Initial Environmental Examination

June 2017

Myanmar: Greater Mekong Subregion Highway Modernization Project

Prepared by the Ministry of Construction for the Asian Development Bank.

CURRENCY EQUIVALENTS
(as of 9 June 2017)

Currency unit	–	Myanmar Kyat (MK)
MK1.00	=	$ 0.00074
$1.00	=	MK 1,349

ABBREVIATIONS

ADB	–	Asian Development Bank
AP	–	Action Plan
CEMP	–	Contractor Environmental Management Plan
COI	–	Corridor of Impact
CSC	–	Construction Supervision Consultant (also called the "Engineer")
dB(A)	–	A-weighted sound scale
DO	–	dissolved oxygen
EIA	–	Environmental Impact Assessment
EMP	–	Environmental Management Plan
EMR	–	Environmental Management Report
ESSRSS	–	Environment, Social Safeguards and Road Safety Section (of DOH)
GRM	–	Grievance Redress Mechanism
IEE	–	Initial Environmental Examination
IES	–	International Environmental Specialist
km	–	kilometer
m	–	metre or meter
mm	–	millimeter
m^3	–	cubic meter
MIMU	–	Myanmar Information Management Unit
MONREC	–	Ministry of Natural Resources and Environmental Conservation
MOC	–	Ministry of Construction
NES	–	National Environmental Specialist
NPT	–	Nay Pyi Taw
PMU	–	Project Management Unit
PMU	–	Project Management Unit – Safeguards Officer
PPE	–	personal protective equipment
PY	–	person-years
ROW	–	right-of-way
SPS	–	Safeguards Policy Statement
TA	–	Technical Assistance
WB	–	World Bank
WHO	–	World Health Organisation

WEIGHTS AND MEASURES

^{o}C	–	degree Celsius
dB	–	decibel
Km	–	Kilometer
Kph	–	Kilometer per hour
LAeq	–	Equivalent Continuous Level 'A weighting' - 'A'-weighting = correction by factors that weight sound to correlate with the sensitivity of the human ear to sounds at different frequencies
m	–	meter

NOTE

(i) In this report, "$" refers to US dollars.

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EXECUTIVE SUMMARY

Project

1. The Ministry of Construction (MOC), Department of Highways (DOH) is the Project Proponent for the Greater Mekong Subregion Highway Modernization Project, which plans to rehabilitate or improve sections of three highways; (i) Yangon–Pathein; (ii) Bago–Thanlyin; and (iii) Yangon–Mandalay Expressway (see Table 2).

2. **Rehabilitation of Yangon–Pathein highway (177 km**). The first 10 km of the highway leading to the improvement section will be resurfaced with asphalt concrete. From km 10 to Pathein the highway will be widened to two lanes (7 meters) with 1.5 meter paved shoulders, and overlaid with asphalt concrete. The 20-km section in the flood-prone area will be raised by about 2 meters. In that section, five bridges will be replaced, and a new bridge will be constructed over a flood-prone railway crossing. The road will be provided with safety furniture and marking and junctions will be improved.

3. **Rehabilitation of Bago–Thanlyin highway (99 km).** The road will be reconstructed over its current alignment with widening to two lanes (7 meters) with 1.5 meter paved shoulders, and paved with asphaltic concrete. Village sections will be resurfaced with asphaltic concrete only. Fifteen bridges will be replaced.

4. **Yangon–Mandalay Expressway Improvement (Hlegu–Bawnetgyi section)**. The expressway safety enhancement part of the project when completed will provide, for the initial 62 km section of the existing expressway north of Yangon, inner and outer surfaced shoulders for each of the two carriageways, an asphaltic concrete overlay, and road safety installations. These will include safety barriers along the roadway and at bridge approaches, mountable curbs, signage and line marking, and major improvements to the intersections at the commencement of the section.

5. **Yangon–Mandalay Safety improvement program (Bawnetgyi–Mandalay section) excluding section 64 km to 184 km.** For the remaining 404 km of the expressway the improvements will generally be limited to signage and line marking, and installation of safety barriers at some critical bridge approaches. Areas prone to frequent accidents (“blackspots”) will be identified, and when feasible improved under the project. The interchange at Bawnetgyi will also be reconstructed to modern expressway standards. The pavement of the Bawnetgyi–Payagyi access road that provides access to the expressway will be improved.

Table: Planned Road Rehabilitations, Improvements, and Road Safety Measures

Road	Length (km)	Works
Yangon–Pathein	176.9	Rehabilitation
Bago–Thanlyin	99.3	Rehabilitation
Expressway (Hlegu–Bawnetgyi section)	62.3	Improvements
Expressway (Bawnetgyi–Mandalay section) excluding section 64 km to 184 km	403.9	Road Safety Measures

Source: Project preparatory consulting team

6. In addition, the project will carry out pavement field trials to test new technologies and provide for a consulting services for detailed design for a new highway alignment between Bago and Kyaikto.

7. **Road periodic maintenance trials.** With support from the project's supervision consultant, DOH will carry out about 80 km of pavement field trials which will introduce new and more up-to date technologies to improve sustainability of the road network.

8. **Detailed technical preparation of the GMS EWEC Highway Development Project (excluding Sittaung bridge section).** The project will finance consulting services for detailed design for a new highway alignment between Bago and Kyaikto, fully develop and finalize safeguards planning documents, assist MOC in civil works procurement, and facilitate the project's land acquisition, resettlement and income restoration programs.

Initial Environmental Examination

9. This Initial Environmental Examination (IEE) Report addresses the construction and operational phases of the GMS Highway Modernization Project. The IEE assesses the environmental impacts of the construction works and highway operations. It identifies issues to be considered and addressed in the design, construction and operation of the project road, and presents measures to prevent, and mitigate potential environmental impacts.

10. The Report was prepared in accordance with the ADB Safeguard Policy Statement (SPS, 2009). It also is in accordance with Myanmar Environmental Impact Assessment (EIA) Procedure (2015).

11. **Screening and Categorization**. In accordance with the ADB Safeguard Policy Statement (2009) the project was screened by ADB. The project was assigned Category B requiring preparation of an Initial Environmental Examination including an Environmental Management Plan.

12. In accordance with Myanmar Environmental Assessment Procedure (2015), the project was screened in coordination with the Environmental Conservation Department of the Ministry of Natural Resources Environmental Conservation. The project was assigned as a project requiring Initial Environmental Examination (IEE) Report with separate IEEs prepared for each sub-project.

13. This IEE Report is based on field work and investigations conducted from October 2016 through to March 2017. The present road, the road corridor and surrounding landscapes were examined. Published and online data and information were reviewed; and site and location inspections were made. ADB, DOH/MOC and DOH regional personnel were met and assisted with the field assessment. Initial community consultation meetings were arranged and conducted by DOH and Consultant Team personnel.

Description of the Environment

14. **Bago–Thanlyin Highway.** The physical environment is a typical delta formed by the deposition of sediments carried originally by the ancient Ayeyarwady River and more recently by the Sittaung and Bago rivers. Land throughout the project area is almost flat but slopes very gently to the sea. The soil is fine alluvium, sandy loam and gravels deposited over eons by the combined forces of the Ayeyarwady and Bago rivers. The land lies barely above the sea. The maximum elevation in the road corridor being less than 3 m above mean sea-level.

15. The climate is tropical humid. There is a marked wet monsoon of about 6 months from May through October and very little rain in the remaining months. Due to the combination of high

rainfall during the warm, wet monsoon and the almost flat, very low elevation, coastal flooding can be severe. It is made worse by periodic storm events and associated sea-surges when the sea acts as a barrier preventing river discharge.

16. The land in the road corridor is almost entirely in rice cultivation with small patches of other agricultural production. Towns and villages are spaced more-or-less equidistant along and near the road alignment, the towns being at intersections with cross-roads.

17. Rice cultivation predominates with two rice crops annually facilitated by irrigation. The Bago area was exporting rice in the 15th century. Although rice culture dominates the economy and lifestyles, there is an increasing amount of animal husbandry, mainly of chickens, pond-fish and small-holder cattle farmers. Additionally, a growing proportion of residents are employed in agricultural-support services and equipment supply and maintenance, truck, bus, taxi and limited water-transport services. And a significant, number of people work in factories located in Thanlyin Township and the eastern fringes of Yangon.

18. There are few sensitive receptors of physical cultural resources along the alignment or close to it. However, a specific survey was undertaken to identify sensitive receptors within 100 m of the center-line. This identified 36 temples and monasteries, 16 schools, two nursing homes, one hospital and one orphanage.

19. **Yangon–Pathein Highway**. The physical environment is a typical delta formed by the deposition of sediments carried by the Ayeyarwady River and its many distributaries. These deposit sediments at or near sea-level where the rivers lose their strength along the coastal littoral, and have been so doing for millions of years. Distributaries from the main channel trend southwest because their passage to the southeast is blocked by the low hills on which sits the original Yangon.

20. Land throughout the project area is almost flat but slopes very gently to the sea. The soil is fine alluvium, sandy loam and gravels deposited over eons by the main river and its distributaries. The land is barely above the sea. The maximum elevation in the entire area being less than 3 m above mean sea-level.

21. The climate is tropical humid. There is a marked wet monsoon of 6–7 months from May through October and very little rain in the remaining months. Due to the combination of high rainfall during the warm, wet monsoon and the almost flat, very low elevation, coastal flooding can be severe. It is made worse by periodic storm events and associated sea-surges when the sea acts as a barrier preventing river discharge.

22. Due to the low-lying and relatively flat land, the surface-water in rivers is influenced by the tides. This has a beneficial effect. The fresh water rides up, over the incoming sea water and raises river-water levels. This facilitates wide-ranging river-transport but unfortunately also worsens flooding particularly during storms.

23. The road corridor is almost entirely in rice cultivation with small patches of other agricultural production and small to medium-sized villages spaced along and near the alignment.

24. With two rice crops annually facilitated by irrigation, the Delta earns its title as “rice granary of Myanmar”. Although agriculture dominates the economy and lifestyles, a growing small proportion of residents are employed in agricultural-support services and equipment supply

and maintenance, truck, bus, taxi and water transport services and in factories located in Pathein and the western fringes of Yangon.

26. There are few sensitive receptors of physical cultural resources along the alignment or close to it. However, a specific survey was undertaken to identify sensitive receptors within 100 m of the center-line. This identified 36 temples and monasteries, 16 schools, two nursing homes, one hospital and one orphanage.

28. With respect to climate change, higher global and regional temperatures can be expected in coastal locations at these latitudes to cause an increase in the frequency and magnitude of seasonal floods and sea-based storm events such as the cyclonic storm “Nargis” in 2008. Such storms are expected to increase in frequency and intensity as global warming increases.

27. **Yangon – Mandalay Expressway.** The Expressway, is situated in a strip of land averaging more than 100 m wide and previously cleared of trees and structures when the expressway was constructed from 2005 to 2008. Within the cleared highway transport corridor there is little of the original environment remaining. There are no trees except those planted after the expressway was completed. There are no unique areas of any form and no agriculture, cultural archaeological, recreational, religious or educational values of significance in the 100 m-wide transport corridor.

28. **Environmental Sensitive and Protected Areas.** No ecologically sensitive or unique natural features have been identified within the road corridors.

Public Consultation

29. There are seven villages along the Bago–Thanlyin Highway alignment. Community discussions were held in in December 2016 and April 2017. Participants from the towns and townships provided useful comments that provided useful guidance for the project design. Questionnaire responses indicated that the most important impact concerns were concerns related to construction traffic, interactions with the work-force and impacts on land resources

30. Along the Yangon–Pathein Highway alignment are 9 villages. Initial community discussions were held in December 2016 and April 2017. Participants from the villages and nearby areas provided useful guidance for the project design. Questionnaire responses indicated that the most important impact concerns related to construction traffic, interactions with the work-force and water pollution.

Grievance Redress Mechanism

31. A Grievance Redress Mechanism (GRM), consistent with the requirements of the ADB Safeguard Policy Statement (2009) will be established to prevent and address community concerns, reduce risks, and assist the project to maximize environmental and social benefits. In addition to serving as a platform to resolve grievances, the GRM has been designed to help achieve the following objectives: (i) open channels for effective communication, including the identification of new environmental issues of concern arising from the project; (ii) demonstrate concerns about community members and their environmental well-being; and (iii) prevent and mitigate any adverse environmental impacts on communities caused by project implementation and operations. The GRM is accessible to diverse members of the community, including more vulnerable groups such as women and youth. Opportunities for confidentiality and privacy for complainants are to be honored where this is seen as important.

Benefits

32. **Rehabilitation.** The rehabilitated roads will provide all-weather transport links and the improved road surface and signage will reduce: accidents, travel times, wear and tear on vehicles, and localized air pollution, road noise and vibration. The road will include improved drainage. This will not only enhance the longevity of the road asset but also improve health of people living and working near the alignment by reducing water puddling and associated populations of mosquitoes and other disease vectors.

33. **Connectivity.** The project will also have significant positive economic impact on the wider economy as it will provide improved access northern, southern and eastern Myanmar. It will enhance connectivity and access to economic opportunities, health, social and educational services for residents and businesses. People with better access to markets will benefit via improved opportunities to sell their labor and products.

34. **Community Health and Safety**. A benefit from the road will be a reduction in dust as vehicles will no longer be travelling on unpaved surfaces when overtaking, because the wider paved shoulders and carriageway. Currently the residents and other road users are subject to relatively high levels of airborne dust when a vehicle passes at speed if it is not fully on the pavement. This can have detrimental impacts on health, particularly for children and people with respiratory disorders.

35. **Road Safety.** All highway improvements will increase road safety and reduce the potential for accidents.

Impacts and Mitigation Measures Construction

36. The main potential impacts of concern are to: (i) air quality as a result of dust associated removal of old pavement, hauling of construction materials, erosion of construction material storage sites, operation of the concrete and asphalt batching plants; (ii) air quality as a result of emissions from operation of the concrete and asphalt batching plants, construction equipment; (iii) water quality as a result of storm water runoff from construction sites, construction camps and storage area; erosion of embankment while under construction; spills and leaks from fuel and chemicals storage sites; and disposal of waste water from construction camps; (iv) sensitive receptors as a result due to noise associated with construction equipment and truck hauling construction materials; (v) land and soils as a result soil erosion; soil contamination; inappropriate management of borrow pits; and improper disposal of unwanted material and spoil (vi) flora as a result of the removal of roadside trees to allow for road widening; (vii) traffic congestion, delays, accidents resulting construction activities, (viii) occupational health and safety as result of inadequate personal protection equipment and accommodation; (ix) community health and safety as result of disruption and interaction with construction workforce.

37. **Impacts on Air Quality**. Air quality impacts include dust associated removal of old pavement; operation of borrow pits: hauling of construction materials; erosion of construction material storage sites; earthworks for creation of the embankment and cut and filling; and operation of the concrete and asphalt batching plants. Air quality impacts include emissions from operation of the concrete and asphalt batching plants, and construction equipment.

38. **Mitigation of Impacts on Air Quality**. The mitigation measures include: (i) locating asphalt and concrete plants downwind and well away of residential areas. Plants to be fitted with

necessary equipment to reduce fugitive dust emission; (ii) spraying water on construction sites and material handling routes where fugitive dust is generated; (iii) covering trucks carrying earth, sand or stone with tarpaulins or other suitable cover; (iv) maintaining construction vehicles and machinery to minimize emissions; and (v) and cleaning up mud or dusty materials which are left on or around public roads.

39. **Impacts: Water**. Impacts on water quality may result storm water runoff from construction sites, construction camps and storage area; erosion of embankment while under construction; spills and leaks from fuel and chemicals storage sites; disposal of waste water from construction camps; and direct damage to water bodies and wells from construction equipment

40. **Mitigation of impacts on Water**. Temporary drainage will be provided during construction to ensure that any storm water runoff and erosion will be controlled. To limit the spill of materials into water bodies during construction, no soil, spoil, aggregates, fuel, chemicals or other construction materials will be stored within 50 m of a waterbody

41. Fuel storage, maintenance shop and vehicle cleaning areas will be located 300 m away from the nearest water body. Enclosed drainage around fuel, chemical and hazardous materials storage areas will be on concrete or asphalt hardstands. Wastes will be stored on hardstands and protected from rain and wind. Waste and contaminated water will be removed from construction sites and taken to approved disposal facilities. Domestic waste water treatment and disposal systems will be installed at construction camps or arrangements for adequate off-site disposal made. Sensitive water receptors which accidentally damaged during construction includes wells, will be identified in advance of construction and demarcated to ensure machinery does not encroach on them.

42. **Impacts of Noise**. Sensitive receptors will be impact as a result due to noise associated with replacement of existing surface materials for road rehabilitation, construction equipment, operation of asphalt and concrete plants, and truck hauling construction materials. For most construction activities, the potential sensitive receptors will be exposed to short term impacts. The exception is the hauling of construction materials which will be continuous throughout the construction period.

43. Construction activities are expected to produce noise levels up to 90 dB(A) within 5 m of machinery[1]. No receptors other than construction workers will be this close to the machinery, and they will be required to use appropriate PPE. To assess possible impacts on sensitive receptors along the Bago–Thanlyin Highway, an assessment was made to determine which facilities were within 100 m of the road center-line along the corridor. The assessment identified 36 temples, pagodas, monasteries or chapels; 14 primary schools; two secondary schools; two nursing homes; one hospital; and one orphanage within 100 m of the center-line. On the Yangon–Pathein Highway there were

44. **Mitigation for Impacts of Noise.** Noise will be controlled at source by maintain all exhaust systems in good working order; undertaking regular equipment maintenance, enclose stationary equipment (e.g., generators); and controlling vehicle speeds around sensitive receptor. Asphalt and concrete plants will be sited 500 m away from sensitive receptors. Construction operations will be restricted to specific times of day through agreements with

[1] ADB, 2014. ADB GMS East–West Economic Corridor (EWEC): Eindu to Kawkareik Road Improvement Project – Initial Environmental Evaluation (November 2014).

nearby residents to avoid any unnecessary disturbances. Notification of construction activities will be given to communities and sensitive receptors.

45. **Impacts on Soil Resources.** Four types of potential impacts on soil may occur, including: (i) soil erosion; (ii) soil contamination; (iii) inappropriate management of borrow pits; and (iv) improper disposal of unwanted material and spoil. Soil erosion be caused by cut and fill operations, stockpiles and spoils from earthworks, road grading and construction camp construction and erosion of embankment slopes. Soil contamination may result from the inappropriate transfer, storage, and disposal of petroleum products, lubricants, chemicals, hazardous materials, liquids and solid waste. In appropriate management of borrow pits may result in loss or contamination of the topsoil. Improper disposal of excavation spoils may degrade land, water and vegetation; create dust and disrupt drainage.

46. **Mitigation of Impacts of Soil erosion:** Mitigation measures include: (a) minimizing the area of soil clearance; (b) maintaining slope stability at any cut faces; (c) construction in erosion and flood-prone areas will be mainly restricted to the dry season where possible; (d) control silt runoff particularly around cross drainage structures when they are over water; (e) cover soil stockpiles; (f) properly stabilize slopes and re-vegetate disturbed surfaces using locally available indigenous grass species; and (g) protect slopes on both sides of any road crossing structures to prevent soil loss; (h) use of temporary berms or other appropriate temporary drainage provisions at construction sites to prevent water eroding cut faces, stockpiles and other exposed areas of soil particularly if construction occurs in the rainy season.

47. **Mitigation of Soil contamination**: Mitigation measures include: (a) store chemicals/ hazardous products and waste on impermeable surfaces in secure, covered areas with clear labeling of containers and with a tray or bund to contain leaks; (b) regularly remove all construction wastes from the site to approved waste disposal sites; (c) disseminate spill management plan to construction team and conduct training in emergency spill response procedures; (d) provide spill cleanup measures and equipment at each construction site; (e) ensure fuel storage areas have spill containment features and that refueling takes place on hard standing area away from surface water.

48. **Mitigation: Disposal of unwanted materials and spoils.** Before excavation and removal of pavement commence, CSC/Engineer and MOC/DOH need to undertake inspection and provide approval of the contractors' disposal site. Disposal sites should be management using the measures to prevent soil erosion (see above).

49. **Mitigation: Operation and Restoration of Borrow pits:** If borrow pits are used to source construction materials, the following mitigation measure will be undertaken: (i) obtain approval from CSC to investigate the feasibility of operating a borrow-pit, should the Contractor decide to proceed with this possibility; (ii) do not select a potential borrow-pit site within 300 m of a settlement (iii) obtain the required permits and licenses; (iv) remove and keep topsoil for later use in site restoration; (v) provide adequate drainage and sediment controls; (vi) prepare a plan for operation and restoration (vii) restore the site and include fencing and signage where warranted.

50. **Impact on Flora: Removal of Roadside Trees:** For both the Yangon–Pathein Highway and Bago–Thanlyin Highway, the removal of road side trees the cutting and removing hundreds of trees is expected to cause concern for the community and for the regional and local governments. Most trees for removal along the Yangon–Pathein Highway alignment are Teak trees (locally called "Kyun Tint" trees) planted by the Department of Forestry (DOF). Other "community" trees, such as Acacia (Acacia), Eucalyptus (Eucalyptus), Koak Ko trees (Albizzia

lebbeck) and Tamarind trees (Tamarindus indica), are under the general ownership of surrounding communities. The Myanmar Forestry Department on 24 March 2017 has advised DOH that all of the trees within the right of way are the property of the Myanmar Government. The Forestry Department will assess the number of impacted trees and will be responsible for their disposal. Replanting will be undertaken by the Contractor.

61. **Impact on Visual Appearance**. The road construction will have a medium-term impact on the appearance of the road corridor because of the loss of mature trees which currently make the road look more pleasing, providing greenery and shade and vegetation. The road corridor is not an area of specific natural beauty but the loss of the trees will have impact on the appearance of the road.

62. **Mitigation of Impacts of Loss of Roadside Trees: Tree Retention.** Where possible, the design and the road construction teams will seek to retain the trees, reducing the visual impact as far as possible. Contractor will identify and label all trees which they consider need to be removed prior to construction in order that this can be monitored during the construction phase. Permits for teak tree removal will also need to be obtained by the contractor. Trees to be removed will be determined accurately after the investigation and consultation with the Department of Forests planned for mid-2017. Only those trees in the road corridor of impact will be affected; other trees within the Right of Way will not be affected.

63. **Off-set tree planting.** Replacement of trees where they are removed; for every tree removed at least one will be replanted. Some of these trees will be planted along the edge of the road as close to the locations of the removed trees as possible. Replacement tree will be planted outside of the clear zone as a road safety measure. The clear zone will be 6 m from the edge line in rural areas and 3 m in urban areas. Following advice during consultations, trees will also be planted in the grounds of pagodas and schools. Teak trees are of no commercial or other benefit to community members therefore replacement trees will not be teak but other species of use to the community; the community in each village will be consulted on tree replacement.

64. **Sapling Aftercare**. Trees will be replanted in the appropriate season to increase their viability. Ensuring good quality aftercare of planted trees to ensure they survive and can grow to maturity. The budget support to the community groups should ensure that the saplings are protected and cared for particularly in the dry season when young saplings may be vulnerable to the weather conditions.

65. The program of tree aftercare starts during construction as tree planting should be undertaken as soon as possible in each section of road when the construction is completed i.e. not all at the end of the construction phase, dependent on the season. Advice on tree planting will be taken from the Department of Forestry.

66. **Impact: Traffic Congestion, Delays, and Accidents**: The project will cause traffic congestion and delays to journey times, caused by the need to close sections of the road when construction is taking place.

67. **Mitigation: Traffic management plan and signage**. The Contractor will have to prepare, and have approved by the Engineer, a traffic management plan will set out how access along the project road will be maintained safely during construction. The Contractor will place clear signs will guide road users and advise them on changes to road priorities in order to make their journey as smooth as possible and to ensure road safety as unanticipated changes e.g.

change of lane, will be avoided. Signage to be placed by the Contractor will be required to meet best practice and will be described in detail in the Specifications. The Contractor will also place signs will be placed along the road in advance of construction giving details on the construction dates and duration warning people to expect delays. Speed restrictions will be placed on trucks hauling construction materials and other traffic traversing the work site, especially on partially competed works.

58. **Impacts on occupational health and safety**. Workers will necessarily be exposed to occupational risks during construction work. Risks will arise from a range of hazards such as the use of hazardous materials, heavy machinery and working near traffic. During the day, many movements of trucks, equipment, other machines and people create conditions for accidents to occur. There will be drains under construction, temporary ditches, stored materials, barriers, holes, and many different activities. There may be sharp edges, falling objects, toxic welding gases, chemicals, noise, emissions and potential for injuries. Workers and members of the public will be risk. During the night, the risk of accidents to people and non-works traffic is greater.

59. **Mitigation: Occupation and Health Safety Program**. Contractors will appoint a trained Occupational Health and Safety Officer and provide staff with training at least every three months. First aid stations will be established to provide first-line care. Workers will be provided with potable drinking water, hand and body-wash facilities, adequate sanitary facilities, equipped kitchens and clean eating areas.

60. **Mitigation: Personal Protective Equipment**. Workers will be provided with personal safety equipment and protective clothing (PPE). Contractor supplied equipment will include: protective eye-glasses, ear-protective devices, steel-toed boots, hard hats, nose and mouth masks with active-carbon filters, and safety gloves. Occupation Health and Safety Officer will check on the availability and use of the recommended PPE and provide employees with training on use.

61. **Mitigation: Fire Protection**. Provide fire extinguishers and fire-fighting equipment in workshops, work-camps, fuel storage/supply facilities, asphalt-batching plants and fire-hazard sites.

62. **Emergency Response**. Contractors are to prepare an emergency response plan to address emergencies including: (i) work place accidents, injuries and deaths; (ii) traffic accidents; (iii) fire and explosions; (iv) accidental spills of oil, fuel, chemical and other hazardous substances; and (v) flooding and severe weather events.

63. **Impact on Community Health and Safety**. Construction camps provide temporary accommodation for workers, most being unaccompanied men, engaged in project works. Workers can be noisy and untidy and their camps sources of pollutants unless managed well. Work-camps and the work-force can cause anxiety and nuisance in the community. Waste generation and management, poor sanitation, toilet waste, runoff water and sedimentation, health impacts and community social stress are the main impacts. The questionnaire survey of community perceptions of likely impacts showed that 57% of respondents had medium or serious concerns about the work-force.

64. During construction, there may be a risk to the public safety from hazards such as the use of heavy machinery, excavations, and changes in traffic priorities.

65. **Mitigation. Construction Camp Management.** Work camps will be located away from residential areas. Camps will be managed closely to ensure high standards of cleanliness, control of surface-water runoff, and reasonable worker behavior. Workers will be provided with guidelines for acceptable behavior in/around work camps and communities. Camps will have proper solid waste management and domestic waste water treatment and disposal systems.

66. **Mitigation: Safety Awareness**. A road safety awareness campaign in the project areas will be conducted by DOH during the project. Clear signs will be placed at construction sites including borrow pits, in view of the public, warning people of potential dangers such as moving vehicles, hazardous materials and excavation and raising awareness on safety issues. Heavy machinery will not be used after day light and all such equipment will be returned to its overnight storage area/position before night. All sites including storage areas will be made secure, discouraging access by members of the public by fencing when appropriate.

67. **Impact on Cultural Resources**. Access to many religious buildings is required from the project road, including temples, monasteries and pagodas. The road construction will impact on the accessibility of the sites and any processions which may occur along the road during construction. The buildings are not close enough to be impacted on directly by vibrations from the construction works. At present, there is no information of any archaeological sites.

68. **Mitigation**: **Consultation with Sensitive Receptors**. To reduce the impacts of road construction on access to religious and cultural sites and practices, the following mitigation measures will be implemented. Each religious site will be consulted in advance of construction in identify any sensitive dates or times during which construction would have an unacceptable impact. The leader or senior members of each site will be kept informed of the timings of construction activities in his / her area.

69. **Mitigation: Chance Find Procedure.** Although at present there is no information of any archaeological and cultural assets, the potential for impact requires precautionary measures. An effective approach to avoid potential damage to any archaeological and cultural assets during the construction phase is the inclusion of EMP provisions in construction documents requiring the contractors to immediately stop excavation activities and promptly inform the local authorities and the Department of Archaeology of the Ministry of Culture if potential archaeological assets are discovered.

70. **Impact on utilities provision**. The project will require the relocation of electricity poles which may lead to interruption of electricity supplies for local residents.

71. **Mitigation**. The Contractor will cooperate with local communities, utility companies and local authorities. Households, government offices, and business establishment will be notified well in advance. Relocation or replacement of irrigation facilities, water pipelines, power supply lines, communication lines, irrigation lines and other utility infrastructure will be undertaken prior to removing/relocating existing structures and before rehabilitation works commence.

72. **Consultation and information dissemination**. The affected people will be consulted during project implementation and will make the Project Management Unit (PMU) aware of any significant issues resulting from loss of electricity. The people will be informed by the PMU in advance of any power cuts and the duration of the cut will be made clear in order that they can plan around the lack of power.

Impacts and Mitigation Measures: Project Operation Phase

73. **Issue – Air pollution and noise levels*:*** One set of related concerns over new/improved/ rehabilitated roads is the potential increase in traffic and the potential increase in noise, vibration and emissions. However, the rehabilitated road should enable quieter travel, reduced emissions and lower vibration intensity than at present. Also, ongoing innovations of vehicles continue to reduce emissions and noise and can be expected to continue to do so. Thus, the advantages of the rehabilitated road can be expected to last into the 2030's. Also, the road alignment, mostly through open areas of flat land, enables noise and emissions to dissipate. Hence, the rehabilitated road should be able to handle a large increase in traffic before noise and emissions become a serious problem.

74. **Mitigation. Monitoring Noise Levels**. The DOH/MOC will monitor and police road users, traffic and vehicles to ensure that vehicles meet noise and emission standards. Protective noise barriers will be considered when and where future noise level are nuisance to sensitive receptors.

75. **Issue – Poor drainage**: Poor and poorly managed drainage leads to water puddling, soil erosion, damaged road assets and sedimentation on nearby land. Drains can become clogged easily by sediment and detritus.

76. **Mitigation**. **Drainage Management Program**. The DOH/MOC will prepare and implement a suitable road drainage maintenance program. DOH/MOC will (i) clear and regularly maintain/repair road drainage facilities, such as culverts, lateral and longitudinal drains; (ii) regularly inspect drains, sediment traps, sediment ponds and drains leading to receiving waters and ensure their stability and good performance, remove sediment and debris, and make repairs; and (iii) ensure that oil and debris does not reach land and water bodies adjacent to the road by retro-fitting barriers, screens, sediment traps, oil sumps as necessary.

77. **Issue – Increased Risk of Road Accidents**: Road accidents should decrease because the structure of the widened and rehabilitated road, improved road signage, road markings and paved shoulders will make the road safer for road users. However, road traffic is expected to increase and it may travel at higher speeds than at present. Pedestrians, non-motorized and slow traffic may be at increased risk when drivers do not pay attention. Accidents should be anticipated.

78. **Mitigation**. The DOH/MOC will develop and implement a road safety campaign for implementation in communities and schools. DOH/MOC will monitor and maintain the road and road markings, signage, drainage and safety features in good working order; and monitor and police road users, traffic and vehicles to maintain smooth operations and safe use of the road.

79. **Issue – Increased risk of water pollution**: Road traffic and travel-speeds are expected to increase. Accidents are less likely as a proportion of road users but increased traffic may release more oil, grease, fuel and particulates into the environment. These substances may get into runoff water, particularly during periods of high rainfall or flooding, and reach water bodies. There may also be an increase in accidental spills.

80. **Mitigation.** DOH/MOC together with local administrations will prepare an accidental spill response plans for the highways. The plan will include: (i) a list of road users transporting toxic and hazardous materials along the road and the quantities involved; (ii) procedures to stop the flow of a spill and contain it to prevent its spread; (iii) requirements to purchase appropriate

materials and equipment to mop-up spills (and store it at 2 strategic locations along the road); and (v) measures to dispose of the hazardous used spill cleanup materials.

61. **Issue – Protecting Embankment slopes and the Legal RO**W: An issue of importance for this road rehabilitation project is the removal and compensation of structures built and trees planted by illegal squatters. Road embankments and drainage structures form parts of the road structure. The ROW 23 m each side of the road center-line is under DOH/MOC jurisdiction.

62. **Mitigation**. DOH/MOC will develop a regulation and permitting system under a pertinent law to protect and manage land-use within the legal ROW. A guideline will be distributed pertinent government agencies, townships and settlements informing them of the importance of the ROW, the DOH/MOC jurisdiction over it and the collective responsibility to protect and manage it. DOH/MOC will (i) regularly inspect its road and ancillary structures and ROW to ensure their good maintenance; (ii) prevent the planting of trees within 5 m of the outer edge of unpaved shoulders and/or within 5 m of the base of any embankment; and prevent the construction of any non-permitted permanent or temporary structures within 10 m of the outer edge of unpaved shoulders and/or within 10 m of the base of any embankment.

63. **Greenhouse Gas Emissions.** The operation of the project roads will impact on Myanmar's carbon dioxide (CO_2) emissions. Emissions during construction include fuel burnt for transportation, powering construction machines, and materials preparation. A standard ratio of 200 tons of CO_2 emissions per km of secondary road construction is used.

64. Emissions during maintenance are mainly linked to the periodic resurfacing of the road. A standard ratio for roads is that maintenance emissions are about 10% of construction emissions. However, this would be required regardless of the project road as the current pavement is maintained by the Government therefore this maintenance figure is not included in the total calculation.

65. The estimated CO_2 emissions for construction are 56,850 tons with Yangon–Pathein (36,180 tons) Bago–Thanlyin (20,420 tons); and the Expressway Hlegu–Bawnetgyi section (12,880 tons). The estimated CO_2 emissions for annual maintenance are 5,658 tons with Yangon – Pathein (3,618 tons) Bago–Thanlyin (2,042 tons); and the Expressway Hlegu–Bawnetgyi section (1,288 tons).

Environmental Management

66. An environmental management plan (EMP) has been prepared to guide implementation of the mitigation measures and monitoring programs. The plan outlines the institutional arrangement for supervision and monitoring of the EMP; summarizes the mitigation measures; outlines monitoring requirements; provides a cost estimate, and schedule for implementation of mitigation measures and monitoring requirements. The cornerstone of the implementation of the EMP, is the Contractor Environmental Management Plan. The Plan must be prepared prior to the start of the construction.

67. **Institutional Arrangements**. The project will have one Project Management Unit situated with DOH (DOH PMU). A Construction Supervision Consultant will be hired to assist DOH with the implementation of the project.

Environmental Management Responsibilities. There are seven agencies that are involved in the implementation, supervision, and monitoring of the environmental management plan: the Department of Highways, the Contractor, the Construction Supervision Consultant, the Department of Highways Project Management Unit, Ministry of Natural Resources, and Environmental Conservation, ADB, and independent, third party Environmental Monitoring Contractors (see reporting relationships below).

Construction Contractor. The Construction Contractor will be responsible for implementation of the pre-construction and construction environmental mitigation measures; and frequent monitoring and reporting of environmental management plan implementation.

Construction Supervision Consultant (CSC). The CSC will be responsible for (i) supervision and monitoring of and reporting the contractor implementation of the EMP on behalf of DOH PMU; (ii) supervision of third party environmental monitoring contractors; summarizes the mitigation measures; (iii) assisting DOH PMU in preparing of the environmental safeguard monitoring reports; and (iv) assist DOH PMU in organization of training and capacity development.

DOH PMU. The DOH PMU will have overall responsibility for (i) ensuring implementation of all mitigation measures and ensuring implementation of all monitoring programs; (ii) establishment and operation of the Grievance Redress Mechanism; (ii) training and capacity development of environmental staff of PMU, Constructor Supervision Consultant; (iii) meeting all the conditions of the Environmental Compliance Certificate (as issued by MONREC); and (iv) submitting semi-annual Monitoring Reports to the MONREC and to ADB.

Ministry of Natural Resources and Environmental Conservation (MONREC). MONREC is responsible for: (i) review of the periodic environmental safeguard monitoring reports submitted by DOH to ensure that adverse impacts and risks are mitigated as planned; (ii) as necessary, conduct monitoring and inspection of projects to determine compliance with all environmental and social requirements; (iii) as necessary, impose penalties and /or require Project Proponent to undertaken corrective action; and (iv) where projects are not in compliance or not likely to comply with its environmental and social requirements, take appropriate enforcement actions including suspension of project operation; and employing third parties to correct non-compliance.

ADB. ADB is responsible for (i) conducting periodic site visits for projects with adverse environmental impacts; (ii) conducting supervision missions for detailed review for projects with significant adverse environmental impacts; and (iii) reviewing the periodic environmental safeguard monitoring reports submitted to ensure that adverse impacts and risks are mitigated as planned.

Independent Third Party Environmental Monitoring Contractors. Environmental Monitoring Contractors will be responsible for conducting air quality, water quality, noise, and biological environmental monitoring programs on behalf of the DOH PMU.

Training and Capacity Development. Environmental staff are needed by the (i) Construction Contractor, (ii) Construction Supervision Consultant, and (iii) the DOH PMU. DOH needs to provide capacity development and/or training programs to ensure staff in all three agencies (i) fully understand the environmental management plan; (ii) understand their responsibilities; and (iii) are capable to undertake their responsibilities. As DOH does not have environmental and social management staff, DOH needs to hire a qualified contractor through the PMU or the CSC to conduct necessary training and capacity development programs.

96. **Reporting Requirements**. Monitoring of the implementation of the environmental management plan will require weekly reporting by the Contractor; and monthly reporting by the CSC. The CSC will draft semi-annual environmental monitoring reports. The PMU will finalize the environmental monitoring reports and DOH will submit the reports to MONREC/ECD and ADB.

97. **Contractor Environmental Management Plans**. Before the construction starts each Contractor will prepare a Contractor Environmental Management Plan (CEMP) consistent with the EMP. The CEMP is to include all mitigation measures and monitoring requirements to be carried by the Contractor. The CEMP will be submitted to the CSC for review and approval. Contract documents shall explicitly indicate the requirement for the CEMPs Construction cannot start until all CEMPs are prepared. To ensure that the Contractor allocates sufficient funds to prepare and implement the CEMP, the Tender and Bid documents will require that the cost of implementing the EMP and CEMP is included in the Contractor Bid price.

98. **Environmental Management During Operations** After project hand-over and during road operations, Environmental Management will be responsibility of MOC/DOH. The cost of environmental management and environmental impact prevention and mitigation is to be included in MOC/DOH operation and maintenance costs and provided for from the Government funds.

99. **Environmental Monitoring Requirements.** An Environmental Monitoring Plan and schedule has been prepared. It includes the parameters to be monitored, locations to be monitored, methodology, frequency and the party/parties responsible for the monitoring. The plan outlines programs for environmental monitoring of air quality, water quality, and noise during the construction phase. It also outlines supervision monitoring for checking on implementation on the EMP.

100. **Pre-Construction Ambient Environmental Monitoring**. Ambient environmental data on surface water quality, air quality, and noise in the road corridors was not available for preparation of the IEE. Therefore, conduct environmental baseline ambient monitoring must be conducted prior to start of construction. Sampling will be undertaken at fixed locations during the pre-construction period. The sampling stations will be near to the road at key points along it. Indicative monitoring indicators are provided in Table 58. The ambient monitoring will provide information for designing mitigation measures to be included in the detailed Contractor's Environmental Management Plans. Monitoring program will be conducted by independent contractors under the supervision of CSC.

101. **Cost estimate for implementation of the Environmental Management Plan.** The cost estimate for implementation of the EMP includes costs for implementation of mitigation measures and monitoring programs, costs for environmental staff in the DOH/PMU, the CSC, and Contractors; and costs for training and capacity development. The total cost is estimated to be $2.34 million.

Conclusion

102. Assuming that mitigation measures and monitoring requirements in the Environmental Management Plan are effectively implemented, the project is not expected to have a significant adverse environmental impact.

CHAPTER 1 INTRODUCTION AND LEGAL FRAMEWORK

1.1 Introduction

103. The Ministry of Construction (MOC), via the Department of Highways (DOH) is the Project Proponent for the Greater Mekong Subregion Highway Modernization Project, which plans to rehabilitate or improve sections of three highways; (i) Yangon–Pathein; (ii) Bago–Thanlyin; and (iii) Yangon–Mandalay Expressway.

104. This Initial Environmental Examination (IEE) Report addresses the construction and operational phases of the GMS Highway Modernization Project. The IEE assesses the environmental impacts of the construction works and highway operations. It identifies issues to be considered and addressed in the design, construction and operation of the project road, and presents measures to prevent, and mitigate potential environmental impacts.

105. The IEE Report is based on field work and investigations conducted from October 2016 through to March 2017. The present road, the road corridor and surrounding landscapes were examined. Published and online data and information were reviewed; and site and location inspections were made. ADB, DOH/MOC and DOH regional personnel were met and assisted field assessment. Initial community consultation meetings with were coordinated by DOH and Consultant Team personnel.

106. The Report was prepared in accordance with the ADB Safeguard Policy Statement (SPS, 2009) including Appendix 1 Safeguards Requirement 1: Environment. It also is in accordance with Myanmar Environmental Impact Assessment (EIA) Procedure (2015).

1.2 Myanmar Environmental Policy, Legal and Administrative Framework

107. The *Environmental Conservation Law (2012*) provides the mandate for Environmental Impact Assessment and assigns the duty and power the Ministry to develop and implement "a system of environmental impact assessment and social impact assessment as to whether or not a project or activity to be undertaken by any Government department, organization or person may cause a significant impact on the environment".

108. The *Environmental Conservation Rules (2013), Chapter XI Environmental Impact Assessment* provide for environmental screening and where required – for the proponent to conduct an environmental impact assessment, and to prepare and submit and environmental impact assessment report to the Ministry of Natural Resources and Environmental Conservation).

109. The Rules also give the Ministry authority to determine the categories of plan, business, service or activity which shall carry out environmental impact assessment. Also, the Ministry may scrutinize whether or not it is necessary to conduct environmental impact assessment or conduct initial environmental examinations. The Rules also require the proponent to prepare an environmental impact assessment or initial environmental examination and submit it to the Ministry.

110. The *Environmental Impact Assessment Procedure (2015)* provides the procedures for environmental screening, scoping, preparation of an IEE, preparation of EIA, preparation of an Environmental Compliance Certificate (ECC). The procedures also delineate

responsibilities for monitoring compliance with Environmental Management Plans (EMPs) and ECCs.

