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RECORD OF ENVIRONMENTAL DECISION
Environmental Assessment for the Proposed Phase I – Banda Aceh to Meulaboh Road Reconstruction and Rehabilitation

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OVERVIEW

Environmental Assessment of the Phase I Reconstruction and Rehabilitation of Banda Aceh to Meulaboh Road, Sumatra, Indonesia describes the Proposed Action and alternatives that were considered for the Phase I activities. The Proposed Action of Phase I is the "priority construction" between Banda Aceh and Lamno which includes realigning and constructing a new road segment and necessary bridges and water crossings starting approximately at Km marker 54 extending south –up to 10 kilometers in length- and all necessary repairs and maintenance of the existing roadway between Banda Aceh-Lamno to provide a suitable riding surface. The alternatives considered in the Phase I were Realign Five Segments and Rebuild Kr. Raba Bridge and Non-phased Alternative, which were eliminated from further analysis to avoid construction logistical problem and the delay of the activity.

DISCUSSION

The EA for the Phase I activities assessed the Proposed Action in terms of potential direct, indirect and cumulative impacts that may cause significant adverse environmental effects (see Table 1.1 in the EA phase I for Summary of Project-Related Impacts).

Direct impacts associated with the Proposed Action primarily include adverse impacts to topography, soils, hydrology and surface water quality, air quality and noise, which can be largely mitigated to less than significant levels by implementing Best Management Practices and utilizing sound construction design and techniques, such as erosion control (see Table 1.2 in the EA Phase I for the Summary of Major Impacts and Mitigation Measures).

Indirect impacts resulting from the Proposed Action may potentially include impacts from erosion and sedimentation, alterations to surface hydrology, and changes in land use. Potential indirect impacts from erosion/sedimentation and alterations to surface hydrology can be prevented or mitigated by implementing Best Management Practices and utilizing some construction design and techniques. Changes to land use are being addressed by the Government of Indonesia.

Cumulative impacts could potentially resulted from the Proposed Action along with other planned post-tsunami reconstruction projects. These potential effects would primarily be construction-related and to some extent, operational, which can be minimized and/or prevented through the use of Best Management Practices and appropriate management and environmental monitoring during construction.

Predicted impacts from the Proposed Action are expected to be related primarily to changes in topography, impacts to soils, alteration to surface hydrological systems and surface water quality, air quality and noise. Application of appropriate measures can mitigate impacts. Mitigation measures are listed in Table 1.2 of the EA Phase I for the Summary of Major Impacts and Mitigation Measures. The Design-Build Contractor will also be required to comply with the environmental management and monitoring efforts as stipulated in the UKL-UPL (the English version attached in Appendix C of the EA phase I). These efforts are summarized in Table 6.1 in Chapter 6.0 Compliance Procedures of the EA phase I.

Although land acquisition has not been completed for the 10 km realigned road segment, Government of Indonesia is actively working on the issue. A transparent process involving government officials at the regional and local levels, village leaders and the public will be implemented that should mitigate any adverse impacts to public perception.

DECISION

The EA for the Proposed Phase I-Banda Aceh to Lamno Road Reconstruction and Rehabilitation is recommended for **approval**.

ENVIRONMENTAL ASSESSMENT

For The Proposed

PHASE I - BANDA ACEH TO MEULABOH ROAD RECONSTRUCTION AND REHABILITATION

With Financial and Technical Assistance Provided By

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT (USAID)

2005

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ADDENDA

12 September 2005

Document: *Environmental Assessment For The Proposed Phase I – Banda Aceh to Meulaboh Road Reconstruction and Rehabilitation With Financial and Technical Assistance Provided by United States Agency for International Development (USAID)*

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Date of Report: 2005

Addenda

1. The pre-final UKL-UPL annexed in this environmental assessment as Appendix C has since been finalized with no substantive amendments that affect the environmental assessment's findings or recommended mitigation.

End of list

ENVIRONMENTAL ASSESSMENT

For The Proposed

PHASE I - BANDA ACEH TO MEULABOH ROAD RECONSTRUCTION AND REHABILITATION

With Financial and Technical Assistance Provided By

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT (USAID)

2005

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ACRONYMS/GLOSSARY

AASHTO	American Association of State Highway and Transportation Officials
A-E	architect-engineer contractor
AIDS	Acquired Immune Deficiency Syndrome
AMDAL	Analisis Mengenai Dampak Lingkungan (environmental impact assessment)
ASEAN	Association of Southeast Asian Nations
BAPPENAS	Badan Perencanaan dan Pembanguanan Nasional (National Development Planning Agency)
BERP	Borrow Area Excavation and Restoration Plan
BMP	Best Management Practice
BRR	Badan Rehabilitasi dan Rekonstruksi (Agency for Rehabilitation and Reconstruction)
˚C	degrees(s) Celsius
CEQ	Council on Environmental Quality
CITES	Convention on International Trade in Endangered Species of Wild Flora and Fauna
CFR	Code of Federal Regulations
cm	centimeter
CO	carbon monoxide
CO_2	carbon dioxide
CSC	Construction Supervision Consultant
dBA	A-scale decibel(s)
D-B	Design-Build
EA	Environmental Assessment
EIS	Environmental Impact Statement
ESC	Erosion and Sediment Control
FAO	Food and Agricultural Organization of the United Nations
FDC	Fugitive Dust Control
GAM	Gerakan Aceh Merdeka (Free Aceh Movement)
GDP	gross domestic product
GIS	Geographic Information System
GOI	Government of Indonesia
H_2S	hydrogen sulfide
ha	hectare
HC	hydrocarbon
HIV	Human Immunodeficiency Virus

IDHS	Indonesia: Demographic and Health Survey
IDP	internally displaced person
kL	kiloliter(s)
km	kilometer(s)
km^2	square kilometer(s)
µg	microgram(s)
m	meter(s)
m^2	square meter(s)
m^3	cubic meter(s)
mm	millimeter(s)
MT	metric ton(s)
NAD	Nanggroe Aceh Darussalam province
NH3	ammonia
NMT	non-motorized traffic
NO	nitrogen oxide
NO_2	nitrogen dioxide
O_x	ozone
P2JJ	Perencanaan dan Pengawasan Jalan dan Jembatan Provinsi Nanggroe Aceh Darussalam (Road and Bridges Planning and Monitoring, Public Works Department, Aceh Province)
Pb	lead
PERSUAP	Pesticide Evaluation Report and Safe Use Action Plan
RCRA	Resource Conservation and Recovery Act
ROW	right-of-way
SO_2	sulfur dioxide
sp.	species
SPCC	Spill Prevention, Control and Countermeasures
SSHP	Site Safety and Health Plan
STD	Sexually Transmitted Disease
UKL	Upaya Pengelolaan Lingkungan (environmental management effort)
UNDAC	United Nations Disaster Assessment and Coordination Team
UNEP	United Nations Environment Programme
UPL	Upaya Pemantauan Lingkungan (environmental monitoring effort)
U.S.	United States
USAID	United States Agency for International Development
UXO	Unexploded Ordnance

VOC	Volatile Organic Compound
WRI	World Resources Institute
WWF	World Wildlife Foundation

1.0 SUMMARY OF FINDINGS

INTRODUCTION

On 26 December 2004, the island of Sumatra experienced severe damage to its public infrastructure by an earthquake-generated tsunami. The area most impacted by the tsunami was Sumatra's northernmost province of Aceh, which likely suffered the highest loss of life. The most significant damage was to the coastal areas, up to 2 kilometers (km) inland. In some low-lying areas, up to 5 km inland was damaged. The main coastal highway along Sumatra's northwestern coast was severely damaged by the tsunami, becoming impassable and in some areas, completely destroyed. This road was critical in that it served as the primary transportation and communication link between the coastal towns and villages in Aceh.

In the aftermath of the tsunami, a temporary road from Banda Aceh to Meulaboh was created, composed of portions of the original road; old trails and dirt roads used for agriculture or logging; and new temporary road surfaces constructed by emergency aid agencies. Travel along this temporary road is slow, and in many areas, only traversable by four-wheel-drive vehicles. In its current state, the temporary road provides only minimal service to the coastal villages. In response to this situation, the U.S. Agency for International Development (USAID) is providing financial and technical assistance to support the Government of Indonesia (GOI) efforts to rehabilitate and reconstruct the permanent Banda Aceh-to-Meulaboh road. The Perencanaan dan Pengawasan Jalan dan Jembatan Provinsi Nanggroe AcehDarussalam (Road and Bridges Planning and Monitoring, Public Works Department, Aceh Province) or P2JJ has been designated by the GOI as the project proponent. The reconstructed permanent road will improve the communication, mobility, livelihood, and conditions for economic growth for the communities along the west coast of Aceh province.

The Proposed Action, and the subject of this Environmental Assessment (EA), is to rebuild Krueng Raba (Kr. Raba) Bridge, located near the 14.5 km marker (north of the cement factory); rebuild the bridge at Krueng Lambeseu River (located just south of Lamno) with a temporary Bailey bridge; reconstruct up to 10 km in length, a roadway segment that begins approximately at km marker 54 and extends southward, including any bridges and water crossings within this segment; and to maintain all temporary roads and water crossings between Banda Aceh and Lamno until the complete road is reconstructed. The Proposed Action constitutes Phase I of a two-phase project to reconstruct and rehabilitate the entire Banda Aceh-to-Meulaboh Road.

Projects identified for funding by USAID are subject to the environmental procedures established by Title 22 of the U.S. Code of Federal Regulations, Part 216 (22 CFR 216). Pursuant to those procedures, actions that have a potential for significant impacts within a country require preparation and subsequent approval of an EA and its recommendations to avoid or otherwise mitigate potential adverse environmental impacts. The procedures identify eleven (11) classes of action (22 CFR §216.2(d)(1)) as having an inherent potential for significant adverse environmental effect, including "penetration road building or road improvement projects."

This EA document was prepared in parallel with the environmental documents required by the GOI under its AMDAL process. In accordance with GOI regulations, a streamlined AMDAL process is authorized for the new construction of up to 10 km of road. Maintenance and repair activities are exempt from the AMDAL procedures. The streamlined Indonesian environmental documents consist of a combined Upaya Pengelolaan Lingkungan (environmental management effort)/Upaya Pemantauan Lingkungan (environmental monitoring effort) (UKL-UPL). The UKL addresses design and operating efforts to minimize potentially adverse impacts that may result from a project. The UPL details environmental monitoring efforts that shall be conducted during the project to ensure that any impacts resulting from the project are within the guidelines and standards established by the GOI.

1.1 MAJOR CONCLUSIONS

1.1.1 Direct, Indirect, and Cumulative Impacts

The Proposed Action was assessed in terms of potential direct, indirect, and cumulative impacts on the environment. Each of these impacts and how they pertain to the Proposed Action is discussed below.

Direct Impacts

Direct impacts are environmental effects that are caused by the action and occur at the same time and place. A typical example of direct impacts are the effects of construction activities on the immediate surrounding environment during the period such operations are taking place. During construction activities the Proposed Action would result in unavoidable, short-term, direct impacts. Direct impacts associated with the Proposed Action primarily include adverse impacts to topography, soils, hydrology and surface water quality, air quality and noise. These adverse construction-related impacts however, can be largely mitigated to less than significant levels by implementing Best Management Practices (BMPs) and utilizing sound construction design and techniques.

Indirect Impacts

Indirect impacts are effects that may occur removed in distance or time from the Proposed Action. Indirect impacts may include growth inducing impacts and other effects related to changes in land use patterns, population density or growth rate, and related effects on air, water, and other natural systems. Indirect impacts resulting from the Proposed Action may potentially include impacts from erosion and sedimentation, alterations to surface hydrology, and changes in land use. Potential indirect impacts from erosion/sedimentation and alterations to surface hydrology can be prevented or mitigated by implementing BMPs and utilizing sound construction design and techniques. Changes to land use are being addressed by the GOI, through the Badan Rehabilitasi dan Rekonstruksi (BRR) and other agencies.

Cumulative Impacts

Cumulative impacts are two or more individual effects, which when considered together, compound or increase the overall impact. Cumulative impacts can arise from the individual effects of a single action or from the combined effects of past, present, or future actions. Thus, cumulative impacts can result from individually minor but collectively significant actions taken over a period of time. The cumulative impacts of implementing the Proposed Action along with

past and reasonably foreseeable future projects proposed were assessed based upon available information.

The Proposed Action along with other planned post-tsunami reconstruction projects could potentially result in cumulative impacts to the environment. However, these potential effects would primarily be construction-related and to some extent, operational. Construction-related cumulative impacts can be minimized and/or prevented through the use of BMPs, and appropriate management and environmental monitoring during construction. Incorporating appropriate drainage and water conveyance features into roadway design can mitigate operational impacts, such as storm water runoff from paved surfaces and increased erosion and sedimentation.

