. However, based on the interview, there is no information on poor family and the risk group.

4.4.3.5 Gender

Most people living in two villages are Lao Loum and be the Buddhist. However, Hmong ethnic believe in spiritual. Regarding to the interview on gender, most of interviewees stated that even though the head of family is male but female and male have the equal right or make the decision related to the economy, education, politic as well as tradition. In additions, regarding to the social role, females will obtain the opportunity or have the equal right as males in term of working or positions.

4.4.4 Healthcare Information

4.4.4.1 Healthcare Situation in the District

There is one district hospital with 30 beds, five health care centres with 15 beds, eight the private clinics, 24 pharmacies in Vangvieng district. The healthcare security fund is covered 61 villages with the equivalent of 100%. The achievement on the hygiene and health promotion is including: Hbo reached 103,56%, BCG for 99,74%, Penta1 for 10,93%, Penta 3 for 98,21%, MCV1 for 94,09%, and MCV2 for 85,04%; The mobility service on the integrated mother and child health care in the 16 remoted villages, people who accessed to cleaned water covered 86%, toilet for 96%, the outstanding villages on health care covered 88,52%. In additions, regarding to the health care in the project area, as these villages are distant from the city for 12 Km and there is Namone healthcare centre located in Ban Phonesavang, therefore people can access easily. People in this area are aware on the health care. Our interview team noticed that there is at least 1 toilet in each house with the soaps for hand washing and hand towels. The house is clean. Food is cooked. People drink boiled water or bottled water which was disinfected from the factory.

- The waste disposal of local people is the village landfill. The garbage collection company will transport the waste to the district dump fill which is far from Namone Bridge for 3 km along 13th north road and it is distant from 13th north road for 800m to the East. However, some families still bury or burn the waste but some throw the garbage in the forest. In additions, people are aware on the sanitary disposal for their hygiene and good health.
- Despite of the human diseases, there are some animal diseases occurred in that area including foot and mouth disease, plague and other disease. These were caused by the animal vaccination and were seasonal occurred.
- Based on the survey result, people who are sick will go to the hospital, clinic or health care center upon the case. If it is not serious, they will go to the district hospital or nearby healthcare center. If it is

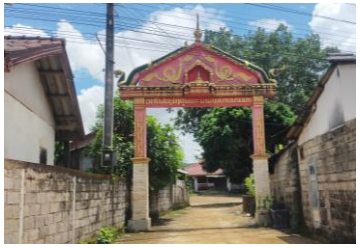
serious, they will go to the district hospital, provincial hospital or clinic as their convenience.

(Details of the social-economic information is in the appendix 4

Spiritual Stupa of Ban

Nam Mone Bridge

Phone savang Market



Namone's temple

Namone Primary school

Phonesavang Secondary School

Soldier Academy No.1

Phonesavang primary school

Na Mone public health center, But located in Phonesavang village

Figure4. 10 The important place around the Nam Mone Bridge.

Chapter 5: Impact Assessment and Mitigation Measures

5.1 Purpose

To comply with the Agreement on the Endorsement and Promulgation of List of Investment Projects and Activities to Requiring for Conducting the Initial Environmental Examination or Environmental and Social Impact Assessment, No.8056/MoNRE, date on 17 December 2013.

To implement the instruction on the study on the Initial Environmental Examination or Environmental and Social Impact Assessment of Investment Projects and Activities, No.8029/MoNRE, date on 17 December 2013.

To implement the Agreement on the Endorsement and Promulgation of the Guideline on Public Participation in the Environmental and Social Impact Assessment of Investment Project, No.707/MoNRE, date on 5 Feb 2013.

The purpose of the Initial Environmental Examination of this project is to define the issues and the protection-mitigation measures and also to minimize the adverse environmental and social impact occurred by the project in order to build the capacity in term of contribution in the national economic and social development to be sustainable.

5.2 Impact Assessment Methodology

The impact assessment methodology consists of the data collection from the secondary data, the field survey, and using the interviews form to interview the people who are living in the project area, the using of scientific measurement device and mapping.

The secondary data collection from the secondary information: is the data collection from the Feasibility Study of the project owner and to collect the data from the satellite image to use as the baseline information for making the report.

The data summary from the field survey: is the coordination between the experts from the environmental consulting company, the project owner and the local authorities. However, this data shall be the baseline information and use to study on the potential impact assessment affected by the project implementation and activities. This is to anticipate the impact on environmental ecology and city ecology in that area in order to prepare the study report.

The using of questionnaire form to interview people in the project area.
Is to interview on the economy-society in the community located in and nearby project area in order to assess the potential impact occurred by the project particularly on the assets and income source of people and also to protect and mitigate. In addition, this will be the baseline information to compare with the project implementation in the future.

The use of scientific measurement device
Is to measure the environmental quality which required to use the device and scientific principles for testing the air, noise and water qualities during the construction period in order to be the baseline information in term of comparison, management, monitoring and also to solve it to be complied with the National Standard.

The potential environmental impacts regarding to the activities of the Namone Maintenance Project in between Ban Namone and Ban Phonesavang will be

described in this section, where the concerns for key environmental impacts and mitigation measures are outlined in this section. The impact levels were evaluated here by applying the "Matrix" principle, which is an overall rating that indicates the level of impact. The impact assessment assesses only the main and potential impacts, such as impacts on climate change, noise and vibration, water quality (water discharge from the project area), transportation safety, and other issues. The assessment method will use terms with different meanings: Occurrence, Magnitude, Sensitivity, and Ranking as described below:
Occurrence: It means that it can happen, or it may happen or it may happen unexpectedly

Magnitude: It means that the impacts are significant or severe from those affects that should be seriously addressed and mitigated.
Sensitivity: It means that the social and environmental sensitivity are quick to recognize or be quick to respond to the environmental impacts of those activities.

Ranking: A rating of the impact resulting from the evaluation results in the three figures above and then divide by 3, in order to calculate the average impact level in the formula as following:

$$Ranking = \frac{(Occurrence + \text{Magnitude} + \text{Sensitivity})}{3}$$

Table5. 1 Score indicator of the impact level

Impact level	Occurrence	Magnitude	Sensitivity
0	No occurrence	No impact	No impact
1	Not likely to occur	Low impact	Low
2	More likely to occur	Medium impact	Medium
3	Possible to occur	High impact	High
4	High possibility to occur	Very high impact	Very high

Table5. 2 The ranking of impact risk

Average range of the impact	Color of the impact level	Risk level
≤ 0.5		No risk
0.5 to <1.5		Low risk
1.5 to <2.5		Medium risk
2.5 to < 3.5		High risk
≥ 3.5		Very high risk

5.3 Scope of the Impact Assessment

The scope of the IEE for Nam Mone Bridge Maintenance and Management Project will be the pilot project located between Ban Namone and Ban Phonesavang, Vangvieng district, Vientiane Province which will include an

impact assessment of activities to be undertaken during the pre-construction /construction phase and operation phase.

5.4 Screening of Impact

The screening of impact is to expect the impact of Namone Bridge Maintenance Project based on the project activities or the causes of environmental and social impact including the land clearance for construction project, the bypass construction (To construct the temporary bridge for crossing Namone bridge), office, and worker camp. Therefore, in order to facilitate on the improvement and to increase the safety, the social infrastructure and environmental protection shall get along. However, in order to to have the balance in all aspects, the mitigation measures for the potential impact will be based on the detailed study on the project's activities, areal information and the site survey. The discussion with people living nearby the project area can be concluded that the potential impact by the project activities will be in the construction phase. However, the pre-construction and operation phases will have no adverse environmental and social impacts.

However, the environmental and social impact assessment of the project will be conducted in three phases including: Pre-construction Phase, Construction Phase and Operation Phase in order to indicate the activities in each project periods as details following:

The document preparation, the training, survey on the damage points.

Table5. 3 The impact assessment from project activities (Pre-construction phase)

No	Environmental Elements	No mitigation measure				Mitigation measure			
		Occurrence	Magnitude	Sensitivity	Ranking	Occurrence	Magnitude	Sensitivity	Ranking
1.	**Physical environment**								
1.1	Landscape	0.5	0.5	0.5	0.5	0	0	0	0
1.2	Soil and soil erosion	0.5	0.5	0.5	0.5	0	0	0	0
1.3	Water source and water quality	0.5	0.5	0.5	0.5	0	0	0	0
1.4	Air quality	0.5	0.5	0.5	0.5	0	0	0	0
1.5	Noise and vibration	0.5	0.5	0.5	0.5	0	0	0	0
1.6	Waste	0.5	0.5	0.5	0.5	0	0	0	0
2.	**Biological environment**								
2.1	Forest and wildlife	0	0	0	0	0	0	0	0
2.2	Aquatic animal and living organism	0	0	0	0	0	0	0	0
2.3	Protected and conservation areas	0	0	0	0	0	0	0	0
3.	**Socio-economy**								
3.1	Land use	0	0	0	0	0	0	0	0
3.2	Community and population	0	0	0	0	0	0	0	0
3.3	Employment and	0	0	0	0	0	0	0	0

No	Environmental Elements	No mitigation measure				Mitigation measure			
		Occurrence	Magnitude	Sensitivity	Ranking	Occurrence	Magnitude	Sensitivity	Ranking
	household incomes								
3.4	Local Business	0	0	0	0	0	0	0	0
3.5	Facilities	0	0	0	0	0	0	0	0
3.6	Traffic and transportation	0	0	0	0	0	0	0	0
3.7	Impact on people's assets	0	0	0	0	0	0	0	0
3.8	Health and Safety	0	0	0	0	0	0	0	0
3.9	Cultural and historical sites	0	0	0	0	0	0	0	0
3.10	Scenery	0	0	0	0	0	0	0	0

Table5. 4 The impact assessment from project activities (Construction phase)

No	Environmental Components	No mitigation measure				Mitigation measure			
		Occurrence	Magnitude	Sensitivity	Ranking	Occurrence	Magnitude	Sensitivity	Ranking
1.	**Physical environment**								
1.1	Landscape	1	1	1	1	0.5	0.5	0.5	0.5
1.2	Soil and soil erosion	1	1	1	1	0.5	0.5	0.5	0.5
1.3	Water source and water quality	1	3	2	2	2	1	1	1.3
1.4	Air quality	1	3	2	2	1	2	1	1.3
1.5	Noise and vibration	1	2	1	1.3	1	1	1	1
1.6	Waste	2	2	2	2	1	1	1	1
2.	**Biological environment**								
2.1	Forest and wildlife	0	0	0	0	0	0	0	0
2.2	Aquatic animal and living organism	0	0	0	0	0	0	0	0
2.3	Protected and conservation areas	0	0	0	0	0	0	0	0
3.	**Socio-economy**								
3.1	Land use	0	0	0	0	0	0	0	0
3.2	Community and population	0	0	0	0	0	0	0	0
3.3	Employment and household incomes	1	1	1	1	+2	+2	+2	+2
3.4	Local Business	2	2	2	2	+2	+2	+2	+2
3.5	Facilities	1	1	1	1	0.5	0.5	0.5	0.5
3.6	Traffic and transportation	3	3	3	3	2	2	2	2
3.7	Impact on people's assets	0.5	0.5	0.5	0.5	0	0	0	0
3.8	Health and Safety	2	3	3	2.6	2	2	2	2
3.9	Cultural and historical sites	0	0	0	0	0	0	0	0
3.10	Scenery	2	2	2	2	1	1	1	1

Remarks: , + : expected to have positive impact on the component

Table5. 5 The impact assessment from project activities (Operation Phase)

No	Environmental Components	No mitigation measure				Mitigation measure			
		Occurrence	Magnitude	Sensitivity	Ranking	Occurrence	Magnitude	Sensitivity	Ranking
1.	**Physical environment**								
1.1	Landscape	0.5	0.5	0.5	0.5	0	0	0	0
1.2	Soil and soil erosion	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
1.3	Water source and water quality	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
1.4	Air quality	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
1.5	Noise and vibration	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
1.6	Waste	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
2.	**Biological environment**								
2.1	Forest and wildlife	0	0	0	0	0	0	0	0
2.2	Aquatic animal and living organism	0	0	0	0	0	0	0	0
2.3	Protected and conservation areas	0	0	0	0	0	0	0	0
3.	**Socio-economy**								
3.1	Land use	0	0	0	0	0	0	0	0
3.2	Community and population	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
3.3	Employment and household incomes	+2	+2	+2	+2	+2	+2	+2	+2
3.4	Local Business	+3	+3	+3	+3	+3	+3	+3	+3
3.5	Facilities	+2	+2	+2	+2	+2	+2	+2	+2
3.6	Traffic and transportation	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
3.7	Impact on people's assets	0	0	0	0	0	0	0	0
3.8	Health and Safety	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
3.9	Cultural and historical sites	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
3.10	Scenery	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

Remarks:
value after mitigation measure is still remain, but it's less than medium risk ranging, because it's the natural of living
+ : expected to have positive impact on the component

Table5. 6 Summary on the impact assessment from the project activities in each project period

No	Impact	level			**Brief Description**
		PCP	CP	OP	
1. Pollution Protection					
1.1	Air quality	-	C	-	Construction: Limit the air pollution to be occurred from the using of heavy machines and construction activities. The operation and after the completed construction occurred from the traffic: anticipated that there is no impact on the air but will occurred by the social service
1.2	Water Quality	-	C	-	Construction: Anticipated that there is temporary pollution including: the demolition, using of chemical for concrete mixing and the storage of construction material. In addition, there will be temporary water pollution from the worker camp/office and warehouse (if there is construction) or if renting the house, there will be minor impact. Operation: anticipated that there is no water pollution
1.3	Waste	-	C	-	Construction: the demolition of old building, the land clearance in order to construct the linkage between the bridge –new road, the waste from material packaging, rubble; therefore, there is debris from the construction, waste from the worker and office.
1.4	Soil contamination	-	C	-	Construction: there might be the contamination from fuel and chemical for concrete mixing used for the maintenance work.
1.5	Noise and vibration	-	C	-	Construction: anticipated that noise and vibration from the project activities might be minor and in the working time
1.6	Soil subsidence	-	-	-	will not occur because there is no earth work or excavation of foundation
1.7	Bad Odor	-	C	-	Construction: no activities which caused the bad odor, there is only temporary waste, fuel from the plastic decomposition or concrete material
1.8	Air quality	-	C	-	Construction: there are some activities caused to the dust in short time Operations: the construction area will be improved so there is no impact on air quality
2. Natural Environment					
2.1	Conservation Area	-	-	-	There is no conservation area
2.2	flora, fauna and biodiversity	-	-	-	anticipated that there is no impact on flora, fauna and biodiversity because the project construction area is an existing place and also in the limited area. There is no conservation area for flora, fauna and biodiversity in the nearby area.

No	Impact	level			**Brief Description**
		PCP	CP	OP	
2.3	Hydrological Condition	-	-	-	Construction/operation: anticipated that there is no activity caused the impact on hydrology.
2.4	Landscape and Topography-flow direction	-	C	-	Construction: anticipated that if there is the bypass, the landscape will be temporary changed for a bit but when the construction is completed, that area will be improved for better or in the same condition. Operation: anticipated that there is no activity caused the adverse impact on landscape and topography as the project area is in an existing area and no expansion.
3. Social Environment					
3.1	Non- voluntary resettlement	C		-	Operation/operation: The community in the project area is not resettled but there is only the state land nearby the bridge which invaded by local people to be acquired to the Government. In addition, the land at the bridgehead (on Ban Phonesavang side) is under the conciliation process (as shown in the image). However, the land on Ban Namone side had completed for the conciliation.
3.2	Poverty (poverty family, family with female head family)	-	-	-	Anticipated that there is no direct impact on poverty family.
3.3	Ethnic	-	-	-	Anticipated that there is no impact on the ethnic group nearby the construction area
3.4	Economy, employment, people livelihood	-	C+	A+	Construction: has the positive impact on the employment of local people Operation: the increase on water supply will contribute to better life living of people in the project area
3.5	Land use and the benefit of resource source to local people	-	C	-	Construction or operation will not affect to the lands use of people nearby the project area
3.6	Infrastructure and social service	-	C	-	Construction: the construction activities affect to the traffic on 13th north road in the project area to be more difficult sometimes Operation: facilitate the traffic to be better
3.7	damage the existing infrastructure such as road, bridge and others	-	C	-	Construction: Using the 13th north road as the road for material and waste transportation from the construction area but the work volume is less
3.8	Conflict in the local community	-	-	-	The project's purpose is to develop on the national transportation and economy particularly the using of national road and the strategy on

No	Impact	level			**Brief Description**
		PCP	CP	OP	
					the linkage between the central to the north. This is to ensure the long- term use.
3.9	Cultural heritage	-	-	-	There is no cultural heritage in the nearby project
3.10	Scenery	-	-	-	The project's purpose is to keep the scenery and expand the bridge to have good scenery
3.11	Gender	-	-	-	The project's purpose is to build the capacity of the technical officers for the Provincial of Transportation Department and also to be the pilot project to ensure the long-term use. However, regarding to the public, there is no impact on the gender.
3.12	Children Right	-		-	The project's purpose is to ensure the long-term use by maintenance at the broken point. The public facility is expected not to effect on the children right.
3.13	Transmitted diseases including HIV/AIDS	-	C	-	Construction: the influx of workers in the project area has potential to occur the transmitted disease in the local community. But the worker working for the project will be trained and have the health check regularly.
3.14	Covid 19		C	-	Construction: The influx of worker from various areas caused the risk on Covid-19 but the project shall establish the standard to manage the migrant workers and their mobility. Currently, the Government provided the vaccines for Covid-19 up to 3-4 doses average for one person. Operation: there is no impact to the technical experts and migrant worker.
3.15	Working environment (including occupation health and safety)	-	C	-	Construction: the unproper management on working environment will increase the accident and diseases. Operation: Anticipated that the project will be able to manage the Safety Standard, there is no potential to working overtime.
4. Others					
4.1	Accident	-	C	C	Construction: the construction activities on the 13th north road will increase the accident in the local community and the road traffic. The implementation shall be complied with the detailed management standard in order to ensure the safety particular the adequate light during the night time and the entry-exit in the appropriate distance. Operation: Shall install the traffic signs in the appropriate place in order to warn people to be more cautious while using the road.
4.2	Global warming	-	-	-	Construction/operation: anticipated that there is no activity caused the adverse impact on global

No	Impact	level			**Brief Description**
		PCP	CP	OP	
					warming.

Noted: PCP-Pre construction phase, CP-Construction phase, OP-Operation phase, A-expected to have the significant impact, C- expected to have minor impact, + : expected to have positive impact, U: Unexpected impact and required for inspection, the impact occurred during the study process, -: No impact. Note:

5.5 Description on the physical impact

5.5.1 Landscape

1) Pre-construction

Potential Impact:

The landscape of the project area is the flat area, which is the existing place of Namone Bridge and there is no expansion. During the pre-construction phase, there are only designing work, construction planning, land clearance for construction area and data collection on economic technique, environmental studies and others. There will not be resettlement or invasion of the governmental land in both sides of the bridge. Therefore, the local authority shall encourage people who invaded the governmental land to relocate from the project area to ensure their safety. However, the project does not have to implement any mitigation measure.

2) Construction Phase

Potential Impact:

During the construction phase, the project will construct the temporary warehouse, office, staff parking and other relevant activities. There will be the earth work at the abutment in order to construct the access as well as the excavation. However, after the infrastructure was completely constructed, there will be soil filling. Therefore, it expected that the impact on landscape is low and able to minimise by the implementation of mitigation measures.

Mitigation measures:

- Build the temporary fence surrounding the construction area (as appropriate with the limited area) and there should be maintained well throughout the construction period including the cleaning inside and outside the construction area. In addition, the landscape shall not be disturbed and not to have any obstacles on the road.
- Tools and construction materials must be kept well organized on site, to ensure that they will not block the transportation and to reduce the risk of accident and mitigate the impacts on project landscapes in the project area.
- Keep the construction sites clean and tidy.

3) Operation

Potential Impact:

The construction project is completed in this phase and commenced on the project operation. This phase will be only the traffic and there is no activity caused the changing of landscape.

Mitigation Measures:

- Manage the traffic of vehicles towards the project area in order to avoid the obstacles in and nearby project area.
- Reforest and provide the green area for the beautiful scenery in the project area.

5.5.2 Climate and Air Quality

Regarding to the actual works, there is no impact on air and communication.

1) Pre-Construction Phase

Potential Impact:
There is no impact

2) Construction Phase

Potential Impact:
During this period, there are some construction activities such as: soil excavation, landfilling, ground levelling, soil compaction, for the access, the storage of construction materials like soil, gravel and sand when there's wind blowing, which may cause dusting from soil and sand, the disposal of construction materials from the high constructing building to the ground, the cleaning of construction litters especially the warehouse in the construction site, that would spreading the dust particles, moreover, the burning fuel in vehicle use and heavy machines in construction activities will create CO, HC, NO_x which also cause the change in climate and air quality.
Generally, dust occur in the construction site also base on each activity characteristic, soil components, soil humidity as well as meteorological condition like: wind speed and direction, total duration of the construction, dust concentration in the air will be changing according to the amount of particles occurred from source, small soil component will change due to the soil humidity, climate condition like: temperature, humidity, pressure, wind direction and distribution of the pollution source during the day time. Besides, the transportation of construction materials and equipment in-out of the construction area such as: the heavy trucks driving in-out on the dirt road can cause dusting, dust from construction ground attached truck's wheels and dust from the falling soil, gravel, sand from uncover truck beds and others. These issues also cause the changing in air quality.

The affected people from dust and air pollution from construction activities are the staff and workers, also people who live nearby the construction site and along the construction transportation access road. Mitigation Measures:

- Spray, sprinkle the ground surface where it has been dredging for construction and where the soil, gravel, sand accumulated daily for at least 2times/day (In the morning and evening) or more than twice in case there's too much dust noticed
- Build the temporary wall with more than 2m height surrounding the project construction area and not to have the traffic obstacles.
- Shall hire the workers for daily cleaning in the construction area and spray water before cleaning in order to minimise the dust distribution. The cleaning time is based on the convenience.

- The materials transport into the construction area must have the proper bed truck cover to prevent any falling on the ground that may cause dust and accident to the passengers using this access road
- The transportation vehicles' wheels must be washed when passing in-out of the project and also speed limit for the transportation vehicles
- Unloading soil, gravel, sand should be considering the weather condition, no unloading when there's heavy wind to prevent the scattering of soil, sand particles and the long period of soil and sand accumulation should be covered too
- Arrange, locate machines and construction works in the long distance from affected people. Machines and equipment which only use for sometimes shall be turn off and should not turn it on when not using to reduce the releasing of pollution from engines
- Maintenance and repair machines and construction equipment frequently in the best conditions, to reduce the releasing of pollution from engines
- Awareness raising and set out rules that workers are prohibited to burn solid waste in the construction site
- Shall assign staff that responsible for public relation work and frequently ask these following measures are proposed to minimize the impacts from the transportation accidents
- Provide the dust protection gears to staffs/workers who work with engines and their duties concerning with spreading dust. Strictly implement in accordance to the regulations and Law on Construction No.05/NA Dated 2009

3) Operation

Potential Impact:

There is no specific impact but it is occurred by the transportation and the traffic. But the management will be responsible by the government sector which has the overall management standard.

5.5.3 Soil and Soil Erosion

1) Pre-construction phase

Potential impacts:

During the pre-construction phase, there will only be the designing work, construction planning, and data collection on economic technique, environmental studies and others, meanwhile there will not be any activity that causes soil and erosion impacts within these areas. Therefore, the project does not have to implement any necessary mitigation measure.

2) Construction phase

Potential impacts

The infrastructure construction of this project will be the earthwork and excavation in order to construct the bridge's access road, but the excavation in this area will be in small area. However, after the access road completed the concrete pavement. The soil compaction can cause the erosion especially during the heavy rain. Besides, the soil excavation or bringing soil from outsource to accumulate for ground levelling might cause soil erosion.

During the construction phase, there will be soil transportation, which may result in some soil falling and environmental impact includes the impact to

people who use this access road, it might cause difficulty to the traffic and impacts on residents in the project vicinity. As the fallen soil might cause dust to occur, clogging the drainage, etc., Moreover, it will cause dirtiness and lose its scenery. However, this problem is only occurred temporary during the construction phase and can be mitigated as carry out these following measures:

Impact mitigation measures:

- The maintenance shall be implemented in the dry season
- Build the temporary fences in the project area particularly in the excavated area. The borrow pit (soil, gravel and sand from other sources) for the ground levelling shall be maintained throughout the construction phase. This is to ensure that there is no erosion during the rain in and surrounding project area. However, the quantity of material is in small amount and is able to store at the production source.
- If the excavation in the large area, it shall be determined and adjusted the slope to be appropriate with the pit to ensure the movement and erosion.
- The excavated soil shall be immediately transported from the construction area as the soil is in small quantity and is easy to transport.
- Construct the drainage in the construction area in order to avoid the erosion.
- Strictly implement on the air quality mitigation measures such as: covering during the soil transportation, speed limit and clean vehicle wheels.
- All trucks must have the truck bed cover, in case there is the soil falling on the road or anywhere, the contractor must clean or hire related government sectors to clean the access road immediately to reduce dust issues and difficult traffic.
- Collaborate with related sectors in determining management plan about the soil falling to reduce dust issue and the project must assign its staff to responsible for specific work on the construction site including providing the contact number that can be seen clearly in front of the project entrance for the convenience in contacting and problem solving if there is any.

3) Operation Phase

Potential impacts:

There is no impact mitigation in this phase so it is not required for the additional mitigation measures.

5.5.4 Water source and water quality

1) Pre-Construction Phase

Potential impacts

In the previous, there is no information on water quality in Namone. Therefore, prior the bridge maintenance, the water quality test shall be implemented particularly the cleanliness of water source. For instance, turbidity, odor, color, pH, BOD5, COD as the reference in the construction phase.

2) Construction phase

Potential Impact

Regarding to the discussion with two village authorities along Namone, currently there is an issue on waste water discharge from the households into the river. Therefore, water quality will be worse in some areas which is the village concerns. In addition, the water usage caused the wastewater or the surface water impact in the construction phase. The wastewater from the daily living of the staff and workers includes waste water from the toilet, bathroom and cleaning. In additions, wastewater from the cleaning for construction activities are cleaning of concrete plant, chemical for concrete mixing and other construction materials.

It expected that there is no impact on the underground water due to the fact that the water source for the construction activity will be coordinated by the project in order to install the water supply in the construction. Regarding to the survey in two villages, it indicated that the water supply is not fully accessed and the water quality is not complied with the water supply standard. Therefore, most people use the ground water but the project activity use less water which caused the limited wastewater. However, the mitigation measures for the water source are as following:

Impact mitigation measures:

- Wastewater from the household shall be managed properly.
- Build drainages surround building construction area to prevent the wastewater in the project area.
- Construction waste must be accumulated and handled properly, then; it should be sent to a defined municipal dumpsite. And the project shall provide training to staff and workers to have a better understanding about waste impacts, as well as waste management, and prohibit all littering into water sources, any violation, shall be fined or fired.
- Cleaning of construction equipment or tools shall be in the specific area which is no risk on the soil contamination or water source in the nearby project area.
- The water quality test in the maintenance period shall be implemented regularly in order to inspect the water quality changing.

3) Operation Phase

Potential Impact

There is no activity caused the adverse impact on the surface water and groundwater quality due to the fact that the construction does not use more water. Therefore, there is no direct impact on water quality.

5.5.5 Mining

The project area is the governmental and individual land surrounding by the structures, roads and others. This area is not the mining concession area as there is no potential on mining. For this reason, the project implementation will not affect to mining.

5.5.6 Noise and vibration

Regarding to the data collection on noise and vibration by the project environmental officers, the noise measurement result in the nearby project area indicated that the noise condition is normal because there is no source

for exceeded noise in this area but there is only noise from the traffic, maintenance, equipment and others.

1) Pre-construction phase

Potential impacts:

During the pre-construction phase, the project activities only included data survey, construction design and planning which did not require any tools with loud noise that could disturbed the community. Therefore, the project is not necessary to implement any loud noise mitigation measures.

2) Construction phase

Potential impacts:

During the construction phase, all types of construction activities will cause some disturbance noise. During this period, activities that require using heavy machines for the excavation, drilling, ground compaction and maintenance. The equipment transportation in the construction site will cause the disturbance noise to the nearby area. The affected people from the noise will be the staff and construction workers. However, the surrounding project area with the consideration by the construction area indicated that it borders with the paddy field on the north and west, the community (market) on the south and houses on the west. Therefore, it is possible to have the disturbance noise from the construction activity in sometimes. The project shall build the temporary fence in the surrounding area in order to prevent the noise. Thus, it expected to have the moderate impact on noise in this phase from some construction activities. However, this could be minimized by the following

Mitigation Measures:

- In case the project will use the machines and equipment with the loud noise in the nearby area, it shall inform people living in that area in order to avoid the impact on noise and vibration to be occurred by the project.
- Set construction schedule for noisy works such as: avoid the night time from 19:00PM – 6:00AM, if it is necessary to work during the night time, must avoid activities that create loud noise and must notice the village authorities or residents nearby before.
- If there is a complaint on noise from the community, it shall have the noise measurement. If the noise is exceeded the standard, it shall be solved immediately.
- Construction tools and equipment that only use sometimes shall be turn off while not using, to reduce loud noise.
- Select construction tools and equipment that make less noise
- Maintenance and repair machines and construction equipment frequently to be in its best condition and will not produce loud noise.
- Transportation of huge construction materials to construction site, which pass through community area shall be carefully done to prevent any falling subjects that may cause loud noise
- Speed limit for transportation trucks shall not exceed 30Km/hour for community area and do not use horn or increase engine power if not necessary, enforce the truck drivers to follow the traffic rule strictly, put up the warning sign in the construction site, speed limit sign for all passing vehicles through construction area, especially the sensitive area.

- Provide hearing protection gears to staffs/workers who work with machines and must explode to loud noise

3) Operation Phase

Potential impacts:

There is no activity caused the vibration and noise

5.5.7 Waste Disposal

1) Pre-construction Phase

Potential Impact*:*

In the project predation phase, most activities are the document preparation in the office. Waste is controllable and there is impact on the pilot project.

2) Construction Phase

Potential impacts:

During this construction phase of the project, the huge amount of solid waste is anticipated such as: construction waste like: excavated soil waste, plastic wrappers, not standardized materials or not in accordance to the requirements, leftover construction waste (wood waste, steel, nail, brick and other waste), hazardous waste that contains engine oil, and other waste from staffs and worker's daily use. These issues may not be a severe issue, but should be well taken care of, in case of its proper storage and management in order to avoid the environmental impacts and other following issues. Therefore, it is necessary to limit and set up disposal sites as well as the proper waste management.

Mitigation Measures:

- Waste from construction activities that can be reuse should be separate and reuse or sold to related sectors to reduce an amount of waste for disposal, for those that can't reuse should be accumulate properly and dispose where there's the proper amount.
- Provide sufficient bin for worker camps and separate the waste in each category in order to facilitate on the waste collection
- Control the waste burning or littering and provide the awareness raising event for staffs to understand about the disadvantage of waste and know the proper disposal method, any violation shall be fine.
- Shall coordinate with related sectors such as: Waste Collection Company in Vangvieng District to facilitate on the waste transportation to the landfill regularly based on the coordination between the project and waste collection division.
- Clearing-cleaning trash bins every time after the waste have been collected for disposal to reduce the chance of bacteria grow
- The construction area should be clean daily and accumulate waste within the project area as described in the primary design

3) Operation Phase

Potential impacts

There is no worker or activity caused the waste. After the bridge construction is completed.

5.6 Biological Impacts

5.6.1 Forest and Terrestrial Ecology

1) Pre-construction Phase

Potential Impact:

There is no worker or activity in this phase

2) Construction Phase

Potential Impact:

The location of the Namone Bridge Maintenance Project is located in two villages of Vangvieng district, surrounding by the people residents, the individual land, the abandoned land and others. There is no critical or endanger fauna, the forest area and as well as the animal habitat. Therefore, there is no impact on terrestrial ecology.

3) Operation Phase

Potential Impact:

There is no worker or activity in this phase.

5.6.2 Aquatic Ecology

1) Pre-construction phase
2) Construction phase

Potential impacts:

Even though the project area is located in the upstream of Namone but the maintenance activity is not implemented in the river. This area is the fish conservation area of the village or the district, however, the worker or staff are limited for fishing. The mitigation measures in this phase are as following:

Mitigation Measures:

- The mitigation on the fishing prohibition for the worker or staff.

3) Operation Phase

Potential impact:

There is no worker or activity in this phase.

5.6.3 Conserved – Protected Area

1) Pre-Construction/Construction/Operation Phase

Potential impact:

The bridge maintenance is the existing area with no expansion. There is no conservation or protection forest in the surrounding area. Therefore, there is no impact.

5.7 Socio-Economic and Cultural Impact Assessment

5.7.1 Land Use

1) Pre-Construction/Construction/Operation Phase

Potential impact:

As mentioned above, the project area is the public land and is the Infrastructure Improvement Project with no expansion.

5.7.2 Road and Traffic

1) Pre-Construction Phase

Potential impact:

There is no activity caused the traffic impact in the project area

2) Construction Phase

Potential impact:

In this phase, the traffic might be more complicated and crowded due to the transportation of project vehicles. In addition, the traffic at the bridge will be only one lane (one traffic lane) and the maintenance period will be 12 months. Therefore, this caused the impact in the area.

Mitigation measures:

- Shall have project name sign and symbol for the project location
- Install the warning sign for construction area and trucks' passing in-out far from the construction area in an appropriate area, in order to warn all passengers along 13th north road crossing the bridge to be more careful and more cautious.
- Shall Install the signage or labels and provide the staff to facilitate the traffic along the Namone bridge on both sides. As there is only one traffic lane, it required to have the walkie-talkie to communicate between two sides in order to give the traffic signal and not to have the congestion.
- Provide the training on the emergency response in case there is congestion in the project area
- Properly plan for the huge material transportation when passing through community area, to be minimum period and very carefully
- Plan beforehand for all period that will have a lot of transportation trucks using the roads such as cement, soil, gravel/sand transportation trucks, that will be passing in-out of the project to prevent the trucks to park on the side road
- Determine the project parking lot in order to avoid the obstacles for traffic
- Avoid to use the vehicles with poor condition along the project area in order to avoid the congestion, if necessary, it required to have the response plan
- Determination of transportation and trucks passing in-out the project that should comply with the traffic rules particularly the truck's weight and limit the speed based on the traffic rule.
- All transportation trucks passing in-out of the project, must have the bed truck covers to avoid any falling object, if there any falling incident, it must inform staffs to clean out in order to prevent any accident which may cause traffic jam
- If possible, put-on sign or sticker, that define project's name, contractor, including coordinator's contact number that can be contact for information and give complaint, the sign should be in suitable size which can be clearly seen from the side of the construction transportation trucks
- Assign the project coordinator for grievance complaint, in case of any annoying grievance from project transportation.

3) Operation phase

Once the construction is completed, the bridge using will be in normal condition and there is no obstacles for traffic and no impact for using of 13th north road.

5.7.3 Social Impacts

5.7.3.1 Community and Population

1) Pre-construction

Potential Impact:

This phase, there is no impact on community. The coordination on the field data collection with local authority is followed as the line management and the relevant divisions in accordant with the regulation.

2) Construction Phase

Potential Impact:

The bridge maintenance could affect to local people living in Nam Mone Bridge and nearby area particularly the impact on noise, dust and accident. However, as surrounding area is the paddy field and some residents, it expected that the impact is still low. In addition, the demand on the construction worker will have the migrant workers which cause the impact on community and population.

Potential Impact:

- Strictly implement the measures on noise, dust and others in order to minimize the community impact.
- To establish the grievance division for project in order to settle the conflict among the community and the project.
- To collect and register the labour registration, name tags or cards to identify the workers and then report to the local authority in the project location. This to ensure the safety in community.
- To control and regulate the construction workers not to cause the trouble in local community.
- Consider to recruit the local workers living in the project area as well as the internal labour for the construction in order to increase their incomes.

3) Operation Phase

Potential Impact:

All workers moved out the project area. Therefore, there is no impact on community.

5.7.3.2 Ethnic and Religions

1) Pre-construction Phase

Potential Impact:

There is no impact on ethnic and religion due to the fact that the project activities does not cause the impact on population and community. The architecture and survey activities are implemented by the Technical and Environmental Teams.

2) Construction Phase

Potential Impact:

There are two temples in the surrounded area including Wat Phoxaymongkoun Thanaram (Ban Namone) and Wat Xayamongkoun Tanaram (Ban Phonesavang), the spiritual stupa in Ban Na as the worship and ceremony place for local people. However, the construction activity will cause the indirect impact. These places are far from the project area therefore the impact is minor. For instance, the construction project will cause the dust.