111. ***National Environmental Quality (Emission) Guidelines (2015)*** provide emission and effluent discharges levels permitted for different sectors and technologies. These Guidelines have been primarily excerpted from the International Finance Corporation (IFC) Environmental Health and Safety (EHS) Guidelines, which provide technical guidance on good international industry pollution prevention practice for application in developing countries.

112. ***Ambient Environmental Quality Guidelines***. ADB is providing technical assistance for the development of Ambient Environmental Quality Guidelines.

113. ***Other Relevant Policies and Laws***. In addition to legislation on EIA, the Government has also enacted a number of key legislative instruments and policies which relate to environmental management, which includes:

i. Protection of Wildlife and Protected Areas Law (1994);
ii. Forest Law (1992);
iii. Rules on the Protection of Wildlife and Conservation of Natural Areas Law (2002);
iv. Protection and Preservation of Cultural Heritage Regions Law 1998;
v. National Environmental Policy; and
vi. National Biodiversity Strategy and Action Plan

114. *International Environmental Agreements.* The Union of Myanmar is a party to relevant international environmental conventions, treaties and agreements on the principles and actions necessary for sustainable development and environmental protection. It ratified in 1994 both the Convention on Biological Diversity and the United Nations Framework Convention on Climate Change. These international conventions explicitly reference the application of environmental assessment to address the effects of human activities. The Convention on Biological Diversity, in particular, promotes the use of appropriate procedures requiring environmental impact assessment of proposed projects that are likely to have significant adverse effects on biological diversity.

1.2.1 Environmental Conservation Department of MONREC

116. The Environmental Conservation Department (ECD) has responsibility for the administration on the environmental impact assessment process. It has responsibility for developing EIA regulations, guidelines, and procedures. It also has responsibility for the review of environmental assessment documents. It also has responsibility for supervision and monitoring compliance with environmental management plans associated with environmental impact assessments.

118. There are regional level ECDs for Yangon and Bago. Their capacity for EIA Review is limited. It is understood that IEEs and EIAs are reviewed at the Union Level. However, the regional level ECDs will be involved in the monitoring of the implementation of the environmental management plan for the project.

1.2.2 Environmental Impact Assessment Procedure (29 December 2015)

117. The Environmental Impact Assessment Procedure was approved on 29 December 2015. Under the Procedure, the MOECAF, now MONREC has the responsibility and authority to:

i. define Project screening criteria;
ii. approve technical guidelines for IEE and EIA;
iii. review and approve IEE Reports;
iv. provide guidelines for, and approve TOR of, EIA;
v. review and approve EIA Reports;
vi. review and approve EMP, Construction Phase EMP and Operational Phase EMP;
vii. determine and impose conditions applicable to any Ministry approval of an IEE, EIA or EMP;
viii. monitor and enforce implementation of the EMP, including any amendments thereof occasioned once the detailed design of the proposed Project has been finalized or by or on account of experience during implementation of the Project;
ix. require any Project to update its EMP and to submit such updated EMP to the Ministry for review and approval according to a schedule defined by the Ministry; and
x. perform other duties and functions relating to IEE/EIA as stipulated by the Union Government.

1.3 ADB Safeguard Policy Statement 2009

118. ADB's SPS (2009) sets out the policy objectives, scope and triggers, and principles for Environmental safeguard areas to be followed across all aspects of its operations. ADB adopts a set of specific safeguard requirements that borrowers/clients are required to meet in addressing environmental impacts and risks. Borrowers/clients comply with these requirements during the project preparation and implementation phases (ADB's Safeguard Requirements 1: Environment in ADB Safeguard Policy Statement (2009)).

1.4 Screening and Categorization

1.4.1 Myanmar Requirements for Screening and Categorization

119. Based on Environmental Impact Assessment Procedures (para 23–29, see below)

"23. Screening

(a) The Project Proponent shall submit the Project Proposal to the Ministry for Screening. In accordance with this Procedure, the submission of the Project Proposal for Screening is the same as the submission of an application for Prior Permission.

(b) The Ministry will send the Project Proposal to the Department to determine the need for environmental assessment.

(c) Following the preliminary Screening and verification that the Project Proposal contains all required documents and related materials, subject to Articles 8, 9, 10, 11, 26 and 27 the Department shall make a determination in accordance with Annex 1 'Categorization of Economic Activities for Assessment Purposes', taking into account Article 25 and the additional factors listed in Article 28 in order to designate the Project as one of the following, and then submit their designation to the Ministry:

i) an EIA Type Project, or

ii) an IEE Type Project, or

iii) A Non IEE or EIA Type Project, and therefore not required to undertake any environmental assessment.

24. The Ministry shall also make a determination whether an EMP shall be required in respect of any Project….

29. Within fifteen (15) working days of receiving the complete Project Proposal, the Department shall determine the type of environmental assessment (EIA, IEE, or none)

which the Project will require, and the Department shall inform the Project Proponent in writing as to such determination in accordance with the Ministry guidance."

1.4.2 ADB Requirements for Screening and Categorization

120. **Environment Categorization**. ADB uses a classification system to reflect the significance of a project's potential environmental impacts. A project's category is determined by the category of its most environmentally sensitive component, including direct, indirect, cumulative, and induced impacts in the project's area of influence. Each proposed project is scrutinized as to its type, location, scale, and sensitivity and the magnitude of its potential environmental impacts. Projects are assigned to one of the following four categories:

i. **Category A**. A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment (EIA) is required.
ii. **Category B**. A proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination (IEE) is required.
iii. **Category C**. A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications need to be reviewed.
iv. **Category FI**. A proposed project is classified as category FI if it involves investment of ADB funds to or through a financial intermediary.

1.4.3 Environmental Categorization under the Myanmar EIA Procedure (2015)

121. By letter dated 15 May 2017 the Environmental Conservation Department advised that the project is categorized as requiring an initial environmental examination (IEE) with the following conditions:

i. In order to minimize the environmental and social impacts, the project needs to apply necessary measures and mediation.
ii. The project has to prepare separate IEE for each of the roads and submit to ECD for review and approval process.
iii. The project has to follow the ECD's existing Policy, Legal and Institutional Framework.

122. A copy of the letter is included in **Appendix A**.

1.4.4 ADB Environmental Categorization

123. In accordance with the ADB Safeguard Policy Statement (2009) the project was screened by ADB. The project was assigned Category B requiring preparation of an Initial Environmental Examination including an Environmental Management Plan.

1.4.5 Assessment of Environmental Safeguard Capacity of Department of Highways

124. The Department of Highways of the Ministry of Construction does not have an environmental and social management system for its operations.

126. The Department has established an Environmental and Social Safeguard and Road Safety Unit (with an estimated 12 officers and 90 staff). However, it is understood that this Unit does not have project level responsibilities for environmental and social safeguards.

125. In two other ADB funded projects with Department, the MYA: Greater Mekong Subregion East–West Economic Corridor Eindu to Kawkareik Road Improvement Project and the MYA: Maubin–Pyapon Road Rehabilitation Project, the institutional arrangements for supervision and monitoring of the implementation of the environmental management plan relied on international and national environmental consultants in the Construction Supervision Consultant and the environmental staff of the Contractors. However, the Department's Project Implementation Units/ Project Management Units for these projects have designated Environmental and Social Safeguard Officers.

1.4.6 Environmental, Health, and Safety Standards

127. The Myanmar National Environmental Quality (Emission) Guidelines (2015) were adopted for the environmental impact assessment contained this IEE. In cases where these Guidelines are not applicable, the World Bank Group Environment, Health, Safety Guidelines will be used. In cases, where Myanmar Guideline values and the World Bank Group Health and Safety Guideline values differ, the most stringent guideline value was applied.

CHAPTER 2 DESCRIPTION OF PROJECT

2.1 Introduction

128. The GMS Highway Modernization Project will rehabilitate or improve sections of three highways; (i) Yangon–Pathein; (ii) Bago–Thanlyin; and (iii) Yangon–Mandalay Expressway. For detailed technical description see Appendix 1.

129. **Rehabilitation of Yangon–Pathein highway (180 km**). The first 10 km of the highway leading to the improvement section will be resurfaced with asphalt concrete. From km 10 to Pathein the road will be widened to two lanes (7 meters) with 1.5 meter paved shoulders, and overlaid with asphalt concrete. The 20-km section in the flood-prone area will be raised by about 2 meters. In that section, five bridges will be replaced, and a new bridge will be constructed over a flood-prone railway crossing. The road will be provided with safety furniture and marking and junctions will be improved.

130. **Rehabilitation of Bago–Thanlyin highway (99 km).** The road will be reconstructed over its current alignment with widening to two lanes (7 meters) with 1.5 meter paved shoulders, and paved with asphaltic concrete. Village sections will be resurfaced with asphaltic concrete only. Fifteen bridges will be replaced.

131. **Yangon–Mandalay Expressway Improvement (Hlegu–Bawnetgyi section)**. The expressway safety enhancement part of the project when completed will provide, for the initial 62 km section of the existing expressway north of Yangon, inner and outer surfaced shoulders for each of the two carriageways, an asphaltic concrete overlay, and road safety installations. These will include safety barriers along the roadway and at bridge approaches, mountable curbs, signage and line marking, and major improvements to the intersections at the commencement of the section.

132. **Yangon–Mandalay Safety improvement program (Bawnetgyi–Mandalay section).** For the remaining 524 km of the expressway the improvements will generally be limited to signage and line marking, and installation of safety barriers at some critical bridge approaches. Areas prone to frequent accidents (“blackspots”) will be identified, and when feasible improved under the project. The interchange at Bawnetgyi will also be reconstructed to modern expressway standards. The pavement of the Bawnetgyi–Payagyi access road that provides access to the expressway will be improved.

133. **Road periodic maintenance trials.** With support from the project’s supervision consultant, DOH will carry out about 80 km of pavement field trials which will introduce new and more up-to date technologies to improve sustainability of the road network.

134. **Detailed technical preparation of the GMS EWEC Highway Development Project (excluding Sittaung bridge section).** The project will finance consulting services for detailed design for a new highway alignment between Bago and Kyaikto, fully develop and finalize safeguards planning documents, assist MOC in civil works procurement, and facilitate the project’s land acquisition, resettlement and income restoration programs.

135. Planned road rehabilitations, improvements, and road safety measures are summarized in Table 1. A detailed description of project components is provided in Appendix 4.

Table 1: Planned Road Rehabilitations, Improvements, and Road Safety Measures

Road	Length (km)	Works
Yangon–Pathein	176.9	Rehabilitation
Bago–Thanlyin	99.3	Rehabilitation
Expressway (Hlegu–Bawnetgyi section)	62.3	Improvements
Expressway (Bawnetgyi–Mandalay section) excluding 65 – 184 km	403.9	Road Safety Measures
Total	**742.4**	

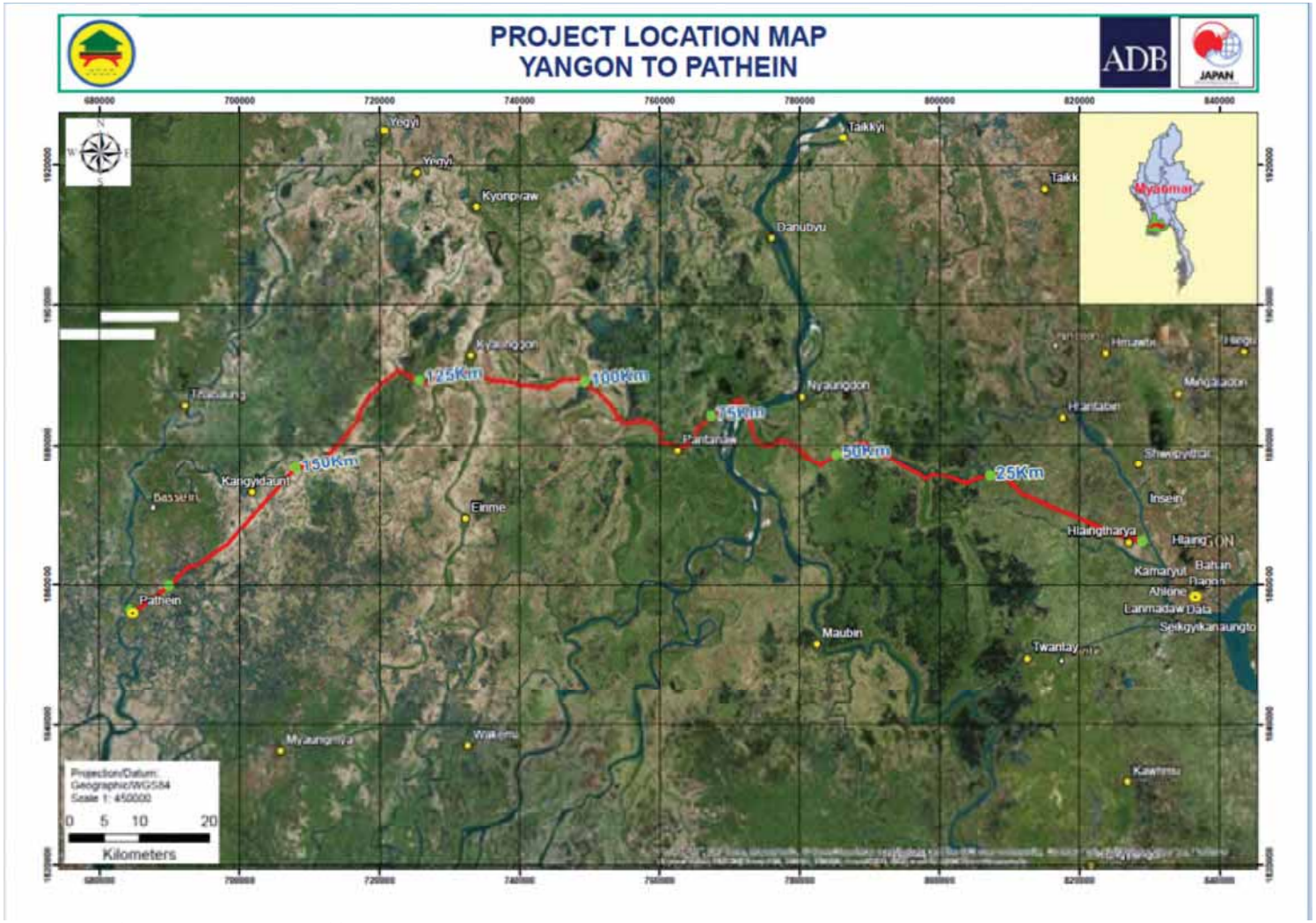
Source: Project preparatory consulting team

2.2 Rehabilitation of the Yangon–Pathein Highway

136. The Yangon–Pathein highway is the main access road for the Ayeyarwady delta region It has two lanes with a 6 to 7 m wide pavement and earth shoulders except for about 10 km in the Yangon area, where it has four lanes. Traffic reached 4,000 vehicles per day in 2016 (not including motorcycles), as compared to less than 2,000 in 2013. To accommodate medium-term traffic, the surfacing, resulting in a rough surface. It needs to be resurfaced with asphalt concrete. A 20 km section is periodically flooded and needs to be raised to enable all-year round access. Safety features, which are currently missing, should be installed.

137. The 177 km project road crosses parts of five townships, four in the Ayeyarwady region and one in the Yangon region; nine villages are scattered along the alignment (see Figure 1 and Table 2).

Figure 1: Yangon–Pathein Highway Alignment



Source: Project preparatory consulting team

Table 2: Project-Affected Regions, Townships, Villages

Township Name/No.	Number	Region	Villages
Htantabin	296	Yangon	Hlaing Tha Yar
Nyaungdon	91	Ayeyarwady	Changale Posonsu Samalauk Aungdon
Pantanaw	20	Ayeyarwady	Pantanaw Inma
Kyaunggon	10	Ayeyarwady	Kyaunggon
Kangyidaunt	7	Ayeyarwady	Kan Gwi Daunt

Source: Field surveys by project preparatory consulting team

132. **Planned Works.** The planned works are summarized in Table 3.

Table 3: Planned Road Rehabilitation Works

The Road	**Yangon – Pathein: 176.9 km** 1st tollgate on Old Bridge (Km 0.0), Yangon to intersection with Tadagyidan Road, Pathein

Planned Works	• Km0.0 – Km11.4:
	  o Asphalt-concrete overlay only
	• Km11.4 – Km148 and Km 168 to Km 179 at Pathein:
	  o Widen carriageway to 7.0 m (2-lanes, each 3.5 m wide)
	  o Add 1.5 m paved shoulders
	  o Add 1.0 m unpaved shoulder
	  o Improve road drainage
	• Km128 to Km148:
	  o Same as Km0.0 to Km148.0, plus raise embankment 2 m and include a bridge over the railway line

Overview	• The project-affected area has been intensely cultivated for 150-years • The road has been in place for nearly 30-years • The 20-km section of road embankment to be raised will require wider horizontal space to accommodate the embankment slopes • Many trees will be removed and many poles relocated • Rebuilding the embankment will require a large volume of fill material • Transport of fill material, other works traffic, and works activities will be disruptive but impacts can be prevented or reduced to acceptable levels

Source: Project preparatory consulting team

133. Rehabilitation works activities will:

- Remove trees within the planned 2-lane (7.0 m) carriageway, 1.5 m paved shoulders and 1.0 m unpaved shoulders (a combined width total of 12.0 m where the alignment is at grade) and trees that may interfere with embankment slopes
- Relocate poles and associated wiring to be outside the 12.0 m strip (and beyond the toes and longitudinal drains of the embankment)
- Relocate other utility infrastructure as required
- Remove existing macadam pavement, grind it and re-use it as fill material in the improved embankment
- Improve and widen the embankment with new fill material as necessary to accommodate the required 12.0 m strip

- Raise the embankment with new fill material over the 20 km section (Km148 to Km168)
- Install a new asphalt-concrete paved 2-lane, 7.0 m carriageway
- Install paved 1.5 m shoulders each side of the carriageway
- Improve drainage including repairing and extending culverts, adding culverts and improving lateral drainage (across the shoulders to receiving waters)
- Add road signage, markings and safety barriers where required to improve road safety
- Not alter underground or surface waters
- Not use explosives anywhere near work-sites
- Carry out works activities by following internationally accepted procedures and practices.

140. No permanent structures, except poles, require removal. However, a limited number of temporary structures will be relocated beyond the required works areas. The associated involuntary resettlement and any compensation issues are addressed in the *Resettlement Plan* for the Sub-Project (a separate report prepared for this project).

2.3 Rehabilitation of the Bago–Thanlyin Highway

141. The Bago–Thanlyin highway connects Yangon's Thilawa special economic zone with the East–West Economic Corridor, and is an important access road to a densely-populated agricultural area. The road currently has one to two narrow lanes with a 4 to 6 meter wide pavement and earth shoulders. Traffic reached 1,000 vehicles per day in 2016 (less than 400 in 2013). The road's penetration macadam surfacing is partly disintegrated and the underneath pavement is very weak. The highway should be reconstructed and widened.

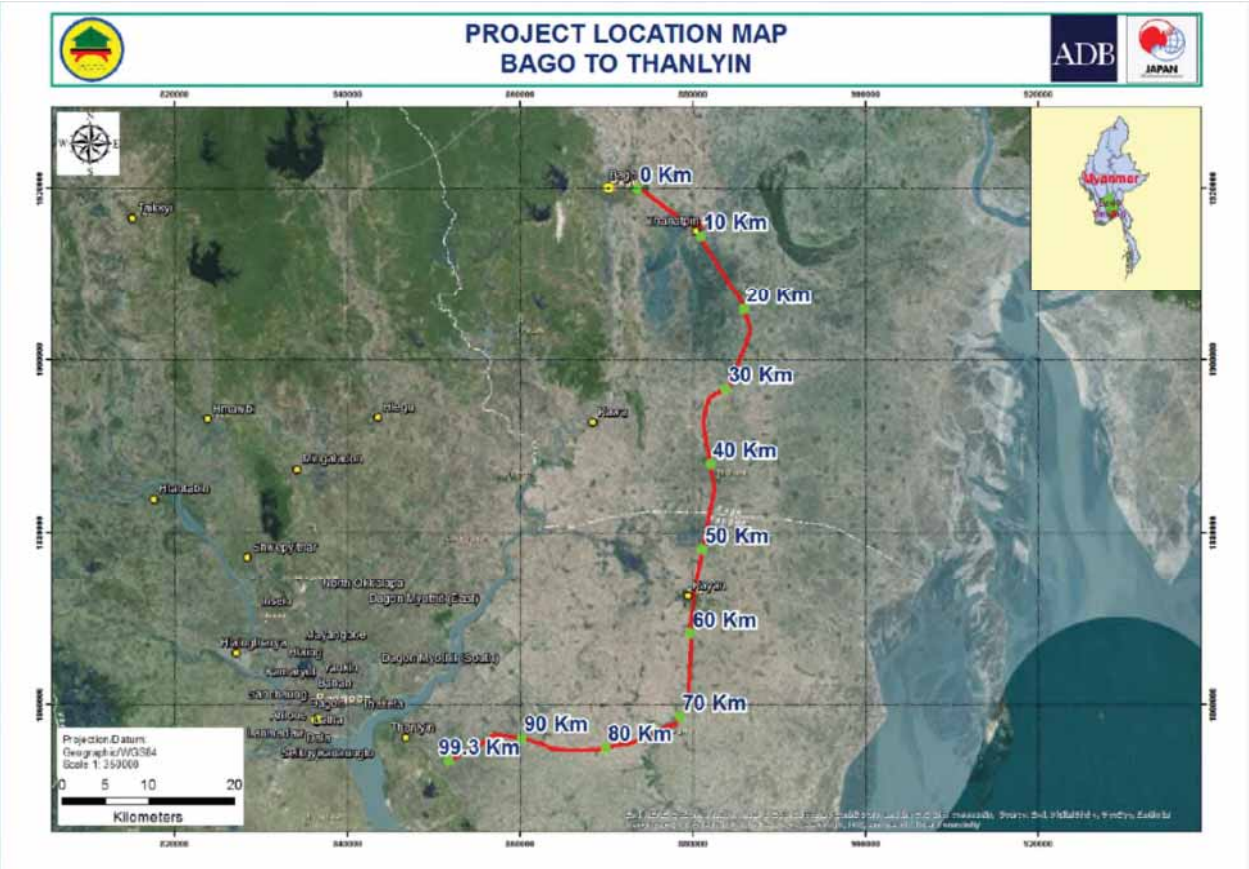
142. The road alignment stretches in a concave curve east of Bago River, from close to the center of Bago City, Bago East Region, to Thanlyin on the Bago River near its junction with Yangon River and in Yangon Region (Figure 2). The road stretches 99 km from the intersection of the alignment with Seinthalyaung Pagoda Road in Bago City, to the intersection with Thilawa Road, in Thanlyin on the outskirts of Yangon. The project-affected villages are shown in Table 4.

Table 4: Project-Affected Regions, Townships, Villages

Bago–Thanlyin Highway			
Township	**No.**	**Region**	**Towns/Villages**
Thanatpin	38	Bago	Thanatpin, Kamase
Kawa	29	Bago	Onhne, Thekkaia
Kayan	300	Yangon	Kayan
Thongwa	323	Yangon	Thongwa
Thanlyin	321	Yangon	Thanlyin

Source: Field surveys by project preparatory consulting team

Figure 2: Bago–Thanlyin Highway Alignment



Source: Project preparatory consulting team

143. The road runs east from Bago, crosses the Bago–Sittaung Canal at Thanatpin and then turns south to Thongwa before turning west towards the end of the project alignment at Thilawa in Thanlyin.

144. The Yangon and Bago rivers are influenced by tidal fluctuations which affect the fresh-water table. This is high throughout the year and floods over the land, but not the road, during the wet monsoon. The road is inefficient, deteriorating and difficult to maintain.

145. North of Ohne Hne, for about 30 km to the outskirts of Bago, the road sits on top of a raised embankment some 2.0 m above the surrounding ground. This section of the alignment does not flood but the road is too narrow for normal, safe operations and the embankment is too narrow to support a modern, 2-lane road. The embankment on which the road sits was previously a railway embankment until the nineteen forties, hence, its narrowness. The embankment will be widened. Also, over this 30 km road section, are eight, 1-lane, deteriorating bridges. They will be replaced by new, reinforced concrete bridges. South of Ohn Hne, towards Thanlyin, the bridges have already been replaced by 2-lane concrete structures.

146. **Planned Works**. Planned rehabilitation works are presented in Table 5.

Table 5: Proposed Rehabilitation Works and Works-related Issues

The Road	**Bago to Thanlyin: 99 km**
Proposed Works	• Reconstruct 15 bridges including six wooden and two Bailey bridges • Widen carriageway to 7.0 m (2-lanes, each 3.5 m wide) • Add 1.5 m paved shoulders • Add 1.0 m for unpaved shoulders • Note: The total width of the road will be 12.0 m, plus longitudinal drainage
Overview	• The project-affected area has been intensely cultivated for hundreds of years • The Bago–Thanlyin Highway alignment has been in place for more than 50 years and part of it was previously occupied by a railway line • A wider carriageway and shoulders requires a wider embankment • The embankment will be 12 m or more wide – depending on its height above grade • The wider embankment will require large amounts of new earth-works material, the transport of which will disrupt "normal" traffic • A number of trees will be removed. Those for removal will be marked • There will be an increase in noise during construction and a reduction in air quality due to dust generation during construction • There is the potential for water contamination as there is a significant irrigation canal network adjacent to the proposed construction site

Source: Project preparatory consulting team

147. Construction activities will:

- Replace the single-lane Bailey and wooden bridges in the northern section of the alignment with new 2-lane bridges
- Widen the embankment in the same northern section to accommodate the 12 m road width (see Table 5) required for the rehabilitated 2-lane carriageway, paved shoulders and unpaved shoulders (Note: because the embankment over the northern section of road is 2.0 m above grade, with a slope of 30 degrees, the base of the embankment will be 8 m wider than its top)
- Remove trees within the required 14 m-wide strip (20 m over the 30 km of road section on top of the old railway embankment in the northern part of the alignment).
- Relocate poles and associated wiring to be outside the 14 m strip (and beyond the toes and longitudinal drains of the embankment)
- Remove existing macadam pavement, crush and re-use it as fill material in the embankment
- Widen the embankment with new fill-material as necessary to accommodate the required lateral space
- Install a 2-lane, 7 m wide paved carriageway with paved shoulders 1.5 m wide
- Pave the 2-lane carriageway and paved shoulders with asphaltic concrete
- Improve drainage by repairing and adding culverts and improving lateral drainage (across the shoulders to receiving waters).
- Add 2.0 m of unpaved shoulders and longitudinal drains.

148. No permanent structures, except poles, require removal but a limited number of temporary structures will be relocated beyond the required works areas. The associated involuntary resettlement and any compensation issues are addressed in the *Resettlement Plan* (a separate report prepared for this project).

149. Contractors are expected to use typical road construction equipment, such as excavators, scrapers, graders, bitumen trucks, dump trucks, road rollers, asphalt and concrete batching

plants, concrete mixers, water trucks, and small ancillary items, e.g., water pumps, rotary hoes, sweepers and so on. Construction will be carried out following internationally accepted procedures and practices.

150. Replacement of the 8 short bridges towards the northern end of the B-T alignment will probably use cast reinforced concrete beams but the Contractor/s will determine the method based on the contract drawings. Bridge construction will be from the sides of the channels crossed.

151. There will be no alterations to underground or surface waters, and no encroachment into environmentally sensitive areas. There are no ecologically sensitive or unique natural features within the road corridor, the entire area having long been in intensive agriculture.

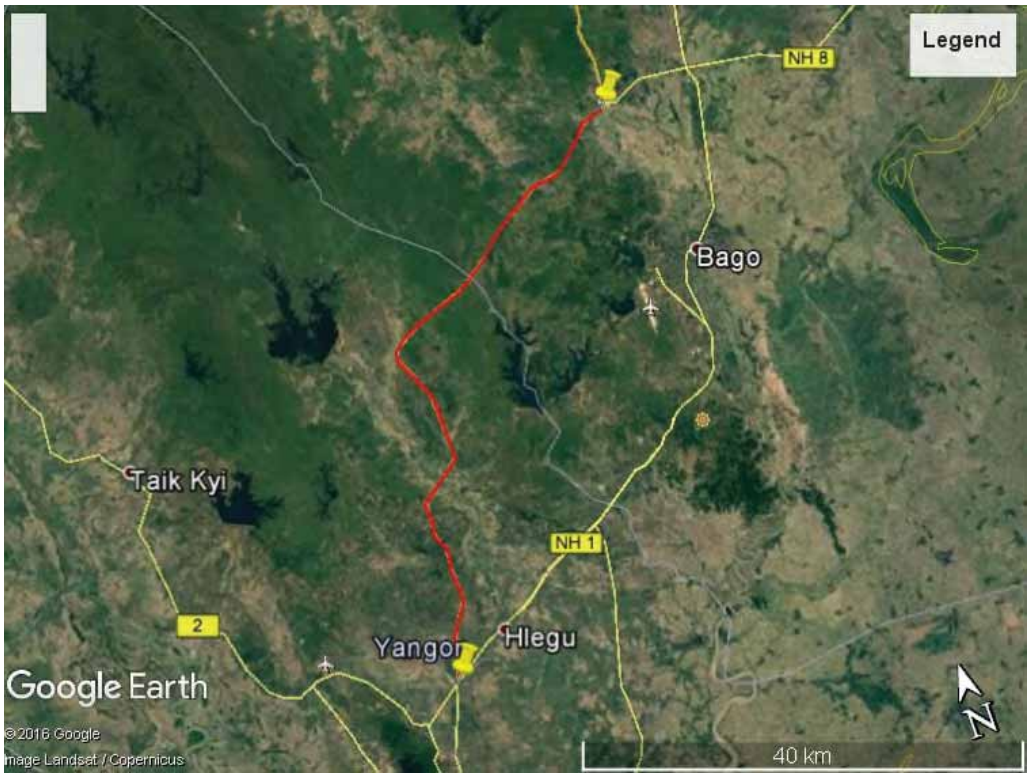
2.4 Existing Yangon–Mandalay Expressway Improvement

152. The expressway between Yangon and Mandalay was constructed without reference to generally-accepted design principles. Road crashes on the expressways kill about 150 people a year, and trucks are banned to use it because the government believes that this may be too hazardous. The government considers improving the expressway's safety a high priority, and a requirement before allowing trucks to use it. MOC requested ADB to finance improvements of the first 63 km section of the expressway, and installation of safety features on the rest of the expressway. MOC has been consulting other development partners who may be requested to finance other sections of the expressway's improvement.

153. The Expressway, known locally as "Ah Myan Lan", begins at Km 0.0, the intersection with the Old Highway, on the northern outskirts of Yangon City, and end at Km 596.2 in Mandalay. The Expressway Improvement Sub-project has the objectives to improve the first 64.4 km of the Expressway that is from Km0.0 on the northern outskirts of Yangon City to Km 62.3, the Yangon side abutment of the bridge over the Bago River south of the Baw Na Gyi Interchange (Figure 3).

154. **Safety improvement program (Bawnetgyi–Mandalay section) excluding 64–184 km).** For the remaining 404 km of the expressway 1, the improvements will generally be limited to signage and line marking, and installation of safety barriers at some critical bridge approaches. Areas prone to frequent accidents ("blackspots") will be identified, and when feasible improved under the Project. The interchange at Bawnetgyi will also be reconstructed to modern expressway standards. The pavement of the Bawnetgyi–Payagyi access road that provides access to the expressway will be improved.

Figure 3: Yangon–Mandalay Expressway: Alignment of 62.3 km-Section



Source: Google Earth

156. The section of the expressway to be improved transits townships in Yangon North and Bago Regions (Table 6).

Table 6: Project-Affected Regions & Townships

Township	Region
Hiego	Yangon North
Bago	Bago

Source: Project preparatory consulting team

157. The full expressway (596 km long) links Yangon City (Yangon) with Nay Pyi Taw, Myanmar's modern capital, and Mandalay, an ancient regional capital in the north of the country. The 62.3 km project section has an average daily traffic (ADT) count of 4,126. This is close to the ADT that travels the Expressway between Yangon and Nay Pyi Taw, the 325 km-long section of the Expressway opened in March 2009.

158. The Expressway does not meet internationally accepted design or construction standards and is unsafe to travel. The highway is 2–3 lanes each side, divided by a median. There are no paved shoulders. The structure, not counting unformed shoulders, is about 32 m wide but presents many design, structural and maintenance issues that affect the safety of the highway and require correction. They include the:

- Inconsistent number of lanes which vary from 2-lanes to 3-lanes (each and either side),

- Sub-standard radii of curvature (vertical as well as horizontal) of the pavement at several locations
- Absence of turn-out lanes at exit points and U-turns
- Very solid, poorly marked concrete barriers at the ends of the intermittent 3-lane stretches of highway
- Crenellated aptly named “crash barriers”
- Bridge abutments which constrain river flow (severely and bridge-damaging particularly in the wet monsoon)
- Sub-standard reinforced concrete used in bridge construction and their poor design causing water to damage their structural integrity
- Minimal, inconsistent safety barriers, signage and highway markings.

158. Photographs showing examples of the above structural and maintenance issues are presented in Figure 4**.**

Figure 4: Illustration of Deficiencies to be Remedied

Source: Project preparatory consulting team

159. There were 926 accidents on the expressway in 2016, 101 of them resulting in death. Most accidents involved light trucks (404 accidents) and cars (250 accidents); combined they accounted for 654 accidents in 2016 (71% of all accidents and 68% of all deaths) along the expressway.

160. **Improvements**. The planned improvement works are summarized in Table 7**.**

Table 7: Planned Improvements to 64.4 km of Expressway

Expressway section	Old Highway, Yangon Region – Baw Na Gyi Interchange, Bago Region (Km 0.0 – Km 62.3)
Planned Works	• Make consistent the number of lanes • Replace the very solid, existing concrete-block barriers with appropriate, properly designed, safer barriers, painted in reflective paint • Remove the crenellated "crash barriers" and replace them with properly designed safety barriers • Provide properly designed turn-out lanes (deceleration lanes) at exit points and U-turns • Add paved shoulders on the outside and inside edges of the carriageways • Improve the radii of curvature (vertical and horizontal) in the pavement • Modify and, in some cases, replace bridge abutments so that river-water is not forced through an un-naturally narrow channel • Repair bridges and bridge abutments • Repair the concrete pavement • Replace sub-standard reinforced concrete portions in bridges • Provide proper highway signage to international standards • Reshape the top profile of the median from concave up to concave down (to improve highway drainage and safety) • Replant the median in indigenous plant species
Overview	• Expected environmental impacts will be confined to work-sites within a 50 m strip (existing carriageways, median, plus 5 m each side to accommodate paved shoulders and/or deceleration lanes • Traffic management will be very important • The expressway is situated in a cleared strip averaging more than 100 m wide within which most expected impacts will occur, except potential accidents involving vehicles or spills of hazardous substances • Surface run-off and potential erosion will be confined to the median and shoulder/deceleration-lane work-sites • There is no agricultural land within the 100 m cleared strip • Air pollution, noise, vibration will not be greater than at present along the Expressway and they will be attenuated to negligible within the 100 m-wide cleared corridor • There are no structures and no trees to remove thus, there will be no resettlement • There are no forests, reserves, eco-systems, agricultural areas, pagodas, archaeological sites, or other areas of cultural significance within the 100 m-wide cleared corridor • Works traffic will travel along the expressway to/from work-sites and, as the expressway has excess capacity, will hardly affect other traffic along it.

Source: Project preparatory consulting team

2.5 Sources and Transport of Construction Materials

181. Embankment fill material will be difficult to source locally. The road alignment crosses deltaic, alluvial, "wet soils" with high organic content and poor compression strength making them unsuitable for road construction. Construction material will be sourced from outside the immediate area.

182. The Contractor will decide on the sources of materials but they are most likely to be obtained from commercial quarries north and/or west of the road corridor. River gravel is expected to be sourced from the Ayeyarwady River upstream from the alignment and be moved by barge to unloading sites, or drop sites near it. Sand may be obtained from the same

source. Local borrow pits may be suitable sources of silts and clays needed for blending with other materials.

183. Materials will be transported as much as possible by barge and rail to unloading areas. Final delivery to work-sites will be by truck from the unloading areas, or drop-sites.

2.6 Project Facilities, Borrow Pits, and Material Storage Sites

184. Contractors are expected to use typical road construction equipment, such as excavators, scrapers, graders, bitumen trucks, dump trucks, road rollers, asphalt and concrete batching plants, concrete mixers, water trucks, and small ancillary items, e.g., water pumps, rotary hoes, sweepers and so on. Construction will be carried out following internationally accepted procedures and practices.

185. The Contractor will be required to enter commercial arrangements for locations for its proposed construction camps, staging areas, batching plants, material stockpile sites, potential borrow sites, and construction material sites. The specific location of the sites cannot be determined in advanced, as it is dependent on the Contractor's work program.

2.7 Traffic Projections

186. The current average annual daily traffic (AADT) traffic estimates for project roads. The total AADT for Yangon–Pathein is 4,121 (mile 34) and 3,161 (mile 45). The total for Bago–Thanlyin is 1,747 (mile 4) and 992 (mile 36) as shown in Table 8.

Table 8: Estimated Current Average Annual Daily Traffic on the Project Roads

AADT	Yangon–Pathein mile 34	Yangon–Pathein mile 45	Bago–Thanlyin mile 4	Bago–Thanlyin mile 36
Personal Car incl. 4WD	1,064	1,160	451	439
Pick-up, van, small trucks <3.5 t	526	247	97	235
Medium and Large Bus	881	491	110	124
Small truck 3.5- 12 t (2 axle)	1,517	1,152	1,058	103
Truck above 12 t (3 axle)	52	50	1	7
Articulated trucks (>4 axles) and Truck trailers	82	60	29	84
Total (without motorcycles)	**4,121**	**3,161**	**1,747**	**992**

Source TA 8987 Traffic Report.

187. The predicted design traffic levels over the design life of the road are presented in Table 9.

Table 9: Recommendeded Design Traffic Levels (AADT)

Road Section	Total (without motor-cycles)	Personal Car incl. 4WD	Pick-ups, vans, small trucks < 3.5 t	Medium and Large Bus	Small truck. 3.5–12 t (2 axle)	Trucks above 12 t (3 axle)	Articulate trucks >4 axles and Truck trailers
Yangon–Pathein mile 0–12	**9,980**	4,732	717	2,157	1,215	88	241
Yangon–Pathein mile 12–34	**4,121**	1,064	526	881	1,517	52	82
Yangon–Pathein mile 34–100	**3,161**	1,160	247	491	1,152	50	60
Yangon–Pathein mile 100–112	**3,900**	1,883	503	746	451	27	18
Bago–Thanlyin mile 0–20	**1,747**	451	97	110	1,058	1	29
Bago–Thanlyin mile 20–69/2	**992**	439	235	124	103	7	84

Source TA 8987 Traffic Report.

168. In the absence of historical traffic data, and data related to the overall growth of the vehicle fleet, the projected growth is correlated with the economic growth. The forecast growth in motorization is largely determined by the forecast growth in incomes (hence GDP): other factors which might influence motorization are assessed to be fairly small by comparison. The nature of the relationship between motorization and income is assumed to lead to an eventual saturation level, and to increase more and more slowly as this level is approached, however, it has been assumed here that Myanmar would not reach such level over the analysis period, meaning before at least 10–15 years, leading to relatively high elasticity.

169. Historically, GDP in Myanmar was growing and positive in the last 5 years, with growth rates shown in Table 10.

Table 10: GDP growth in Myanmar, 2011-2015

Item	2011	2012	2013	2014	2015
GDP growth (%)	5.9	7.3	8.4	8.7	7.2

Source: ADB country reports

170. According to ADB forecast, growth is expected to continue at the pace of 8.3%–8.4% in 2016–17. GDP Annual Growth Rate in Myanmar according to “Trading Economics” is expected to be a little lower at 6.8% for this year.

171. In the long-term, the Myanmar GDP Annual Growth Rate is projected to trend around 8% till 2020, slowing down after that.

172. Countries with lower GDP, have usually higher elasticities, comprised between 1 and 2.5, while high GDP countries have their elasticities inferior to 1. Elasticity of traffic growth with GDP has thus been set here, and in absence of other indications, at the average level of 1; both for freight and passenger transport. This is also the value adopted by SMEC for the East–West corridor development project.

173. Proposed growth rates are shown in Figure 11, without any difference in growth proposed between freight and passenger transport.

Table 11: Proposed Traffic Growth for the Project

Item	2017–2020	2020–2030	After 2030
GDP growth (%)	8%	7%	6%

Source: Project preparatory consulting team

2.8 Alternatives

174. There are no alternative routes or alignments as the rehabilitation and improvements will takes place in the existing alignments. There are no technologies alternatives as the road rehabilitation and road safety improvements will use standards engineering and construction practices.

175. Contractor will have alternative for locations for its proposed construction camps, staging areas, batching plants, material stockpile sites, potential borrow sites, and construction material sites. However, the specific locations of the sites cannot be determined in advanced, as it is dependent on the Contractor's work program. Guidelines concerning the choice of locations are include in the Environmental Management Plan.

176. **Alternatives for Sourcing Construction Materials**. Contractors may choose to source materials from commercial operators and transport them to the site. Alternatively, contractors may choose to source material from local borrow pits. The impacts of each alternative are assessed in Chapter 5.

CHAPTER 3 DESCRIPTION OF EXISTING ENVIRONMENT

3.1 Yangon–Pathein Highway

3.1.1 Physical Environment

177. The entire central plain occupies a geologically ancient valley carved through sand-stones, shales, and clays overlain by a thick layer of recent alluvium carried and deposited over-time by the rivers.

178. The project-affected physical environment sits on deltaic alluvium. It is part of a typical delta, an alluvial plain formed over millions of years by the deposition of sediments carried by the Ayeyarwady River and its many distributaries.

179. The River system average discharge of 13,000 cubic meters of water per second (ranging from 32,600 m^3/s in the wet season to 2,300 m^3/s in the dry season) makes it one of the largest rivers in Asia. The Main River, with the Pathein, Pyapun, Bogale and Toe rivers as the main distributaries off it, carry large loads of sand, sediment and rocks. The carried load is deposited into the sea at or near sea-level where the rivers lose their strength along the Andaman coastal littoral. The coastline is more-or-less in equilibrium with an approximate balance between land accretion, coastal erosion and subsidence (Hedley, P. J., et al, *Geographic Journal*, vol. 176, no. 2, June 2010).