Table 1.1: Summary of Project-Related Impacts

ENVIRONMENTAL ATTRIBUTE	DIRECT IMPACTS	INDIRECT IMPACTS	CUMULATIVE IMPACTS
Physical Resources			
Topography	-	-	-
Soils	-	-	-
Seismic and Geological Characteristics	o	o	o
Hydrology and Surface Water Quality	-	-	-
Climate and Air Quality	-	o	o
Debris and Hazardous Materials	-	o	o
Natural/Biological Resources			
Flora	o	o	o
Fauna	o	o	o
Sensitive Habitat and Protected Areas	o	o	o
Coastal and Marine Resources	o	o	o
Other Environmental Concerns Noted by 22 CFR 216			
Land Use and Development Policies and Controls	-	-	-
Energy and Conservation	o	o	o
Natural/Depletable Resources	o	-	-
Urban Quality/Design of the Built Environment	+	o	o
Historic and Cultural Resources	-	o	-
Reuse and Conservation	o	o	o
Additional Environmental Concerns			
Socio-Economic	+	+	+
Public Health	-	-	+
Safety	-	o	+
Noise	-	o	o
Other Infrastructure Systems	o	o	o

o No significant impact anticipated
+ Beneficial Impact
- Anticipated adverse impact; mitigation required

As noted in Table 1.1, most of the potential environmental consequences resulting from the Proposed Action are direct, short-term impacts. As stated earlier, much of these impacts can be prevented or mitigated through the use of BMPs and sound construction techniques. Indirect impacts also may result, particularly if BMPs are not implemented. Cumulative and permanent, unavoidable impacts may result from the Proposed Action; however, these adverse effects would be offset by the overall long-term benefits of reconstructing the road, the primary transportation route along Aceh's western coast.

1.1.2 Mitigation Measures

Typical of road construction projects, the environmental consequences resulting from the Proposed Action are expected to be related primarily to changes in topography, impacts to soils, alterations to surface hydrological systems and surface water quality, air quality and noise. Many of these impacts are short-term and temporary occurring only during the construction phase. Some impacts are more enduring, possible even permanent; however, their significance can be mitigated through the application of appropriate measures. In some cases, adverse impacts are unavoidable, but the long-term benefits of the project outweigh what permanent impacts may be incurred. Table 1.2 summarizes these main impacts and their related mitigation measures.

Table 1.2: Summary of Major Impacts and Mitigation Measures

Environmental Criteria	Potential Impact	Mitigation Objective	Mitigation Measures
Topography	Cut and fill activities	◆Minimize erosion	◆Re-vegetate exposed areas. ◆Stabilize embankment slopes and road cuts. ◆Use appropriate drainage structures.
	Borrow areas	◆Minimize drainage and erosion problems.	◆Implement a BERP.
	Quarry operations	◆Minimize fugitive dust, noise and loss of resources.	◆Use only licensed quarrying operations. ◆Implement a FDC plan. ◆Implement noise control measures.
	Soil erosion and re-deposition	◆Minimize erosion and sedimentation.	◆Implement an ESC plan.
Soils	Conversion of agricultural soils.	◆Prevent further loss of fertile agricultural soils.	◆Avoid and minimize activities in areas with fertile soils. ◆Implement an ESC plan to minimize additional loss of topsoil. ◆Removed topsoil should be used to enhance adjacent agricultural fields.
	Erosion	◆Minimize erosion and increased sedimentation.	◆Implement an ESC plan. ◆Apply temporary erosion control measures to exposed ground during construction.
	Contamination	◆Prevent and minimize potential for spillage of hazardous materials.	◆Implement an SPCC plan. ◆Stress the use of BMPs to minimize the potential for inadvertent spillage or release of hazardous materials.

Environmental Criteria	Potential Impact	Mitigation Objective	Mitigation Measures
Hydrology and Water Quality	Surface Hydrology	◆Prevent and minimize erosion and sedimentation. ◆Minimize alterations to hydrological systems.	◆Implement an ESC plan. ◆Incorporate appropriate drainage structures in the roadway design. ◆Designs of bridges and water crossings should not obstruct water flow and increase current velocities. ◆Carefully site ancillary construction activities. ◆Minimize disturbance to stream banks and streambeds.
	Water Quality	◆Minimize potential for contamination. ◆Prevent and minimize erosion and sedimentation.	◆Implement a SPCC plan. ◆Implement an ESC plan. ◆Monitor water quality during construction. ◆Implement environmentally conscious roadway design.
	Wetlands	◆Prevent and minimize erosion and sedimentation. ◆Minimize alterations to hydrological systems.	◆Implement an ESC plan. ◆Incorporate appropriate drainage structures in the roadway design. ◆Carefully site ancillary construction activities.
	Flooding	◆Minimize alterations to surface hydrological systems. ◆Minimize potential for flood events.	◆Design of stream crossings shall allow for river channel development. ◆Incorporate appropriate drainage structures in the roadway design. ◆Designs of bridges and water crossings should not obstruct water flow and increase current velocities.
	Riverbed and Fisheries Sediments	◆Minimize erosion and sedimentation. ◆Minimize potential for flood events.	◆Implement an ESC plan. ◆Design of bridges and other stream crossings shall enable fish passage and maintain natural in-stream structures.
Climate and Air Quality	Construction Stage	◆Minimize emissions and fugitive dust.	◆Implement a FDC plan. ◆Properly maintain vehicles and other construction equipment. ◆Prohibit open burning. ◆Implement air quality monitoring during construction.
Noise	Construction Stage	◆Minimize overall noise levels, particularly around sensitive receptors and during sensitive time periods.	◆Control noise emissions at its source. ◆Apply time and activity constraints. ◆Conduct noise monitoring during construction.
Fauna	Disturbance of sea turtle habitat	◆Prevent disturbance/destruction of sea turtle habitat.	◆Restore and prohibit sand loss. ◆Protect nesting activity. ◆Implement monitoring program.

In addition to the mitigation measures listed here, the Design-Build (D-B) contractor will be required to comply with the environmental management and monitoring efforts stipulated in the UKL-UPL (the English version is attached as Appendix C). These efforts are summarized in Table 6.1 in Chapter 6.0 *Compliance Procedures*.

1.2 AREAS OF CONTROVERSY

No areas of controversy have been identified that relate to any potential environmental consequences resulting from the Proposed Action.

1.3 ISSUES TO BE RESOLVED

An issue of concern that has yet to be fully resolved is the acquisition of land for new the road alignments. If handled improperly, negative public perceptions could arise, which may delay the reconstruction and rehabilitation of the road. As spelled out in the UKL, a transparent process involving government officials at the regional and local levels, village leaders, and the public will be implemented that should mitigate any adverse impacts to public perception.

2.0 PURPOSE OF THE PROPOSED ACTION

The Proposed Action will be conducted along a stretch of roadway between Banda Aceh and Lamno, in the Kabuptens of Aceh Besar and Aceh Jaya, Sumatra Island, Indonesia. The Proposed Action is to rebuild Kr. Raba Bridge, located near the 14.5 km marker (north of the cement factory); rebuild Kr. Lambeseu Bridge (south of Lamno) with a temporary Bailey bridge; reconstruct a roadway segment, up to 10 km in length, including any bridges and water crossings within this segment; and to maintain all temporary roads and water crossings between Banda Aceh to Lamno until the complete road is reconstructed. The 10 km of new roadway segment begins approximately at km marker 54 and extends southward.

The purpose and need of the Proposed Action is to reconstruct, as quickly as possible, a critical road segment and two bridges in order to facilitate travel along the coast. Current travel time between Banda Aceh and Lamno – previously 1.5 hours - is now three (3) hours or more. These improvements will improve transportation mobility and access from Banda Aceh to Lamno, decrease travel time between the two towns, help to restore essential services to the communities along the route, help to rejuvenate the local economy, and in general, facilitate recovery efforts in the area.

The Proposed Action constitutes the Phase I portion of a larger road rehabilitation and reconstruction project. Phase I activities are considered "priority construction," and will improve transportation conditions between Banda Aceh and Lamno in the interim, while Phase II reconstruction is being designed. Phase II of the project will encompass the entirety of the Banda Aceh-to-Meulaboh Road, incorporating approximately 240 kilometers of roadway, extending from Banda Aceh south to Meulaboh. The subject road is the main coastal highway along Sumatra's western coast and is the primary transportation route between the two towns.

3.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

INTRODUCTION

This chapter of the EA describes the Proposed Action and alternatives that were considered to satisfy the purpose and need for the road reconstruction and rehabilitation project.

- The Proposed Action: Rebuild Kr. Raba and Kr. Lambeseu Bridges, reconstruct a 10-km road segment, and maintain all temporary roads and water crossings.
- Alternative 1: Realign five (5) segments, rebuild Kr. Raba Bridge, and maintain all temporary roads and water crossings.
- No Action Alternative (no U.S. government involvement).
- Alternatives Considered and Eliminated.
  - Phase I Alignment Alternatives
  - Non-Phased Alternative

Project Background

The Proposed Action constitutes Phase I of the Banda Aceh-to-Meulaboh Road Reconstruction and Rehabilitation Project. As mentioned, this two-phased project involves USAID providing financial and technical assistance to the GOI for the rehabilitation and reconstruction of the Banda Aceh-to-Meulaboh Road that was damaged by the 26 December 2004 earthquake and tsunami. The GOI Project proponent is P2JJ. The Proposed Action includes rebuilding the Kr. Raba and Kr. Lambeseu Bridges, the reconstruction of an up to 10-km road segment, and the maintenance of all temporary roads and water crossings. The overall project (Banda Aceh to Meulaboh Road) includes widening, improving, and reconstructing the existing roadway; and constructing new alignments of roadway where the existing road has been damaged or destroyed, or where segments of remaining roadway are deemed unsafe in tsunami-altered locations. The road design and construction will include, but is not limited to, roadway geometrics, pavements, earthwork, drainage, roadway appurtenances, roadway signage and pavement markings, bridges and other structures, structure foundations, causeways and shoreline protection, erosion and sedimentation control, environmental protection, rights-of-way verification and definition, bus stops, lookouts and other traffic turnouts. No utilities infrastructure or lighting will be included.

Execution of the overall project to rehabilitate and reconstruct the Banda Aceh-to-Meulaboh Road would allow the proponent to address restoration of basic communication, mobility, livelihood and economic growth for the communities along the west coast of Aceh Province, Indonesia. Design and construction elements of the overall project (e.g., routing and alignment of the roadway, project phasing and construction contracting methods) reflect a deliberate effort to accelerate the completion of this vital roadway, and restore essential services.

The overall design of the roadway is intended to be in accordance with the standards established by the American Association of State Highway and Transportation Officials (AASHTO) and the Association of Southeast Asian Nations (ASEAN) as applicable; including water crossings such as bridges, culverts and drainage structures. The Class II roadway standards call for a 2-lane

highway with pavement width of 7 meters; shoulder widths of 2.5 meters in flat or rolling terrain, and 2.0 meters in hilly terrain; and an overall road right-of-way (ROW) of 30 meters, including utility corridors and drainage ditches. All roads will be paved with a bituminous hot asphalt mix surface. All bridges, culverts and drainage crossings are currently planned to be constructed of concrete.

Routing and alignment of the new roadway shall include rehabilitated portions of existing roadway, reconstruction of former or temporary roadway, new roadway alignment, bridges, and appurtenances. Construction will include clearing and grubbing, earthwork, pavements, temporary and permanent slope protection and erosion control, roadway drainage, other drainage to include ditches and drainage crossings and structures, bridges, causeways, shoreline protection, guardrails, roadway signage and pavement markings, other roadway appurtenances, environmental protection, maintenance and safety of existing vehicular and pedestrian traffic to include temporary roads and structures as necessary.

In order to meet the urgent needs of the Indonesian people, environmental documentation (both EA and AMDAL), design, and construction has been separated into two phases in the attempt to expedite the rehabilitation and reconstruction process:

Phase I - Priority Construction. Phase I will be accomplished through a Design-Build (D-B) contract to expedite the implementation of the temporary road improvements. The Architectural and Engineering (A-E) contract for Phase II will be awarded around the same time as the D-B contract so that the A-E contractor can oversee the D-B activities. The A-E contractor will ensure that the D-B actions do not result in irretrievable commitment of funds and resources that would arbitrarily limit the alternatives for the Phase II design and construction. Groundbreaking for Phase I construction is scheduled for August 2005, pending approval of U.S. and GOI environmental documents.

Phase II - Banda Aceh-to-Meulaboh Road Reconstruction and Rehabilitation (full length of roadway from Banda Aceh to Meulaboh). Phase II roadway will be accomplished through a more conventional design, bid and build construction scenario. More time will be allocated to the design and bid process in Phase II, as compared to the prioritized effort in Phase I. Phase II road design is slated to begin in August 2005, groundbreaking is planned for March 2006 and construction completed in May 2009.

Two EAs will be prepared, one for each phase of the project. This EA addresses Phase I – Priority Construction. Information on Phase II is included herewith for continuity within the respective documents.

<u>Phase II of the Rehabilitation and Reconstruction of the Banda Aceh-to-Meulaboh Road</u>
Phase II construction activities encompass the full length of roadway from Banda Aceh to Meulaboh, which is located in the Kota Banda Aceh, *Kabupaten* Aceh Besar, *Kabupaten* Aceh Jaya and *Kabupaten* Aceh Barat. The road is categorized as a national road. Phase II activities include road widening, and improving and reconstructing existing and new sections in accordance with standards established by AASHTO and ASEAN, as applicable. More than 110 water crossings will be constructed or repaired, inclusive of concrete bridges, culverts, and

drainage structures. Concrete construction is proposed for these bridges, culverts, and drainage structures.