Mitigation Measures:

- Strictly implement the mitigation measures on the air impact including noise, dust and others to avoid the impact on community
- To inspect the construction equipment regularly in order to avoid the pollution from the fuel combustion and noise of machines affected to the ceremony at the temple
- To establish the regulation to the drivers for the equipment transportation in order to comply with the traffic rule particularly the truck's weight and speed limit.
- Provide the day-off to be appropriate with the social activity in the surrounding villages.

3) Operation Phase
All workers and staff moved from the site, but had left only the achievement on bridge maintenance as well as the social service. Therefore, the operation phase will not cause the impact on ethnic and religion.

5.7.3.3 Education

Both villages (Namone and Phonesavang) consist of three schools including Namone Tai Primary School (did not change the name yet after the village separation), Phonesavang Primary School and Namone High School (existing name after the village separation)

1) Pre-Construction Phase
This pre-construction phase will not cause the impact on education

2) Construction Phase

Potential Impact:

The material transportation might disturb to the students who study in the school as well as their transportation. However, all the project activities will cause the minor impact on the noise and vibration. The construction phase will cause the dust from the construction activity. The material transportation might disturb to the students who study in the school. However, based on the surrounding area of the project area, the nearest distance of three schools is 300 m and the furthest distance is 700m. This will not cause the direct impact and the impact is low. As the result, the project shall have the mitigation measures as following:

Mitigation Measures

- To strictly implement the mitigation on noise, dust and others impact in order to avoid the impact on community.
- To inspect the construction equipment regularly in order to avoid the pollution from the fuel combustion and noise of machines affected to the students

- To establish the regulation to the drivers for the equipment transportation in order to comply with the traffic rule particularly the truck's weight and speed limit.

3) Operation Phase
The operation phase will not cause the impact on education

5.7.4 Health Impact Assessment

5.7.4.1 The health Care in the Project Area

The project area is located from the District Hospital of Vangvieng for 12 km with 15mn driving, and from the Provincial Hospital for 72 km with 2 hrs driving. In addition, there is small hospital, clinic and pharmacies to provide the social service in the community. However, this operation phase, there are some activities that caused the risk on health of worker. Therefore, the health care is important for the project and shall have the protection measures. In addition, the project implementation will not affect on the health but the project shall provide the equipment and first aid kit in case there is an emergency including: the dangers of machines, accidents and others. This shall deliver to the district and provincial hospitals respectively. Therefore, there is no impact on the healthcare service in this area.

Mitigation Measures:

The project shall prepare the response plan for the accident or health issue to be occurred in the future. In addition, the project shall prepare the medical equipment, medicine and vehicles for the patient's delivery.

- Provide the Personal Protection Equipment at the risky point and to control the working time in the sensitive area and the noisy and dusty activities.
- Maintain the machinery at the site particularly the old machinery.

5.7.4.2 Health and Safety

1) Pre-construction Phase

Potential impact:

There is no environmental and social impact.

2) Construction Phase

Potential impact:

The construction activities might impact on the worker and people health in the surrounding construction site including: dust from the construction activity, pollution from the fuel combustion and construction material, the disturbance noise from the demolition, maintenance as well as the accident from the material transportation and traffic.

- The health impact from the dust occurred by the construction activity and the pollution from the fuel combustion and construction equipment: the affected people are the construction workers and people living in the surrounding construction area.
- During the construction period, there will be the vehicles for construction material transportation along the road. Therefore, there might be the risk for accident to the passengers. There also be the soil and sand falling along the road which caused the slippery floor as well as the accident. If the material

transportation is in high speed, this could cause the accident too. In order to prevent and minimize the accident in the project area, the contractor shall implement the following measures:

Mitigation Measures:

- Provide the Personal Protection Equipment to the construction workers as required including the reflective cloths, helmet, safety shoes, noise protection gear and gloves- the first aid kits in each construction point.
- Inspection, maintenance, or checking the tools/machines used for construction shall be carried out regularly to minimize released pollution.
- Provide the training on using of machines and construction equipment to the construction workers.
- To provide the warning signs, reflective ropes or the blockage.
- To prepare the adequate light in the construction site during the night time in order to facilitate and avoid the accident along the 13th north road crossing Namone bridge to ensure the safety visual.
- Determination of transportation and trucks passing in-out the project that should comply with the traffic rules particularly the truck's weight and limit the speed based on the traffic rule.
- To record on the accident, root cause, solution as well as the damage

3) Operation Phase

Potential Impact:

There is no activity caused the impact on labour. The material is moved from the site but remaining only the infrastructure.

5.7.4.3 Health and Safety Issues for the construction

The construction activity might cause various dangers including the falling of material, chemicals and concrete to be used in the project. In addition, there are server accidents caused the life dangers including the electrocution, accident, falling from height, and other accidents. These accidents could be protected as following:

Mitigation Measures:

- Shall disclose on the dangers and the mitigation measures regularly.
- Shall provide the PPE to the workers, staff and visitors who accessed to the construction site including helmet, safety shoes, gloves, and others.
- For the safety in the construction site, it shall divide the working areas and the traffic signs.
- During the construction phase, in case there is an incident including storm, fire or other disasters, the project shall install the warning signs in the construction site. However, if the accidents are served, the construction shall be suspended to ensure the safety of staff.

5.7.4.4 Transmitted Disease

As the use of internal labour is diverse and the workers will be from different places, therefore the project shall pay attention on the risk. Even though the project staff or workers are not the permanent employment (temporary labour) but this could cause the disease from other places; the risk on the disease transmission or spread including: dengue fever, Covid 19, AID, sexual

transmission disease and others. These issues shall be planned and resolved. The mitigation measures are as following:

Mitigation Measures

- Shall check the transmitted disease particularly Covid 19 and the staff shall be vaccinated as required.
- Provide the adequate temporary toilets for workers and staff in the construction site.
- Provide the equipment for garbage storage and bins in order to avoid the dirtiness, bad smell and disease transmission in the project area. This is to protect the disease transmission to the surrounding area and the project area by using the local service or the project itself.
- To raise awareness on the transmitted disease as well as the protection and mitigation measure to the workers.
- To monitor on the injury statistic of project workers regularly.
- To disclose the information on the disease spread, the dangers and the protection.
- In case there is the severe disease transmission among the project workers or staff during the construction phase, the project developer shall coordinate with the relevant provincial and district authorities in order to resolve this issue immediately.

5.7.5 Economic Assessment

5.7.5.1 Employment and Household Income

1) Pre-construction/ Construction Phase

Mitigation Measure:

As the project area located in the nearby community, it is the governmental land in the existing area. Therefore, there is no issue on the people resettlement and no economic impact as well as the private assets. The construction activities could support on the occupation and income of people in the surrounding area such as: construction worker, cleaners, security guards and others. This will improve the quality of life living to be better.

Mitigation Measures:

- The employment of local people in the project area is the priority.
- Employment process shall be fair and transparent and the salary rate should be suitable with experiences and educational qualification
- Employment contract conditions shall be complied with Labour Law 2013, Social Security law and salary standards as well as related laws and regulations.

5.7.5.2 Local Business

1) Pre-construction Phase

Potential Impact:

There is no positive and negative impact to the nearby villages as there are no labour and experts.

2) Construction Phase

Potential Impact:

During the construction phase, there will be activities caused the impact on local business including dust and noise from the construction activity as well as the traffic congestion.

Mitigation Measures

- To implement the mitigation measure to minimize the air impact particularly in the sensitive area including hospital, school and temple.
- To implement the mitigation measure to minimize the noise and dust impact and others to avoid the impact on local business in the community.

3) Operation Phase
The need on road using and the using of standard bridge will be increased, this will support the economy and society in local community or wider or between the north to the south. This is the advantage for the transportation with no congestion and able to use it all time.

5.7.6 Impact Assessment on Infrastructure

1) Pre-Construction-Construction Phases
Potential Impact
The main impact on community basic infrastructures during the pre-construction and construction phases is the increasing number of material transportation vehicles on the roads, which may result in damaged/bad and dirty roads

Mitigation Measures:

- Must follow the weight limit set by the Department of Transportation for each type of transportation truck.
- Set the standard speed limit
- Build wheel washing point before leaving the project area.
- Coordinate with local authorities to assist in monitoring weight and vehicle speed.
- Repairing the roads when they are in bad conditions.

2) Operation Phase

Potential Impact
The possible impact on community basic infrastructures may be caused by the increasing number of cargo transportation trucks on the access roads to the project area, which may be the cause of the bad roads or damaged before the expected period.

Mitigation measures:

- Set up the vehicles' weighting points before leaving the dry port area to ensure that all trucks did not carry too much weight that exceeded the prescribed standard.
- Contributing fund on the national road renovation to the responsible governmental organizations.

5.7.7 Water Sources, Use and Supply

1) Pre-construction Phase
Potential impact: there is no activity required water use as it is the data collection and the survey in the surrounding area.

2) Construction Phase

Potential Impact

Water consumption of the staff/workers, the contractor shall supply the cleaned water to construction workers based on the hygiene principle. The water source to be used in the project area shall be water supply from the standard factories or able to use water from the local source including underground water. However, the labour use for the project is less and required less water. Therefore, it expected that there is no impact on water supply in the nearby community.

Mitigation Measures

- Shall have the standard on water usage and inspect the piping system regularly.

3) Operation Phase

Potential impact: There is no impact as the labour and facility are moved out from the project area.

5.7.8 Power Source, Use and Supply

Potential impact:

The project implementation will not effect on the electric use in the community. The construction aactivities are not required the electric use which not affect to the local community.

Mitigation Measures

There is no mitigation measure

5.7.9 Historical and Cultural Places

Potential impact:

The project area is located in the governmental land and far from the cultural area of Ban Namone (Spiritual stupa). Therefore, there is no impact.

- Cultural Structures

The cultural structures or heritage places are important for the life living. Based on the data collection, there are Wat Phoxaytanaram (Ban Namone), Wat Xayamoungkhoun Vanaram (Ban Phonesavang) in the surrounding area as well as the spiritual stupa (Ban Namone) located in the project area. This might cause the indirect impact during the construction phase.

Mitigation Measures

Strictly implement the standard on air, noise and wastewater qualities and the traffic in-out the project area.

5.7.10 Scenery

1) Pre-construction Phase

There are activities for data collection, survey and planning design for the construction with no impact on scenery in the project area.

2) Construction Phase

Potential Impact:

The out-door warehouse, project activities and waste storage will cause the natural and social scenery. However, there is only temporary impact during the construction phase. Therefore, the impact on scenery is low.

Mitigation Measures:

- Construct the temporary fence in the construction site and maintainin during the construction phase
- Keep clean in the construction site.

3) Operation Phase

Mitigation Measures

This will improve the scenery to be more beautiful.

Chapter 6: Management and Monitoring Plan

The Initial Environmental Examination and Mitigation Measures in this report will assess the potential impacts and the mitigation measures to minimize the impact during the operation phase.

6.1 Purpose of the Monitoring and Management Plan

The purpose of the Monitoring and Management Plan is to monitor on the environment and society to be affected by the project. Therefore, there is the Management and Monitoring Plan for the Construction and Operation phases. The main purpose of this plan is to be the guideline to prepare the framework for the Environmental Management and Monitoring Plan, the implementation of mitigation measures for the direct and indirect environmental impacts as well as the accurate monitoring to be the evident, the scientific principle and the National Environmental Standard.

6.2 Physical Impact and Mitigation Measure

The maintenance period (12/2022-12/2023): is to commence the implementation plan on the maintenance and facilitation to the project staff and worker. Therefore, the direct impact on traffic particularly in two villages includes the dust, noise of machinery, vibration, transportation, erosion as well as people's life living.

After the maintenance: there is no impact on the using of 13 north road at the crossing point of Namone Bridge but the structure and scenery will be better and more beautiful.

Table6. 1 Summary on the main physical impact and the mitigation measures

Environment and Social	Activity and Cause of Impact	Overall Mitigation in term of Implementation	Level of Impact after the Mitigation Implementation	Responsible Division	Monitoring Division
1. Pollution Protection					
Air Pollution	• Dust from the construction activity • dust from construction ground attached truck's wheels and dust from the falling soil, gravel, sand from uncover truck beds and others • Fuel combustion from the vehicle using and heavy machinery for the construction activity	• Spray, sprinkle the ground surface where there have been excavations and where the soil, gravel, sand accumulate daily for at least 2 times/day • There shall be workers who sweeping, clearing and cleaning in the construction area and water spraying in order to minimize the dust • The material transport into the construction area must have the proper bed truck cover to prevent any materials falling on the ground that may cause and to avoid the accidents for people passing by the road. • Wash the transportation vehicle's wheels and enforce a speed limit for vehicles • Unloading soil, gravel, sand should be considering the weather condition, no unloading when there's heavy wind to prevent the scattering of soil, sand particles and the long period of soil and sand accumulation should be covered too	Moderate (1.5)	Project Owner/Construction Contractor	Project's EMU/ Governmental EMU

Environment and Social	Activity and Cause of Impact	Overall Mitigation in term of Implementation	Level of Impact after the Mitigation Implementation	Responsible Division	Monitoring Division
		• Inspection, maintenance, or checking the tools/machines used for construction shall be carried out regularly to minimize released pollution. • Awareness raising and set out rules that workers are prohibited to burn solid waste in the construction site. • Assign responsible staff for the public relation works and interviewing residents living nearby the construction area particularly houses restaurants, if any grievance about loud noise occurred it shall be dealt with immediately - Dust masks should be provided (where applicable) to construction workers.			
Water Pollution	• Turbidly water might have the gravel and concrete debris falling into the water source during the construction phase • Oil strain and contaminated chemicals from	• Set out the work plan for clearance work and ground leveling work to be done during dry season to prevent the soil erosion during the rainy season • The borrow pit and construction material shall be located from the water source and the rainwater discharge in order to avoid the erosion into the river • The maintenance area of construction equipment-machinery shall be located from the	Moderate (2)	Project Owner/Construction Contractor	Project's EMU/ Governmental EMU

Environment and Social	Activity and Cause of Impact	Overall Mitigation in term of Implementation	Level of Impact after the Mitigation Implementation	Responsible Division	Monitoring Division
	the using of construction machinery and equipment and concrete debris from the construction • Wastewater from the consumption of the staff and worker • Wastewater from cement or chemical products for the maintenance work.	water source and the flow direction of rainwater • Strictly control not to throw the construction waste (cement, wood, steel) into the river • Provide sufficient bin for worker camps and separate the waste • Prohibit on the wastewater discharge and waste dumping from the worker camp into the river			
Waste management	Construction waste which is not standardized materials or not in accordance to the requirements, leftover construction waste (wood waste, steel, nail, brick and other waste),	• Provide sufficient bin for worker camps and separate the waste in each category in order to facilitate on the waste collection. • Control waste burning or littering and raise awareness on the consequence of waste as well as the waste disposal. If there is a violent, it shall be fined as the lesson learnt and not to repeat the mistake. • Shall coordinate with related sectors such as: Waste Collection Company in Vangvieng	Low (1)	Project Owner/Construction Contractor	Project's EMU/ Governmental EMU

Environment and Social	Activity and Cause of Impact	Overall Mitigation in term of Implementation	Level of Impact after the Mitigation Implementation	Responsible Division	Monitoring Division
	hazardous waste that contains engine oil, and other waste from staffs and worker's daily use.	District to facilitate on the waste transportation to the landfill in daily or weekly based on the coordination between the project and waste collection division.			
Soil Contamination	Construction: might have the contamination from fuel and chemicals by concrete mixing but it will be in small quantity.	• Build the temporary fence in the construction site and the borrow pit (soil, gravel and sand from other sources) for the ground levelling shall be maintained throughout the construction phase. This is to ensure that there is no erosion during the rain in and surrounding project area. • If there is a heavy rain, it shall construct the drainage along the pit to prevent water discharge into the pit to ensure there is no erosion. • All trucks must have the truck bed cover, in case there is the soil falling on the road or anywhere, the contractor must clean or hire related government sectors to clean the access road immediately to reduce dust issues and difficult traffic.	Low (0.5)		
Noise and Vibration	Noise from activities that require using heavy machines for the excavation,	• Set construction schedule for noisy works. if it is necessary to work during the night time, must avoid activities that create loud noise and must notice the village authorities or residents.	Moderate (1.5)	Project Owner/Construction Contractor	Project's EMU/ Governmental EMU

Environment and Social	Activity and Cause of Impact	Overall Mitigation in term of Implementation	Level of Impact after the Mitigation Implementation	Responsible Division	Monitoring Division
	ground levelling and material transportation.	• Assign responsible staff for the public relation works and interviewing residents living nearby the construction area, if any grievance about loud noise occurred it shall be dealt with immediately • Maintenance and repair machines and construction equipment frequently to be in its best condition and will not produce loud noise • Transportation of huge construction materials to construction site, which pass through community area shall be carefully done to prevent any falling subjects that may cause loud noise • Speed limit for transportation trucks shall not exceed 20-30Km/hour for community area and do not use horn or increase engine power if not necessary. Provide hearing protection gears to staffs/workers who work with machines and must explode to loud noise			
2. Social Environment					
Road and Traffic	- The increase of vehicles by the project including	• Shall have project name sign and pointed object to tell direction throughout the project, in front each construction site	Moderate (2)	Project Owner/Construction	Project's EMU/ Governmen

Environment and Social	Activity and Cause of Impact	Overall Mitigation in term of Implementation	Level of Impact after the Mitigation Implementation	Responsible Division	Monitoring Division
	vehicles for material and workers transportation - the congestion from the one traffic lane	• Install warning sign for construction area and trucks' passing in-out along the road before reaching the construction site for 200 m • If possible, put-on sign or sticker, that define project's name, contractor, including coordinator's contact number that can be contact for information and give complaint, the sign should be in suitable size which can be clearly seen from the side of the construction transportation trucks • Determination of transportation and trucks passing in-out the project that should only operate out of rush hours in accordance to traffic rules, if it is necessary to work, there must be workers facilitating the traffic • Provide the staff to facilitate the traffic along the Namone bridge as there is only one traffic lane • Properly plan for the huge material transportation when passing through community area, to be minimum period and very carefully • Plan beforehand for all period that will have a lot of transportation trucks using the roads such as cement, soil, gravel/sand transportation trucks, that will be passing in-out of the project to prevent the trucks to park		Contractor	tal EMU

Environment and Social	Activity and Cause of Impact	Overall Mitigation in term of Implementation	Level of Impact after the Mitigation Implementation	Responsible Division	Monitoring Division
		on the side road • During the rush hours, all project vehicles shall be organized properly or park at prescribed points, do not park on the side road. So, it won't block the traffic • Parking any vehicle at project vicinity during the rush hours, if it can't be avoided, there must be a signal for passengers, it could be symbols or signs • Assign project coordinator for grievance complaint, in case of any annoying grievance from project transportation			
Transmitted Disease including HIV/AID	Construction: The influx of construction workers in the construction site will cause the risk on transmitted disease in the local community. The workers shall have the health check prior starting work.	• Raise awareness on the sexual transmitted disease particularly HIV/AID to the construction workers • If possible, the project shall provide the condoms to the staff in order to prevent the transmitted disease • It shall limit the in-out times in the worker camp • Provide the day-off for the migrant workers to visit their hometown in accordant with the regulation.	Low (1)	Project Owner/Construction Contractor	Project's EMU/ Governmental EMU
Covid19	The migrant workers might cause the disease in the	▪ The site staff shall be vaccinated with fully doses. ▪ Raise awareness on the protection of Covid 19 disease			

Environment and Social	Activity and Cause of Impact	Overall Mitigation in term of Implementation	Level of Impact after the Mitigation Implementation	Responsible Division	Monitoring Division
	community	▪ Provide the sink and handwash in the workplace ▪ Provide the sufficient masks and alcohol gel ▪ Health check regularly and separate the risky staffs.			
Working environment (including the safety working)	The risk on the health safety by the dust from the construction activity, pollution from the fuel combustion, disturbance noise from the construction activity, accident from the material transportation and the traffic of vehicles	▪ Provide the personal protection equipment to construction workers ▪ Inspection, maintenance, or checking the tools/machines used for construction shall be carried out regularly to minimize released pollution. ▪ Provide the training on using of machines and construction equipment to the construction workers. ▪ To provide the warning signs, reflective ropes or the blockage. ▪ To prepare the adequate light in the construction site during the night time to ensure the safety visual. ▪ Determination of transportation and trucks passing in-out the project that should comply with the traffic rules particularly the truck's weight and limit the speed based on the traffic rule. ▪ To record on the accident, root cause, solution as well as the damage ▪ During the construction phase, in case there is an incident including storm, fire or other	Moderate (2)	Project Owner/Construction Contractor	Project's EMU/ Governmental EMU

Environment and Social	Activity and Cause of Impact	Overall Mitigation in term of Implementation	Level of Impact after the Mitigation Implementation	Responsible Division	Monitoring Division
		disasters, the project shall install the warning signs in the construction site. However, if the accidents are served, the construction shall be suspended to ensure the safety of staff.			
Remarks: The Level of Impact after the Mitigation Implementation value is referred to the table 5.2 in the chapter 5					

Remarks: The Level of Impact after the Mitigation Implementation value is referred to the table 5.2 in the chapter 5

6.3 Details of the Management and Monitoring Plan

6.3.1 Reason of Management

In order to comply with the Lao Law particularly the Decree on the Environmental Impact Assessment, No.21/GO, date on 31 Jan 2019, the technical guideline on the Establishment of the Initial Environmental Examination Report, MONRE. DESIA. DMM, date on 19 Dec 2016. Therefore, the development of the Environmental and Social Management and Monitoring Plan is significant part of the Initial Environmental Examination Report.

6.3.2 Organizational Structure for the Management

The Organizational Structure for the Management and Monitoring Plan (ESMMP) consists of two parts: (1) The government sector and (2) the project as following:

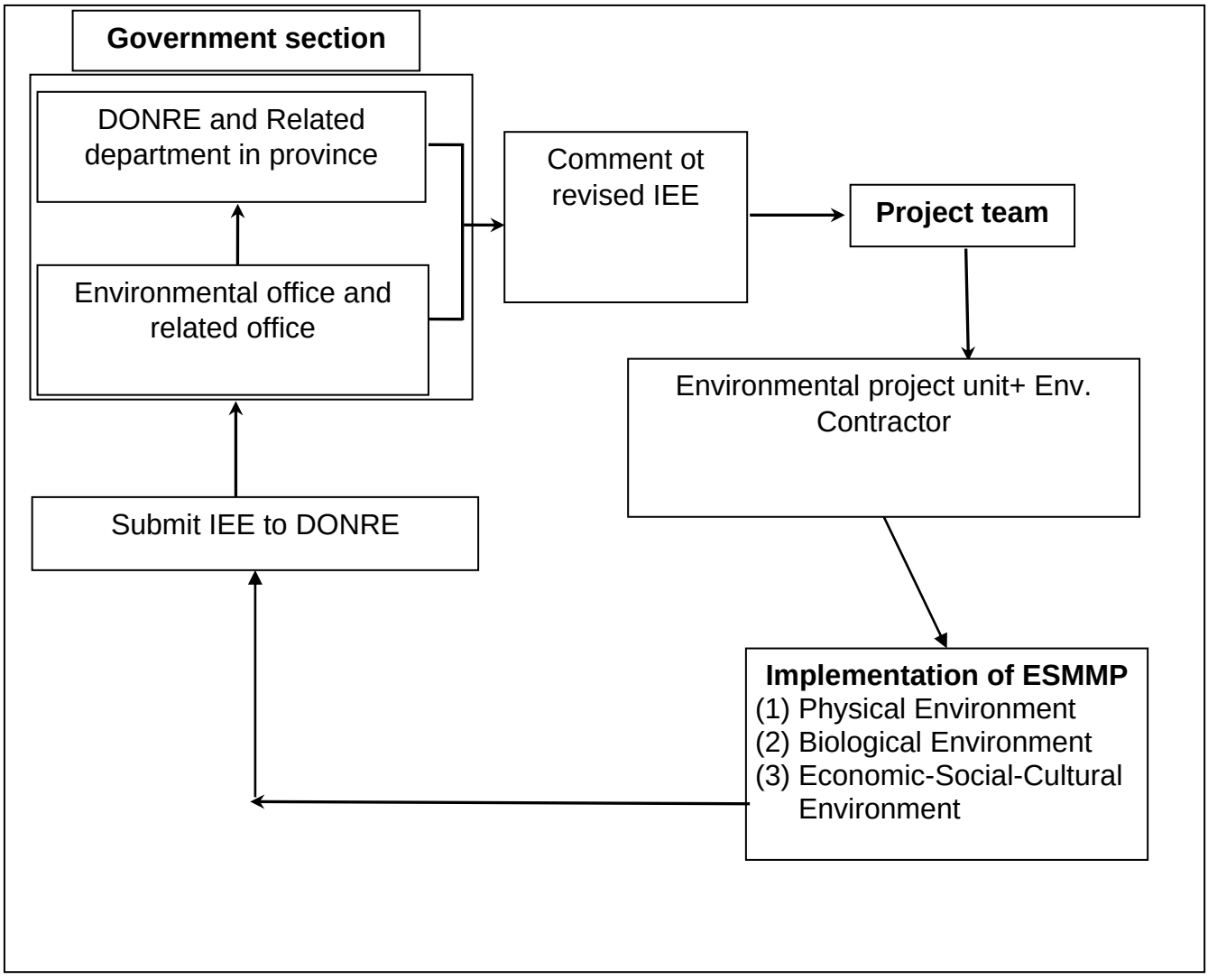


Figure6. 1 Organizational Structure for the Management and Monitoring

6.3.3 The responsibility on the Environmental and Social Management Plan

- Project owner

  The project shall establish the Environmental Management Unit including the technical officers to be responsible for the ESMMP. This plan is required to strictly implement on the mitigation measure as described in the ESMMP throughout the construction phase. In addition, there is an obligation on review of ESMMP.

  The Project Owner shall describe the context and obligations on the environmental and social management and monitoring measures as stated in the ESMMP in the contractor contract for its accurate and comprehensive implementation. But the project owner still has fully responsibility. In addition, three months prior the project termination, the project owner shall propose to DONRE in order to monitor and evaluate on the ESMMP implementation. In case the project had completely implemented in accordant with the ESMMP and there is no remaining environmental and social issue, DONRE shall issue the certificate to the project owner. In contrast, if the issue is remained, DONRE shall advise to the project in order to resolved it prior the project termination.

  Construction Contractor:

  The Project's Construction Contractor (subcontractor) will be responsible for the implementation of mitigation measures to avoid and minimize the environmental and social impact, particularly the project's worker and public health impact. The construction contractors are also required to comply with the procedures of National Environmental Standard and shall follow the described mitigation measures.

- Responsibility of the state sector

  The Natural Resources and Environment Department and Office is the central coordination with the relevant divisions and to monitor on the implementation of the Environmental and Social Management and Monitoring Plan as well as to provide the comments on this plan once the project operation is not complied with the described ESMMP. In addition, it shall summarize and report on the implementation on the Initial Environmental Examination and Environmental and Social Management and Monitoring Plan to the district and provincial authorities.

6.3.4 Monitoring and Evaluation

After the project received the Environmental Certificate for the ESIA Report, the monitoring and evaluation of ESMMP is required for the implementation. The implementation of ESMMP shall be collaborated with various divisions including: the monitoring by the project owner, the state sectors and the external if necessary. The frequently and the reporting for the monitoring and evaluation is determined as following:

The frequently for the monitoring and evaluation of the ESMMP implementation is importance for the assessment result of ESMMP. This will support on the new decision or planning if the initial plan is not efficient or required for revision in order to make it more comprehensive and suitable with the location condition.

Table6. 2 Monitoring activities for the project implementation

No.	Monitoring	Responsible Division for Monitoring		
		Project + Contractor	District	Province
I. Pre-Construction Phase				
1	Conduct the ESIA study to get approval the Environmental Compliance Certificate (Consultant Company	Entire study phase	Entire study phase	Entire study phase
2	Project information disclosure to the local people during the ESIA study (by consultant company)	Involve every time	Involve every time	Involve every time
3	Compensation (if any)	Involve every time	Involve every time	Involve every time
II. Maintenance Phase 12 months				
Environmental Monitoring				
1	Air Quality Management (Dust)	Daily - Monthly	2-3 Times/year	1-2 Times/year
2	Noise and Vibration Management	Daily - Monthly	2-3 Times/year	1-2 Times/year
3	Construction wastewater management	Daily - Monthly	2-3 Times/year	1-2 Times/year
4	Worker camp Management	Daily - Monthly	2-3 Times/year	1-2 Times/year
Social Monitoring				
1	Traffic In-out project area			
2	Health and Safety Management	Daily - Monthly	2-3 times/year	1-2 Times/year
3	Social issues Management	Daily - Monthly	2-3 times/year	1-2 Times/year
III. Operation Phase after the completed maintenance				
1	Environmental Issues		2-3 times/year	1-2times/year

- Reporting, Monitoring and Evaluation

The project owner or its Environmental Management Unit are obligated to develop and submit the implementation report as described in the ESSMP to the relevant state sectors at the district and provincial levels for monthly and quarterly throughout the construction phase. The report shall include as following:

- The progress, violation or disadvantage including the monitoring result on the implementation of mitigation measures for the environmental
- The difficulties on the project operation in the implementation on the mitigation measures on environmental and social impacts and other situations as required.

and social impacts under the ESMMP. This includes the conditions as mentioned in the Environmental Certificate and other contracts.	

The Project Developer shall submit the report to the Environmental and Social Department and Office and other relevant division for three sets or more in order to facilitate on the monitoring and evaluation on the implementation of ESMMP in periodically. In addition, the project owner shall submit the quarterly report to the district and provincial levels.

6.3.5 The Grievance Resolution

The proposed grievance procedure is to provide the opportunity to the affected people to provide their comment in term of the environmental and social issues or to propose the complaint and conflicts with the project as well as other environmental issue. The main purpose of this procedure is to resolve the grievance at the local level as soon as possible. This to ensure that the resolution has the transparent procedure with the mutual agreement to ensure the justice among the people to be affected by the project. The detailed mechanism is indicated in the figure below:

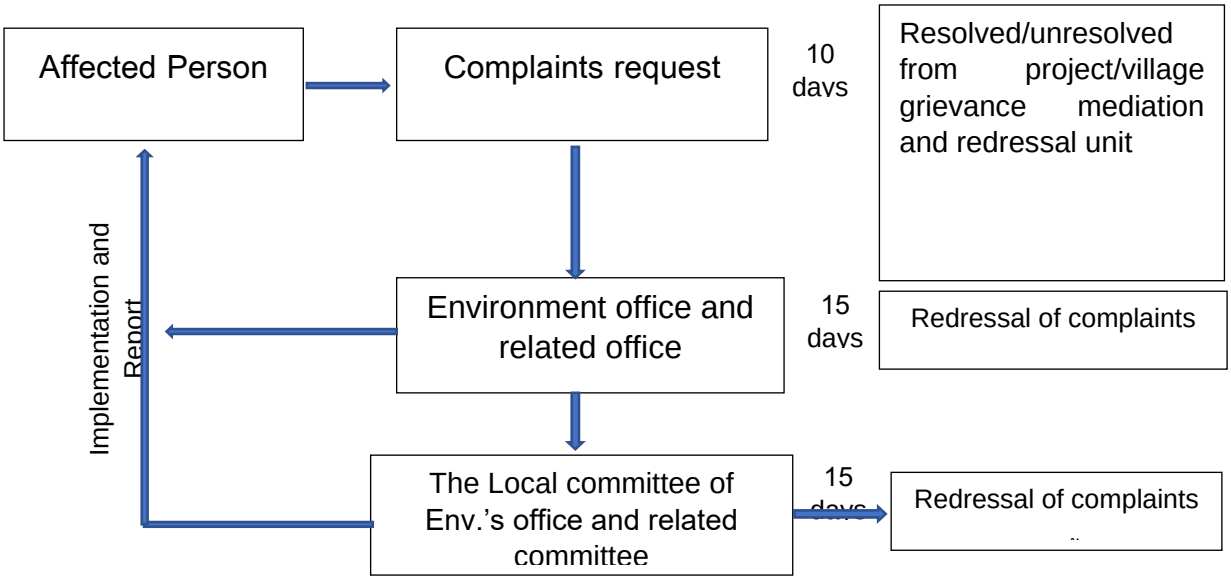


Figure6. 2 The diagram on the grievance and resolution procedure

6.3.6 The Budget on Environmental Monitoring

Environmental and Social Management and Monitoring obligations for the potential impact by their own project is required for all development projects, less or more obligation is depending on consequences of the project impact. Less – more potential impact by the project is depending on the type, size and location of the project, if those projects are located in the sensitive area on natural ecosystems, those projects will have higher obligations. Therefore, the environmental and social obligation is a necessary measure of project developer or project owner have to responsible on the budget for

management and mitigation measures to minimize direct and indirect potential impact, with both short-term and long-term.

The Bridge Maintenance and Management Project is a project which has an obligation on the environmental and social, to contribute to the environmental and social protection and also to be the reference for the budget allocation in term of the implementation of the environmental and social obligations of this project.

for the table 6.3 to table 6.5 are budget on Environmental Management and monitoring for the Project Owner the environmental and social obligations of this project is based on the key legislation as follows:

Table6. 3 The environment monitoring budget of Project owner

No.	Description of the budget	lump sum budget (Construction Phase 1 year) (USD)	Responsibility
1	Air Quality Impact Management and Monitoring (Dust and exhaust emission)	1.200	Project owner/contractor is responsible for the budget and implementation by themselves
2	Wastewater Management and Monitoring	1.200	Project owner/contractor is responsible for the budget and implementation by themselves
3	Solid Waste and Hazardous Waste Disposal from the construction	1.200	Project owner/contractor is responsible for the budget and implementation by themselves
4	Health and Safety of workers and community	2.000	Project owner/contractor is responsible for the budget and implementation by themselves
5	Training on Environment and information disclosure	1.000	Project owner/contractor is responsible for the budget and implementation by themselves
6	Budget for Emergency Incident	5.000	Project owner/contractor is responsible for the budget and implementation by themselves
Total		**USD 11.600**	

Table6. 4 The environment monitoring Budget for the State Sector

NO.	Monitoring Division	Budget for the Construction Phase (12 Months)/Time	Number of People	USD	Total in USD
1	Monitoring by the Provincial of Natural Resource and Environment Department of Vientiane	2	4	120	960
2	Monitoring by the District of Natural Resource and Environment Office of Vangvieng	4	2	100	800
Total					**1.760**

Table6. 5 Summary of Environmental and Social Management and Monitoring Budget

No.	**Environmental and Social obligation budget of the project**	**Total (USD)**
1	Land Compensation Budget (not required as the land is owned by the project owner)	0
2	Environmental Management and Monitoring Budget for Project Owner	11.600
3	Management and Monitoring Budget for state sector	1.760
Total (USD)		**13.360**

Chapter 7: Public Consultation

7.1 Purpose

- In order to comply with the Agreement No. 707/MoNRE, date on 5 Feb 2013, the Guideline on the Public Participation in the Environmental Impact Assessment for the Investment Projects.
- In order to discuss and to disclose on the investment project information in order to obtain the feedback from the affected people or beneficial people from the investment project including people who are interested in the project investment. This will be the reference on the establishment and consideration of the Initial Environmental Examination and the Environmental and Social Management and Monitoring Plan.

7.2 Stage and Approachh

7.2.1 Stage of Consultation

As the Bridge Maintenance and Management Project is a project which focuses on the capacity building for the technical officers and the Bridge Management Division. Therefore, the maintenance of Namone Bridge will be one of the pilot activities for the overall projects. This is to indicate on the principle, resolution as well as the implementation on maintenance and management works. The meeting, consultation-discussion for idea exchange among other divisions and the project stakeholder particularly the relevant state and private sectors who are interested in the consultation and public participation. After the Environmental and Social Consulting Company is assigned by the Project Developer. The consultation and the data collection are commenced on the implementation and had been continuously conducted until the project approved. The pilot bridge maintenance (Namone Bridge) was discussed among the Environmental Consulting Company, the Project Coordinators, the Provincial of Natural Resource and Environment Department, the District of Natural Resource and Environment Office and the Village Chiefs of two villages located in the project area in order to determine the guideline for the implementation in each stage in accordant with the government policies.

Data collection and disclose: Prior the field data collection, the Environmental Consultants had issued the letter through the project owner to the Road Department regarding to propose to the Provincial of Natural Resource and Environment Department of Vientiane in term of data collection. After that, DONRE had discussed on the relevant works with the District of Natural Resource and Environment Office and the Village Chiefs of two villages located in the project area regarding to the disclose on project information. The DONRE and villages had surveyed, collect the physical and biological, economic-social information's as well as the water sampling.