180. The Delta is bounded on the west by the southern Rakhine Yoma range and on the east by the Bago Yoma, a set of low hills on the southern end of which sits old Yangon. The Main river and its distributaries trend SW because their passage to the southeast is blocked by the low hills of the Bago Yoma. See Figure 5 and note the extensive surface waterways throughout the Delta (Myanmar Hydrology Branch, Khon Ra, 2014).

Figure 5: Main Rivers in the Ayeyarwady Delta

Source: Project preparatory consulting team

181. The main river, its distributaries, and some canals and streams in the delta are navigable. Due to the low-lying and relatively flat land, the surface water in rivers and canals is influenced by tidal movements. Dense, incoming sea water pushes under the lower density fresh water and raises water levels in the rivers. This not only facilitates wide-ranging water-transport but also unfortunately worsens the annual floods particularly during storm events.

182. Project area soils are alluvial in origin – a mixture of sand, sediment and fine clays deposited at or below water-level over thousands of years. The soils, classified collectively by FAO as Gleysol (FAO, Soil Classification System) are hydro-morphic, formed under anaerobic, water-logged conditions (Encyclopedia Britannica, 2002). Gleysols are scattered around the world where water-tables are high. When drained, they make very good agricultural land.

183. The southern part of the Delta including the Yangon–Pathein Highway corridor was mangrove forest/swamp until drained in the 1850s and turned into rice paddy during the British rule. The landscape throughout the project area was built on the rich, water-retaining soil. The land is essentially flat but slopes extremely gently to the sea and is barely above it; the maximum elevation over most of the area being less than 3 m above mean sea-level (NASA Earth Observatory, *Sinking River Deltas – Irrawaddy River*, 22 September 2009)[2]. Rice paddy now dominates the landscape and has increasingly dominated it over the past 150-years. Rice paddy now stretches across the plain shared with villages and towns surrounded by clusters of trees and other crops.

184. The Ayeyarwady Delta lies in the humid tropics. There is a marked wet season of 6–7 months of heavy rainfall interspersed with short humid breaks from April through October during which there is about three meters of rain. This is followed by 5-months with very little rain (under 100 mm) during the dry, cooler period from November through March. Table 12 shows 10-year average rainfall data from two meteorological stations near the road corridor.

Table 12: Project Area Annual & Monthly Precipitation (Years 2004/14) in mm

Met Station	Annual	Max.	Min.	Nov.–Mar.	Apr.–Oct.
Yangon	3,050	775 – Jul	3 – Feb	93	2,957
Pathein	3,366	836 – Jul	3 – Feb	81	3,285

Source: Dept. Meteorology and Hydrology (*Myanmar Statistical Yearbook*, 2015)

185. The 10-year data above is complemented by a Department of Meteorology and Hydrology examination of rainfall variability over 51-years, 1950 to 2000. Relative to most other parts in Myanmar, the total annual rainfall at the Yangon and Pathein meteorological stations are among those recording the least rainfall variability in the country. Table 13 presents 51-year rainfall data for Yangon and Pathein.

Table 13: Annual Rainfall Variability in Yangon & Pathein (Years 1950/2000) in mm

Met Station	Highest	Lowest	Mean	Std. Deviation	No. Years "normal" Rain
Yangon	3,523	1,995	2,686	350	44 out of 51
Pathein	3,644	1,891	2,855	391	43 out of 51

Source: Dept. Meteorology & Hydrology Data, Yangon

[2] at http://earthobservatory.nasa.gov/IOTD/view.php?id=40257

186. The water table lies close to the land surface much of the year, over-topping it frequently during the wet Monsoon months from June through September. The normal annual cyclical surface sheet-flooding not only supports production of two rice crops per year but also replenishes soil nutrients via the deposition of sediment carried in the swollen rivers.

187. It is notable that 96% of the annual rain occurs during April–October – a period to be avoided as much as possible with earthworks construction. In contrast, only 4% of the annual rain falls during November–March.

188. There are no available data on air quality and noise in the project-affected area. However, the road alignment is not affected by hills/valleys and essentially crosses a flat landscape located a few km from the sea. The current average traffic count is little over 3,000 vehicles per day and there are no significant emission sources in the agricultural setting. The three factors suggest high local air quality with low concentrations of sulfur dioxide, nitrogen dioxide and particulate matter. Noise data are similarly lacking and the ambient noise levels are similarly low. Base-line noise and water quality testing will be undertaken prior to project commencement.

189. The Natural Hazards Risk Map of Myanmar (*UN, OCHA, 2011*), shows that the project area lies within tropical storm intensity zone 1. On 2 and 3 May 2008, Nargis, a category 3 cyclone struck the Ayeyarwady and nearby regions causing widespread damage. Thirty-seven townships were affected and there were 84,500 deaths caused by winds that reached 200 kph and the associated heavy rain and storm surge as high as 3.6 m. Although not affecting the project directly, Myanmar has a low-level of resilience to natural disasters. Resilience will be improved by having reliable, all-weather road access.

190. In tropical coastal regions, the rise in global air-temperature is expected to cause an increase in the frequency and magnitude of seasonal floods and sea-based storm events.

191. The project area lies west of the Sagiang Fault Zone where the risk of major earthquake is less than closer to the Fault but experts warn that areas of soft, wet soil may be subject to serious shaking in a major earthquake (Santi Pailoplee, *Journal of Earthquake and Tsunami,* 07/04, Nov. 2013).

192. The road comprises 42 existing bridges from 6 m to 1495 m of length crossing major rivers, irrigation canals and streams. The list is given in the following Table 14. Additionally, there are 10 major box culverts (over 3 m opening) and 27 minor box culverts.

Table 14: List of Existing Bridges (Yangon–Pathein Road)

Station	Name	Type of superstructure	Carriage-way width (m)	Footway width (m)	Width between parapets (m)	Height (m)	Overall length (m)	Span distribution / opening (m)	Deck length (m)
14+392		RC girders	8.25	1.00	10.25	5.00	26.00	18.00	20.00
18+756		RC girders	7.75	0.60	8.95	3.50	15.00	8.00	10.00
19+137		Composite	9.00	0.60	10.20	4.00	17.00	12.80	14.80
19+822		Composite	7.50	0.60	8.70	3.50	20.00	12.00	14.00
21+740		RC girders	8.50	1.00	10.50	4.00	24.00	16.00	18.00
23+268	Ma Shwe Eu	RC girders	8.50	1.00	10.50	4.80	13.00	11.50	13.50
26+160		RC girders	6.70	0.60	7.90	5.00	24.00	16.50	18.50
28+354	Pen Taing	RC girders	7.50	1.00	9.50	6.00	24.50	17.00	19.00
34+768	Me Za Li	Steel truss	7.30	0.45	8.20	11.00	83.50	16.30+36.00+16.30	70.60
47+948		RC girders	8.50	1.00	10.50	5.00	20.00	14.00	16.00
50+197	A Thing Su	RC girders	8.50	1.00	10.50	4.50	15.50	10.50	12.50
52+780	Ka Zen	RC girders	11.10	0.75	12.60	2.80	15.00	15.00	17.00
60+488	Kyon Ta Mar	RC girders	8.50	1.00	10.50	4.50	28.00	19.00	21.00
61+305	Lin Lun Pin	RC girders	8.50	1.00	10.50	5.00	64.50	3x18.00	54.00
63+520	Me Chaung Ai	RC girders	8.50	1.00	10.50	6.00	45.50	2x17.50	37.00
63+970	Hart Sai	RC girders	8.50	1.00	10.50	6.00	45.50	2x17.00	36.00
64+262	Gaw Du	RC girders	8.50	1.00	10.50	6.00	45.00	2x17.00	36.00
65+921	Htape Wa Lay	RC girders	8.50	1.00	10.50	6.00	20.00	17.00	19.00
66+515	Out Su	RC girders	8.50	1.00	10.50	6.50	60.00	3x17.00	51.00
68+125	Bo Myat Htun (Irrawaddy, 1999)	Steel truss	7.60	3.20	14.00	50.00	1 900.00	16x18.30+16x50+22x18.30	1 495.00
82+331	Mar Lar Yoe	RC girders	7.30	1.00	9.30	4.50	22.50	14.00	16.00
83+279	Bal De	Steel truss	7.30	0.45	8.20	10.00	57.00	41.50	43.50
86+448	Ka Wel	Steel truss	7.30	0.45	8.20	5.00	37.00	36.00	38.00
87+401	Set Taing Yoe	Composite	7.30	0.20	7.70	3.50	14.00	13.00	15.00
87+972	Ai Zouth	Steel truss	7.30	0.45	8.20	6.50	37.50	36.00	38.00
89+789	Nga Phal Ga Yet	RC girders	7.30	0.30	7.90	4.50	12.40	10.00	12.00
90+673	Kyon Ka Naung	Steel truss	7.30	0.45	8.20	7.00	72.80	16.00+36.00+16.00	70.00
92+899	Pa Thwe	Steel truss	7.30	0.45	8.20	13.50	133.00	9.00+3x36.00+9.00	128.00
99+436	In Ma	Steel truss	7.30	0.45	8.20	7.50	72.40	16.00+36.00+16.00	70.00
101+243	Aung Min Ga Lar	RC girders	8.50	1.00	10.50	5.80	24.20	2x11.00	24.00
114+446		RC girders	8.50	1.00	10.50	4.50	9.70	7.70	9.70
117+891		RC girders	7.55	1.50	10.55	7.90	10.80	9.00	11.00
118+050	Kyaung Gon (1989)	Steel truss	7.30	1.80	10.90	15.00	185.00	17.00+4x36.00+17.00	180.00
126+332	Thel Kong	RC girders	8.50	1.00	10.50	7.50	96.00	5x18.00	90.00
130+808	Hle Seike	RC girders	8.50	1.00	10.50	7.60	47.00	3x13.30	39.90
142+008		RC girders	6.70	0.60	7.90	4.50	20.00	11.50	13.50
144+744	Der Ka	RC girders	8.50	1.50	11.50	14.20	425.00	5x18.00+[8x12.00+7x18]+6x18	413.00
147+749	Kyaine Chaung	RC girders	8.50	1.00	10.50	8.50	38.70	2x15.00	32.00
148+968		RC girders	8.20	0.30	8.80	5.00	13.30	11.00	13.00
161+621		Plain RC slab	7.30	0.60	8.50	2.00	3.50	2x7.00	16.00
170+496	A Pin Hnit Sal	RC girders	8.00	1.00	10.00	10.00	73.40	5x13.00	65.00
172+513	Koe Su	RC girders	8.50	0.60	9.70	6.00	34.50	2x13.00	26.00
									3 468

Source: Field surveys by project preparatory consulting team

123. Following the inspections carried-out in December 2016 and January 2017, five bridges are considered beyond repair and need reconstruction. They are highlighted in red in the previous table. In addition to the bridges to be reconstructed, a new flyover is planned to be built at chainage 147+125 in order to eliminate the railway at-grade crossing.

124. Major bridges and their environs are shown in Figures 6 to 14.

Figure 6: Me La Zi Bridge over Canal East of Ma Za Li (Chainage 34+768)

Source: Google Earth

Figure 7: Road across sluice gate west of Ma Za Li (around Chainage 36 km)

Source: Google Earth

Figure 8: Bo Myat Htun Bridge across Ayeyarwady River (Chainage 68+125)

Source: Google Earth

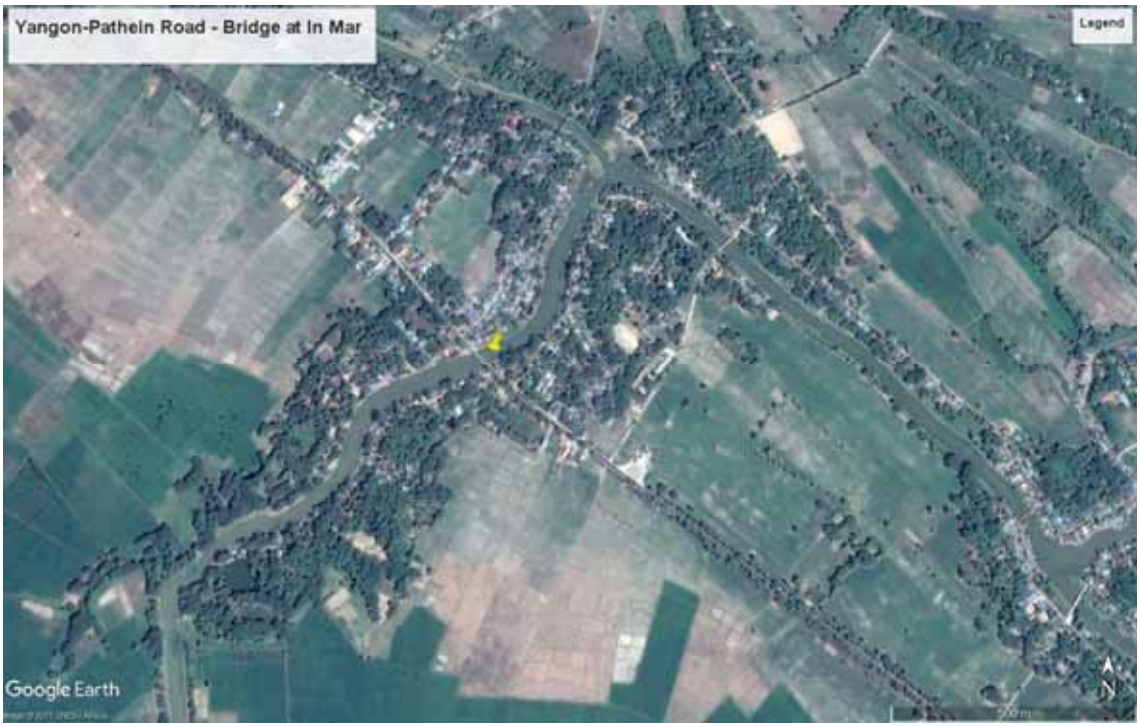
Figure 9: Kyon Ka Naung Bridge (Chainage 90+673)

Source: Google Earth

Figure 10: Pa Thwe Bridge (Chainage 92+899)

Source: Google Earth

Figure 11: In Ma Bridge (Chainage 99+436)



Source: Google Earth

Figure 12: Kyaung Gon Bridge (Chainage 118+050)

Source: Google Earth

Figure 13: Thel Kong Bridge (Chainage 126+332)

Source: Google Earth

Figure 14: Der Ka Bridge (Chainage 144+744)

Source: Google Earth

125. **Flood Prone Sections.** The only section of road that is flood prone is the stretch between Km 128 to Km 149. There are some serious flooding areas and cross drainage structures that must be rehabilitated so that there is capacity adequate to balance any differential flooding. During the 2016, the Oriental Highway Corporation reported flood levels between 0.15 m to 0.75 m along this section of the highway.

126. The project will raise the embankment as much as 2 m in the worst flood affected sections between Km 128 and Km 148.

3.1.2 Biological Environment

127. The project affected biological environment is bereft of natural, indigenous flora and fauna except for migratory birds using the delta area seasonally. There are no forests, protected areas or mangrove areas and no special status trees, endangered species, or threatened eco-systems.

128. The environmental setting in the road corridor is intensely developed agricultural landscape dominated by rice paddies with small clusters of bamboo, banana, coconut and other fruit trees and small vegetable gardens around settlements.

129. Much of the roadside (under DOH/MOC jurisdiction) has been heavily planted in Teak trees (local name Kyun Thit) by the Department of Forestry (DOF). Many have been planted recently. Those that impact the safe use of the road and works requirements will be removed to make way for the road rehabilitation; see Figure 15.

Figure 15: Teak Trees along a Section of Yangon–Pathein Highway

Source: Field surveys by project preparatory consulting team

200. Other roadside trees of community interest include Koak Ko (Albizzia lebbek), Tamarind (Tamarindus indica, local name Ma Gyee), Acacia (Acacia leucophloea, local name Htar Naung Pin) and Eucalyptus (Eucalyptus, local name Eucalit) trees. Some trees along short stretches of the road, particularly Koak Ko and Tamarind, are old, large and very close to the road. Those in the way of planned paved shoulders and clearly presenting safety risks will be removed. Those that can be kept will be kept. There are many other tree species represented along the alignment; these are listed in Table 15.

Table 15: Common & Botanical Names of Trees Observed along Yangon–Pathein Highway

Burmese Vernacular Name	Botanical Name
Ba Dan Pin	Leucaena glanca
Baw Sa Gin	Terminalia catappa
Eucalit	Eucalyptus
Hta Naung Pin	Acacia leucophloea
Htan Pin	Borassus flaballifer
Koak Ko	Albizzia lebbek
Kyoon Pho	Premna pyramidata
Lan Tamar	Polythia longifolia
Ma Gyee	Tamarindus indica
Mai Sai Lee	Broussouetia papyrifera
Acacia mangium	Malaysia padauk
Ngu Pin	Cassia fistula
Pa Dauk	Pterocarpus macrocarpus
Sain Pan	Delonix regia
Swai Taw	Bauhinia
Ta Mar	Azadirachta indica
Ta Yoye Sa Gur	Plumeria alba
War Pin	Bamboosa sp.

Source: Project preparatory consulting team

201. Where and when appropriate compensation will be paid and/or new trees will be planted as replacement-trees after the main works have been completed will be determined in consultation with the Forest Department and the respective townships.

3.1.3 Socio-Economic

202. Humans have used the area along and around the Yangon–Pathein Highway corridor with increasing intensity for over 150 years. The road corridor is now entirely in rice cultivation with small patches of other agricultural production and small to medium-sized villages spaced along and near the road. Before the road, completed in 1988, settlements clustered near the railway and used it and water-transport to get around. Today the intensity of agricultural production is everywhere apparent.

203. **Land Use.** The area is rural. Rice cultivation dominates economic activity with two rice crops annually facilitated by irrigation over most of the delta, known as Myanmar's "rice granary". From satellite images (Google, on-line *Earth Satellite Images*) rice paddies cover more than 95% of the land surface and there are very few buildings between the towns and villages along the road (see Table 16).

Table 16: Dominant Land Use along the Yangon–Pathein Highway Corridor

Location (Chainage)[3] (km)	Dominant Land Use
0.0 to 8.2 km	Residential and industrial
8.2 to 33.5	Rice paddy
33.0 to 35.2	Residential and commercial
35.2 to 40.6	Rice paddy
40.6 to 45.3	Residential and commercial
45.3 to 79.6	Rice Paddy
79.6 to 82.0	Residential and commercial
82.0 to 97.8	Rice Paddy
97.8 to 98.8	Residential and commercial
98.8 to 102.3	Rice paddy
102.3 to 104.8	Residential and commercial
104.8 to 115.2	Rice paddy
115.2 to 117.2	Residential and commercial
117.2 to 143.4	Rice paddy
143.4 to 145,5	Residential and commercial
145.5 to 173.4	Rice paddy
173.4 to 176.9	Residential and aviation

Source: Project preparatory consulting team

204. More than 60% of the working age population is engaged in rice production. Other primary employment activities include animal husbandry, market-gardening, fruit-growing and pond aquaculture. Crops such as: bananas, maize, sesame, pea-nuts, sunflower, beans and, of course, table-vegetables, are produced for local use and for sale at market, mostly in Yangon.

205. The rehabilitated and improved road with increased service capacity to provide reliable, lower cost and quicker goods transport to Yangon at one end of the alignment and to Pathein at the other, will undoubtedly lead to enhanced economic opportunities including encouraging an increase in market gardening.

206. Non-farm locally employed workers find employment in farm-support services such as materials and equipment supply and services, truck, bus, rail and water transport and the associated vehicle and equipment supply, servicing and maintenance. At the Yangon and

[3] From commencement of project at 1st Toll Gate

Pathein ends of the alignment a small but increasing proportion of people work in the peripheries of these cities and more can be expected to work there when the road rehabilitation has been completed by 2022 and many youth reach maturity and seek employment.

207. The population density is relatively high and has been increasing rapidly in recent years. The combined population of the five project-affected townships was, at latest count, 937,796 people with 491,633 of them (52.4%) under 18-years of age (Township data, Dec 2016). The very high proportion of young people testifies to a veritable population explosion over the past two decades and the urgent need for job generation programs.

208. There are few commercial areas and these tend to be small, very localized and clustered around intersections with feeder road or around bridge sites, for example the road-side area at about Km 33. Along the road and in the larger settlements there are also small clusters of building suppliers and small-scale fabricators of concrete and welded products that may be able to participate in road rehabilitation works.

209. The project area is served by rail, road and water transportation. The road dominates. Frequent large, small and mini-buses ply the Yangon–Pathein Highway and points in between. They are complemented by village-based taxi services, privately owned farm-trucks and an increasing number of privately owned cars and motor-bikes. Barges along the canals, Main River and its distributaries carry large volumes of bulk goods. Small boats and canoes operating on canals carry people, harvested rice, other crops and small goods to central transfer points. And trains along the rail-line linking Yangon and Pathein carry people, goods and bulk materials.

210. The area is served by government operated electricity supply (most private companies also have generators) and by government-operated cell phone service.

211. **Human Values, Social and Cultural Issues:** In the 2014 Census households were asked to indicate which modes of transport were available in each household (see Table 17. Some households had more than one mode of transport available whilst others had none; hence the total percentages for a township can be less than or greater than 100%. In all townships the predominant transport modes are motor cycle/mopeds and bicycles. Bullock carts remain a significant transport mode in rural townships as does water transport. It was observed during surveys on the road that bullock carts were not sighted whilst the other modes of transport were.

Table 17: Conventional Households by Availability of Transportation Items

Township	Conventional Households	Car/ Truck /Van	Motorcycle/ Moped	Bicycle	4-wheel Tractor	Canoe/boat	Motor Boat	Cart (Bullock)
Yangon Region[1]								
Htantabin	34,211	1.2	18.7	35.3	2.9	11.8	4.9	13.2
Ayeyarwady Region[2]								
Nyaungdon	51,201	0.7	23.9	44.4	4.1	17.0	5.6	10.4
Pantanaw	60,277	0.8	21.5	52.6	4.9	24.3	5.7	9.9
Kyaunggon	41,402	0.4	20.7	49.7	5.0	7.8	1.0	13.5
Kangyidaunt	42,966	0.6	17.4	34.6	2.6	14.8	5.4	13.9
Pathein	66,036	2.5	35.4	50.1	1.1	5.9	3.0	7.7

[1] Adapted from: Republic of Myanmar, Ministry of Immigration and Population, The 2014 Myanmar Population and Housing Census: Yangon Region, Census Report 3-L, May 2015, Table J6.
[2] Adapted from: Republic of Myanmar, Ministry of Immigration and Population, The 2014 Myanmar Population and Housing Census: Ayeyarwady Region, Census Report 3-N, May 2015, Table J6.
Source: Project preparatory consulting team

212. Human cultural issues of significance are not apparent in structures along the alignment or close to it. No pagodas, schools, recreational structures or parks, or archaeologically important areas will be affected by the road rehabilitation, nevertheless, the EMP addresses nuisance factors such as noise, vibration and localized air-pollution.

213. Despite a literacy rate above 95% (except in Htantabin township where it is reported to be just 75%) and the above mentioned economic activities, poverty presents a serious issue to some 16% (Htantabin) to more than 25% (Kangyidaunt) of the population (Township data, Dec 2016). Several NGOs are actively addressing this and health issues in the area.

214. Health in the area is somewhat problematic. Care is provided by township hospitals and many clinics. Most people get their water from tube-wells and have access to latrines or toilets. But endemic, chronic diseases such as: malaria, dengue fever and dysentery/diarrhea are overlain by more modern acute diseases such as: hypertension, diabetes, cirrhosis of the liver and occasional cases of TB.

215. Sensitive Receptors along the Yangon–Pathein Highway are provided in Table 18.

Table 18: Sensitive Receptors on Yangon–Pathein Highway

No.	Receptor	Approximate Location (Chainage) from Start of Road (km)	Distance from Current Edge of Pavement (m)	Distance from Current Center-line (m)
1	Hospital	10.6	41	45
2	Secondary School	11.4	23	27
3	Monastery & Temple	11.4	23	27
4	Monastery	13.5	41	45
5	Monastery	14.0	41	45
6	Monastery	16.8	37	41
7	Religious Center	24.4	8	12
8	Monastery & Temple	34.6	41	45
9	Monastery & Temple	37.0	19	23
10	Primary School	37.0	30	34
11	Primary School	38.2	30	34
12	Church	38.8	30	34
13	Monastery & Temple	39.2	30	34
14	Monastery & Temple	40.4	30	34
15	Primary School	41.5	19	23
16	Monastery	41.5	19	23
17	Village Health Center	42.4	19	23
18	Church	42.4	20	24
19	Temple & Religious Center	44.3	25	29
20	Primary School	44.6	15	19
21	Monastery (x2) & Temple	44.6	15	19
22	Temple & Religious Center	44.9	25	29
23	Community Center	45.0	8	12
24	High School	45.3	11	15
25	Primary School	45.6	9	13
26	Monastery	45.6	9	13
27	Hospital	45.9	28	32
28	Higher Primary School	53.0	25	29
29	Monastery & Temple	55.6	19	23
30	Teaching Center	57.6	28	32
31	Secondary School	59.7	4	8
32	Village Health Center	59.7	41	45
33	Monastery & Temple	60.3	41	45
34	Secondary School	71.1	28	32
35	Monastery & Temple	71.1	28	32
36	Village Health Center	74.3	7	11
37	Monastery	74.4	200	204
38	Monastery	74.7	25	29
39	Primary School	76.0	30	34
40	Temple	79.0	200	204
41	Monastery & Temple	80.4	33	37
42	Retirement Home	80.8	40	44
43	Monastery & Teaching Center	80.9	40	44
44	Secondary School	83.0	33	37
45	Temple	83.0	33	37
46	Temple	84.1	150	154
47	Temple	96.6	50	54
48	Primary School	96.8	19	22.5

No.	Receptor	Approximate Location (Chainage) from Start of Road (km)	Distance from Current Edge of Pavement (m)	Distance from Current Center-line (m)
49	Monastery & Temple	97.5	100	103.5
50	Hospital	99.2	30	33.5
51	Higher Primary School	103.0	18	21.5
52	Village Health Center	103.0	18	21.5
53	Monastery	105.2	12	15.5
54	Village Health Center	105.4	14	17.5
55	Church	105.4	23	26.5
56	High School	105.7	20	23.5
57	Monastery & Temple	107.2	20	23.5
58	Primary School	108.7	50	53.5
59	Temple & Monastery	109.7	22	25.5
60	Temple	115.8	32	35.5
61	Secondary School	120.0	36	39.5
62	Monastery	120.0	45	48.5
63	Monastery	121.5	36	39.5
64	Monastery	129.5	100	103.5
65	Temple	130.5	80	83.5
66	Primary School	131.1	14	17.5
67	Primary School	134.6	19	22.5
68	Monastery	134.6	23	26.5
69	Primary School	137.6	40	43.5
70	Temple	143.6	30	33.5
71	Temple	161.7	50	53
72	Temple	161.8	40	43
73	Monastery	162.4	15	18
74	Church	165.0	10	13
75	Monastery & Temple	166.6	15	17.75
76	Nursery & High School	166.9	15	17.75
77	Monastery	167.5	20	23
78	Primary School	169.5	20	23
79	Monastery	169.5	20	23
80	Monastery	172.3	13	16
81	Secondary School	172.5	16	19.75
82	Monastery	175.2	9	16.3
83	High School	175.8	7	14.3
84	Monastery	176.2	7	14.3
85	School	176.3	7	14.3
86	Monastery	176.8	9	16.3
87	Polytechnic School	177.0	13	17.5
88	Small Temple	177.8	3	10

Source: Field surveys by project preparatory consulting team

218. A detailed measurement survey (DMS) of affected households within the corridor of impact undertaken as part of the project preparation. All affected households are located within the existing right of way and no gardens, fruit bearing trees were affected. Roadside trees along the road corridor are in the ownership of the government.

3.2 Bago–Thanlyin Highway

217. The alignment runs across “flat” land in rice paddy. The water table is close to ground level. The towns and main villages along the route cluster close to the road. The towns show, via the age of Pagodas in their midst, e.g., Khayan, that the area has been intensely cultivated for a long time and population density testifies to the area’s productivity. Intense cultivation is possible due to fertile soil deposited as sediment in this deltaic area. In the northern area, rice paddy cultivation is being replaced by commercial fish farms and associated poultry farms. These are mainly located adjacent to the project road because of ease of access to the market.

218. The landscape and environmental setting vary little along the entire alignment. There are few trees visible across the floodplain except around villages where they are often close to the road.

219. The area is serviced by a number of irrigation canals with the most important being the Bago–Sittaung Canal that the road crosses at Thanatpin as well as a number of creeks. As discussed below the road alignment crosses irrigation canals and minor streams at 28 locations. The canals are used for irrigation and water transport using canoes or small long-tailed boats. The current water quality needs to be assessed.

220. During the field inspection, air quality appeared to be generally good as there is very little industry in the area and the number current number of vehicles using the road is currently 1,000 per day or less. Pollution from motorized water craft also expected to be low due to their small number. The current air quality needs to be assessed.

3.2.1 Physical Environment

221. The entire central plain of Myanmar occupies a geologically ancient valley carved through sand-stones, shales, and clays overlain with more recent alluvium carried and deposited over-time by the rivers. The principal river, the Ayeyarwady drains 60% of Myanmar, carries huge amounts of sediment and has done so for millions of years. In the Pleistocene Period, the Sittaung (Sittang) and Bago rivers east of Bago Yoma, the low hills on which at their southern end sits Old Yangon, and east of Yangon River, have continued to shape the now separate Bago Delta (*Encyclopedia Britannica*, 2009).

222. The project-affected physical environment is a typical delta, an alluvial plain, formed by the deposition of sediments, carried over millions of years. Hence, project area soils are alluvial in origin – a mixture of sand, sediment and fine clays deposited at or below water-level over thousands of years. The soils, which formed under water in coastal mangrove swamps, are hydro-morphic, classified collectively by FAO as Gleysol (FAO, Soil Classification System). Such soils are found in many locations around the world. Formed under anaerobic, water-logged conditions, when drained, they make very good agricultural land (*Encyclopedia Britannica*, 2002).

223. The Bago Region including the road corridor has for hundreds of years been a rich rice-growing area. It was exporting rice in the 15th Century. Throughout the project area the landscape was built on the rich, water-retaining soil. The land is essentially flat but slopes extremely gently to the sea and is barely above it; the maximum natural elevation in the road corridor being less than 3 m above mean sea-level. Rice paddy dominates the landscape

shared with villages and towns surrounded by and incorporating clusters of trees and other crops.

224. **Climate** The entire delta area in mid-Myanmar lies in the humid tropics. There is a marked wet season of 6–7 months of heavy rainfall interspersed with short humid breaks from April through October during which the rainfall often exceeds 3.0 m. This is followed by 5-months with very little rain during the dry, cooler period from November through March. Table 19 shows 10-year average rainfall data from two meteorological stations near the road corridor.

Table 19: Annual and Monthly Precipitation in mm (Years 2004/14)

Meteorological Station	Annual	Max. & Month	Min. & Month	Nov.–Mar.	Apr.–Oct.
Yangon	3,050	775 (Jul)	3 (Feb)	93	2,854
Bago	2,947	671 (Jul)	1 (Feb)	104	3,264

Source: Dept. Meteorology & Hydrology (p. 6, *Myanmar Statistical Yearbook, 2015*

225. The 10-year data above is complemented by a Department of Meteorology and Hydrology examination of rainfall variability over 51-years 1950 to 2000. Yangon and Bago are among the regions in Myanmar with the least rainfall variability. Table 20 presents 51-year rainfall data for Yangon and Bago.

Table 20: Annual Rainfall at Yangon & Bago and its Variability – mm (51 Years, 1950/2000)

Meteorological Station	Highest	Lowest	Mean	Std. Deviation	No. Years "normal" rain
Yangon	3,523	1,995	2,686	350	44 out of 51
Bago	4,188	2,083	3,182	437	46 out of 51

Source: Dept. Meteorology & Hydrology Data, Yangon

226. The water table lies close to the land surface much of the year, over-topping it from June through September. The normal annual cyclical surface sheet flooding not only supports production of two rice crops per year but also replenishes soil nutrients via the deposition of sediment carried in the swollen rivers. Normal flooding occurs frequently during the wet Monsoon months of June, July, August and September and sometimes in May and October.

227. It is notable and very important for the project that only 3.2% of the annual rain falls during November–March, the dry season during which site preparation and earth-works should be concentrated. In contrast, more than 96% of the annual rain occurs during April–October. Therefore, site preparation and earth-works should be avoided as much as possible from April to the end of October.

228. The Natural Hazards Risk Map of Myanmar (UN, OCHA, 2011), shows that the project area lies within tropical storm intensity zone 1. On 2 and 3 May 2008, Nargis, a category 3 cyclone struck mid-Myanmar including the Yangon and Bago regions causing widespread damage. Thirty-seven townships were affected and there were an estimated 84,500 deaths caused by winds that reached 200 km/h and the associated heavy rain and storm surge as high as 3.6 m.

229. The NAPA Report (*Myanmar's National Adaptation Programme of Action (NAPA) to Climate Change, 2012*) includes the following climate change projections for Myanmar:

- “an increase in the temperature across the whole country, particularly from December to May with the Central and Northern regions experiencing the greatest increases;
- “an increase in clear sky days exacerbating drought periods;
- “an increase in rainfall variability during the rainy season including an increase across the whole country from March to November (particularly in Northern Myanmar), and decrease between December and February;
- “an increase in the risk of flooding resulting from a late onset and early withdrawal of monsoon events;
- “an increase in the occurrence and intensity of extreme weather events, including cyclones/strong winds, flood/storm surge, intense rains, extreme high temperatures and drought.”

230. **Air Quality and Noise***:* There are no available data on air quality in the project- affected area. However, the road alignment crosses an agricultural area not affected by hills or valleys and essentially crosses a flat landscape a few km from the sea. The current average annual daily traffic (ADDT) count along the B-T road alignment is about 1,750 is the busiest sections. There are appear to be few other emission sources. Also, the flat terrain, agricultural setting and absence appear of large urban clusters enables air to dissipate. Noise data are similarly lacking and the ambient noise levels are similarly low.

231. The project area lies close to the Sagiang Fault Zone where there is risk of earthquake and, as soft, wet soil predominates, may be subject to serious shaking in a major earthquake (Santi Pailoplee, *Journal of Earthquake and Tsunami,* 07/04, Nov. 2013). Also, the article points out that Myanmar has a low-level of resilience to natural disasters. Resilience will be improved by having reliable, all-weather, quick road access.

232. **Water:** The existing alignment crosses irrigation canals and minor streams by way of 28 existing bridges from 9 m to 68 m in length. The list is given in Table 21. Additionally, there are two major box culverts (over 3 m opening) and 56 minor box culverts. Following the inspections carried-out in December 2016 and January 2017, 15 bridges, narrow and in poor condition, need to be reconstructed. They are highlighted in red in Table 21.

233. The road cross-section continues across the bridges without reduction in width: two lanes of 3.50 m + 2 shoulders of 1.50 m which is 10 m between curbs. Footways are provided beyond the shoulders. Parapets consist of reinforced concrete barrier. In order to speed-up the construction and enable cost-savings, standard girders of 10 m, 12 m, 14 m and 16 m are adopted, in single or multi-spans layout depending of the desired length. The deck consists of 25 precast pre-tensioned girders topped by a cast-in situ reinforced concrete slab.

Table 21: List of Existing Bridges (Bago–Thanlyin Highway)

Station	Name	Type of superstructure	Carriage-way width (m)	Footway width (m)	Width between parapets (m)	Height (m)	Overall length (m)	Span distribution / opening (m)	Deck length (m)
8+998		RC girders	6.70	0.95	8.60	12.00	67.20	3x18.50+6.00	61.50
12+277	Thein	Pretensioned hollow girders	7.30	1.00	9.30	5.20	27.50	2x12.00	24.00
15+929	Ka Laing	Steel truss	5.00	0.45	5.90	7.60	32.40	32.00	32.00
19+205	Sein Ner Cut	Plain RC slab	6.55	0.75	8.05	4.50	21.40	3x6.00	18.00
22+347		RC girders	7.30	0.90	9.10	4.50	19.60	19.50	19.50
24+036		Steel girders/wooden deck	4.00	0.00	4.00	4.50	21.00	3x7.00	21.00
28+126		Steel girders/wooden deck	4.00	0.00	4.00	6.40	29.50	4x7.35	29.40
29+401	Kha Mel Pyin	Steel girders/wooden deck	4.00	0.00	4.00	4.00	21.00	3x7.00	21.00
30+954		Plain RC slab	7.15	0.90	8.95	3.70	13.60	2x6.00	12.00
33+652	Tha Min Phyu	RC girders	7.45	0.90	9.25	6.00	15.10	13.00	13.00
39+291		Composite/RC girders/Slab	6.70	0.90	8.50	5.40	14.30	2x6.00	12.00
40+202		Steel girders/wooden deck	4.00	0.00	4.00	7.00	27.00	3x9.00	27.00
42+110		Steel girders/wooden deck	4.00	0.00	4.00	5.40	28.00	8.00+12.00+8.00	28.00
46+702		Composite	7.30	0.90	9.10	7.60	30.40	30.00	30.00
48+601		Bailey/wooden deck	4.80	0.00	4.80	5.7	15.50	15.00	15.00
49+539		Steel girders/wooden deck	4.00	0.00	4.00	3.20	14.40	14.00	14.00
51+309		Bailey/wooden deck	3.80	0.00	3.80	4.50	15.40	15.00	15.00
53+165		Plain RC slab	8.50	0.90	10.30	4.60	9.50	10.00	10.00
55+782	Kha Yan	RC girders	8.50	0.90	10.30	8.00	66.80	13.50+2x18+13.50	63.00
59+105		RC girders	8.50	0.90	10.30	5.00	14.10	2x7.00	14.00
60+036		RC girders	8.50	0.90	10.30	5.00	14.00	2x7.00	14.00
67+977		Composite/RC girders/Slab	6.00	0.00	6.00	5.00	15.20	2x6.00	12.00
73+098	Thongwa	PC girders	8.50	1.60	11.70	10.00	68.20	19.00+30.00+19.00	68.00
74+101	Thongwa	PC girders	8.50	1.60	11.70	8.00	67.80	19.00+30.00+19.00	68.00
75+310		Composite	4.25	0.65	5.55	3.80	10.10	9.00	9.00
87+717		Composite	5.30	0.25	5.80	4.40	12.80	12.00	12.00
93+083		Composite	4.90	0.60	6.10	3.00	10.20	9.00	9.00
99+039	Kyar Ni Kan	RC girders	6.70	0.45	7.60	3.50	13.40	12.00	12.00

Source: Field surveys by project preparatory consulting team

234. Major bridges and their environs are shown in Figures 16 to 18.

Figure 16: Bridge over Bago Sittaung Canal at Thanatpin (Chainage 8+998)

Source: Google Earth

Figure 17: Bridge over Kinpunchin Creek at Khayan (Chainage 55+782)

Source: Google Earth

Figure 18: Bridge over Kinpunchin Creek at Khayan (Chainages 73+098 and 74+101)

Source: Google Earth

236. **Flood Prone Sections**, The Bago–Thanlyin Highway protected by dykes and levees is above the flood line throughout its length and there are enough cross drainage structures to provide balance if one side of the road is flooded. The only place where flooding does occur in all the urban, village and built up areas there is a problem with drainage. U-Drains should be used in those locations with as many outlets as required.

3.2.2 Biological Environment

237. **Flora**. There are no forests, protected areas or mangrove areas within 10 km of the road alignment. There are no special status trees or endangered species and no threatened eco-systems. The entire area supports intense agriculture and has done so for hundreds of years.

238. The environmental setting along the project road alignment and surrounding area is intensely developed agricultural landscape dominated by rice paddies with small clusters of bamboo, banana plants, coconut trees, other fruit trees and small vegetable gardens around settlements. Roadsides are planted with a mixture of tree-types some of which impact the safe use of the road (these will be removed to make way for the improvements and increase road safety).

239. **Road Side Trees**. Along the road-side, trees have been planted at different times and scattered locations. Some of these trees, mostly Acacia/Hta Naung Pin (*G. Acacia*), Koak Ko (*Albizia lebbeck*), and Eucalyptus (*G. Eucalyptus*) with Toddy Palm (Borassus flabelliferus) (Myanmar name: Htan pin) near Kawa & Thanatpin townships lie within the 14 m-wide strip needed for the new paved lanes, paved shoulders and unpaved shoulders. These trees will be removed and, where and when appropriate compensation paid and/or new trees will be planted as replacement-trees after the main works have been completed. See Figure 19.

Figure 19: Trees along Bago–Thanlyin Highway

Source: Field surveys by project preparatory consulting team

Table 22: Common Botanical Names and Botanical Names of Trees and Number of Trees Observed within the Corridor of Impact along Yangon–Pathein Highway

English Name	Myanmar Vernacular Name	Botanical Name	Number
Teak			12,016
Banana Plant			333
Banyan Tree		Ficus spp	18
Bauhinia	Swal Taw	Bauhinia spp	19
Coconut Tree			57
Cotton Tree	Lat-pan-pin	Bombax ceiba	21
Eucalyptus Tree	Eucalit	Eucalyptus	847
Gold Mohur Tree	Sein Ban	Delonix regia	352
Golden Shower Tree	Ngu-war-pin	Cassia fistula	6
Indian Mast Tree	Lan tamar	Polyalthia longifolia	163
Larch	Htin_shue_pin	Larix spp.	80
Mangium	Malaysia Padauk	Acacia mangium	13,809
Mango Tree			149
Paper Mulberry	Mai-sai-le	Broussonetia papyrifera	800
Rain Tree	Koak Ko	Albizia lebbek	997
Rosewood	Padauk	Pterocarpus macrocarpus	150
Toddy Palm	Htan pin	Borassus flabelliferus	957
Tropical Almond	Bar Din Pin	Terminalia catappa	73
White Lead Tree	Bo zagain	Leucaena leucocephala	926
Total			**31,773**

Source: Project preparatory consulting team

3.2.3 Socio-Economic Environment

236. Humans have used the area around the Bago–Thanlyin Highway corridor with increasing intensely for over 500 years. The road corridor is now almost entirely in rice cultivation with small patches of other agricultural production and small to medium-sized villages spaced along and near the road. Before the road, completed in the nineteen fifties, settlements

clustered near the railway and used it and limited water-transport to move around. Today the intensity of agricultural production is everywhere apparent.

240. **Land Use**. The area is rural. Rice cultivation dominates economic activity with two rice crops annually facilitated by irrigation over most of the Delta. Visually and from satellite images (Google Earth, on-line Earth Satellite Images) rice paddies cover more than 95% of the land surface (see Table 23).