Phase II will cover the entire alignment of Phase I, from Banda Aceh to Lamno, plus the additional roadway length from Lamno south to Meulaboh, for a total linear alignment of approximately 240 km. Except for the new 10-km road segment, the Banda Aceh to Lamno reconstructed roadway alignment will, for the most part, follow the alignment of the existing road or existing temporary roads. From Lamno south to Meulaboh, most of the previous roadway, a coastal road, has been washed into the sea or has been severely damaged by the tsunami and is not feasible for reuse. Remnants of the previous roadway in these areas will be abandoned. The abandoned sections of road will be replaced by a reconstructed road located more inland.

3.1 PROPOSED ACTION: TEMPORARY MAINTENANCE OF 80 KM OF ROAD FROM BANDA ACEH TO LAMNO INCLUDING REBUILDING KR. RABA AND KR. LAMBESEU BRIDGES, AND REALIGNING A 10-KM ROAD SEGMENT.

The Proposed Action is Phase I of the two-phase project to rehabilitate and reconstruct the Banda Aceh-to-Meulaboh Road. Phase I activities will occur along a stretch of roadway extending between Banda Aceh and Lamno only, a distance of approximately 80 km. The Proposed Action site is located in the province of Nanggroe Aceh Darussalam (NAD), along the northwestern coast of the island of Sumatra, Indonesia. Figures A-1 and A-2 (Appendix A) show the location of the Proposed Action and the overall project. A description of the overall project and Phase II activities was provided in the introduction to Chapter 3.0.

The Proposed Action includes the following activities:

- Realign and construct the road segment starting approximately at km marker 54, extending south for up to 10 km in length (Figure A-5, Appendix A).
- Build a concrete bridge located at km marker 14.4 (Kr. Raba Bridge) (Figure A-4, Appendix A).
- Repair the water crossing at Kr. Lambeseu with the construction of a temporary bailey bridge approximately 100 m long and 6 m wide (Figure A-6, Appendix A).
- Repair and maintain the existing roadway from Banda Aceh to Lamno including water crossings. Some of these locations are temporary gravel roads constructed by the Indonesian Military and will require frequent maintenance. Additional aggregate may be required as needed. The purpose of repairing and maintaining the existing roadway is to provide a suitable riding surface for local traffic flow. The D-B contractor will be responsible for removing rocks that block the roadway, when required. Maintenance of the temporary roadway will continue until the permanent road is reconstructed.
- Remove all collapsed metal bridge debris between Banda Aceh and Lamno. The D-B contractor will remove all collapsed metal truss bridges that have fallen into waterways. The D-B contractor will transport the metal trusses to the Public Works storage yard in Banda Aceh. The truss bridges at approximate km markers 25 and 58 are not included as they have or will be removed by the GOI.

The realignment and construction of the 10-km road segment will be built according to standards established AASHTO and ASEAN as applicable. The roadway will be paved with a bituminous hot asphalt mix and the side ditches will be constructed with mountain rock. Table 3.1 lists roadway dimensions and Figure B-1 (Appendix B) shows a typical road cross section that will be applied to the Proposed Action. Table 3.2 lists the approximate fill volume and other estimated material volumes necessary for the Proposed Action.

Table 3.1: Roadway Dimensions

No.	Description	Dimension	
1.	Road length	10	Km
2.	Width of ROW	30	M
3.	Width of road pavement	7	M
4.	Width of shoulders	2 x 2	M
5.	Width of side ditches	1.5	M

Table 3.2: Approximate Roadway Material Volumes

No.	Description	Quantity	Unit of Measurement
1.	Asphaltic Concrete (5 cm)	3,486	m^3
2.	Base Course (15 cm)	10,459	m^3
3.	Subbase Course (20 to 25 cm)	13,972	m^3
4.	Clear and Grubbing	19.29	ha
5.	Stripping	2,990	m^2
6.	Grassing	30,317	m^2
7.	Unlined Swales	8,750	m^2
8.	Signs	201	--
ha = hectare(s), m^2 = square meter(s), and m^3 = cubic meter(s)			

Figures B-2 to B-19 (Appendix B) show typical cross sections of bridges and other water crossings that may be used in the Proposed Action. Bridges will be constructed using concrete construction. Culverts and other water crossings typically will be pre-fabricated concrete construction complying with K350 standards. It is estimated that there are approximately 33 water crossings along the existing route between Banda Aceh and Lamno. Based on interpretations from Geographic Information System (GIS) data, it is estimated that there are five (5) major water crossings along the realigned 10-km road segment.

Because of the vital nature of this project, the award of a “design-build” (D-B) contract will occur while the EA is under development. Burden will be placed on the D-B contractor to

conduct appropriate topographic and geologic surveys to define the final road alignment and to identify the ancillary construction and support needs and locations. These include but are not limited to, temporary detours, borrow area locations, quarries and other source material locations, equipment staging locations, construction of temporary living quarters and sanitation needs for construction crews. The most cost effective designs that still meet engineering and environmental standards will be chosen. As currently planned, the D-B contract will be awarded in late July 2005, with groundbreaking planned for August 2005 pending approval of U.S. and GOI environmental documents.

3.2 ALTERNATIVE 1: SEGMENT REALIGNMENTS AND REBUILD KR. RABA BRIDGE

Similar to the Proposed Action, Alternative 1 is also considered as Phase I – Priority Construction; however, Alternative 1 differs in the number and location of road segments to be reconstructed. Alternative 1 encompasses the construction of five (5)separate road segments and the Kr. Raba Bridge, all located between Banda Aceh and Lamno, in the *Kabupaten* of Aceh Besar (Figure A-3, Appendix A). The purpose of segmenting these construction activities is to prioritize and reconstruct, as expeditiously as possible, the road in areas where former roadway surfaces have been completely destroyed and where now only a temporary road or crossing exists.

Activities of Alternative I shall include road widening, improvement, and reconstruction of selected road segments in accordance with the AASHTO and ASEAN standards as applicable. Alternative I construction will total 9.5 km of new road, including water crossings such as bridges, culverts, and drainage structures.

All road realignments will have the general goal of relocating the road as far from the shoreline as possible to minimize impacts to the shore environment, to avoid potential future tsunami inundation areas, and to provide more sound engineering locations. Selection of road segments to be included in Phase I – Priority Construction is based on the availability of funds.

The Alternative I segments with approximate km markings include:

- Rebuild Kr. Raba Bridge at 14-km marker.
- Realign road section between 1-7 and 17.5-km markers, including construction of all necessary water crossing and drainage structures.
- Realign road section between 21.5- and 25-km markers, including construction of all necessary water crossing and drainage structures.
- Realign road section between 31.1- and 31.5-km markers, including construction of all necessary water crossing and drainage structures.
- Realign road section between 47- and 48-km markers, including construction of all necessary water crossing and drainage structures.
- Realign road section between 60- and 64-km markers, including construction of all necessary water crossing and drainage structures. This section will include the alternative to realign the road on the existing temporary road, and realigning the road close to the base of the mountain along a more upland route. This alternative upland route will be determined based on further site investigations.

Except for the road section between 60- and 64-km markers, current area conditions typically allow for minimal alignment alternatives in the coastal lowlands. The lowland areas are small and shallow with relatively similar and homogeneous environmental concerns throughout. The alternatives predominantly involve localized alignment options which were chosen to reduce impacts or resolve engineering/cost implications. Significant realignment options are not available.

3.3 NO ACTION ALTERNATIVE (NO U.S. GOVERNMENT INVOLVEMENT)

Under the No Action alternative, the U.S. government would not provide financial and technical assistance to the GOI for the rehabilitation and reconstruction of the Banda Aceh-to-Meulaboh Road. Without U.S. government involvement, the status quo would be maintained and the current roadway system of existing, damaged and temporary surfaces will continue to be used to the extent possible. The current devastated condition of the Banda Aceh-to-Meulaboh roadway would continue to affect the economic and social well-being of the west coast of Sumatra, Indonesia. It is anticipated that the circumstance of the No Action alternative would not remain static, and financial and technical assistance to ultimately rebuild the road will be accomplished through other nations/organizations capable of meeting this critical need. In the meantime, temporary roadway surfaces would likely be constructed to accomplish minimal transportation access.

An anticipated consequence of the No Action alternative is that the health, safety and quality of life in this region will continue to be jeopardized. No Action is expected incur the loss of opportunity costs at the expense of a more efficient recovery for the region from the affects of the tsunami inundation. Additionally, the No Action alternative would likely affect the future construction timing or quality of the road.

3.4 ALTERNATIVES CONSIDERED AND ELIMINATED FROM DETAILED STUDY

The environmental procedures established by 22 CFR 216 process requires that all reasonable alternatives for federally funded actions be analyzed. Accordingly, the following alternatives were considered and eliminated from further analysis because they did not meet the objectives of the agency.

3.4.1 Phase I Alignment Alternatives

Activities of Phase I include road widening, improvement, and replacement construction of selected road segments with a total road length not to exceed 10 km of new road; including water crossings such as bridges, culverts and drainage structures.

Phase I includes existing roadway that traverses through hilly terrain unaffected by the earthquake or tsunami. These portions of the roadway are in generally good condition and no alterations to their alignment were deemed necessary. Some minor shoulder and pavement widening improvements for these areas are projected for Phase II.

Phase I roadway segments located in the shoreline lowlands, which received heavy earthquake and tsunami damage, are the prioritized areas. New roadway in these segments will replace portions of the existing road which have either disappeared or are now in such compromised

locations due to shoreline subsidence or recession that relocation of the roadway inland would be prudent. These segments would have the engineering goal of relocating as far from the shoreline as practicable to minimize impacts to the shore environment and to provide more sound engineering locations. However, although good engineering practice dictated the location of new alignments of these segments at distances well-away from subsided and receded shoreline, the alignment opportunities further inland either increased the lineal feet and difficulty of roadway to be constructed, or were severely constrained by hilly topography.

Under such conditions within the lateral lowland corridors available for location of the roadway, few options existed for development of alternative alignments. As such, alignment alternatives in Phase I were generally similar and restricted to the narrow corridors available. No significant inland alternatives except for the road segment between 60- and 64-km markers were considered.

3.4.2 Non-Phased Alternative

Under this alternative, the Banda Aceh-to-Meulaboh Road rehabilitation and reconstruction would not be separated into two phases, and all proposed work would occur in a single phase. As a consequence, time-critical Phase I activities as discussed above would be delayed, but ultimately incorporated and accomplished under Phase II activities.

Delay of the Proposed Action (Phase I – Priority Construction) by incorporating it into Phase II activities for single phase implementation may allow other events to occur. First, the Non-Phased Alternative would in the short/immediate-term be similar to the No Action Alternative as it would prolong the devastated condition of the Banda Aceh-to-Meulaboh roadway currently affecting the health, economic and social well-being of the west coast of Sumatra, Indonesia. Second, an anticipated consequence of delaying the Phase I – Priority Construction is that the quality of the basic communication, mobility, livelihood and economic growth for the communities along the west coast of Aceh Province, Indonesia may be further degraded.

The Proposed Action, Phase I – Priority Construction, is intended to address the immediately needed and prioritized new segment(s) of roadway to facilitate travel on the roadway at least to Lamno. The effort to proceed with these segment(s) is intended to initiate some rehabilitation and reconstruction effort in the interim until design and construction of the entire alignment (Phase II) can be properly undertaken.

Under the Non-Phased Alternative, a delay of the Proposed Action does not meet the objective of establishing improved transportation access and mobility as quickly as practicable. Therefore, this alternative was deemed not acceptable and eliminated from further consideration.

3.5 COMPARATIVE ANALYSIS

Both the Proposed Action and Alternative 1 satisfy the purpose and need for the road reconstruction and rehabilitation project. Both help to satisfy urgent transportation needs by improving access between Banda Aceh and Lamno in the near-term, and in the interim until more comprehensive road planning, design and reconstruction can occur for the entire length of the Banda Aceh-to-Meulaboh Road. Construction logistics however, do not favor Alternative 1. The summer high tides are an issue of concern. Some of the proposed segments in Alternative 1

are located near the shore in areas that may be affected by the high tides, which may hinder reconstruction activities. Because of this logistical problem, reconstruction of the single 10-km road segment was selected as the preferred alternative and the Proposed Action over Alternative 1. It should be noted that the five road segments covered under Alternative 1 will eventually be reconstructed and rehabilitated under Phase II of the Banda Aceh-to-Meulaboh Road Reconstruction and Rehabilitation Project.

4.0 AFFECTED ENVIRONMENT

INTRODUCTION

This chapter describes the environment that may be affected by the Proposed Action. In regards to effects occurring outside the United States, 22 CFR §216.1(c)(10) defines the environment as "the natural and physical environment." In addition to the natural and physical environment, this chapter will also address other environmental concerns identified in 22 CFR 216. The critical and urgent nature of the Proposed Action and the resulting accelerated schedule to prepare this EA precluded the ability to conduct intensive in-the-field assessments of the affected environment. Descriptions of the affected environment were garnered mostly from existing sources and are by necessity general in nature and encompass Aceh Province, Sumatra Island, and in some cases Indonesia as a whole. In some instances, preliminary field observations conducted post-tsunami were compiled and included in the relevant environmental criterion discussion. Where information was readily available, descriptions of the environment pre- and post-tsunami were discussed.