Project Operation: After the field data collection, the Environmental and Social Consultants had analysed the economic-social information in and surrounding project area in order to anticipate on the impact and mitigation measures by applying the scientific -environmental-social principals. Afterwards, the consultation meeting was organized in each level starting from the village to the provincial levels.

7.2.2 Implementation Approach

The disclose on the project information is the priority for planning and implementation on the public consultation. The purpose is to understand the visions of the stakeholders. This is required the collaboration on planning and development work in order to exchange information among the stakeholders in different levels.

The priority for designing on the consultation approach is included:

- To ensure that the stakeholders understand on the project information and potential impacts as well as the management plans in order to minimize the impacts.
- To ensure that the stakeholders understand on the project components and its purpose for the maintenance of Namone Bridge.

7.2.3 Applicable Technique

The consultation techniques are designed to meet the need of the participants, which is necessary to be considered on the techniques in order to meet the requirements of the studied teams. The applied techniques include various approaches as following:

- Presentation with pictures, maps and advertisement particularly at the local level and in the project area
- Organize the consultation meeting, the meeting at village level, the interview, the techniques on the result assessment for the public participation as well as the site visit.
- Summary the project description in Lao, the documents to be distributed to the community leader, staff and stakeholder.

7.2.4 Public Consultation Process

The project developer shall implement the consultation meeting in order to get feedback from people or groups (youth, women, ethnic, vulnerable) affected from the investment project and other participants. The consultation meeting shall be on the impact by the project and take those feedbacks in the account in the draft and revised ESIA. In addition, the consultation shall be followed four stages as following:

7.2.4.1 Consultation meeting at the Village level

As the project does not cause the impact on lands use of people, to ensure that the flow and fast communication, the discussion with the community is implemented at the Namone village office to represented by village head of Phonesavang and Namone and DONRE*[3] . And then but this work is implemented with the village chief who coordinates with the community or disclose on the project's framework in order to explain to people using 13th north road to be cautious on safety traffic. Beside that the technical public consultation level is will be organize in the next stage after submit the draft of IEE report to the DONRE.

Disclose and interview with the village chiefs of two villages at Ban Namone	Site inspection with the Technical Officers of DONRE

[3] See the appendix 5-Participant list at the Namone village office

Figure7. 1 The disclose on the project information to the Village Chief and DONRE of Vientiane Province

7.2.4.2 Consultation meeting at the district level

This project is under the management of the Provincial of Public Works and Transport Department of Vientiane Province which is responsible for the national roads and bridge along the 13th north road. This department is responsible on the environmental management. However, the Project Developer shall collaborate with the Environmental Consulting Company, the Provincial of Natural Resource and Environment Department in order to disclose on the project's frameworks to the district authority for the acknowledgement and understanding on the operation process, the project implementation approach, the potential impact from the project to people using the road crossing that point during the maintenance period for 12 months.

Disclose and interview with the Env. office chiefs of Vangvieng district	Disclose and interview with the Env. office chiefs of Vangvieng district
	

Figure7. 2 The disclose on the project information to the environmental office of Vangvieng

7.2.4.3 Consultation meeting at the provincial level

- DoNRE will review on the IEE If the content of the report is comprehensive, the DONRE of Vientiane shall organize the technical meeting and site visit (if required) by the project developer in order to prepare the relevant information and the proposal on IEE
- After that, the DONRE of Vientiane shall provide the comments to the project developer for the revision and submit to the DONRE for the final review in order to submit to the Provincial Environmental Committee to issue the Environmental Certificate.

Chapter 8: Conclusion and Recommendation

8.1 Conclusion

Regarding to the result of the Initial Environmental Examination, it indicated that the Namone Bridge Maintenance and Management Project cause the positive impact rather than the adverse impact. The adverse impact is minor, which is the temporary impact occurred during the construction phase including difficult traffic, dust and safety traffic. During the maintenance period, this impact is controllable and temporary by the implementation of the proposed mitigation measures as describe in this report. In addition, the adverse impact on the physical environment is minor which is under control. The main impacts are the disturbance noise, waste, surface water quality during the bridge maintenance to be occurred in the construction phase. These cause the impact to the community located in the surrounding project area including the congestion in the project area as there are market, school, temple and small hospital. However, this area has the most people living there.

In term of the biology, there is no impact on flora and fauna due to the fact that the project is located in the existing place. Therefore, there is not impact on the animal or plant habitats.

There is no economic-social and cultural impacts particularly the assets and land use as the project area is the governmental land. However, the invasion in the state conservation area (Ban Phonesavang side) shall be resolved.

The proposed impacts can be prevented and minimized by strictly implementation on the measures as described in the Chapter 5 and the monitoring and management plan in the Chapter 6 of this report.

Based on the data assessment, it can be concluded that the environmental and social impact is minor comparing with the positive consequence as the project will contribute in the national economic-social development particularly the linkage among provinces.

8.2 Recommendations

- The village and district authorities shall continuously conciliate on the invaded land by people (Ban Phonesavang side) to be completed prior the maintenance. The project developer shall strictly implement in accordant with the Environmental and Social Monitoring and Management Plan.
- The contractor shall develop its mitigation measures based on this report in order to revise the information prior the actual implementation.
- To ensure on the safety and security in the construction phase, the project shall record the number of staff and workers and report the labour information to the village authority for the acknowledgement and facilitation on the security work.
- The project shall collaborate with the local authority to provide the information to people using the road to ensure on the safety.

Appendix

- Appendix 1: Image on the damage of Namone Bridge
- Appendix 2: The Minutes on the conciliation on the invasion in the conservative area (Ban Namone side), Vangvieng District, Vientiane Province, date on 16 May 2022
- The Minutes on the conciliation on the invasion in the conservative area (Ban Phonesavang side), Vangvieng District, Vientiane Province, date (does not have)
- Appendix -3 The laboratory result from Phanthamit Lab
- Appendix -4 The questionnaire for the interview on the Economy-society with the Village Chief of Ban Namone and Ban Phonesavang
- Appendix -5 Participant list on the public consultation with village level at the Namone village

INITIAL ENVIRONMENTAL EXAMINATION (IEE) STUDY (XE-BANGNOUAN BRIDGE)

The Project for Capacity Development on Bridge Maintenance and Management Xebangnouan Bridge Songkon District, Savannakhet Province

Initial Environmental Examination

(Draft Version)

Submitted to

Department of Natural Resources and Environment, Vientiane Province

Prepared by

Project Owner	**Environmental Consulting Company**
Department of Road Project Engineer: JICA-BMM (head by: IDCJ) Project Financier: JICA-BMM	Lao Consulting Group Ltd (LCG)

Abbreviations and Acronyms

BMM	Bridge Maintenance and Management
BMS	Bridge Management System
Covid-19	Coronavirus disease 2019
CP	Construction phase
DOE	Department of Environment
DONRE	Department of Natural Resources and Environment in Vientiane Capital/Province.
DOR	Department of Road
DPWT	Department of Public Work and Transport
EIA	Environmental Impact Assessment
EMMP	Environmental Management and Monitoring Plan
GDP	Gross Domestic Product
GoL	Government of Lao PDR
Gov	Government
HH	Household
IDCJ	International Development Center of Japan
IEE	Initial Environmental Examination
JCC	Joint Coordinating Committee
JICA	Japan International Cooperation Agency
MONRE	Ministry of Natural Resources and Environment
NA	National Assembly
NUOL	National University of Laos
OJT	On Job Training
ONRE	Office of Natural Resources and Environment in Districts.
OP	Operation phase
PC-I	Prestress Concrete I Girder
P-CP	Pre-Construction phase
PTI	Public Works and Transport Institute
RC-T	Reinforce Concrete T Girder
RMS	Road Management System
TWG	Technical Working Group
USD	United States Dollar

km	Kilometer
m	Meter
mm	Millimeter
cm	Centimeter
ha	Hectare
km^2	Square Kilometer
m^3	Cubic Meter
m^3/min	Cubic Meter/Minute
m/s	Meter/Second
kg	Kilogram
dB(A)	Decibel

Executive Summary

Regarding to the development of transportation network of the Lao Government since the Independence Day to the current, it indicated that the road network has been developed for connecting within the nation for 56.000 km and the bridge for 3.580 places. As Laos is the landlock country, therefore the road transport is the main option for the logistic and passengers. Thus, the maintenance and quality of transportation as the rehabilitation of road and bridge infrastructure is essential for the industrial development and the economic balance of the nation. In addition, the road and bridge maintenance work were included in the 5 years Economic-Social Development Plan, and the priority ranking on the budget allocation for the road and bridge maintenance is challenged and sensitive as the Lao PDR is a small country with the total population of seven million people and the annual budget for 3.7 billion US dollar. This budget is very limited comparing with one province in Japan. Currently, the spread of Covid 19 in the world has affected to the economy-society not be developed and recessive. For instance, the annually revenue of Lao PDR is decreased for 0.7 billion US dollar in this year (2021). For this reason, the report from the Lao Government through the Ministry of Planning and Investment indicated that the government is considering decreasing the development budget for 50% and the budget for central government for 30% and the budget for local government for 10%. Moreover, there is the potential to decrease the number of Government Officers as well as the bridge maintenance budget. However, regarding to the activities for implementation of the bridge maintenance, it indicated that the bridges have been used for many years which are damaged and broken but there are only the price assessment plans for the maintenance-rehabilitation work. These plans will be implemented once the damage occurred but there is no any maintenance plan. In Laos, there are 3.850 bridges, the national roads for 1.350 roads with 35% required for the regular maintenance and 17% required for the emergency maintenance. In addition, 40% of the bridges are the temporary bridges which were built by wood and steel. These bridges are not strong which have been broken regularly. In the previous, the accidents occurred for many times caused by the inappropriate maintenance and rehabilitation, the bridge damage or the over weight's truck. Most bridges in Laos were financially supported on the construction and maintenance from Japan. However, to ensure the safety traffic and smooth transportation on the road, the planning on bridge maintenance is significant in order to avoid the congestion.

As the result, JICA as the organization which always supported the Lao Government agreed to provide the grant to the Lao Government through the capacity building on the bridge maintenance and management under the project name "The Capacity Building on Bridge Maintenance and Management Project", to be called as "JICA-BMM". This project will define the bridge maintenance cycle including the inspection-analysis-planning and maintenance and the contribution in the capacity building on the bridge maintenance and management for the Department of Road, the Public Works and Transport Institution, Department of Public Work and Transport by the cooperation between the government-private-technical officers and the using of Japanese modern technology for the inspection and damage analysis of the bridge structure. JICA-BMM focuses on the implementation on the infrastructure management and time extension for using modern technology, the establishment of institution, the implementation plan for the maintenance work to cover all roads in Lao PDR.

Therefore, the bridge selection to be the pilot project for the management and maintenance is to survey along the national road by the participation of relevant divisions including the Department of Road and the Provincial of Public Work and Transport Department. The target bridges are located along National road 13th north and south roads based on the bridge management and maintenance plan of the Department of Road including along 13 north road: Paktang bridge for 80 m length, Houay Pong bridge for 23 m length, Namv Bee bridge for 51 m length, Namone bridge for 46 m length, Houay Pongsong for 40m length, along 13 south road: Xechampone bridge for 128m length, Xexamxoi bridge for 100 m length, Xebanghieng for 250 m length and Xebangnouan bridge for 140,37 m length. Based on the consideration by the project and relevant divisions, two bridges are selected; one bridge located along 13 north road and one along the 13 south roads as the pilot project for the implementation. The project selected Namone bridge located in the 13 north road which were built since 1991 and located in Km 142+300 from Vientiane Capital and along the 13 south road is Xebangnouan bridge which were built since 1988 and located in Km 540+200 from Vientiane Capital. The project activities are the capacity building for the technical officers on the inspection-analysis-planning and maintenance. Therefore, the pilot bridge maintenance will be one of project activities with the structure maintenance in the top and bottom parts. Based on the survey and analysis by the technical team, the project activities shall be prepared the IEE in accordant with the Lao Law.

- Based on the study on physical environment, the implementation of this proposed maintenance project will not cause the adverse environmental project as it is the maintenance project with no expansion. However, there will be minor and temporary impact from the construction activity such as dust, noise. however, the maintenance project is located quite distance from community, but the community is always organizing the weekly temporary market (Every Wednesday in the the week), so the project activity potential disturbs to this event, but the potential impact is able to control and minimize by the strictly implementation of mitigation measures as described in Chapter 5 and 6 of this report. Moreover, the project also plans and allocates the budget for the Environmental and Social Management and Monitoring Plan for the project implementation throughout the construction phase.
- The impact on surface water quality in Xebangnouan will be minor, due to the fact that the work volume and the chemicals caused the contaminated water is less. However, the project also developed the mitigation measures to avoid the damage on the water source by explaining the detail in the management plan to ensure the strictly implementation.
- The forest area is not lost as the project area is located in the existing place with no expansion.
- There is no invasion and resettlement in the project area, however there are district's soldier security house guard at the both end of Xebangnouan Bridge, but they are not inside the reserve area of road and bridge. And The implementation on the mitigation measures is described in the impact mitigation plan in the Chapter 5 and 6.
- In term of the safety, the impact from the construction project is moderate as it is the bridge maintenance located in the national road; and the transportation is in high volume and the bridge is located out of speed limited, the vehicle will drive in high speed, so the lighting in the project area will low and safe sight distance will

be sort, therefor, this potential impact mitigation plan is developed for the strictly implementation in order to minimize the impacts from the construction activities in each phase.

It can be concluded the environmental and social impact is minor and temporary comparing with the positive impact. This project will contribute in the human resource development in order to enhance the capacity on the work implementation to be complied with the technical principle and to be sustainable. This is to ensure the long-term use and the traffic flow in order to save the budget for the new construction and also to develop the national economic-social development as mention above.

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Chapter 1: Project Overview

1.1 Project's Introduction and Reasons

Laos has developed a 56,000 km road network of and 3,580 bridges in a land locked country where road transport is a dominant transport mode to carry majority of passengers and cargos. Proper maintenance and performance assurance of these road and bridge infrastructures are indispensable for realizing the balanced industrial and economic development across the country as stimulated in the five-year National Socio-economic Development Plan. However, the institutional arrangement for maintaining and managing those road and bridge infrastructure is fragile. Laos is a small country with a population of about 7 million and an annual national budget of 3.7 billion USD, which is comparable to that of a small local government in Japan, and its external demand-led economic and industrial structure represented by the mining industry is easily affected by the global market. In fact, due to the worldwide spread of the new coronavirus and stagnant socio-economic activity, Laos expects a decrease in revenue of 0.7 billion USD this year. Due to this effect, it is reported that the Ministry of Planning and Investment of Laos is considering "50% reduction of development budget", "30% reduction of central government budget", and "10% reduction of local government budget". The risk of human resource reductions and budget cuts for bridge maintenance in Laos is extremely high.

Looking at the practice of the bridge maintenance, many bridges are being damaged and deteriorated, but only "breakdown-maintenance" is in place, in which repairs are performed only after the damage to the bridge has enlarged and "planned repair" has been absent. There are 3,580 bridges and structures nationwide, including 1,350 on National Roads, of which 35% require regular maintenance and 17% require emergency repairs. In addition, 40% are temporary bridges such as wooden bridges and Bailey bridges, which usually lack durability, and there have been multiple incidents of bridge collapse due to damage to bridges mainly caused by improper bridge repair and maintenance and overloaded vehicles. Bridges in Laos have been constructed and maintained with the support of Japan, but in order to ensure safe and smooth traffic on trunk roads, well planned maintenance and repair of bridges is crucial.

Accordingly, JICA provides a grand to the Lao government through the bukding capacity the technical assistance program, entitled the Project for Capacity Development on Bridge Maintenance and Management (hereinafter referred to as "JICA-BMM") to establish bridge maintenance cycles (i.e., Inspection-Diagnosis-Planning-Repair) and contributes to the improvement of bridge maintenance capabilities of DOR, PTI and DPWTs. Notably, Public-Private-Academia collaboration and adaptation of Japanese technologies to the bridge inspection and diagnosis are part of area JICA-BMM emphasizes in order to practice effective infrastructure management and lifetime extending maintenance technology and establish institutional maintenance framework and nationwide robust road network in Laos

1.2 Development Projects

In order to implement the Project for Capacity Development on Bridge Maintenance and Management will implement the inspecting the bridges along the National Road No. 13 North south such as: Pak Thang Bridge (the length is 80 m), Houay Pong Bridge (the length is 23 m), Nam Bee (the length is 51 m), Nam Mone Bridge (the length is 46 m), and Houay Pong Song Bridge (the length is 40 m), Xe Champone bridge (the length is 128 m), Xe Xamsoy bridge (the length is 100 m), Xe Banghieng bridge (the length is 250 m) and Xebangnouan bridge (the length is 140.37 m) which are selected as a model for project's implementation. The project selected Nam Mone Bridge which was built in 1991 and located on NR No. 13 North of Km 142 + 300 far from Vientiane capital and Xebangnouan bridge which was built in 1998 and located on the NR 13 south at Km 540+200 from Vientiane capital. This IEE report was studying the Xebangnouan Bridge, it is located in the boundary line between Savannakhet and Salavan province by Xebangnoun village, Songkon district and Phouthamphouang village, Lakhonpheng distict. The main structure of this bridge is steel girder, and 3 spans by 43 m, 53m, and 43 m respectively. This bridge is This proposed selection is carried out correctly and in accordance with the policy and laws of Lao PDR, particularly Ministry of Natural Resources and Environment which provides the policies, legislation, regulations and laws to protect the environment from development projects and activities in Lao PDR, such as: the Decree on Environmental Impact Assessment No. 21/GOL, dated 31 January 2019, this decree is for the implementation and expansion of the contents set forth in Articles 21 and 22 of the Law on Environmental Protection (Revised version) No. 29/NA, dated 18 December 2012 and with aim of making all investment projects and activities of state and private sector both domestic and foreign working within the Lao PDR that cause or will cause the environmental and social impact to be unified process throughout the nation within the implementation of the study process on environmental impact assessment from investment projects and activities to be effective and actively contribute to the economic-social development of the nation to be sustainable.

Based on government's development and environmental protection policies will expect to make the proposed project in a sustainable project. Therefore, IDCT is through Department of Roads as the owner project, signed a contract with LCG (Lao Consulting Group Ltd), which is environmental and social consulting company to conduct a study-survey and prepare IEE report of this project. All process of study and survey are carried out in accordance with the regulations and guidelines issued by Ministry, Information dissemination, holding consultation meeting and participation from all parties, which starts from the village consultation meeting where is adjacent the project's area that are expected to be directly and indirectly affected, meetings at different levels respectively.

1.3 Objective and Scope of Study Initial Environmental Examination (IEE)

For the objective and scope of study IEE are focused on the study and assessment of potential impacts which may arise from activities and tasks related to the demolition, maintenance and operation of the project between 2 villages, namely Phonsavang and Na Mone villages, Vangvieng District, Vientiane Province, in IEE study will cover physical, biological, economic and

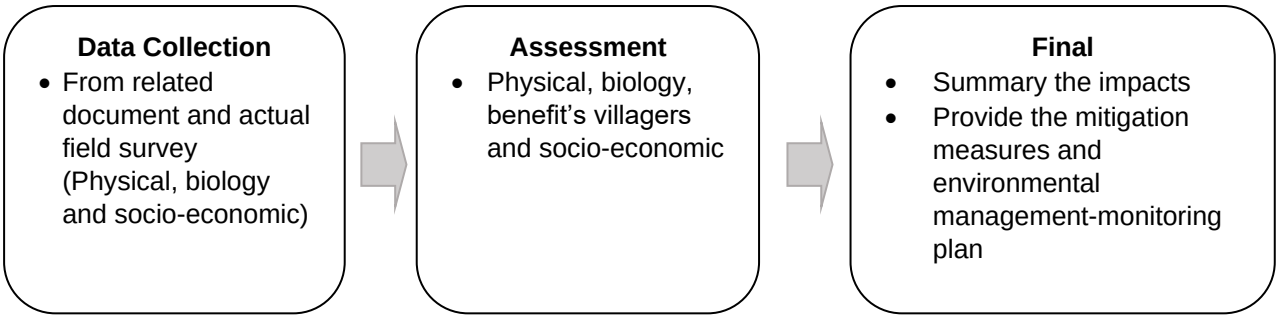
cultural-social within the project and surrounding areas. In order to ensure that this project meets the environmental goals of Laws set by Lao PDR. In addition, IEE study will still provide the appropriate mitigation measures to minimize the potential impacts which may arise from project's activities and tasks. By main objective of this IEE study is:

- To study the details of the current environmental area in the project's location and nearby areas before the construction of project.
- To assess the potential impacts both positive and negative due to the project's construction and operation activities.
- To provide the prevention of plan and determine the necessary measures to minimize the potential impacts which may occur by project's activities, including the timing of monitoring measures.

The study will cover various impacts that may be occurred during project's construction and operation activities such as:

- ✓ Generation of dust is from construction activities
- ✓ Noise is caused from construction equipment
- ✓ Solid waste is from construction
- ✓ Vehicular traffic and safety
- ✓ And other potential impacts

Study Methodology



1.4 Details about Project Owner and Environmental Consulting Company which prepares this IEE report

1.4.1 Project Owner (Department of Roads)

Department of Roads is the direct authority of Ministry of Public Works and Transport, and work as a secretary for Minister and Deputy Minister of the Ministry of Public Works and Transport in the micro-management of road-bridge works throughout the country, and according to rights and duties set out in Section 2, Article 3, Article 4 of the Agreement No. 27255/PWT dated 8 December 2017 on DOR's implementation and activities.

E-mail: lamphounk@yahoo.com, https://www.mpwt.gov.la/en/department-of-roads

1.4.2 Environmental Consulting Company

According to the discussion between IDCJ and DOR, on behalf on the project owner, agreed to hire the environmental consulting Company as Lao Consulting Group (LCG) will be representative agency to study IEE for Project for Capacity Development on Bridge Maintenance and Management – Na Mone Bridge that located between Phon Sa Vang Village and Na Mone Village, Vangvieng District, Vientiane Province.
Lao Consulting Group is a business consulting company in many areas such as: structural design, infrastructure, project management consultants service, environmental consulting service has been registered about environmental and social impact assessment with Ministry of Natural Resources and Environment. According the business license No. 565/MONRE. DOEP, dated 19 June 2021. LCG headquarter is at Building No. 249, Lao – Thai Road, Watnak Village, Sisattanak District, Vientiane Capital, PO Box 3097, Phone number: +85621 313259 and +85621 314627, Fax number: +85621 313258,
E-mail address: lcg@laoconsulting.com , https://www.laoconsulting.com

1.5 The Outline of IEE report

The outline of Initial Environmental Examination Report or (IEE) is prepared on Project for Capacity Development on Bridge Maintenance and Management – Na Mone Bridge that located between Phonsavang Village and Na Mone Village, Vangvieng District, Vientiane Province is according to Decree No. 21/GOL, dated 31 January 2019. Also, according to Technical Guideline on Initial Environmental Examination Writing from Investment Projects and Activities in Lao PDR, No. 29797. 1/MONRE.DESIA.DMM. Vientiane Capital, dated 19 December 2016 is the main version. However, the outline of report may not follow all the steps or topics that defined in table of content of the technical guideline. Because the technical guideline is applied for all types of projects that have studied and there are different types of impact assessment. It depends on process and implementation of that project. This report includes 8 chapters with the following detail and outlines are shown below:

Chapter 1 Introduction: There are the brief description of the project's background, objectives, project goals, information of project developer, information of environmental consulting company, and project study plan.

Chapter 2 Relevant Policies and Laws: it is a presentation on regulations, policies, laws, decrees, agreement, guidelines, etc. which are the basic of environmental standard, the relevant of legislations on environmental and social as the reference of the project study.

Chapter 3 Project Description: it is about the details of project which contains the type and size of the project, the importance of the project, service, details of project, construction and operation activity, etc.

Chapter 4 Current of Project Environmental Area: physical elements (Climate/meteorology, topography, soil and erosion, water resource and water quality, air quality, mineral resource, noise and vibration and waste disposal). Biological elements (condition of forest and plant species,

wild animals, aquatic animals and aquatic habitats, protected areas). Economic condition (condition of industrial, infrastructure, transportation) and culture and social (land use right, community, population, religion, health, education, culturally important places and etc.,)

Chapter 5 Impact Assessments and Mitigation Measures: is to conduct the assessment of potential impact and mitigation measures (Project's construction and operation phase). In that, IEE will be divided into the following aspects: physical environment, biological environment, economic and cultural – social environment. To provide the mitigation measures of impacts.

Chapter 6 Environmental and Social Management and Monitoring Plan: is summarized the major impacts and overall mitigation impact of project, details of the monitoring and budget plan is provided for environmental and social monitoring activity.

Chapter 7 Consultation and Public Participation: is to explanation about the implementation of consultation with public, also evaluation and summarizing the villager's opinions and suggestion to project such as there is the community participation in proposed working plan.

Chapter 8 Conclusion and Recommendations: it summarizes the results of study and provides the recommendations for both project implementation and environmental impact management.

1.6 Consultant Team on IEE Study

Technical officers who participate for this study and survey - information gathering for IEE of Project for Capacity Development on Bridge Maintenance and Management – Xebangnouan Bridge that located between Xebangnouan village, Songkon district Savanankhet province and Phouthamphouang village, Lakhonepheng district, Salavan province. Most of them are experts and officers from Lao Consulting Group. In addition, LCG also invited local government officer to participate in the survey – data collection and field consultation meeting every time such as: representative unit of Department of Natural Resources and Environment, Vientiane Province, and Office of Natural Resources and Environment, Vangvieng District and other related sectors.

Name List of Consultant Team on IEE

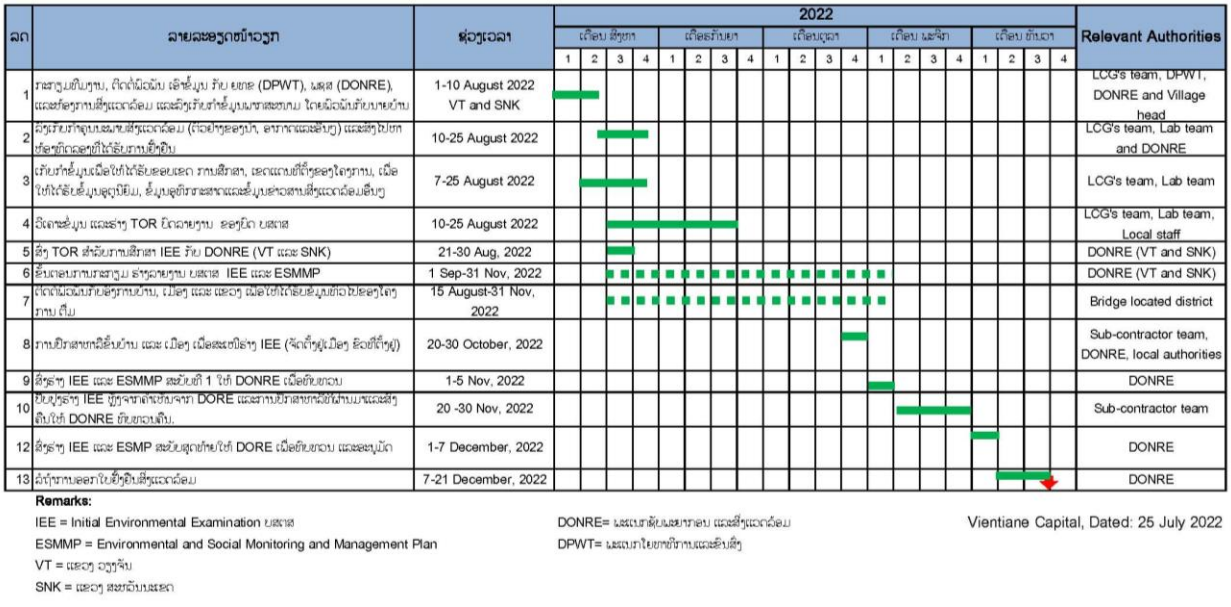
Name List of Consultants	Specialist And Responsibilities
Mr. Bounzou Wangsakoun	Social Specialist/ Project Coordinator
Mr. James Peter Grindey	Water Management and Irrigation Specialist
Mr. Kanda Keosopha	Social Specialist
Mr. Olivier Philaphandeth	GIS and Environmental Sciences Specialist
Mr. Bounpanh Thepphavong	Environmental Engineering Specialist
Mrs. Thipphachanh Souphihalath	Environmental Engineering Specialist
Mr. Phasouk Manivanh	Environmental Science Specialist
Mr. Viengdavanh Phommachanh	Geology Officer
Mr. Xay Lor	GIS and Engineering Officer.

1.7 Project Study Plan

Project study plan will implement for each critical works, it is expected by timing of usage. Timing can be flexible for each works which can depend on the consideration and decision from the relevant divisions, particularly the task of meeting depends on the government sector's levels who can make the decision on it. On this manner, proposed timing can be adaptable any time as below:

Table1. 1: Project Study Plan

Implementation IEE study plan of Project for Capacity Development on Bridge Maintenance and Management



Chapter 2: Relevant Policies and Laws

This proposed Project for Capacity Development on Bridge Maintenance and Management will be conducted the study of IEE, based on the relevant laws and policies such as: details of laws, decrees, agreement, instructions and regulations. Those are related to environmental and social management that are effective for environmental and social impact assessment. The project's activities shall comply with the requirements that specified in the legislation, the line organizations of government are right to issue the policies and laws which are related to environmental and social impacts. The framework of policies is objective to minimize the potential impacts on community and environment from the project. In expansion, the project's execution is to guarantee the sustainable development and compliance with government – party's socio-economic development policy. The legislation, laws and regulations include:

2.1 Law and Regulation

2.1.1 Environmental Protection Law (No 29/NA, December 18, 2012)

The Environmental Protection Law defines principles, regulations and measures related to environmental management, monitoring of protection, control, preservation and rehabilitation, with quality, of mitigating impacts and pollution created by anthropogenic loads or by nature, aiming to provide balance between social and natural environment, to sustain and to protect natural resources and public health; and contribution into the national socio-economic development and reduction of global warming.

This project is a development project to increase the efficiency of transportation, bridge maintenance and management. Which must concern on the implementation work of demolition and maintenance, traffic within project's area.

According to Part I, Article 6 Principles of Environmental Protection and Article 7 Commitment in Environmental Protection, Part III, Article 12 Importance of Environmental Protection, Article 17 Environmental Prevention Tasks and Article 21 Initial Environmental Examination, Article 25 Limitation of Impacts Derived from Construction Activities and Others. and Part VIII, Article 70 Prohibitions of Operators or Project Developer (new) are applied for the project development shall implement works with environmental protection, it is supervised by Department of natural resources and environment; and district office of natural resources and environment as specified in Article 80 and 81. This proposed project is located near the community, along the main road or national road, it shall implement the impact mitigation strictly (both construction and operation phase) based on the articles that defined in this law.

2.1.2 Law on National Road the revise version (No.03/NA November 8, 2016)

With regulations and measures on the management and monitoring of highway works, such as planning, surveying, design, construction and development to make these works high quality, safe, ensuring traffic in all seasons between the urban, connecting cities to rural areas, and remote areas to be able to easily connect to the region and connect with the

international community for the socio-economic development of the country. As the article 4 with the government policy on National highway work, the state encourages and promotes highway activities to be carried out in accordance with the law, maintenance and repair, ensuring quality, efficiency, safety, beauty and environmental protection, as well as promoting the use of labor and internal construction materials.
There is also the principle of highway work defined in Article 5. National Highway work should be carried out in accordance with the principles.
Article 6 Obligations regarding highway works Lao citizens and foreigners living in Laos must comply with laws and regulations regarding highways and contribute to the construction, maintenance and repair of highways for safe and secure traffic.

2.1.3 Law on Construction (No.05/NA, November 26, 2009)

The Construction Law defines the rules, regulations and measures on the management, permission, control, monitoring and inspection of all types of construction as define in Article 5 Construction activity shall ensure It shall be compliance with the national socio-economic development plan, the master development plans of each sector, the quality, the safety, and will not cause excessive negative impacts on social and environment. It shall not cause any over-limit annoyance to the people living close to the construction site.
Article 34 Safety Measures: In general, the safety measures shall follow the regulations issued out by relevant sectors such as: The danger warning signs, the fence around the construction site, the safety equipment, for laborers (helmets, boots, gauntlet, glasses).
In case the forced majeure such as: Flood, storm, fire, earthquake, landslide or other disasters happens, which affects the construction, the contractor shall immediately take preventive and corrective measures as follows:

1. Provide disaster warning in the construction site;
2. Temporarily stop the construction and take solving measures in time to ensure the safety of laborers and to protect the properties of the construction project;
3. Report any case of the incident to project owner, relevant officers as well as local authority immediately for prompt action.

2.1.4 Law on Road traffic (No. 023/NA December 12, 2012)

This law has defined the principles, regulations, and measures regarding the organization, activities, management, and monitoring of land traffic to control the movement of people and the use of various types of vehicles along the land transportation route to be convenient, safe, and orderly in order to reduce accidents, traffic congestion and mentioned in Article 6 of this law for the obligation of road users whether they are Lao citizens, foreigners, stateless persons, or foreigners who travel on the roads in the territory of the Lao PDR must respect, and comply with the traffic regulations and comply with this law.

2.1.5 Land Transportation Law (No. 024/NA, December 12, 2012)

The Land Transport Law has the function of determining the regime for the administration and operation of the domestic, international and cross-border transport of goods and of passengers in order to efficiently and safely expand travel and distribution of goods without environmental and social impacts., increase the contribute to socio-economic development and international cooperation.

Article 5 (new) Principles on Land Transport

1. To ensure relevance to the national socio-economic development plan as well as to ensure socio-economic effectiveness, peace in the country and environment protection;
2. To ensure quality, comfort, rapid service and life's safety, health, asset, right protection and benefit for service provider;
3. To ensure transparency, justice and good manner in service;
4. To ensure economic-technical, modern technology, standard service on land transport.
5. To collaborate with the relevant sectors and local authorities in order to effectively manage, monitor and inspect on land transport sector. The operator's obligations on land transport, they shall follow the law on land transport, security, follow the rule, road protection, environmental and social, employee training as well as fulfill other obligations stipulated in Article 5 regarding to law on land transport. In this Article 33 defines the construction project, road maintenance or other road construction, it shall ensure to minimize the environmental and social impacts as following:
   To ensure the traffic is convenient and follow the rule,
   To ensure the safety by install traffic sign, reflective warning signs that can be seen easily and clearly from a distance, install lights and hazard warning lights in night time.

Project shall ensure the construction or maintenance to complete on working schedule, quickly, on time and get the quality for the traffic.

2.1.6 Land Law (No. 70/NA, June 21, 2019)

Land Use for project development shall ensure the effectiveness of the work aiming and regulation, thus contributing to national socioeconomic development as well as to protect the environmental and social. The related Article with type of this proposed project is belong following articles: Article 6 Protection of Land and Environment: All individuals and organizations shall have the obligation to protect the land to ensure that it is in a good condition in which there is no soil erosion, land subsidence, and soil degradation and which is suitable to each category of land, and to ensure that the area of each land category is not decreased without due authorization.

2.1.7 Law on Investment Promotion (No. 14/NA, November 17, 2016)

This Law applies to investment of domestic and foreign natural persons and legal entities investing and doing business in the Lao PDR.
In Article 4 Government policies on investment promotion: The Government promotes investment in all sectors, business operations and

in areas throughout the country except for the areas and business operations which are detrimental to national security, natural environment, at present and in long-term, public health and fine national cultures.

2.1.8 Labor Law (No.043/NA, December 24, 2013)

This law objective defines for labor protection, labor skills development in order to enhance the quality and productivity of work in society, so as to ensure the transformation to modernization and industrialization aimed at safeguarding the rights of employees and employers, without discrimination as well as the legitimate interests does not allow the use of forced labor in any form if there is recruitment any foreign worker per labor unit, shall give priority to Lao workers first. Day off shall be compliance with government's policy and the continual improvement of their livelihoods, while contributing to the promotion of investment, national socio-economic development, and regional and international links.
The employer must set hours of work and hours of rest for the employee as part of its responsibilities in accordance with the location of the labor unit and real working conditions as mentioned in Article 51 in every labor unit will be no more than six days per week and eight hours per day or no more than forty-eight hours per week and Hours of rest for lunch break shall be no less than sixty minutes per day.
Determination of Salary or Minimum Wage in Article 108: The State promulgates the level of minimum wage or salary at every interval based on the results of consultations with third parties.