Table 23: Dominant Land Use along the Bago–Thanlyin Corridor

Location (Chainage)[4] (km)	Dominant Land Use
0 to 7.4	Rice paddy
7.4 to 10.2	Residential and commercial
10.2 to 11.6	Rice paddy
11.6 to 17.2	Aquaculture/poultry complexes and rice paddy
17.2 to 24.4	Rice paddy
24.4 to 25.5	Residential and commercial
25.5 to 32.6	Rice paddy
32.6 to 33.6	Residential and commercial
33.6 to 40.7	Aquaculture/poultry complexes and rice paddy
40.7 to 42.3	Residential and commercial
42.3 to 54.3	Rice paddy
54.3 to 57.8	Residential and commercial
57.8 to 70.5	Rice paddy
70.5 to 74.8	Residential and commercial
74.8 to 90.4	Rice paddy
90.4 to 91.2	Residential and commercial
91.2 to 92.6	Rice paddy
92.6 to 93.3	Residential and commercial
93.3 to 99.3	Rice paddy

Source: Field surveys by project preparatory consulting team

241. There are very few buildings between the villages along the road. The predominance of agricultural land is clear and more than 60% of the working age population is engaged in it. In addition to rice, crops such as: bananas, other fruit, jute, pea-nuts, pulses, sugar-cane and, of course, table-vegetables, are produced for local use with a small quantity being transported for sale in Yangon but the output and sale of non-rice cash-crops is constrained by the lack of efficient, reliable and safe road access.

242. Other primary employment activities include animal husbandry (raising chickens, goats and cattle), market-gardening, fruit-growing and pond aquaculture. The chicken-farms visible from the road north of Ohne Nhe, are linked to pond-fish aquaculture. Chickens are raised in sheds supported by platforms on “stilt-piles” over ponds. The chickens are kept cool by the proximate water and the fish eat algae that feed on the nutrients in the chicken excrement. There are also a few home-based cottage industries in Kawa Township.

243. Non-farm locally employed workers find employment in farm-support services such as materials and equipment supply and services, truck and bus transport services, and vehicle and equipment supply and maintenance. At the Yangon end of the alignment a small but

[4] From start of project at Seinthalyaung Pagoda Road, Bago.

increasing proportion of people work in factories in Thanlyin Township and the eastern periphery of Yangon.

244. There are few commercial areas and these are small, within villages, larger in the towns, e.g., Khayan and Kawa. Also, there are clusters of informal businesses in temporary structures near some of the bridges in the northern section of the alignment. The first 5 km of the northern end of the alignment lies in the urban shadow of Bago. There are many small shops and supply companies selling farm-supplies, building materials and components, cast-concrete and welded products, bicycles and farm-equipment and providing vehicle and equipment repair services. Many of these companies may be able to participate in the road rehabilitation works program. Positive socio-economic impacts during construction will be created via casual and part-time work opportunities, the supply of food, and small-scale sub-contracts, e.g., making culverts.

245. Thanlyin Township at the southern end of the alignment lies in the economic shadow of Yangon. The commercial land-use pattern is similar to that at the northern end of the alignment in the urban outskirts of Bago. There are many small shops and supply companies providing products and services and, by the number of buses plying the Thanlyin–Yangon route, many people travel to/from Yangon regularly to work in factories (mostly garment factories) or other establishments in Thanlyin itself and the eastern periphery of Yangon.

246. The rehabilitated and improved road, with increased service capacity to provide reliable, lower cost and quicker goods transport to Yangon, close to the Thanlyin end of the alignment, will undoubtedly lead to enhanced economic opportunities including encouraging an increase in market gardening, animal husbandry and aquaculture and non-farm workers who can expect to be able to commute easier than currently to work opportunities in Thanlyin and Yangon. More people can be expected to work in the urbanized and urbanizing areas towards the ends of the road alignment when the rehabilitation has been completed, by which time many youth will reach maturity and seek employment.

247. The project area is served by road and limited water transportation. The road dominates. Large, small and mini-buses serve the area in two service sections. The northern section of the B-T Road is served from/to Bago City; the southern section from/to Thanlyin and Yangon. The southern section has far more traffic than the northern section. Public buses and trucks are complemented by village-based taxi services, privately owned farm-trucks and an increasing number of privately owned cars and motor-bikes.

248. Canoes of different sizes and other boats carry small groups of people and small amounts of freight to/from landing sites along the shallow water-ways. Large canoes were observed unloading bamboo and rice at landing sites.

249. The area is served by government operated electricity supply (most private companies also have generators) and by commercial cell phone services.

250. **Human Values, Social and Cultural Issues** The names of project-affected regions, townships and villages are listed in Table 24. The road passes through seven villages, four in Bago Region: two in Thanaptin Township and two in Kawa Township, and three villages in Yangon Region: one in Kayan Township, one in Thongwa township and one in Thanlyin Township.

Table 24: Project-Affected Regions, Townships, Villages

Bago–Thanlyin Highway			
Township	**No.**	**Region**	**Towns/Villages**
Thanatpin	38	Bago	Thanatpin, Kamase
Kawa	29	Bago	Onhne, Thekkaia
Kayan	300	Yangon	Kayan
Thongwa	323	Yangon	Thongwa
Thanlyin	321	Yangon	Thanlyin

Source: Field surveys by project preparatory consulting team

251. In the 2014 Census households were asked to indicate which modes of transport were available in each household (see Table 25). Some households had more than one mode of transport available whilst others had none; hence the total percentages for a township can be less than or greater than 100%. In all townships the predominant transport modes are motor cycle/mopeds and bicycles. Bullock carts remain a significant transport mode in rural townships as does water transport, particularly in the two rural townships in Bago Region. It was observed during surveys on the road that bullock carts were not sighted on the Bago–Thanlyin Highway whilst the other modes of transport were.

Table 25: Conventional Households by Availability of Transportation Items

Township	Conventional Households	Car/ Truck / Van	Motorcycle/ Moped	Bicycle	4-wheel Tractor	Canoe/boat	Motor Boat	Cart (Bullock)
Bago Region[1]								
Bago	107,132	2.7	37.5	46.3	0.9	1.8	0.5	10.8
Thanatpin	32,527	0.6	23.9	35.0	2.7	14.4	8.9	21.4
Kawa	46,075	0.5	25.6	36.2	4.0	7.2	6.3	25.6
Yangon Region[2]								
Khayan	39,314	1.2	31.3	56.7	5.2	1.6	2.1	21.8
Thongwa	40,087	1.3	31.1	54.8	9.4	1.8	2.1	21.7
Thanlyin	61,597	3.5	29.2	34.1	2.1	0.7	0.7	8.0

[1] Adapted from: Republic of Myanmar, Ministry of Immigration and Population, The 2014 Myanmar Population and Housing Census: Bago Region, Census Report 3-G, May 2015, Table J6.
[2] Adapted from: Republic of Myanmar, Ministry of Immigration and Population, The 2014 Myanmar Population and Housing Census: Yangon Region, Census Report 3-L, May 2015, Table J6.

252. Along the B-T alignment there are seven villages and a relatively high rural population density testifying to the region's rich agricultural productivity. The population density is relatively high and has been increasing rapidly in recent years. The combined population of the 4 project-affected was, at latest count, 801,007 people with 495,557 of them (61.9%) under 18-years of age (Township data, Dec. 2016). The very high proportion of young people testifies to a veritable population explosion over the past 2-decades and the urgent need for job generation programs.

253. Despite a very high literacy rate (above 98%) and the above mentioned economic activities, poverty presents a serious issue to some 16% of the Kawa Township population

(Township data, Dec. 2016). NGOs are actively addressing poverty and health issues in the area.

254. Health care in the area is provided by township hospitals and clinics. Most people get their water from tube-wells and most have access to latrines or toilets, over 97% having toilet access in Thanlyin and Thanatpin townships (Township data, Dec. 2016). But health is somewhat problematic. Endemic, chronic diseases such as: malaria, dengue fever and dysentery/diarrhea are overlain by more modern diseases such as hypertension and heart disease.

255. **Sensitive Receptors**. To assess possible impacts on sensitive receptors an assessment was made to determine which facilities were within 100 m of the road center-line along the corridor (see Table 26).

Table 26: Sensitive Receptors on Bago–Thanlyin Highway

No.	Receptor	Approximate Location (Chainage) km	Distance from Current Center-line to Front of Structure (m)
1	Stupa	4.0	11
2	Monastery	4.5	>500
3	Monastery	10.5	22
4	Monastery	10.5	22
5	Hermitage	11.0	110
6	Primary School	11.0	28
7	Monastery	12.0	18
8	Temple	12.5	6
9	Chapel	13.0	10
10	Monastery	13.4	17
11	Monastery	14.4	23
12	Orphanage	14.4	23
13	School	14.4	23
14	Nursing Home	14.4	16
15	Post Primary School	17.3	47
16	Monastery	17.4	24
17	Chapel	21.0	8
18	Monastery	25.3	80
19	Welfare Center for Food Offering	27.5	14
20	Chapel	27.8	14
21	Monastery	34.1	30
22	Welfare Center for the Deaf	35.0	23
23	Hospital	35.5	48
24	Monastery	35.5	72
25	Temple	35.5	35
26	Monastery	43.5	24
27	Welfare Center and Chapel	49	12
28	Temple	49.0	50
29	High School	49.5	12
30	Primary School	54.3	46.6
31	Nursing Home	58.0	36
32	Stupa	58.0	32
33	Monastery	58.0	32
34	Education Office	58.8	37

No.	Receptor	Approximate Location (Chainage) km	Distance from Current Center-line to Front of Structure (m)
35	Post Primary School	58.8	37
36	Monastery	59.4	21.4
37	Monastery	59.4	40.5
38	Monastery	59.6	57.5
40	Monastery	62.2	20.4
41	Primary School	64.8	61
42	Stupa	66.6	31
43	High School	66.6	22
44	Temple and Stupa	74.1	300
45	High School	74.3	35.5
46	Temple and Stupa	75.5	17
47	Primary School	76.9	9
48	Monastery & Stupa	77.5	21
49	Monastery	77.5	14
50	Stupa	77.5	13
51	Monastery	77.5	40
52	Monastery	77.5	11
53	Middle School	77.5	97
54	Monastery	77.78	32
55	Monastery	89	10.2
56	Primary School	94	92
57	Monastery & Stupa	94	92
58	Monastery	94	99
59	Branch of Health Department	94	42.2
60	Middle School	94	44.2
61	Primary School	96	13
62	Stupa	96.2	36.7
63	Primary School	96.2	37.6
64	Temple	96.2	13

Source: Field surveys by project preparatory consulting team

256. A detailed measurement survey (DMS) of affected households within the corridor of impact undertaken as part of the project preparation. All affected households are located within the existing right of way and no gardens, fruit bearing trees were affected. Roadside trees along the road corridor are in the ownership of the government.

3.3 Yangon–Mandalay Expressway Improvements

257. This sub-project, to essentially improve safety and maintenance of the Expressway, is situated in a strip of land averaging more than 100 m wide and previously cleared of trees, structures, and so on when the expressway section under this project was constructed from 2005 to 2008. Within the cleared highway transport corridor there is little of the original environment remaining. There is no normally functioning natural ecosystem. There are no trees except those planted after the expressway was completed. There are no unique areas of any form and no agriculture, cultural archaeological, recreational, religious or educational values of significance in the cleared, 100 m-wide transport corridor.

3.3.1 Physical Environment

258. The 62.3 km of expressway for improvement occupies a strip about 32 m wide running approximately north-south along the floor of the Central Plain approximately 40 km east of the Ayeyarwady River and range of low hills. The entire Myanmar Central Plain occupies a geologically ancient valley carved through sand-stones, shales, and clays overlain by a thick layer of recent alluvium carried and deposited over-time mostly by the main river.

259. The project-affected physical environment is an entirely built environment sitting within the 100 m-wide cleared transport corridor, all on deltaic alluvium.

260. The subject expressway section (64.4 km) lies in the humid tropics. There is a marked wet season of 6–7 months of heavy rainfall interspersed with short humid breaks from April through October during which there is about three meters of rain. This is followed by 5-months with very little rain (under 100 mm) during the dry, cooler period from November through March. Table 27 shows 10-year average rainfall data from the nearby Yangon meteorological station.

Table 27: Project Area Annual & Monthly Rainfall (mm 2004/14)

Meteorological Station	Annual	Max.	Min.	Nov.–Mar.	Apr. –Oct.
Yangon	3,050	775 – Jul	3 – Feb	93	2,957

Source: Dept. Meteorology and Hydrology (*Myanmar Statistical Yearbook*, 2015)

261. The 10-year data above is complemented by a Department of Meteorology and Hydrology examination of rainfall variability over 51-years, 1950 to 2000. Relative to most other parts in Myanmar, the annual rainfall in the Yangon area is among those recording the least rainfall variability in the country. Table 28 presents 51-year rainfall data for Yangon.

Table 28: Project Area Annual Rainfall Variability (mm) (51 Years 1950/2000)

Meteorological Station	Highest	Lowest	Mean	Std. Deviation	No. Years "normal" rain
Yangon	3,523	1,995	2,686	350	44 out of 51

Source: Dept. Meteorology & Hydrology Data, Yangon

262. It is notable that 96% of annual rainfall occurs during April–October and only 4% falls during November–March.

263. There are no available data on air quality and noise in the project-affected area. However, the expressway alignment is not affected by hills or valleys close-by. It crosses a gently rising, undulating and open landscape, except in the semi-urban periphery at its very beginning north of Yangon City.

264. **Water:** The existing alignment crosses irrigation canals and minor streams by way of 18 existing bridges and ends at the Yangon abutment of the bridge over the Bago River. The list of bridges is provided in Table 29.

Table 29: List of Existing Bridges – Expressway 0.00 to 62.3 km

No.	Start Chainage (km)	End Chainage (km)	Comments
1	4.85	4.95	Irrigation Canal
2	5.95	6.05	Irrigation Canal
3	7.68	7.70	Irrigation Canal
4	8.66	8.71	Irrigation Canal
5	10.8	10.84	Stream
6	18.16	18.26	Stream
7	19.18	19.22	Irrigation Canal
8	20.71	20.79	Stream
9	21.68	21.74	Stream
10	31.01	31.07	Stream
11	38.54	38.56	Stream
12	42.58	42.69	Stream
14	51.51	51.55	Stream
15	53.48	53.5	Stream
17	56.63	56.65	Stream
18	59.80	59.88	Flood Channel of Bago River
19	62.31	62.48	Bridge over Bago River

Source: Field surveys by project preparatory consulting team

2.2.6. The bridge over the Bago River and its environs is shown in Figure 20.

Figure 20: Bridge over Bago River near Baw Net Gyi (Chainage 62.3 km)

Source: Google Earth

2.2.7. The project area lies relatively close to the Sagiang Fault Zone where there is a risk of earthquake (Santi Pailoplee, *Journal of Earthquake and Tsunami,* 07/04, Nov. 2013). However, as the expressway is in place and has been operating for 8-years, there will be no incremental change in risk level.

3.3.2 Biological Environment

267. The project affected biological environment has little natural, indigenous flora and fauna. It is a highway strip within a 100 m-wide transport corridor cleared of existing vegetation including trees when the expressway was constructed 2005/09. The corridor crosses agricultural land over much of its alignment and semi-urban land over part of it near its beginning in the Yangon semi-urban periphery.

268. There are no ecologically sensitive or unique natural features close to the cleared transport corridor. The area outside the 100 m-wide, cleared transport corridor has long been developed for mixed agriculture. There are no forests, protected areas or mangrove areas and no special status trees, endangered species, or threatened eco-systems within the expressway corridor or near to it. See Figure 21 showing a typical landscape along the expressway section to be improved.

Figure 21: Typical Landscape along Project Section of Expressway

Source: Field surveys by project preparatory consulting team

3.3.3 Socio-Economic

269. The expressway begins in the semi-urban fringe of Yangon City and bears in a northerly direction that quickly becomes rural where the 100 m-wide, cleared transport corridor begins. Humans have used the area around and within the corridor for hundreds of years as it lies within the much wider historic beltway within which lie many ancient and more recent cultural and archeological sites, proof of the long human habitation. The area around the expressway corridor has been in human use for agriculture, mostly for 1-crop/year rice cultivation, fruit, and other vegetable crops, with settlements scattered across it, for many hundreds of years.

270. The landscape is uneven and undulating. Irrigation is not widespread. There are no villages or larger settlements immediately adjacent to the cleared, transport corridor.

271. Non-farm locally employed workers find employment in farm-support services such as materials and equipment supply and services, truck, bus and rail transport and the associated vehicle and equipment supply, servicing and maintenance. At the Yangon end of the expressway, a growing proportion of people work in Yangon.

272. Dominant land use along the Expressway is provided in Table 30.

Table 30: Dominant Land Use along the Expressway Corridor (0+00 to 62.3 km)

Location (Chainage)[5] (km)	Dominant Land Use
0.0 to 25.2	Rice paddy
25.9 to 29.1	Forest
29.1 to 33.1	Rice paddy
33.1 to 60.3	Forest
60.3 to 62.3	Rice paddy

Source: Field surveys by project preparatory consulting team

273. Large buses and small trucks frequently use the expressway to serve the Yangon–Nay Pyi Taw and Yangon–Mandalay routes. Accidents are common including frequent car, small trucks and bus accidents.

274. **Human Values, Social and Cultural Issues**. Human cultural issues of significance are not apparent in structures along the alignment or close to it. No pagodas, schools, recreational structures or parks, or archaeologically important areas will be affected physically by the improvement works. Sensitive receptors within 100 m of the edge of carriageway are provided in Table 31. There were no schools, hospitals and retirement home in this section, only temples and monasteries.

Table 31: Sensitive Receptors on Yangon–Mandalay Expressway

No.	Receptor	Approximate Location (Chainage) km	Distance from Current Edge of Pavement to Property Boundary (m)	Distance from Current Center-line to Property Boundary (m)	Distance from Center-line to Main Building (m)
Eastern Side of Expressway					
1	Temple	1.6	14	61	78
2	Temple	3.6	150	163	313
3	Monastery	24.8	48	61	71
4	Temple	25	48	61	661
5	Monastery	26.6	48	61	1,261
6	Monastery	61.5	80	93	393
Western Side of Expressway					
7	Monastery Land	61.2	80	93	61
8	Small Temple	61.5	48	61	393
9	Cloister	40.3	80	93	323
10	Religious Center	24.4	70	83	383
11	Cloister	22.4	48	61	111
12	Community Hall (religious) under construction	1.5	48	61	71

Source: Field surveys by project preparatory consulting team

[5] From commencement of Expressway.

CHAPTER 4 INFORMATION DISCLOSURE, COMMUNICATIONS AND COMMUNITY DISCUSSIONS

4.1 Rehabilitation of the Yangon–Pathein Highway

4.1.1 Community Discussions: Yangon–Pathein Highway, 15/16 December 2016

276. Initial community meetings were held in two townships along the Yangon–Pathein Highway, namely, Nyaungdon and Kyaunggon (see Table 32). The results from those meetings are presented below.

Table 32: Attendance at Community Discussions Yangon–Pathein Highway (15–16 Dec 2016)

Date	Region Road Section	Community	No. Participants Completing Attendance Record	
15–16 Dec. 2016	Yangon and Ayeyarwady	Nyaungdon	81	Total
	Yangon–Pathein Highway	Kyaunggon	29	110

Source: Field surveys by project preparatory consulting team

278. Participants at the discussions included representatives from:

- Region and district representatives
- Administrators from affected communities
- Village elders
- School-teachers and monks
- Representatives of Electricity, Forestry and Irrigation Departments
- Farmers
- Shop-keepers and stall-holders
- DOH township and local staff engineers
- Project personnel: Consultants and DOH Assistant Director

277. Participants were provided with Myanmar language summaries of:

- The planned road rehabilitation project
- The most important environmental impacts that may be created by the project
- The key impact mitigation measures.

278. Participants were also provided with a 1-page questionnaire designed to capture their perceptions about the existing road and the likely impacts from works activities.

279. Copies of the original English language versions of the project information Handout and the Questionnaire are presented in Appendix B. Copies of the meeting attendance records are presented in Appendix C.

280. The Project National Resettlement Specialist, a member of the Consultant Team gave a short presentation in Myanmar language and, together with the Assistant Director, DOH/MOC, (Environment, Social Safeguards and Road Safety) clarified issues raised in the discussions. He also acted as interpreter for the International Environmental Specialist on the Consultant Team who provided advice and comment as necessary to ensure clear understanding.

251. The verbal presentation in the Myanmar language (by Project National Resettlement Specialist) included:

- An introduction to the project and the planned road works
- A summary of the environmental impacts likely to be caused
- A summary of the main impact prevention and mitigation measures.

252. Participants were invited to raise questions and express their concerns in a discussion session following the presentation. The consultants and DOH addressed concerns and answered the questions. Issues raised in the discussions and comments made in the questionnaire are summarized in Table 33**.**

Table 33: Comments from the Meeting Participants and Proponent's Response

Comment	Proponent's Response
Want 4-lanes	The current and predicted traffic levels do not justify widening to four lanes. The addition of 1.5 m sealed shoulders will significantly improve traffic flow.
Want wider shoulders	Agreed. The rehabilitation will provide a 1.5 m sealed shoulder on each side plus an outer unsealed shoulder.
Want shorter project preparation and construction period	The project has been planned so that the work matches the capacity of contractors to complete what is a significant project. It is proposed to split the project into three lots with the work in each lot being undertaking simultaneously.
The road and its drainage was a lot better before cyclone Nagis (2008)	The road surface and its drainage will be improved as part of this project.
Need more culverts and drainage (some drains now too high and do not work properly)	Drainage will be improved as part of this project including the replacement of culverts and the provision of additional culverts on the section between 128 and 148 km.
Road was built in 1988; no compensation was paid at that time.	Noted. Affected persons will be provided with compensation for the impacts of this project.
Many issues related to compensation (2012 Law on compensation under Land Reclamation Dept./Fruit stall and small business owner concerns about conflict when temporary structures dismantled/Why squatters get compensated/What to be compensated/Need for an early cut-off date for compensation eligibility/Need notice when to move stall).	The compensation process was explained several times during the consultation and has been explained subsequently to all affected persons and at village meetings.
Keep to schedule (many responses)	A realistic program has been developed and the Contractor is expected to meet the schedule. Weather will, of course, affect the program.
Enforce the EMP	The Contractor must meet the requirements of the EMP. This will be ultimately enforced by the DOH Project Management Unit (PMU) which has full time safeguards staff.
Want bridges repaired and widened to 7.0 m or wider (several comments)	Bridges will be repaired. Any replacement bridges will have 3,5 m lanes, 2,5 m shoulders and separate footpaths on each side. Existing steel truss bridges will be provided with footways outside of the trusses. The bridge over the Ayeyarwadi River will not be widened however.

Comment	Proponent's Response
Concern about relocation of electrical lines	Utility services have been placed within the right of way on the understanding that they will be moved by the utility company at the request of DOH. Affected services are being identified.
The source of embankment-construction material	It is realized that embankment construction material is unavailable close to the road. It is up to the contractors to source their own material from available sources and have it delivered to the site.
Dealing with emergency situations	The Contractor will be responsible for dealing with emergency situations in relation to its own works. The Contractor will also be responsible to ensure that its work is planned so that it does not impede the passage of emergency services personnel.
Not happy with BOT Contractor	Noted.
No concerns at all (most frequent written response)	Noted.

Source: Field surveys by project preparatory consulting team

4.1.2 Questionnaire

283. A questionnaire designed to capture perceptions about the project and respondent views of its likely impacts was completed by most participants. The first part of the questionnaire asked a number questions about the condition of the existing road (Table 34). Most respondents were discontent with the current road conditions and supported its rehabilitation. Also, most respondents (64%) expected that works activities would affect the environment.

Table 34: Responses to Statements about the Condition of Existing Road

Do you agree with the following?	Total Responses	"Yes" No.	Responses "Yes" %
The road-lanes are very narrow	74	47	**64**
The shoulders (sides of road) are too narrow	87	85	**98**
The road floods during the wet season	84	77	**92**
The road condition makes travel very slow	82	80	**98**
There are no problems with the existing road	90	38	**42**
The road needs to be improved	84	83	**98**
Do you think that road works activities may affect the local environment?	81	52	**64**

Source: Field surveys by project preparatory consulting team

284. The second part of the questionnaire asked questions about people concerns over the environmental impacts (see Table 35). The three most significant concerns about environmental impacts (i.e., responses that indicated expected medium and serious impact) related to the work-force (84%), construction traffic (74%) and water pollution (72%). The fourth and fifth ranked concerns were impacts on land (64%) and air pollution (56%). Noise impacts were the least concern; 58% of respondents rated noise as 1, "no impact".

285. The high rates of community concern over the potential impacts from the work-force, construction traffic, and water pollution are common public concerns of community impact identified in perception surveys of other highway projects in SE Asia locations.

Table 35: Summary of Impact Perceptions

Likely Impacts	Response No.	No Impact (Questionnaire Score 1) No.	%	Medium Impact (Questionnaire Scores 2 and 3) No.	%	Serious Impact (Questionnaire Scores 4 and 5) No.	%
Noise	78	45	58	26	33	7	9
Water pollution	79	22	28	46	58	11	14
Air pollution	75	33	44	32	43	10	13
Works traffic	73	19	26	33	45	21	29
Work force	75	12	16	44	59	19	25
Impacts on land	78	28	36	39	50	11	14

Note: % rounded to nearest whole number
Source: Field surveys by project preparatory consulting team

Photographs of the meetings are provided in Figures 22 and 23.

Figure 22: Photographs of Public Meeting in Kyaunggon Township

Source: Field surveys by project preparatory consulting team

Figure 23: Photographs of Public Meeting in Nyaungdon Township

Source: Field surveys by project preparatory consulting team

4.1.3 Community Discussions: Yangon–Pathein Highway, 28/30 April 2017

287. Another series of meetings were held in April 2017 (see Table 36). The meetings were held in five locations and mainly focused on resettlement issues. In addition, participants raised issues concerning the project and its potential impact.

Table 36: Attendance at Community Discussions Yangon–Pathein Highway (28–30 April 2017)

Date	Village/ Township/ District	Local Resident		Local Authorities & Government Agencies	
		Male	Female	Male	Female
28 April	Hlaing Thar Yar	2	4	17 (DOH, Planning & Village Officials)	1 (Village official)
29 April	Pantanaw	34	15	Nil	Nil
29 April	Nyaungdon	39	3	Nil	Nil
30 April	Kangidaunt	13	5	17 (DOH, Planning & Village Officials)	1 (Village official)
30 April	Kyaunggon	24	Nil	24 (DOH, Police & Village official)	2 (DOH)

Source: Field surveys by project preparatory consulting team

288. As noted above participants were invited to raise questions and express their concerns in a discussion session following the presentation. The consultants and DOH addressed concerns and answered the questions. Issues raised in the discussions are summarized are summarized in Table 37.

Table 37: Comments from the Meeting Participants and Proponent's Response

Comment	Proponent's Response
Hlaing Thar Yar Township (27 April 2017)	
What are the proposed interventions within the Hlaing Thar Yar Township?	The work on the existing four lane section from the first to the second toll gates will consist mainly of an asphalt overlay over the existing surface. For the remainder of the works progress will be slower as the pavement will be widened to incorporate the existing 7 m carriageway and provide 1.5 m sealed shoulders plus 1 m unsealed shoulders on each side.
How-long and when will the civil works be completed in the Township?	The project is planned to commence in mid-2018 and be completed in 2022. The project has been planned so that the work matches the capacity of contractors to complete what is a significant project. It is proposed to split the project into three lots with the work in each lot being undertaking simultaneously. The works program will be prepared by the Contractor to minimize the disruption to all affected persons along the road corridor. The work on the existing four lane section from the first to the second toll gates will consist mainly of an asphalt overlay over the existing surface so the work will be carried out fairly quickly. For the remainder of the works progress will be slower as the pavement will be widened to incorporate the existing 7 m carriageway and provide 1.5 m sealed shoulders plus 1 m unsealed shoulders on each side.

Comment	Proponent's Response
Will the road surface be concreted or asphalted?	The pavement will be asphalt.
How will compensation be paid for affected farm-land?	No farm land will be affected.
If the households affected by the Project would be allowed to stay in the ROW, other villagers would move in the ROW?	Village tracts and township DOH will manage this issue. Township DOH will work with village tracts to manage the ROW properly. Village tracts know who are actually staying in the ROW. Measures will be applied to prevent others villagers moving in the ROW after this project.
Consultation Meeting in Nyaungdon Township (28 April 2017)	
How wide the pavement will be?	The pavement will be widened to incorporate the existing 7 m carriageway and provide 1.5 m sealed shoulders plus 1 m unsealed shoulders on each side.
How-long and when will the civil works be completed in Nyaungdon Township?	The project is planned to commence in mid-2018 and be completed in 2022. The project has been planned so that the work matches the capacity of contractors to complete what is a significant project. It is proposed to split the project into three lots with the work in each lot being undertaking simultaneously. The works program will be prepared by the Contractor to minimize the disruption to all affected persons along the road corridor.
Will pavement be constructed all along the road or just in some road sections?	The road will be widened to provide a 7 m carriageway plus shoulders on each side. Rehabilitation will be undertaken as required and the whole length will be resurfaced.
The Township DOH issued the Notice requesting the households that are staying in the ROW to move-out of the ROW. What can the households do now?	The households should not move out now but wait for the next advice from the DOH. DOH Yangon Region will work with DOH Township to soon advise the households on the situation.
Will compensation be made for the affected bus-stops of the private transport providers?	DOH has advised that the bus-shelters in the Right of Way are their assets. They will be moved or replaced if they are impacted by the project works. Yes, if the project impacts on the bus-stops of the private transport providers, compensation will be made fully for the bus-stops.
Cash compensation for the bus-stops is fine, but there will be no suitable place in the villages to reconstruct of bus-stops.	DOH will work with the local authorities to ensure that suitable sites will be found should the bus-shelters be affected.
Consultation Meeting in Pantanaw Township (28 April 2017)	
No question on the technical design of road section in the Township	Noted.
The village has some structures such as the village name boards, the fence and yard of monasteries...that may be affected - will compensation be paid for the impacts?	Compensation will be affected assets within the corridor of impact, which is narrower than the existing Right of Way. Village signboards will be moved or replaced as required as part of the contract works.
Consultation Meeting in Kyaunggon Township (29 April 2017)	
How-long and when will the civil works be completed in Kyaunggon Township?	The project is planned to commence in mid-2018 and be completed in 2022. The project has been planned so that the work matches the capacity of contractors to complete what is a significant project. The works program will be prepared by the Contractor to minimize the disruption to all affected persons along the road corridor. As the work in Kyaunggon township is significant

Comment	Proponent's Response
	due the raising the height of the existing road the works will take a significant time, especially allowing for time lost during the monsoon period.
Will the road section in Kyanggon be lifted up?	The road between km marker 128 and km marker 148 will be raised so that the road pavement structure is above the 20 year return flood level.
Will there be fly-over structures in the intersections to avoid traffic jams?	No. Existing and predicted traffic levels do not justify the provision of flyovers at intersections. In addition, this would require property acquisitions which would severely disadvantage exiting property owners.
Will compensation be for the decoration garden that was constructed by villagers?	Any village gardens that are affected by the project will be restored or relocated by the contractor.
What are the roles of village tracts in resettlement planning and implementation?	Village tracts will coordinate with township DOH for the activities such as information disclosure, identify of replacement costs for affected structures, arrange the replacement place for the relocating shop owners/households, payment to affected individuals and households, monitor of payment, and manage the ROW, etc.
Consultation Meeting in Kangidaunt Township (29 April 2017)	
Will the road section in Kangidaunt be lifted up as it is flooded sometimes?	The road between km marker 128 and km marker 148 will be raised so that the road pavement structure is above the 20 year return flood level.
How-long and when will the civil works be completed in Kangidaunt Township?	The project is planned to commence in mid-2018 and be completed in 2022. The project has been planned so that the work matches the capacity of contractors to complete what is a significant project. The works program will be prepared by the Contractor to minimize the disruption to all affected persons along the road corridor. As the work in Kyaunggon township is significant due the raising the height of the existing road the works will take a significant time, especially
Will compensation be for the decoration garden that constructed by villagers and trees planted by villagers to decorate the village?	Any decorative gardens will be restored by the Contractor. DOH has advised that all trees belong to the government so no compensation will be paid. A tree planting scheme will be instituted as part of the contract.
Is the resettlement plan in Myanmar language?	The resettlement plan will be in Myanmar language.
When will the relocating shops have to move to the new place?	From March–June 2018 – but township DOH will inform three months in advance to the community and the relocating shop-owners on when relocation is required.
Consultation Meeting in Kangidaunt Township (29 April 2017)	
No question on the technical design of road section in the Township	Noted.

Source: Field surveys by project preparatory consulting team

Attendance lists are provided in Appendix C. Photographs of the meetings are provided in Figures 24 to 29.

Figure 24: Photographs of Public Meeting in Hlaing Thar Yar Township

Source: Field surveys by project preparatory consulting team

Figure 25: Photographs of Public Meeting in Nyaungdon Township

Source: Field surveys by project preparatory consulting team

Figure 26: Photographs of Public Meeting in Pantanaw Township

Source: Field surveys by project preparatory consulting team

Figure 27: Photographs of Public Meeting in Kyaunggon Township

Source: Field surveys by project preparatory consulting team

Figure 28: Photographs of Public Meeting in Kangidaunt Township

Source: Field surveys by project preparatory consulting team

Figure 29: Photographs of Public Meeting in Pathein Township

Source: Field surveys by project preparatory consulting team

4.2 Rehabilitation of the Bago–Thanlyin Highway

4.2.1 Introduction

2501. An environmental reconnaissance survey of the road was undertaken on 27 and 28 October and the opportunity was taken to undertake six informal small group meetings in six separate villages throughout the townships. Participants in the meetings generally expressed positive opinions about the project, saying that better quality and wider roads will result to travel convenience, and road safety. A few teashop owners, and a village resident (house is on road shoulder) are apprehensive that the widening and shoulder improvement may affect

business, and house, respectively. Names of participants were not recorded. Some teashops and possibly a few residential structures (all structures made of light native materials) are sitting on the (existing) shoulders within the ROW of the proposed improvement. This was observed in the areas under the jurisdiction of the townships of Thongwa, Kawa, and Thanatpin.

Figure 30: Photographs of Part of Taike Tuu Kan Village in Thongwa Township, and Informal Meeting with Roadside Occupants

Source: Field surveys by project preparatory consulting team

4.2.2 Public Consultations – 12 and 13 December 2016

291. Initial community meetings were held in two communities along the B-T alignment, namely, the townships of Khayan and Onhe Nhe in which the roadside occupants will be most affected by the road works (see Table 38). The public consultations and results from those meetings are presented below.

Table 38: Attendance at Community Meetings

Date	Community	No. Participants Signing Attendance Record	
12 & 13 Dec. 2016	Khayan	35	Combined total = 83
	Ohne Nhe	48	

Source: Field surveys by project preparatory consulting team

292. Participants included:

- Central government representatives and members of government committees
- Region and district representatives
- Administrators from affected communities
- Representatives of Agriculture, Fisheries, Forestry and Land Departments
- Village elders
- Teachers
- Farmers
- Householders
- Business managers
- DOH township and local staff engineers
- Project personnel: Consultants and DOH Assistant Director

293. Participants were provided with a Myanmar language information handout summarizing:

- The planned road rehabilitation project
- The most important environmental impacts that the project may cause
- The key impact prevention and reduction measures (mitigation measures).

294. Participants were also provided with a 1-page questionnaire designed to capture their perceptions about the construction-stage impacts that bothered them. The information handout and the questionnaire were both in the Myanmar language. Copies of the original English language versions form Appendix B; copies of meeting attendance records are in Appendix C.

295. A verbal presentation in the Myanmar language was delivered, as in the handout above:

- Introduction to the project and the planned road works
- The main environmental impacts likely to be caused by the project
- EMP and impact prevention and mitigation measures

296. Participants were invited to raise questions and express their concerns in a discussion session following the presentation. The consultants and DOH addressed the concerns and answered the questions as best as possible. Issues raised in the discussions and comments made in the questionnaire are summarized in Table 39. The table also includes how the project addresses those concerns.

Table 39: Comments from the Meeting Participants and Proponent's Response

Comment	Proponent's Response
The embankment alignment used to be for railway, now want proper road to international-standards.	The road will be two-lane with 3.5 m lanes and 1.5 m sealed shoulders built to international standards.
Want shorter project preparation and construction period.	The project preparation is currently being undertaken and reconstruction activities will commence as soon as funding is secured. The construction period will be the minimum possible taking into account the complexity of the work and the need to curtail some activities during the monsoon season.
Drainage is important; temporary drainage during construction and permanent drainage.	Agreed. Temporary drainage will be provided and permanent drainage will be improved as part of the project.
Prefer a bypass around the Khayan town-center – there were several such comments	The immediate aim is to improve the road to two lanes with sealed within the existing right of way without the need to acquire land.
Many issues related to compensation (what and where, potential conflicts, houses encroach (Kawa), concern over compensating "illegals", what to do about trees (DOF), do not want delays in compensation, need a cut-off date for compensation (earlier the better). The compensation process and GRM were explained several times.	The only affected persons are those who occupy the existing Right of Way. It is ADB policy to compensate affected persons even if they are occupying the Right of Way. The cut-off date will apply soon after the detailed surveys of affected people persons has been completed. The project will require the removal of a large number of roadside trees but only those that will be impacted by the road-works and not to clear the Right of Way
Need to relocate electrical and other utilities and irrigation lines before construction.	Agreed.

Comment	Proponent's Response
Keep as many trees as possible	Agreed. Unfortunately, many trees have been planted within the right of way and too close to the road. Only those trees that will be impacted by the works and isolated trees that have an adverse impact on road user safety will be removed and replaced further from the edge of the pavement.
Bridges need to be at least 7.0 m wide – same as road.	All new bridges will be 10 m wide curb to curb and will also have pedestrian walkways on each side.
Concern to maintain stream capacities when bridges replaced.	There will be no change to steam capacity when bridges are replaced.
Concern about access and temporary crossings of streams during bridge re-construction.	The Contractor will be required to provide temporary bridges such as Bailey bridges prior to bridge reconstruction being undertaken.
Embankment construction material source and material transport.	It is up to the contractor to source materials. The contractor will have to strictly comply with the EMP. High quality stone will have to be sourced from outside of the area and will probably be transported by rail and truck.
Need adequate safety barriers for public and vehicle safety	The project works will include enhanced road safety measures designed by an international road safety specialist.
Maintenance of completed road is important	Agreed. This will be the responsibility of the Department of Highways once the completed works are handed over to them.
Enforce the EMP and manage construction well	Agreed. The works will be carried out by reputable international contractors under the supervision of international contract supervision consultants. They will both be overseen by the Department of Highways.

Source: Field surveys by project preparatory consulting team

4.2.3 Questionnaire

297. A questionnaire designed to capture perceptions about the project and respondent views of its likely impacts was completed by most participants (82%). The first part of the questionnaire asked a number questions about the condition of the existing road (Table 40). The results show that 71% or more respondents were discontent with the current road; 100% thought the travel-lanes were too narrow, the shoulders were too narrow and the road needed improvement, and just over half of the respondents expected works activities would affect the environment

Table 40: Reponses to Statements about Existing Road Conditions

Do you agree with the following statements?	Number Responses	"Yes"	"Yes" Responses %
The road-lanes are very narrow	68	68	**100**
The shoulders (sides of road) are too narrow	68	68	**100**
The road floods during the wet season	62	53	**85**
The road condition makes travel very slow	68	65	**96**
There are no problems with the existing road	63	18	**29**
The road needs to be improved	63	63	**100**
Do you think that road works activities will affect the environment?	58	31	**53**

Source: Field surveys by project preparatory consulting team

297. The second part of the questions asked respondents to indicate significant concerns (see Table 41). Respondents indicated that their three most significant concerns related to construction traffic (65% of respondents expected medium or serious impact), the work-force (57% of respondents expected medium or serious impact), and impacts on land (42% of respondents expected medium or serious impact). However more respondents (58%) did not expect land to be impacted. The responses showed also that most people completing the questionnaire expected no impact from air pollution (86%), noise (76%), or water pollution (65%).

Table 41: Summary of Perceptions of Impacts – Responses to Questionnaire

Likely Impacts	Total Responses	No Impact (Score 1)		Medium Impact (Scores 2 and 3)		Serious Impact (Scores 4 and 5)	
		No.	%	No.	%	No.	%
Noise	59	45	76	12	20	2	3
Water pollution	60	39	65	15	25	6	10
Air pollution	57	49	86	8	14	2	3
Construction traffic	60	21	35	33	55	6	10
Work force	55	24	44	24	44	7	13
Impacts on land	59	34	58	23	39	2	3

Note: % rounded to nearest whole number
Source: Field surveys by project preparatory consulting team

4.2.4 Community Discussions: Bago–Thanlyin Highway, 24/27 April 2017

298. Another series of meetings were held in April 2017 (see Table 42). The meetings were held in five locations and mainly focused on resettlement issues. In addition, participants raised issues concerning the project and its potential impact.

Table 42: Attendance at Community Discussions Bago–Thanlyin Highway (25–27 April 2017)

Date	Village/Township/ District	Local Resident		Local Authorities & Government Agencies	
		Male	Female	Male	Female
25 April	Bago (combined meeting with Thanatpin)	7	3	4 (Village officials)	Nil
25 April	Thanatpin (Combined meeting with Bago)	18	Nil	26 (DOH, Planning & Village officials)	5 (Village Officials)
25 April	Kawa	27	4	5 (DOH & Village officials)	Nil
26 April	Thongwa	57	14	4 (DOH, Planning & Village officials)	3 (DOH & Village officials)
26 April	Phayar Kyoung	28	3	8 (Planning & Village officials)	4 (DOH & Planning officials)
26 April	Kayan	12	Nil	21 (Planning, DOH & Village officials)	Nil
27 April	Thanlyin	Nil	Nil	32 (DOH & Village officials)	Nil

Source: Field surveys by project preparatory consulting team

As noted above participants were invited to raise questions and express their concerns in a discussion session following the presentation. The consultants and DOH addressed concerns and answered the questions. Issues raised in the discussions are summarized are summarized in Table 43.