The coastal road from Banda Aceh to Lamno passes largely through areas that have been affected by the tsunami. What follows are brief descriptions of three broad categories addressing tsunami-affected conditions.

Tsunami-Affected Land – Tsunami-affected land has been stripped of most vegetation and topsoil. As such, all habitats and sensitive environmental components likely have been destroyed. In these areas, rivers and streams have been impacted by sedimentation, while soils and groundwater have suffered from seawater intrusion that could potentially affect long-term soil and groundwater quality. There is little or no risk of significant environmental damage occurring from the Proposed Action on tsunami-affected land.

Tsunami-Affected Settlements – The majority of structures located within tsunami-affected settlements were destroyed. These areas are characterized by debris and remnants of housing structures. Most people have relocated from these areas to refugee camps situated on higher ground. There is little or no risk of significant environmental damage occurring from the Proposed Action through tsunami-affected settlements with the exception of land ownership issues.

Unaffected Settlements – Settlements that were not affected by the tsunami mainly consist of small housing areas. Most houses are located along or close to the existing main road in mountainous regions. The main form of livelihood for most residents is farming and subsistence agriculture, and fishing. Significant existing settlements along the main road corridor from Banda Aceh to Lamno are Lhok `Nga, Lhoong, and Lamno.

4.1 PHYSICAL RESOURCES

4.1.1 Topography

Sumatra is the northernmost island in a chain of five (5) major islands that make up the country of Indonesia. Part of the Greater Sunda Islands, Sumatra is on the Sunda Shelf, an extension of the Malay Peninsula and the Southeast Asian mainland. Sumatra is approximately 473,606 square kilometers (km^2). The mountains range between 3,000 and 3,800 m above sea level, with the highest mountain being Gunung Kerinci (3,805 m). Steep limestone mountains located close to the shore with narrow coastal lowlands and valleys intermixed characterize the west coast of Sumatra. In northern Sumatra there are 73 streams and rivers that are characterized as short and fast flowing.[1] Sumatra has several large lakes; however, none occur in the vicinity of the Proposed Action. Along the west coast, there are some small natural ponds scattered in the larger valleys and two wetland areas.

Since the tsunami, the terrain of the western coast of Aceh province has changed significantly. Prior to the tsunami, the western coast supported coral reefs, sandy beaches, wetlands and mangroves, river deltas, and coastal lowlands and forests. Forests were dense enough that the sea was often not visible from the coastal highway. As a result of the tsunami, sandy beaches have washed away, coral reefs have been smothered with silt and sand, wetlands and mangroves have become brackish lagoons, river deltas have significantly changed their patterns, and coastal lowlands and forests have subsided. The valleys are bare and open from the mountains to the sea. The once well-defined rivers and floodplains have potentially reverted to "young" braided river systems as the rivers are working to redefine their channels in the silted-in beds and floodplains. The topographic changes to the valleys, rivers, shoreline and inter-tidal areas are in the process of being assessed and resurveyed.[2]

The morphology of Banda Aceh and the surrounding area is flat with slope gradients of 0 to 3 percent. Average elevation is 0 to 3 m above sea level. The morphological unit is dominated by alluvial flood plains and beaches. The Proposed Action is located largely in the lowlands, between the mountains and the sea.

For the Proposed Action, the first 30 km from Banda Aceh to Pulut is flat terrain going through coastal lowlands. The road is intact up to km marker 14 and Kr. Raba. After Kr. Raba, the road has been destroyed or severely damaged by the tsunami in the lowland areas, with the road being primarily a temporary dirt road. From approximate km 30 to km 45 near Lhoong, the road goes through a steep mountainous area. In the mountainous areas, the original pre-tsunami road is fully intact and the adjacent areas are undisturbed. From approximately km 45 to km 62, the road passes through damaged coastal lowlands again. There is a final mountainous reach from km 62 through 72, similarly undamaged as the previous mountain area. In the final reach from km 72 to 80, the road through Lamno, the pre-tsunami road is relatively intact though some of the paved areas are riddled with potholes. The final river crossing in the Proposed Action at Kr. Lambeseu has been destroyed by the tsunami. The current crossing is a small wooden barge powered by an outboard motor, running the 100-plus-meter crossing at the approximate location of the pre-tsunami bridge.

[1] UNEP, p. 23.
[2] UNEP, p. 21.

4.1.2 Soils

The area impacted by the tsunami consists mainly of heavy clay soils. According to U.S. Department of Agriculture (USDA) global maps[3], the west coast of Aceh province is primarily made up of ultisols with mollisols occurring along the shoreline in the north (Banda Aceh) and entisols along the western shoreline. Pockets of andisols exist inland of the western coastline.

Ultisols are typically acidic soils with the majority of the nutrients in the upper few inches. They are formed from an intense weathering and leaching process that results in clay-enriched subsoils dominated by minutes, including quartz, kaolinite and iron oxides. Ultisols have a low capacity for retaining additional lime and fertilizer. Mollisols have a relatively high content of organic matter and are base rich through the entire soil column, making them very fertile. They typically form under grass in climates with a moderate to pronounced seasonal moisture deficit. Andisols are formed from weathering processes creating minerals with little crystalline structures, often associated with volcanic materials. These minerals typically result in an unusually high water- and nutrient-holding capacity. Andisols tend to be highly productive soils. Entisols have little to no evidence of pedogenic horizon development. They typically occur in areas with a recent deposit of parent materials or in areas where erosion and deposition rates are faster than the rate of soil development such as dunes, steep slopes, and flood plains.

As a result of the tsunami, soils in some of areas are likely to have eroded, with new soil deposits in other areas.[4] The United Nations Environment Programme (UNEP) noted that much of the topsoil in the more agriculturally productive areas, such as areas with mollisols or andisols, was removed by the tsunami. UNEP also noted that many of the soils re-deposited by the tsunami are heavy in silts and silty clays.[5]

Soils also have been heavily saturated through inundation by salt water. Even if the topsoil was not affected, the soils in the short-term are presently salinized, and therefore overall soil fertility is impacted. As an example, rice fields have already experienced yellowing, an indication of saltwater intrusion.[6] In the long term, it is anticipated that the salt will leach out of the soils.

The Food and Agriculture Organization of the United Nations (FAO) has determined that 70 percent, approximately 27,000 ha of farmland on Sumatra's west coast has been damaged due to soil impacts, and an additional 50,000 ha of wetlands and drylands have been adversely affected. Soils have been categorized by FAO into three zones for soil recovery planning purposes:

> • *Class A: rapid reclamation and salt leaching is possible either through normal rainfall or irrigation and where land could be productive for the April/May cropping season without major intervention.*
>
> • *Class B: special works are needed to reclaim the soil and restore the land surface. Farmers may need to grow salt-tolerant crops during the next season and partly diversify production.*

[3] http://soils.usda.gov/use/worldsoils/mapindex/.
[4] http://soils.usda.gov/use/worldsoils/mapindex/order.html.
[5] UNEP, p. 21.
[6] UNEP, p. 25.

• *Class C: reclamation in time for the next cropping season is unlikely. Farmers could be compensated for abandoning their land or assisted in diversifying into other economic activities.*[7]

In urban areas, including Banda Aceh, Calang, and Meulaboh, the soils have been impacted by rubble; sewage; municipal solid waste; and household and small business items, such as fuels, oils, cleaning chemicals, solvents etc. While the full impact to the soils by urban debris and waste has not been fully analyzed, initial soil testing from Banda Aceh confirmed high ammonia levels.[8]

For the Proposed Action, the area is denuded of vegetation and topsoil in the coastal lowland reaches damaged by the tsunami. The remaining soil is primarily sandy silts and silty clays. In some areas, the topsoil was removed by the tsunami, exposing subsurface infertile silts and clays. In other areas, silts and clays were deposited over the topsoil as a result of wave action. The mountain reaches are dominated by limestone cliffs.

4.1.3 Seismic and Geological Characteristics

The region is in a highly tectonically unstable area as the island is in close proximity to a major fault line (the Sumatra Fracture Zone) and almost 100 volcanoes—15 of which are active—occur on the island in the Barisan Mountain Range. Prior to and after the tsunami, Sumatra experienced earthquakes in the 4.0 and 6.0 ranges on a fairly consistent basis.[9] Earthquakes in the area are generated mainly from tectonic shifting along the Sumatra Fault Zone; however, some earthquakes are also triggered by subsurface activity from one of the many active volcanoes.

Flat coastal lowlands that are former embayments are silted-in by natural erosion from the mountains and sand deposition from the sea. The lowlands are characterized by silty sandy clays and wetland pockets throughout. Post-tsunami, several large rock slides have occurred in the mountains due to the earthquakes and the geology in many reaches is adjusting to the new conditions and therefore unstable. The lowlands have been altered significantly as well, undergoing changes in soil erosion and deposition, and removal of vegetation and topsoil by the tsunami.

The geological structure underlying Banda Aceh is dominated by alluvial sediments consisting of unconsolidated gravels, pebbles, and clays. To the west of Banda Aceh and towards Lamno, the geological structure is Lho'nga Formation; a formation of limestone, Lhong Formation, and Lamno rock formation. In general, the geotechnical strength of these formations is low to medium, meaning that there is a high risk of landslides, especially on slopes and near rivers.

Based on discussions with the Mining Agency in Aceh, the area around the Proposed Action is characterized by limestone cliffs with limestone bedrock below the lowlands at 100 to 1,000 m

[7] UNEP, p. 25.
[8] UNEP, p. 25.
[9] http://earthquake.usgs.gov/.

deep. The material above the bedrock is silty clay. The area around Kr. Raba Bridge and the 10-km road segment have largely been removed of vegetation and presumably topsoil as well.

4.1.4 Hydrology

According to World Resources Institute (WRI), 2,793 cubic kilometers (km^3) of surface water was produced internally in Indonesia from 1977-2001, groundwater recharge was 455 km^3, with an overlap of 410 km^3, for a total amount of internal renewable water resources of 2,838 km^3. The amount of renewable water resources per capita in Indonesia is 13,046 cubic meters (m^3) per person. The amount of water withdrawals in 1990 totaled 74.3 km^3, or 407 m^3 per person. This made up 3.1 percent of the actual renewable water resources with 93 percent of the withdrawals coming from agriculture, 1 percent from industry and 6 percent from domestic activities.[10]

Approximately 9 percent of Aceh province's total population had access to piped water prior to the tsunami. Most irrigation was self-provided or from community-based systems. In Aceh, there were 465 irrigation schemes spread across 335,084 ha. All the coastal irrigation schemes (covering 28,000 ha of land) were significantly damaged along with flood protection dykes.[11] In addition, the tsunami damaged, destroyed or contaminated 560,000 wells and 15,000 hand pumps.

Human settlement areas were served primarily by septic tank systems. Surface water near human settlements was contaminated as septic tank discharge mixed with seawater and other surface materials. While streams and rivers are anticipated to either have flushed clean or will be flushed clean in the next heavy rain season, the impact of saltwater intrusion and intrusion by other materials to the groundwater is a concern.

There are numerous rivers and streams throughout the Proposed Action area. The largest river crossings are at Kr. Raba (km 14); km 26 (river name unknown) south of Leupung; km 28 (river name unknown) south of Pulut; two embayment crossings at Kr. Kala (km 44) near Tanah Ano and Kr. Lam Ara (km 57) near Pasi; a river crossing at Kr. Lhoong (km 61) just before the road rises into the mountains to cross into Lamno; and, the crossing at Kr. Lambeseu (km 80). Kr. Raba and Kr. Lambeseu are associated with massive watersheds that extend far into the mountains. The two watersheds combined cover almost the entire Aceh Besar *Kabupaten* or district.

In the Proposed Action area, the impact of the highly salinated water can be seen in the agricultural fields through yellowing of the vegetation. The rivers and floodplains appear to have reverted to "young" braided systems covering expansive undefined floodplains as they work to redefine their channels in a heavily silted-in environment.

4.1.5 Climate and Air Quality

Sumatra is split almost in half by the Equator. With its equatorial location, Sumatra has two tropical seasons, i.e., the dry season (June to September) that is influenced by meridian or "the Hardley" air circulation and the wet season (October to May) that is influenced by equatorial or "the Walker" air circulation. The Hardley circulation is generated by air masses moving north

[10] WRI Earthtrends, Water Resources and Freshwater Ecosystems – Indonesia.
[11] UNEP, p. 29.

from Australia and the Walker circulation is generated by air masses coming from Asia and the Pacific. The two circulation patterns contribute to the displacement and intensity of the Inter-Tropical Convergence Zone, an equatorial trough of low pressure that produces rain.[12]

Although separated as dry and wet seasons, Sumatra experiences rain year-round. Aceh Province experiences a maximum monthly rainfall of 693 mm in December, with an average rainfall number of days with rainfall between 6 to 21 days. The lowest monthly rainfall was 3 mm in March, with an average number of days with rainfall of 2 days. Average monthly rainfall ranges from 33 mm to 291 mm. Data taken from the Sultan Iskandar Muda meteorlogical station indicates that average monthly temperatures range from 26 degrees Celsius (°C) to 28 °C. Average relative humidity is between 69 percent and 86 percent.