2.1.9 Law on Water and Water Resources (No. 23/NA, May 11, 2017)

This Law determines the necessary principles, regulations, and measures relating to the management, administration, protection, development, use and water resources, prevention of water degradation, rehabilitation of impact areas, to ensure water volume and quality in sustainability as in Article 6 shall be managed and Part IV-Article 26 Protection of Water and Water Resources defines that Individuals, legal entities, or organizations have the obligations to preserve water and water resources in good, not cause to be polluted to water and water resources.

Article 31 (new) Permission of wastewater discharge: Polluted water that exceeds the discharge standard must first be treated before they may be dumped or discharged into water sources by Individuals, legal entities or organizations. They shall get permission from relevant sectors such as: Department of Natural Resources and Environment, pay the fee and service of wastewater discharge according to the regulation. There are 3 levels of wastewater such as: small, medium, and large based on the volume of wastewater and the concentration of chemicals mixed in the wastewater.

2.1.10 Law on Hygiene, and Health Promotion (No. 73/NA, November 22, 2019)

The construction development shall follow law, regulation and measures in hygiene disease prevention that may arise from the project's implementation. The project developer shall conduct the health promotion in order to maintain the good health, quality of life and increase the

awareness of important hygiene, environmental and social protection to focus on reduction of sickness, death and diseases prevention.
Article 20: The employers shall provide safety equipment to workers and shall ensure the hygiene of the work places, mainly, provision of sufficient light and air ventilation, appropriate temperature, humidity, vibration, noise, odor and dust that shall not be over the standards provided by relevant regulations. Employees and business operators, particularly in the sectors of activities which are hazardous to health, shall be protected, received health examinations, treatment and health care in accordance with the laws and regulations

2.2 Decree, Policy, Technical Guideline and Standard

2.2.1 Decision (No.707/MONRE, December 5, 2013)

Decision on the approval and promulgation of Guideline on Public Involvement in the Environmental Impact Assessment process for project's investment (No. 707/MONRE, dated on 5/12/2013. This objective is to ensure the implementation of public involvement to be corrective and compliance with regulation, transparency and participated by affected person from project's investment in the participation process. To help them receive the justice in solving the impacts that caused by investment project in reasonable way.
This goal of decision is to open opportunities for the public involvement in the plaining and decision-making of project's investment, including the resolution of environmental and social impacts. The benefits will be obtained from the project in a fair manner and to avoid or reduce the occurrence of conflicts with the development of project's investment; giving them the opportunity to present their opinion on the implementation of project; At the same time, they can learn and share lessons with relevant sectors in career development, local economy, protection and management of natural resources.

2.2.2 Ministerial Agreement No. 80565/MONRE, December 17, 2013

Ministerial Agreement on the Endorsement and Promulgation of List of Investment Projects and Activities Requiring for Conducting the Initial Environmental Examination or Environmental and Social Impact Assessment (No. 8056/MONRE, dated on 17 December 2013) defines that the list of Investment Projects and Activities consists of types and scales of Investment Projects and Activities has categorized into two groups such as: group 1 shall prepare Initial Environmental Examination (IEE) and group 2 shall prepare environmental and social impact assessment (ESIA).
Investment Projects and Activities are classified into 5 sectors such as: (1) Energy Sector, (2) Agriculture and Forestry Sector, (3) Industrial Processing Sector, (4) Infrastructure and Service Sector, and (5) Mining Sector. This proposed project is categorized in No. 4.12 on Rehabilitation of national, provincial, district, rural and special roads.

2.2.3 Decision No. 2797.1/ MONRE. DESIA. DMM, December 19, 2016

Decision on the approval and promulgation of Technical Guideline on IEE report No. 2797.1/ MONRE. DESIA. DMM, December 19, 2016. It has

been to guide and assist project developers and environmental consultant service how to prepare IEE from project investments and activities in Lao PDR. The goal is to ensure that the IEE reports include quality, accuracy, adequate project descriptions and being an effective implementation. In addition, to ensure IEE report to follow the process and provisions of the relevant laws, both with the quality of the content and in accordance with the set of standards and international standards.

2.2.4 Decree on Environmental Impact Assessment (No. 21/GOL, January 31, 2019)

This Decree provides rules, regulations and measures on management and monitoring implementation of environmental impact assessment activities to make sure that such activities are proceeded correctly with transparency and in concerted form with purpose to protect environment, mitigate and remedy impacts on environment, ensuring that the compensation is reasonable, relocation and occupational resumption and restoration of livelihood of the affected people is improved more than before, making management and use of the natural resources is efficient, securing the rights and interests of the nation and the people, contributing to the implementation of the National Social and Economic Development Plan in the direction of green and sustainability.

Article 9 Grouping of Investment Projects and Activities: The investment projects and activities that are believed that will cause less or not-severe impacts on social and natural environment will be conducted IEE (This project is project developer's land for the implementation, no new resettlement, and compensation and land transformation to be used in the project). Detail of this IEE defines in Group 1 covers Article 11 – Article 18 which has specified the fully process of IEE study.

2.2.5 Decision on construction management (No.2241/MPWT January 31, 2019)

This agreement defines the principles, regulations and various measures related to the management of construction in the urban and to ensure that the permit applicant is comfortable, comfortable, quick and transparent as well as to ensure that the construction is orderly, beautiful, safe, sanitary, unique and in harmony with the surrounding environment and correct according to the urban plan. In accordance with Article 2 on construction management: related to the implementation process, research, consideration for licensing, control and monitoring of construction according to the permission of the proposed project, which must be combined with Article 14 on construction monitoring: In relation to the urban planning management organization (provincial and district level) which will inspect the construction of the project in 3 phases: the initial phase, the operational phase and the final phase. Each time the inspection must be completed a record of the inspection results and discussion (in the case of modifications in the construction plan) together with the construction contractor and the project developer as a basis for considering the issuance of the certificate of validity of the construction. Also, attention was paid to Article 19 on the function and responsibilities of the construction contractor: in general, attention must be paid to arranging

the new construction site in an orderly manner such as: vehicles, machinery, tools, equipment and construction materials in order to protect safety, do not obstruct traffic and do not negative effects on residents around the project area. Therefore, the project must take into account this agreement strictly so as not to cause any problems or effects related to the construction of the proposed project.

2.2.6 Guidelines on public participation in the environmental impact assessment process of investment projects No.707/MONRE December 05, 2013

it is intended to ensure the implementation of public participation correctly and in accordance with the principles, transparent and inclusive, especially the participation of the people affected by the investment project in the participation process so that they can receive fairness in solving the effects caused by the investment project in a reasonable.

This agreement aims to open opportunities for the public to participate in the planning and decision-making of investment projects, including the resolution of environmental and social impacts, the benefits to be obtained from the project in a fair manner, and to avoid or reduce the occurrence of conflicts with the development of investment projects, giving them the opportunity to present their opinions on the implementation of the project; At the same time, and share the idea with relevant parties in career development, local economy, protection and management of natural resources.

2.2.7 Decision on National Environmental Standards (Amended) No.81/GoL, February 21, 2017.

This Decision determines parameters and levels of pollutant concentrations in the national environmental standards as scientific reference in the monitoring of the environmental quality and controlling of pollutions emitted to air, or discharge to soil and water, noise. There are 6 chapters and 18 Articles which has detail about environmental standards, Pollution standard, type of pollution, volume of concentration, parameter and concentration indicator to control the pollution into environment which may arise impacts to life, health of human, animal and ecology system from the development projects.

2.2.8 Decree on Labor Safety and Health (No. 22/GOL, February 05, 2019)

This decree defines the principles, regulation and measures on labor safety and health to prevent labor accident and occupation disease that may occur, which aims to protect the rights, benefit of employer and employee, which is related to the content of Article 2 - Labor safety and health: to control the risk assessment of work environment, proper measures to reduce hazards and how to prevent labor accident, prevent occupation diseases and focuses on the safety culture within workplace. All above mentioned details are specified in Article 5 – the principle on safety work and labor's health, Article 8 – Employee's Right, Article 10 – Employer's Right, Article 17 – Measures on the use of Personal Protective Equipment, Article 18 – Sticking of Symbols, Signs and Warning Signs of Danger, Article 19 – Culture Safety and Labor's Health, Article 20 - Prevention of Labor Accident, Article 21 – Occupational Disease and other related disease. Therefore, project shall pay attention to this decree

because it is related directly on hiring of staff, labor and worker to work with this project in the future.

2.2.9 Road Manual on Maintenance Activity Codes (MAC), August 2020

This is a manual and method about the implementation of road repair, maintenance in the same standard and uniform to apply throughout the country and local level. This manual defines the types of roads, preparation method, maintenance method, how to use mechanical equipment and related components in the implementation of work such as: the project shall use the code of bridge maintenance which mentioned in the manual. For example: Code No.142 means the bridge cleaning, Code No. 145 means the maintenance of steel bridge surface, AA 003 means the method of maintenance on steel bridge's part, AA 005 means the maintenance of bridge surface pavement with concrete floor, AA 009 means the method of expansion joint is between road and bridge.

2.3 Protocol and International Conventions Related to the Impact of the Project

The government of the Lao PDR has participated as a party to protocols and conventions related to the following projects:

Convention

- United Nations Framework Convention on Climate Change (1992);
- ASEAN Agreement on the Conservation of Nature and Natural Resources in 1985;
- International Plant Protection Convention (IPPC) in 1955
- Kyoto Protocol to reduce greenhouse gas emissions in 2003.

Protocols and standards

- Kyoto Protocol of United Nations Framework Convention on Climate Change, dated on 11 December 1997 and 15 November 2002 was effective on 21 November 1998, and 6 February 2003.
- ISO 14001 and International Finance Corporation (IFC).

Chapter 3: Project Description

3.1 Project Introduction and Concept

From the monitoring and survey of the bridge management in Laos, the previous characteristics are shown below:

- Most of the concrete and steel bridge, including those were supported by the previous Soviet Union in the 1960s and 1970s and large bridges which were for the most part built by foreign donors.
- At the same time, there were temporary bridges such as: Bailey bridge was built by steel. (Remark: deterioration mechanism of bailey bridge was conducted the research by Nagasaki University/National University of Laos)
- 1/6 of number of bridges are on the national road, they have been in utilize more than 40 years. 1/10 of number of bridges is very urgent for maintenance.
- The request of emergency maintenance is very high increasing. Japan would like to utilize the knowledge and experience on bridge maintenance and management.
- The bridge inspection has not done since 2016 because there was a few changing of responsibility (handover from PWTI to DOR). The previous inspection was conducted by visual inspection without devices of detail inspection. Remark: the lasted of bridge inspection was conducted through the WB-LRSP2 Project in 2020.
- Damage diagnosis was identified by RMS/BMS but is not yet effective. Due to the lack of fully understanding is about the bridge's structure, deterioration mechanism, prioritization and maintenance method.
- The planning of yearly budget was spent for the bridge restoration and maintenance approximately 1 million US dollar in each year (1% of Road Fund Budget), most of budget was spent for emergency works. As the results, it was very difficult to restoration and prevention for medium and long term.
- Maintenance work was only conducted by sub-detail of maintenance in field after the bridge had been deteriorated.

3.1.1 Project's Objectives, Results and Activities

- Before Project for Capacity Development on Bridge Maintenance and Management (JICA-BMM) will implement, it was executed the detailed planning design in February and March 2020. The objective was to identify the project's scope and target by utilizing Matrix PDM, it is an advance standard in engineering to identify of targets, objectives, results and project (JICA-BMM) activities. After that, there was the discussion and agreement on the detailed planning design and implementation with key unit particularly with MPWT of JICA-BMM. The summary was evaluated the project's (JICA-BMM) results and alternative by PDM as following below table:

Table3. 1 Project's Evaluation of Results and Alternative

PDM designed during the Detailed Planning Survey
Overall Goal Bridges in pilot provinces (Vientiane, Savannakhet and Champasak) are properly maintained.
Project Purpose Bridge management capability of DOR and pilot DPWTs is improved.
Output 1. Bridge inspection and diagnosis capability of DOR and pilot DPWTs is improved. 2. Bridge repair and maintenance capability of DOR and pilot DPWTs is improved. 3. Operational and management capability of Bridge Management System (BMS) of DOR and pilot DPWTs is improved. 4. Capability for bridge management planning of DOR and pilot DPWTs is improved.
Activities 1-1. Conduct situation analysis and identify issues for bridge inspection and diagnosis 1-2. Prepare draft Bridge Inspection and Diagnosis Manual, including that for Large-scale bridge(s)1-3. Implement pilot bridge inspection and diagnosis, following the Manual drafted in Item 1-2. 1-4. Review and revise Bridge Inspection and Diagnosis Manual and finalize thru approval by MPWT 1-5. Carry out technical trainings for Bridge Inspection and Diagnosis Manual 2-1. Conduct analysis and identify issues in the condition of bridge for repair and maintenance 2-2. Prepare draft Bridge Repair and Maintenance Manual, including that for Large-scale bridge(s) 2-3. Implement pilot bridge repair and/or maintenance, following the Manual drafted in Item 2-2. 2-4. Review and revise Bridge Repair and Maintenance Manual and finalize through approval by MPWT 2-5. Carry out technical trainings for Bridge Repair and Maintenance Manual 3-1. Conduct situation analysis and identify issues on management of Bridge Inventory 3-2. Development of beta version of BMS that demonstrate how to collect data for damage inspection. 3-3. Carry out data input and analysis utilizing beta version of BMS 3-4. Properly and corrective customize BMS is improved. 3-5. Carry out technical trainings for BMS correctly 4-1. Implement situation analysis on bridge maintenance and management plan, in line with BMS analysis 4-2. Identity priority bridge repair projects and revise bridge maintenance and management plan 4-3. Finalize bridge maintenance and management plan and request the budget 4-4. Carry out planning, monitoring and evaluation of pilot bridge inspection and repair works (Item 1-3 and Item 2-3), following bridge maintenance and management plan 4-5. Carry out technical trainings for BMS based bridge maintenance and management plan

Source: JICA expert team

3.1.2 Scope of the Project Study

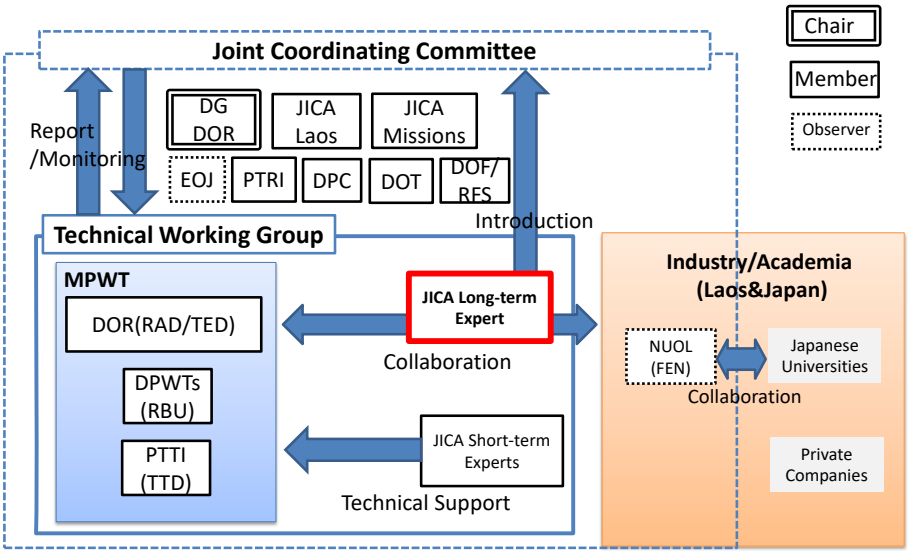
Vientiane, Savannakhet and Champasak provinces are pilot provinces to apply the bridge maintenance and management system (Bridge Inspection and Maintenance) through the on-the-job training (OJT) in project operation phase. It is expected that all the mentioned provinces will participate directly or indirectly, when there are the dissemination of information and practicing on the bridge management system/Technical Manual are developed by JICA-BMM.

3.1.3 Project's Organization Chart

After the establishment of JICA-BMM, there are two groups to implement the project: Joint Coordinating Committee (JCC) and Technical Working Group (TWG). JCC is responsible for monitoring the project's progress,

giving recommendations, and some cases have to be approved the work for TWG to implement the actual work within JICA-BMM. JCC is chaired by Director of DOR and team members from the relevant sectors in MPWT. The work implementation of TWG is composed of experts who will be appointed by JICA such as: technical officers and administrative officers during project's operation.

The JICA-BMM's character is similar with other projects that are supported by JICA, require the cooperation from many divisions such as: private-public-technical officers from the related institutions, appointed experts from JICA. Faculty of Engineering, National University of Lao (NOUL) was selected to participate in JICA-BMM as a partner in this work. It is expected that there will contribute the project's activities for research and consulting services. In addition, it will promote the sustainable development of the project. Appointed JICA's experts will work as the center of cooperation among government – private sectors and technical officer from education institution of Lao – Japan.



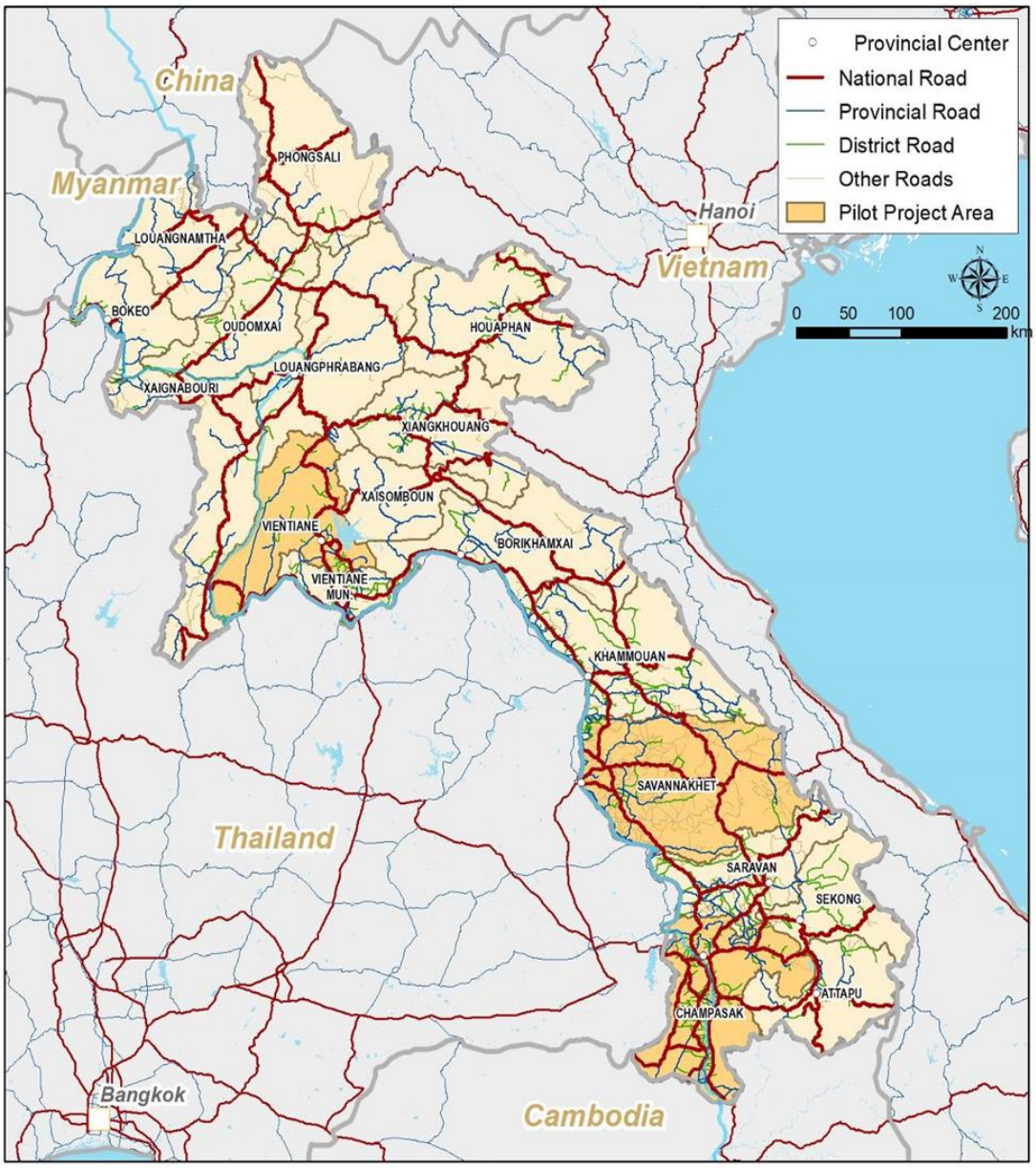
Note: **RFS**: Road Fund Secretariat, **RAD:** Road Administration Division, **TED:** Technical& Environment Division, **RBU:** Road and Bridge Unit, **TTD:** Technical Training Division, **FEN:** Faculty of Engineering

Source: Record of Discussion of JICA-BMM

Figure3. 1 Project's Organization Chart

3.1.4 Project Location

The target project is located in 3 provinces as previously mentioned in topic 3.1.2 within these provinces.



Source: JICA Expert Team

Figure3. 2 Locations of Pilot Project Area in Vientiane province, Savannakhet province and Champasak province

3.2 Project Concept

3.2.1 The Overall of Project Concept

As a result of large-scale and intensive road and bridge infrastructure development in Japan during the period of high economic growth, one out of ten bridges have been in service for more than 50 years, the bridge infrastructure has become aging. Due to the declining birthrate and aging population and lower economic growth, Japan faces difficulty to sustain human resources and secure financial resources for the infrastructure maintenance and management. In the middle of those circumstances, the public sector, private industry and academia worked together to design a system for extending the lifetime of infrastructure, triggered by the "Sasako Tunnel Ceiling Plate Collapse Accident," occurred in 2012, which

was the worst accident in the history of Japan Highway. As a result of this accident, standard guidelines for inspection and diagnosis were developed, technical qualifications for inspection and diagnosis were established and operated, and mandatory regular bridge inspections were regulated once every five years. It also leads to the promotion and operation of the introduction of new technologies related to inspection/ diagnosis and repair of the infrastructure.

Making maximum use of these experiences and know-how obtained in Japan, the Expert Team sets the following four pillars of the project approach, including the response to the on-going COVID-19 epidemic, and provides efforts to maintain and manage bridge infrastructure and extend the service life of those bridges under the constraints of human resources and financial resources in Laos

3.2.2 List of Project Works item and Activities:

- Prepare of the work process
- Finalization of Work Process
- Selection of C/P personnel and TWG members
- Set up the Organization of JCC
- Evaluation in collaboration with Road Asset Management Platform
- Preparation of Monitoring Sheet
- Conducting Trainings
- Implementation of the Pilot Project (Bridge Repair)

3.3 Details on the selection of model bridge for the project.

From the results of initial inspection/diagnosis and proposed bridge maintenance which implemented between February and March 2020, including 5 enforced concrete bridges and 4 steel bridges in Vientiane and Salavan provinces. The results are summarized in the below table:

Table3. 2 Inspection Results of Deteriorated Bridges in Vientiane and Savannakhet Provinces.

Name of Bridge	Location of Bridge	Superstructure Work type	Element							
			Superstructure			Substructure	Bridge accessories			
			Main girder	Cross girder	Deck slab		Bearing	Column	flexibility	Drainage
1. Houay Som Sa Nuk	Vientiane Province	PC-I	C	B	D	A	B	D	D	D
2. Houay Ngam		PC-I	B	-	D	B	-	D	B	B
3. Nam Mone		PC-T	C	B	D	A	B	D	C	B
4. Nam Pong		PC-I	C	A	D	B	B	D	C	B
5. Houay Ta Bong Phet	Savannakhet Province	RC-T	C	B	C	B	C	C	D	C
6. Xe Cham Phone		Steel-I	A	A	B	B	B	B	C	C
7. Xe Xam Xoy		Steel-I	B	B	C	B	B	C	D	C
8. Xe Bang Hieng		Steel-I	B	B	C	B	C	B	D	C
9. Xe Bang Nouan		Steel-I	B	A	C	B	D	B	D	C

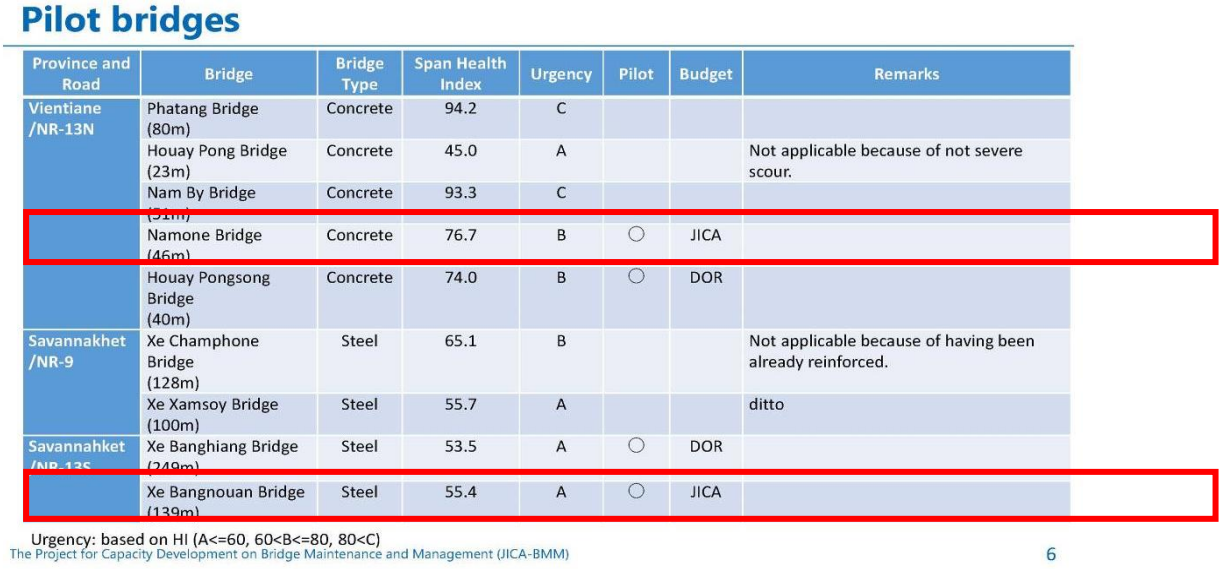
Remark:

Table3. 3 Level-Status of Damage, Requirement of Repair Duration

Level of Damage	Status of Damage	Requirement of Repair Duration
Level A	No damage	-
Level B	Little damage	It is required to repair when available.
Level C	Medium damage	It is required for urgency repair.
Level D	High damage	It is required for the most urgency repair.
Level E	Very high damage	The structural part is collapse and require to build new one.

After the detailed inspection was reviewed by project's specialists, DOR and rerated sectors. The selection of the pilot bridge is Nam Mone Bridge, Vangvieng district, Vientiane province and Xebangnouan Bridge in Songkhone district, Savannakhet province.

And this IEE report will be study on Xebangnouan bridge to see the initial impact on the environment and society
The criteria were considered for the selection of the pilot bridge summarized in the meeting on 22/8/2022 as following figure:



Pilot bridges

Province and Road	Bridge	Bridge Type	Span Health Index	Urgency	Pilot	Budget	Remarks
Vientiane /NR-13N	Phatang Bridge (80m)	Concrete	94.2	C			
	Houay Pong Bridge (23m)	Concrete	45.0	A			Not applicable because of not severe scour.
	Nam By Bridge (31m)	Concrete	93.3	C			
	Namone Bridge (46m)	Concrete	76.7	B	○	JICA	
	Houay Pongsong Bridge (40m)	Concrete	74.0	B	○	DOR	
Savannakhet /NR-9	Xe Champhone Bridge (128m)	Steel	65.1	B			Not applicable because of having been already reinforced.
	Xe Xamsoy Bridge (100m)	Steel	55.7	A			ditto
Savannahket /NR-13S	Xe Banghiang Bridge (249m)	Steel	53.5	A	○	DOR	
	Xe Bangnouan Bridge (139m)	Steel	55.4	A	○	JICA	

Urgency: based on HI (A<=60, 60<B<=80, 80<C)

The Project for Capacity Development on Bridge Maintenance and Management (JICA-BMM) 6

Figure3. 3 Detailed the Selection of the Pilot Bridge and Maintenance Budget

3.4 Detailed of the Pilot Xebangnouan Bridge

Xebangnouan Bridge was built in 1998, along National Road No. 13 south, Km 540+200 from Vientiane capital to Savannakhet province. This bridge is located the boundary between Savannakhet and Salavan province by Xebangnouan village Songkhone district and Phouthamphouang village, Lakhonepheng district respectively which is main structure is steel girder and 3 spans by 43 m, 53m and 43 m for the girder number 1-3 respectively. The total length is 140.37 m and the width of bridge surface is 7,30 m as shown in the below figures:

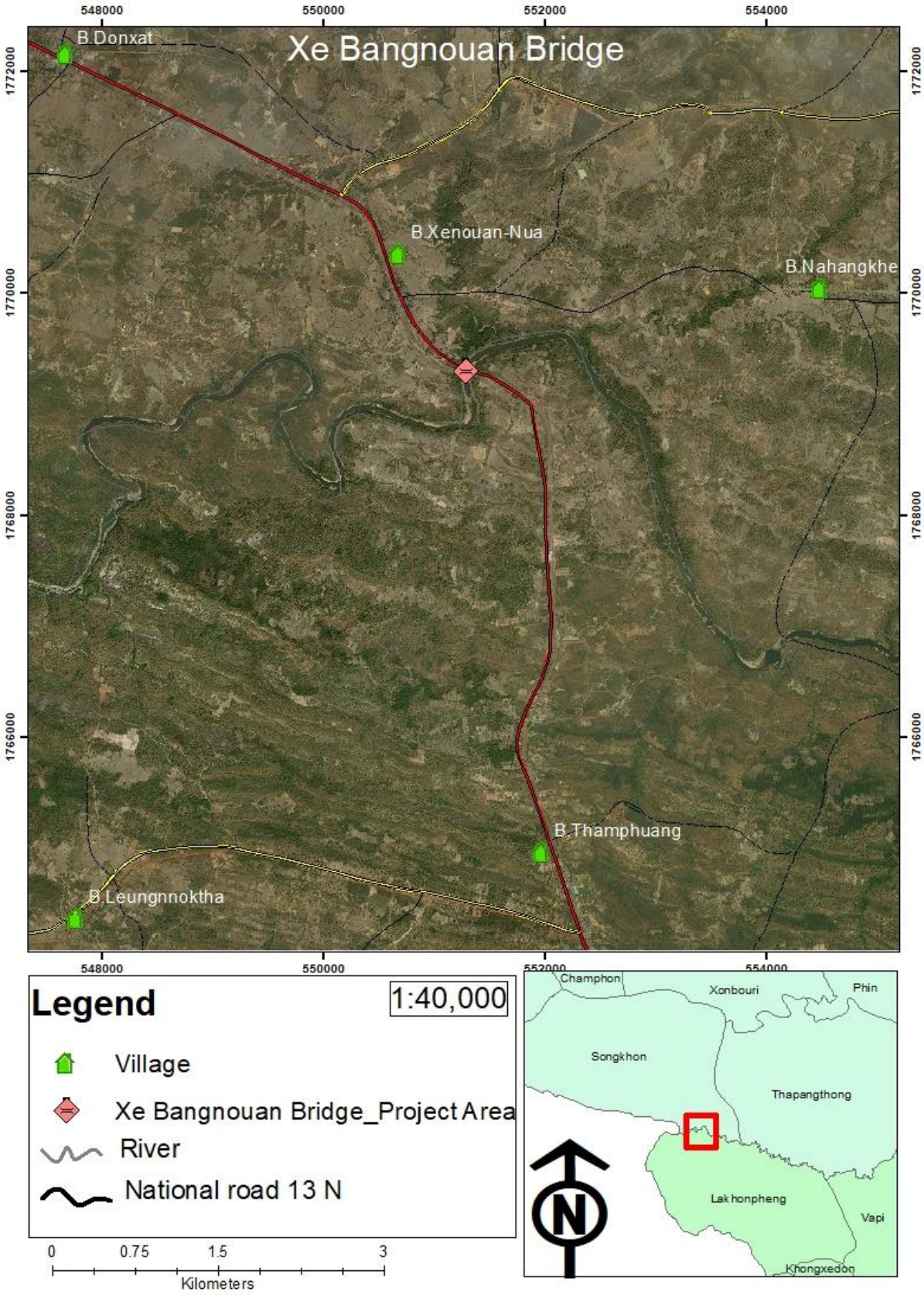


Figure3. 4 Location Map of Xebangnouan Bridge

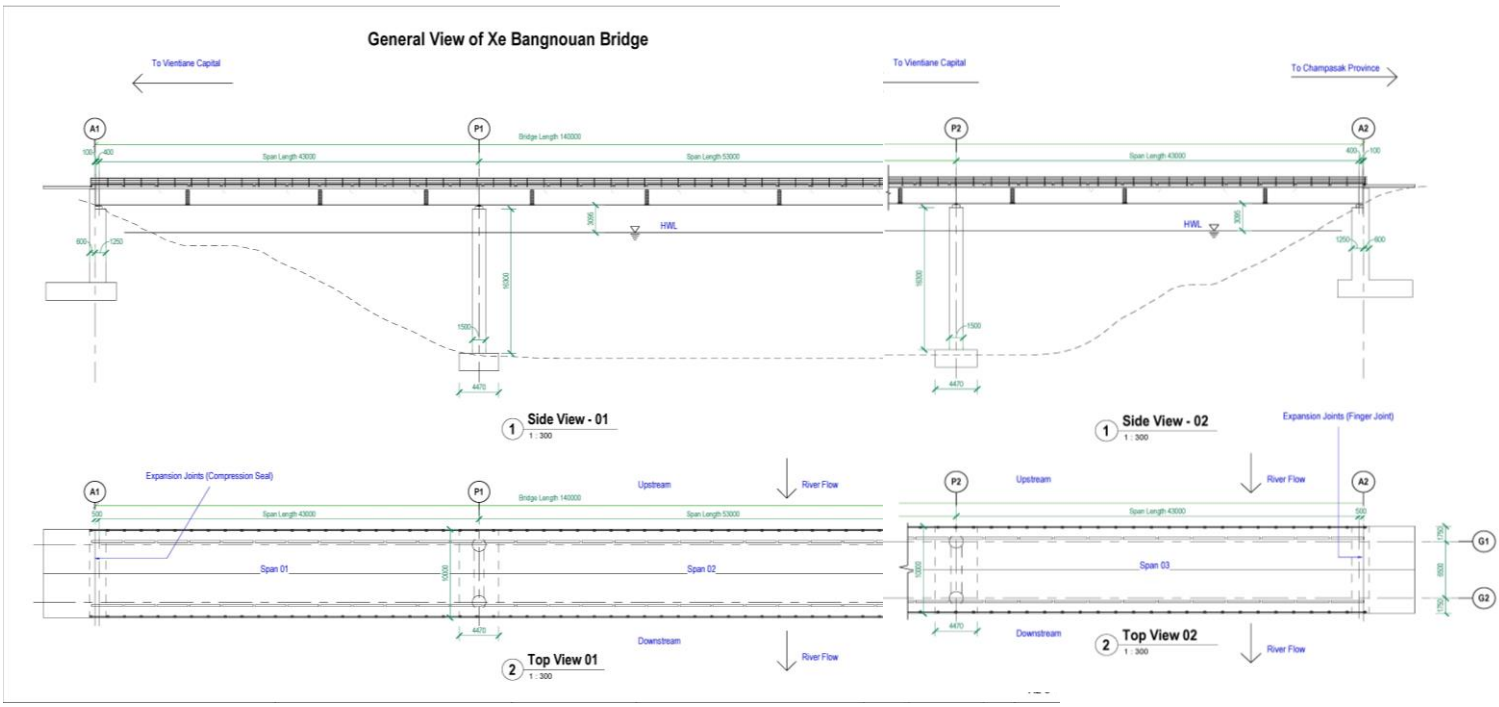


Figure3. 5 General View of Xebangnouan Bridge

Figure3. 6 The top view of Entrance the bridge to Savannakhet province

Figure3. 7 The top view of Entrance the bridge to Salavan province

Bridge General View

Road No.	13S	Bridge location (Chainage)	540 Km + 200 m
Road name	NR No.13 South	Bridge location (Province)	Savannakhet
Bridge ID/No.	Unknown	Coordinates (Latitude)	16° 00' 10.17"
Bridge name	Xe Bangnouan	Coordinates (Longitude)	105° 28' 45.19"