Table 43: Comments from the Meeting Participants and Proponent's Response

Comment	Proponent's Response
Combined Bago and Thanatpin Townships Meeting (26 April 2017)	
When will the civil works will start?	The project is planned to commence in mid-2018 and be completed in 2022. The project has been planned so that the work matches the capacity of contractors to complete what is a significant project. The works program will be prepared by the Contractor to minimize the disruption to all affected persons along the road corridor. As the road embankment will require widening in many places to take account of the wider pavement and work will have to take account of the ends of traffic progress will be relatively slow. In addition, time will be lost during the monsoon period.
Can the Corridor of Impact of 13.8 m (45 feet to both sides from the current road center) be confirmed in this meeting?	No. The 13.8 m Corridor of Impact is the maximum width. The actual Corridor of Impact will be determined prior to the commencement of the works. Essentially it is the distance from the center-line to the toe of the embankment required for the widened shoulder plus 2 m to allow for the movement of construction equipment.
What are actual interventions with the road in Thanatpin Township?	The work will consist of widening the existing carriageway to provide a 3.5 m lane in each direction plus a 1.5 m sealed shoulder and a 1 m unsealed shoulder on each side. Draining will be improved and culverts/bridges will be repaired or replaced as required. where required to provide for the existing 7 m carriageway and provide 1.5 m sealed shoulders plus 1 m unsealed shoulders on each side. In residential/commercial areas the works will be minimized to limit disruption. An asphalt pavement will provide throughout.
How-long and when will the civil works will complete in Bago and Thapatpin Townships?	The project is planned to commence in mid-2018 and be completed in 2022. The project has been planned so that the work matches the capacity of contractors to complete what is a significant project. The works program will be prepared by the Contractor to minimize the disruption to all affected persons along the road corridor. As the road embankment will require widening in many places to take account of the wider pavement and work will have to take account of the ends of traffic progress will be relatively slow. In addition, time will be lost during the monsoon period.
After rehabilitation, the road standard will be international standards or ASEAN standards	The project will meet the standards set by DOH for such roads.
Land that was acquired to constitute the current right-of-way in the year 1995 and 2000 but compensation has not yet been made to the households? Will this project compensate for the households for the land that	No, if the households have not yet been compensated for the land acquired in 1995 and 2000 for the existing ROW, the households can request the relevant agencies to compensate for the acquired land or lodge their grievance to competent agencies following the provisions of the national legislations – but this project will not compensate for that land.

Comment	Proponent's Response
acquired for the current ROW?	
Consultation Meeting in Kawa Township (25 April 2017)	
How much is the total project cost?	The information on the total project cost is not available at the moment as feasibility study is not yet been completed
How long is the loan and how much is the interest for the loan that the Government will have to pay?	The information on the loan is not available the moment as it will be discussed during the loan preparation and negotiation.
What are actual the interventions within the road in the Township.	The road will be widened to provide two 3.5 m lanes plus shoulders on each side. Rehabilitation will be undertaken as required and the whole length will be resurfaced.
How long and when the civil works will complete in the Township?	The project is planned to commence in mid-2018 and be completed in 2022. The project has been planned so that the work matches the capacity of contractors to complete what is a significant project. The works program will be prepared by the Contractor to minimize the disruption to all affected persons along the road corridor. As the road embankment will require widening in many places to take account of the wider pavement and work will have to take account of the ends of traffic progress will be relatively slow. In addition, time will be lost during the monsoon period.
Will compensation be made in cash for dust and noise during rehabilitation of road?	No, the measures to mitigate dusts and noise will be applied and monitored in accordance with the provisions of the Environmental Management Plan.
Consultation Meeting in Kayan Township (25 April 2017)	
The corridor of impact of 13.8 m (45 feet to both sides from the current road center) is too large! It should be 25 feet (7.7 m) to both sides from the current road center. DOH should confirm to the people.	The 13.8 m Corridor of Impact is the maximum width. The actual Corridor of Impact will be determined prior to the commencement of the works. Essentially it is the distance from the center-line to the toe of the embankment required for the widened shoulder plus 2 m to allow for the movement of construction equipment.
What are actual the interventions with the road in Kayan Township?	The road will be widened to provide two 3.5 m lanes plus shoulders on each side. Rehabilitation will be undertaken as required and the whole length will be resurfaced.
Will the road surface be concrete or asphalt?	Asphalt
How long and when will the civil works be completed in Kayan Township?	The project is planned to commence in mid-2018 and be completed in 2022. The project has been planned so that the work matches the capacity of contractors to complete what is a significant project. The works program will be prepared by the Contractor to minimize the disruption to all affected persons along the road corridor. As the road embankment will require widening in many places to take account of the wider pavement and work will have to take account of the ends of traffic progress will be relatively slow. In addition, time will be lost during the monsoon period.
Land that was acquired to constitute the current right-of-way in the year of 2000 but compensation has not yet been made to the	No, if the households have not yet been compensated for the land acquired in the year of 2000 for the existing ROW, the households can request the relevant agencies to compensate for the acquired land or lodge their grievance to competent agencies following the provisions of

Comment	Proponent's Response
households? Will this project compensate for the households for the land that acquired for the current ROW?	the national legislation – but this project will not compensate for that land.
Relocation should occur before July 2018 - before raining season.	DOH will consider this factor in working with village tracts and township administration when arranging relocation.
Will electricity poles along the road be compensated?	Utility services will be relocated as part of the project.
There are some water-pipes installed by the households or by the village – will these schemes be compensated for?	Yes, if the schemes are affected, fully compensation will be provided for. But if the schemes are not affected, no compensation will be for the scheme. The preferred option is to relocate the pipes as part of the project.
Consultation Meeting in Thongwa Township (26 April 2017)	
As Thongwa township center is very narrow, will the road rehabilitation be the with the diversion road (the road section that runs around of the town-center to avoid the town center) or include 3 mile-road section in the center?	It will be the existing road (including 3 mile road section in the town center). In addition, this would require property acquisitions which would severely disadvantage exiting property owners. The plan is to restrict the rehabilitation works within the residential/commercial area to an asphalt overlay only to limit the impact on the residents and shop-keepers.
What are actual the interventions with the road in Thongwa Township?	The plan is to restrict the rehabilitation works within the residential/commercial area to an asphalt overlay. In rural areas road will be widened to provide two 3.5 m lanes plus shoulders on each side. Rehabilitation will be undertaken as required and the whole length will be resurfaced.
The Township DOH issued the Notice requesting the households that are staying in the ROW to move-out of the ROW. What can the households do now?	The households should not move out now but wait for the next advice from the DOH. DOH Yangon Region will work with DOH Township to soon advise the households on the situation.
Will electricity poles along the road be compensated for?	Utility services will be relocated as part of the project.
The village has some structures such as the village name boards, the fence and yard of monasteries...that may be affected – will compensation be for the impacts?	Compensation will be affected assets within the corridor of impact, which is narrower than the existing Right of Way. Village signboards will be moved or replaced as required as part of the contract works.
Consultation Meeting in Thanlyin Township (26 April 2017)	
How-long and when the civil works will complete in Thanlyin Township?	The project is planned to commence in mid-2018 and be completed in 2022. The project has been planned so that the work matches the capacity of contractors to complete what is a significant project. The works program will be prepared by the Contractor to minimize the disruption to all affected persons along the road corridor. As the road embankment will require widening in many places to take account of the

Comment	Proponent's Response
	wider pavement and work will have to take account of the ends of traffic progress will be relatively slow. In addition, time will be lost during the monsoon period.
Does the corridor of impact of 13.8 m (45 feet to both sides from the current road center) include the road shoulders?	Yes. The 13.8 m Corridor of Impact is the maximum width. The actual Corridor of Impact will be determined prior to the commencement of the works. Essentially it is the distance from the center-line to the toe of the embankment required for the widened shoulder plus 2 m to allow for the movement of construction equipment.
Will the road section within the town-center be widened?	No. The project ends in the rural area at the intersection with the access road to Thilawa Port north-east of East Yangon University.
Will compensation be paid to those who are staying in the ROW but are not affected?	No, those who are staying in the ROW but not within the Corridor of Impact (no structures affected) – no compensation will be paid.
Will the resettlement budget will be from ADB's loan?	No, the resettlement budget will be part of the counterpart funding of the Government.

Source: Field surveys by project preparatory consulting team

201. Attendance lists are provided in Appendix C. Photographs of the meetings are provided in Figures 31 to 35.

Figure 31: Photographs of Public Meeting for Bago/Thanatpin

Source: Field surveys by project preparatory consulting team

Figure 32: Photographs of Public Meeting in Kawa Township

Source: Field surveys by project preparatory consulting team

Figure 33: Photographs of Public Meeting in Kayan Township

Source: Field surveys by project preparatory consulting team

Figure 34: Photographs of Public Meeting in Thongwa Township

Source: Field surveys by project preparatory consulting team

Figure 35: Photographs of Public Meeting in Thanlyin Township

Source: Field surveys by project preparatory consulting team

4.3 Yangon–Mandalay Expressway Improvements

2012. The rehabilitation and safety improvements to the Expressway are within the existing corridor and are part of the existing operations of DOH. In addition there are no affected persons. As result no community consultation was undertaken.

4.4 Grievance Redress Mechanism

4.4.1 Introduction

2013. Unforeseen problems and issues may arise due to construction and operational impacts. Therefore, to resolve these issues, the DOH will establish a mechanism to receive and facilitate resolution of affected peoples' concerns, complaints, and grievances about the

project's environmental performance. It should be emphasized that this grievance redress mechanism related only to the project's environmental performance.

4.4.2 Objectives of Grievance Redress Mechanism

304. A Grievance Redress Mechanism (GRM), consistent with the requirements of the ADB Safeguard Policy Statement (2009) will be established to prevent and address community concerns, reduce risks, and assist the project to maximize environmental and social benefits. In addition to serving as a platform to resolve grievances, the GRM has been designed to help achieve the following objectives: (i) open channels for effective communication, including the identification of new environmental issues of concern arising from the project; (ii) demonstrate concerns about community members and their environmental well-being; and (iii) prevent and mitigate any adverse environmental impacts on communities caused by project implementation and operations. The GRM is accessible to diverse members of the community, including more vulnerable groups such as women and youth. Opportunities for confidentiality and privacy for complainants are to be honored where this is seen as important.

305. DOH will appoint a Public Complaints Officer (PCO) to the DOH PMU to deal with complaints from affected people throughout implementation of the project. Prior to construction, the PCO will finalize the GRM in collaboration with local government. The local government bodies at the village and township level will act as focal points for contact with the PCO. DOH PMU and the village and township focal points will issue notices to inform the public within the project area of the GRM. The PCO's phone number, fax, address, email address will be disseminated to the people through displays at the respective offices of the government administrations and public places.

306. The PCO should have experience and/or training in dealing with complaints and mediation of disputes. The PCO will have facilities to maintain a complaints database and communicate with Contractors, the Construction Supervision Consultant, the DOH PMU, and village and township representatives and with complainants.

4.4.3 GRM Process and Timeframes

307. The GRM process and proposed timeframes is summarized in Table 44.

308. **GRM Entry Points**. Formal complaints may be made directly to the PCO or through: (i) DOH offices, Contractors, the Construction Supervision Consultant, Village Governments, and Township Governments.

309. **Stage 1: Informal Resolution.** If a concern arises, the affected person may to resolve the issue of concern directly with the Contractor. The Contractor must inform the PCO of the complaint and its resolution. If the issue is successfully resolved, no further follow-up is required.

310. **Stage 2: Formal Complaint**. Affected people will submit an oral or written complaint to the directly to the PCO or through GRM entry points (DOH offices, Contractors, the Construction Supervision Consultant, Village Governments, and Township Governments). For an oral complaint, the PCO must make a written record. For each complaint, the PCO must investigate the complaint, assess its eligibility, and identify an appropriate solution. It will provide a clear reply within five (5) working days to the complainant, Village Government and/or Township Government, DOH, and Contractor.

311. The PCO will, as necessary, through the DOH PMU and the Construction Supervision Consultant; instruct the Contractor to take corrective actions. The PCO will review the Contractor's response and undertake additional monitoring. During the complaint investigation, the PCO will work in close consultation with the Contractors, and the Construction Supervision Consultant. Contractors during construction should implement the redress solution and convey the outcome to the PCO within seven (7) working days.

312. **Stage 3: Multi-stakeholder Meeting**. If no solution can be identified by the PCO or if the complainant is not satisfied with the suggested solution under Stage 2, the PCO will organize, within 21 days of filing of the complaint, a multi-stakeholder meeting under the auspices of the head of DOH, where all relevant stakeholders (i.e., the complainant, DOH PMU, Contractor, Construction Supervision Consultant, Village Government and/or Township Government focal points) will be invited. The meeting should result in a solution acceptable to all, and identify responsibilities and an action plan. The Contractors should implement the agreed-upon redress solution and convey the outcome to the PCO within seven (7) working days;

313. **Stage 4: ADB Special Mission** If the multi-stakeholder hearing process is not successful, the PCO will inform ADB accordingly, and the ADB project team will organize a special mission to address the problem and identify a solution; and

314. **Stage 5**: **Judicial Proceedings.** If the affected people are not satisfied with the reply in Stage 4, he or she can go through local judicial proceedings.

315. **Reporting**. The PCO will record all complaints, investigations, and subsequent actions and report monthly. A summary report on PCO operations and Complaint logs will be included in semi-annual environmental monitoring reports to ADB and MONREC.

Table 44: Summary of Grievance Redress Process

Stage	Process	Time from Complaint Submission
1. Informal Resolution	Only for minor complaints Affected person tries to resolve the problem with the Contractor Contractor must keep a record and report to PCO	1–3 days
2. Formal Complaint	Affect person contacts PCO directly or through one of GRM entry points (i.e., DOH offices, Contractors, the Construction Supervision Consultant, Village Governments, and Township Governments) PCO records and investigates complaint If the complaint in not eligible, PCO informs Complainant If the complaint is eligible, PCO works with Contractor, CSC, and PMU to find a solution PCO notifies affected people and instructs Contactor	5 days
	Contractor implements solution within 7 days of agreement on the solution	12 days
3. Multi-stakeholder meeting	If the complaint cannot be resolved, a multi-stakeholder meeting convened under the auspices of DOH. All relevant stakeholders (i.e., the complainant, DOH PMU, Contractor, Construction Supervision Consultant, Village Government and/or Township Government focal points) will be invited.	21 days

Stage	Process	Time from Complaint Submission
	The meeting should result in a solution acceptable to all, and identify responsibilities and an action plan.	
	Contractor implements the agreed solution within 7 days of the multi-stakeholder meeting	28 days
4. ADB Special Mission	If complaint cannot be resolved, ADB is notified ADB project team will field a special mission to address the problem and identify a solution	60 days
5. Judicial Proceedings	If the complaint cannot be resolved, the complainant has recourse to the local judicial process	indeterminate

Source: Project preparatory consulting team

4.4.4 Responsibilities of PCO

316. The responsibilities of the PCO are:

i. The PCO will instruct contractors and construction supervisors to refer any complaints that they have received directly to the PCO. Similarly, the PCO will coordinate with Village and Township focal points to "capture" complaints made directly to them;
ii. The PCO will log complaint and date of receipt onto the complaint database and inform the Construction Supervision Consultant and the Contractor;
iii. The PCO, with the Construction Supervision Consultant and the Contractor, will investigate the complaint to determine its validity, and to assess whether the source of the problem is due to project activities, and identify appropriate corrective measures. If corrective measures are necessary the PCO, through the Construction Supervision Consultant, will instruct the Contractor to take necessary action.
iv. The PCO will inform the Complainant of investigation results and the action taken;
v. If complaint is transferred from local government agencies, the PCO will submit interim report to local government agencies on status of the complaint investigation and follow-up action within the time frame assigned by the above agencies;
vi. The PCO will review the Contractors response on the identified mitigation measures, and the updated situation;
vii. The PCO will undertake additional monitoring, as necessary, to verify as well as review that any valid reason for complaint does not recur; and.
viii. The PCO will review the Contractors response on the identified mitigation measures, and the updated situation; and
ix. During the complaint investigation, the PCO should work together with the Contractors and the Construction Supervision Consultant. If mitigation measures are identified in the investigation, the Contractors will promptly carry out the mitigation. The Construction Supervision Consultant will ensure that the measures have been carried out by the Contractors.

317. The tracking and documenting of grievance resolutions within the PCO and/or DOH PMU will include the following elements: (i) tracking forms and procedures for gathering information from project personnel and complainant(s); (ii) dedicated staff to update the database routinely; (iii) systems with the capacity to analyze information so as to recognize grievance patterns, identify any systemic causes of grievances, promote transparency, publicize how complaints are being handled, and periodically evaluate the overall functioning of the mechanism; (iv) processes for informing stakeholders about the status of a case; and (v) procedures to retrieve data for reporting purposes, including the periodic reports to the DOH.

CHAPTER 5 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

5.1 Positive Impact and Environmental Benefits

318. **Rehabilitation**. The road will provide all-weather transport links and the improved road surface and signage will reduce: accidents, travel times, wear and tear on vehicles, and localized air pollution, road noise and vibration. The road will include improved drainage of lanes and shoulders. This will not only enhance the longevity of the road asset but also improve health of people living and working near the alignment by reducing water puddling and the associated populations of mosquitoes and other disease vectors.

319. **Connectivity.** The project will also have significant positive economic impact on the wider economy as it will provide improved access between the Thilawa Port and Special Economic Zone and Bago; thence to northern, southern and eastern Myanmar. It will enhance connectivity and access to economic opportunities, health, social and educational services for residents and businesses. People with better access to markets will benefit via improved opportunities to sell their labor and products. The linked effects will assist to raise the quality of life for those living and working in the areas served by the road.

320. **Beneficiaries**. The Bago Thanlyin Road will directly benefit the residents along the project road, which consists of over 320,000 households. The people will benefit in a number of ways including better access to services such as health care and education.

321. **Health and Community Health & Safety**. A benefit from the road will be a reduction in dust as vehicles will no longer be travelling on unpaved surfaces when overtaking, because the wider paved shoulders and carriageway. Currently the residents and other road users are subject to relatively high levels of airborne dust when a vehicle passes at speed if it is not fully on the pavement. This can have detrimental impacts on health, particularly for children and people with respiratory disorders. The current narrow, poorly delineated pavement is also a hazard for all road users including pedestrians.

5.2 Environmental Impact Screening

322. The potential adverse impacts were screened to identify their relative significance, reflecting the requirements set out by ADB's SPS, 2009. Impacts during pre-construction, construction and operation phases were considered separately.

5.2.1 Methodology

323. Impacts were considered in terms of the receptor, sensitivity of the receptor, and magnitude of the impacts:

i. "Receptor": the resource (human/natural environment/economic/social) which is potentially going to receive and have to cope with an impact.
ii. "Sensitivity": ability to cope with an impact and/or its importance to the country of Myanmar. It is generally accepted that human health is always a high sensitivity receptor, however in terms of environmental/natural resources, the sensitivity varies according to the receptor e.g. scrubland with no significant biodiversity is considered less sensitive than a mature forest which supports ecosystems and livelihoods.
iii. "Magnitude": the size of the potential impact. Impacts may be short term and considered low magnitude (e.g. noise or temporary reduction of income during a short construction project)

or high magnitude (e.g. the poor disposal of large quantities of hazardous waste into a water course).

324. Overall impact significance was assessed qualitatively using Table 45.

Table 45: Potential Impact Significance

		Magnitude of Impact		
		LOW	**MEDIUM**	**HIGH**
Receptor Sensitivity & Importance	**LOW**	Low	Low	Medium
	MEDIUM	Low	Medium	High
	HIGH	Medium	High	High

Source: Project preparatory consulting team

325. The residual impact significance is the significance of the impact remaining after mitigation has taken place. Mitigation measures cannot always eliminate all impacts and this is reflected in the screening. However, residual impact significance more accurately describes the impacts of the project as it is anticipated that the requirements of the EMP will be followed and impacts satisfactorily mitigated.

Table 46: Environmental Impact Screening

Category	Impact Yes/ No	Receptor Sensitivity	Magnitude	Potential Impact Significance	Residual Impact Significance
Water	Yes	Irrigation Canals Medium	Short term, during embankment construction as well as bridge and culvert construction/ rehabilitation, potential contamination and sediment disturbance. Medium	Medium	Medium
Flooding	Yes	Residential and Business Buildings	Short term, during embankment construction as well as bridge and culvert construction/ rehabilitation,	Medium	Low
Soil	Yes	Sandy soil may be eroded, possible existing contamination adjacent to road from vehicles. Borrow sites needed but far from receptors. Medium	Worst case is medium term if contamination is from chemical spillage and loss of eroded soil. Medium	Medium	Low
Air	Yes	Humans are sensitive to air quality issues such as dust and odor. High	Short term and localized but close to houses. Medium	High	Medium
Waste	Yes	Poor waste controls could affect soil / water, and public health. High	It is not anticipated that large quantities of hazardous wastes will be produced but very limited capacity to manage waste in the area. Low	Medium	Medium
Noise	Yes	Noise can cause nuisance to public. High	Short term and localized but close to houses. Medium	High	Medium

Category	Impact Yes/ No	Receptor Sensitivity	Magnitude	Potential Impact Significance	Residual Impact Significance
Visual impact	Yes	Impact for humans regarding the appearance of the road and surroundings. Low	Long term as mature trees which improved the appearance of the area will be removed but trees are intermittent; short term impacts from construction sites. Low	Low	Low
Flora	Yes	Trees adjacent to road and in new alignment will be removed during construction. Medium	Long term impact. The trees are mature and will take time to be replaced and perform an ecological function. High	High	Low
Cultural Resources	Yes	Affect access to religious sites. Low	During construction. Medium	Low	Low
Occupational Health and Safety	Yes	Occupational health. High	Throughout construction serious risks may arise. Medium	High	Low
Community Health and Safety	Yes	Public health High	Temporary during construction but construction is in a public area to which access must be maintained. Medium	Low	Low
Utilities Provision	Yes	Limited economic impact assuming short term disruption. Low	Short term during construction of each section. Low	Low	Low
Induced Congestion	Yes	Travel time may be increased. Low	Short term during construction. Low	Low	Low

Source: PADECO PPTA Team with tool based on GMS East–West Economic Corridor (EWEC): Eindu to Kawkareik Road Improvement Project – Initial Environmental Evaluation (November 2014)

5.3 Impacts and Mitigation Measures: Design and Pre-Construction

326. **Impact: Removal of Roadside Trees: Yangon–Pathein Highway.** Cutting and removing hundreds of trees may cause concern in the community and with tree "owners". Most trees for removal along the Yangon–Pathein Highway alignment are Teak trees (locally called "Kyun Tint" trees) planted by the Department of Forestry (DOF). Other "community" trees, such as Acacia (Acacia), Eucalyptus (Eucalyptus), Koak Ko trees (Albizzia lebbeck) and Tamarind trees (Tamarindus indica), are under the general ownership of surrounding communities. There are many other tree species represented along the alignment (see Chapter 3, Table 17).

327. In the case of DOF "owned" teak trees, an agreement will be reached between the two agencies of government (MONREC/DOF and MOC/DOH). Monetary compensation may be paid of MOC/DOH may agree to provide offset land to enable DOF to plant replacement trees away from the immediate vicinity of the road.

328. **Impact: Removal of Roadside Trees; Bago–Thanlyin Highway**. One of the major impacts of the road will be the removal of many roadside trees that have been planted on the existing formation but outside of the carriageway. It is estimated that around 10,000 to 15,000 will require removal and replacement with appropriate species which will be planted within the right of way but further from the centerline. At a meeting with the Myanmar Forestry Department on 24 March 2017 the Proponent was advised that all of the trees within the right of way are the property of the Myanmar Government. The Forestry Department will assess the number of impacted trees and will be responsible for their removal and disposal.

329. **Mitigation: Tree Retention.** Where possible, the design and the road construction teams will seek to retain the trees, reducing the visual impact as far as possible. Contractor will identify and label all trees which they consider need to be removed prior to construction in order that this can be monitored during the construction phase. Permits for teak tree removal will also need to be obtained by the contractor.

330. Trees to be removed will be determined accurately after the investigation and consultation with the Department of Forests planned for mid-2017. Only those trees in the road corridor of impact will be affected; other trees within the Right of Way will not be affected.

331. **Impact: Flooding**. As both the Yangon–Pathein and Bago–Thalyin road corridors are located in low-lying delta areas flooding is a potential continuing hazard. Much of the area is protected by levee banks but that does not protect the areas from local flooding during heavy rain. It has been identified that the section of Yangon–Pathein Highway between km post 128 and km post 148 regularly floods and disrupts traffic for several days during most monsoon seasons.

332. **Mitigation**: A number of mitigations measures are proposed on both roads. Damaged culverts will be replaced and additional culverts proposed as indicated during the design. Waterways ways will be cleaned of debris near structures. Where bridges are replaced the waterway area will not be less than that of the structures they will be replacing. Drainage structures along the edge of the corridor of impact in residential/commercial areas will be cleaned and replaced or augmented as required.

333. On the Yangon–Pathein Highway the embankment between km post 128 and km post 148 will be raised so that the pavement structure will be above the calculated 20 year flood

return period. Additional culverts will be added and an over-bridge is proposed over the railway line to keep the road above the flood level without affecting the railway line.

5.4 Impacts and Mitigation Measures: Project Construction Phase

5.4.1 Water Quality

324. **Potential Impacts: Water Quality**. The project may impact on surface water quality during construction through accidental contamination and increased sedimentation of water courses. Potential sensitive human receptors and aquatic ecology will be exposed to short term impacts arising from a potential increase in turbidity of surface water during construction.

325. Surface-water runoff, especially large quantities in the wet season, erodes exposed soil, can damage work-sites, storage and dump sites, works in progress, adjacent land, and undermine built structures. Water running over the ground-surface pushes or carries dust, soil, detritus, and garbage. Sediment, other materials and debris can be carried long-distances and be deposited on adjacent land. It can block drains, damage land and crops, create excess turbidity in receiving waters, diminish water quality and adversely affect aquatic biota. Control of surface-water runoff and sediment from work and storage sites is vital to prevent erosion and damage both on-site and off-site.

326. Construction projects have potential to contaminate groundwater if accidental spills occur in areas of high water table; there are ground water drinking sources in the area. As no groundwater depth information in the project area was available during IEE preparation, measures to protect ground water will be included, primarily in relation to spills from hazardous materials.

327. There is a risk of the water becoming contaminated during construction during the placing of fill materials and the reconstruction of the bridges and the possibility of leakage of oil and petroleum from construction equipment. Only clean fill will be utilized and, where possible, the bridge components will be prefabricated off site. The other possible impact is the restriction in the flow of water during and after construction. Bridge sites are unlikely to be impacted but there may be minor impacts on the irrigation canals that run parallel to road, particularly in the northern section. This could result in a slight reduction in the width of the canal but not a restriction on its flow.

328. **Mitigation of impacts on surface water**. The impacts on surface water will be mitigated through the following measures:

- Sensitive water receptors which may be accidentally damaged during construction includes wells, will be identified in advance of construction and demarcated to ensure machinery does not encroach on them. Identification of water receptors will require consultation with community members.
- To limit the spill of materials into water bodies during bridge construction, no materials will be stored within 50 m of a water course, including soil, spoil, aggregates, chemicals or other materials used during construction.
- Temporary drainage provision will be provided during construction to ensure that any storm water running off construction areas will be controlled around al permanent water bodies. This will ensure that potentially contaminated water does not impact on sensitive receptors. Contaminated water from construction camps will be removed off-site for disposal;

- Enclosed drainage around chemical storage areas on construction sites and storage will be on hard standing.
- Develop and implement contingency plans for control of spills of oil and other hazardous substances;
- Fuel storage, maintenance shop and vehicle cleaning areas must be placed at least 300 m away from the nearest water body and will include enclosed drainage to ensure contaminated water does not cause pollution and storage, maintenance and cleaning activities will be on hard standing;
- Construction wastes and materials (e.g. fuel) will be properly contained during construction and fuel tanks will be located in a bunded area which has a capacity of 110% of the fuel tank. Wastes will be stored in a hard standing area which is protected from rain and wind; and waste removed from site and taken to approved disposal facilities;
- Water collection basins and sediment traps will be installed in all areas where construction equipment is washed. Contaminated water will be removed off-site for disposal in the facilities identified; and
- Effective septic treatment and disposal systems will be installed at construction camps or arrangements for adequate off-site disposal made.

339. **Monitoring.** Water quality monitoring will be conducted for key water quality parameters (see Table 59 in section 6.4.2. Monitoring results will be compared with the Environmental Quality Standards (see Appendix D).

5.4.2 Soil Resources

340. **Impacts on Soil Resources.** Four types of potential impacts on soil may occur, including: (i) soil erosion; (ii) soil contamination; (iii) inappropriate management of borrow pits; and (iv) improper disposal of unwanted material and spoil.

- **Soil erosion.** May be caused by cut and fill operations, for culverts and borrow pits, stockpiles and spoils from earthworks during rehabilitation of roads, road grading and construction camp construction and erosion of embankment slopes which will be higher than current embankment levels in specific locations.
- **Soil contamination.** Contamination of soil in the construction phase may result from the inappropriate transfer, storage, and disposal of petroleum products, lubricants, chemicals, hazardous materials, liquids and solid waste. These impacts are particularly associated with construction camps where the majority of potentially contaminating chemicals are stored, and during refueling of plant and equipment.
- **Borrow pits and spoil disposal.** For many road projects, borrow pits and quarries to provide fill for earthworks. However, Borrow-pits are not expected to be used on this project because local “soil” is largely unsuitable for fill material due to its high carbon content, structure and low load-bearing strength. However, the Contractor may decide to take fill from borrow-pits with approval of local authorities and DOH.
- **Improper disposal of excavation spoils**. Damage to the environment will most likely arise if suitable disposal sites for excavated soil and removed pavement are not identified prior to commencement of site works. The contractor may resort to indiscriminate dumping of spoils that could pollute water bodies and damage productive land.

341. **Mitigation: Soil erosion:** (a) minimizing the area of soil clearance; (b) maintaining slope stability at any cut faces; (c) construction in erosion and flood-prone areas will be mainly

restricted to the dry season where possible; (d) control silt runoff particularly around cross drainage structures when they are over water; (e) cover soil stockpiles; (f) properly stabilize slopes and re-vegetate disturbed surfaces using locally available indigenous grass species; and (g) protect slopes on both sides of any road crossing structures to prevent soil loss; (h) use of temporary berms or other appropriate temporary drainage provisions at construction sites to prevent water eroding cut faces, stockpiles and other exposed areas of soil particularly if construction occurs in the rainy season.

342. **Mitigation: Soil contamination**: (a) store chemicals/hazardous products and waste on impermeable surfaces in secure, covered areas with clear labeling of containers and with a tray or bund to contain leaks; (b) regularly remove all construction wastes from the site to approved waste disposal sites; (c) disseminate spill management plan to construction team and conduct training in emergency spill response procedures; (d) provide spill cleanup measures and equipment at each construction site; (e) ensure fuel is stored in a bunded tank and vehicle refueling takes place on hard standing area away from surface water.

343. **Mitigation: Disposal of unwanted materials and spoils.** There will be large volumes of spoil removed from the existing road-bed after pavement removal. Some of this spoil may meet the requirements for re-use but much of it will not. Improper disposal of unwanted spoil may impact land, water and vegetation and may create dust, block drains. To avoid such impacts, before excavation and removal of pavement commence, CSC/Engineer and MOC/DOH need to undertake inspection and provide approval of the contractors' disposal sites to ensure that the EMP criteria for such sites are met. Specific mitigation measures include:

- Transport of removed spoil to approved sites
- Sorting of the removed spoil into re-usable and unwanted spoil
- Keep re-usable spoil for re-use
- Cover spoil stock-piles to prevent it being blown by wind or eroded by rain
- Surround the stock-pile with a temporary drain leading to receiving waters

344. **Mitigation: Operation and Restoration of Borrow pits**: If borrow pits are used to source construction materials, the following mitigation measure will be undertaken:

- Obtain approval from CSC to investigate the feasibility of operating a borrow-pit, should the Contractor decide to proceed with this possibility.
- Do not select a potential borrow-pit site within 300 m of a settlement.
- Obtain the required permits and licenses.
- Remove and keep topsoil for later use in site restoration
- Provide adequate drainage and sediment controls
- Prepare a plan for operation and restoration including:
    - Include copies of required permits/approvals from local & township authorities, and a copy of the contract between the Contractor and the land-owning party
    - Provide a schedule of operations
    - Indicate borrow-pit capacity agreed to by the land-owner and local authorities
    - Include a map or diagram showing the borrow-pit site and access routes
    - Identify the measures to be taken for temporary drainage and dust control
    - Specify the measures to restore the site to be stable, safe, landscaped, planted or returned to agriculture, to the satisfaction of the land-owner and affected community.
- Restore the site and include fencing and signage where warranted

5.4.3 Air Quality

345. **Impacts on Air Quality**. Moderate temporary air quality impacts during the construction stage of the project could be anticipated because of fugitive dust generation along road sections under construction and construction sites for river crossings and construction-related activities such as asphalt plants. Minor increases in the level of nitrogen oxides (NOx) and sulphur oxides (SOx) from construction plants and machinery are expected. Air quality impacts during construction are likely to result from the following sources:

- Emissions from construction machinery and equipment, movement of haulage trucks;
- Asphalt paving will produce fumes containing small quantities of toxic and hazardous chemicals such as volatile organic compounds and poly-aromatic hydrocarbons;
- Fugitive dust from stripping of pavement during road rehabilitation;
- Fugitive dust from earthworks such as establishment and use of borrow pits, creation of embankments and cutting and filling activities;
- Fugitive dust from loading, unloading and haulage of spoil for disposal and construction materials from borrow pits particularly in areas where receptors (people) are present such as in villages;
- Fugitive dust from concrete batching plants; and
- Dust created from unprotected surfaces by wind.

346. Air quality issues could affect nearby residential areas in villages and towns. The street vendors and business owners adjacent to the road will also be impacted by short term lowering of air quality and this may affect their ability to conduct business during the construction period immediately outside their business location.

347. **Mitigation of Impacts on Air Quality**. The mitigation measures to protect sensitive receptors from air quality issues are:

- **Asphalt plants and concrete batching plants** to be located at least 500 m downwind or as far as practicable from the nearest dwellings in order to reduce the impact of fumes on humans and to be fitted with necessary equipment such as bag house filters to reduce fugitive dust emissions.
- **Stockpiles** must be managed to reduce dust emissions. The location of the stockpile must be downwind of sensitive receptors. The stockpile must be sprayed with water before material is moved. If the stockpile is within 300 m of dwellings additional precautions must be taken including using a reusable stockpile cover and fencing to form a high barrier and prevent wind lifting and dispersing.
- **Construction site management**. Water will be sprayed on construction sites and material handling routes where fugitive dust is generated.
- **Transport of materials**. Trucks carrying earth, sand or stone will be covered with tarpaulins or other suitable cover. Construction vehicles and machinery will be maintained to a high standard to minimize emissions. River transport will be used where possible and practicable.
- **Clean up**. During all construction, the contractors will immediately clean up any mud or dusty materials which are left on or around public roads.
- **Advance Warning**. Before the road is constructed, people in the construction area will be given advanced warning of the works, enabling them to take measures against the dust, such as ensuring all food open for sale is covered.

Monitoring. Air quality monitoring will be conducted for key air quality parameters (see Table 59 in section 6.4.2). Monitoring results will be compared with the Environmental Quality Standards (see Appendix D.

5.4.4 Solid Waste Management

348. **Impacts from solid waste generation.** Minimizing waste conserves valuable natural resources, such as oil, metal ores and wood pulp. Disposal of construction wastes could have adverse impacts on the soil, water and health of contractors and the community. Waste streams will include inert construction wastes (e.g. soil, spoil, debris, concrete) and municipal type wastes (construction workers' food and packaging wastes from construction consumables) and hazardous wastes from construction (e.g. fuel containers, oil filters, oily rags).

349. To manage risks associated with the disposal of municipal waste, which may give rise to leachate, the new sites which will be allocated by DOH will be used for inert construction wastes only and municipal type wastes will be taken to existing dump sites which means a lower risk of impacts from this as the location of the new sites may not be appropriate for municipal wastes. In addition, any new areas of municipal wastes will attract other wastes dumped by residents, for which the contractor will not be responsible. Therefore, limiting the disposal of municipal wastes to existing sites is likely to lower the impacts from these wastes.

350. **Mitigation**. The potential impacts arising from solid waste production and disposal will be mitigated through a number of activities defined in the EMP, and which will be incorporated in the bid documents and construction contracts.

- **Waste hierarchy**. Construction will be subject to the waste hierarchy to ensure efficient use and management of resources. The preference is for prevention of waste at source. This means the effective management of materials on site through good house-keeping and work planning, in order to generate less waste. Procurement options will play a role in waste prevention as the procurement of materials which have less packaging for example, would be preferable. Waste minimization is the second preferred option. Reuse or recycling options will be considered prior to disposal and where possible include:
  - The existing road surface will be recycled and used as sub-base
  - Block work from abutments used as rubble back fill for drainage layer for bridges
  - Concrete that meets grading requirements to be used as fill.
- **Storage and containment.** Provide appropriate waste storage containers for worker's construction and hazardous liquid wastes; Install confined storage points of solid and liquid wastes away from sensitive receptors;
- **Site hand over.** Ensure proper removal and disposal of any significant residual materials, wastes and contaminated soils prior to construction camp site handover;
- **Spoil and inert waste management**. Spoil and other inert wastes will be disposed of only in sites which are approved by the CSC in accordance with the Aggregate, Borrow Pit and Spoil Management Plan; spoil will not be disposed of where it may impact on any vegetation; Rehabilitate and restore spoil disposal sites in accordance with the agreed plan.

- **Municipal type waste**. Municipal type waste (from construction workers and accumulations along the road) will be placed in whichever waste disposal site is nearest.
- **Hazardous waste** such as oily rags or chemical containers, will be neutralized as far as possible, kept as dry as possible to reduce likelihood of leachate and will be disposed of in plastic bags.
- **Management**: Prohibit burning of waste at all times.

351. Waste will inevitably be generated by the project and in a region without sound waste disposal facilities. However, with good procurement practice combined with good housekeeping on construction sites and camps, impacts from waste management are not anticipated to be significant for the project.

5.4.5 Construction Camps

352. **Impact:** Construction camps provide temporary accommodation for workers, most being unaccompanied men, engaged in project works. Workers can be noisy and untidy and their camps sources of pollutants unless managed well. Work-camps and the work-force can cause anxiety and nuisance in the community. Waste generation and management, poor sanitation, toilet waste, runoff water and sedimentation, health impacts and community social stress are the main impacts. The questionnaire survey of community perceptions of likely impacts (Dec 2016) showed that 57% of respondents had medium or serious concerns about the work-force.

353. Mitigation. Mitigation measures include:

- Locate work camps at least 50 m from residences.
- Manage work camps closely to ensure high standards of cleanliness, control of surface-water runoff, and reasonable worker behavior.
- Provide workers with guidance on acceptable behavior in/around work camps and communities.
- Provide adequate solid waste receptacles at key locations around the camp.
- Provide a covered area on an impermeable surface for parking large steel or plastic waste collection containers for temporary storage of solid waste for pickup.
- Ensure regular solid waste pickup and disposal.
- Install proper toilet facilities connected to buried pump-out septic storage tanks.
- Install proper, fully-equipped kitchens with sinks emptying to buried pump-out septic storage tanks.
- Pump-out septic storage tanks regularly by licensed liquid waste company.
- Build an adequate drainage system leading surface water to a settlement pond of sufficient capacity to control the large quantities of wet-season rain and runoff.
- Enable settled/clarified water to exit to the environment via a piped or open dispersion system.

5.4.6 Noise and Vibration

354. **Impacts from noise and vibration**. The major sources of noise pollution are removal and replacement of existing surface materials for road rehabilitation and the removal and replacement of cross drainage structures. These project sub-components will require the use of equipment such as excavators for embankments, vibratory road rollers for compacting sub-

grade and pavement. Also, the general movement of construction vehicles, the haulage of construction materials to the construction sites and the use of generators will create noise.

356. The Myanmar noise standards (Myanmar Environmental Quality Emission Guidelines (2015)) specify the maximum one hour noise level (see Table 47).

Table 47: Recommended Maximum One Hour LAeq (dBA) Levels for Myanmar

	One Hour LAeq (dBA)	
Receptor	**Daytime 07:00–22:00 (10:00–22:00 for Public holidays)**	**Nighttime 22:00–07:00 (22:00–10:00 for Public holidays)**
Residential, institutional, educational	55	45
Industrial, commercial	70	70

Source: Project preparatory consulting team

357. Construction activities could reasonably be expected to produce noise levels up to 90 dB(A) within 5 m of machinery[6]. No receptors other than construction workers will be this close to the machinery, and they will be required to use appropriate PPE.

358. Along the project roads there are other receptors (residential areas, businesses and institutions such as religious buildings and schools) that are within approximately 10 m of the current road edge. Therefore, these are the key locations for noise and may be expected to be subject to noise outside of 80 db(A) close to machinery.

359. Table 48 provides the theoretical distances that receptors must be from construction equipment noise source to reach levels recommended in the Myanmar Environmental Quality **Emission Guidelines (2015).** In practice, the actual distance will be less as noise will be reduced by environmental factors and barriers (e.g., trees, buildings, and fences). The identification of sensitive receptors for this assessment used a distance of 100 m from the center line of the road.

Table 48: Distances at which Noise Levels will Meet Myanmar Environmental Quality Emission Guidelines (2015)

Receptor		**Guidelines (dB)**	**Distance from Construction Equipment Noise Source (m)[a]**
Residential, institutional, educational	Daytime 07:00–22:00 (10:00–22:00 for Public holidays)	55	180
	Nighttime 22:00–07:00 (22:00–10:00 for Public holidays	45	550
Industrial, commercial	Daytime 07:00–22:00 (10:00–22:00 for Public holidays)	70	32
	Nighttime 22:00–07:00	70	32

[6] ADB, 2014. ADB GMS East–West Economic Corridor (EWEC): Eindu to Kawkareik Road Improvement Project – Initial Environmental Evaluation (November 2014).

	(22:00–10:00 for Public holidays

a Estimates are based on the noise attenuation curve for a clear field. In practice, the actual distance will be lower.

359. **Yangon–Pathein Road.** To assess possible impacts on sensitive receptors an assessment was made to determine which facilities were within 100 m of the road center-line along the corridor (Table 16). The assessment identified 88 sensitive receptors: including hospitals, schools, monasteries, temples, churches, village health care centers, community centers, and retirement centers.