While specific information on climate change issues for Sumatra are not available, climate change issues for Indonesia overall, would apply to Sumatra as well. Global climate change is a major concern for Indonesia due to the potential impacts it may have on its economy via agriculture, forestry and fishing. Climate change modeling also predicts potential impacts to public health due to potential increases in heat stress, skin cancer, immune response and the like; however, these issues are not as directly related to the project as the economic impacts. Based on predictive modeling, global climate change could result in increased flooding during the wet seasons with subsequent erosion, and increased evapotranspiration during the dry season affecting irrigation capabilities. Climate changes to the wet and dry seasons would result in changes in soil moisture that could adversely impact agricultural activities. In addition, global climate change modeling predicts that Indonesia will be impacted by sea level rise resulting in a loss of arable land.[13] For western Sumatra, the flat coastal lowlands, where the majority of the agricultural activity occurs, would be susceptible to sea level rise impacts.

Climate change modeling predicts a positive effect for tropical forests in Indonesia with a 12 percent increase in biomass productivity. The forests would benefit from increased carbon fertilization. The increase in forests would also increase the forests' ability to absorb carbon dioxide (CO_2) emissions, especially if GOI implements its international commitment to establish 20 million ha of forest plantations by year 2030.[14]

Specific information on air quality for Sumatra was not readily accessible. However, information was available for the country of Indonesia. According to WRI, CO_2 emissions average 1.1 thousand metric tons (MT) per capita or 24 percent. By comparison, per capita CO_2 emissions for Asia is 2.1 thousand MT or 19 percent. The cumulative CO_2 emissions for Indonesia from 1900 to 1999 were 4,443 billion MT (total Asian CO_2 emissions were 161,972 billion MT). The primary sources of these emissions are transportation (24 percent); public electricity, heat production, and auto producers (21 percent); and, manufacturing industries and construction (18 percent). In 1995, the total amount of sulfur dioxide (SO_2) emissions in Indonesia was 797,000 MT (55,129,000 MT for Asia overall), total nitrogen oxide (NO) emissions was 1,387,000 MT (28,962,000 MT for Asia overall), total carbon monoxide (CO)

[12] http://www.asianinfo.org/asianinfo/indonesia/pro-geography.htm.
[13] http://www.ccasia.teri.resi.in/country/indo/.
[14] http://www.ccasia.teri.resi.in/country/indo/.

was 28,784,000 MT (258,325,000 MT for Asia overall), and total non-methane volatile organic compound (VOC) emissions was 4,582,000 MT (42,036,000 MT for Asia overall).[15]

Based on anecdotal information while in Aceh province, the air quality in Aceh was relatively good in comparison to other populated cities, such as Jakarta. However, it should be noted that leaded fuel is used in Banda Aceh so pollution from vehicle emissions is still high, just less in overall pollution due to the smaller population. The air pollution was not as readily visible as in other areas of Indonesia. Along the road corridor outside of Banda Aceh, there was little to no air pollution noticeable. The major air quality concern is airborne dust generated from areas now denuded of vegetation.

For the Proposed Action area, an air quality sample was collected as part of the preparation of the UKL-UPL from *Simpang Lampuuk* in *Lhok Nga*, near the area of the Kr. Raba Bridge, and analyzed at a Jakarta laboratory. Analysis results show that all parameters are within Indonesia's ambient air quality standard, indicating generally good air quality. Furthermore, it is possible that air quality in Aceh has improved since the tsunami because of the reduction in industrial activity and vehicular traffic. Analytical results of the air quality sample are shown in the following table.

[15] WRI.

Table 4.1: Air Quality Analysis Results

No.	Parameter	Unit	Standard [b]	Result
1.	Dust	$\mu g/m^3$	230	157.00
2.	Hydrocarbon (HC)	$\mu g/m^3$	160	150.00
3.	Carbon Monoxide(CO)	$\mu g/m^3$	10.000	1.371
4.	Nitrogen Dioxide (NO_2)	$\mu g/m^3$	150	15.81
5.	Sulfur Dioxide (SO_2)	$\mu g/m^3$	365	8.08
6.	Ozone (O_x)	$\mu g/m^3$	235	74.18
7.	Lead (Pb)	$\mu g/m^3$	2	0.14
8.	Ammonia (NH_3)	$\mu g/m^3$	1.360 [c]	6.63
9.	Hydrogen Sulfide (H_2S)	$\mu g/m^3$	28 [c]	< 1.00

[a] $\mu g/m^3$ = micrograms per cubic meter
[b] Standard from Government Regulation No. 41 of 1999 regarding national ambient air standards
[c] Standard from Decree KepMenLH No. 50 of 1996 regarding odor level standards

4.1.6 Debris and Hazardous Material

Debris and hazardous materials (e.g., petroleum products, asbestos containing materials, paints and solvents, pesticides and other agricultural chemicals, medical and human wastes, human and animal bodies, commercial and industrial wastes) from before and resulting from the 26 December 2004 tsunami may be present in portions of the Phase I area. However, even with all the destruction, the United Nations Disaster Assessment and Coordination Team (UNDAC) concluded that for Banda Aceh there was little potential for acute impacts to public health and the environment from exposure to hazardous or radioactive materials in comparison to the overall disaster situation because of the enormous quantities of water washing materials away. UNEP noted that detailed soil and groundwater assessments were needed to determine the degree of localized contamination.

The deposition of debris from the tsunami followed two routes: 1) the tsunami dragged the debris offshore into the sea, or 2) the tsunami carried debris from the coastal areas and deposited it further inland, washing some back towards the coast and into the sea, essentially spreading the debris over the impact area. A large volume of mud and sand was left in Banda Aceh. Other debris left in the wake of the tsunami, in approximate order of volume, included bricks and concrete; wood (planks, trees, and other organic matter); and, some plastics and metals (iron, aluminum, and copper). UNEP estimated that 80 percent of the debris cleared consisted of soil, building materials or vegetative matter. The amount of potentially hazardous waste created from household and small-scale industrial chemicals, fertilizers, and fuel is unknown.

Many of the waste disposal areas or landfill sites were located near the coast and are damaged or destroyed. As a result, routine collection of urban municipal solid waste post-tsunami has been hampered by the loss of landfill sites, equipment and staff. In addition, landfill sites prior to the tsunami were not run according to internationally accepted standards. Destruction of these landfill areas may have resulted in additional hazardous materials exposure. As the larger urban area, there is a greater risk for hazardous materials to occur in Banda Aceh than in other cities

and towns. As discussed in Section 4.1.2 – *Soil*s and Section 4.1.4 – *Hydrology*, the debris has a high risk of contaminating the soils and groundwater in the affected area.

Within the vicinity of the Proposed Action, three potential localized contamination areas were identified: 1) the Pertamina oil depot in Banda Aceh, where approximately 8,000 kiloliters (kL) of oil leaked from the oil storage facilities; 2) the Semen Andalas Indonesia cement factory in Banda Aceh; and 3) a large barge that has been grounded by the tsunami along one portion of the Phase I construction area, and which is likely to have spilled fuel or other chemicals. Also located within the vicinity of the Proposed Action is the debris of several collapsed steel truss bridges that have fallen into waterways.

4.2 NATURAL AND BIOLOGICAL RESOURCES

4.2.1 Flora

A large tropical island, Sumatra is one of the most biodiverse areas in the world. Indonesia has 29,375 different known vascular plants.[16] Thirty flora species are listed as endangered and 1,023 species are listed as threatened under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).[17] As a result of the tsunami, a tremendous amount of devastation has occurred in Sumatra. The impacts to threatened and endangered plant species have yet to be assessed.

For western Aceh, five (5) main vegetation types are found, i.e., mangroves, peat swamps, lowland evergreen and lowland forest types, and forest restricted to limestone. UNEP estimates the loss of coastal forests, other than mangroves, as 48,925 ha.[18]

Forest types can be segregated into two general groups—Primary and Secondary Forests. A primary forest has not been disturbed, or if there is any disturbance, it is relatively minor. The primary forest around the western coastal area is a tropical lowland forest; a forest type that occurs between zero to 1,200 m elevation. The physiognomy of the primary forest has the characteristics of tropical lowland forest, including the presence of high trees with large diameter trunks, the presence of layer stratification and the presence of lianas and epiphytes. The area is almost always wet due to relatively high rainfall. Generally, vegetation diversity and complexity decreases with increased elevation, as does the average height and diameter of trees. Secondary forest was originally primary forest, which had been cleared for cultivation, then abandoned to return to its natural state. Field observations indicate that both primary and secondary forest contain some areas of open canopy. These openings in the primary forest occur due to natural tree falls caused by wind or tree death, or occasionally due to cutting down of young trees for the purpose of pole making, tracking and bridge making. Secondary forest areas have a vegetation structure that is quite different to that of primary forest. This forest type lacks tree stands but still has a few stands of pole level growth.

[16] WRI Earthtrends – Biodiversity and Protected Areas – Indonesia.
[17] http://www.cites.org/eng/resources/species.html.
[18] UNEP, p. 23.

The remaining forests in Aceh province are in the Leuser Ecosystem and the Ulu Masin Forest Complex. These forest systems run from Lhok Nga in the north (located directly west of Banda Aceh) to Singkil in the south (located on the western coast south of Medan). The total area of forest complex is estimated at 33,000 km^2. These forests are considered the richest assemblage of biological diversity remaining in Southeast Asia. In recent history, these forests have experienced significant pressures from legal and illegal logging activities. There is a concern that the huge amount of post-tsunami reconstruction needed will increase the amount of illegal logging occurring in these areas.[19]

Floristic ecosystems existing in the vicinity of the Proposed Action activities include mangrove ecosystems, coastal ecosystems, mixed agricultural and cultivated vegetation ecosystems, and secondary forest vegetation. Mangroves are unique ecosystems located in coastal areas where sea water meets fresh water (see Section 4.2.3 – Sensitive Habitats and Protected Areas). Field observations indicated that mangrove ecosystems were damaged by the tsunami. The coastal ecosystem has been largely destroyed and only a small number of live plants were found during field observations, including sea hibiscus (*Hibiscus tiliaceus*), ironwood or beach she-oak (*Casuarina equisetifolia*) and Weeping Fig (*Ficus benjamina*). Agricultural and cultivated vegetation consists of plants intentionally grown for economic value and protection. Dryland agriculture exists in the coastal, upland and highland areas, and consists of, among others coconuts, oil palm, rubber, nutmeg, cocoa, banana, durian, papaya, and coffee. Dominant species in the area that were not affected by the tsunami include mango (*Mangifera indica*), jackfruit (*Arthocarpus heterophylla*), cashew apple (*Anacardium ocidentale*), coconut (*Cocos nucifera*), banana (*Musa paradisiaca*), rambutan (*Nephielium lappaceum*), paw paw (*Carica papaya*), durian (*Durio zibethinum*), areca nut (*Arecha catechu*), and Gnetum Gnetum (*Gnetum gnemon*). Community rice fields were observed also at a few locations. Secondary forests along the Banda Aceh-Lamno road generally were unaffected by the tsunami. Species most commonly seen during field observations include teak (*Tectona grandis*), Trembesi (*Samanea samans*), durian, sea hibiscus, dadap (*Erythrina s.p*), petai (*Parkia speciosa*), Tampu (*Macaranga s.p*), areca nut, tropical almond (*Terminalia catappa*), Chinese albizia (*Albizzia chinensis*), and bamboo (*Bambussa sp.*).

In preparation of the UKL-UPL, a survey of the floristic species along the road corridor from Banda Aceh to Lamno, which encompasses the Proposed Action, was conducted. Table 4.2 lists the species identified during the survey.

[19]Griffiths & Momberg.