Side Views

Plan Views

Figure3. 8 General and side view of Xebangnouan Bridge

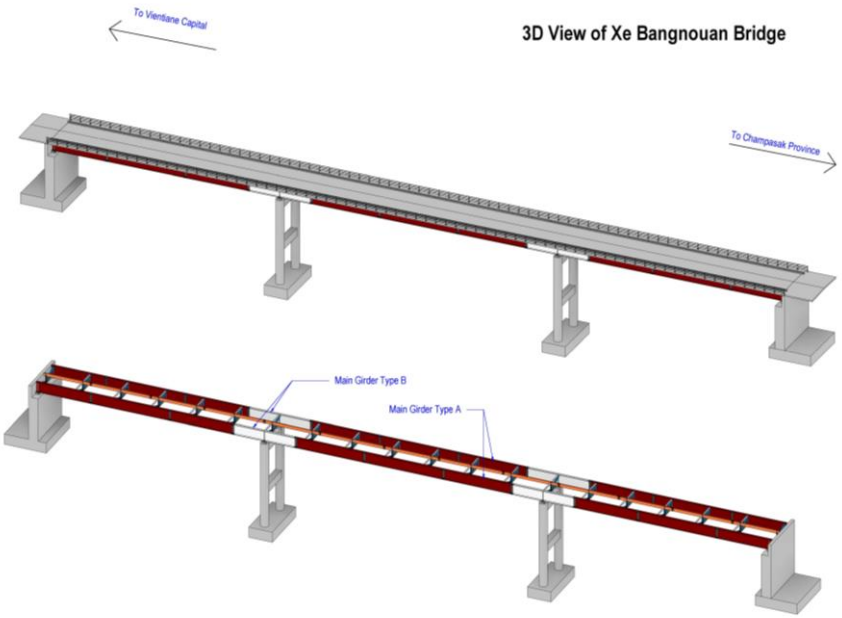


Figure3. 9 Diagram of main steel girder position of Xebangnouan Bridge

Figure3. 10 General pavement condition of Xebangnouan Bridge

3.4.1 The Characterizes of Damage on Xebangnouan Bridge

Based on the damage survey report of Xebangnouan Bridge is summarized as the following table:

Table3. 4 Summary the Damage Element of Xebangnouan Bridge

Photo no.	Element name	Damage grade	Damage type	Component	Photo no.	Element name	Damage grade	Damage type	Component
001	Main structure-Steel girder	B	01	Superstructure	019	Main structure-Steel girder	B	01	Superstructure
002	Main structure-Steel girder	B	01	Superstructure	020	Main structure-Steel girder	B	01	Superstructure
003	Main structure-Steel girder	B	01	Superstructure	021	Others-Vertical bracing	B	01	Superstructure
004	Main structure-Steel girder	B	01	Superstructure	022	Others-Vertical bracing	B	01	Superstructure
005	Main structure-Steel girder	B	01	Superstructure	023	Others-Vertical bracing	B	01	Superstructure
006	Main structure-Steel girder	B	01	Superstructure	024	Others-Vertical bracing	B	01	Superstructure
007	Main structure-Steel girder	B	01	Superstructure	025	Others-Vertical bracing	E	02	Superstructure
008	Main structure-Steel girder	B	01	Superstructure	026	Others-Vertical bracing	E	02	Superstructure
009	Others-Vertical bracing[1]	B	01	Superstructure	027	Deck	D	11	Superstructure
010	Others-Vertical bracing	B	01	Superstructure	028	Deck	D	11	Superstructure
011	Others-Sub girder	B	01	Superstructure	029	Deck	D	11	Superstructure
012	Others-Sub girder	B	01	Superstructure	030	Deck	D	11	Superstructure
013	Main structure-Steel girder	B	01	Superstructure	031	Deck	D	11	Superstructure
014	Main structure-Steel girder	B	01	Superstructure	032	Deck	D	11	Superstructure
015	Main structure-Steel girder	B	01	Superstructure	033	Deck	D	11	Superstructure
016	Main structure-Steel girder	B	01	Superstructure	034	Deck	D	11	Superstructure
017	Main structure-Steel girder	B	01	Superstructure	035	Deck	D	11	Superstructure
018	Main structure-Steel girder	B	01	Superstructure	036	Deck	D	11	Superstructure
					037	Deck	D	11	Superstructure

[1] Vertical Bracing

Photo no.	Element name	Damage grade	Damage type	Component	Photo no.	Element name	Damage grade	Damage type	Component
038	Deck	D	11	Supper structure	064	Mortar (Grout pad)	C	07	Supper structure
039	Deck	D	11	Supper structure	065	Bearing body	E	17	Supper structure
040	Deck	D	11	Supper structure	066	Bearing anchor bolt	C	23	Supper structure
041	Deck	D	11	Supper structure	067	Abutment A1	E	20	Supper structure
042	Deck	D	11	Supper structure	068	Abutment A1	E	21	Supper structure
043	Approach slab	E	11	Supper structure	069	Bearing body	C	01	Supper structure
044	Deck	C	13	Supper structure	070	Bearing body	C	05	Supper structure
045	Deck	C	07	Supper structure	071	Bearing body	E	17	Supper structure
046	Deck	C	07	Supper structure	072	Bearing body	C	01	Supper structure
047	Deck	C	07	Supper structure	073	Bearing body	C	14	Supper structure
048	Deck	C	07	Supper structure	074	Bearing body	E	17	Supper structure
049	Deck	E	20	Supper structure	075	Bearing anchor bolt	E	03	Supper structure
050	Deck	E	20	Supper structure	076	Abutment A2	E	20	Supper structure
051	Deck	D	08	Supper structure	077	Abutment A2	C	23	Supper structure
052	Deck	D	08	Supper structure	078	Abutment A2, Wingwall	B	06	Supper structure
053	Deck	D	08	Supper structure	079	Abutment A2-Parapet wall	D	06	Supper structure
054	Deck	D	08	Supper structure	080	Abutment A2-Parapet wall	D	06	Supper structure
055	Bearing body	C	01	Supper structure	081	Abutment A2-Parapet wall	D	06	Supper structure
056	Bearing body	C	05	Supper structure	082	Abutment A2-Parapet wall	D	06	Supper structure
057	Mortar (Grout pad)	E	06	Supper structure	083	Abutment A2-Parapet wall	D	06	Supper structure
058	Bearing body	E	17	Supper structure	084	Abutment A2-Parapet wall	D	06	Supper structure
059	Bearing anchor bolt	E	23	Supper structure	085	Pier P1	C	06	Sub structure
060	Bearing body	C	01	Supper structure	086	Pier P2	E	06	Sub structure
061	Bearing body	C	05	Supper structure	087	Foundation P1	E	06	Sub structure
062	Mortar (Grout pad)	B	06	Supper structure	088	Pier P1	E	26	Sub structure
063	Mortar (Grout pad)	B	06	Supper structure	089	Bearing body	C	01	Sub structure

Photo no.	Element name	Damage grade	Damage type	Component	Photo no.	Element name	Damage grade	Damage type	Component
090	Bearing body	C	01	Sub structure	118	Wheel guard	E	06	Supper structure
091	Foundation Pier FP1	D	06	Sub structure	119	Wheel guard	E	06	Supper structure
092	Pier 2	C	26	Sub structure	120	Wheel guard	E	06	Supper structure
093	Pier 2	C	26	Sub structure	121	Wheel guard	E	06	Supper structure
094	Pier 2	C	26	Sub structure	122	Wheel guard	E	06	Supper structure
095	Bearing body	C	01	Sub structure	123	Wheel guard	E	06	Supper structure
096	Bearing body	C	01	Sub structure	124	Wheel guard	E	06	Supper structure
097	Railing	C	01	Supper structure	125	Wheel guard	E	06	Supper structure
098	Railing	C	01	Supper structure	126	Wheel guard	E	06	Supper structure
099	Railing	C	01	Supper structure	127	Wheel guard	E	06	Supper structure
100	Railing	C	01	Supper structure	128	Wheel guard	E	06	Supper structure
101	Railing	C	01	Supper structure	129	Wheel guard	E	06	Supper structure
102	Railing	C	01	Supper structure	130	Wheel guard	E	06	Supper structure
103	Railing	C	01	Supper structure	131	Wheel guard	E	06	Supper structure
104	Railing	C	01	Supper structure	132	Wheel guard	E	06	Supper structure
105	Railing	C	01	Supper structure	133	Wheel guard	C	07	Supper structure
106	Railing	C	01	Supper structure	134	Wheel guard	C	07	Supper structure
107	Railing	C	01	Supper structure	135	Wheel guard	C	07	Supper structure
108	Railing	C	01	Supper structure	136	Wheel guard	C	07	Supper structure
109	Railing	C	01	Supper structure	137	Wheel guard	C	07	Supper structure
110	Railing	C	01	Supper structure	138	Wheel guard	C	07	Supper structure
111	Railing	C	01	Supper structure	139	Wheel guard	C	07	Supper structure
112	Railing	C	01	Supper structure	140	Wheel guard	C	07	Supper structure
113	Railing	C	01	Supper structure	141	Wheel guard	C	07	Supper structure
114	Railing	C	01	Supper structure	142	Wheel guard	C	07	Supper structure
115	Wheel guard	E	06	Supper structure	143	Wheel guard	C	07	Supper structure
116	Wheel guard	E	06	Supper structure	144	Deck	E	11	Supper structure
117	Wheel guard	E	06	Supper structure	145	Deck	E	11	Supper structure

Photo no.	Element name	Damage grade	Damage type	Component	Photo no.	Element name	Damage grade	Damage type	Component
146	Deck	E	11	Supper structure	170	Pavement	C	14	Supper structure
147	Deck	E	11	Supper structure	171	Pavement	C	14	Supper structure
148	Deck	E	11	Supper structure	172	Pavement	C	14	Supper structure
149	Deck	E	11	Supper structure	173	Pavement	C	14	Supper structure
150	Deck	E	11	Supper structure	174	Pavement	C	14	Supper structure
151	Deck	E	11	Supper structure	175	Pavement	C	14	Supper structure
152	Deck	E	11	Supper structure	176	Pavement	C	14	Supper structure
153	Deck	E	11	Supper structure	177	Pavement	C	14	Supper structure
154	Deck	E	11	Supper structure	178	Pavement	C	14	Supper structure
155	Deck	E	11	Supper structure	179	Pavement	C	14	Supper structure
156	Deck	E	11	Supper structure	180	Pavement	C	14	Supper structure
157	Slab	E	11	Supper structure	181	Pavement	C	14	Supper structure
158	Slab	E	11	Supper structure	182	Pavement	C	14	Supper structure
159	Slab	E	11	Supper structure	183	Pavement	C	14	Supper structure
160	Slab	E	11	Supper structure	184	Pavement	C	14	Supper structure
161	Slab	E	11	Supper structure	185	Pavement	C	14	Supper structure
162	Slab	E	11	Supper structure	186	Pavement	C	14	Supper structure
163	Expansion joint[2]	E	14	Supper structure	187	Pavement	C	14	Supper structure
164	Expansion joint	E	14	Supper structure	188	Pavement	E	14	Supper structure
165	Expansion joint	E	14	Supper structure	187	Pavement	E	14	Supper structure
166	Expansion joint	E	14	Supper structure	190	Pavement	E	14	Supper structure
167	Expansion joint	E	14	Supper structure	191	Pavement	E	14	Supper structure
168	Expansion joint	E	14	Supper structure	192	Pavement	E	14	Supper structure
169	Pavement	C	14	Supper structure	193	Approach slab	E	17	Supper structure

[2] Expansion Joint

Photo no.	Element name	Damage grade	Damage type	Component	Photo no.	Element name	Damage grade	Damage type	Component
194	Approach slab	E	17	Supper structure	200	Approach slab	E	17	Supper structure
195	Approach slab	E	17	Supper structure	201	Approach slab	E	17	Supper structure
196	Approach slab	E	17	Supper structure	202	Expansion joint	E	24	Supper structure
197	Approach slab	E	17	Supper structure	203	Expansion joint	E	24	Supper structure
198	Approach slab	E	17	Supper structure	204	Expansion joint	E	17	Supper structure
199	Approach slab	E	17	Supper structure					

Remark: See the details in attachment 1

3.4.2 Service Management System

After the maintenance is completed, it will be handover to DPWT of Savannakhet province as Management Unit of Utilize and Maintenance, to ensure the National Road No.13 South is comfort and quick particularly the bridge is between Xebangnouan and Phouthamphouang village

3.4.3 The Maintenance Fund

The fund of proposed bridge maintenance is a grant assisted by Japan government through JICA as a main administrative unit. The entire of cost is approximately 917.000,00 US Dollar, but not include the finalized cost because it is under the project bidding at the moment.

3.4.4 Project Implementation Plan

The total duration of project construction is 36 months or 3 years, project will commence on 11/2020 and expect to complete within 11/2023. However, the implementation bridge repair plan will be spent only 12 months in the whole plan and it will start 11/2022 to 11/2023. Project implementation plan includes each imperative sub-tasks which is evaluated the implementation phase, it can be adaptable in accordance with other social condition for the actual implementation. In the manner, the duration can change any time. The detail of project implementation plan is summarized below:

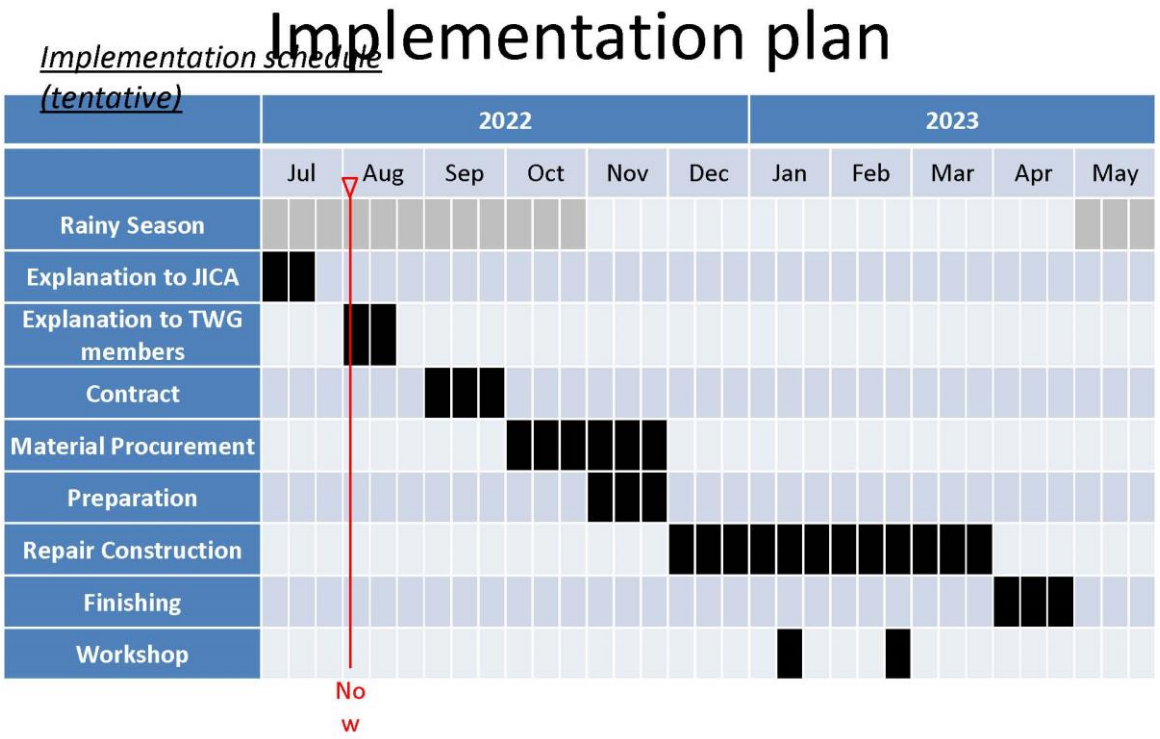


Figure3. 11 Project Implementation Plan

3.5 Detailed Design and Method of Maintenance

3.5.1 Maintenance on the Sub and Superstructure of Bridge

Maintenance on the bottom of bridge is consists the foundation of pier P1, Abutment wingwall, Pier body, Deck, Approach slab, Bearing, bearing anchor bolt, Pavement, railing and wheel guard.

3.5.2 Maintenance on Element of Bridge

According to table 3.3 above, the almost damage is minor issues, and repair method is not necessary to construct the detour road, it will be block one traffic lane to repair

3.5.3 Method of Maintenance

Bridge maintenance will be implemented in dry season and spent about 12 months by temporary blocking of one traffic lane. The traffic will block only one lane or all lanes in few periods, but there will provide the detour in the dry season to allow traffic at all times (if necessary). However, the detailed designs on method of maintenance will define again in the implementation phase of technical practice. But there is not any impact on villagers or property adjacent.

If it is necessary to block two lanes, project will provide a detour through Xebangnouan by utilizing the box convert which is suitable for drainage and safety traffic. The location of detour is near the bridge (in the reserve area) which is the state land; it will be utilized to travel on this way.

After the previous methods were reviewed and discussed about new technology utilizing into the maintenance many times. Project can summary the methods of maintenance as the following below table:

Table 3. 1: Previous and Revised Repair Methods (Xebangnouan Bridge)

Previous and revised repair method (Xe Bangnouan Bridge)

Type	Element	1st proposal (Nov/2021)	2nd proposal (May/2022)	Final proposal (Aug/2022)
Bridge Repair and Reinforcement	Main Girder / Crossbeam	Repainting	Repainting	Touch-up painting for preventive maintenance
	RC Deck Slab	Crack Injection	Crack Injection	Crack Injection
		Sectional Repair	Sectional Repair	Sectional Repair
		CFS Bonding	-	
	Abutment	Crack Injection	Crack Injection	Crack Injection
		Cleaning on bearing seat	Cleaning on bearing seat	Cleaning on bearing seat
		-	Re-compaction of abutment backfill	Re-compaction of abutment backfill
		-	Installment of approach slab	Installment of approach slab
	Pier	Sectional Repair	Sectional Repair	Sectional Repair
	Pavement	Replacement	Replacement	Replacement to asphalt pavement
	Expansion Joint	Replacement	Replacement	Replacement
	Bearing	Replacement	Replacement	No repair because still functioning
	Railing	-	-	Touch-up painting for preventive maintenance
	Wheel guard	Crack Injection	Crack Injection	Crack Injection Repainting (Black and white)

As keeping safety of bridge and road condition, following items are to be done;
Road marking / Installment of safety sign board / Installment of guide post

Red : New reviewed Items for pilot project

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Especially the surface pavement of Xebangnouan Bridge will replace the existing material by new asphalt concrete (Better than seal coat for the existing), the amount of volume is only around 120 m^3, the asphalt concrete mixing plant will be not construct on construction site to prevent the impact on social and environment issues, beside that the budget to construct the asphalt concrete plant is so higher than budget provided however the project will order from the private company which is located in Songkhone district and the distance is about 40 Km or 25 minute on delivery.

Chapter 4: Environmental and Social Descriptions

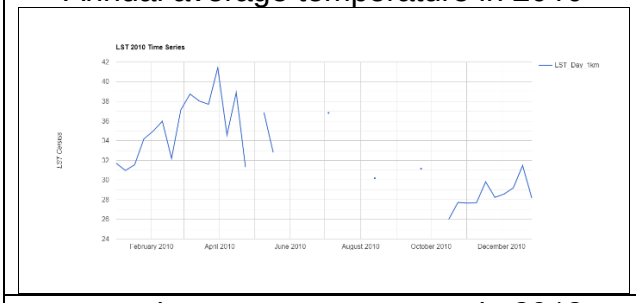
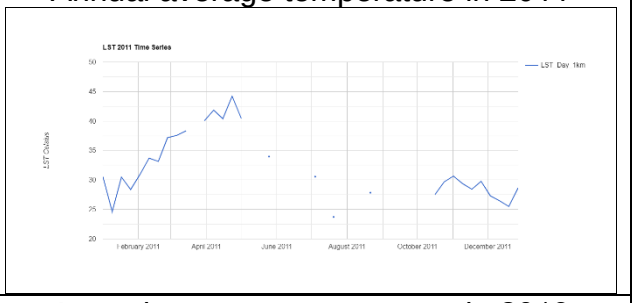
4.1 Scope of the Study

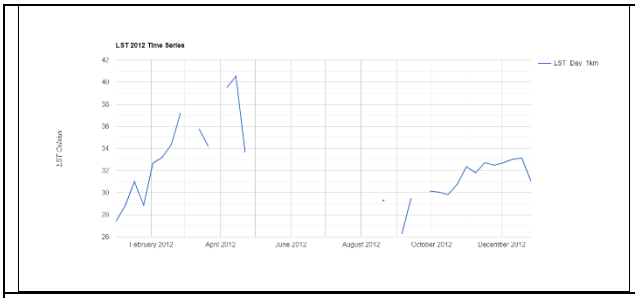
The Initial Environmental Examination is for the Xebangnouan Bridge Maintenance and Management Project, crossing between 2 provinces, they are Xebangnouan village Songkhone district, Savannakhet province and Phouthamphouang village, Lakhonepheng district Salavan province. The detailed study includes the physical, biological and economic-social components, the cultural and visual components in the current project area. In additions, the study on each component is complied with the Technical Guideline on Establishment of Initial Environmental Examination Report for the Investment Projects and Activities in Lao PDR, No.2797/ MONRE/DESIA/DRM., Vientiane Capital, and Dated on December 19, 2016. And Decree on Environmental Impact Assessment (No. 21/GOL, dated 31/01/2019). However, the recent environmental study for this project might not follow all steps or topics as described in the table of content due to the fact that this guideline is applied for all types of projects with different environmental studies and impacts.

4.2 Physical Component

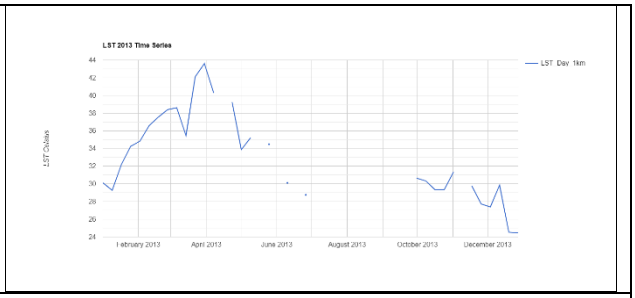
4.2.1 Climate/Meteorology

Songkhone district Savannakhet province and Lakhonepheng district Salavan province is located boundary between the middle part and southern part of Laos, Area is located in the Southeast Asia tropical monsoon climate. Two monsoons, the northeast and then southwest, dominate the climate conditions and create two distinct seasons including dry and rain season. The dry season starting from November to April. During the dry season, the weather will be little strong winds and cold, according they located in plains area and no mountain around, so the weather will be hot in rainy season due to the topography of the plain and monsoon weather from Vietnam and normally it's start from June to October, the average annual precipitation in Savannakhet is around 1,430 mm, although this is highly variable from year to year (1,295 mm – 1,739 mm in 10 years).

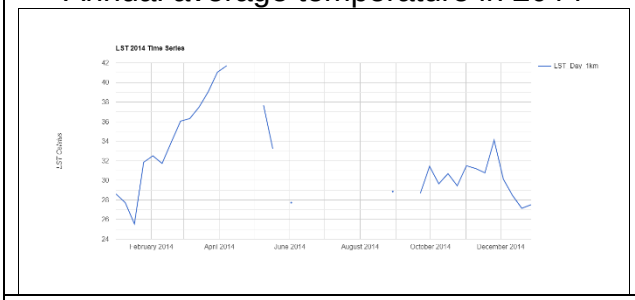
Annual average temperature in 2010	Annual average temperature in 2011
	
Annual average temperature in 2012	Annual average temperature in 2013



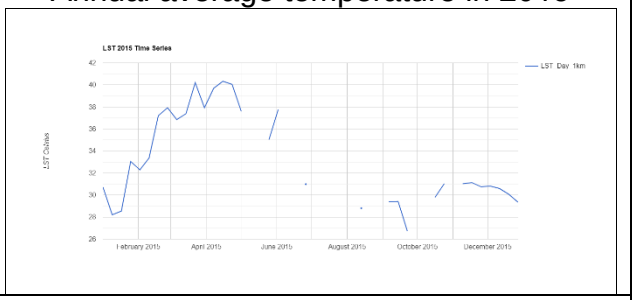
Annual average temperature in 2014



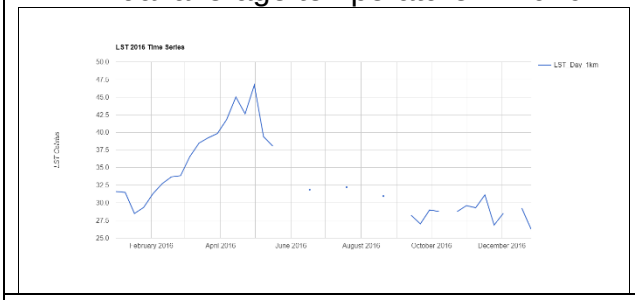
Annual average temperature in 2015



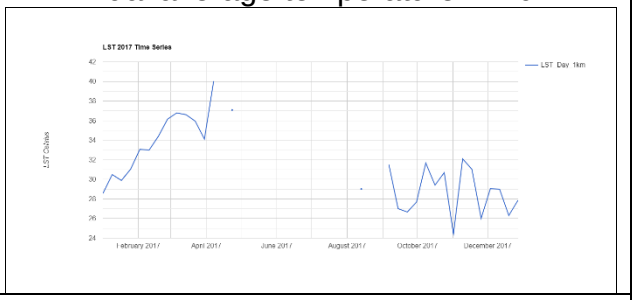
Annual average temperature in 2016



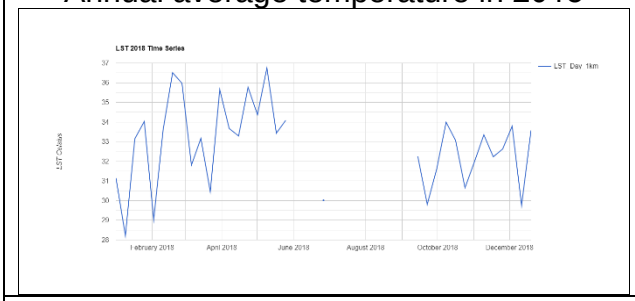
Annual average temperature in 2017



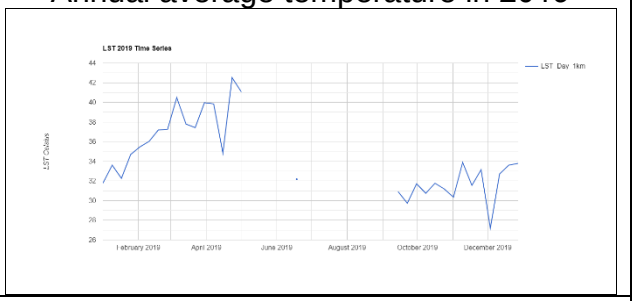
Annual average temperature in 2018



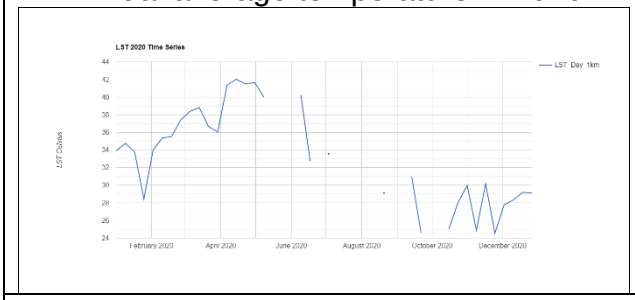
Annual average temperature in 2019



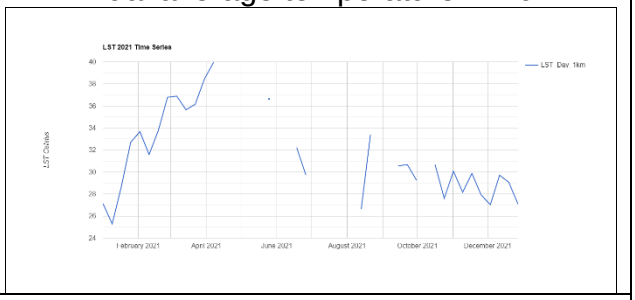
Annual average temperature in 2020



Annual average temperature in 2021



Annual average temperature in 2022



Location map of temperature measurement area

Source: Land surface Temperature MODIS

Figure4. 1 Annual average temperature graph from year 2010 to 7/2022 at Xebangnouan bridge area

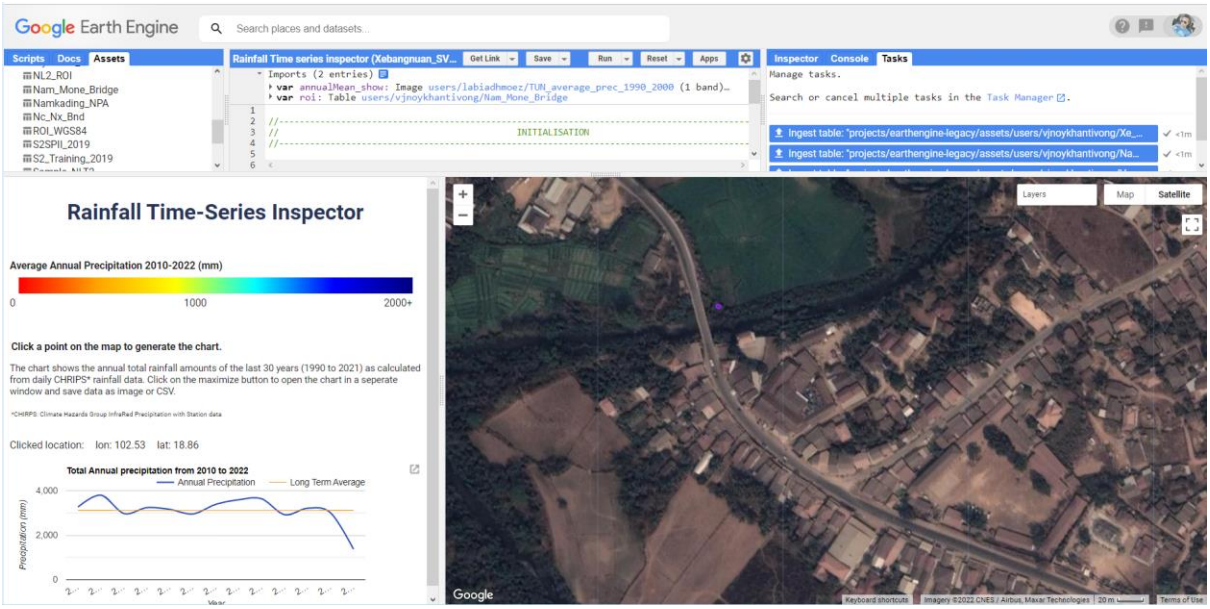
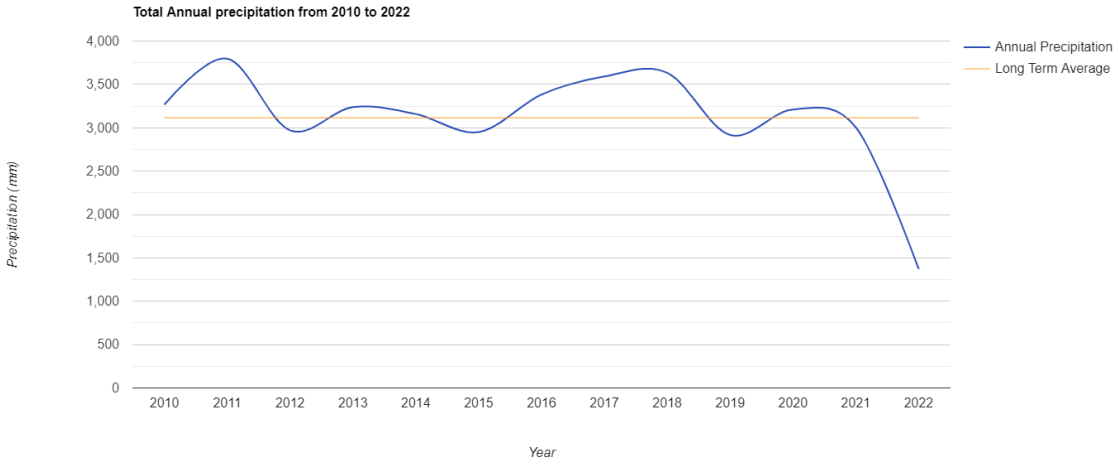


Figure4. 2 Land surface precipitation from MODIS



Source: Google earth engine - MODIS Satellite image

Figure4. 3 Annual average precipitation graph from 2010 to 2022 at Xebangnouan bridge area

❖ National environment standards

Table4. 1 General air quality standards.

Parameter	Symbol	Average	Standard Less than	Unit
Carbon monoxide	CO	1 hour	30	ppm
		8 hours	9	ppm
Nitrogen dioxide	NO_2	1 hour	0.11	ppm
		1 year	0.02	ppm
Sulfadiazine	SO_2	1 hour	0.13	ppm
		24 hours	0.05	ppm
Total suspended particulate<100	TSP	24 hours	0.33	mg/m^3
		1 year	0.10	mg/m^3
Particulate matter <10	PM-10	24 hours	0.12	mg/m^3
		1 year	0.05	mg/m^3
Particulate matter <2.5	PM-2.5	24 hours	0.05	mg/m^3
		1 year	0.015	mg/m^3
Ozone	O_3	1 hour	0.20	mg/m^3
		8 hours	0.14	mg/m^3
Lead	Pb	1 year	0.00015	mg/m^3

Source: National Environment standard, article 5, table5, page 3/38

4.2.2 Landscape

Almost of landscape in the middle part and southern part of Laos is also to be large scale of plains and plateau. Songkhone and Lakhonepheng districts is located in the end of middle part and southern part of Laos respectively, and area is minor slope from East to West, and is bordered by Salavan Province in the south, Khammouane Province in the north, Vietnam to the east and Thailand to the west. The eastern portion is flat to gently rolling terrain under 400 m north and south of the Xebangnouan. The flats are bounded by low hills to the north and the south. In the central portion, the river breaks through a large block of steep hills. East from the hills the river again flows in a wide valley rising north, south, and east to hills the crest of which demarcates the edge of the Xebangnouan catchment.

4.2.3 Geology and Soil

Typically, soils on the command area are mostly derived from alluvial deposits and are classified as acrinols, which are strongly acidic, have good water holding capacity and have high activity clays in the subsoil and generally lack nitrogen (N) and potassium (K), as well as phosphorus (P) to a lesser degree. They are suitable to shallow rooting crops such as rice, and intensive irrigated and rain fed agriculture. Yields can be significantly improved through the application of fertilizer. Soil type along the canal alignment is clayey soil. Two similar soil types had been observed in the command area which is clayey loam and silty loam. Within the project, the command area has high potential for increase agricultural production

The soil condition of the project area (Songkhone and Lakhonepheng district) is in a low-lying area near the river. Most of the initial soil

sediments are sedimentary rocks that accumulate between stones and sand. Typically, the soil in the bottom area near the river bank will be classified as highly acidic, with good water retention capacity and high humus in various soil layers. In general, the soil in the project area has low levels of nutrients such as nitrogen (N), potassium (K), and phosphorus (P) that are suitable for growing shallow root crops such as rice, corn, and other vegetables. In summary, the soil is not very rich, but the amount of rain is in the right range for various crops, and the farmers have used new production techniques to gradually increase the agricultural yield without using chemical fertilizers.

4.2.4 Erosion and Sediment

According to the condition of the area and according to the villages in the target area of the project, it is seen that the area has a relatively low level compared to the average height from the sea level, causing a lot of sedimentation and erosion during the rainy season. Due to the heavy rains, the level of Xebangnouan, Xechamphone water rises, combined with the amount of rainwater that is difficult to drain, causing flooding and corrosion, and sedimentation in streams, canals, swamps, and rivers, which affects agricultural production. During the dry season, precipitation is caused by strong winds.

4.2.5 Hydrology water source and Water Quality

In Savannakhet have many important river networks, such as: Nong Louang is a natural lake located in the flood plain of three major rivers the Xebanghieng, Xechamphon and Xexamxoy. The lake has a water surface area 700ha measured from a Google Earth image dated 25 December 2015. It was reported that the lake has an average depth of 3m. The catchment area of Nong Louang was measured as 47.8km2 from a Google earth image with one main stream Houay Sala flowing into and through the lake. Houay Lamphone branches from Houay Sala and drains Nong Louang into a wetland area to the north of the lake. Timmins (2014)9 stated “Nong Louang has a hydrological system somewhat akin to the Tonle Sap of Cambodia, with water flowing into it when the Xe Champhone and Xebanghiang systems are in flood.” The local community also reports there are many small springs within the lake. There is inflow water from Vixaisong Irrigation Scheme, and irrigation system drawing water from Xe Banghiang River to a command area of approximately 100ha on the eastern side of the lake which is about 1 km north of Dongsavang village. However, The Xebangnouan is the boundary river between Savannakhet and Salavan province and it’s come from Xebangnouan National protected area in Salavan province. It has a length of 326 Km and fall into the Mekong River. It is important in agricultural production, and fishing (getting aquatic animals for livelihood and selling them as goods). In addition, local people also take advantage of the water source for consumption. In the rainy season, there will be a lot of water, which causes some areas along the river to flood, but in the dry season, there are some rivers, small creeks are dry land, and some sources are stagnant water and do not flow in some places.