360. **Bago–Thanlyin Highway**. To assess possible impacts on sensitive receptors an assessment was made to determine which facilities were within 100 m of the road center-line along the corridor (Table 23). The assessment identified 36 temples, monasteries and chapels; 14 primary schools; two secondary schools; two nursing homes; one hospital; and one orphanage within 100 m of the center-line.

361. **Expressway**. To assess possible impacts on sensitive receptors an assessment was made to determine which facilities were within 100 m of the edge of carriageway (Table 28). The assessment identified 12 sensitive receptors. There were no schools, hospitals and retirement home in this section, only temples and monasteries.

362. **Mitigation**. The potential noise impacts will be mitigated through a number of activities;

- **Source control.** Maintain all exhaust systems in good working order; undertake regular equipment maintenance, enclose stationary equipment such as generators where practicable and reduce vehicle speeds around sensitive receptors including temples and schools;
- **Siting**. Locate sites for concrete-mixing and similar activities at least 500 m away from sensitive areas;
- **Timing**. Operate between 8 a.m.–6 p.m. only and reach an agreement with nearby residents regarding the timing of heavy machinery work, to avoid any unnecessary disturbances;
- **Community notification**. In advance of construction, representatives from the religious sites, schools and village leaders along the project road will be consulted on the timing of construction so key ceremonies, exam times, or other significant events may be impacted upon as little as possible;
- **Consultation and engagement**. Information procedure of handling noise complaints through the Grievance Redress Mechanism will be disseminated and continually seek suggestions from community members to reduce noise annoyance.

Potential sensitive receptors will be exposed to short term impacts. With the above mitigation measures in place, potential noise quality impacts during the construction stage are anticipated to be acceptable. In addition, during construction, noise monitoring will be undertaken near sensitive receptors (see Table 59 in Section 6.4.2) to identify corrective action if needed. Monitoring results will be compared with the Environmental Quality Standards (see Appendix D).

5.4.7 Visual Impacts

363. **Impact on visual appearance**. The road construction will have a medium-term impact on the appearance of the road corridor because of the loss of mature trees which currently make the road look more pleasing, providing greenery and shade and vegetation. The road corridor

is not an area of specific natural beauty but the loss of the trees will have a low impact on the appearance of the road.

264. **Mitigation**. The potential visual impact will be mitigated through:

- **Design for Tree Retention**. Where possible the design and the road construction teams will seek to retain the trees, reducing the visual impact as far as possible.
- **Tree Planting and Aftercare.** Replacement of trees where they are lost and ensuring good quality aftercare of planted trees to ensure they survive and can grow to maturity. Some of these trees will be planted along the edge of the road as close to the locations of the removed trees as possible. See also Impacts and Mitigation on Flora.

5.4.8 Impacts on Aquatic Fauna

265. **Impact on aquatic fauna**. Based on expert opinion and understanding of the scale of the project components, impacts on aquatic fauna are expected to be minimal. The project does not require piling or other major activities in the water body which could elevate suspended sediment concentrations or introduce toxic contaminants in the water column.

266. **Mitigation of impacts on aquatic fauna**. Mitigation on aquatic fauna will result from the following measures:

- Mitigation of impacts on surface water quality; and
- Soil protection measures avoid is not water contamination.

5.4.9 Impacts on Flora

267. **Impact on flora**. The road construction will necessarily cause the loss of trees which are currently within the right of way but restricted to the corridor of impact. The Inventory of Loss (IOL) undertaken as part of the resettlement safeguards for the project has identified the loss of no rice paddy, nor farming, residential or commercial land to be acquired. Trees found during a detailed assessment of the Corridor of Impact are shown in Table 49 (Yangon–Pathein Highway) and Table 50 (Bago–Thanlyin Highway)**.**

Table 49: Trees Identified in Corridor of Impact (Yangon–Pathein Highway)

Common Name	Number of Trees Lost
Rubber	-
Cashew	-
Teak	12,016
Jack Fruit	-
Mango	149
Coconut	57
Banana	333
Lime	-
Guava	-
Silk cotton tree (kapok)	-
Betel nut	--
Jering (Jengkol, Dogfruit or Danyin)	-
Durian	-
Rain Tree	997

Common Name	Number of Trees Lost
drumstick (moringa)	-
Other	-
Total Loss of Trees in IOL	**18,221**

Source: Project preparatory consulting team

Table 50: Trees Identified in Corridor of Impact (Bago–Thanlyin Highway)

Common Name	Number of Trees Lost
Rubber	-
Cashew	-
Teak	293 (101 young trees)
Jack Fruit	-
Mango	6
Coconut	-
Banana	-
Lime	-
Guava	-
Silk cotton tree (kapok)	-
Betel nut	--
Jering (Jengkol, Dogfruit or Danyin)	-
Durian	-
Rain Tree	704
drumstick (moringa)	-
Other	346
Total Loss of Trees in IOL	**1,346**

Source: Project preparatory consulting Team

None of the trees to be removed, within the right of way individually or collectively are of high significance in terms of the habitats they provide e.g. habitat for endangered species, however they do all perform ecosystem services and therefore mitigation measures are required for all trees removed. Table 51 and Table 52 estimates the total trees lost and the compensation planting required. No trees will be lost on the Yangon-Mandalay Expressway.

Table 51: Tree Planting Required (Yangon–Pathein Highway)

Location	Trees Removed	Source of Data/Assumptions
Within Right of Way	31,773	Consultant count
Outside Right of Way	nil	IOL
Compensation Trees Needed	32,000	Replacement one-fold

Source: Project preparatory consulting team

Table 52: Tree Planting Required (Thanlyin–Bago Road)

Location	Trees Removed	Source of Data/Assumptions
Within Right of Way	1,349	Consultant count
Outside Right of Way	nil	IOL
Compensation Trees Needed	4,100	Replacement three-fold

Source: Project preparatory consulting team

Mitigation of impacts on flora. The potential impact on flora will be mitigated through:

- **Design for tree retention**. Where possible the design and the road construction teams will seek to retain the trees, reducing the visual impact as far as possible.
- **Tree identification**. Contractors to label all trees deemed necessary to be removed for construction before they are removed.
- **Off-set tree planting.** Replacement of trees where they are removed; for every tree removed three will be replanted. Some of these trees will be planted along the edge of the road as close to the locations of the removed trees as possible. Following advice during consultations, trees will also be planted in pagodas and schools. Teak trees are of no commercial or other benefit to community members therefore replacement trees will not be teak but other species of use to the community; the community in each village will be consulted on tree replacement.
- **Sapling Aftercare**. Trees will be replanted in the appropriate season to increase their viability. Ensuring good quality aftercare of planted trees to ensure they survive and can grow to maturity. The budget support to the community groups should ensure that the saplings are protected and cared for particularly in the dry season when young saplings may be vulnerable to the weather conditions.
- **Prevention of displacement of ecologically valuable flora**. If land is provided as compensation for loss, the land provided will not be in an area of natural vegetation. Compensation land will only be in areas used for existing agriculture or land which is already cleared of natural vegetation but is not cultivated. This will prevent the displacement of natural vegetation by agriculture during the compensation process.

370. The program of tree aftercare starts during construction as tree planting should be undertaken as soon as possible in each section of road when the construction is completed i.e. not all at the end of the construction phase, dependent on the season. Advice on tree planting will be taken from the Department of Forestry.

5.4.10 Cultural Resources

371. **Impact on Cultural Resources**. Access to many religious buildings is required from the project road, including temples, monasteries and pagodas. The road construction will impact on the accessibility of the sites and any processions which may occur along the road during construction. The buildings are not close enough to be impacted on directly by vibrations from the construction works. At present, there is no information of any archaeological sites

372. **Mitigation: Consultation with Sensitive Receptors**. To reduce the impacts of road construction on access to religious and cultural sites and practices, the following mitigation measures will be implemented. Each religious site will be consulted in advance of construction in identify any sensitive dates or times during which construction would have an unacceptable impact. The leader or senior members of each site will be kept informed of the timings of construction activities in his / her area.

373. **Mitigation: Chance Find Procedure**. Although at present there is no information of any archaeological and cultural assets, the potential for impact requires precautionary measures. An effective approach to avoid potential damage to any archaeological and cultural assets during the construction phase is the inclusion of EMP provisions in construction documents requiring the contractors to immediately stop excavation activities and promptly inform the local authorities and the Department of Archaeology of the Ministry of Culture if potential archaeological assets are discovered.

5.4.11 Occupation Health and Safety

374. **Impacts on occupational health and safety**. The contractors will necessarily be exposed to occupational risks during construction work. Risks will arise from a range of hazards such as the use of hazardous materials, heavy machinery and working near traffic. During the day, many movements of trucks, equipment, other machines and people create conditions for accidents to occur. There will be drains under construction, temporary ditches, stored materials, barriers, holes, and many different activities. There may be sharp edges, falling objects, toxic welding gases, chemicals, noise, emissions and potential for injuries. Workers and members of the public will be risk. During the night, the risk of accidents to people and non-works traffic is greater.

375. **Mitigation**. The civil works contractors will implement adequate precautions to protect the health and safety of construction workers. The occupational health and safety risks will be managed by applying measures in the following order of preference: avoiding, controlling, minimizing hazards, and providing adequate protective equipment. In addition, the contractors will undertake the following activities:

- Appoint a trained Occupational Health and Safety Officer
- Provide staff with training on OHS at least every three months
- Establish first-aid stations with eye-wash facilities and ensure their constant availability.
- Equip first-aid stations to provide first-line care, including: (i) Counter with sink and water for washing; (ii) Phone; (iii) List of medical professionals, clinics, hospitals (with contact details) able to provide emergency assistance; and (iv) First-aid equipment: stretcher, wash bowls and towels, splints, slings, bandages, “plasters”, anti-septic hand-wash liquid, paracetamol to provide first aid care of bone fractures, large and small wounds.
- Identify and ensure 24/7 on-call availability of a vehicle with driver.
- Locate the first-aid station(s) close to eating, washing, sanitary facilities.
- Provide employees potable drinking water, hand and body-wash facilities, adequate sanitary facilities, equipped kitchens and clean eating areas adjacent to each-other.
- Provide employees with safety equipment and protective clothing (PPE) appropriate to ensure their safety while performing their allotted tasks. Contractor supplied equipment will include: protective eye-glasses, ear-protective devices, steel-toed boots, hard hats, nose and mouth masks with active-carbon filters, safety gloves, and so on, appropriate in the performance of allotted tasks.
- Ensure that sufficient replacement PPE is available in locked storage (the OHSO to have the key) to maintain the full complement of supply levels.
- Check on the availability and use of the recommended PPE and provide employees with training on OHS, managing and handling hazardous substances, and emergency response at least every 6-months and more frequently as advised by the CSC.
- Provide fire extinguishers and fire-fighting equipment in workshops, work-camps, fuel storage/supply facilities, asphalt-batching plants and fire-hazard sites.
- Maintain above facilities and support equipment in clean, fully operational condition and ensure its regular inspection (at least 3-monthly) by the EHSO or appointed staff.

5.4.12 Community Health and Safety

376. **Impact on community health and safety**. During construction, there may be a risk to members of the public from hazards such as the use of heavy machinery, excavations, and changes in traffic priorities.

377. **Mitigation of impacts on community health and safety**. The following activities will be undertaken minimize impacts on the community during construction:

- **Road Safety Awareness**. A road safety awareness campaign in the project areas will be conducted by DOH during the project.
- **Construction Safety**. Clear signs will be placed at construction sites including borrow pits, in view of the public, warning people of potential dangers such as moving vehicles, hazardous materials and excavation and raising awareness on safety issues. Heavy machinery will not be used after day light and all such equipment will be returned to its overnight storage area/position before night. All sites including storage areas will be made secure, discouraging access by members of the public by fencing when appropriate.

5.4.13 Emergency Response

378. Emergency response procedures are those procedures for handling sudden or unexpected emergency situations. The objective is to be prepared to:

- Prevent fatalities and injuries to workers
- Reduce damage to buildings, stock, and equipment
- Protect the environment and people in the community
- Accelerate the resumption of normal operations

379. Contractors are to prepare an emergency response plan to addresses emergencies including: (i) work place accidents, injuries and deaths; (ii) traffic accidents; (iii) fire and explosions; (iv) accidental spills of oil, fuel, chemical and other hazardous substances; and (v) flooding and severe weather events.

380. Emergency response plans should include:

- responsibilities for administration of the plan
- hazard identification/assessment;
- emergency resources;
- communication systems;
- emergency response procedures;
- communication of the procedures; and
- debriefing and post-traumatic stress procedure.

5.4.14 Traffic Management

381. **Impact: Traffic Congestion and Delays**: The project will indirectly cause traffic congestion and delays to journey times, caused by the need to close sections of the road when construction is taking place.

382. **Mitigation: Traffic management plan and signage**. A traffic management plan will set out how access along the project road will be maintained safely during construction. Clear

signs will guide road users and advise them on changes to road priorities in order to make their journey as smooth as possible and to ensure road safety as unanticipated changes e.g. change of lane, will be avoided. Signs will be placed along the road in advance of construction giving details on the construction dates and duration warning people to expect delays.

5.4.15 Utilities Relocation

363. **Impact on utilities provision**. The project will require the relocation of electricity poles which may lead to interruption of electricity supplies for local residents. Other infrastructure (e.g., irrigation facilities, water pipelines, power supply lines, communication lines) may also need relocation.

364. **Mitigation**. The Contractor will cooperate with local communities, utility companies and local authorities. Households, government offices, and business establishment will be notified well in advance. Relocation or replacement of irrigation facilities, water pipelines, power supply lines, communication lines, irrigation lines and other utility infrastructure will be undertaken prior to removing/relocating existing structures and before rehabilitation works commence.

365. **Consultation and information dissemination**. The affected people will be consulted during project implementation and will make the Project Management Unit (PMU) aware of any significant issues resulting from loss of electricity. The people will be informed by the PMU in advance of any power cuts and the duration of the cut will be made clear in order that they can plan around the lack of power.

5.4.16 Impacts of Sourcing and Transporting Embankment Fill Material

Impact: Commercially Purchased Sources

366. **Yangon–Pathein Highway**. Most fill-material can be moved by barge to locations close to the road corridor road and from there, directly to work-site or to drop-sites close to the alignment. The exact amount of required embankment-fill material cannot be determined at this stage as the quality and load-bearing capacity of the earth-works materials in the current road and its embankment have not yet been determined. The quantity of required is estimated to be approximately 1 million m^3.

367. Assuming trucks of 10 m^3 capacity move the 1 million m^3 of embankment-fill would require 100,000 truck-trips to carry the fill from rail-sidings to work-sites. Over a 3-year period to rehabilitate the road embankment, there would be about 100 truck movement per day. Additionally, there will be trucks carrying crushed stone, cement, diesel, oil, other goods and waste materials, and vehicles transporting personnel.

368. **Bago–Thanlyin Highway.** Most fill-material can be moved by train to rail-sidings in Bago and the Yangon Port for the Bago–Thanlyin road and from there, directly to work-site or to drop-sites close to the alignment. he exact amount of required embankment-fill material cannot be determined at this stage as the quality and load-bearing capacity of the earth-works materials in the current road and its embankment have not yet been determined. However, by making some basic assumptions, the quantity of required is estimated to be approximately 0.7 million m^3.

3[illegible]. Assuming trucks of 10 m^3 capacity move the 0.7 million m^3 of embankment-fill would require 70,000 truck-trips to carry the fill from rail-sidings to work-sites. Over a 3-year period to rehabilitate the road embankment, there would be about 100 truck movement per day. Additionally, there will be trucks carrying crushed stone, cement, diesel, oil, other goods and waste materials, and vehicles transporting personnel**.**

3[illegible]. **Impacts: Use of Borrow Pits**. The location of borrow pits will be determined by the Contractor in consultation with CSC. The possible number of options is limited. The most likely scenario is that the Contractor will be able to negotiate with landholders adjacent to the road to excavate paddies or fishponds and use the excavated material in the embankment.

3[illegible]. **Mitigation.** Mitigation measures include:

- Obtain embankment-fill material from licensed commercial suppliers responsible for environmental management of their quarries and/or extraction sites.
- Arrange for fill-material to be transported by rail to railway sidings and from there to work-sites by truck
- Ensure material spills and losses are minimized at unloading and transfer sites
- Manage storage areas to prevent erosion and contamination of water bodies
- Ensure traffic management measures will provide for safety of communities associated with the truck movements

5.5 Impacts and Mitigation Measures: Project Operation Phase

3[illegible]. **Issue – Air pollution and noise levels***:* One set of related concerns over new/improved/rehabilitated roads is the potential increase in traffic and the potential increase in noise, vibration and emissions. However, the rehabilitated road should enable quieter travel, reduced emissions and lower vibration intensity than at present. Also, ongoing innovations of vehicles continue to reduce emissions and noise and can be expected to continue to do so. Thus, the advantages of the rehabilitated road can be expected to last into the 2030's. Also, the road alignment, mostly through open areas of flat land, enables noise and emissions to dissipate. Hence, the rehabilitated road should be able to handle a large increase in traffic before noise and emissions become a serious problem.

3[illegible]. **Mitigation.** The DOH/MOC will:

- Monitor and police road users, traffic and vehicles to ensure that vehicles meet noise and emission standards.
- Erect protective noise barriers if, when and where future noise levels present nuisance to sensitive receptors.

3[illegible]. **Issue – Poor drainage**: Poor and poorly managed drainage leads to water puddling, soil erosion, damaged road assets and sedimentation on nearby land. Drains can become clogged easily by sediment and detritus.

3[illegible]. **Mitigation**. The DOH/MOC will:

- Prepare and implement a suitable road drainage maintenance program.
- Clear and regularly maintain/repair road drainage facilities, such as culverts, lateral and longitudinal drains to design-capacity standards.

- Regularly inspect drains, sediment traps, sediment ponds and drains leading to receiving waters and ensure their stability and good performance, remove sediment and debris, and make repairs.
- Ensure that oil and debris does not reach land and water bodies adjacent to the road, retro-fitting barriers, screens, sediment traps, oil sumps as these may become necessary over time.

396. **Issue – Increased Risk of Road Accidents**: Road accidents should decrease because the structure of the widened and rehabilitated road, improved road signage, road markings and paved shoulders will make the road safer for road users. However, road traffic is expected to increase and it may travel at higher speeds than at present. Pedestrians, non-motorized and slow traffic may be at increased risk when drivers do not pay attention. Accidents should be anticipated.

397. **Mitigation**. The DOH/MOC will:

- Develop and implement a road safety campaign for implementation in communities and schools.
- Monitor and maintain the road and road markings, signage, drainage and safety features in good working order.
- Monitor and police road users, traffic and vehicles to maintain smooth operations and safe use of the road.

398. **Issue – Increased risk of water pollution**: Road traffic and travel-speeds are expected to increase. Accidents are less likely as a proportion of road users but increased traffic may release more oil, grease, fuel and particulates into the environment. These substances may get into runoff water, particularly during periods of high rainfall or flooding, and reach water bodies. There may also be an increase in accidental spills.

399. **Mitigation.** DOH/MOC together with local administrations will:

- Prepare an Accidental Spill Response Plans for the Highways. The Plan will include:
  - A list of road users transporting toxic and hazardous materials along the road and the quantities involved.
  - Procedures to stop the flow of a spill and contain it to prevent its spread
  - Purchase appropriate materials and equipment to mop-up spills (and store it at 2 strategic locations along the road).
  - Measures to dispose of the hazardous used spill cleanup materials.

400. **Issue – Protecting Embankment slopes and the Legal ROW**: An issue of importance for this road rehabilitation project is the removal and compensation of structures built and trees planted by illegal squatters. Road embankments and drainage structures form parts of the road structure. The ROW 23 m each side of the road center-line is under DOH/MOC jurisdiction.

401. **Mitigation**. The DOH/MOC will:

- Regularly inspect its road and ancillary structures and ROW to ensure their good maintenance.

- Prevent the planting of trees within 5 m of the outer edge of unpaved shoulders and/or within 5 m of the base of any embankment.
- Prevent the construction of any non-permitted permanent or temporary structures within 10 m of the outer edge of unpaved shoulders and/or within 10 m of the base of any embankment.
- Develop a regulation and permitting system under a pertinent law to protect and manage land-use within the legal ROW.
- Prepare a guideline for distribution to pertinent government agencies, townships and settlements informing them of the importance of the ROW, the DOH/MOC jurisdiction over it and the collective responsibility to protect and manage it.

5.6 Greenhouse Gas Emissions

402. The operation of the project roads will impact on Myanmar's carbon dioxide (CO_2) emissions. Emissions during construction include fuel burnt for transportation, powering construction machines, and materials preparation. A standard ratio of 200 tons of CO_2 emissions per km of secondary road construction is used.

403. Emissions during maintenance are mainly linked to the periodic resurfacing of the road. A standard ratio for roads is that maintenance emissions are about 10% of construction emissions. However, this would be required regardless of the project road as the current pavement is maintained by the Government therefore this maintenance figure is not included in the total calculation.

404. The estimated CO_2 emissions are summarized in Table 53.

Table 53: Carbon Dioxide Emissions (tons) for Road Sections

Road Section	Length	Construction (tons)	Maintenance (tons/year)	Traffic (tons/year)
Emission Factor		200[a]	20[b]	
Yangon–Pathein	180.8	36,160	3,616	Not estimated
Bago–Thanlyin	102.1	20,420	2,042	Not estimated
Expressway (Hlegu–Bawnetgyi section)	64.4	12,880	1,288	Not estimated
Total		**56,580**	**5,643**	-

a. Assumes 200 tons CO_2/km for construction activities
b. Assumes 20 tons CO_2 /km/year for maintenance activities
Source: Field surveys by project preparatory consulting team

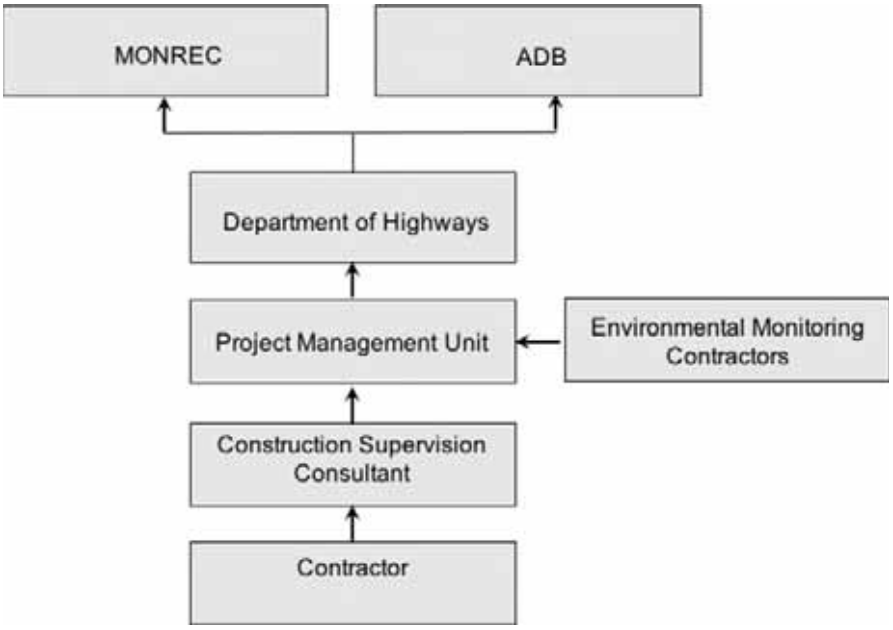
405. Emissions from vehicular traffic were not estimated. However, emissions during operation are linked to the fuel used by the vehicles using the road, and to the CO_2 embedded in the vehicles. The improvement of the riding quality of the road will reduce unit fuel consumption by vehicles. It is likely, that in the operation phase immediately following construction, there will a net reduction in CO_2 emissions. The benefit is caused by higher traffic speeds and free flowing traffic. The benefit will be reduced as traffic increases in the future

CHAPTER 6 ENVIRONMENTAL MANAGEMENT PLAN

6.1 Institutional Arrangements

436. The Ministry of Construction and its Department of Highways (DOH) do not have environmental and social management systems to guide project preparation, project construction, operation, and maintenance of roads. Overall responsibility for implementation of the environmental management plan falls to the Project Management Unit (PMU) for this project.

437. There are seven agencies that are involved in the implementation, supervision, and monitoring of the environmental management plan: the Department of Highways, the Contractor, the Construction Supervision Consultant, the Department of Highways Project Management Unit, Ministry of Natural Resources, and Environmental Conservation, ADB, and independent, third party Environmental Monitoring Contractors (see reporting relationships below).



438. **Construction Contractor**. The Construction Contractor will be responsible for:

i. implementation of the pre-construction and construction environmental mitigation measures; and
ii. frequent monitoring and reporting of environmental management plan implementation

439. Construction Supervision Consultant (CSC). The CSC will be responsible for

i. supervision and monitoring of and reporting the contractor implementation of the EMP on behalf of DOH PMU;
ii. supervision of third party environmental monitoring contractors;
iii. assist DOH PMU in preparing of the environmental safeguard monitoring reports; and
iv. assist DOH PMU in organization of training and capacity development.

410. **DOH PMU.** The DOH PMU will have overall responsibility for:

i. ensuring implementation of all mitigation measures;
ii. ensuring implementation of all monitoring programs;
iii. supervision and monitoring of the implementation of the environmental management plan (EMP);
iv. establishment and operation of the Grievance Redress Mechanism;
v. training and capacity development of environmental staff of PMU, Constructor Supervision Consultant;
vi. meeting all the conditions of the Environmental Compliance Certificate (as issued by MONREC); and
vii. submitting semi-annual Monitoring Reports to the MONREC and to ADB.

411. Ministry of Natural Resources and Environmental Conservation (MONREC). MONREC is responsible for:

i. review of the periodic environmental safeguard monitoring reports submitted by DOH to ensure that adverse impacts and risks are mitigated as planned;
ii. as necessary, conduct monitoring and inspection of projects to determine compliance with all environmental and social requirements;
iii. as necessary, impose penalties and /or require Project Proponent to undertaken corrective action; and
iv. where projects are not in compliance or not likely to comply with its environmental and social requirements, take appropriate enforcement actions including: (i) suspension of project operation; and (ii) employing third parties to correct non-compliance.

412. **ADB.** ADB is responsible for:

i. conducting periodic site visits for projects with adverse environmental impacts;
ii. conducting supervision missions for detailed review for projects with significant adverse environmental impacts; and
iii. reviewing the periodic environmental safeguard monitoring reports submitted to ensure that adverse impacts and risks are mitigated as planned.

413. **Independent Third Party Environmental Monitoring Contractors.** Environmental Monitoring Contractors will be responsible for conducting air quality, water quality, noise, and biological environmental monitoring programs on behalf of the DOH PMU.

6.1.1 Environmental Staffing Requirements

414. Environmental staff are needed by the (i) Construction Contractor, (ii) Construction Supervision Consultant, and (iii) the DOH PMU. It is DOH's responsibility to ensure that qualified and trained staff are hired by all three agencies.

6.1.2 Training and Capacity Development

415. DOH needs to provide capacity development and/or training programs to ensure staff in all three agencies (i) fully understand the environmental management plan; (ii) understand their responsibilities; and (iii) are capable to undertake their responsibilities. As DOH does not have experienced environmental and social management staff, DOH needs to hire a qualified

contractor through the PMU or the CSC to conduct necessary training and capacity development programs.

6.1.3 Independent Third Environmental Monitoring Contractors

416. Independent Third Party Environmental Monitoring Contractors need to retained to conduct ambient environmental monitoring of air quality, water quality and noise.

Table 54: Indicative Staffing and Outside Consultant Needs

Staff	Position	Level of Effort
Contractor	Environmental Engineer (International)	Full time during construction
Construction Supervision Consultants	Environmental Supervision Engineer (International)	Half time during construction
	Three (3) Environmental Safeguard Specialist (National) – one for each road subproject	Full time during construction
DOH PMU	Environmental Safeguard Officer plus one additional staff member for each subproject.	Full time during project
Outside Consultants to PMU or through the Construction Supervision Consultant	Environmental Management Training	$40,000 Lump Sum Contract

Source: Project preparatory consulting team

6.1.4 Recommended Reporting Requirements

417. Monitoring of the environmental management plan will have weekly reporting be the Contractor; and monthly reporting by the CSC. The CSC will draft semi-annual environmental monitoring reports. The PMU will finalize the environmental monitoring reports and DOH will submit the reports to ECD and ADB (see Table 55).

Table 55: Reporting Requirements

Responsibility	Reporting Requirement	Reporting to
Contractor	Weekly inspection and monitoring reports	CSC
Construction Supervision Consultants (CSC)	Monthly inspection and monitoring reports	DOH PMU
	Draft semi-annual environmental monitoring reports	DOH PMU
DOH PMU	Final semi-annual environmental monitoring reports	DOH
DOH	Submission of Final semi-annual environmental monitoring reports	ECD, ADB

Source: Project preparatory consulting team

6.2 Summary of Impact Environmental Mitigation Measures

418. Table 56 presents the mitigation measures, costs and responsibilities for each environmental impact. Included in the mitigation measures is the institution responsible for implementing and overseeing each. Where additional costs are attached to the measures, they are specified in the table.

Table 56: Summary of Mitigation Measures

Issue	Location	Mitigation Measure	Timeframe	Estimated Cost /Funding Source $ USD	Implemented by:	Supervised/ Approved by:
Pre-Construction						
1. Flooding in response to climate change	All bridges and culverts	1a. All bridges and culverts to be designed at a capacity of not less than their current capacity	Prior to Construction	Including in detailed design cost	Detailed Design Team	MOC
2. Noise and dust	Entire road length	2a. Representatives from the religious sites, schools and village leaders will be consulted on the timing of construction so significant events may be impacted upon as little as possible	Prior to Construction	Included in construction contract cost	Contractor	MOC and DOH / CSC
3. Tree Retention	Entire road length	3a. Identify and label all trees in right of way and within new alignment to be removed and obtain necessary permissions for their removal.	Prior to Construction	Included in construction contract cost	Contractor	MOC and DOH / CSC
4. Contractor Management Plans	Entire road length	Contractor Environmental Management Plans will be prepared	Prior to Construction	Included in construction contract	Contractor	MOC and DOH / CSC
5. Improper disposal of excavation spoil and waste pavement	Proposed disposal sites	Before commencement of excavation works and removal of pavement, obtain the CSC's approval of the disposal sites. Such sites will meet the following criteria: a. Located at least 50 m from watercourses b. Will not cause sedimentation or obstruction of the flow in watercourses c. Will not cause damage to productive areas Before commencement of excavation works and removal of pavement, undertake inspection and approval of the contractors' disposal sites to ensure that the above EMP criteria (a to c) for such sites are met.	Prior to Construction	Included in construction contract cost	Contractor CSC	MOC
6. Procurement of materials from illegal sources	Sources of Construction Materials	The contractor will ensure that construction materials such as sand, gravel, aggregates, will only be obtained from sources that have the required government environmental approvals.	Prior to Construction			
Construction Phase						
7. Water Quality	All construction sites adjacent to water bodies	7a Consultation with residents to identify wells or water sources within 50 m of the project road. 7b. Sensitive water receptors which may be accidentally damaged during construction includes wells, shall be identified in advance of construction	Throughout Construction	$75,000	PMU / CSC	MOC and DOH

Issue	Location	Mitigation Measure	Timeframe	Estimated Cost /Funding Source $ USD	Implemented by:	Supervised/ Approved by:
	(permanent or ephemeral)	at each site and demarcated to ensure machinery does not encroach on them. 7c. To limit the spill of materials into water bodies during bridge construction, no materials will be stored within 50 m of a water course, including soil, spoil, aggregates, chemicals or other materials used during construction. 7d. Temporary drainage provision shall be provided during construction to ensure that any storm water running off construction areas will be controlled around al permanent water bodies. This shall ensure that potentially contaminated water does not impact on sensitive receptors. Contaminated water shall be removed off-site for disposal in the facilities identified in the Construction Camp Management Plan 7e Enclosed drainage around chemical storage areas on construction sites and storage shall be on hard standing. 7f Develop and implement contingency plans for control of spills of oil and other hazardous substances (Spill Management Plan as specified in pre-construction actions); 7g Fuel storage, maintenance shop and vehicle cleaning areas must be placed at least 300 m away from the nearest water body and will include enclosed drainage to ensure contaminated water does not cause pollution and storage, maintenance and cleaning activities will be on hard standing; 7h. Construction wastes and materials (e.g. fuel) shall be properly contained during construction and fuel tanks will be located in a bunded area which has a capacity of 110% of the fuel tank. Wastes are to be stored in a hard standing area which is protected from rain and wind and waste removed from site and taken to approved disposal facilities (as specified in the Waste Management Plan in pre-construction actions); 7i. Water collection basins and sediment traps are to be installed in all areas where construction equipment is washed. Contaminated water will be removed off-site for disposal in the facilities				

Issue	Location	Mitigation Measure	Timeframe	Estimated Cost /Funding Source $ USD	Implemented by:	Supervised/ Approved by:
		identified in the Construction Camp Management Plan; and 7j. Effective septic treatment and disposal systems shall be installed at construction camps or arrangements for adequate off-site disposal made.				
8 Soil Erosion	All construction sites	8a. Minimizing the area of soil clearance; 8b. Maintaining slope stability at any cut faces; 8c. Construction in erosion and flood-prone areas shall be mainly restricted to the dry season where possible; 8d. Control silt runoff particularly around permanent rivers; 8e. Cover soil stockpiles; 8f. Properly stabilize slopes and re-vegetate disturbed surfaces and embankments using locally available indigenous grass seeds, species to be advised in consultation with MONREC; 8g Protect slopes on both sides of any road crossing structures to prevent soil loss; 8h use of temporary berms or other appropriate temporary drainage provisions at construction sites to prevent water eroding cut faces, stockpiles and other exposed areas of soil particularly if construction occurs in the rainy season. 8h Use engineering solutions such as rip rap, gabions and geotextile membranes where appropriate to reduce the likelihood of soil erosion at cross drainage structures.	Throughout Construction	Included in construction contract	Contractor	MOC and DOH / CSC 8f Advice from MONREC
9. Soil Contamination	All construction sites	9a. Store chemicals/hazardous products and waste on impermeable surfaces in secure, covered areas with clear labeling of containers and with a tray or bund to contain leaks; 9b Regularly remove all construction wastes from the site to approved waste disposal sites; 9c. Disseminate Spill Management Plan to construction team and conduct training in emergency spill response procedures 9d. Provide spill cleanup measures and equipment at each construction site;	Throughout Construction	Included in construction contract	Contractor	MOC and DOH / CSC

Issue	Location	Mitigation Measure	Timeframe	Estimated Cost /Funding Source $ USD	Implemented by:	Supervised/ Approved by:
		9e Store fuels in a bunded tank and vehicle refueling takes place on hard standing away from sensitive receptors, such as surface water				
10 Borrow Pits	Both borrow site locations	10a. Site borrow pits outside residential areas; 10b. Pit restoration shall follow the completion of works in full compliance with the Borrow Pit and Spoil Management Plan and shall be required before final acceptance and payment under the terms of contracts	Throughout Construction	Included in construction contract	Contractor	MOC and DOH / CSC
11 Air Quality	All construction sites	11a. Asphalt plants and concrete batching plants to be located at least 500 m downwind, or as far as practicable, from the nearest dwellings in order to reduce the impact of fumes on humans and to be fitted with necessary equipment such as bag house filters to reduce fugitive dust emissions. 11b. Stockpiles must be managed to reduce dust emissions. The location of the stockpile must be downwind of sensitive receptors. The stockpile must be sprayed with water before material is moved. If the stockpile is within 300 m of dwellings additional precautions must be taken including using a reusable stockpile cover and fencing to form a high barrier and prevent wind lifting and dispersing. 11c. Construction site management. Water will be sprayed on construction sites and material handling routes where fugitive dust is generated. 11d. Transport of materials. Trucks carrying earth, sand or stone will be covered with tarpaulins or other suitable cover. Construction vehicles and machinery shall be maintained to a high standard to minimize emissions. River transport will be used where possible and practicable 11e. Clean up. During all construction, the contractors will immediately clean up any mud or dusty materials which are left on or around public roads. 11f. Advance warning. Before the road is constructed, people in the construction area will be given advanced warning of the works, enabling them to take measures against the dust generated.	Throughout Construction	$75,000	PMU / CSC	MOC and DOH

Issue	Location	Mitigation Measure	Timeframe	Estimated Cost /Funding Source $ USD	Implemented by:	Supervised/ Approved by:
12 Solid Waste Generation	All construction sites and camps	12a Waste Hierarchy. Construction will be subject to the waste hierarchy to ensure efficient use and management of resources. The preference is for prevention of waste at source. This means the effective management of materials on site through good house-keeping and work planning, in order to generate less waste. Procurement options will play a role in waste prevention as the procurement of materials which have less packaging for example, would be preferable. Waste minimization is the second preferred option. Reuse or recycling options will be considered prior to disposal and where possible include: 1. The existing road surface will be recycled and used as sub-base 2. Block work from abutments used as rubble back fill for drainage layer for bridges; 3. Concrete which can meet grading requirements to be used as fill. 4. The recyclables market in the Myanmar appears to be operating but this can be explored further when the Contractor's Site Waste Management Plan is developed as the waste streams generated will be identified at that stage. 12b Storage and containment: Provide appropriate waste storage containers for worker's construction and hazardous liquid wastes; Install confined storage points of solid and liquid wastes away from sensitive receptors; 12c Site Hand Over: Ensure proper removal and disposal of any significant residual materials, wastes and contaminated soils prior to construction camp site handover; 12d Spoil and Inert waste management. Spoil and other inert wastes will be disposed of only in sites which are approved by the CSC in accordance with the Aggregate, Borrow Pit and Spoil Management Plan; spoil will not be disposed of where it may impact on any vegetation; Rehabilitate and restore spoil disposal sites in accordance with the agreed plan.	Throughout Construction	Included in construction contract	Contractor	MOC and DOH / CSC

Issue	Location	Mitigation Measure	Timeframe	Estimated Cost /Funding Source $ USD	Implemented by:	Supervised/ Approved by:
		12e Municipal type waste. Municipal type waste (from construction workers and accumulations along the road) will be placed in whichever waste disposal site is nearest, in Hpa An and Kawkareik. Waste shall be stored according to the Site Waste Management Plan. 12f Hazardous waste such as oily rags or chemical containers, will be neutralized as far as possible, as dry as possible to reduce likelihood of leachate and shall be disposed of in the Kawkareik or Hpa An disposal sites in plastic bags. 12g Management: Prohibit burning of waste at all times.				
13 Noise	All construction sites	13a. Source control: Maintain all exhaust systems in good working order; undertake regular equipment maintenance, enclose stationary equipment such as generators where practicable and reduce vehicle speeds around sensitive receptors including temples and schools; 13b. Siting. Locate sites for concrete-mixing and similar activities at least 500 m away from sensitive areas; 13c. Timing. Operate between 8 a.m.–6 p.m. only and reach an agreement with nearby residents regarding the timing of heavy machinery work, to avoid any unnecessary disturbances; 13d. Community Notification. Provide advance warning to the community on timing of noisy activities in addition to pre-construction consultation; 13e. Consultation and Engagement. Information procedure of handling noise complaints through the Grievance Redress Mechanism will be disseminated and continually seek suggestions from community members to reduce noise annoyance.	Throughout Construction	Included in construction contract.)	Contractor (13a to 13d) and PMU (13e)	MOC and DOH / CSC
14 Aquatic Fauna		See: Mitigation of impacts on surface water quality and soil protection mitigation measures	-	-	-	-

Issue	Location	Mitigation Measure	Timeframe	Estimated Cost /Funding Source $ USD	Implemented by:	Supervised/ Approved by:
15 Flora	All sites where tree removal is needed	15a Tree Identification. Contractors to label all trees deemed necessary to be removed for construction before they are removed. Following good practice, for every tree removed, three should be replanted. This allows for some tree deaths and ensures that the area is not left with fewer trees than before the project started. Develop ten tree nurseries through community groups which will take care of the saplings until planting. Following advice during consultations, trees should be planted as close to the locations of the removed trees as possible trees and in pagodas and schools and other suitable areas which will not affect road safety/visibility. Teak trees are of no commercial or other benefit to community, therefore replacement trees shall be other species apart from teak. The community in each village shall be consulted on tree replacement e.g. types of trees required. Trees will be replanted in the appropriate season to increase their viability. MONREC will be consulted and will provide technical support for the communities under their Department of Forestry.	Throughout Construction	15a. Included in construction contract	DOH	CSC and MONREC
16 Replacement flora viability	All sites where replacement trees are planted	16a. Sapling Aftercare. Ensuring good quality aftercare of planted trees to ensure they survive and can grow to maturity. This will mean the engagement of a person or persons in each community to ensure the saplings are protected and cared for particularly in the dry season when young saplings may be vulnerable to the weather conditions. The program of aftercare starts during construction as tree planting should be undertaken as soon as possible in each road section when the construction is completed - not all at the end of the construction phase.	During and post construction	Included in 15b	DOH / CSC	MOC / MONREC (Department of Forestry)
17 Ecological displacement	-	17a Prevention of displacement of ecologically valuable flora. If land is provided as compensation for loss, the land provided will not be in an area of natural vegetation. Compensation land will only be in areas used for existing agriculture or land which is already cleared of natural vegetation but is not	During and post construction	No cost	MOC	MONREC

Issue	Location	Mitigation Measure	Timeframe	Estimated Cost /Funding Source $ USD	Implemented by:	Supervised/ Approved by:
		cultivated. This will prevent the displacement of natural vegetation by agriculture during the compensation process				
18 Cultural resources	All construction sites in the vicinity of cultural or religious buildings	18a. Consultation. Each religious site will be consulted in advance of construction in order to identify any sensitive dates or times which construction would have an unacceptable impact on. The leader or senior members of each site will be kept informed of the timings of construction activities in his / her area. 18b Timing. Construction work including the use of machinery will only take place between 8 a.m. and 6 p.m. unless the consultations above dictate otherwise.	Throughout Construction	Included in construction contract	Contractor	MOC and DOH / CSC
19 Occupational health and safety	-	19a. An Environment Health and Safety Officer (EHSO) will be nominated to develop, implement and supervise a Health and Safety Management Plan (HSMP), as well as ensure that the requirements of the EMP are implemented. 19b. Implementation of HSMP. The EHSO will ensure that the HSMP, submitted to MoC prior to construction, is approved and implemented. This includes recording and reporting any occupational health and safety incidents, and reviewing the distribution and use of appropriate PPE.	Throughout Construction	Included in construction contract	Contractor	MOC and DOH / CSC
20 Community Health and Safety	All construction sites	20a. Road Safety Awareness. The community members will be advised on road safety with the key messages reinforced with communities throughout construction. 20b. Construction Safety. Clear signs will be placed at construction sites including borrow pits, in view of the public, warning people of potential dangers such as moving vehicles, hazardous materials and excavation and raising awareness on safety issues. Heavy machinery will not be used after day light and all such equipment will be returned to its overnight storage area/position before night. All sites including storage areas will be made secure, discouraging access by members of the public by fencing when appropriate.	-	20b. Included in construction contract	20a. PMU 20b. Contractor	MOC and DOH / CSC

Issue	Location	Mitigation Measure	Timeframe	Estimated Cost /Funding Source $ USD	Implemented by:	Supervised/ Approved by:
21 Utilities Provision	All sites where utilities will be interrupted	21a. Consultation and information dissemination. The affected people will be consulted during project implementation and will make the project contractors aware of any significant issues resulting from loss of electricity. People will be informed in advance of any power cuts and the duration of the cut will be made clear in order that they can plan around the lack of power.	-	Included in construction contract	PMU-SU	CSC
22 Traffic Management	All construction sites	22a. Traffic management plan and signage. A traffic management plan will set out how access along the project road will be maintained safely during construction. Clear signs will guide road users and advise them on changes to road priorities in order to make their journey as smooth as possible and to ensure road safety as unanticipated changes e.g. change of lane, will be avoided. 22 b. Advance Warning. Signs will be placed along the road in advance of construction giving details on the construction dates and duration warning people to expect delays.	-	Included in construction contract	Contractor	MOC and DOH / CSC
Operation Phase						
23. Air pollution and noise levels	Main entry points Near Sensitive Receptors	23 a Monitor and control road users, traffic and vehicles to ensure that vehicles meet noise and emission standards. 23b Erect protective noise barriers if, when and where future noise levels present nuisance to sensitive receptors.	During Operation	Included in maintenance costs	DOH	DOH/MOC
24. Poor Drainage	All Along the Roadway	24a Prepare and implement a suitable road drainage maintenance program. 24b Clear and regularly maintain/repair road drainage facilities, such as culverts, lateral and longitudinal drains to design-capacity standards. 24c Regularly inspect drains, sediment traps, sediment ponds and drains leading to receiving waters and ensure their stability and good performance, remove sediment and debris, and make repairs 24d Ensure that oil and debris does not reach land and water bodies adjacent to the road, retro-fitting barriers, screens, sediment traps, oil sumps as these may become necessary over time.	During Operation	Included in maintenance costs	DOH	DOH/MOC

Issue	Location	Mitigation Measure	Timeframe	Estimated Cost /Funding Source $ USD	Implemented by:	Supervised/ Approved by:
25. Increased Risk of Road Accidents:	All Along the Roadway	25a Develop and implement a road safety campaign for implementation in communities and schools. 25b Monitor and maintain the road and road markings, signage, drainage and safety features in good working order. 25c Monitor and police road users, traffic and vehicles to maintain smooth operations and safe use of the road	During Operation	Included in maintenance costs	DOH	DOH/MOC
26. Increased risk of water pollution	Nearby water bodies	26a Prepare an Accidental Spill Response Plans for the Highways. The Plan will include: i. A list of road users transporting toxic and hazardous materials along the road and the quantities involved. ii. Procedures to stop the flow of a spill and contain it to prevent its spread iii. Purchase appropriate materials and equipment to mop-up spills (and store it at 2 strategic locations along the road). iv. Measures to dispose of the hazardous used spill cleanup materials.	During Operation	Included in maintenance costs	DOH Local Government	DOH/MOC
27. Protecting Embankment slopes and the Legal ROW	All Along the Roadway	27a Regularly inspect its road and ancillary structures and ROW to ensure their good maintenance. 27b Prevent the planting of trees within 5 m of the outer edge of unpaved shoulders and/or within 5 m of the base of any embankment. 27c Prevent the construction of any non-permitted permanent or temporary structures within 10 m of the outer edge of unpaved shoulders and/or within 10 m of the base of any embankment. 27d Develop a regulation and permitting system under a pertinent law to protect and manage land-use within the legal ROW. 27e Prepare a guideline for distribution to pertinent government agencies, townships and settlements informing them of the importance of the ROW, the DOH/MOC jurisdiction over it and the collective responsibility to protect and manage it.	During Operation	Included in maintenance costs	DOH	DOH/MOC

Source: Project preparatory consulting team

6.3 Contractor Environmental Management Plans

418. Contractor Environmental Management Plans will be prepared for the undertaking of the mitigation measures described in Chapter 5 and summarized in Table 56.