Table 4.2: Floristic Species Identified Along the Road Corridor from Banda Aceh to Lamno

No.	Common/Local Name	Latin Name
1	Sea Hibiscus	*Hibiscus tiliaceus*
2	Beach She-oak (Ironwood)	*Casuarina euisetifolia*
3	Weeping Fig	*Ficus benjamina*
4	Coconut	*Cocos nucifera*
5	Mangoes	*Mangifera indica*
6	Jackfruit	*Arthocarpush heterophylla*
7	Cashew Apple	*Anacardium ocidentale*
8	Banana	*Musa paradisiaca*
9	Rambutan	*Nephelium pappaceum*
10	Paw Paw	*Carica papaya*
11	Durian	*Durio zibethinus*
12	Areca Nut	*Arecha catechu*
13	Gnetum Gnetum	*Gnetum gnemon*
14	Mahogany	*Swietenia mahogani*
15	Acacia	*Acacia auriculiformis*
16	Narra Tree	*Pterocarpus indica*
17	Tropical Almond	*Terminalia catappa*
18	Chinese Albizia	*Albizzia chinensis*
19	Tamarind	*Tamarindus indica*
20	Teak	*Tectona grandis*
21	*Trembesi*	*Samanea samans*
22	*Dadap*	*Erythrina sp.*
23	Petai	*Parkia speciosa*
24	*Tampu*	*Macaranga sp.*
25	Bamboo	*Bambussa sp.*

4.2.2 Fauna

Indonesia supports 515 known species of mammals, 929 known species of breeding birds, 745 known species of reptiles, 278 known species of amphibians, and 4,080 known species of fish.[20] Of these faunal species, 68 are listed as endangered and 1,316 are listed as threatened under CITES.[21] Listed species include Leatherback, Hawksbill and Green Sea turtles, all of which are known to occur on the western shores of Sumatra; the Sumatran tiger known to occur in the mountain areas near Meulaboh; and the orangutan known to occur in the forested areas of Aceh Singkal and Aceh Leuser districts. The impact to listed species from the tsunami has not been fully assessed; however, relatively few animals have been reported dead. It is assumed that they were able to flee the impact area prior to the tsunami.[22]

It is thought that listed and threatened bird species were not significantly affected by the direct impacts of the tsunami, and no extinctions are predicted as a result.[23] However, with the degree of habitat loss that occurred, there may be long-term losses to critical species even if immediate losses were minimal.

Specific to the Proposed Action area, the GOI and the local population stated that sea turtle species are known to frequent the beaches along Sumatra's western coast including the beaches at km marker 14, where Kr. Raba bridge reconstruction is proposed. While they exist in Aceh province, according to the University of Syiah (Aceh University) experts, no orangutans or orangutan habitat are present in the Proposed Action area or the entire Aceh Besar *Kabupaten*. Except for the sea turtle habitat and two avian species (Egret and Tern), field investigations did not identify any protected animals or their habitat. The fauna identified are primarily introduced and domestic animals.

Table 4.3 lists fauna observed in the vicinity of the Proposed Action during field surveys conducted to prepare the UKL-UPL. Of the six species of mammals observed, five are domesticated species; only the long-tail monkey was found as a wild animal, especially around the Mount Grotee area. Note that two species of birds are considered protected based on Government Regulation No. 7 of 1999 addressing Flora and Fauna Preservation.

[20] WRI Earthtrends - Biodiversity and Protected Areas – Indonesia.
[21] http://www.cites.org/eng/resources/species.html
[22] http://news.nationalgeographic.com/news/2005/01/0104_050104_tsunami_animals.html.
[23] http://bobwhitson.typepad.com/howlings/2005/01/birdlife_assess.html.

Table 4.3: Fauna Observed during Field Survey in the Vicinity of the Proposed Action

No.	Species Name	Common Name	Remarks
	MAMMALS		
1.	*Felis cattus*	Cat	
2.	*Canis familiaris*	Dog	
3.	*Bos taurus*	Cow	
4.	*Bubalus bubalus*	Water Buffalo	
5.	*Capricornis sp*	Goat	
6.	*Macaca fasculiformis*	Long-tailed tree Monkey	
	BIRDS		
1.	*Egretta sp .*	Kuntul/Egret	Protected
2.	*Paser montanus*	Tree sparrow	
3.	*Cisticola juncidis*	Fan-tailed warbler	
4.	*Dicaeum sp.*	Flowerpecker	
5.	*Pycnonotus aurigaster*	Sooty-headed bulbul	
6.	*Dendrocygna*	Whistling duck	
7.	*Hirundo tahitica*	Pacific swallow	
8.	*Columba livia*	Rock dove/pidgeon	
9.	*Collokalia esculenta*	Glossy swiftlet	
10.	*Sterna sp.*	Tern	Protected
11.	*Gallus gallus*	Chicken	
12.	*Anas sp.*	Duck	
	REPTILES		
1.	*Varanus sp.*	Monitor lizard	

4.2.3 Sensitive Habitat and Protected Areas

World Resources Institute (WRI) reported that in 2003, there were 965 protected areas in Indonesia, covering 23,893,000 ha with an additional 13,559,000 ha of marine and littoral protected areas. There are 243,000 ha of wetlands of international importance and 2,062,000 ha of biosphere reserves.[24] In addition, Indonesia supports 104,986,000 ha of forest with 95,116,000 ha being natural forest, and 9,871,000 ha being plantations. Between 1990 and 2000, Indonesia lost 11 percent of its total overall forested areas with a 14 percent loss in natural forests. The total dryland area in Indonesia is 5,318,000 ha.[25]

According to UNEP, the following terrestrial protected areas of international importance are within the tsunami impact area; however, none are within the immediate vicinity of the Proposed Action:

[24] WRI Earthtrends - Biodiversity and Protected Areas – Indonesia.
[25] WRI Earthtrends - Forests, Grasslands, and Drylands - Indonesia

• Kuala Jambu Air (10,000 ha). Estuary with mixed mangroves.

• Blok Kluet, Gunung Leuser National Park (200 ha). Fresh water swamp and peat swamp forest. Includes endangered species such as the Leatherback turtle, Sumatran tiger, and orangutan.

• West Singkil (5,500 ha). Relatively undisturbed beach forest series and fresh water swamp forests in excellent condition. The best surviving examples of these habitat types in the province, with all their characteristic flora and fauna. Includes rare and vulnerable species.

• Simeulue Island. Coastal wetlands in the area include approximately 1,000 ha of mangrove forest, coral reefs and sea grass. Includes endemic fauna and endangered species, such as Leatherback, Hawksbill and Green Sea turtles.

• Bangkaru Island, some surviving beach vegetation, lowland forest. Probably the most important nesting site for Green Sea turtles in western Indonesia.

• Pulo Aceh Island Group. Located on the west side of the Banda Aceh Sea, consisting of Breueh Island, Nasi Island, Teunom Island, Batee Island and several other small islands. The 1998 spatial plan for the district of Aceh Besar included plans to designate a protected marine area for Pulo Aceh. Some prior damage from dynamite fishing has affected *Acropora* sp. coral reefs in the waters of the district of Aceh Besar.[26]

For the Proposed Action area, there are small wetlands near Lamcok at km 11 and km 13. However, these wetlands are about ½ a kilometer from the road corridor toward the sea. The wetland areas are well outside the road maintenance and potential staging areas. Wetlands are forming in areas of standing water along the road and near the rivers. These wetlands are very disturbed, impaired in all three parameters, i.e. vegetation, hydrology and soil; and providing limited function and value. It is unclear if the wetlands will continue to remain as a natural feature or are only temporary and will revert to dry land as the system stabilizes and road drainage is improved. It is surmised that these wetlands will revert to dry land over the next few years as the system stabilizes.

There are remnant mangroves near km 44, km 47, and km 57. All the mangroves in these areas have been destroyed by the tsunami. However, there has been some replanting of mangroves in these areas by non-governmental organizations. It should be noted that most of the replanting, though adjacent to the destroyed mangrove stands, is not ideally placed. The replanting appears to be in locations where environmental conditions may not be suitable for mangrove propagation. The field team was unable to identify the responsible party for the replanting to provide more accurate advice for locating future replanting efforts. No intact mangroves occur in the Proposed Action area.

[26] UNEP, p. 26.

The Proposed Action goes through primary and secondary forests. However, in these locations the road is intact and minimal maintenance activity will be necessary. The primary forest crossings occur at km 32 and km 62 though km 70. The secondary forest crossing occur at km 13 near Lho'nga, km 25 near Lamsunje, km 29 to 40 near Paro, and km 73 to 76 near Gle Putuh.

4.2.4 Coastal and Marine Resources

A variety of important coastal and marine ecosystems occur in northern Sumatra and in the smaller islands off Sumatra's west coast, including coral reefs, seagrass beds, sandy beaches that support turtle habitat, and mangroves. The estimated area of coral reefs in northern Sumatra and offshore islands is 100,000 ha.[27] Several pockets of coral reefs exist along the western coast from Banda Aceh to Meulaboh. The reefs may have suffered significant damage from the tsunami, particularly from sediments washed into the sea. Any erosion caused by the Proposed Action would not cause significant impacts to coral reefs compared to the sediment damage caused by the tsunami. Prime seagrass beds, totaling approximately 600 ha, are mainly located off the shores of Nias, Pulau Weh and Banyak islands. The seagrass beds in Pulau Weh support dugongs (manatees). Seagrass beds on the western coast of Sumatra are believed to be limited. Sandy beaches are the predominant feature along the west coast of Sumatra and are known to support Leatherback, Hawksbill, and Green Sea turtles. Mangroves along the western coast are small and patchy; the majority being found on the small islands offshore. Prior to the tsunami, much of the mangrove forests around Banda Aceh had already been replaced by *tambak* (shrimp farms).[28] What mangrove forests remained has been largely destroyed by the tsunami.

The GOI and several international organizations have been conducting surveys and assessing damage to the coral resources resulting from the tsunami. Badan Perencanaan dan Pembanguanan Nasional (BAPPENAS) has estimated that 30 percent (97,250 ha) of the coral reefs, 20 percent (600 ha) of seagrass beds, and 90 percent (300-750 ha) of mangroves were lost or damaged.[29] Wetlands International estimates that 50 percent of the sandy beaches along Sumatra's western coast were lost due to the tsunami, thus impacting sea turtle nesting areas.[30]

A major concern with the coastal areas is the enormous amount of debris washed into the ocean by the tsunami. The debris includes natural and man-made materials such as silt, sand, trees, vehicles, tankers, etc. Debris may be causing secondary damage to coastal areas as wave activity tosses the debris about, scouring and smothering sensitive habitats such as coral reefs.

Coastal and marine resources located within the vicinity of the Proposed Action include coral reefs and sandy beaches. Potentially sensitive coral reefs within close proximity to Phase I activities are located at road markers km 14 (Lho'Nga), and km 30. Also, as mentioned in Section 4.2.2 – *Fauna*, the sandy beach near the km 14 marker is known to support sea turtles.

For the Proposed Action area, there are coral reef systems directly offshore near km 14. At this reach, the road corridor is approximately 0.5 km from the reef area. The road is relatively intact

[27] UNEP, p. 22.
[28] UNEP, p. 23.
[29] UNEP, p. 23.
[30] UNEP, p. 23.

in this reach except for the bridge repair. Work along this reach will be to maintain the existing paved road. Another coral reef system occurs offshore of km 29 and 30. At this reach, a seawall is only partially intact and the road is a combination of temporary dirt road and damaged, pothole ridden, paved road. Other coral reef systems occur at the outer edges of the embayments and away from the Proposed Action activities. These systems are near Paro (km 39), near Kareueng (km 44), near Jantang (km 47), near Daroh (km 52), near Ujung Lambate and Kuala Balohan (km 55), around the island of Sughen in Kluang Bay (offshore of km 68), near Blang Mang and Daya Bay (km 78), and at Ujung Muloh at the mouth of Kr. Lambeseu.

4.3 OTHER ENVIRONMENTAL CONCERNS NOTED BY 22 CFR PART 216

4.3.1 Land Use and Development Policies & Controls

Prior to the tsunami, Indonesia supported a variety of agricultural land uses with an average production of 58,954,000 MT in cereals from 1999-2001 (a 75 percent increase in production from 1979), 18,804,000 MT of roots and tubers, and 1,660,000 MT of meat (a 145 percent increase from 1979). Over 30,987,000 ha of land are in agricultural production, which represents 16.3 percent of the total land area in Indonesia. Of the total agricultural land, 15.5 percent was irrigated in 1999. Agricultural workers make up approximately 55.2 percent of the total work force and agricultural activities make up 16.9 percent of the total GDP. [31] Limited information on agricultural production for Sumatra was available. However, UNEP identified agriculture as comprising the majority of Aceh's economic productivity. The tsunami resulted in damaging 97 percent of Aceh's GDP.[32] The majority of agricultural activities on Sumatra occur on the eastern coast. However, based on satellite imagery, the agricultural areas in the coastal lowlands of the western coast have been almost completely lost.

Prior to the tsunami, the main economies in the Proposed Action area were fisheries, rice production, small subsistence cattle and goat farms, and aquaculture (e.g., shrimp and fish ponds). Though devastated by the tsunami, these communities are slowly re-establishing their economic livelihoods. Kr. Raba is used a major access to offshore fishing grounds. However, boats can only access these grounds during high tide due to the silting in of the river. Former rice paddies occurred in the communities of Leupung (near km 24), Paro (near km 39), Jantang (near km 46), Cunien (near km 55), Lam Baroh (near km 74), and Lamno. Rice paddies throughout the reach are being re-established, with the largest effort noticed at Cunien. At Lamno, the rice paddies are still intact though it does appear some damage due to increased salinity in the water has affected the fields. Aquaculture, as evidenced by damaged "tambaks" or fish and shrimp beds, was also prevalent in the same villages closer to the sea. At Meunasah Lamkuta (near km 49) and Pasi, near (km 57) efforts to re-establish the "tambaks" are underway.