Water quality around the project area. The water sampling was conducted on August 9, 2022 at the location of the project located area, the study team was selected 2 water sampling, they are upstream (WSP1) from the bridge around 100 m and also downstream (WSP2) of the bridge. According the weather situation on the sampling date was terrible by raining, so this period there will be erosion of the surface to the water source, which will fill the surface of the contaminants. Therefore, through the analysis of the water measurement results of COD at WSP1 was 14.2 mg/l and at WSP2 was 11.2 mg/l both of them were a bit over the National standard of surface water. For the result detail is in the table below:

Table4. 2 Data and samples at the site

No	Name of Sample	Time	Sampling Point	Temperature of water	Depth of River	Depth of Sampling	Weather
1	WSP1 Upstream	15:45	48 Q 551302.71 m E 1769408.47 m N	20.50 ◦c	2 m	0.4 m	After raining
2	WSP2 Downstream	16:02	48 Q 551251.63 m E, 1769233.11 m N	21.1 ◦ c	0.55 m	0.15 m	after rain

Source: Google Earth Professional

Figure4. 4 Location map of Surface water sampling water – Xebangnouan

Figure4. 5 Water Sampling Collections

Table4. 3 General surface water quality standards

Parameter	Symbol	Standards					Unit	Analysis method
		1	2	3	4	5		
Color, Order and Taste	NA	n	n'	n'	n'	NA	Not defined	Not defined
Temperature	t °c	n	n'	n'	n'	Not defined	°c	Thermometer
Potential of hydrogen	pH	6-8	6-8	5-9	5-9	Not defined	Not defined	Electrometric pH meter
Dissolved Oxygen	DO	> 7	6.0	4.0	2.0	< 2	mg/L	Azide Modification meter
Electro conductivity	EC	< 500	≤ 1000	≤ 2000	≤ 4000	> 4000	µS/cm	Ec meter
Chemical Oxygen demand	COD	n	5-7	7-10	10-12	> 12	mg/L	Potassium Dichromate Digestion; Open reflux or Close reflux
Total coliform bacteria	Not defined	n	5000	20000	not defined	Not defined	MPN/100ml	Multiple tube Fermentation Technique
Fecal coliform bacteria	Not defined		1000	4000	not defined	Not defined	mg/L	Multiple tube Fermentation Technique
Total suspended solid	TSS	< 10	≤ 25	≤ 40	≤ 60	> 60	mg/L	Glass fiber filter Disc
Phosphate	PO_4	< 0.1	0.5	1	2	> 2	mg/L	Ascorbic Acid
Ammonium ion	NH_4^+	< 0.5	≤ 1.5	≤ 3	≤ 4	> 4	mg/L	Kjeldahl
Nitrate Nitrogen	NO_3-N	n	5.0	5.0	5.0	Not defined	mg/L	Cadmium reduction
Ammonia Nitrogen	NH_3-N	n	0.5	0.5	0.5	Not defined	mg/L	Distillation Nesslerization
Phenol	C_6H_5OH	n	0.005	0.005	0.005	Not defined	mg/L	Distillation-4Amino antipyrene

Remarks:

n= Natural water resource

n' = Natural water resource, but temperature precision ± 3 °C

Source: National Environment standard, article 9, table10, page 15-16/38

Remarks:

Category 1: A good quality natural water source, without through the production process, mixing with chemicals and free from dirty water from all kinds of activities

Category 2: Consumption and drinking water source but must be sterilize, this category is suitable for conservation of aquatic life, fishery, water sport, and etc

Category 3: Consumption and drinking water source but must be sterilize, this category is suitable for agriculture, raise animals and etc

Category 4: Consumption and drinking water source but must be sterilize, this category is suitable for industry, and it is a wetland source for treatment water from urban or community

Category 5: A natural water source for communication, transportation, and it is a wetland source for treatment water from urban or community

The current water sampling is to test the water quality in order to find the parameter of contaminated water as following:

Table4. 4 The analysis result of surface water quality

No.	parameter	Unit	Results)		Standard[3]
			WSP1	WSP2	
1	Color	Pt-Co	less turbidity	less turbidity	
2	Odor		NA	NA	
3	Temperature	°C	20.5	21.1	-
4	pH		7.7	7.0	5.0 - 9.0
5	Chemical Oxygen Demand (COD)	mg/L	14.2	11.2	10 - 12
6	Biological oxygen demand (BOD5)	mg/L	<1 mg/l	<1 mg/l	-

Source: The laboratory result from Phanthamit Lab Limited

The laboratory result is in the Appendix 2

Based on the result of water quality testing, the COD is over the national standards, it's meant the water is quite dirty because of water sampling on the rain season and it's raining, according to the field survey, however if compare to wastewater treatment from toilet standard, both of them are minor. According to field survey, the category was selected is B by BOD_5 <30 mg/L, COD<125 mg/L

there is no mining or agriculture farm on the upstream of the Xebangnouan Bridge, so the heavy metal was not monitoring in this phase.

Table4. 5 The water pollution from toilet control standard

Parameter	Symbol	Standards	Unit	Analysis method
Potential of Hydrogen	pH	6-9	Not defined	pH meter
Biological Oxygen Demand 5 days	BOD_5	30	mg/L	Azide modification at 20°C, 5 days
Chemical Oxygen Demand	COD	125	mg/L	Potassium dichromate Digestion; Open reflux or Close reflux
Total Suspended Solid	TSS	50	mg/L	Grass fiber filter Disc

[3] National Environmental Standards No.81/Gov, February 21, 2017

Total Nitrogen	TKN	10	mg/L	Kjeldahl
Phenol	C_6H_5OH	2	mg/L	Distillation-Aminoantipyine Method 4
Fat, Oil and Grease	FOG	5.0	mg/L	Solvent Extrractionby weight
Total dissolve solid	TDS	400	MPN/mL	Dry Evaporation 103-105° c, 1 hour

Source: Environment National Standard Article 14 Table 14.4 Page 30/38

Table4. 6 The water pollution control from building standard

Building type	Building size				
	A	B	C	D	E
Condominium	A≥ 500 rooms	100≤B≤500 rooms	C≤ 100 rooms	Not defined	Not defined
Hotel	A≥ 200 rooms	600≤B<200 rooms	C≤ 600 rooms	Not defined	Not defined
Dormitory	Not defined	> 250 rooms	50≤C<250 rooms	10≤D<50 rooms	Not defined
Massage (Equivalent to bed)	Not Defined	> 5000 m^2	1000≤C<5000 m^2	Not defined	Not defined
Hospital	A≥ 30 beds	10≤B<30 beds	Not defined	Not defined	Not defined
School, Academy or Institute	A≥ 25000 m^2	5000≤B<25000 m^2	Not defined	Not defined	Not defined
Office or Department	A≥ 55000 m^2	10000≤B<55000 m^2	5000≤C<10000 m^2	Not defined	Not defined
Mega trade center / Super market	A≥ 25000 m^2	5000≤B<25000 m^2	Not defined	Not defined	Not defined
Fresh Market	A≥ 2500 m^2	1500≤B<2500 m^2	1000≤C<1500 m^2	500≤D<1000 m^2	Not defined
Food center / Restaurant	A≥ 2500 m^2	500≤B<2500 m^2	250≤C<500 m^2	100≤D<250 m^2	E<100 m^2

Parameter	Symbol	Maximum value Standards					Unit	Analysis method
		A	B	C	D	E		
Potential of hydrogen	pH	5.5-8.5	5.5-8.5	5.5-8.5	5.5-8.5	Not defined	Not defined	pH meter
Biological Oxygen Demand 5 days	BOD_5	20	30	40	50	60	mg/L	Azide modification at 20°C, 5 days
Total suspended solid	TSS	30	40	50	50	60	mg/L	Glass fiber filter Disc
Dissolved Oxygen	DO	> 7	6.0	4.0	2.0	< 2	mg/L	Azide Modification meter
Sediment solid	SS	0.5	0.5	0.5	0.5	Not defined	mg/L	Imhoff cone 1000 cm^3 1 hour

Total dissolved solid	TDS	500	500	500	500	Not defined	mg/L	Dry evaporation 103-105 °C, 1 hour
Sulfide	S^{2-}	1	1	3	4	Not defined	mg/L	Titration
Nitrogen	TKN	35	35	40	40	Not defined	mg/L	Kjeldahor color metic
Fat, Oil and Grease	FOG	20	20	20	20	100	mg/L	Solvent Extraction by weight

Source: Environment National Standard Article 14 Table 14.1 Page 28-29/38

4.2.6 Mineral Resource

Regarding to the natural resource in the Annual Report in 2021, the both of district consists of various minerals which were not project operated in this area. However, the all most area is private's agriculture, it is expected that in the future there will be a mineral extraction project, but it is an area with no potential in terms of mineral resources, where most of the land is fields, as well as agricultural production areas, and therefore the resettlement and compensation value will be high and limited.

4.2.7 Noise and vibration

Noise and vibration are one of the social and environmental impacts, especially the sensitive places like: hospital-healthcare center, school, temple, according to the scientific definition if the noise source exceeded 70 dB(A) is considered to be an affected place. These components are sensitive for noise and vibration impacts; However, this proposed project will cause the noise and vibration impact therefore, it is necessary to define the suitable prevention and mitigation measure in the nearby community due to the fact that the noise will be occurred by the bridge construction, the land clearance activities, the transportation of construction materials and other activities. In additions, the noise occurred by the traffic along the 13th south road as well as the community activities.

The National Environmental standard no. 81/GOV, February 21, has mention vibration control only the mining and crusher source only

Table4. 7 General noise quality standards.

Standards	Measurement method
Maximum noise (L_{max}) less than 115dB (A)	Measurement noise level (L_{eq}) while noise level is changing
Average noise level 24 hours ($L_{eq}24$) less than 70 dB(A)	Continues measurement (L_{eq})

Source: National Environment standard, article 15, table15, page 34/38

4.3 Biological Component

4.3.1 Terrestrial Ecology and Wildlife

Regarding to the areal condition and the comparison on project type, the project activities indicated that there is no impact on wildlife due to the fact that the project activities are not related to the clearance of forest area or wildlife habitat. The activities are to maintain the bridge and to minimize the environmental and social impact.

4.3.2 Forest and Vegetation

The forest and vegetation covered in Songkon District will include the Xebangnouan National Protection Forest which covers an area of approximately 4,500 hectares of the total forest area is 129,705,54 hectares, it also covers the area of Thapangthong District of Savannakhet Province and the remaining area is located in Salavan Province and in addition there is the National production Forest which covers the total area 49,171,00 hectares in Songkhone district. Besides that, there are 5 district reservation forests with in.

Forests and Vegetation Cover Lakhonepheng District has Xebangnouan National protection forest and Phouxiengthong National protection forest which continue to cover Champasak Province as well.

In the village between the two ends of the Xebangnouan bridge, which is close to these two types of forests, people often go to harvest forest products to use in their lives. At the same time, it is also a water source forest to create abundance for the trees, streams, and wild animals that live in the forest area and also create biodiversity in the area. But even so, the repair and maintenance project of the bridge over the Xebangnouan River is far away from all the mentioned forests and it is a repair of the existing structure with the use of a small amount of project's labour

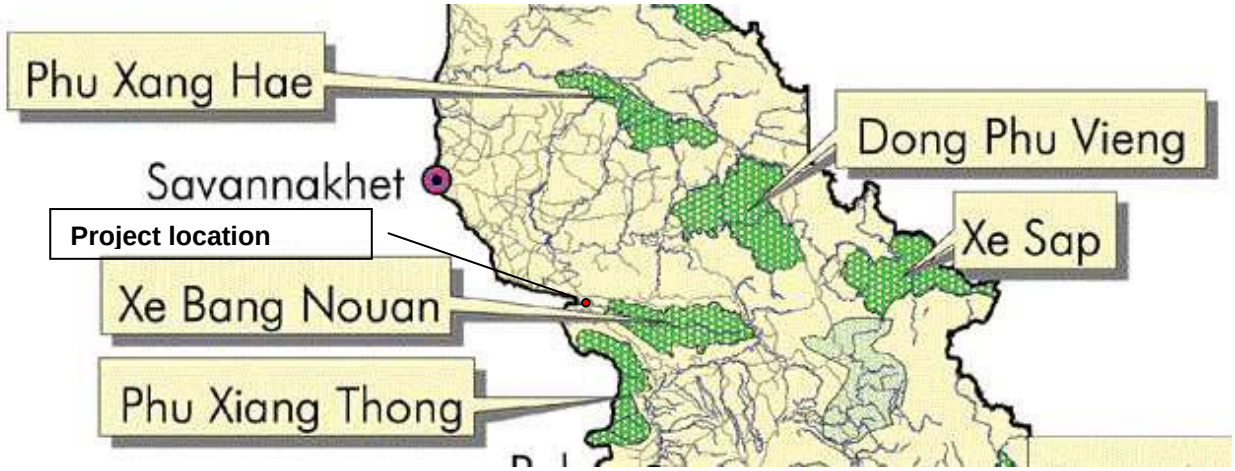


Figure4. 6 National Protected Areas Near the project

4.3.3 Aquatic Fauna and Aquatic habitat

Aquatic life and animal habitats Aquatic animals are an important part of the water source and it indicates the richness of each area whether the environmental condition of the water source is good or not. According to the survey and collected information from interviews with the village head and a number of villagers, it was found that the majority of people who live along the river bank or near the Xebangnouan, Xebanghieng, Xechamphone, and the Mekong River are fishing source as a place to get food by engaging in supplementary occupations during their vacations from paddy, and some families still stick to fishing as their main occupation because there is not enough paddy field, Therefore, fishing for the trade of people in two villages around the project site is an important source of income. Most of their livelihoods are caught to bring to sell and

a part is to bring to consumption but only within the family to reduce the family's expenses. The fish that live in the Xebangnouan that most people normally catch as the following examples:

Table4. 8 Fish type Xebangnouan around the village

ລດ No.	ຊື່ປາທ້ອງຖິ່ນ Local Name	ຊື່ປົກກະຕິ Common Name	ຊື່ວິທະຍາສາດ Scientific name
1	ປາຈາດ	Pa Chat	*Poropuntius spp.*
2	ປາກົດ	Pakod	
3	ປານາງ	Pa Narng	*Phalacronotus bleekeri*
4	ປາຄໍ	Striped Snakehead	*Channa striata*
5	ປາດຸກ	Walking Catfishes	*Clarias batrachus*
6	ປາກະດິດ	Three spot Gourami	*Trichogaster trichopterus*
7	ປາເກັດແລບ	Silver carp	Hypophthalmichtys molitrix
8	ປາຂາວ	Thick Lipped Barb	*Probarbus labeamajor*
9	ປາແກງ	Mud Carp	*Cirrhinus molitorella*
10	ປາສູດ	Eye spot Barb	*Hampala dispar*
11	ປາຊິວ	Minnow	*Phoxinus*
12	ປາແຂກ	Goonch	*Bagarius yarrelli, B. lica* *B. niewenhuisi*
13	ປານິນ	Mozambique Tilapia	*Oreochromis2* *mossambicus*
14	ປາໃນ	Common carp	*Cyprinus rubrofuscus*
15	ປາປາກ	Silver Barb Carp	*Barbus chiloensis*
16	ປາຍອນ	Pangasius	*Pangasius conchophilus*
17	ປາເພ້ຍ	Black sharkminnow	*Labeo chrysophekadion*
18	ປາຕອງ	Clown featherback	*Chitala ornata*
19	ປາຂະແຍ້ງ	Two spot Catfish	*Mystus castaneus Ng*
20	ປາເຊື່ອມ	Pa Seuam	*Ompok bimaculatus*

Both 2 villages are not reservation ponds in the project area; but even so, there is no fishing in the project area, so it can be seen that the fishing and the project activities are not affected by each other.

4.3.4 Conservation-Protection Forests and Wetland

According to the annual report of Songkhone district and Lakhonepheng district. There is only Xebangnouan National protection forest, Dongsithouane production forest, 5 reservation forest of district and Phouxiengthong national protection forest only, however all of forest is not cover the project location.

The forest condition in the area around the project area is very little, there are only forests along the farmland, and along the river banks of the Xebangnouan.

4.4 Economic-social Component

4.4.1 Administration and Limitation

The organization structure of the Lao Government consists of the central, provincial, district, local and village authorities. However, each level of authorities has the detailed responsibilities under the same law of Lao PDR.

Savannakhet Province is located in the Savannakhet Plain, which is the largest plain in Laos, with a total area of 21,774 km2 and is divided into 14 districts and 1 city of Kai Son, which includes the following: 1. Nakon Kaison, Uthumphon district, 3. Aspungthong district, 4. Pin district, 5. Sepon district, 6. Nong district, 7. Tha Pang Thong district, 8. Songkhon district. , 9. Champhon district, 10. Chonburi district, 11. Xaiburi district, 12. Vilaburi district, 13. Aasphon district, 14. Xaiphuthong district and 15. Tha Phalanxay district.

4.4.2 Land Use (Land Use Map)

Land used in the project area as a whole is divided according to the management of the village. It will include construction land, farmland, garden land, land for other agricultural production, and forests (Including production, preservation, and protection of forests), according to the level administration allocation of the village, district, and province levels. The difference in land use of each village is more or less different. However, according to the actual situation and actual data of land use collection in Songkon District and Lakhonepheng District, it is not disturbing the project area, because the project is maintaining the existing structure of the bridge to its original condition and safe for use.

For this bridge repair project, there is no encroachment on the land in the surrounding area of the project, because it's only a maintenance exiting structure and no expansion of the area. Besides, the project developer will use the stone ore materials related to the work by using materials from local sources to facilitate transportation in the project area.

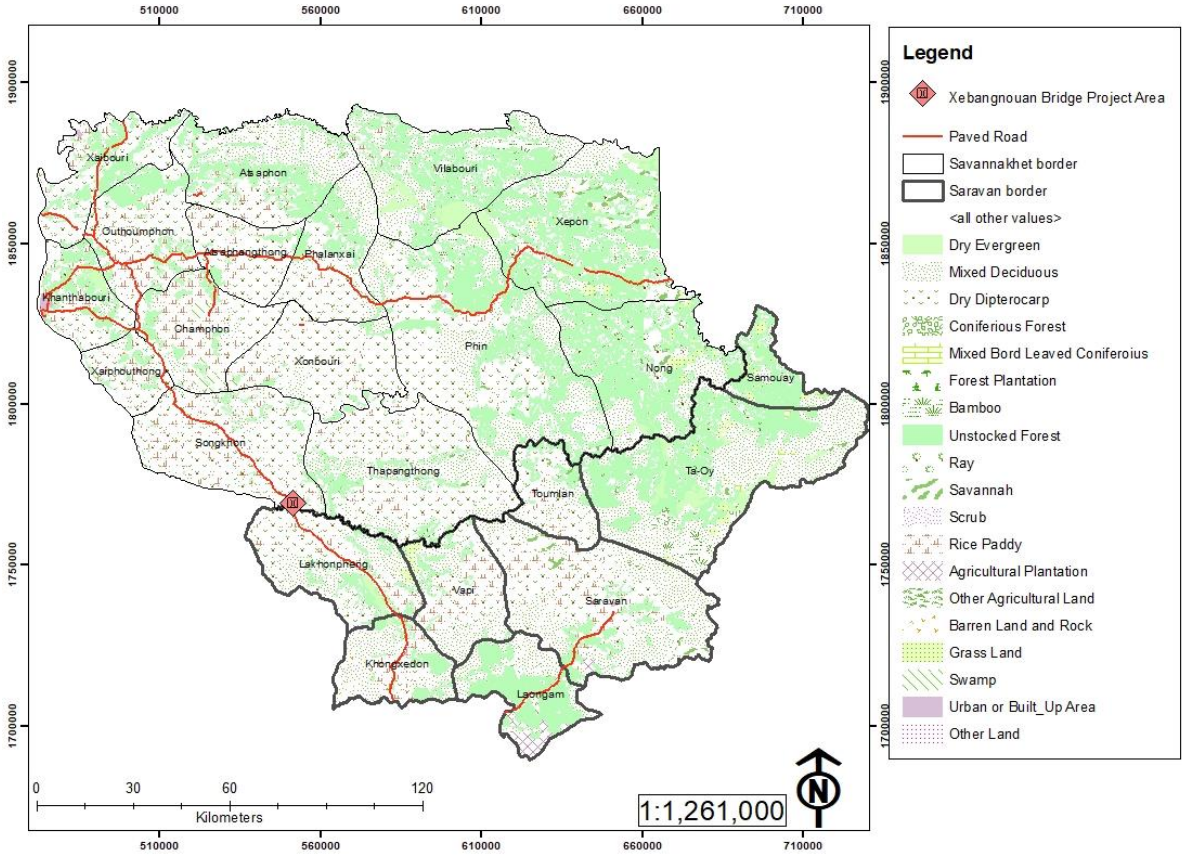


Figure4. 7 Land use map around at the Savannakhet and Salavan province around the project area

4.4.3 Social Information

4.4.3.1 Community and Population

The villages in the project area consist of two villages including Xebangnouan village, Songkhone district, Savannakhet province and Phouthamphoung village, Lakhonepheng district, Salavan province, and the important infrastructure in the Xebangnouan village is Buddhism temple 3 places, church 2 places, a Secondary school 1 place, Primary school 1 place, a Village office, public security group (Xenouan zone) 1 place, public community health centre 1 place. In addition, 1 temporary market (will be open twice a week, Thursday and Sunday). And also, almost road in the village is seal coat pavement, and the other is earth road. For the population's detail will be summary in table below. Phouthamphouang village has only 1 Buddhism temples, village office, public community health centre 1 place, Primary school 1 place, but there is no secondary or high school; however, there are 4 cemeteries in the village, beside that the market will be open every Tuesday in weekly. The road condition is almost pavement by seal coat, there is only earth access road. one specially There is also 1 religious tourism source, but it's close until present, because of lack maintenance and service budget.

Table4. 9 The analysis result of surface water quality

No.	Village name	House hold	Family	Population	Female	Lao ethnic	Religion (Fam)

							Buddhism	Christian
1	Xebangnouan	310	378	2,384	1,178	2,384	144	234
2	Phouthamphoung	331	395	1,912	957	1,912	286	45
	Total	641	773	4,296	2,135	4,269	430	279

The occupations of local people include employees, hired workers, business owners, traders, farmers, and gardeners,

4.4.3.2 Ethnic and Religion

According to the interview village head form, they are show the people who are living in both village are Lao ethnic and based on the village history, the people living in the Xebangnouan village have had missionaries of the Cristian religion come and build a church and teach the people to believe in that religion and later the people who migrated to settle in the Xebangnouan village also respect an believe in Buddhism and spread it later according to the beliefs of the people who later migrated, from Table 4.4 above is show the number of population who are believe and follow up in different religions.

Buddhism temple

Church for Cristian

Figure4. 8 Temple and Church in the Xebangnouan village

4.4.3.3 Education

According to the social and economic 5-year plan (2015-2019) of Salavan province, there are 90 nursery-kindergarten schools and it's increase 21 units when compared to the previous year, the number of primary schools is up to 604 units, Secondary school is 56 units, and it's increase of 4 units, there are 42 high schools from the previously 35 units, 2 vocational colleges and 1 is of which is privately college, and beside that 1 teacher training college. However, the education in the project area, based on the interview form both of 2 villages, In the Xebangnouan village has school begin from nursery up to Secondary

school, but for the high school need to travel to Xebanghieng village and spend time to travel around 40 minutes, however in the year 2022, at the Xebangnouan is upgrade to high school in the same place.
Phouthamphoung village has nursery school to primary school only, for the secondary and high school need to study at Nonesavang village Lakhonepheng district which travel around 10-15 minute. For the detail of school and student in the year 2021 is in the table below:

Table4. 10 Number of student and school around the project

No.	Village	Nursery	Primary	Secondary	High school
		Qty.	Qty.	Qty.	Student qty.
1	Xebangnouan	56	318	213	-
2	Phouthamphoung	27	173	at Nonesavang village distance around 6-7 Km	


Figure4. 9 Primary and Secondary school at Xebangnouan village

4.4.3.4 Poverty Family[4] and Risk Group

Regarding to the poor families and risk group, currently based on the interview, Xebangnouan village consists of 310 household, 378 families and the total population of 2384 people with 1178 females. The vulnerable families with female head of family consist of 20 families and there are 6 families who are Elderly and disabled people. In additions, Phouthamphoung village consists of 331 household and 395 families; the total population of 1964 people with 957 females and also there are 2 families who are Elderly and disabled people. However, the economic-social changing caused the development of these families later than others.

4.4.3.5 Gender

Equality between men and women is one of the main goals of development and is the basis of innovative economic development. Increasing gender equality can help raise the productivity of production, improve development outcomes for future generations and lead to

[4] Laos' poverty line is constructed on an absolute basis, comprising a food poverty line (based on 2,100 kcal per day), a non-food poverty line (30% of total consumption), not enough clothes, and non-permanent residents, no ability to pay for medicine and basic education, and cannot access to the basic public service network

greater equality between women and men in various organizations. As the country continues to developing, empowering women and children will become an important point to harnessing the country's economic growth and the collective strength of the youth to improve living standards. In that, women and men will benefit simultaneously, for the role of gender in the project area through information inquiry is equal in decision-making, living together as a family.

4.4.4 Healthcare Information

4.4.4.1 Healthcare Situation in the District

There are 16 public health in Songkhone district; they are 1 district hospital, 3 minor hospitals and 12 public community health centres in each village. According to the Social and Economic 5 years plan. According to the development plan, along with training and upgrading, knowledge and skills of nurse , doctor and medical staff in district hospital level and public community health centre in a every year, so that the people can receive a wide range of health services and good quality, Apply the implement health policy to the people by free treatment for pregnant women, give a childbirth without charge, and service the children who under 5 years old, poor families and monks, including provide good quality service to the general people

For the public health of Salavan province has been continuously expanding and covering the infrastructure including the construction and renovation of district hospitals, community minor hospitals, public local health centres and provincial hospitals in order to provide comprehensive and high-quality services and treatment to the people.

4.4.4.2 Public health conditions in the project area

Both of 2 villages in the project area have public community health centres that people can easily access. In this area, there is a good awareness of hygiene, which is shown when field inspection and data survey in these village and all the households. There is at least one toilet per household, and cleaning facility in bathroom such as: soap, cleaning hand jell, towels and etc..., beside that people normally cleaning their home area, prepares clean food and good taste, beside that consume drinking water that has been sterilized from the factor.

- Good solid waste management in village, almost household make arrangement to sort out the recycle waste and reuse it if necessary, such as: Can, Bottle and etc…to keeping good sanitation and hygiene in their home area
- In addition to the diseases that happen to people, there are also diseases that happen to animal, such as foot and mouth disease, dysentery, and other diseases that are caused by animal not being vaccinated and most of them occur seasonally.
- From the results of the field survey, when people are sick, they will go to the district hospital, clinic or community public health centre for treatment depending on the case, if are there any injure case or serious case, the district hospital, provincial hospital or private clinic are according to convenience

. (Details of the social-economic information is in the appendix 3)

Temporary market-twice a

Critiane church 1

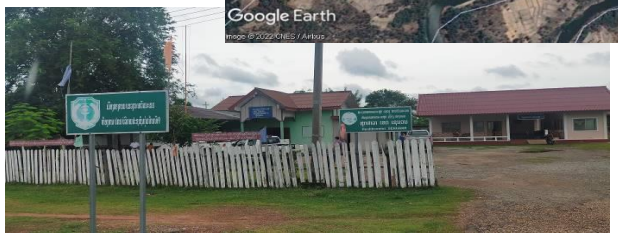
Critiane church 2

Cemetery temple

Xenouan Tai temple

Tamtao temple

Env. Field Survey team



Village office-Public security group-Community health center

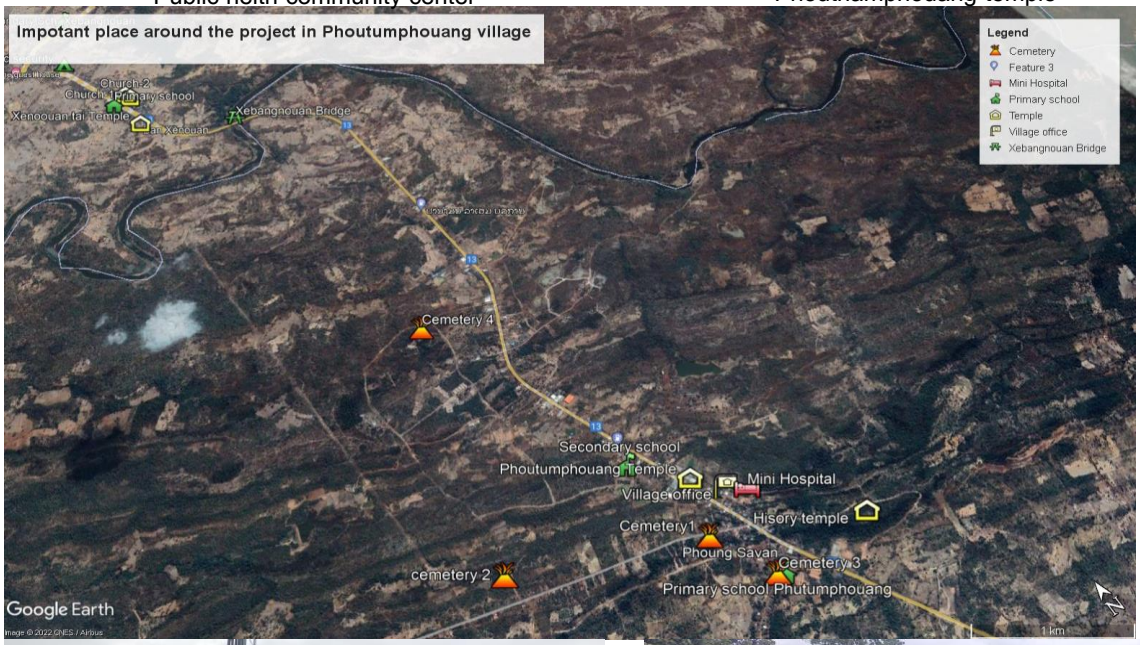
Primary school

Secondary school

Figure4. 10 The important place around the Xebangnouan village

Public helth community center

Phouthamphouang temple



Phouthanphouang tourist temple

Phouthamphouang Primary school

Village office

Primary school (Upto grade 3)

Chapter 5: Impact Assessment and Mitigation Measures

5.1 Purpose

To comply with the Agreement on the Endorsement and Promulgation of List of Investment Projects and Activities to Requiring for Conducting the Initial Environmental Examination or Environmental and Social Impact Assessment, No.8056/MoNRE, date on 17 December 2013.

To implement the instruction on the study on the Initial Environmental Examination or Environmental and Social Impact Assessment of Investment Projects and Activities, No.8029/MoNRE, date on 17 December 2013.

To implement the Agreement on the Endorsement and Promulgation of the Guideline on Public Participation in the Environmental and Social Impact Assessment of Investment Project, No.707/MoNRE, date on 5 Feb 2013.

The purpose of the Initial Environmental Examination of this project is to define the issues and the protection-mitigation measures and also to minimize the adverse environmental and social impact occurred by the project in order to build the capacity in term of contribution in the national economic and social development to be sustainable.

5.2 Impact Assessment Methodology

The impact assessment methodology consists of the data collection from the secondary data, the field survey, and using the interviews form to interview the people who are living in the project area, the using of scientific measurement device and mapping.

- The secondary data collection from the secondary information: is the data collection from the Feasibility Study of the project owner and to collect the data from the satellite image to use as the baseline information for making the report.

- The data summary from the field survey: is the coordination between the experts from the environmental consulting company, the project owner and the local authorities. However, this data shall be the baseline information and use to study on the potential impact assessment affected by the project implementation and activities. This is to anticipate the impact on environmental ecology and city ecology in that area in order to prepare the study report.

- The using of questionnaire form to interview people in the project area.

It's to interview on the economy-society in the community located in and nearby project area in order to assess the potential impact occurred by the project particularly on the assets and income source of people and also to protect and mitigate. In addition, this will be the baseline information to compare with the project implementation in the future.

- The use of scientific measurement device

Is to measure the environmental quality which required to use the device and scientific principles for testing the air, noise and water qualities during the construction period in order to be the baseline information in term of comparison, management, monitoring and also to solve it to be complied with the National Standard.

The potential environmental impacts regarding to the activities of the Xebangnouan Maintenance Project in between Xebangnouan village and

Phouthamphouang village will be described in this section, where the concerns for key environmental impacts and mitigation measures are outlined in this section. The impact levels were evaluated here by applying the "Matrix" principle, which is an overall rating that indicates the level of impact. The impact assessment assesses only the main and potential impacts, such as impacts on climate change, noise and vibration, water quality (water discharge from the project area), transportation safety, and other issues. The assessment method will use terms with different meanings: Occurrence, Magnitude, Sensitivity, and Ranking as described below:

- Occurrence: It means that it can happen, or it may happen or it may happen unexpectedly
- Magnitude: It means that the impacts are significant or severe from those affects that should be seriously addressed and mitigated.
- Sensitivity: It means that the social and environmental sensitivity are quick to recognize or be quick to respond to the environmental impacts of those activities.

Ranking: A rating of the impact resulting from the evaluation results in the three figures above and then divide by 3, in order to calculate the average impact level in the formula as following:

$$Ranking = \frac{(Occurrence + \text{Magnitude} + \text{Sensitivity})}{3}$$

Table5. 1 Score indicator of the impact level

Impact level	Occurrence	Magnitude	Sensitivity
0	No occurrence	No impact	No impact
1	Not likely to occur	Low impact	Low
2	More likely to occur	Medium impact	Medium
3	Possible to occur	High impact	High
4	High possibility to occur	Very high impact	Very high

Table5. 2 The ranking of impact risk

Average range of the impact	Colour of the impact level	Risk level
≤ 0.5		No risk
0.5 to <1.5		Low risk
1.5 to <2.5		Medium risk
2.5 to < 3.5		High risk
≥ 3.5		Very high risk

5.3 Scope of the Impact Assessment

The scope of the IEE for Xebangnouan Bridge Maintenance and Management Project will be the pilot project located between Ban Xebangnouan and Ban Phouthamphouang, Songkhone district, Savannakhet province and Lakhonphend district, Salavan respectively which will include an impact

assessment of activities to be undertaken during the pre-construction /construction phase and operation phase in physical and biological environment

5.4 Screening of Impact

The screening of impact is to expect the impact of Xebangnouan Bridge Maintenance Project based on the project activities or the causes of environmental and social impact including the land clearance for construction project, the bypass construction (To construct the temporary bridge for crossing Namone bridge), office, and worker camp. Therefore, in order to facilitate on the improvement and to increase the safety, the social infrastructure and environmental protection shall get along. However, in order to to have the balance in all aspects, the mitigation measures for the potential impact will be based on the detailed study on the project's activities, areal information and the site survey. The discussion with people living nearby the project area can be concluded that the potential impact by the project activities will be in the construction phase. However, the pre-construction and operation phases will have no adverse environmental and social impacts.

However, the environmental and social impact assessment of the project will be conducted in three phases including: Pre-construction Phase, Construction Phase and Operation Phase in order to indicate the activities in each project periods as details following:

The document preparation, the training, survey on the damage points.