420. **Contractor Management Plans**. Before the construction starts each Contractor will prepare a Contractor Environmental Management Plan (CEMP) consistent with the EMP. The CEMP is to include all mitigation measures and monitoring requirements to be carried by the Contractor. The CEMP will be submitted to the CSC for review and approval. Approval will be required one month prior to the start of construction

421. Contract documents shall explicitly indicate the requirement for the CEMPs Construction cannot start until all CEMPs. To ensure that the Contractor allocates sufficient funds to prepare and implement the CEMP, the Tender and Bid documents will require that the cost of implementing the EMP and CEMP is included in the Contractor Bid price.

6.3.1 Pre-Construction

422. During works preparation, before site-clearance or any work activity can commence, the Contractor will:

- Appoint a sufficiently qualified person to as the project Environment Engineer and first line of reference on environmental, safety, and grievance management.
- Prepare and obtain approval for the Construction EMP.
- Meet project-affected community representatives, the CSC, DOH/MOC and other parties to identify concerns and explain the approach to and procedure of the works program

423. Information disclosure, communications and community discussions form important parts of the project implementation process. It is very important that people living and working in the project affected area be kept informed of planned and ongoing works and have opportunities to meet Contractor representatives, particularly the Environmental Engineer on a regular basis to receive information and provide feedback on works-related issues that affect them.

6.3.2 Environmental Management during Operations

424. After project hand-over and during road operations, Environmental Management will be responsibility of MOC/DOH. The cost of environmental management and environmental impact prevention and mitigation is to be included in MOC/DOH operation and maintenance costs and provided for from the Government funds.

6.4 Environmental Monitoring Requirements

425. The Environmental Monitoring Plan is presented in Table 57. It includes the parameters to be monitored, locations to be monitored, methodology, frequency and the party/parties responsible for the monitoring.

Table 57: Environmental Monitoring Plan and Schedule

Parameters monitored	Locations	Monitoring method	Monitoring frequency/timing	Monitoring Responsibility
Pre-Construction – Before Site Preparation – Responsibility Contractor				
Initial Community Discussions	Project Entire road	**Method:** Consultations and observations **Parameters:** Consult village leaders, affected people and residents. Observe the signboards required to advertise the PMU contact details for GRM	Once Before site preparation	CSC PMU
CEMP prepared by Contractor	Project Entire road	Visual check CSC records	Before site preparation	CSC PMU
Contractor coordinates with utility companies, DOH, affected communities	Entire road Affected sites	Utility companies DOH Communities	As required Before site preparation	CSC PMU
Tree Removal	Project Entire road	**Method:** Review permits and trees labeled for removal **Parameters:** Ensure all permits are in place to remove any teak trees as required by the project. Ensure trees labeled as requiring removal are necessary to be removed to allow the project to progress	Before site preparation	PMU CSC
Preconstruction Baseline Monitoring – Responsibility PMU through CSC to hire and Independent Third Party Monitoring Contractor				
Surface Water Quality	Project At all canal crossings	**Method:** Establish project specific baseline water quality. **Parameters:** Temperature, Suspended particles, BOD, COD, pH, Oil and Grease	Once Before site preparation	PMU Specialist consultant
Air Quality	Project At key receptors including residential, education, religious and healthcare sites along project road.	**Method:** Establish project specific baseline for air quality at key receptors **Parameters:** Suspended particles (dust), NOx, SOx, CO	Once Before site preparation	PMU Specialist consultant
Noise	Project At key receptors including residential, education, religious and healthcare sites along project road.	**Method:** Establish project specific baseline for noise at key receptors **Parameters:** Db(A) at receptors outside and inside. Sampling periods for noise will be undertaken consistent with and will be	Once Before site preparation	PMU Specialist consultant

Parameters monitored	Locations	Monitoring method	Monitoring frequency/timing	Monitoring Responsibility
		compared to Myanmar Noise Standards and *World Health Organization (1999) Guidelines on Community Noise.*		
Construction – Beginning at work-site preparation – Impact Mitigation Responsibility Contractor				
Community discussions every 3 months	Communities	Minutes	Every 3-months	PMU/CSC
Interviews with affected people				PMU/CSC
Site-preparation: Utility relocation Bare land Drainage and sediment Trees	Entire road Work-sites	Inspection Relocation plans Utility companies	Weekly Daily when required	PMU/CSC
Noise control/ management Equipment operations near sensitive receptors Use of PPE	Entire road Communities	Inspection Complaints Log	Daily	PMU/CSC
Dust: Covered stockpiles Dust-covers on trucks Wheel washing Open burning	Entire road Work-sites Communities	Inspection Complaints Log Interviews	Daily	PMU/CSC
Air quality - dust	Near construction sites	**Method**: Visual observation of dust at receptors/ dwellings near construction sites. Observations to record if dust generated by construction activities crosses property boundaries. **Parameters:** Fugitive dust emissions	Monthly	PMU/CSC
Hazardous materials management: Training delivered Storage and labelling Sealed containers Spill clean-up materials Trucks suitable for transporting hazardous substances	Entire road Fuel/oil sites Equipment servicing sites	Inspection Interviews Staff	Weekly	PMU/CSC
Traffic Management: TMAP followed Temporary bypasses and Access	Entire road	Inspection Complaints Log Interviews	Weekly and as needed	PMU/ CSC
Safety and OHS at and around work-sites: Warning signs Barriers Lights	Entire road Work-sites	Inspection OHSO records Village admin.	Weekly and as needed	PMU/ CSC

Parameters monitored	Locations	Monitoring method	Monitoring frequency/timing	Monitoring Responsibility
Flagmen as needed				
Work-camps: Toilets and kitchens Septic pump-out tanks Waste management Drainage/runoff/sediment control Worker behavior	Work-camps Toilets Kitchens Waste mgt. Runoff	Inspection OHSO records Interviews	Once before woks Monthly thereafter	PMU/CSC
OHS: First aid and eye-wash stations PPE issued/used Sanitation facilities	Project Entire road Work-sites Batch-plants	Inspection	Weekly	PMU/CSC
Training and environmental management: OHS and Emergency response Community information	Project Entire road	OHSO Records Interviews	6-monthly	PMU/CSC
Drainage and sedimentation	Entire road Culverts and drains	Inspection Contractor records	Monthly After heavy rain	PMU/CSC
Works Contract sign-off & Handover Clear sites, Waste disposal Site safety, Drainage Landscaping	Entire road Work-sites Work-camps Other sites	Inspection Records Village admin.	Once Before sign-off	PMU/CSC

Source: Project preparatory consulting team

6.4.1 Pre-Construction Ambient Environmental Monitoring

Ambient environmental data on surface water quality, air quality, and noise in the road corridors was not available for preparation of the IEE. Therefore, conduct environmental baseline ambient monitoring must be conducted prior to start of construction. Sampling will be undertaken at fixed locations during the pre-construction period. The sampling stations will be near to the road at key points along it. Indicative monitoring indicators are provided in Table 58. The ambient monitoring will provide information for designing mitigation measures to be included in the detailed Contractor's Environmental Management Plans. Monitoring program will be conducted by independent contractors under the supervision of CSC.

Table 58: Ambient Environmental Baseline and Subsequent Sampling

Item	Sampling Parameter
Water Quality	➢ total suspended solids (TSS) ➢ biochemical oxygen demand (BOD) ➢ dissolved oxygen (DO) ➢ fecal coliforms ➢ pH ➢ oil and grease
Air Quality	➢ total suspended particulates (tsp) ➢ sulfur dioxide ➢ nitrogen dioxide ➢ carbon monoxide
Noise	➢ dB(A)

Source: Project preparatory consulting team

6.4.2 Construction Phase Environmental Monitoring

427. During the construction phase monitoring will be conducted for surface water quality, air quality, and noise. The monitoring program design is summarized in Table 59.

Table 59: Construction Environmental Quality Monitoring

Component	Parameters	NEQEG[a] Guideline	Locations	Monitoring frequency	Monitoring Responsibility
Surface Water Quality	Biological oxygen demand	30 mg/l	Project Major water bodies	Twice – seasonally during first year	PMU/CSC Third Party Monitoring Contractor
	Chemical oxygen demand	125 mg/l			
	Oil and grease	10 mg/l			
	pH	6-9			
	Total coliform bacteria	400 per 100ml			
	Total nitrogen	10 mg/l			
	Total phosphorus	2 mg/l			
	Total suspended solids	50 mg/l			
Noise	Residential Day	55 dBA	Entire road At key receptors including residential, education, religious and healthcare sites along project road.	Monthly	PMU/CSC Third Party Monitoring Contractor
	Residential Night	45 dBA			
	Commercial Day	70 dBA			
	Commercial Night	70 dBA			
Air Quality	Nitrogen dioxide (1hour average)	200 µg/m^3	Entire road At key receptors including residential, education, religious and healthcare sites along project road	Following complaints or pollution/ discharge events that may be attributed to the project	PMU/CSC Third Party Monitoring Contractor
	Ozone (8 hour maximum)	100 µg/m^3			
	Particulate matter PM_{10} (24 Hour Average)	50 µg/m^3			
	Particulate matter $PM_{2.5}$ (24 hour Average)	25 µg/m^3			
	CO[b] (8 hour average)	9 ppm			

[a] See Appendix D. Environmental Standards

[b] US EPA Standard. https://www.epa.gov/criteria-air-pollutants/naaqs-table

6.5 Cost Estimate

428. The costs for implementation and operation of the Environmental Management Plan is set out in Table 60.

Table 60: Environmental Management Plan Indicative Cost Estimate

Item	Cost ($)	Comment
Mitigation Measures		Normally included in construction contracts. However, an indicative cost is required.
Implement and maintaining temporary drainage structures	700,000	
Dust amelioration	180,000	
Replacement of trees	75,000	
Monitoring Programs		Contracted out by PMU to qualified environmental monitoring agencies.
Noise Monitoring	50,000	
Water Quality Monitoring	100,000	
Air Quality Monitoring	50,000	
Environmental Staff		
Contractor	200,000	36 person months
Construction Supervision Consultant	500,000	12 person months (International) 36 person months (national)
PMU Environmental Staff	90,000	36 person months
PMU Grievance Redress Staff	45,000	36 person months
Capacity Development and Training	40,000	
Vehicles	100,000	
Subtotal	2,130,000	
Contingency (10% of subtotal cost)	213,000	
Total Costs	**2,343,000**	

Source: Project preparatory consulting team

CHAPTER 7 CONCLUSION

429. The Greater Mekong Subregion Highway Modernization Project plans to rehabilitate or improve sections of three highways in Myanmar: (i) Yangon–Pathein; (ii) Bago–Thanlyin; and (iii) Yangon-Mandalay Expressway. The Rehabilitation of the Yangon–Pathein highway and Bago–Thanlyin highway will see the highways widened to two lanes paved shoulders, and overlaid with asphalt concrete. A 20-km section of the Yangon–Pathein highway in the flood-prone area will be raised by about 2 meters. Bridges will be replaced. The road will be provided with road safety improvements and the marking and junctions will be improved.

430. The initial 62.3 km (Hlegu–Bawnetgyi) section of the existing Yangon-Mandalay Expressway will have the inner and outer surfaced shoulders for each of the two carriageways will be improved with an asphaltic concrete overlay, and road safety installations. These will include safety barriers along the roadway and at bridge approaches, mountable curbs, signage and line marking, and major improvements to the intersections at the commencement of the section. For the remaining 524 km (Bawnetgyi–Mandalay section**)** of the expressway the improvements will generally be limited to signage and line marking, and installation of safety barriers at some critical bridge approaches. The interchange at Bawnetgyi will also be reconstructed to modern expressway standards. The pavement of the Bawnetgyi–Payagyi road that provides access to the expressway will be improved.

431. **Environmental Assessment.** In accordance with the ADB Safeguard Policy (2009), the project has been classified as Category B, requiring an IEE. Under the Myanmar EIA Procedure (2015), the project has been classified as a IEE Type project requiring an IEE report. MONREC has requested separate IEE reports for each of the three roads. This IEE Report has been prepared in accordance with requirements of the SPS and Myanmar EIA Procedure (2015). Public consultation was undertaken and a grievance redress mechanism has been designed to address issues and complaints that may arise during construction.

432. **Environmental Benefits**. The rehabilitated roads will provide all-weather transport links and the improved road surface and signage will reduce: accidents, travel times, wear and tear on vehicles, and localized air pollution, road noise and vibration. The road will include improved drainage. The project will also have significant positive economic impact on the wider economy as it will provide improved access northern, southern and eastern Myanmar. It will enhance connectivity and access to economic opportunities, health, social and educational services for residents and businesses. People with better access to markets will benefit via improved opportunities to sell their labor and products. Another benefit from the road will be improved community health and safety. There will be reduction in dust as vehicles will no longer be travelling on unpaved surfaces when overtaking, because the wider paved shoulders and carriageway. All the proposed highway improvements will increase road safety and reduce the potential for accidents.

433. **Environmental Impacts and Mitigation Measures**. Most project construction and operational impacts on air quality and the acoustic environment are expected to be limited and temporary. The exception is the impact of transport of construction materials, which will continue creates dust and noise throughout the construction period. The EMP identifies sensitive receptors and provides for necessary measures to reduce impacts during construction and operation.

434. **Impacts on Roadside Trees**. For both the Yangon–Pathein Highway and Bago–Thanlyin Highway, the removal of road side trees the cutting and removing hundreds of trees is

expected to cause concern for the community and for the regional and local governments. Most trees for removal along the Yangon–Pathein Highway alignment are Teak trees planted by the Department of Forestry (DOF). Other “community” trees, such as Acacia, Eucalyptus, Koak Ko trees and Tamarind trees, are under the general ownership of surrounding communities. The Myanmar Forestry Department on 24 March 2017 has advised that all of the trees within the right of way are the property of the Myanmar Government. The Forestry Department will assess the number of impacted trees and will be responsible for their removal and disposal. The road construction will have a medium - term impact on the appearance of the road corridor because of the loss of mature trees which currently make the road look more pleasing, providing greenery and shade and vegetation.

4[illegible]. **Mitigation Loss of Roadside Trees.** Where possible, the design and the road construction teams will seek to retain the trees, reducing the visual impact as far as possible. Impacts will be offset by planting of replacement trees. Trees will be replanted in the appropriate season to increase their viability. Ensuring good quality aftercare of planted trees to ensure they survive and can grow to maturity. The program of tree aftercare starts during construction as tree planting should be undertaken as soon as possible in each section of road when the construction is completed. Advice on tree planting will be taken from the Department of Forestry.

4[illegible]. **Sourcing and Transport of Construction Materials**. Embankment fill material will be difficult to source locally. The road alignment crosses deltaic, alluvial, “wet soils” with high organic content and poor compression strength making them unsuitable for road construction. Construction material will be sourced from outside the immediate area. It is recommended that the Contractor use commercial sources of aggregate and other subgrade materials for construction of embankment. If this option is adopted by the Contractor for the Bago–Thanlyin highway, then most fill-material can be moved by train to rail-sidings in Bago and the Yangon Port and from there, directly to work-site or to drop-sites close to the alignment.

4[illegible]. For the Yangon–Pathein highway, Contractor may decide on the sources of materials from commercial quarries north and/or west of the road corridor. River gravel is expected to be sourced from the Ayeyarwady River upstream from the alignment and be moved by barge to unloading sites, or drop sites near it. Sand may be obtained from the same source. Local borrow pits may be suitable sources of silts and clays needed for blending with other materials. Materials will be transported as much as possible by barge and rail to unloading areas. Final delivery to work-sites will be by truck from the unloading areas, or drop-sites.

4[illegible]. **Impacts on Air Quality, Noise, and Road Safety.** Transport of commercial sourced construction materials will create continuous dust, noise, and traffic safety concerns throughout the construction. For the Bago–Thanlyin highway, initial estimates of estimates of the amount of fill needed translates into 100,000 truck-trips to carry the fill from rail-sidings to work-sites. Over a 3-year period to rehabilitate the road embankment, there would be about 100 truck movement per day. Additionally, there will be trucks carrying gravel, cement, diesel, oil, other, and waste supplies, and vehicles transporting personnel.

4[illegible]. **Impacts: Use of Borrow Pits**. If the Contractors choose the source materials from local borrow pits, the location of borrow pits will be determined by the Contractor in consultation with Construction Supervision Consultant. The possible number of options is limited. The most likely scenario is that the Contractor will be able to negotiate with landholders adjacent to the road to excavate paddies or fishponds and use the excavated material in the embankment. If

this option is used, the Contractors will need prepare plans for operation and restoration of borrow pits.

440. **Pre-Construction Ambient Environmental Monitoring** Ambient environmental data on surface water quality, air quality, and noise in the road corridors was not available for preparation of the IEE. Therefore, conduct environmental baseline ambient monitoring must be conducted prior to start of construction. Sampling will be undertaken at fixed locations during the pre-construction period. The sampling stations will be near to the road at key points along it. Indicative monitoring indicators are provided in Table 6.6. The ambient monitoring will provide information for designing mitigation measures to be included in the detailed Contractor's Environmental Management Plans. Monitoring program will be conducted by independent contractors under the supervision of CSC.

441. **Environmental Management**. A detailed environmental management plan has been prepared for the project with a total cost $2,343,000 Mitigation measures and have been designed for both construction and operation periods. Monitoring requirements have been specified.

442. **Contractor Environmental Management Plans**. Before the construction starts each Contractor will prepare a Contractor Environmental Management Plan (CEMP) consistent with the EMP. The CEMP is to include all mitigation measures and monitoring requirements to be carried by the Contractor. The CEMP will be submitted to the CSC for review and approval. Contract documents shall explicitly indicate the requirement for the CEMPs Construction cannot start until all CEMPs are prepared. To ensure that the Contractor allocates sufficient funds to prepare and implement the CEMP, the Tender and Bid documents will require that the cost of implementing the EMP and CEMP is included in the Contractor Bid price.

443. **Environmental Monitoring** An environmental quality monitoring program has been prepared to monitor impacts of noise, air pollution, and to assess changes in water quality during construction. Approximately $200,000 has been allocated to contract independent environmental monitoring consultants.

444. **Supervision**. The PMU will be responsible for ensuring environmental supervision of the implementation of the EMP. The PMU will be supported by a Construction Supervision Consultant that will directly supervision the implementation of the CEMP by the contractors. The Contractors will be required to have permanent staff on site with responsibility for environmental management, reporting to the supervision engineers, environmental specialists and government counterparts.

445. **Conclusion.** Assuming that the mitigation measures and monitoring requirements in the Environmental Management Plan are effectively implemented, the project is not expected to have a significant adverse environmental impact.

Appendix A: Letter Advising Categorization by Environmental Conservation Department

THE REPUBLIC OF THE UNION OF MYANMAR

Ministry of Natural Resources and Environmental Conservation

Minister Office

Date: 23rd May, 2017

INFORMAL TRANSLATION

To

Ministry of Construction

Subject: **Remarks on Environmental Impact Assessment Process**

1. The Ministry of Construction, Department of Highways and Asian Development Bank (ADB) plans to rehabilitate or improve sections of Yangon – Mandalay Expressway, Yangon-Pathein Highway and Bago – Thanlyin Highway and submit the document to ECD for screening and to determine the need for environmental assessment.

2. According to the Environmental Assessment Procedure by the Ministry of Natural Resources and Environmental Conservation, ECD will determine the project type as "EIA", "IEE", or "Non IEE/EIA" based on the submitted proposal, in accordance with Annex A "Categorization of Economic Activities for Assessment Purposes".

3. In accordance with the above mentioned, The Ministry of Construction, Department of Highways and Asian Development Bank (ADB) needs to carry out the rehabilitation or improvement of Yangon – Mandalay Expressway, Yangon-Pathein Highway and Bago – Thanlyin Highway as follows.

(A) In order to minimize the environmental and social impacts caused by the proposed projects, the Project Proponent shall describe the detailed project description and apply necessary measures and medication.

(B) The Project Proponent shall prepare IEE (Initial Environmental Examination) Report with respective specialists for each project and submit to MONREC for approval.

(C) The project Proponent shall follow the existing Law, Policy, Legal and Institutional Frameworks.

(Win Zaw)

Deputy Permanent Secretary

ဝန်ကြီးရုံး

ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်အစိုးရ
ဆောက်လုပ်ရေးဝန်ကြီးဌာန
ဝန်ကြီးရုံး
နေပြည်တော်

၁၁၈၈
30.5.2017

အကြောင်းအရာ။ **သဘာဝပတ်ဝန်းကျင် ဆန်းစစ်ခြင်းဆိုင်ရာ သဘောထားမှတ်ချက်များ ဆောင်ရွက်ပေးနိုင်ပါရန်ကိစ္စ**

ရည် ညွှန်း ချက် ။ သယံဇာတနှင့်သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာန၏၂၀၁၇ခုနှစ် မေလ(၂၃)ရက် နေ့စွဲပါစာအမှတ်၊ (သစ်တော)၃(၂)/၀၃(ခ)/(၁၆၂၀/၂၀၁၇)

၁။ ဆောက်လုပ်ရေးဝန်ကြီးဌာန၊ လမ်းဦးစီးဌာနနှင့်အာရှဖွံ့ဖြိုးရေးဘဏ်(ADB)တို့သည် ရန်ကုန်-မန္တလေးအမြန်လမ်းမကြီး၊ ရန်ကုန်-ပုသိမ်လမ်းနှင့် ပဲခူး-သန်လျင်လမ်း တို့အား အဆင့်မြှင့်တင်ခြင်းဆိုင်ရာ လုပ်ငန်းများဆောင်ရွက်ရန်အတွက် မည်သည့်ဆန်းစစ်ခြင်းအမျိုးအစားတွင် ပါဝင်ကြောင်း သဘောထားမှတ်ချက်တောင်းခံထားခြင်း ကိစ္စနှင့်ပတ်သက်၍ ရည်ညွှန်းချက်ပါ စာဖြင့်ပြန်ကြားလာခြင်းအပေါ် အမြဲတမ်းအတွင်းဝန်မှအောက်ပါအတိုင်း မှတ်ချက်ပြုထားပါသည်-

DG(လမ်း)
မှတ်ချက်အရ
ဆက်လက်ဆောင်ရွက်ရန်

၂။ အမြဲတမ်းအတွင်းဝန်၏ အထက်ပါ မှတ်ချက်ကို သိရှိလိုက်နာ ဆောင်ရွက်သွားနိုင်ပါရန် ရည်ညွှန်းချက်ပါ စာမိတ္တူနှင့်အတူပူးတွဲ ပေးပို့အကြောင်းကြားအပ်ပါသည်။

ဒု-ညွှန်ချုပ်(စီမံရေး)
စိစစ်ဆောင်ရွက်ရန်

ညွှန်ကြားရေးမှူးချုပ်
လမ်းဦးစီးဌာန

29/5/17

ပြည်ထောင်စုဝန်ကြီး(ကိုယ်စား)
(ကျော်ကျော်ဝင်း၊ဒုတိယညွှန်ကြားရေးမှူး)

ညွှန်ကြားရေးမှူးချုပ် ၊
လမ်းဦးစီးဌာန ။

စာအမှတ် ၊ ၃/ဌာနခွဲ-၃/၂၀၁၇(အထွေထွေ)(စီ ၁၃၃၆)
ရက် စွဲ ၊ ၂၀၁၇ ခုနှစ် မေလ ၂၉ ရက်
မိတ္တူကို

- ဒုတိယညွှန်ကြားရေးမှူးချုပ်(စီမံရေး/တည်ဆောက်ရေး/လမ်းထိန်းသိမ်းရေး)၊ လမ်းဦးစီးဌာန ။

၂၅.၅.၁၇

ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်အစိုးရ
သယ်ယာတနှင့်သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာန
ပြည်ထောင်စုဝန်ကြီးရုံး

စာအမှတ် (သစ်တော)၃(၂)/၀၃(ခ)(၁၆၂၀ /၂၀၁၇)
ရက်စွဲ ၂၀၁၇ ခုနှစ် ၊ မေလ ၂၃ ရက်

သို့

ဥက္ကဋ္ဌ၊ဆောက်လုပ်ရေးဝန်ကြီးဌာန

ဌာနမှဲ(၃)
စာအမှတ် ၁၃၉၀
ရက်စွဲ ၂၆-၅-၂၀၁၇

အကြောင်းအရာ။ **သဘာဝပတ်ဝန်းကျင် ဆန်းစစ်ခြင်းဆိုင်ရာ သဘောထားမှတ်ချက်များ ဆောင်ရွက်ပေးနိုင်ပါရန်ကိစ္စ**

ရည်ညွှန်းချက် ။ ဆောက်လုပ်ရေးဝန်ကြီးဌာန၏ ၁၀-၃-၂၀၁၇ ရက်စွဲပါစာအမှတ်၊ ၃/ ဌာနခွဲ -၃/ ၂၀၁၇ (ADB) (စီ ဝ၆၅၀)

၁။ ဆောက်လုပ်ရေးဝန်ကြီးဌာန၊ လမ်းဦးစီးဌာနနှင့် အာရှဖွံ့ဖြိုးရေးဘဏ်(ADB) တို့သည် ရန်ကုန်-မန္တလေး အမြန်လမ်းမကြီး၊ ရန်ကုန်-ပုသိမ်လမ်းနှင့် ပဲခူး-သန်လျင်လမ်းတို့အား အဆင့်မြှင့်တင်ခြင်းဆိုင်ရာ လုပ်ငန်းများ ဆောင်ရွက်ရန်အတွက် မည်သည့်ဆန်းစစ်ခြင်းအမျိုးအစား တွင်ပါဝင်ကြောင်း သဘောထားမှတ်ချက် ပြန်ကြားပေးနိုင်ပါရန် ရည်ညွှန်းစာဖြင့် ညှိနှိုင်း အကြောင်းကြားလာပါသည်။

၂။ အဆိုပါ ကိစ္စနှင့်ပတ်သက်၍ သယ်ယာတနှင့်သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီး ဌာန၏ စိစစ်သုံးသပ်ချက်အရ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ထုံးလုပ်နည်း၊ နောက်ဆက်တွဲ(က)တွင် ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်ခြင်း သို့မဟုတ် ပတ်ဝန်းကျင် ထိခိုက်မှု ဆန်းစစ်ခြင်း ဆောင်ရွက်ရန် လိုအပ်သည့် စီမံကိန်းအမျိုးအစားနှင့် အရွယ်အစား သတ်မှတ်ချက် များ၏ အမှတ်စဉ်(၁၃၁)တွင် လမ်းများအဆင့်မြှင့်တင်ခြင်းလုပ်ငန်းနှင့်ပတ်သက်၍ အရှည်(၅၀) ကီလိုမီတာနှင့်အထက် ဆောင်ရွက်မည်ဆိုပါက ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်ခြင်း ပြုလုပ်ရန်နှင့် သတ်မှတ်သည့် စီမံကိန်းအားလုံးကို ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းပြုလုပ်ရန် လိုအပ် ကြောင်း ဖော်ပြပါရှိပါသည်။

၃။ သို့ဖြစ်ပါ၍ ဆောက်လုပ်ရေးဝန်ကြီးဌာန၊ လမ်းဦးစီးဌာနနှင့် အာရှဖွံ့ဖြိုးရေးဘဏ်(ADB) တို့သည် ရန်ကုန်-မန္တလေး အမြန်လမ်းမကြီး၊ ရန်ကုန်-ပုသိမ်လမ်းနှင့် ပဲခူး-သန်လျင်လမ်းတို့အား အဆင့်မြှင့်တင်ခြင်းလုပ်ငန်းများအား တဖက်ပါအတိုင်း ဆောင်ရွက်ရန်လိုအပ်ပါကြောင်းသဘော ထားပြန်ကြားအပ်ပါသည်-

(က) အဆိုပြုလုပ်ငန်းများဆောင်ရွက်မှုကြောင့် ဖြစ်ပေါ်လာနိုင်သည့် ပတ်ဝန်းကျင်နှင့် လူမှုရေးထိခိုက်ပျက်စီးမှုကို လျော့နည်းစေရန်အတွက် လုပ်ငန်းဆိုင်ရာအချက်အလက်များကို ပြည့်စုံစွာဖော်ပြပြီး လုပ်ငန်းဆောင်ရွက်ရာတွင် ပတ်ဝန်းကျင်ထိခိုက်မှုအနည်းဆုံးဖြစ်စေမည့် နည်းစနစ်များကို အသုံးပြုရန်၊

(ခ) အဆိုပြုလုပ်ငန်းများ ဆောင်ရွက်မှုကြောင့် ပတ်ဝန်းကျင်နှင့် လူမှုရေးထိခိုက်ပျက်စီးမှုမရှိစေရေး(သို့မဟုတ်)အနည်းဆုံးဖြစ်စေရေးအတွက် စီမံကိန်းတစ်ခုခြင်းစီအလိုက် ကနဦးပတ်ဝန်းကျင်ဆန်းစစ်ခြင်း (Initial Environmental Examination-IEE) ကို သီးခြားစီ ကျွမ်းကျင်ပညာရှင်များဖြင့် ရေးဆွဲ၍ သယံဇာတနှင့် သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနသို့ တင်ပြအတည်ပြုချက်ရယူရန်၊

(ဂ) ပြဌာန်းထားသည့် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဥပဒေ၊ နည်းဥပဒေ၊ လုပ်ထုံးလုပ်နည်း၊ ညွှန်ကြားချက်များနှင့်အညီ လိုက်နာဆောင်ရွက်ရန်။

၁၃/၁/၂၀၁၇

ပြည်ထောင်စုဝန်ကြီး(ကိုယ်စား)
(ဝင်းဇော်၊ ဒုတိယအမြဲတမ်းအတွင်းဝန်)

မိတ္တူကို
ညွှန်ကြားရေးမှူးချုပ်
ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန

Appendix B: Project Information Handout & Questionnaire on Perceptions: Expected Environmental Impacts from Road Works

1. Project Information

Under the Asian Development Bank (ADB) funded Project TA MYA–8987 Greater Mekong Subregion Highway Modernization Project, the Department of Highways (DOH), Ministry of Construction (MOC), plans to rehabilitate the Yangon–Pathein Highway in Yangon and Ayeyarwady Regions.

Main Works Issues and Activities
• Works on the road will take about 4 years to complete. • The road will be 2-lanes of 3.5 m each (total width 7.0 m, or about 24 feet). • Shoulders each side of the road will be built or widened to 1.5 m and be paved. • A section of the road (around Km128 to Km148) will be raised 2 m. • The embankment will be widened to accommodate 2 x 3.5 m-wide lanes, 2 x 1.5 m paved shoulders, and 2 x 1.0 m unpaved shoulders (to protect the road). • Extra width will be required where the embankment is raised. • The road lanes will be paved in asphalt concrete. • Road drainage and safety will be improved. • Construction will follow standard, internationally accepted procedures and practices.

2. Likely Impacts from Road Works

The existing project-affected area has been in intense rice growing for a long time. No environmentally or ecologically sensitive or unique natural features remain.

The most serious impacts will relate to transport of required embankment construction material. The associated impacts have been investigated and will be reduced by using rail and barge transport as much as possible.

Other environmentally significant issues are work-site specific; all can be prevented or mitigated (reduced). They include:

- Soil erosion and sedimentation at and near construction sites
- Noise and vibration caused by construction and materials transport
- Localized air pollution due to construction and materials transport
- Oil, diesel and other hazardous material spills and releases
- Traffic congestion, disruption to public access and possible accidents
- Health and social risks associated with work-camps
- Occupational health and safety at work sites
- Improper management of construction sites.

An Environmental Management Plan (EMP) has been prepared to guide works activities to prevent or reduce impacts. The EMP includes:

- Impact prevention/reduction measures and responsibilities for implementation
- A Monitoring Plan to follow-up and ensure performance and compliance
- A Draft Grievance Redress Mechanism (GRM) by which people may complain about works activities or seek compensation for damages.

Questionnaire on Expected Environmental Impacts

Please express your concerns about the project by filling in the questionnaire below. Your answers will help environmental management during road works.

Questions	**"YES"**	**"NO"**
Did you know about the project before this meeting?		

Please comment on issues with the existing road.
Do you agree or not agree with the following statements?

Please circle either "YES" or "NO"	**"YES"**	**"NO"**
The road-lanes are very narrow		
The shoulders (sides of road) are too narrow		
The road floods during the wet season		
The road condition makes travel very slow		
There are no problems with the existing road		
The road needs to be improved		
Do you think that road works activities may affect the local environment?		

What impacts most concern you about road works?	***Please circle one number for each issue below***				
	No Impact 1	**Mild Impact 2**	**Neutral impact or not sure 3**	**Serious Impact 4**	**Very serious impact 5**
Water Pollution	1	2	3	4	5
Air Pollution	1	2	3	4	5
Damage to land	1	2	3	4	5
Construction Traffic	1	2	3	4	5
Noise	1	2	3	4	5
Workers or Work-Force	1	2	3	4	5

Please identify other concerns that you have about the project:

Appendix C: Names of Participants in Community Meetings

Kyaung Kone

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ADB TA 8987 Improving Road Network Management and Safety

Attendance List

Region
District
Township
Date

Nos စဉ်	Name အမည်	M/F ကျား/မ	Occupation အလုပ်အကိုင်	Village ရွာ	VT အုပ်စု	Remark မှတ်ချက်
၁	[illegible]	M	[illegible]	[illegible]	[illegible]	[illegible]
၂	" [illegible]	M	[illegible]	[illegible]	[illegible]	[illegible]
၃	" [illegible]	"	Admin Off	"	"	[illegible]
၄	" [illegible]	"	[illegible]	"	"	[illegible]
၅	" [illegible]	"	[illegible]			[illegible]
၆	[illegible]	"	"	[illegible]	"	[illegible]
၇	" [illegible]	"	"	[illegible]	"	[illegible]
၈	" [illegible]	"	[illegible]	"	"	[illegible]
၉	" [illegible]	"	V/g Elders	[illegible]	"	[illegible]
၁၀	" [illegible]	"	"			[illegible]
၁၁	" [illegible] Elder	"	[illegible]	[illegible]	[illegible]	[illegible]
၁၂	[illegible] "	"	[illegible]	[illegible]	[illegible]	[illegible]
၁၃	" [illegible] "	"	[illegible]	[illegible]	[illegible]	[illegible]
၁၄	[illegible] V/g Admin	"	[illegible]	[illegible]	[illegible]	[illegible]
၁၅	" [illegible] Elder	"	[illegible]	"	"	[illegible]
၁၆	" [illegible] Clerk	"	[illegible]	[illegible]	[illegible]	[illegible]
၁၇	" [illegible] Admin	"	[illegible]	[illegible]	[illegible]	[illegible]
၁၈	" [illegible] Elder	"	[illegible]	[illegible]	[illegible]	[illegible]
၁၉	" [illegible] Admin	"	[illegible]	[illegible]	[illegible]	[illegible]
၂၀	" [illegible] "	"	[illegible]	[illegible]	[illegible]	[illegible]
၂၁	" [illegible] Elder	"	[illegible]	[illegible]	[illegible]	[illegible]
၂၂	" [illegible] "	"	"	[illegible]	[illegible]	[illegible]
၂၃	" [illegible] Admin	"	[illegible]	[illegible]	[illegible]	
၂၄	" [illegible] Elder	"	[illegible]			[illegible]
၂၅	" [illegible] Admin	"	[illegible]			[illegible]
၂၆	[illegible] Admin	"	[illegible]	[illegible]	[illegible]	[illegible]
၂၇	[illegible] "	"	[illegible]	[illegible]	[illegible]	[illegible]
၂၈	[illegible] "	"	[illegible]			[illegible]
၂၉	[illegible] (Electricity)	"	[illegible]			[illegible]

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ADB TA 8987 Improving Road Network Management and Safety

Attendance List

Region Ayeyarwady
District Ma U Bin
Township Nyaung Tone
Date 15-12-16

Meeting at Mei Za Li, Irrigation Department hall at 31 Km from Ygn.