4.3.2 Energy and Conservation

The total energy production for Indonesia in 2000 was 229,478,000 MT of oil equivalent. The total energy consumption for Indonesia in 1999 was 136,121,000 MT of oil equivalent. Indonesia's primary sources of energy consumption are fossil fuels (86,325,000 MT oil equivalent), primary solid biomass (46,748,000 MT oil equivalent), geothermal (2,346,100 MT

[31] WRI, Earthtrends - Agriculture and Land Use - Indonesia.
[32] UNEP, p. 23

oil equivalent), and hydroelectric (806,000 MT oil equivalent). Fossil fuel production consists of crude oil and natural gas liquids, natural gas, and coal and coal products, in order of highest consumption. Residential activities consume the largest amount of energy (62,671,000 MT oil equivalent), followed by transportation (19,901,000 MT oil equivalent), industry (19,724,000 MT oil equivalent), and agriculture (1,784,000 MT oil equivalent).[33]

The tsunami has impaired both energy use and energy consumption in Aceh. Two of Pertamina's oil depots were destroyed, and the Exxon Mobil pipeline was severely damaged. Current production and consumption for the area is unknown at this time. In the Proposed Action area, most of the settlements and villages appear to be running off generators supported by oil or natural gas. Except in the mountain reaches, constant electricity has not been re-established. Oil and natural gas are transported to the settlements from Banda Aceh via large trucks.

4.3.3 Use of Natural/Depletable Resources

The tsunami resulted in a huge loss of timber sources. It also significantly increased the demand for timber as a resource for reconstruction activities. Expected uses for timber include the construction of temporary barracks to house tsunami evacuees, the construction of low-cost permanent housing, the repair and reconstruction of other building types, and the rebuilding of the fishing fleet consisting of approximately 3,000 vessels.[34] UNEP has cited that a major concern with tsunami reconstruction will be the demand for timber. The projected demand is estimated at 4 to 8 million m^3 of logs[35], which translates to approximately 125,000 to 250,000 ha of forest. Potential sources of timber include Aceh's production forests, timber plantations, community-owned forests and crop plantations, imported timber, and timber that has been stolen, found, seized or donated. World Wildlife Federation (WWF) Indonesia determined that there is not an adequate amount of sustainable and legally harvestable forests to meet this demand.[36]

The tsunami also affected depletable resources such as the Exxon Mobil natural gas resources and pipeline, and the industrial fertilizer plants on the east coast. Within the vicinity of the Proposed Action, a cement plant on Sumatra's western coast, south of Lhok Nga and the Kr. Raba Bridge, was also impacted by the tsunami.[37]

In the Proposed Action area, rebuilding of the communities has begun. Most of the rebuilding appears to be using either recovered timber from damaged structures or brick and cement made locally in Aceh. A few larger homes appeared to be using new timber for the construction. It is unknown where the brick and cement manufacturing is occurring. The large cement factory was not fully functioning as of June 2005 site investigations.

4.3.4 Urban Quality/Design of the Built Environment

The primary urban area in the vicinity of the Proposed Action is Banda Aceh. Traveling south along the Banda Aceh-to-Meulaboh Road, the next urban area is Lamno. Both of these areas

[33] WRI Earthtrends - Energy and Resources – Indonesia.
[34] Greenomics Indonesia.
[35] Greenomics Indonesia, pg. 1.
[36] UNEP, p. 27.
[37] UNEP, p. 30.

have experienced considerable damage and loss to the urban quality or environment. According to UNEP, 14 public port facilities in Aceh Province experienced heavy damage and five ports experienced light damage (mainly east coast ports). Two key industrial sites were damaged, i.e., Pertamina oil depot and Semen Andalas Indonesia cement factory.

Lhoonga, a community within the Proposed Action area, is also growing into a small urban environment as one of the few villages located in the mountain areas as evidenced by the establishment of a large resettlement camp, a shopping bazaar, and few small restaurants and businesses.

4.3.5 Historic and Cultural Resources

The presence of historic and/or cultural resources in the area of the Proposed Action is unknown. Sumatra, Aceh province in particular, has a long history of human development. In the 16th century, Aceh was already established as a center of Islam and a major trading nation, trading with China, the near east and Europe. Aceh province remained independent from European control until 1871 when the Dutch declared war. The war lasted for 35 years before the Sultan of Aceh, Tuanku Muhammat Dawot, surrendered.[38] With this long and colorful history, it is likely that historic and cultural resources may occur in the vicinity of the Proposed Action, especially in the areas near Banda Aceh. For the Proposed Action area, no intact historic or cultural sites have been identified.

4.3.6 Reuse and Conservation

As discussed under Section 4.1.6 – Debris and Hazardous Materials, portions of the existing roadway and bridge reconstruction may require clearance of debris and other materials. This offers an opportunity to reuse the debris for reconstruction activities and thus conserve the use of new materials. Reuse of debris for reconstruction can already be seen in the village communities that are being re-built within the Proposed Action area.

4.4 ADDITIONAL ENVIRONMENTAL CONCERNS NOTED FOR CONSIDERATION

4.4.1 Socio-Economic Considerations

The Proposed Action area occurs in the *Kabupaten* of Aceh Besar. The majority of the district's population resides in the city of Banda Aceh.. However, when traveling west out of Banda Aceh and south along the Aceh Province coastline, the population greatly diminishes through the district. The population of Aceh prior to the tsunami was 4.2 million citizens. Assessments of loss of life continue to increase but the most recent estimates were 128,715 lives lost[39] and 412,438 people displaced. The majority of the western coast was severely damaged, and communities and villages were completely destroyed. Survivors are in the process of reestablishing in their original communities.

[38] Lonely Planet, Indonesia. 2004, p. 468.
[39] http://www.cbc.ca/storyview/MSN/world/national/2005/04/18/indonesia-050418.html.

The majority of people residing along the west coast of Aceh derive their livelihoods from agriculture. As such, the loss of agricultural land would have a significant impact on socio-economics. Detailed information on post-tsunami economics currently is not available.

4.4.2 Public Health and Education

Because Aceh Province has been isolated for the last 20 years, specific health statistics for Aceh Province are not available. It is generally assumed that for most public health issues, Aceh is at best equal to standards in the rest of the country but more likely primary health care is at a lower standard due to its isolation.

In the absence of specific information, general information for Indonesia is provided. For Indonesia, the total population in 2005 was estimated at 272,911,000 people. In the most recent addition of "Indonesia: Demographic and Health Survey: 2002-2203" (IDHS), the following findings were provided:[40]

- Child Mortality – 46 out of 1,000 births die before the age of five (5) and 35 out of 1,000 births die as an infant (down from 142 death per 1,000 births in 1967). In the poorer households 61 children out of 1,000 births die before the age of 5.
- Adult Mortality – Female mortality was 2 deaths per 1,000 women for the period of 0 to 4 years before the 2002-2003 survey. Male mortality for the same period was also 2 deaths per 1,000 men. However, male mortality rates were slightly higher than female rates for most ages.
- Fertility – Fertility has declined from 3.0 children per woman in 1998-1991 to 2.6 children per woman in 2000-2002 with rural women having on average 2.7 children and when in the poorest households having on average 4.4 births each. Decline in fertility has been associated with increased level of education in women, increased age at first birth, desire for fewer children, and greater use of contraceptive methods.
- Reproductive health – Reproductive health has improved in antenatal, delivery and postnatal care – 9 in 10 mothers receive care from a medical professional during their pregnancy.
- Child health – 52 percent of children from 12 to 23 months of age are fully immunized (down from 55 percent in 1997 but up from 50 percent in 1991).
- Access to health care – 24 percent of women stated that economic reasons limited their access to health care in 2002-2003; 12 percent were limited by distance to health services and transportation.
- Awareness of Human Immunodeficiency Virus (HIV), Acquired Immune Deficiency Syndrome (AIDS), and other Sexually Transmitted Diseases (STD) – Knowledge of HIV/AIDS in Indonesia is fairly low. For women, 59 percent of married women and 73 percent of married men reported having heard of HIV/AIDS in 2002-2003. Knowledge of the principles for reducing HIV/AIDS—abstinence, use of condoms and reducing the number of partners—was limited with 1 percent of women and men citing abstinence, 6 percent women and 10 percent men citing number of partners, and 5 percent women and 13 percent men citing condoms. Most common response was to avoid sex with

[40] Following information is summarized from "Indonesia Demographic and Health Survey 2002 -2003", prepared by Statistics Indonesia, Natinal Family Planning Coordination Board – Jakarta Indonesia, Ministry of Health – Jakarta Indonesia, and ORC Macro – Calverton, Maryland USA, December, 2003.

prostitutes and having sex with only one person. For other STDs, 73 percent of married women reported no knowledge of the symptoms associated with STDs and 13 percent of men reported no knowledge of symptoms.

- Education of women – The number of educated women has increased—13 percent of women between 15 and 49 had no education in 1997 and 8 percent of women in the same range had no education in 2002-2003. In 2002-2003, 38 percent of women had some secondary education.

The challenges identified in the IDHS are as follows:

- Fertility – 10 percent of births in the 5 years proceeding the survey were wanted but at a later time and 7 percent were not wanted. The IDHS cited that more emphasis was needed on long-term family planning methods such as IUD, implants and sterilization.
- Maternal Health – the target of 90 percent of women having a minimum of one antenatal care visit in the first trimester has not been reached.
- Child Health – neonatal tetanus immunization has declined from 53 percent in 1997 to 51 percent in 2002-2003 and the coverage of child immunizations against the 6 major diseases has declined from 55 percent in 1997 to 52 percent in 2002-2003.
- Childhood Mortality – 1 in 3 births in Indonesia has an elevated risk that is avoidable, i.e., births in mothers that are too young, births in mothers that are too old, birth intervals that are too short, or mother has had too many prior births.

As stated before, Aceh Province has been isolated for at least 20 years before the December 2004 tsunami. The improvement in public health in Indonesia is due to education, access to services, quality of services, and access to commodities and medical supplies. It is unknown whether Aceh had similar standards to the rest of Indonesia; it is assumed that Aceh was at a lower standard of health care. Due to the tsunami, the weak level of health care has now been severely compromised.[41] The public health community assumes the following conditions prior to the tsunami:

- Immunization rate is poor.
- Family planning and maternal health is equivalent to or worse than other rural areas in Indonesia.
- Access to commodities and medication is slow and limited.
- The community is at low risk for HIV/AIDS as a result of its isolation.
- Malaria is endemic in Aceh province (more so in the mountainous areas of the west coast than in the lowlands).
- A tuberculosis risk in Aceh is similar to Indonesia. Indonesia is considered the 3rd highest burdened country in the work with tuberculosis averaging 400 deaths a day.

After the tsunami, overall health conditions have worsened. Access to health care is more limited than before with approximately 77 health facilities destroyed or severely damaged by the tsunami. Access to commodities and medical care has also been restricted further as road networks are damaged or destroyed. Sanitation issues are a concern as people are currently in temporary facilities where the level of appropriate sanitation control is not consistent. Due to the quick response of the international health community after the tsunami, the potential for many

[41] Personal communication with Ms. Lynn Adrian – Mission Public Health Officer, USAID Indonesia, 25 July 2005.

health epidemics were avoided including cholera, hepatitis, malaria and dengue. The temporary facilities and housing were all well sprayed for mosquito control to limit the potential for malaria or dengue fever outbreaks. Delivery of safe drinking water kept diarrhea diseases in check. There was a minor outbreak of tetanus after the tsunami due to the large amount of hazardous debris in the area. Since tetanus is a self-limiting disease, the community was able to curb that as well.

The concerns today for public health in the Proposed Action area is ensuring that as communities rebuild, adequate drinking water, access to fresh water, adequate water drainage, latrines, and sewage disposal are incorporated along with education and access to primary health care.

In terms of children's education, no statistical information is available for Aceh Province. Nationally, for every 100 children that began primary school in 1997, only 78 entered year 6, only 75 graduated year 6 and only 52 started SMP Class 1 (year 7).[42] Based on these statistics, almost half of the students starting primary school drop out of formal education before ages 12 and 13. These children are then likely to enter the workforce at an early age, adding to problems associated with child labor.

4.4.3 Safety

Safety issues related to civil unrest are a concern in the Proposed Action area, as they are in the rest of Aceh Province. As of 20 July 2005, it appears a full treaty with a permanent cease fire will be implemented between GOI and Gerakan Aceh Merdeka (GAM) or Free Aceh Movement. However, skirmishes between GOI and GAM may still occur in the project area as well as the potential for some criminal activities in unpopulated mountain areas.

In terms of traffic safety, traffic volumes in Banda Aceh and the Phase I area are light to medium in comparison to other urban areas. In rural areas, traffic volumes are light. Non-motorized traffic (NMT) is encountered in some areas. In agricultural and rural areas, the NMT is typically farm animals. In small villages, towns and cities, NMT is more typically pedestrians, especially children before and after school hours.

4.4.4 Noise

Along the Proposed Action route, noise levels are low with limited noise-producing sources or receptors existing in the area. Within Banda Aceh, the road experiences higher noise levels from regular urban activity. The main noise receptors along the Phase I area are the towns of Banda Aceh and Lamno. Temporary schools and hospital clinics have been set up in or near the settlement camps. School zones and hospital zones are considered sensitive noise receptors.

In preparation of the UKL-UPL, a noise level measurement was taken at Lhok Nga. The results are shown in the following table. The measured noise level was below the Indonesian standard.