Table5. 3 The impact assessment from project activities (Pre-construction phase)

No	Environmental Elements	No mitigation measure				Mitigation measure			
		Occurrence	Magnitude	Sensitivity	Ranking	Occurrence	Magnitude	Sensitivity	Ranking
1.	**Physical environment**								
1.1	Landscape	0	0.5	0.5	0.33	0	0	0	0
1.2	Soil and soil erosion	0	0.5	0	0.016	0	0	0	0
1.3	Water source and water quality	0	0	0.5	0.16	0	0	0	0
1.4	Air quality	0	0.5	0.5	0.33	0	0	0	0
1.5	Noise and vibration	0	0	0.5	0.16	0	0	0	0
1.6	Waste	0.5	0	0	0.16	0	0	0	0
2.	**Biological environment**								
2.1	Forest and wildlife	0	0	0	0	0	0	0	0
2.2	Aquatic animal and living organism	0	0	0	0	0	0	0	0
2.3	Protected and conservation areas	0	0	0	0	0	0	0	0

No	Environmental Elements	No mitigation measure				Mitigation measure			
		Occurrence	Magnitude	Sensitivity	Ranking	Occurrence	Magnitude	Sensitivity	Ranking
3.	**Socio-economy**								
3.1	Land use	0	0	0	0	0	0	0	0
3.2	Community and population	0	0	0	0	0	0	0	0
3.3	Employment and household incomes	0	0	0	0	0	0	0	0
3.4	Local Business	0	0	0	0	0	0	0	0
3.5	Facilities	0	0	0	0	0	0	0	0
3.6	Traffic and transportation	0	0	0	0	0	0	0	0
3.7	Impact on people's assets	0	0	0	0	0	0	0	0
3.8	Health and Safety	0	0	0	0	0	0	0	0
3.9	Cultural and historical sites	0	0	0	0	0	0	0	0
3.10	Scenery	0	0	0	0	0	0	0	0

Table5. 4 The impact assessment from project activities (Construction phase)

No	Environmental Components	No mitigation measure				Mitigation measure			
		Occurrence	Magnitude	Sensitivity	Ranking	Occurrence	Magnitude	Sensitivity	Ranking
1.	**Physical environment**								
1.1	Landscape	1	1	1	1	0.5	0.5	0.5	0.5
1.2	Soil and soil erosion	1	1	1	1	0.5	0.5	0.5	0.5
1.3	Water source and water quality	1	3	2	2	1	1	1	1
1.4	Air quality	1	3	2	2	1	2	1	1.33
1.5	Noise and vibration	1	2	1	1.3	1	1	1	1
1.6	Waste	2	2	2	2	1	1	1	1
2.	**Biological environment**								
2.1	Forest and wildlife	0	0	0	0	0	0	0	0
2.2	Aquatic animal and living organism	0	0	0	0	0	0	0	0
2.3	Protected and conservation areas	0	0	0	0	0	0	0	0
3.	**Socio-economy**								
3.1	Land use	0	0	0	0	0	0	0	0
3.2	Community and population	0	0	0	0	0	0	0	0
3.3	Employment and household incomes	1	1	1	1	+2	+2	+2	+2

No	Environmental Components	No mitigation measure				Mitigation measure			
		Occurrence	Magnitude	Sensitivity	Ranking	Occurrence	Magnitude	Sensitivity	Ranking
3.4	Local Business	2	2	2	2	+2	+2	+2	+2
3.5	Facilities	1	1	1	1	0.5	0.5	0.5	0.5
3.6	Traffic and transportation	3	3	3	3	2	2	2	2
3.7	Impact on people's assets	0.5	0.5	0.5	0.5	0	0	0	0
3.8	Health and Safety	2	3	3	2.6	2	2	2	2
3.9	Cultural and historical sites	0	0	0	0	0	0	0	0
3.10	Scenery	2	2	2	2	1	1	1	1

Remarks: , + : expected to have positive impact on the component

Table5. 5 The impact assessment from project activities (Operation Phase)

No	Environmental Components	No mitigation measure				Mitigation measure			
		Occurrence	Magnitude	Sensitivity	Ranking	Occurrence	Magnitude	Sensitivity	Ranking
1.	**Physical environment**								
1.1	Landscape	0.5	0.5	0.5	0.5	0	0	0	0
1.2	Soil and soil erosion	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
1.3	Water source and water quality	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
1.4	Air quality	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
1.5	Noise and vibration	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
1.6	Waste	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
2.	**Biological environment**								
2.1	Forest and wildlife	0	0	0	0	0	0	0	0
2.2	Aquatic animal and living organism	0	0	0	0	0	0	0	0
2.3	Protected and conservation areas	0	0	0	0	0	0	0	0
3.	**Socio-economy**								
3.1	Land use	0	0	0	0	0	0	0	0
3.2	Community and population	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
3.3	Employment and household incomes	+2	+2	+2	+2	+2	+2	+2	+2
3.4	Local Business	+3	+3	+3	+3	+3	+3	+3	+3
3.5	Facilities	+2	+2	+2	+2	+2	+2	+2	+2
3.6	Traffic and transportation	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
3.7	Impact on people's assets	0	0	0	0	0	0	0	0
3.8	Health and Safety	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

No	Environmental Components	No mitigation measure				Mitigation measure			
		Occurrence	Magnitude	Sensitivity	Ranking	Occurrence	Magnitude	Sensitivity	Ranking
3.9	Cultural and historical sites	0.5	0.5	0.5	0.5	+1	+1	+1	+1
3.10	Scenery	0.5	0.5	0.5	0.5	+1	+1	+1	+1

Remarks:
value after mitigation measure is still remain, but it's less than medium risk ranging, because it's the natural of living
+ : expected to have positive impact on the component

Table5. 6 Summary on the impact assessment from the project activities in each project period

No	Impact	level			**Brief Description**
		PCP	CP	OP	
1. Pollution Protection					
1.1	Air quality	-	C	-	Construction: Limit the air pollution to be occurred from the using of heavy machines and construction activities. The operation and after the completed construction occurred from the traffic: anticipated that there is no impact on the air but will occurred by the social service
1.2	Water Quality	-	C	-	Construction: Anticipated that there is temporary pollution including: the demolition, using of chemical for concrete mixing and the storage of construction material. In addition, there will be temporary water pollution from the worker camp/office and warehouse (if there is construction) or if renting the house, there will be minor impact. Operation: anticipated that there is no water pollution
1.3	Waste	-	C	-	Construction: the demolition of old building, the land clearance in order to construct the linkage between the bridge –new road, the waste from material packaging, rubble; therefore, there is debris from the construction, waste from the worker and office.
1.4	Soil contamination	-	C	-	Construction: there might be the contamination from fuel and chemical for concrete mixing used for the maintenance work.
1.5	Noise and vibration	-	C	-	Construction: anticipated that noise and vibration from the project activities might be minor and in the working time
1.6	Soil subsidence	-	-	-	will not occur because there is no earth work or excavation of foundation

No	Impact	level			**Brief Description**
		PCP	CP	OP	
1.7	Bad Odour	-	C	-	Construction: no activities which caused the bad odour, there is only temporary waste, fuel from the plastic decomposition or concrete material
1.8	Air quality	-	C	-	Construction: there are some activities caused to the dust in short time Operation: the construction area will be improved so there is no impact on air quality
2. Natural Environment					
2.1	Conservation Area	-	-	-	There is no conservation area
2.2	flora, fauna and biodiversity	-	-	-	anticipated that there is no impact on flora, fauna and biodiversity because the project construction area is an existing place and also in the limited area. There is no conservation area for flora, fauna and biodiversity in the nearby area.
2.3	Hydrological Condition	-	-	-	Construction/operation: anticipated that there is no activity caused the impact on hydrology.
2.4	Landscape and Topography-flow direction	-	C	-	Construction: anticipated that if there is the bypass, the landscape will be temporary changed for a bit but when the construction is completed, that area will be improved for better or in the same condition. Operation: anticipated that there is no activity caused the adverse impact on landscape and topography as the project area is in an existing area and no expansion.
3. Social Environment					
3.1	Non- voluntary resettlement	C		-	Operation/operation: The community in the project area is not resettled, there is no state land invaded by local people
3.2	Poverty (poverty family, family with female head family)	-	-	-	Anticipated that there is no direct impact on poverty family.
3.3	Ethnic	-	-	-	Anticipated that there is no impact on the ethnic group nearby the construction area
3.4	Economy, employment, people livelihood	-	C+	A+	Construction: has the positive impact on the employment of local people Operation: the increase on water supply will contribute to better life living of people in the project area
3.5	Land use and the benefit of resource source to local people	-	C	-	Construction or operation will not affect to the Lanusse of people nearby the project area
3.6	Infrastructure and social service	-	C	-	Construction: the construction activities affect to the traffic on 13th north road in the project area to be more difficult sometimes

No	Impact	level			**Brief Description**
		PCP	CP	OP	
					Operation: facilitate the traffic to be better
3.7	damage the existing infrastructure such as road, bridge and others	-	C	-	Construction: Using the 13th north road as the road for material and waste transportation from the construction area but the work volume is less
3.8	Conflict in the local community	-	-	-	The project's purpose is to develop on the national transportation and economy particularly the using of national road and the strategy on the linkage between the central to the north. This is to ensure the long- term use.
3.9	Cultural heritage	-	-	-	There is no cultural heritage in the nearby project
3.10	Scenery	-	-	-	The project's purpose is to keep the scenery and expand the bridge to have good scenery
3.11	Gender	-	-	-	The project's purpose is to build the capacity of the technical officers for the Provincial of Transportation Department and also to be the pilot project to ensure the long-term use. However, regarding to the public, there is no impact on the gender.
3.12	Children Right	-		-	The project's purpose is to ensure the long-term use by maintenance at the broken point. The public facility is expected not to affect on the children right.
3.13	Transmitted diseases including HIV/AIDS	-	C	-	Construction: the influx of workers in the project area has potential to occur the transmitted disease in the local community. But the worker working for the project will be trained and have the health check regularly.
3.14	Covid 19		C	-	Construction: The influx of worker from various areas caused the risk on Covid-19 but the project shall establish the standard to manage the migrant workers and their mobility. Currently, the Government provided the vaccines for Covid-19 up to 3-4 doses average for one person. Operation: there is no impact to the technical experts and migrant worker.
3.15	Working environment (including occupation health and safety)	-	C	-	Construction: the unproper management on working environment will increase the accident and diseases. Operation: Anticipated that the project will be able to manage the Safety Standard, there is no potential to working overtime.
4. Others					
4.1	Accident	-	C	C	Construction: the construction activities on the 13th south road will increase the accident in the local community and the road traffic. The

No	Impact	level			**Brief Description**
		PCP	CP	OP	
					implementation shall be complied with the detailed management standard in order to ensure the safety particular the adequate light during the night time and the entry-exit in the appropriate distance. Operation: Shall install the traffic signs in the appropriate place in order to warn people to be more cautious while using the road.
4.2	Global warming	-	-	-	Construction/operation: anticipated that there is no activity caused the adverse impact on global warming.

Noted: PCP-Pre construction phase, CP-Construction phase, OP-Operation phase, A-expected to have the significant impact, C- expected to have minor impact, +: expected to have positive impact, U: Unexpected impact and required for inspection, the impact occurred during the study process, -: No impact. Note:

5.5 Description on the physical impact

5.5.1 Landscape

1) Pre-construction

Potential Impact:

The landscape of the project area is the flat area, which is the existing place of Xebangnouan Bridge and there is no expansion. During the pre-construction phase, there are only designing work, construction planning, and land clearand for construction area and data collection on economic technique, environmental studies and others. There will not be resettlement or invasion of the governmental land in both sides of the bridge. Therefore, the local authority shall encourage people who invaded the governmental land to relocate from the project area to ensure their safety. However, the project does not have to implement any mitigation measure.

2) Construction Phase

Potential Impact:

During the construction phase, the project will construct the temporary warehouse, office, staff parking and other relevant activities. There will be the earth work at the head bridge in order to construct the access as well as the excavation. However, after the infrastructure was completely constructed, there will be soil filling. Therefore, it expected that the impact on landscape is low and able to minimise by the implementation of mitigation measures.

Mitigation measures:

- Build the temporary fence surrounding the construction area (as appropriate with the limited area) and there should be maintained well throughout the construction period including the cleaning inside and outside the construction area. In addition, the landscape shall not be disturbed and not to have any obstacles on the road.

- Tools and construction materials must be kept well organized on site, to ensure that they will not block the transportation and to reduce the risk of accident and mitigate the impacts on project landscapes in the project area.
- Keep the construction sites clean and tidy.

3) Operation

Potential Impact:

The construction project is completed in this phase and commenced on the project operation. This phase will be only the traffic and there is no activity caused the changing of landscape.

Mitigation Measures:

- Manage the traffic of vehicles toward the project area in order to avoid the obstacles in and nearby project area.
- Reforest and provide the green area for the beautiful scenery in the project area.
- Designate the planting of trees and the allocation of green areas of the project for the beauty and harmony with the landscape of the project area.

5.5.2 Climate and Air Quality

Regarding to the actual works, there is no impact on air and communication.

1) Pre-Construction Phase

Potential Impact:
There is no impact

2) Construction Phase

Potential Impact:
During this period, there are some construction activities such as: soil excavation, landfilling, ground levelling, soil compaction, for the access, the storage of construction materials like soil, gravel and sand when there's wind blowing, which may cause dusting from soil and sand, the disposal of construction materials from the high constructing building to the ground, the cleaning of construction litters especially the warehouse in the construction site, that would spreading the dust particles, moreover, the burning fuel in vehicle use and heavy machines in construction activities will create CO, HC, NO_x which also cause the change in climate and air quality.
Generally, dust occur in the construction site also base on each activity characteristic, soil components, soil humidity as well as meteorological condition like: wind speed and direction, total duration of the construction, dust concentration in the air will be changing according to the amount of particles occurred from source, small soil component will change due to the soil humidity, climate condition like: temperature, humidity, pressure, wind direction and distribution of the pollution source during the daytime. Besides, the transportation of construction materials and equipment in-out of the construction area such as: the heavy trucks driving in-out on the dirt road can cause dusting, dust from construction ground attached truck's wheels and dust from the falling soil, gravel, sand from uncover truck beds and others. These issues also cause the changing in air quality.

The affected people from dust and air pollution from construction activities are the staff and workers, also people who live nearby the construction site and along the construction transportation access road. Mitigation Measures:

- Spray, sprinkle the ground surface where it has been dredging for construction and where the soil, gravel, sand accumulated daily for at least 2times/day (In the morning and evening) or more than twice in case there's too much dust noticed
- Build the temporary wall with more than 2m height surrounding the project construction area and not to have the traffic obstacles.
- Shall hire the workers for daily cleaning in the construction area and spray water before cleaning in order to minimise the dust distribution. The cleaning time is based on the convenience.
- The materials transport into the construction area must have the proper bed truck cover to prevent any falling on the ground that may cause dust and accident to the passengers using this access road
- The transportation vehicles' wheels must be washed when passing in-out of the project and also speed limit for the transportation vehicles
- Unloading soil, gravel, sand should be considering the weather condition, no unloading when there's heavy wind to prevent the scattering of soil, sand particles and the long period of soil and sand accumulation should be covered too
- Arrange, locate machines and construction works in the long distance from affected people. Machines and equipment which only use for sometimes shall be turn off and should not turn it on when not using to reduce the releasing of pollution from engines
- Maintenance and repair machines and construction equipment frequently in the best conditions, to reduce the releasing of pollution from engines
- Awareness raising and set out rules that workers are prohibited to burn solid waste in the construction site
- Shall assign staff that responsible for public relation work and frequently ask these following measures are proposed to minimize the impacts from the transportation accidents
- Provide the dust protection gears to staffs/workers who work with engines and their duties concerning with spreading dust. Strictly implement in accordance to the regulations and Law on Construction No.05/NA Dated 2009

3) Operation

Potential Impact:

There is no specific impact but it is occurred by the transportation and the traffic. But the management will be responsible by the government sector which has the overall management standard.

5.5.3 Soil and Soil Erosion

1) Pre-construction phase

Potential impacts:

During the pre-construction phase, there will only be the designing work, construction planning, and data collection on economic technique, environmental studies and others, meanwhile there will not be any activity that

causes soil and erosion impacts within these areas. Therefore, the project does not have to implement any necessary mitigation measure.

2) Construction phase

Potential impacts

The infrastructure construction of this project will be the earthwork and excavation in order to construct the bridge's access road, but the excavation in this area will be in small area. However, after the access road completed the concrete pavement. The soil compaction can cause the erosion especially during the heavy rain. Besides, the soil excavation or bringing soil from outsource to accumulate for ground levelling might cause soil erosion.

During the construction phase, there will be soil transportation, which may result in some soil falling and environmental impact includes the impact to people who use this access road, it might cause difficulty to the traffic and impacts on residents in the project vicinity. As the fallen soil might cause dust to occur, clogging the drainage, etc., Moreover, it will cause dirtiness and lose its scenery. However, this problem is only occurred temporary during the construction phase and can be mitigated as carry out these following measures:

Impact mitigation measures:

- The maintenance shall be implemented in the dry season
- Build the temporary fences in the project area particularly in the excavated area. The borrow pit (soil, gravel and sand from other sources) for the ground levelling shall be maintained throughout the construction phase. This is to ensure that there is no erosion during the rain in and surrounding project area. However, the quantity of material is in small amount and is able to store at the production source.
- If the excavation in the large area, it shall be determined and adjusted the slope to be appropriate with the pit to ensure the movement and erosion.
- The excavated soil shall be immediately transported from the construction area as the soil is in small quantity and is easy to transport.
- Construct the drainage in the construction area in order to avoid the erosion.
- Strictly implement on the air quality mitigation measures such as: covering during the soil transportation, speed limit and clean vehicle wheels.
- All trucks must have the truck bed cover, in case there is the soil falling on the road or anywhere, the contractor must clean or hire related government sectors to clean the access road immediately to reduce dust issues and difficult traffic.
- Collaborate with related sectors in determining management plan about the soil falling to reduce dust issue and the project must assign its staff to responsible for specific work on the construction site including providing the contact number that can be seen clearly in front of the project entrance for the convenience in contacting and problem solving if there is any.

3) Operation Phase

Potential impacts:

There is no impact mitigation in this phase so it is not required for the additional mitigation measures.

5.5.4 Water source and water quality

1) Pre-Construction Phase

Potential impacts

In the previous, there is no information on water quality in Xebangnouan. Therefore, prior the bridge maintenance, the water quality test shall be implemented particularly the cleanliness of water source. For instance, turbidity, odor, Color, pH, BOD5, COD as the reference in the construction phase.

2) Construction phase

Potential Impact

Regarding to the discussion with two village authorities and field survey along Xebangnouan. There is no household living near the project site, however there is only military camp and consist 10 soldiers in both side of bridges to protect the bride in Savannakhet and Salavan province side. For the waste water and waste management in their camp is good practice, No waste water discharge directly the river. So, there is no potential impact of wastewater from household to the river in current situation at the around the project point. In addition, the water usage caused the wastewater or the surface water impact in the construction phase. The wastewater from the daily living of the staff and workers includes waste water from the toilet, bathroom and cleaning. In additions, wastewater from the cleaning for construction activities are cleaning of concrete plant, chemical for concrete mixing and other construction materials.
It expected that there is no impact on the underground water due to the fact that the water source for the construction activity will be coordinated by the project in order to install the water supply in the construction. Regarding to the survey in two villages, it indicated that the water supply is not fully accessed and the water quality is not complied with the water supply standard. Therefore, most people use the ground water but the project activity use less water which caused the limited wastewater. However, the mitigation measures for the water source are as following:

Impact mitigation measures:

- Wastewater from the household shall be managed properly.
- Build drainages surround building construction area to prevent the wastewater in the project area.
- Construction waste must be accumulated and handled properly, then; it should be sent to a defined municipal dumpsite. And the project shall provide training to staff and workers to have a better understanding about waste impacts, as well as waste management, and prohibit all littering into water sources, any violation, shall be fined or fired.
- Cleaning of construction equipment or tools shall be in the specific area which is no risk on the soil contamination or water source in the nearby project area.
- The water quality test in the maintenance period shall be implemented regularly in order to inspect the water quality changing.

3) Operation Phase

Potential Impact

There is no activity caused the adverse impact on the surface water and groundwater quality due to the fact that the construction does not use more water. Therefore, there is no direct impact on water quality.

5.5.5 Mining and Quarry

The project area is the governmental and individual land surrounding by the structures, roads and others. For the house hold is quite far from Xebangnouan bridges around 2-6 Km, this area is not the mining concession area as there is no potential on mining. However, a crusher plant is Phouthamphouang village and far from project site around 5-6 Km, for this reason, the project implementation will not affect to mining.

5.5.6 Noise and vibration

Regarding to the data collection on noise and vibration by the project environmental officers, the noise measurement result in the nearby project area indicated that the noise condition is normal because there is no source for exceeded noise in this area but there is only noise from the traffic, maintenance, equipment and others.

1) Pre-construction phase

Potential impacts:

During the pre-construction phase, the project activities only included data survey, construction design and planning which did not require any tools with loud noise that could disturbed the community. Therefore, the project is not necessary to implement any loud noise mitigation measures.

2) Construction phase

Potential impacts:

During the construction phase, all types of construction activities will cause some disturbance noise. During this period, activities that require using heavy machines for the excavation, drilling, ground compaction and maintenance. The equipment transportation in the construction site will cause the disturbance noise to the nearby area. The affected people from the noise will be the staff and construction workers. However, the surrounding project area with the consideration by the construction area indicated that it borders with the paddy field and village's reservation forest on the west and east, the temporary community market and military camp on the north, and the south it's border with paddy field and military camp of Phouthamphouang village. But for the household community is far around 6 km from the project site. Therefore, it is possible to have the disturbance noise from the construction activity in sometimes to the market and military camp only. The project shall build the temporary fence in the surrounding area in order to prevent the noise. Thus, it expected to have the moderate impact on noise in this phase from some construction activities. However, this could be minimized by the following

Mitigation Measures:

- In case the project will use the machines and equipment with the loud noise in the nearby area, it shall inform people living in that area in order to avoid the impact on noise and vibration to be occurred by the project.
- Set construction schedule for noisy works such as: avoid the night time from 19:00PM – 6:00AM, if it is necessary to work during the night time, must avoid activities that create loud noise and must notice the village authorities or residents nearby before.
- If there is a complaint on noise from the community, it shall have the noise measurement. If the noise is exceeded the standard, it shall be solved immediately.
- Construction tools and equipment that only use sometimes shall be turn off while not using, to reduce loud noise.
- Select construction tools and equipment that make less noise
- Maintenance and repair machines and construction equipment frequently to be in its best condition and will not produce loud noise.
- Transportation of huge construction materials to construction site, which pass through community area shall be carefully done to prevent any falling subjects that may cause loud noise
- Speed limit for transportation trucks shall not exceed 30Km/hour for community area and do not use horn or increase engine power if not necessary, enforce the truck drivers to follow the traffic rule strictly, put up the warning sign in the construction site, speed limit sign for all passing vehicles through construction area, especially the sensitive area.
- Provide hearing protection gears to staffs/workers who work with machines and must explode to loud noise

3) Operation Phase

Potential impacts:

There is no activity caused the vibration and noise

5.5.7 Waste Disposal management

1) Pre-construction Phase

Potential Impact*:*

In the project preparation phase, most activities are the document preparation in the office. Waste is controllable and there is impact on the pilot project.

2) Construction Phase

Potential impacts:

During this construction phase of the project, the huge amount of solid waste is anticipated such as: construction waste like: excavated soil waste, plastic wrappers, not standardized materials or not in accordance to the requirements, leftover construction waste (wood waste, steel, nail, brick and other waste), hazardous waste that contains engine oil, and other waste from staffs and worker's daily use. These issues may not be a severe issue, but should be well taken care of, in case of its proper storage and management in order to avoid the environmental impacts and other following issues.

Therefore, it is necessary to limit and set up disposal sites as well as the proper waste management.

Mitigation Measures:

- Waste from construction activities that can be reuse should be separate and reuse or sold to related sectors to reduce an amount of waste for disposal, for those that can't reuse should be accumulate properly and dispose where there's the proper amount.
- Provide sufficient bin for worker camps and separate the waste in each category in order to facilitate on the waste collection
- Control the waste burning or littering and provide the awareness raising event for staffs to understand about the disadvantage of waste and know the proper disposal method, any violation shall be fine.
- Shall coordinate with related sectors such as: Waste Collection Company in Vangvieng District to facilitate on the waste transportation to the landfill regularly based on the coordination between the project and waste collection division.
- Clearing-cleaning trash bins every time after the waste have been collected for disposal to reduce the chance of bacteria grow
- The construction area should be clean daily and accumulate waste within the project area as described in the primary design

3) Operation Phase

Potential impacts

There is no worker or activity caused the waste. After the bridge construction is completed.

5.6 Biological Impacts

5.6.1 Forest and Terrestrial Ecology

1) Pre-construction Phase

Potential Impact:

There is no worker or activity in this phase

2) Construction Phase

Potential Impact:

The location of the Xebangnouan Bridge Maintenance Project is located in two villages of Songkhone and Lakhonepheng district, surrounding by the people residents but not close to the project site, the individual land, the abandoned land and others. There is no critical or endanger fauna, the forest area and as well as the animal habitat. Therefore, there is no impact on terrestrial ecology.

3) Operation Phase

Potential Impact:

There is no worker or activity in this phase.

5.6.2 Aquatic Ecology

1) Pre-construction phase
2) Construction phase

Potential impacts:

Even though the project area is located on the Xebangnouan river by crossing the river but the maintenance activity is not implemented in the river. This area isn't the fish conservation area of the village or the district, however, the worker or staffs are limited for fishing. The mitigation measures in this phase are as following:

Mitigation Measures:

- Prohibition for the worker or staff to fishing in this area
- Provide enough meal to the labour and staff to prevent fishing in the river

3) Operation Phase
Potential impact:
There is no worker or activity in this phase.

5.6.3 Conserved – Protected Area

1) Pre-Construction/Construction/Operation Phase

Potential impact:

The bridge maintenance is the existing area with no expansion. There is no conservation or protection forest in the surrounding area. Therefore, there is no impact.

5.7 Socio-Economic and Cultural Impact Assessment

5.7.1 Land Use

1) Pre-Construction/Construction/Operation Phase

Potential impact:

As mentioned above, the project area is the public land and is the Infrastructure Improvement Project with no expansion.

5.7.2 Road and Traffic

1) Pre-Construction Phase

Potential impact:

There is no activity caused the traffic impact in the project area

2) Construction Phase

Potential impact:

In this phase, the traffic might be more complicated and crowded due to the transportation of project vehicles. In addition, the traffic at the bridge will be only one lane (one traffic lane) and the maintenance period will be 12 months. Therefore, this caused the impact in the area.

Mitigation measures:

- Shall have project name sign and symbol for the project location
- Install the warning sign for construction area and trucks' passing in-out far from the construction area in an appropriate area, in order to warn all passengers along 13th north road crossing the bridge to be more careful and more cautious.
- Shall Install the signage or labels and provide the staff to facilitate the traffic along the Xebangnouan bridge on both sides. As there is only one traffic lane,

it required to have the walkie-talkie to communicate between two sides in order to give the traffic signal and not to have the congestion.

- Provide the training on the emergency response in case there is congestion in the project area
- Properly plan for the huge material transportation when passing through community area, to be minimum period and very carefully
- Plan beforehand for all period that will have a lot of transportation trucks using the roads such as cement, soil, gravel/sand transportation trucks, that will be passing in-out of the project to prevent the trucks to park on the side road
- Determine the project parking lot in order to avoid the obstacles for traffic
- Avoid to use the vehicles with poor condition along the project area in order to avoid the congestion, if necessary, it required to have the response plan
- Determination of transportation and trucks passing in-out the project that should comply with the traffic rules particularly the truck's weight and limit the speed based on the traffic rule.
- All transportation trucks passing in-out of the project, must have the bed truck covers to avoid any falling object, if there any falling incident, it must inform staffs to clean out in order to prevent any accident which may cause traffic jam
- If possible, put-on sign or sticker, that define project's name, contractor, including coordinator's contact number that can be contact for information and give complaint, the sign should be in suitable size which can be clearly seen from the side of the construction transportation trucks
- Assign the project coordinator for grievance complaint, in case of any annoying grievance from project transportation.

3) Operation phase

Once the construction is completed, the bridge using will be in normal condition and there are no obstacles for traffic and no impact for using of 13th north road.

5.7.3 Social Impacts

5.7.3.1 Community and Population

1) Pre-construction

Potential Impact:

This phase, there is no impact on community. The coordination on the field data collection with local authority is followed as the line management and the relevant divisions in accordant with the regulation.

2) Construction Phase

Potential Impact:

The bridge maintenance could affect to local people living in Xebangnouan Bridge and nearby area particularly the impact on noise, dust and accident. However, as surrounding area is the paddy field and some residents, it expected that the impact is still low. In addition, the demand on the construction worker will have the migrant workers which cause the impact on community and population.

Potential Impact:

- Strictly implement the measures on noise, dust and others in order to minimize the community impact.
- To establish the grievance division for project in order to settle the conflict among the community and the project.
- To collect and register the labour registration, name tags or cards to identify the workers and then report to the local authority in the project location. This to ensure the safety in community.
- To control and regulate the construction workers not to cause the trouble in local community.
- Consider to recruit the local workers living in the project area as well as the internal labour for the construction in order to increase their incomes.

3) Operation Phase

Potential Impact:

All workers moved out the project area. Therefore, there is no impact on community.

5.7.3.2 Ethnic and Religions

1) Pre-construction Phase

Potential Impact:

There is no impact on ethnic and religion due to the fact that the project activities does not cause the impact on population and community. The architecture and survey activities are implemented by the Technical and Environmental Teams.

2) Construction Phase

Potential Impact:

There are three temples in the surrounded area part of Xebangnouan village; they are cemetery temple, Thamtao temple and Xenouan Tai temple that's distance around 1.2 km from project site. Including 2 churches, beside that t the part of Phouthamphong village has 2 temples; they are Phouthamphoung temple and tourism on temple (but it's currently close), and they are far from project site around 5.5 Km, However, the construction activity will cause the indirect impact. These places are far from the project area therefore the impact is minor. For instance, the construction project will cause the dust.

Mitigation Measures:

- Strictly implement the mitigation measures on the air impact including noise, dust and others to avoid the impact on community
- To inspect the construction equipment regularly in order to avoid the pollution from the fuel combustion and noise of machines affected to the ceremony at the temple
- To establish the regulation to the drivers for the equipment transportation in order to comply with the traffic rule particularly the truck's weight and speed limit.
- Provide the day-off to be appropriate with the social activity in the surrounding villages.

3) Operation Phase

All workers and staff moved from the site, but had left only the achievement on bridge maintenance as well as the social service. Therefore, the operation phase will not cause the impact on ethnic and religion.

5.7.3.3 Education

According to the field survey data in village around the project site, the education facilities are summary in the table 5.6 below:

Table5. 7 Summarize educational facilities in both villages around the project

No.	Village	Nursery	Primary school	Secondary school	High school
1	Xebangnouan	1	1	1	At Xebanghieng village 17-20 Km from Xebangnouan
2	Phouthamphoung	1	2	At Nonsavang village 5-7 Km from Phouthamphoung village	

However, in this year 2022, the Xebangnouan secondary school is upgraded to high school, therefore in this education year is not necessary so study outside the village.

1) Pre-Construction Phase

This pre-construction phase will not cause the impact on education

2) Construction Phase

Potential Impact:

The material transportation might disturb to the students who study in the school as well as their transportation. However, all the project activities will cause the minor impact on the noise and vibration because the education facilities not located along the road No.13 South (there is an access road to the school), and construction phase will cause the dust from the construction activity. The material transportation might disturb to the students who study in the school. However, based on the surrounding area of the project area, the nearest distance of schools from Xebangnouan and Phouthamphoung are 1000 m and the furthest distance is 5000m respectively. This will not cause the direct impact and the impact is low. As the result, the project shall have the mitigation measures as following:

Mitigation Measures

- To strictly implement the mitigation on noise, dust and others impact in order to avoid the impact on community.
- To inspect the construction equipment regularly in order to avoid the pollution from the fuel combustion and noise of machines affected to the students
- To establish the regulation to the drivers for the equipment transportation in order to comply with the traffic rule particularly the truck's weight and speed limit.
- Avoid transportation of materials during the rush time, such as when students are traveling to and return from school

3) Operation Phase

The operation phase will not cause the impact on education

5.7.4 Health Impact Assessment

5.7.4.1 The health Care in the Project Area

The project area is located from the District Hospital of Songkhone and Lakhonpheng for 42 km and 13 Km with 60mn and 25 mn driving respectively, and from the Savannakhet and Salavan Provincial Hospital for 120 km and 115 Km with over 2 hrs driving, because of the road condition in addition, there is small hospital, clinic and pharmacies to provide the social service in the community. However, this operation phase, there are some activities that caused the risk on health of worker. Therefore, the health care is important for the project and shall have the protection measures. In addition, the project implementation will not effect on the health but the project shall provide the equipment and first aid kit in case there is an emergency including: the dangers of machines, accidents and others. This shall deliver to the district and provincial hospitals respectively. Therefore, there is no impact on the healthcare service in this area.

Mitigation Measures:

- The project shall prepare the response plan for the accident or health issue to be occurred in the future. In addition, the project shall prepare the medical equipment, medicine and vehicles for the patient's delivery.
- Provide the Personal Protection Equipment at the risky point and to control the working time in the sensitive area and the noisy and dusty activities.
- Eliminate the place of epidemic or the source of disease-carrying
- Promote basic health education knowledge to employees
- Maintain the machinery at the site particularly the old machinery.

5.7.4.2 Health and Safety

1) Pre-construction Phase

Potential impact:

There is no environmental and social impact.

2) Construction Phase

Potential impact:

The construction activities might impact on the worker and people health in the surrounding construction site including: dust from the construction activity, pollution from the fuel combustion and construction material, the disturbance noise from the demolition, maintenance as well as the accident from the material transportation and traffic.

- The health impact from the dust occurred by the construction activity and the pollution from the fuel combustion and construction equipment: the affected people are the construction workers and people living in the surrounding construction area.
- During the construction period, there will be the vehicles for construction material transportation along the National Road 13th south. Therefore, there might be the risk for accident to the passengers. There also be the soil and sand falling along the road which caused the slippery floor as well as the accident. If the material transportation is in high speed, this could cause the

accident too. In order to prevent and minimize the accident in the project area, the contractor shall implement the following measures:

Mitigation Measures:

- Provide the Personal Protection Equipment to the construction workers as required including the reflective cloths, helmet, safety shoes, noise protection gear and gloves- the first aid kits in each construction point.
- Regularly maintain vehicles in good condition to minimize exhaust emissions
- Inspection, maintenance, or checking the tools/machines used for construction shall be carried out regularly to minimize released pollution.
- Provide the training on using of machines and construction equipment to the construction workers.
- To provide the warning signs, reflective ropes or the blockage.
- To prepare the adequate light in the construction site during the night time in order to facilitate and avoid the accident along the 13th south road crossing Xebangnouan bridge to ensure the safety visual.
- Determination of transportation and trucks passing in-out the project that should comply with the traffic rules particularly the truck's weight and limit the speed based on the traffic rule.
- To record on the accident, root cause, solution as well as the damage
- Eliminate the place of epidemic or the source of disease-carrying

3) Operation Phase

Potential Impact:

There is no activity caused the impact on labour. The material is moved from the site but remaining only the infrastructure.

5.7.4.3 Health and Safety Issues for the construction

The construction activity might cause various dangers including the falling of material, chemicals and concrete to be used in the project. In addition, there are severe accidents caused the life dangers including the electrocution, accident, falling from height, and other accidents. These accidents could be protected as following:

Mitigation Measures:

- Shall disclose on the dangers and the mitigation measures regularly.
- Shall provide the PPE to the workers, staff and visitors who accessed to the construction site including helmet, safety shoes, gloves, and others.
- For the safety in the construction site, it shall divide the working areas and the traffic sign.
- During the construction phase, in case there is an incident including storm, fire or other disasters, the project shall install the warning signs in the construction site. However, if the accidents are severe, the construction shall be suspended to ensure the safety of staff.
- Install first aid kids in place
- Sufficient lighting at night to reduce the occurrence of accidents by road users passing through the Xebangnouan bridge
- Guidance signs and warning signs should be installed on both sides of the bridge and at appropriate distances, as well as being clearly visible, because the point is far from wet areas, so road users may drive at high speed.

5.7.4.4 Transmitted Disease

As the use of internal labour is diverse and the workers will be from different places, therefore the project shall pay attention on the risk. Even though the project staff or workers are not the permanent employment (temporary labour) but this could cause the disease from other places; the risk on the disease transmission or spread including: dengue fever, Covid 19, AID, sexual transmission disease and others. These issues shall be planned and resolved. The mitigation measures are as following:

Mitigation Measures

- Shall check the transmitted disease particularly Covid 19 and the staff shall be vaccinated as required.
- Provide the adequate temporary toilets for workers and staff in the construction site.
- Provide the equipment for garbage storage and bins in order to avoid the dirtiness, bad smell and disease transmission in the project area. This is to protect the disease transmission to the surrounding area and the project area by using the local service or the project itself.
- To raise awareness on the transmitted disease as well as the protection and mitigation measure to the workers.
- To monitor on the injury statistic of project workers regularly.
- To disclose the information on the disease spread, the dangers and the protection.
- In case there is the severe disease transmission among the project workers or staff during the construction phase, the project developer shall coordinate with the relevant provincial and district authorities in order to resolve this issue immediately.