Nos စဉ်	Name အမည်	M/F ကျား/မ	Occupation အလုပ်အကိုင်	Village ရွာ	VT အုပ်စု	Remark မှတ်ချက်
၁	[illegible]	M ကျား	ကျွမ်းကျင်	ညောင်တုန်း	Electric/Power	
၂	"	M ကျား	ဝန်ထမ်း	Nyaung Tone	Admin Dept	[illegible]
၃		M ကျား	ဝန်ထမ်း	"	Forestry	
၄	[illegible]	F မ	[illegible]	" Tsp	Officer DOH	
၅	[illegible]	F မ	[illegible]	" Asst	" DOH	
၆	[illegible]	M ကျား	[illegible]	[illegible] Asst	" DOH	
၇	[illegible]	M ကျား	တောင်သူ	[illegible]	[illegible]	Farmer
၈	[illegible]	M ကျား	[illegible]	[illegible]	Mei Za Li	"
၉	[illegible]	M ကျား	[illegible]	[illegible]	"	"
၁၀	[illegible]	M ကျား	[illegible]	[illegible]	"	"
၁၁	[illegible]	M ကျား	[illegible]	[illegible]	"	"
၁၂	[illegible]	M ကျား	[illegible]	[illegible]	"	"
၁၃	[illegible]	M ကျား	[illegible]	[illegible]	"	"
၁၄	[illegible]	M ကျား	[illegible]	[illegible]	"	"
၁၅	[illegible]	M	M	"	"	"	"
၁၆	[illegible]	M	M	"	"	"	"
၁၇	[illegible]	M	M	"	"	"	"
၁၈	[illegible]	F မ	[illegible]	[illegible]	~~Shop~~ "	Shop
၁၉	[illegible]	M ကျား	"	"	"	"
၂၀	[illegible]	M ကျား	"	"	"	"
၂၁	[illegible]	M ကျား	"	"	"	"
၂၂	[illegible]	M ကျား	"	"	"	"
၂၃	[illegible]	M ကျား	"	"	"	"
၂၄	[illegible]	M ကျား	"	"	"	"
၂၅	[illegible]	M ကျား	"	"	"	"
၂၆	[illegible]	M ကျား	"	"	"	"
၂၇	[illegible]	M ကျား		"	"	"
၂၈	[illegible]	M ကျား	[illegible]	"	"	"
၂၉	[illegible]	M ကျား	[illegible]	"	"	"
၃၀	[illegible]	M ကျား	[illegible]	"	"	"
၃၁	[illegible]	M ကျား	[illegible]	"	"	Farmer
		M ကျား		"	"	"

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ADB TA 8987 Improving Road Network Management and Safety

Attendance List

Region Ayeyarwady
District Maubin
Township Nyaung Pone
Date 15-12-16

Nos စဉ်	Name အမည်	M/F ကျား/မ	Occupation အလုပ်အကိုင်	Village ရွာ	VT အုပ်စု	Remark မှတ်ချက်
၁		M	ကျောင်	~~Fruit~~ Mei Zu Li		Fruit Seller
၂		M	ကျောင်	"		"
၃		F	ဆေ	"		"
၄		M	ကျောင်	"		"
၅		M	ကျောင်	"		"
၆		F	ဆေ	"		"
၇		F	ဆေ	"		"
၈		M	ကျောင်	"		"
၉		M	ကျောင်			Farmer
၁၀		F	ဆေ			Fruit Seller
၁၁		M	ကျောင်			"
၁၂		M	ကျောင်			Farmer
၁၃		M	ကျောင်			"
၁၄		M	ကျောင်			"
၁၅		M	ကျောင်			"
၁၆		M	ကျောင်			Grocery Seller
၁၇		M	ကျောင်			"
၁၈		M	ကျောင်			"
၁၉		M	ကျောင်			"
၂၀		M	ကျောင်			"
၂၁		M	ကျောင်			"
၂၂		M	ကျောင်			"
၂၃		M	ကျောင်			"
၂၄		M	ကျောင်			"
၂၅		M	ကျောင်			"
၂၆		M	ကျောင်			"
၂၇		M	ကျောင်			"
၂၈		M	ကျောင်			"
၂၉		M	ကျောင်			"
၃၀		M	ကျောင်			"
၃၁		M	ကျောင်			"
၃၂		M	ကျောင်			"

ADB TA 8987 Improving Road Network Management and Safety

Attendance List

Region Ayeyarwady
District [illegible]
Township Nyaung Tone
Date 15-12-16

Nos စဉ်	Name အမည်	M/F ကျား/မ	Occupation အလုပ်အကိုင်	Village ရွာ	VT အုပ်စု	Remark မှတ်ချက်
၆၄	[illegible]	[illegible]	[illegible]	Mei Za Li		Farmer
၆၅	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
၆၆	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
၆၇	[illegible]	[illegible]	[illegible]			[illegible]
၆၈	[illegible]	[illegible]	[illegible]			[illegible]
၆၉	[illegible]	[illegible]	[illegible]			[illegible]
၇၀	[illegible]	[illegible]	[illegible]			[illegible]
၇၁	[illegible]	[illegible]	[illegible]			[illegible]
၇၂	[illegible]	[illegible]	[illegible]			[illegible]
၇၃	[illegible]	[illegible]	[illegible]			[illegible]
၇၄	[illegible]	[illegible]	[illegible]			[illegible]
၇၅	[illegible]	[illegible]	[illegible]			[illegible]
၇၆	[illegible]	[illegible]	[illegible]			[illegible]
၇၇	[illegible]	[illegible]	[illegible]			[illegible]
၇၈	[illegible]	[illegible]	[illegible]			[illegible]
၇၉	[illegible]	[illegible]	[illegible]			[illegible]
၈၀	[illegible]	[illegible]	[illegible]			[illegible]
	[illegible]	[illegible]	[illegible]			Shop
	[illegible]	[illegible]	[illegible]			[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]

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ADB TA 8987 Improving Road Network Management and Safety

Attendance List

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Region Yangon
District Thonlyin
Township Khayan
Date 12-12-16

Nos စဉ်	Name အမည်	M/F ကျား/မ	Occupation အလုပ်အကိုင်	Village ရွာ	VT အုပ်စု	Remark မှတ်ချက်
.	[illegible]	M	[illegible]	[illegible]		[signature]
			Tsp Admin Officer	Khayan Tsp		
	[illegible]	M	[illegible]	Tsp Congress	Rep.	[signature]
	[illegible]	M	EO [illegible]			[signature]
			Executive Officer, Tsp		Devt Committee	
	[illegible]	F	[illegible]	[illegible]	[illegible]	
			Tsp Officer	Khayan	DOH	
	[illegible]	F	"	[illegible]	"	
			Agri Dept	Tha Nat Pin	"	
	[illegible]	M	[illegible]	[illegible] Thone Khwa Tsp		[signature]
	[illegible]	M	" —	[illegible] Khayan Tsp		[signature]
	[illegible]		[illegible]			[signature]
			Vlg Admin	Khayan Tsp		[signature]
	[illegible]		[illegible]			
			Vlg Admin	"		
	[illegible]		" "			[signature]
			"	"		
	[illegible]	M	[illegible]	[illegible] Congress Rep. Khayan		[signature]
	[illegible]		[illegible]		(Khayan Tsp)	
			[illegible]	Patrol [illegible] Ta Nat Pin Tsp		[signature]
	[illegible] Forestry	M	[illegible]	[illegible]		[signature]
	[illegible]		[illegible]	[illegible]		[signature]
			Patron	Khayan		
	" [illegible] Planning		[illegible]	[illegible] Khayan		
	" [illegible]		[illegible]	[illegible]		[signature]
			Rice Mill	Khayan		
	" [illegible] Admin	M	[illegible]	[illegible] Vlg		[signature]
	[illegible] Admin	M	—	[illegible]	Ward (2)	[signature]
	[illegible]	M		[illegible]	Ward (5)	[signature]
	[illegible]	M	[illegible]	"	Ward (4)	[signature]
	[illegible]	M		"	Ward (4)	[signature]
	[illegible]	M	[illegible]	[illegible]	Ta Man Gyi Vlg	[signature]

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ADB TA 8987 Improving Road Network Management and Safety

Attendance List

Region Yangon
District Thanlyin
Township Khayan
Date 12-12-16

Nos စဉ်	Name အမည်	M/F ကျား/မ	Occupation အလုပ်အကိုင်	Village ရွာ	VT အုပ်စု	Remark မှတ်ချက်
	[illegible]	M	[illegible]	[illegible]	Kwan Four Dan	[illegible]
	[illegible]	"	Administrator	[illegible]	8 - Ward	[illegible]
	[illegible]	"	"	[illegible]	10 - Ward	[illegible]
	[illegible]	"	"	[illegible]	11 - Ward	[illegible]
	[illegible]	"	"	[illegible]	7 - Ward	[illegible]
	[illegible]	"	"	[illegible]	5 - Ward	[illegible]
	[illegible]	"	[illegible] Staff	[illegible]	Tet Core Kone	[illegible]
	[illegible]		" "	[illegible]	19 - Ward	[illegible]
	[illegible]		[illegible]	[illegible]	14 - Ward	[illegible]
	[illegible]		"	[illegible]	2 - Ward	[illegible]
	[illegible]		Farmer			[illegible]
	[illegible]	F	[illegible] Staff	[illegible]		[illegible]
	[illegible]	M	Farmer	[illegible] V		[illegible]

13

(3)

ADB TA 8987 Improving Road Network Management and Safety

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Attendance List

Region Bago
District
Township Ka Wa Tsp, Ta Nat Pin Tsp
Date 13-12-16

Nos စဉ်	Name အမည်	M/F ကျား/မ	Occupation အလုပ်အကိုင်	Village ရွာ	VT အုပ်စု	Remark မှတ်ချက်
၁	ဦး [illegible]	m	AD - DOA	Bago - District		
၂	ဦး [illegible]	m	[illegible]	[illegible]		[signature]
			Tsp Administrator - Tet Kala Tsp -			
၃	ဦး [illegible]	m	SO / [illegible]	[illegible]		[signature]
			Asst Tsp Administrator - Tanat pin Tsp			
၄	[illegible]	မ	[illegible]	[illegible]		[signature]
			Officer / Fishery Dept. Tanatpin Tsp -			
၅	ဦး [illegible]	m	[illegible]	[illegible]		[signature]
			Tsp Elder - Tat Kala Tsp			
၆	ဦး [illegible]	m	[illegible]	[illegible]		[signature]
			Vlg Admin	Kandaw Vlg		
၇	ဦး [illegible]	m	[illegible]	〃		[signature]
			Vlg Elder/Patron	〃		
၈	ဦး [illegible]	m	[illegible]	〃		[signature]
			100 household leader	〃		
၉	ဦး [illegible]	m	[illegible]	〃		[signature]
			Vlg Patron			
၁၀	ဦး [illegible]	m	[illegible]	[illegible]		[signature]
			Vlg Patron	Tanatpin		
၁၁	〃 [illegible]	m	〃	〃		[signature]
၁၂	〃 [illegible]	m	〃	〃		[signature]
၁၃	〃 [illegible]	m	〃	〃		[signature]
၁၄	〃 [illegible]	m.	[illegible]	[illegible]		[signature]
			Tsp Officer	Land Record Dept. KaWa		
၁၅	〃 [illegible]	m.	[illegible]	[illegible]		[signature] 13/12
			Asst. Tsp. Officer	Admin Dept KaWa		
၁၆	〃 [illegible]	m	[illegible]	[illegible]		[signature]
			Tsp Officer	Fishery Dept. KaWa		

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ADB TA 8987 Improving Road Network Management and Safety

Attendance List

Region Bago
District
Township
Date

Nos စဉ်	Name အမည်	M/F ကျား/မ	Occupation အလုပ်အကိုင်	Village ရွာ	VT အုပ်စု	Remark မှတ်ချက်
၁.	ဦး [illegible]	က	လယ်	ကမာဆိပ်ကျေးရွာ	ကမာဆိပ်	
		M	Farmer	Kamar Sei Vlg	Ka Wa	
၂.	[illegible]	ကျား	ဆန်စက်	[illegible]		
		M	Rice Mill	Tat [illegible]	Tsp	
၃.	ဦး [illegible]		[illegible]	[illegible]		
			Vlg Admin Office	Vlg		
၄.	ဦး [illegible]	ကျား	လယ်သမား			
		M	Farmer			
၅.	ဦး [illegible]	ကျား	လယ်သမား	,,		
		M	Farmer			
၆.	ဦး [illegible]	ကျား	ကုန်သည်	[illegible]		
		M	Trader	Ohn Nare Vlg		
၇.	ဦး [illegible]	ကျား	ရာအိမ်မှူး	,,		
		M	Vlg Administrator	,,		
၈.	ဦး [illegible]	ကျား	Farmer	,,		
		M				
၉.	ဦး [illegible]	ကျား	[illegible]	[illegible]	[illegible]	
		Male	Tsp Office	Ta Nat Pin Tsp - Agri Dept.		
၁၀.	,, [illegible]	ကျား	လယ်	[illegible]		
		Male	Farmer	Ohn Nare	Vlg	
၁၁.	,, [illegible]		Farmer	[illegible]	Tat Ka La	
၁၂.	,, [illegible]	M	ကုန်သည်	[illegible]		
		Male	Trader	Yit Kan	Railway Station	
၁၃.	,, [illegible]		Farmer	[illegible]	Tat Ka La Vlg	
၁၄.	,, [illegible]	M	Farmer	,,	,,	
၁၅.	[illegible]	မ	Housewife	[illegible]	Ohn Nare Vlg	
		F				
၁၆.	,, [illegible]	,,	,,	[illegible]	Yit Kan Vlg	
		F				

16

ADB TA 8987 Improving Road Network Management and Safety

Attendance List

Region Bago
District
Township
Date

Nos စဉ်	Name အမည်	M/F ကျား/မ	Occupation အလုပ်အကိုင်	Village ရွာ	VT အုပ်စု	Remark မှတ်ချက်
၁၇	ဦး [illegible]	M	Farmer	[illegible]	Myay Kan Vt	[signature]
၁၈	" [illegible]	ကျ. M	Farmer	[illegible]	Ohn Nare Vt	[signature]
၁၉	[illegible]	ကျ M	Farmer	"	"	[signature]
၂၀	" [illegible]	ကျ M	Farmer	[illegible] Ah Lare Vlg		[signature]
၂၁	" [illegible]	ကျ M	" "	[illegible] Ohn Nare Vt		[signature]
၂၂	" [illegible]	ကျ M	Farmer	"	"	
၂၃	" [illegible]	ကျ M	"	[illegible]	Ah Lare Vlg	[signature]
၂၄	" [illegible]	ကျ. M	"	"	"	[signature]
၂၅	" [illegible]	ကျ M	[illegible] Vlg Admin	"	"	[signature]
၂၆	" [illegible]	ကျ. M	Farmer	[illegible]	Ohn Nare Vt	[signature]
၂၇	" [illegible]	ကျ. M	Farmer	[illegible]	Ta Nat Pin Esp	[signature]
၂၈	" [illegible]	ကျ M	Farmer	[illegible]	"	[signature]
၂၉	" [illegible]	ကျ M	"	[illegible]	Ohn Nare Vt	[signature]
၃၀	" [illegible]	ကျ M	"	"	"	[signature]
၃၁.	" [illegible]	M.	ဒီ.A.ရီ. High School Teacher	[illegible] Ta Nat Pin Esp		[signature]
၃၂.	" [illegible]	မ F	ဒီ.A.E "	[illegible] "		[signature]

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TA-8987 MYA: Improving Road Network Management and Safety

Consultation Meeting

Township: Kawa

Date: 25 April 2017

List of Participants

	Full Name	Position	Agencies	Gender		Signature
				Male	Females	
1.				✓		
2.				✓		
3.				✓		
4.				✓		
5.				✓		
6.		"		✓		
7.		"		✓		
8.		"		✓		
9.		"		✓		
10.				✓		
11.				✓		
12.				✓		
13.				✓		
14.				✓		
15.		"			✓	
16.						
17.		"			✓	
18.		"			✓	
19.		"			✓	
20.					✓	
21.		"		✓		
22.		"			✓	

23.	[illegible]	[illegible]		✓		[signature]
24.	ဦးဝင်းမောင်	၁၁ ရပ်ကွက်		✓		[signature]
25.	ဦးဟန်ရွှေ	၁၁ ရပ်ကွက်		✓		[signature]
26.	[illegible]	၁၁ ရပ်ကွက်		✓		[signature]
27.	[illegible]	၁၁ ရပ်ကွက်		✓		[signature]
28.	[illegible]	၁၁ ရပ်ကွက်		✓		[signature]
29.	ဒေါ်သျှားညို	"		✓		[signature]
30.	ဒေါ်သန်းဦးကျော်	"		✓		[signature]
31.	ဒေါ်ကလေးမြင့်	"		✓		[signature]
32.	[illegible]				✓	[signature]
33.	[illegible]			✓		[signature]
34.	ဝေနိုင်	"			✓	[signature]
35.	ကြူကြူ	"			✓	[signature]
36.	ကြူလင်း	"		✓		[signature]
37.	ဒေါ်ခင်ဝေ				✓	[signature]
38.	[illegible]	[illegible]			✓	[signature]
39.	[illegible]	"			✓	[signature]
40.	[illegible]	[illegible]		✓		[signature]
41.	[illegible]	"		✓		[signature]
42.						
43.						
44.						
45.						

TA-8987 MYA: Improving Road Network Management and Safety

Consultation Meeting

Township: **Kayan** Date: **26 April 2017**

List of Participants

	Full Name	Position	Agencies	Gender		Signature
				Male	Females	
1.				✓		
2.				✓		
3.				✓		
4.				✓		
5.				✓		
6.				✓		
7.				✓		
8.				✓		
9.				✓		
10.				✓		
11.				✓		
12.				✓		
13.				✓		
14.						
15.				✓		
16.				✓		
17.				✓		
18.				✓		
19.					✓	
20.				✓		
21.				✓		
22.				✓		

23.	ဦးကျော်ဝင်း	၁၂/ရပ်ကွက်		✓		[signature]
24.	ဦးလင်းနိုင်ဦး	[illegible]		✓		[signature]
25.	ဦးတင်ဦး	၁၀ ရပ်ကွက်		✓		[signature]
26.	ဦးသန်းလွင်	[illegible]/ရွာ		✓		[signature]
27.	" ဦးဌေး	၄ "		✓		[signature]
28.	" [illegible]	၅ "		✓		[signature]
29.	" ဝင်းမြိုင်	၇ "		✓		[signature]
30.	" ကျော်ဝင်း	ကျေး/ရပ်		✓		[signature]
31.	" သိန်းမြ	[illegible]		✓		[signature]
32.						
33.	ဦးဝင်းကျော်	ကော်/သာ - ၂ (မြို့)		✓		[signature]
34.	ဦး[illegible]	"		✓		[signature]
35.	ဒေါ်သင်းသင်းကျော်	ဦး[illegible] (မြို့မ)	[illegible]		✓	[signature]
36.						
37.						
38.						
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40.						
41.						
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ဘုရားကုန်း၊

(၂၆.၄.၂၀၁၇)နေ့၊ နေလည်(၁း၀၀)နာရီတွင် ကြာကန်ဗိမာန်တော်၊ ဘုရားကုန်း၊သန်လျင်မြို့၌

ကျင်းပသောအစည်းအဝေးသို့ တက်ရောက်သည့်သူများစာရင်း

စဉ်	အမည်	တက်ရောက်သည့်ဌာန	နေရပ်လိပ်စာ	လက်မှတ်	မှတ်ချက်
၁။	ဦးအောင်ဆန်းကျော်	[illegible]	ဘုရားကုန်း	[signature]	Male
၂။	ဦးဝင်းမြိုင်	〃	〃	[signature]	Male
၃။	ဦးသစ်ပေါင်	〃	〃	[signature]	Male
၄။	ဦးကျော်ညွန့်	〃	〃	[signature]	Male
၅။	ဦးသင်းနိုင်	〃	〃	[signature]	Male

ဌာနဆိုင်ရာ

(၂၆.၄.၂၀၁၇)နေ့၊ နေလည်(၁း၀၀)နာရီတွင် ကြာကန်ပိမာန်တော်၊ ဘုရားကုန်းသန်လျင်မြို့၌

ကျင်းပသောအစည်းအဝေးသို့ တက်ရောက်သည့်သူများစာရင်း

စဉ်	အမည်	တက်ရောက်သည့် ဌာန	နေရပ်လိပ်စာ	လက်မှတ်	မှတ်ချက်
၁	[illegible]	[illegible]	[illegible]	[illegible]	Male
၂	[illegible]	[illegible]	[illegible]	[illegible]	Male
၃	[illegible]	[illegible]	[illegible]	[illegible]	Male
၄	[illegible]	[illegible]	[illegible]	[illegible]	Male
၅	[illegible]	[illegible]	[illegible]	[illegible]	Female
၆	[illegible]	[illegible]	[illegible]	[illegible]	Female
၇	[illegible]	[illegible]	[illegible]	[illegible]	Female
၈	[illegible]	[illegible]	[illegible]	[illegible]	Male
၉	[illegible]	[illegible]	[illegible]	[illegible]	Female
၁၀	[illegible]	[illegible]	[illegible]	[illegible]	Male
၁၁	[illegible]	[illegible]	[illegible]	[illegible]	Male

(၂၆.၄.၂၀၁၇)နေ့၊ နေ့လည်(၁း၀၀)နာရီတွင် ကြာကန်ဗိမာန်တော်၊ ဘုရားကုန်း၊သန်လျင်မြို့၌ ကျင်းပသောအစည်းအဝေးသို့ တက်ရောက်သည့်သူများစာရင်း စစ်ပင်ကွင်း

စဉ်	အမည်	တက်ရောက်သည့်ဌာန	နေရပ်လိပ်စာ	လက်မှတ်	မှတ်ချက်
၁	ဦးခင်ရှိန်		စစ်ပင်ကွင်း		Male
၂	ဦးမြအောင်		"		Male
၃	" ဝင်းမြင့်				Male
၄	" ကျော်မြင့်				Male
၅	" ကျော်စိုး				Male
၆	" စန်းဦး				Male
၇	" ရဲလှိုင်				Male
၈	" မျိုးလှိုင်				Male
၉	" ဟန်မျိုးအောင်				Male
၁၀	" အောင်ကျော်လင်း				Male
၁၁	ဒေါ်ကြည်ဝင်း				Female
၁၂	မြင့်ဝေ				Male
၁၃	ဒေါ်တင်ဦး				Female
၁၄	ဒေါ်အမာချွန်				Female
၁၅	ထွန်းဝေ				Male
၁၆	ဦးသန်းထွန်း				Male

ကာရင်ဆိပ်

(၂၆.၄.၂၀၁၇)နေ့၊ နေလည်(၁း၀၀)နာရီတွင် ကြာကန်ဗိမာန်တော်၊ ဘုရားကုန်း၊သန်လျင်မြို့၌

ကျင်းပသောအစည်းအဝေးသို့ တက်ရောက်သည့်သူများစာရင်း

စဉ်	အမည်	တက်ရောက်သည့်ဌာန	နေရပ်လိပ်စာ	လက်မှတ်	မှတ်ချက်
၁	ကိုမျိုးကျော်		ကာရင်ဆိပ်	[signature]	Male
၂	မ နိုးနိုင်			[signature]	Male
၃	မ ချိုမြင့်			[signature]	Male
၄	မ ဝမ်းနိုင်			[signature]	Male
၅	မ သုံးဝါး			[signature]	Male
၆	မ သိန်းဝေ			[signature]	Male

(၂၆.၄.၂၀၁၇)နေ့၊ နေ့လည်(၁း၀၀)နာရီတွင် ကြာကန်ဗိမာန်တော်၊ ဘုရားကုန်း၊သန်လျင်မြို့၌

ကျင်းပသောအစည်းအဝေးသို့ တက်ရောက်သည့်သူများစာရင်း

စဉ်	အမည်	တက်ရောက်သည့် ဌာန	နေရပ်လိပ်စာ	လက်မှတ်	မှတ်ချက်
၁။	ဦးတင်ဝင်း	မြို့မိမြို့ဖ			Male
၂	[illegible]		[illegible]		Male
၃	[illegible]		〃		Male
၄	[illegible]		〃		Male
၅	[illegible]		〃		Male

TA-8987 MYA: Improving Road Network Management and Safety

Consultation Meeting

Township: **Thanlyin** သန်လျင်မြို့ Date: **27 April 2017**

List of Participants

	Full Name	Position	Agencies	Gender		Signature
				Male	Females	
1.				✓		
2.		SAE	〃	✓		
3.		SAE	〃	✓		
4.				✓		
5.			YESC	✓		
6.				✓		
7.				✓		
8.		〃		✓		
9.			〃	✓		
10.				✓		
11.			〃	✓		
12.			〃	✓		
13.		〃	〃	✓		
14.				✓		
15.		—		✓		
16.				✓		
17.				✓		
18.			〃	✓		
19.			〃	✓		
20.				✓		
21.		〃		✓		
22.				✓		

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TA-8987 MYA: Improving Road Network Management and Safety

Consultation Meeting

Township: **Thanatpine**

Date: **25 April 2017**

List of Participants

	Full Name	Position	Agencies	Gender		Signature
				Male	Females	
1.				✓		
2.				✓		
3.				✓		
4.				✓		
5.				✓		
6.				✓		
7.				✓		
8.				✓		
9.				✓		
10.				✓		
11.				✓		
12.				✓		
13.				✓		
14.				✓		
15.				✓		
16.					✓	
17.				✓		
18.				✓		
19.						
20.					✓	
21.					✓	
22.					✓	

23.				✓		
24.			—		✓	
25.				✓		
26.				✓		
27.				✓		
28.						
29.						
30.						
31.						
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Date - 25.4.17
(တော်)

အစည်းအဝေး တက်ရောက်သူများ စာရင်း

	အမည်	ရာထူး	လက်မှတ်	မှတ်ချက်
၁.	ဦးမြင့်ဦး	[illegible] ရုံးမှူး	[illegible]	(ကလေးနှတ်)
၂.	" စိုးဝင်း	[illegible]	[illegible]	
၃.	" မင်းကျော်	ကားမောင်းသမား	[illegible]	
၄.	" ဝင်းမြင့်	"	[illegible]	
၅	" ရဲမြင့်	"	[illegible]	
၆	" စိုးမြင့်	"	[illegible]	
၇	" ကျော်ထိုက်	"	[illegible]	
၈	" မြင့်	ရေစက်ကျက်	[illegible]	
၉	" သန်းထိုက်	ရေစက်ကျက် စောင့်/မှူး	[illegible]	
၁၀	" ဦးခင်မောင်နိုင်	[illegible]	[illegible]	
၁၁	"ဦးဝင်းနိုင်	[illegible]	[illegible]	
၁၂	ဒေါ် [illegible]	[illegible]	[illegible]	
၁၃	ဦး [illegible]	[illegible]	[illegible]	
၁၄	ဦးမြင့်	" "	[illegible]	
၁၅	ဦး [illegible]	[illegible]	[illegible]	
၁၆	ဦး [illegible]	[illegible]	[illegible]	
၁၇	ဦးဝင်းနိုင်	[illegible]	[illegible]	
၁၈	[illegible]	[illegible]	[illegible]	
၁၉	ဦး [illegible]	" [illegible]	[illegible]	
၂၀	ဦး [illegible]	[illegible]	[illegible]	
၂၁	ဦး [illegible]	[illegible]	[illegible]	
၂၂	ဦး [illegible]	[illegible]	[illegible]	
၂၃	ဦး [illegible]	[illegible]	[illegible]	

TA-8987 MYA: Improving Road Network Management and Safety

Consultation Meeting

Township: **Thongwa** Date: **26 April 2017**

List of Participants

	Full Name	Position	Agencies	Gender		Signature
				Male	Females	
1.		AE			✓	
2.					✓	
3.				✓		
4.				✓		
5.				✓		
6.				✓		
7.				✓		
8.				✓		
9.				✓		
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11.				✓		
12.				✓		
13.				✓		
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15.					✓	
16.				✓		
17.				✓		
18.				✓		
19.				✓		
20.				✓		
21.					✓	
22.				✓		

23.					✓	
24.				✓		
25.			SAE(ကျေးဇူးတင်)		✓	
26.			PE.3(ကျေးဇူးတင်)	✓		
27.				✓		
28.				✓		
29.				✓		
30.				✓		
31.				✓		
32.				✓		
33.					✓	
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TA-8987 MYA: Improving Road Network Management and Safety

Consultation Meeting

Township: **Thongwa** Date: **26 April 2017**

List of Participants

	Full Name	Position	Agencies	Gender		Signature
				Male	Females	
1.	ဂျဇော်	ဥက္ကဋ္ဌ	ကျေးရွာအုပ်ချုပ်ရေးမှူး	ကျား	မ	[signature]
2.	ဦးလှမြင့်					[signature]
3.	ကိုကျော်ထွန်း		ရုံးအဖွဲ့ဝင်များ			[signature]
4.	ဦးမိ		〃			[signature]
5.	ဦးသန်းမြင့်		〃			[signature]
6.	ဦးကြည်ဝင်း		〃			[signature]
7.	ဒေါ်ခင်မြိုင်		〃			[signature]
8.	ဦးထွန်းရင်		〃			[signature]
9.	ဦးထွန်းနိုင်		〃			[signature]
10.	မဝင်းမြင့်		〃			[signature]
11.	ဦးဖြူ		〃			[signature]
12.	ဦးမြင့်လှိုင်		〃			[signature]
13.	ဦးနိုးအောင်		〃			[signature]
14.	ဦးရင်ရွှေ		〃			[signature]
15.	ဦးချစ်ဝေ		〃			[signature]
16.	ဦးထွန်းမြင့်		〃			[signature]
17.	ကိုနိုးရွှေ		〃			[signature]
18.	ဝင်းထွန်း		〃			[signature]
19.	ဒေါ်မြင့်ဝင်း		〃			[signature]
20.	ကိုနိုးမြင့်ဝင်း		〃			[signature]
21.	ကိုမိုးအောင်		〃			[signature]
22.	မအေးအေးသန်း		〃			[signature]

23.	ကိုတင်နိုင်ဦး		မုံရွာရေဦး လယ်တော			[signature]
24.	ဒေါ်ငွေးကြည်		〃			[signature]
25.	ဦးကာရင်		〃			[signature]
26.	ကိုအောင်ရှိန်ဝင်း		〃			[signature]
27.	ကိုမိုးမင်းထွန်း		〃			[signature]
28.	ကိုဇော်လင်း		〃			[signature]
29.	ကိုလှထွန်း		〃			[signature]
30.	ကိုခင်လှိုင်		〃			[signature]
31.	ဒေါ်တင်လှိုင်		〃			[signature]
32.	ဦးငွေးဝင်း		〃			[signature]
33.	ကိုကျော်မိုး		〃			[signature]
34.	ဒေါ်လှဝင်း		〃			[signature]
35.	ကိုလှဝင်း		〃			[signature]
36.	ကိုနိုင်		〃			[signature]
37.	ကိုနေမျိုး		〃			[signature]
38.	ဦးစံရွှေ		〃			[signature]
39.	ဦးသိန်းဆောင်		〃			[signature]
40.	ဒေါ်ခင်စိန်ဦး		〃			[signature]
41.	ဦးမြင့်ဆွေ		〃			[signature]
42.	ဦးအောင်မြင့်		〃			[signature]
43.	ဦးဝင်းဆောင်		〃			[signature]
44.	ဒေါ်သန်းကြည်		〃			[signature]
45.	ဦးအိုးနိုင်					[signature]

ဒေါ်ရွှေ - ရွှေ ၁၀၀ 〃

[signature]

TA-8987 MYA: Improving Road Network Management and Safety

Consultation Meeting

Township: **Hlaing Thar Yar**

Date: **28 April 2017**

List of Participants

	Full Name	Position	Agencies	Gender		Signature
				Male	Females	
1.				✓		
2.				✓		
3.				✓		
4.				✓		
5.				✓		
6.				✓		
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TA-8987 MYA: Improving Road Network Management and Safety

Consultation Meeting

Township: **Kangidaunt**

Date: **30 April 2017**

List of Participants

	Full Name	Position	Agencies	Gender		Signature
				Male	Females	
1.				✓	—	
2.				✓		
3.				✓		
4.				✓		
5.				✓		
6.				✓		
7.				✓		
8.				✓		
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20.					✓	
21.				✓		
22.				✓		

23.	ဦး ခင်ဦး	လယ်သမား	ဝက်လက်ဘော့ ရွာ.	✓		
24.	ဦး သော်	〃	〃	✓		[signature]
25.	ဦး ကျော်ဟိန်	〃	〃	✓		[signature]
26.	ဦးငွေ:ဝင်း	〃	ကပင်မြစ်ဆိပ်ရွာ.	✓		[signature]
27.	ဦးသန်းမြင့်	〃	〃	✓		[signature]
28.	ဦး ခင်မောင်အေး	〃	〃	✓		[signature]
29.	ဦး အောင်ထွန်း	SAE	ဆီကပေါ်တော်ကြီးမီးဗော.	✓		[signature] 29.4.18
30.	ဒေါ်မြမြအေး	လယ်သမား	ရပ်ကွက်(၈).		✓	[signature]
31.	ဒေါ်သက်ဝင်းအေး	〃	ရပ်ကွက်(၂).		✓	[signature]
32.	ဒေါ်ယဉ်မိုး	〃	ရပ်ကွက်(၃)		✓	[signature]
33.	ဒေါ်ဝေမာ.	〃	ဆီဘောင်တစ်ရာရွာ.		✓	[signature]
34.	ဦးမြဝင်း	〃	ကပင်မြစ်ဆိပ်ရွာ.	✓		[signature]
35.	ဦးတက်ဦးအောင်	〃	ဘောက်(၃)ရပ်ကွက်	✓		[signature]
36.	[illegible]	[illegible]	[illegible]	✓		[signature]
37.	[illegible]	〃	〃 (၄) 〃	✓		[signature]
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TA-8987 MYA: Improving Road Network Management and Safety

Consultation Meeting

Township: **Kyaunggon**

Date: **30 April 2017**

List of Participants

	Full Name	Position	Agencies	Gender		Signature
				Female	Males	
1.	ဦးဇော်မျိုးဝင်း	မြို့နယ်အုပ်ချုပ်ရေးမှူး			✓	
2.	ဦးတင်မောင်	မြို့ပိုင်မြို့-ဝ			✓	
3.	ဦးခင်ရိုး	"			✓	
4.	ဦးမြင့်ထွန်း	"			✓	
5.	ဦးသန်းထွန်း	"			✓	
6.	ဦးလှဝင်း	"			✓	
7.	ဦးခင်အောင်ဆွေ	"			✓	
8.	ဦးစိန်တင်	ရပ်/အုပ်			✓	
9.	ဦးဇော်အောင်	ရပ်ပင်			✓	
10.	ဒေါ်ရင်သန်း	လ.ဝ.က		✓		
11.	ဒေါ်မြရည်ဝေ	ကျေးလက်ရည်ပင်		✓		
12.	ဦးတင်ကိုကို	လက်ပံရွာ အုပ်ချုပ်ရေးမှူး			✓	
13.	ဦးသိန်းထွန်း	အမှတ်(၂) အုပ်ချုပ်ရေးမှူး			✓	
14.	ဦးကိုအေး	ဖိုက်အုပ်ရေးမှူး			✓	
15.	ဦးအုတ်ဝင်း	"			✓	
16.	ဦးခင်ကိုကို	တာရှိန်ကိုင်			✓	
17.	ဦးအောင်ကျော်သိန်း	"			✓	
18.	ဦးဆန်းထွန်း	ကိုင်.တာ			✓	
19.	ဦးတင်ဦး	"			✓	
20.	ဦးသန်းဇော်ဝင်း	သံကျန်			✓	
21.	ဦးဇော်မင်းမြင့်	"			✓	
22.	ဦးအေးလွင်	ရင်ခိုင်			✓	

						လက်မှတ်
23.	ဦး နိုင်ကျွန်း	ကျွန်းကြီး ရှင်အိုင်				
24.	ဦး အောင်မြဲ အေး	ကွမ်းခြံကျွန်း			✓	
25.	ဦး လွင်ရိုး	〃			✓	
26.	ဦး သန်းကျွန်း	ဇရပ်ကွင်း			✓	
27.	ဦး ကျွန်းသိန်း	ဂုံမင်း			✓	
28.	ဦး အောင်မျိုးကော်	〃			✓	
29.	ဦး စောကံသန့်ဦး	〃			✓	
30.	ဦး ကျွန်းကျွန်း	〃			✓	
31.	ဦး မိုးရဲ	〃			✓	
32.	ဦး ခင်ဆိုး	အမှတ် (၂)			✓	
33.	ဦး သန်းငွေ	သာကဲ့သိုက်ကျွန်း			✓	
34.	ဦး ခံကြည်	〃			✓	
35.	ဦး အေးမောင်	ကံကလေး			✓	
36.	ဦး ရန်အေး	〃			✓	
37.	ဦး ငွေမိုး	အုပ်ချုပ်(ရွာဥက္ကဋ္ဌ)			✓	
38.	ဦး ဖူငွေ	ရပ်မိ/ရပ်ဖ			✓	
39.	ဦး လှဂဝင်း	〃			✓	
40.	ဦး သန်းဥာဏ်	〃			✓	
41.	ဦး မိုးရင်	ရှိမင်း			✓	
42.	ဦး ဘုန်းမြင့်	အိုးသို			✓	
43.	ဦး မြင့်ဦး	အုပ်ချုပ်ရေးမှူး			✓	
44.	ဦး တင်ရီ	〃			✓	
45.	ဦး ကျော်မိုး	ရပ်မိ/ရပ်ဖ	မြို့ကြီး		✓	

၄၆ ။ ကျော်ဝင်း 〃 〃

၄၇ ။ ဒုရဲမှူး ဦးမြင့် ရဲ

၄၈ ။ ဦးအောင်ဝင်း သဲကျွန်း

၄၉ ။ ဦးသိန်းဝင်း ရပ်ကွက်ရေးမှူး မြို့ကြီး

၅၀ ။ ဦး ရဲနိုင် ရပ်မိ/ရပ်ဖ အိုးကြီး

TA-8987 MYA: Improving Road Network Management and Safety

Consultation Meeting

Township: **Nyaungdon** Date: **29 April 2017**

List of Participants

	Full Name	Position	Agencies	Gender		Signature
				Male	Females	
1.				✓		
2.				✓		
3.				✓		
4.				✓		
5.				✓		
6.				✓		
7.				✓		
8.				✓		
9.				✓		
10.				✓		
11.				✓		
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13.				✓		
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27.					✓	
28.				✓		
29.				✓		
30.				✓		
31.				✓		
32.				✓		
33.				✓		
34.				✓		
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36.					✓	
37.				✓		
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42.				✓		
43.				✓		
44.						
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TA-8987 MYA: Improving Road Network Management and Safety

Consultation Meeting

Township: **Pantanaw** Date: **29 April 2017**

List of Participants

	Full Name	Position	Agencies	Gender		Signature
				Male	Females	
1.						
2.						
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	အမည်	နေရပ်လိပ်စာ		ကျား	မ	လက်မှတ်
23.	[illegible]	၇၀ ရပ်ကွက်		ကျား		[illegible]
24.	[illegible]	[illegible]		[illegible]		[illegible]
25.	[illegible]	[illegible]		[illegible]		[illegible]
26.	[illegible]	[illegible]				[illegible]
27.	[illegible]	[illegible]		ကျား		[illegible]
28.	[illegible]	[illegible]		ကျား	✓	[illegible]
29.	[illegible]	[illegible]		[illegible]		[illegible]
30.	[illegible]	[illegible]		ကျား		[illegible]
31.	[illegible]	[illegible]		ကျား		[illegible]
32.	[illegible]	[illegible]		ကျား		[illegible]
33.	[illegible]	[illegible]		ကျား		[illegible]
34.	[illegible]	〃		〃		[illegible]
35.	[illegible]	[illegible]		ကျား		[illegible]
36.	[illegible]	[illegible]		ကျား		[illegible]
37.	[illegible]	[illegible]		ကျား		Naing
38.	[illegible]	〃		〃		Thet
39.	[illegible]	〃		〃		[illegible]
40.	〃 [illegible]	〃		〃		[illegible]
41.	〃 [illegible]	[illegible]		〃		[illegible]
42.	[illegible]	[illegible]		〃		[illegible]
43.	[illegible]	[illegible]		〃		[illegible]
44.	[illegible]	[illegible]		〃		[illegible]
45.	[illegible]	[illegible]				[illegible]

(46)	[illegible]	ပနိုတချောင်	ကျား	[illegible]
(47)	[illegible]	ပနိုတချောင်	မ	cen
(48)	[illegible]	ပနိုတချောင်	မ	[illegible]
(49)	[illegible]	ပနိုတချောင်	မ	[illegible]
(50)				
(51)				
(52)				
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(55)				

Appendix D: Environmental Standards

Source Myanmar National Environmental Quality (Emission) Guidelines (2015)

1.1 Air Emissions

Projects with significant sources of air emissions, and potential for significant impacts to ambient air quality, should prevent or minimize impacts by ensuring that: (i) emissions do not result in concentrations that reach or exceed national ambient quality guidelines and standards, or in their absence current World Health Organization (WHO) Air Quality Guidelines[7] for the most common pollutants as summarized below; and (ii) emissions do not contribute a significant portion to the attainment of relevant ambient air quality guidelines or standards (i.e. not exceeding 25 percent of the applicable air quality standards) to allow additional, future sustainable development in the same air shed. Industry-specific guidelines summarized hereinafter shall be applied by all projects to ensure that air emissions conform to good industry practice. Reference should be made to WHO's Air Quality Guidelines for Europe[8] for air pollutants not included in the following table.

Parameter	Averaging Period	NEQEG Guideline Value µg/m^3	IFC General Guidelines (Table 1.1.1)
Nitrogen dioxide	1-year 1-hour	40 200	40 200
Ozone	8-hour daily maximum	100	100
Particulate matter PM_{10}[a]	1-year 24-hour	20 50	20 50
Particulate matter $PM_{2.5}$[b]	1-year 24-hour	10 25	10 25
Sulfur dioxide	24-hour 10-minute	20 500	20 500

[a] Particulate matter 10 micrometers or less in diameter

[b] Particulate matter 2.5 micrometers or less in diameter

1.2 Wastewater

The following guideline values apply during the construction phase of projects, covering storm water or surface water, and sanitary wastewater discharges from all project sites.

[7] Air quality guidelines global update. 2005. World Health Organization.

[8] Air quality guidelines for Europe. 1997. WHO regional publications, European series No. 23. World Health Organization.

Site Runoff and Wastewater Discharges (construction phase)

Parameter	Unit	Maximum Concentration	
		NEQEG Guideline	IFC General EHS (Table 1.3.1)
Biological oxygen demand	mg/l	30	30
Chemical oxygen demand	mg/l	125	125
Oil and grease	mg/l	10	10
pH	S.U.[a]	6-9	6-9
Total coliform bacteria[9]	100 ml	400	400
Total nitrogen	mg/l	10	10
Total phosphorus	mg/l	2	2
Total suspended solids	mg/l	50	50

[a] Standard unit

1.3 Noise Levels

Noise prevention and mitigation measures should be taken by all projects where predicted or measured noise impacts from a project facility or operation exceed the applicable noise level guideline at the most sensitive point of reception. Noise impacts should not exceed the levels shown below, or result in a maximum increase in background levels of three decibels at the nearest receptor location off-site.

Receptor	One Hour LAeq (dBA)[a]			
	NEQEG Guideline		IFC General EHS (Table 1.7.1)	
	Daytime 07:00 - 22:00 (10:00 - 22:00 for Public holidays)	**Nighttime 22:00 - 07:00** (22:00 - 10:00 for Public holidays)	**Daytime 07:00 - 22:00** (10:00 - 22:00 for Public holidays)	**Nighttime 22:00 - 07:00** (22:00 - 10:00 for Public holidays)
Residential, institutional, educational	55	45	55	45
Industrial, commercial	70	70	70	70

[a] Equivalent continuous sound level in decibels

[9] Coliforms refer to a group of bacteria which are found in the intestines of warm blooded animals and therefore are present in sewage, and on / in soils, surface waters and vegetation. Total coliforms is used as an indicator organism which, although by itself is not considered to cause diseases in man or animals, usually indicates the presence of pathogenic or disease-causing organisms. By measuring the number of total coliforms present in a sample a judgment can be made as to the water's usability for a given purpose.