5.7.5 Economic Assessment

5.7.5.1 Employment and Household Income

1) Pre-construction/ Construction Phase

Mitigation Measure:

As the project area located in the nearby community, it is the governmental land in the existing area. Therefore, there is no issue on the people resettlement and no economic impact as well as the private assets. The construction activities could support on the occupation and income of people in the surrounding area such as: construction worker, cleaners, security guards and others. This will improve the quality of life living to be better.

Mitigation Measures:

- The employment of local people in the project area is the priority.
- Employment process shall be fair and transparent and the salary rate should be suitable with experiences and educational qualification
- Employment contract conditions shall be complied with Labour Law 2013, Social Security law and salary standards as well as related laws and regulations.

5.7.5.2 Local Business

1) Pre-construction Phase

Potential Impact:

There is no positive and negative impact to the nearby villages as there are no labour and experts.

2) Construction Phase

Potential Impact:

During the construction phase, there will be activities caused the impact on local business including dust and noise from the construction activity as well as the traffic congestion.

Mitigation Measures

- To implement the mitigation measure to minimize the air impact particularly in the sensitive area including hospital, school and temple.
- To implement the mitigation measure to minimize the noise and dust impact and others to avoid the impact on local business in the community.

3) Operation Phase

The need on road using and the using of standard bridge will be increased, this will support the economy and society in local community or wider or between the north to the south. This is the advantage for the transportation with no congestion and able to use it all time.

5.7.6 Impact Assessment on Infrastructure

1) Pre-Construction-Construction Phases

Potential Impact

The main impact on community basic infrastructures during the pre-construction and construction phases is the increasing number of material transportation vehicles on the roads, which may result in damaged/bad and dirty roads

Mitigation Measures:

- Must follow the weight limit set by the Department of Transportation for each type of transportation truck.
- Set the standard speed limit
- Build wheel washing point before leaving the project area.
- Coordinate with local authorities to assist in monitoring weight and vehicle speed.
- Repairing the roads when they are in bad conditions.

2) Operation Phase

Potential Impact

The possible impact on community basic infrastructures may be caused by the increasing number of cargo transportation trucks on the access roads to the project area, which may be the cause of the bad roads or damaged before the expected period.

Mitigation measures:

- Set up the vehicles' weighting points before leaving the dry port area to ensure that all trucks did not carry too much weight that exceeded the prescribed standard.

- Contributing fund on the national road renovation to the responsible governmental organizations.

5.7.7 Water Sources, Use and Supply

1) Pre-construction Phase
Potential impact: there is no activity required water use as it is the data collection and the survey in the surrounding area.

2) Construction Phase

Potential Impact
Water consumption of the staff/workers, the contractor shall supply the cleaned water to construction workers based on the hygiene principle. The water source to be used in the project area shall be water supply from the standard factories or able to use water from the local source including underground water. However, the labour use for the project is less ans required less water. Therefore, it expected that there is no impact on water supply in the nearby community.

Mitigation Measures

- Shall have the standard on water usage and inspect the piping system regularly.
- Treat water before use if it is found that the quality of the water is lower than the groundwater standard

3) Operation Phase
Potential impact: There is no impact as the labour and facility are moved out from the project area.

5.7.8 Power Source, Use and Supply

Potential impact:

The project implementation will not effect on the electric use in the community. The construction aactivities are not required the electric use which not affect to the local community.

Mitigation Measures

- Contact the local electricity service unit to manage the temporary supply of electricity to the construction site or workers' quarters so that the electricity system of the surrounding villages is not affected.
- The project does not require any mitigation measures.

5.7.9 Historical and Cultural Places

Potential impact:

The project area is located in the governmental land and far from the cultural area of Phouthamphouang village around 6.5 Km, Therefore, there is no impact.

- Cultural Structures
The cultural structures or heritage places are important for the life living. Based on the data collection, there are the important infrastructure in both villages were shown in figure 4.9 and Figure 4.10, and those temples are far

from the project site, however This might cause the indirect impact during the construction phase.

Mitigation Measures

- Strictly implement the standard on air, noise and wastewater qualities and the traffic in-out the project area.

5.7.10 Scenery

3) Pre-construction Phase

There are activities for data collection, survey and planning design for the construction with no impact on scenery in the project area.

4) Construction Phase

Potential Impact:

The out-door warehouse, project activities and waste storage will cause the natural and social scenery. However, there is only temporary impact during the construction phase. Therefore, the impact on scenery is low.

Mitigation Measures:

- Construct the temporary fence in the construction site and maintain during the construction phase
- Keep clean in the construction site.

3) Operation Phase

Mitigation Measures

This will improve the scenery to be more beautiful.

Chapter 6: Management and Monitoring Plan

The Initial Environmental Examination and Mitigation Measures in this report will assess the potential impacts and the mitigation measures to minimize the impact during the operation phase.

6.1 Purpose of the Monitoring and Management Plan

The purpose of the Monitoring and Management Plan is to monitor on the environment and society to be affected by the project. Therefore, there is the Management and Monitoring Plan for the Construction and Operation phases. The main purpose of this plan is to be the guideline to prepare the framework for the Environmental Management and Monitoring Plan, the implementation of mitigation measures for the direct and indirect environmental impacts as well as the accurate monitoring to be the evident, the scientific principle and the National Environmental Standard.

6.2 Physical Impact and Mitigation Measure

The maintenance period (11/2022-11/2023): is to commence the implementation plan on the maintenance and facilitation to the project staff and worker. Therefore, the direct impact on traffic particularly in two villages includes the dust, noise of machinery, vibration, transportation, erosion as well as people's life living.

After the maintenance: there is no impact on the using of 13 south road at the crossing point of Xebangnouan Bridge but the structure and scenery will be better and more beautiful.

Table6. 1 Summary on the main physical impact and the mitigation measures

Environment and Social	Activity and Cause of Impact	Overall Mitigation in term of Implementation	Level of Impact after the Mitigation Implementation	Responsible Division	Monitoring Division
1. Pollution Protection					
Air Pollution	• Dust from the construction activity • dust from construction ground attached truck's wheels and dust from the falling soil, gravel, sand from uncover truck beds and others • Fuel combustion from the vehicle using and heavy machinery for the construction activity	• Spray, sprinkle the ground surface where there have been excavations and where the soil, gravel, sand accumulate daily for at least 2 times/day • There shall be workers who sweeping, clearing and cleaning in the construction area and water spraying in order to minimize the dust • The material transport into the construction area must have the proper bed truck cover to prevent any materials falling on the ground that may cause and to avoid the accidents for people passing by the road. • Wash the transportation vehicle's wheels and enforce a speed limit for vehicles • Unloading soil, gravel, sand should be considering the weather condition, no unloading when there's heavy wind to prevent the scattering of soil, sand particles and the long period of soil and sand accumulation should be covered too	Moderate (1.5)	Project Owner/Construction Contractor	Project's EMU/ Governmental EMU

Environment and Social	Activity and Cause of Impact	Overall Mitigation in term of Implementation	Level of Impact after the Mitigation Implementation	Responsible Division	Monitoring Division
		• Inspection, maintenance, or checking the tools/machines used for construction shall be carried out regularly to minimize released pollution. • Awareness raising and set out rules that workers are prohibited to burn solid waste in the construction site. • Assign responsible staff for the public relation works and interviewing residents living nearby the construction area particularly houses restaurants, if any grievance about loud noise occurred it shall be dealt with immediately - Dust masks should be provided (where applicable) to construction workers.			
Water Pollution	• Turbidly water might have the gravel and concrete debris falling into the water source during the construction phase • Oil strain and contaminated chemicals from	• Set out the work plan for clearance work and ground leveling work to be done during dry season to prevent the soil erosion during the rainy season • The borrow pit and construction material shall be located from the water source and the rainwater discharge in order to avoid the erosion into the river • The maintenance area of construction equipment-machinery shall be located from the	Moderate (2)	Project Owner/Construction Contractor	Project's EMU/ Governmental EMU

Environment and Social	Activity and Cause of Impact	Overall Mitigation in term of Implementation	Level of Impact after the Mitigation Implementation	Responsible Division	Monitoring Division
	the using of construction machinery and equipment and concrete debris from the construction • Wastewater from the consumption of the staff and worker • Wastewater from cement or chemical products for the maintenance work.	water source and the flow direction of rainwater • Strictly control not to throw the construction waste (cement, wood, steel) into the river • Provide sufficient bin for worker camps and separate the waste • Prohibit on the wastewater discharge and waste dumping from the worker camp into the river • Prepare action plan when chemicals or hazardous materials spill into the ground or river			
Waste management	Construction waste which is not standardized materials or not in accordance to the requirements, leftover construction waste (wood waste, steel, nail, brick and other waste),	• Provide sufficient bin for worker camps and separate the waste in each category in order to facilitate on the waste collection. • Control waste burning or littering and raise awaress on the consequence of waste as well as the waste disposal. If there is a violent, it shall be fined as the lesson learnt and not to repeat the mistake. • Shall coordinate with related sectors such as: Waste Collection Company in Vangvieng	Low (1)	Project Owner/Construction Contractor	Project's EMU/ Governmental EMU

Environment and Social	Activity and Cause of Impact	Overall Mitigation in term of Implementation	Level of Impact after the Mitigation Implementation	Responsible Division	Monitoring Division
	hazardous waste that contains engine oil, and other waste from staffs and worker's daily use.	District to facilitate on the waste transportation to the landfill in daily or weekly based on the coordination between the project and waste collection division.			
Soil Contamination	Construction: might have the contamination from fuel and chemicals by concrete mixing but it will be in small quantity.	• Build the temporary fence in the construction site and the borrow pit (soil, gravel and sand from other sources) for the ground levelling shall be maintained throughout the construction phase. This is to ensure that there is no erosion during the rain in and surrounding project area. • If there is a heavy rain, it shall construct the drainage along the pit to prevent water discharge into the pit to ensure there is no erosion. • All trucks must have the truck bed cover, in case there is the soil falling on the road or anywhere, the contractor must clean or hire related government sectors to clean the access road immediately to reduce dust issues and difficult traffic.	Low (0.5)		
Noise and Vibration	Noise from activities that require using heavy machines for the excavation,	• Set construction schedule for noisy works. if it is necessary to work during the night time, must avoid activities that create loud noise and must notice the village authorities or residents.	Moderate (1.5)	Project Owner/Construction Contractor	Project's EMU/ Governmental EMU

Environment and Social	Activity and Cause of Impact	Overall Mitigation in term of Implementation	Level of Impact after the Mitigation Implementation	Responsible Division	Monitoring Division
	ground levelling and material transportation.	• Assign responsible staff for the public relation works and interviewing residents living nearby the construction area, if any grievance about loud noise occurred it shall be dealt with immediately • Maintenance and repair machines and construction equipment frequently to be in its best condition and will not produce loud noise • Transportation of huge construction materials to construction site, which pass through community area shall be carefully done to prevent any falling subjects that may cause loud noise • Speed limit for transportation trucks shall not exceed 20-30Km/hour for community area and do not use horn or increase engine power if not necessary. Provide hearing protection gears to staffs/workers who work with machines and must explode to loud noise			
2. Social Environment					
Road and Traffic	- The increase of vehicles by the project including	• Shall have project name sign and pointed object to tell direction throughout the project, in front each construction site	Moderate (2)	Project Owner/Construction	Project's EMU/ Governmen

Environment and Social	Activity and Cause of Impact	Overall Mitigation in term of Implementation	Level of Impact after the Mitigation Implementation	Responsible Division	Monitoring Division
	vehicles for material and workers transportation - the congestion from the one traffic lane	• Install warning sign for construction area and trucks' passing in-out along the road before reaching the construction site for 200 m • If possible, put-on sign or sticker, that define project's name, contractor, including coordinator's contact number that can be contact for information and give complaint, the sign should be in suitable size which can be clearly seen from the side of the construction transportation trucks • Determination of transportation and trucks passing in-out the project that should only operate out of rush hours in accordance to traffic rules, if it is necessary to work, there must be workers facilitating the traffic • Provide the staff to facilitate the traffic along the Xebangnouan bridge as there is only one traffic lane • Properly plan for the huge material transportation when passing through community area, to be minimum period and very carefully • Plan beforehand for all period that will have a lot of transportation trucks using the roads such as cement, soil, gravel/sand transportation trucks, that will be passing in-out of the project to prevent the trucks to park		Contractor	tal EMU

Environment and Social	Activity and Cause of Impact	Overall Mitigation in term of Implementation	Level of Impact after the Mitigation Implementation	Responsible Division	Monitoring Division
		on the side road • During the rush hours, all project vehicles shall be organized properly or park at prescribed points, do not park on the side road. So, it won't block the traffic • Parking any vehicle at project vicinity during the rush hours, if it can't be avoided, there must be a signal for passengers, it could be symbols or signs • Assign project coordinator for grievance complaint, in case of any annoying grievance from project transportation			
Transmitted Disease including HIV/AID	Construction: The influx of construction workers in the construction site will cause the risk on transmitted disease in the local community. The workers shall have the health check prior starting work.	• Raise awareness on the sexual transmitted disease particularly HIV/AID to the construction workers • If possible, the project shall provide the condoms to the staff in order to prevent the transmitted disease • It shall limit the in-out times in the worker camp • Provide the day-off for the migrant workers to visit their hometown in accordant with the regulation.	Low (1)	Project Owner/Construction Contractor	Project's EMU/ Governmental EMU
Covid19	The migrant workers might cause the disease in the	▪ The site staff shall be vaccinated with fully doses. ▪ Raise awareness on the protection of Covid 19 disease			

Environment and Social	Activity and Cause of Impact	Overall Mitigation in term of Implementation	Level of Impact after the Mitigation Implementation	Responsible Division	Monitoring Division
	community	▪ Provide the sink and handwash in the workplace ▪ Provide the sufficient masks and alcohol gel ▪ Health check regularly and separate the risky staffs.			
Working environment (including the safety working)	The risk on the health safety by the dust from the construction activity, pollution from the fuel combustion, disturbance noise from the construction activity, accident from the material transportation and the traffic of vehicles	▪ Provide the personal protection equipment to construction workers ▪ Inspection, maintenance, or checking the tools/machines used for construction shall be carried out regularly to minimize released pollution. ▪ Provide the training on using of machines and construction equipment to the construction workers. ▪ To provide the warning signs, reflective ropes or the blockage. ▪ To prepare the adequate light in the construction site during the night time to ensure the safety visual. ▪ Determination of transportation and trucks passing in-out the project that should comply with the traffic rules particularly the truck's weight and limit the speed based on the traffic rule. ▪ To record on the accident, root cause, solution as well as the damage ▪ During the construction phase, in case there is an incident including storm, fire or other	Moderate (2)	Project Owner/Construction Contractor	Project's EMU/ Governmental EMU

Environment and Social	Activity and Cause of Impact	Overall Mitigation in term of Implementation	Level of Impact after the Mitigation Implementation	Responsible Division	Monitoring Division
		disasters, the project shall install the warning signs in the construction site. However, if the accidents are severe, the construction shall be suspended to ensure the safety of staff.			
Remarks: The Level of Impact after the Mitigation Implementation value is referred to the table 5.2 in the chapter 5					

6.3 Details of the Management and Monitoring Plan

6.3.1 Reason of Management

In order to comply with the Lao Law particularly the Decree on the Environmental Impact Assessment, No.21/GO, date on 31 Jan 2019, the technical guideline on the Establishment of the Initial Environmental Examination Report, No.2797/ MONRE. DESIA. DMM, date on 19 Dec 2016. Therefore, the development of the Environmental and Social Management and Monitoring Plan is significant part of the Initial Environmental Examination Report.

6.3.2 Organizational Structure for the Management

The Organizational Structure for the Management and Monitoring Plan (ESMMP) consists of two parts: (1) The government sector and (2) the project as following:

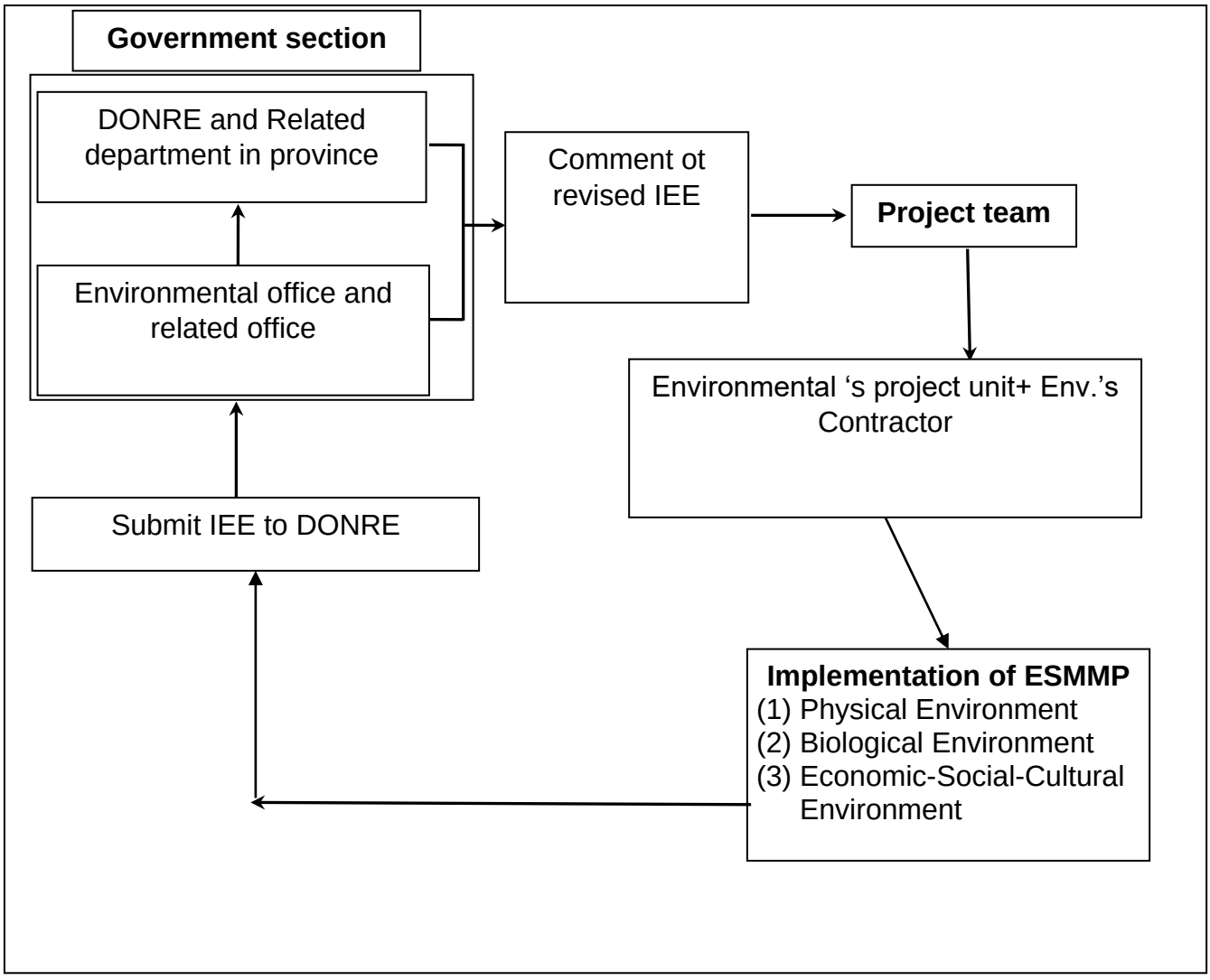


Figure6. 1 Organizational Structure for the Management and Monitoring

The government sector: includes the Department and Office of Natural Resources and Environment which is central in coordination with the related

departments and offices in their local areas to monitor the implementation of the environmental monitoring and inspection plan of the project as well as provide comments to the project department to improve the said plan in the event that the project is not carried out as specified in the IEE report.

The project section: includes the environmental management unit of the project or the environmental and social impact management task coordinator who is responsible for the implementation according to the management plan to monitor and inspect the social and natural environment of the project, recommend and monitor the compliance of the mitigation measures of the contractor or the construction site unit, as well as have the obligation to improve the project, prepare monthly reports and deliver reports to the government.

6.3.3 The responsibility on the Environmental and Social Management Plan

- Project owner

  The project shall establish the Environmental Management Unit including the technical officers to be responsible for the ESMMP. This plan is required to strictly implement on the mitigation measure as described in the ESMMP throughout the construction phase. In addition, there is an obligation on review of ESMMP.

  The Project Owner shall describe the context and obligations on the environmental and social management and monitoring measures as stated in the ESMMP in the contractor contract for its accurate and comprehensive implementation. But the project owner still has fully responsibility. In addition, three months prior the project termination, the project owner shall propose to DoNRE in order to monitor and evaluate on the ESMMP implementation. In case the project had completely implemented in accordant with the ESMMP and there is no remaining environmental and social issue, DoNRE shall issue the certificate to the project owner. In contrast, if the issue is remained, DoNRE shall advise to the project in order to resolved it prior the project termination.

  Construction Contractor:

  The Project's Construction Contractor (subcontractor) will be responsible for the implementation of mitigation measures to avoid and minimize the environmental and social impact, particularly the project's worker and public health impact. The construction contractors are also required to comply with the procedures of National Environmental Standard and shall follow the described mitigation measures.

- Responsibility of the state sector

  The Natural Resources and Environment Department and Office is the central coordination with the relevant divisions and to monitor on the implementation of the Environmental and Social Management and Monitoring Plan as well as to provide the comments on this plan once the project operation is not complied with the described ESMMP. In addition, it shall summarize and report on the implementation on the Initial Environmental Examination and Environmental and Social Management and Monitoring Plan to the district and provincial authorities.

6.3.4 Monitoring and Evaluation

After the project received the Environmental Certificate for the ESIA Report, the monitoring and evaluation of ESMMP is required for the implementation.

The implementation of ESMMP shall be collaborated with various divisions including: the monitoring by the project owner, the state sectors and the external if necessary. The frequently and the reporting for the monitoring and evaluation is determined as following:

The frequently for the monitoring and evaluation of the ESMMP implementation is importance for the assessment result of ESMMP. This will support on the new decision or planning if the initial plan is not efficient or required for revision in order to make it more comprehensive and suitable with the location condition.

Table6. 2 Monitoring activities for the project implementation

No.	Monitoring	Responsible Division for Monitoring		
		Project + Contractor	District	Province
I. Pre-Construction Phase				
1	Conduct the ESIA study to get approval the Environmental Compliance Certificate (Consultant Company	Entire study phase	Entire study phase	Entire study phase
2	Project information disclosure to the local people during the ESIA study (by consultant company)	Involve every time	Involve every time	Involve every time
3	Compensation (if any)	Involve every time	Involve every time	Involve every time
II. Maintenance Phase 12 months				
Environmental Monitoring				
1	Air Quality Management (Dust)	Daily - Monthly	2-3 Times/year	2 Times/year
2	Noise and Vibration Management	Daily - Monthly	2-3 Times/year	2 Times/year
3	Construction wastewater management	Daily - Monthly	2-3 Times/year	2Times/year
4	Worker camp Management	Daily - Monthly	2-3 Times/year	2Times/year
Social Monitoring				
1	Traffic In-out project area			
2	Health and Safety Management	Daily - Monthly	2-3 Times/year	2 Times/year
3	Social issues Management	Daily - Monthly	2-3 Times/year	2 Times/year
III. Operation Phase after the completed maintenance				
1	Environmental Issues		2-3 times/year	2 times/year

- Reporting, Monitoring and Evaluation

The project owner or its Environmental Management Unit are obligated to develop and submit the implementation report as described in the ESSMP to the relevant

state sectors at the district and provincial levels for monthly and quarterly throughout the construction phase. The report shall include as following:

1) The progress, violation or disadvantage including the monitoring result on the implementation of mitigation measures for the environmental and social impacts under the ESMMP. This includes the conditions as mentioned in the Environmental Certificate and other contracts.
2) The difficulties on the project operation in the implementation on the mitigation measures on environmental and social impacts and other situations as required.

The Project Developer shall submit the report to the Environmental and Social Department and Office and other relevant division for three sets or more in order to facilitate on the monitoring and evaluation on the implementation of ESMMP in periodically. In addition, the project owner shall submit the quarterly report to the district and provincial levels.

6.3.5 The Grievance Resolution

The proposed grievance procedure is to provide the opportunity to the affected people to provide their comment in term of the environmental and social issues or to propose the complaint and conflicts with the project as well as other environmental issue. The main purpose of this procedure is to resolve the grievance at the local level as soon as possible. This to ensure that the resolution has the transparent procedure with the mutual agreement to ensure the justice among the people to be affected by the project. The detailed mechanism is indicated in the figure below:

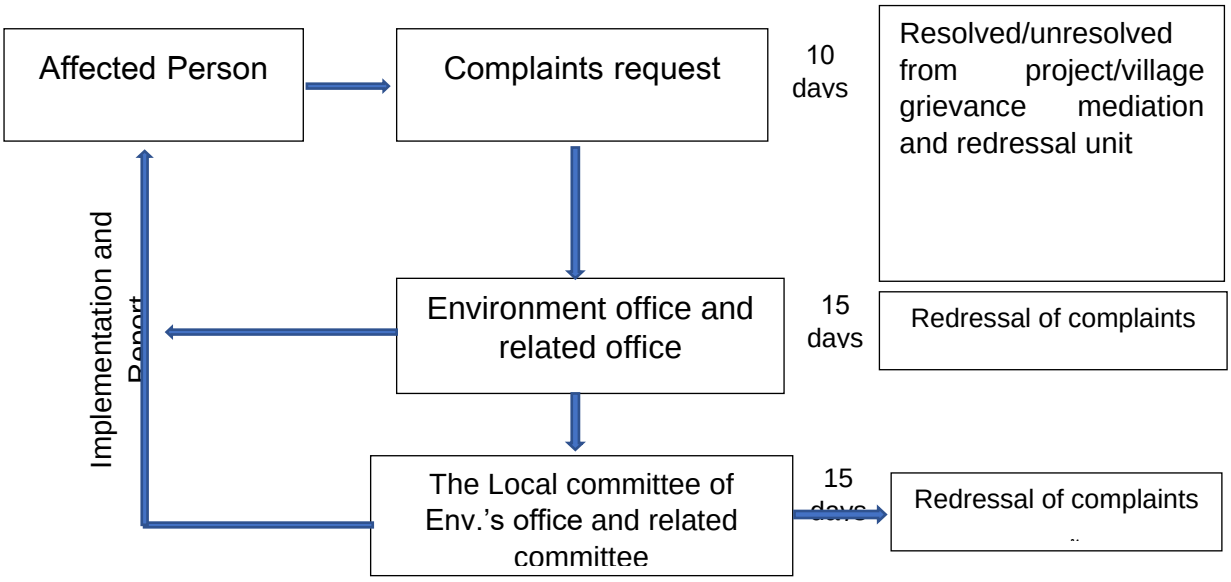


Figure6. 2 The diagram on the grievance and resolution procedure

6.3.6 The Budget on Environmental Monitoring

Environmental and Social Management and Monitoring obligations for the potential impact by their own project is required for all development projects, less or more obligation is depending on consequences of the project impact. Less – more potential impact by the project is depending on the type, size and location of the project, if those projects are located in the sensitive area on natural ecosystems, those projects will have higher obligations. Therefore, the environmental and social obligation is a necessary measure

of project developer or project owner have to responsible on the budget for management and mitigation measures to minimize direct and indirect potential impact, with both short-term and long-term.

The Bridge Maintenance and Management Project is a project which has an obligation on the environmental and social, to contribute to the environmental and social protection and also to be the reference for the budget allocation in term of the implementation of the environmental and social obligations of this project.

for the table 6.3 to table 6.5 are budget on Environmental Management and monitoring for the Project Owner the environmental and social obligations of this project is based on the key legislation as follows:

Table6. 3 The environment monitoring budget of Project owner

No.	Description of the budget	lump sum budget (Construction Phase 1 year) (USD)	Responsibility
1	Air Quality Impact Management and Monitoring (Dust and exhaust emission)	1.500	Project owner/contractor is responsible for the budget and implementation by themselves
2	Wastewater Management and Monitoring	1.500	Project owner/contractor is responsible for the budget and implementation by themselves
3	Solid Waste and Hazardous Waste Disposal from the construction	1.200	Project owner/contractor is responsible for the budget and implementation by themselves
4	Health and Safety of workers and community	2.000	Project owner/contractor is responsible for the budget and implementation by themselves
5	Training on Environment and information disclosure	1.500	Project owner/contractor is responsible for the budget and implementation by themselves
6	Budget for Emergency Incident	6.000	Project owner/contractor is responsible for the budget and implementation by themselves
Total		**USD 13.700**	

Table6. 4 The environment monitoring Budget for the State Sector

NO.	Monitoring Division	Budget for the Construction Phase (12 Months)/Time	Number of People	USD	Total in USD
1	Monitoring by the Provincial of Natural Resource and Environment Department of Savannakhet	2	4	120	960
2	Monitoring by the District of Natural Resource and Environment Office of Songkhone	4	2	100	800
Total					**1.760**

Table6. 5 Summary of Environmental and Social Management and Monitoring Budget

No.	Environmental and Social obligation budget of the project	Total (USD)
1	Land Compensation Budget (not required as the land is owned by the project owner)	0
2	Environmental Management and Monitoring Budget for Project Owner	13.700
3	Management and Monitoring Budget for state sector	1.760
Total (USD)		**15.460**

Chapter 7: Public Consultation

7.1 Purpose

- In order to comply with the Agreement No. 707/MoNRE, date on 5 Feb 2013, the Guideline on the Public Participation in the Environmental Impact Assessment for the Investment Projects.
- In order to discuss and to disclose on the investment project information in order to obtain the feedback from the affected people or beneficial people from the investment project including people who are interested in the project investment. This will be the reference on the establishment and consideration of the Initial Environmental Examination and the Environmental and Social Management and Monitoring Plan.

7.2 Stage and Approach

7.2.1 Stage of Consultation

As the Bridge Maintenance and Management Project is a project which focuses on the capacity building for the technical officers and the Bridge Management Division. Therefore, the maintenance of Xebangnouan Bridge will be one of the pilot activities for the over projects. This is to indicate on the principle, resolution as well as the implementation on maintenance and management works. The meeting, consultation-discussion for idea exchange among other divisions and the project stakeholder particularly the relevant state and private sectors who are interested in the consultation and public participation. After the Environmental and Social Consulting Company is assigned by the Project Developer. The consultation and the data collection are commenced on the implementation and had been continuously conducted until the project approved. The pilot bridge maintenance (Xebangnouan Bridge) was discussed among the Environmental Consulting Company, the Project Coordinators, the Provincial of Natural Resource and Environment Department, the District of Natural Resource and Environment Office and the Village Chiefs of two villages located in the project area in order to determine the guideline for the implementation in each stage in accordant with the government policies.

Data collection and disclose: Prior the field data collection, the Environmental Consultants had issued the letter through the project owner to the Road Department regarding to propose to the Department of Natural Resource and Environment Department of Savannakhet in term of data collection. After that, DoNRE had discussed on the relevant works with the District of Natural Resource and Environment Office and the Village Chiefs of two villages located in the project area regarding to the disclose on project information. The DoNRE and villages had surveyed, collect the physical and biological, economic-social information as well as the water sampling.

Project Operation: After the field data collection, the Environmental and Social Consultants had analysed the economic-social information in and surrounding project area in order to anticipate on the impact and mitigation measures by applying the scientific -environmental-social principals. Afterwards, the consultation meeting was organized in each level starting from the village to the provincial levels.

7.2.2 Implementation Approach

The disclose on the project information is the priority for planning and implementation on the public consultation. The purpose is to understand the visions of the stakeholders. This is required the collaboration on planning and development work in order to exchange information among the stakeholders in diffident levels.

The priority for designing on the consultation approach is included:

- To ensure that the stakeholders understand on the project information and potential impacts as well as the management plans in order to minimize the impacts.
- To ensure that the stakeholders understand on the project components and its purpose for the maintenance of Xebangnouan Bridge.

7.2.3 Applicable Technique

The consultation techniques are designed to meet the need of the participants, which is necessary to be considered on the techniques in order to meet the requirements of the studied teams. The applied techniques include various approaches as following:

- Presentation with pictures, maps and advertisement particularly at the local level and in the project area
- Organize the consultation meeting, the meeting at village level, the interview, the techniques on the result assessment for the public participation as well as the site visit.
- Summary the project description in Lao, the documents to be distributed to the community leader, staff and stakeholder.

7.2.4 Public Consultation Process

The project developer shall implement the consultation meeting in order to get feedback from people or groups (youth, women, ethnic, vulnerable) affected from the investment project and other participants. The consultation meeting shall be on the impact by the project and take those feedbacks in the account in the draft and revised IEE. In addition, the consultation shall be followed four stages as following:

7.2.4.1 Consultation meeting at the Village level

As the project does not cause the impact on land use of people, to ensure that the flow and fast communication, the discussion with the community is implemented at the Xebangnouan village office to represented by village head of Xebangnouan and Phouthamphouang, Jica's monitoring team and DONRE*[5] And then but this work is implemented with the village chief who coordinates with the community or disclose on the project's framework in order to explain to people using 13th south road to be cautious on safety traffic. Beside that the technical public consultation level is will be organize in the next stage after submit the draft of IEE report to the DONRE.

Disclose and interview with the village chiefs of two villages	Site inspection with the Technical Officers of DONRE

[5] List participant is in the appendix 4

Figure7. 1 The disclose on the project information to the Village Chief and DoNRE of Savannakhet Province

7.2.4.2 Consultation meeting at the district level

This project is under the management of the Provincial of Public Works and Transport Department of Vientiane Province which is responsible for the national roads and bridge along the 13th south road. This department is responsible on the environmental management. However, the Project Developer shall collaborate with the Environmental Consulting Company, the Provincial of Natural Resource and Environment Department in order to disclose on the project's frameworks to the district authority for the acknowledgement and understanding on the operation process, the project implementation approach, the potential impact from the project to people using the road crossing that point during the maintenance period for 12 months.

7.2.4.3 Consultation meeting at the provincial level

- DoNRE will review on the IEE If the content of the report is comprehensive, the DONRE of Vientiane shall organize the technical meeting and site visit (if required) by the project developer in order to prepare the relevant information and the proposal on IEE
- After that, the DoNRE of Vientiane shall provide the comments to the project developer for the revision and submit to the DONRE for the final review in order to submit to the Provincial Environmental Committee to issue the Environmental Certificate.

Chapter 8: Conclusion and Recommendation

8.1 Conclusion

Regarding to the result of the Initial Environmental Examination, it indicated that the Xebangnouan Bridge Maintenance and Management Project cause the positive impact rather than the adverse impact. The adverse impact is minor, which is the temporary impact occurred during the construction phase including difficult traffic, dust and safety traffic. During the maintenance period, this impact is controllable and temporary by the implementation of the proposed mitigation measures as describe in this report. In addition, the adverse impact on the physical environment is minor which is under control. The main impacts are the disturbance noise, waste, surface water quality during the bridge maintenance to be occurred in the construction phase. These cause the impact to the community located in the surrounding project area including the congestion in the project area as there are market, school, temple and small hospital. However, this area has the most people living there.

In term of the biology, there is no impact on flora and fauna due to the fact that the project is located in the existing place. Therefore, there is not impact on the animal or plant habitats.

There are no economic-social and cultural impacts particularly the assets and land use as the project area is the governmental land.

The proposed impacts can be prevented and minimized by strictly implementation on the measures as described in the Chapiter 5 and the monitoring and management plan in the Chapter 6 of this report. At the same time, the project developer also prepares action plans to monitoring environmental-social during the construction phase, as well as providing a budget for environmental monitoring for the relevant parties. Based on the data assessment, it can be concluded that the environmental and social impact is minor comparing with the positive consequence as the project will contribute in the national economic-social development particularly the linkage among provinces.

8.2 Recommendations

- The contractor should prepare the contractor environment and social mitigation plan base on the IEE and actual condition.
- The contractor shall develop its mitigation measures based on this report in order to revise the information prior the actual implementation.
- To ensure on the safety and security in the construction phase, the project shall record the number of staff and workers and report the labour information to the village authority for the acknowledgement and facilitation on the security work.
- Ensure the safety of using the road during night traffic closures by providing sufficient lighting

The project shall collaborate with the local authority to provide the information to people using the road to ensure on the safety.

Appendix

Appendix 1 - Photos of the damage on Xebangnouan Bridge

Appendix 2 - The Result of Water Analyses from Phanthamit Laboratory

Appendix 3 - Socio – Economic Questionnaire Form for the Head of Xebangnouan and Phouthamphouang village

Appendix 4 - Participant list on the public consultation with village level at the Namone village