[42] Statistik Persekolahan SD 2003/2004, by Departemen Pendidikan Nasional Badan Penelitian Dan Pengembangan Pusat Data dan Informasi Pendidikan, 2004.

Table 4.4: Measured Noise Level

No.	Location	Result (dBA)	Standard (dBA)
1.	Simpang Lampuuk – Lhok Nga	59.2	70.0
dBA = A-scale decibel(s)			

4.4.5 Other Infrastructure Systems

The road from Banda Aceh to Meulaboh is the primary transportation route along Sumatra's west coast. Prior to the tsunami, most of the infrastructure likely followed this coastal road. The tsunami destroyed the majority of the road in the coastal lowlands and the infrastructure it supported. Based on initial assessments of existing conditions within the Proposed Action area, minimal to no infrastructure exists along the road corridor in the coastal lowlands. Infrastructure and utilities in the mountain areas remain relatively intact.

5.0 ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

The urgency of initiating road reconstruction and the resulting accelerated timetable precluded the ability to conduct extensive site investigations and assessments in the course of preparing this EA. Potential impacts were derived from preliminary field observations, interpretation of GIS data and other descriptive source documents. Due to the lack of detailed baseline data and the resulting general nature of the impact analysis, the discussion within this chapter focuses on mitigation measures, including guidelines and BMPs, rather than explicit environmental consequences resulting from the Proposed Action.

Where a choice of No Action would result in "predictable actions by others", such a consequence of the No Action alternative should be considered in the impact analysis.[43]

The environmental consequences resulting from the No Action alternative are expected to be generally identical to those resulting from the Proposed Action. Under the No Action alternative, it is assumed that the reconstruction and rehabilitation of the Banda Aceh-to-Lamno road will still take place, just without U.S. assistance. Furthermore, because the GOI is actively involved in the planning of this roadway, route alignments are likely to be similar, if not identical to those in the Proposed Action. Because the environmental consequences of No Action and the Proposed Action are expected to be identical, they will not be addressed under separate sections, but rather just as potential impacts under each environmental criterion.

As stated in Chapter 4.0 (Affected Environment), the coastal road from Banda Aceh to Lamno passes largely through areas that have been impacted by the tsunami and is now denuded of vegetation. Any reconstruction activities occurring in tsunami-affected areas are anticipated to have little or no significant adverse impacts to the present localized condition.

5.1 PHYSICAL RESOURCES

5.1.1 Topography

Potential Impacts. Localized alterations to the geology and topography from land-disturbing activities such as clearing, cutting, earthwork, excavation, embankment and filling would occur as a result of the Proposed Action. However, unavoidable effects and the irreversible or irretrievable commitment of resources such as land would be offset by long-term benefits associated with the reconstruction of the road. Potential impacts to topographic conditions of road reconstruction projects are specifically associated with:

- *Cut and Fill Requirements.* For the Proposed Action, the maintenance activities will not require any new road cuts. The mountain areas will be maintained in their current state.

[43] Council on Environmental Quality.

The new 10 km road segment is in a relatively flat area. Some fill will be necessary for the new 10 km road segment and for the maintenance activities on the temporary roads in the coastal lowlands. Estimated fill is about 28,000 m^3 . .For the bridges, some amount of fill will be necessary for the bridge abutments. Kr. Lambeseu will require the placement of piling or other support structure in the center of the crossing to support the long temporary truss bridge.

- *Borrow Area Excavations.* The Proposed Action will require fill from borrow areas and quarries. Activities at borrow area locations may cause drainage and visual problems, and may present a potential for increased vector (e.g. mosquitoes) and water contamination issues.

- *Quarry Operations*. The Proposed Action may require quarried construction materials from which considerable changes in topography could result. Poorly run operations may also create dust problems, contribute to noise pollution, jeopardize worker safety, or cause the loss of natural resources.

- *Soil Erosion*. Both wind and drainage-related soil erosion and re-deposition may result from design and construction factors from the new 10-km road segment. Some soil erosion or re-deposition could occur associated with maintenance of the unpaved temporary roads.

- *Indirect Impacts from the Placement of Stream Crossings*. Stream crossings may impair stream development, exacerbate flooding in the area, and result in head-cutting or shoreline erosion along the stream banks.

- *Shoreline stabilization.* Depending on the integrity of the existing road until a permanent road is constructed, some shoreline stabilization may be necessary where the road runs directly near the sea. At several points along the route (near km 15 to km 18; near km 19 to 26, near km 28, near km 30 to 31, near km 47, near km 57, near km 58 to 61), the road floods with water from the high tides. Erosion is occurring on the road due to tidal energy, consequently shoreline stabilization may be necessary to ensure the road stays open and accessible.

  The placement of hardened and vertical shoreline protection activities may result in exacerbated erosion over time in front of the shoreline protection and at either end of the shoreline protection. Vertical walls are shown to increase wave energy and refraction in front of the structure as well as increasing wave energy along the face of the structure – transferring the energy to either end of the structure. In addition, if shoreline protection is placed in an area considered a “sand source”, sand critical to the littoral cell may be impaired from entering the system. As a result the sediment budget for the littoral cell may be thrown out of equilibrium. Loss of beach and sediment can reduce intertidal habitat, result in the loss of critical habitat for protected sea turtles and impair productivity for fisheries and coral reefs.

Mitigation Measures. In order to minimize impacts to the topography, the D-B contractor will consider the following measures in addition to others identified in this EA:

- *Cut and Fill Requirements.* Incorporate standard BMPs, which include but are not limited to:
    - Use design methods and materials to minimize erosion including, but not limited to: 1) use of materials that are less likely to erode; 2) strategic placement of gibbons and riprap; and 3) appropriate compaction of soil after construction, particularly around bridges, culverts, and underpasses.
    - Re-vegetate exposed areas as soon as practicable after fill placement in order to minimize erosion. Fast methods for re-vegetation (such as, but not limited to, hydroseeding or sod placement) shall be used where practicable. Native species shall be used for re-vegetation efforts to the extent practicable, if native species seed source is unavailable, non-invasive plant species shall be used. Plant species should also be as resistant to grazing as is practicable.
    - Trench along the side of the road, where necessary, to provide adequate road drainage, minimize erosion due to road runoff, and provide adequate hydrology to assist with re-vegetation efforts and natural plant recruitment.
    - Stabilize embankment slopes and road cuts through design and materials including, but not limited to, the use of re-vegetation, placement of fiber mats, riprap, and rock gabions.
    - Implement appropriate drainage structures in the hillside to prevent erosion due to soil saturation.
    - Design side slopes at appropriate angles of repose in order to reduce the potential for erosion or rock slides. If steeper slopes are required than what is necessary to stabilize the slope, riprap or other materials shall be used to stabilize the area.
    - Use step embankments for embankments greater than 6 m.
    - Restrict construction in erosion- and flood-prone areas to the dry season where practicable.

- *Borrow Area Management.* Implement standards BMPs for borrow area management including, but are not limted to:
    - Develop and implement a Borrow Area Excavation and Restoration Plan (BERP) that outlines environmentally sound methods for management for the borrow and surrounding disturbed areas. Management items to be incorporated in the BERP include, but are not limited to the following:
        - Reuse debris material in the area of the Proposed Action to the full extent practicable to minimize demands on the borrow area.
        - Locate borrow areas outside of the highway ROW.
        - Save topsoil from the borrow areas and reuse it to restore and re-vegetate the borrow areas.
        - Grade the borrow area to ensure that it is relatively uniform with the surrounding terrain and that there is adequate drainage.
        - Create siltation/retention basins as needed to control runoff.
    - Borrow areas will not be constructed until the Construction Supervision Consultant (CSC) has approved and provided written acceptance of the BERP. The CSC must confirm that the borrow areas have been restored in compliance with the plan before payment is authorized under the contract.

- Do not create new borrow areas without restoring previous borrow areas that are no longer in use.
- Re-vegetate borrow areas. Native species shall be used for re-vegetation efforts to the extent practicable, if native species seed source is unavailable, non-invasive plant species shall be used. Plant species should also be as resistant to grazing as is practicable.
- Restore borrow areas as soon as practicable after work is completed and in compliance with the BERP.

- *Quarry Operations.* Implement standard BMPs including, but not limited to, the following:
  - Use only licensed quarrying operations for material sources. If licensed quarries are not available, coordinate with the GOI in determining appropriate quarry sources. Set up dedicated crusher plants at approved quarry sites as warranted.
  - Implement dust control measures as discussed below in Section 5.15 – *Climate and Air Quality*.
  - Implement noise mitigation measures as discussed below in Section 5.4.4 – *Noise*.

- *Soil Erosion and Re-Deposition*. Provisions for erosion control are addressed as part of the discussion for soils (Section 5.1.2) and hydrology below (Section 5.1.4), and in "cut and fill requirements" above.

- *Stream Crossing Designs.* BMPs for stream crossings are defined in Section 5.1.4 – *Hydrology*.

- *Shoreline Stabilization.* Implement standard BMPs including, but not limited to, the following:
  - Use design methods and materials to minimize shoreline hardening to the full extent practicable. Alternatives to shoreline hardening that should be considered (based on effectiveness and cost) include: setting back the road from the shoreline to the full extent practicable; re-vegetating the shorelines; replanting mangroves where appropriate to protect against erosion, catch sediment, and reduce wave energy impacts; and, restoring primary dunes that stabilize the road bed and reduce wave energy impacts.

5.1.2 Soils

Potential Impacts. Potential impacts to soils due to the Proposed Action may include:

- *Conversion of agricultural soils to highway use*. With the significant loss in adequate soils for agriculture caused by the tsunami, any additional damage to agricultural soils will have an exponential impact on the area. The Proposed Action crosses through areas that are currently in rice paddy production. The road in these areas is very narrow and will need to be widened to meet the ASEAN Class II design standards. For areas that will be maintained, as stated in Section 4.0 – Affected Environment, the agricultural reaches in lowlands adjacent to the temporary roads have been seriously impacted by the tsunami. However, re-establishment is ongoing. These reaches will be maintained as

temporary roads along their current alignment. Depending on the integrity of the existing road until a permanent road is constructed,, the alignment may need to shift slightly, in one direction or the other to compensate for road loss or damage. The alignment may cross over dry land agricultural areas and rice paddies that survived the tsunami.

- *Conversion of agricultural soils due to indirect/induced impacts*. Because the tsunami caused extensive loss of shoreline, destroyed villages likely will relocate further inland, as well as within closer proximity to the Proposed Action. The villages may have few options but to redevelop in areas that were once agricultural lands. The GOI, through the BRR and other agencies, is working with local villages on the planning of new villages and their associated impacts on land use. Furthermore, the Proposed Action may result in indirect impacts to agricultural soils from the placement of ancillary functions such as asphalt/concrete manufacturing facilities, construction camps, borrow areas, etc. in sensitive areas.

- *Soil erosion*. Short-term soil erosion impacts during construction are expected. Exposed surfaces during road construction along the 10-km new road segment could generate large quantities of eroded soils and silts that may be carried by rainwater runoff into streams and then deposited into delta areas, disturbed mangroves or along the coastline. Soil could be washed from the unpaved temporary road during high tides or heavy rainfall. Silt deposition in the rivers could impair water quality, freshwater fisheries, mangrove growth and coral reef production.. Implementation of standard BMPs during construction should reduce expected impacts to less than significant levels.

  Long-term soil erosion impacts are associated with increased volumes and velocities of stormwater runoff from constructed roads. Proper roadway design which incorporates features that control, minimize and prevent erosion, siltation and runoff, and the implementation of structural controls (e.g., stabilization of grade, conveyance of water from one elevation to another, filtering and retention of sediments, etc.) are expected to reduce long-term impacts to less than significant levels.

- *Contamination of soils due to spills or hazardous materials*. Construction activities may incur inadvertent spills of hydraulic fluids, engine or mechanical lubricants, diesel fuel, gasoline, etc. or improper handling of hazardous materials. Such events could result in contamination of soils. Proper construction practice by the D-B contractor would minimize the potential for spillage and the adverse impacts should a spillage occur.

Mitigation Measures. In order to minimize the additional impacts to soils discussed above, the D-B will adhere to guidelines and implement standard BMPs including, but not limited to the following:

- *Conversion of Agricultural Soils to Highway Use*
  - Minimize road-widening and re-alignment activities in areas that still support fertile agricultural soils, especially where communities have already begun to re-establish agricultural fields.

- Incorporate adequate drainage and water conveyance to ensure that the hydrology for agricultural soils remains well supported.
- Incorporate erosion and sediment controls in road design and construction to minimize the additional loss of topsoil.
- Where adequate topsoil for agricultural activities is removed from the road corridor and is not needed for restoring disturbed areas, the topsoil shall be reused to enhance adjacent agricultural fields as practicable.

- *Conversion of Agricultural Soils due to Indirect/Induced Impacts*
  - Locate all ancillary road construction functions outside areas with prime agricultural soils to the full extent practicable, especially where the community has or is actively in the process of re-establishing agricultural fields.

- *Soil Erosion*
  - Develop and implement an Erosion and Sedimentation Control (ESC) plan for all construction activities. The plan shall address soil erosion, runoff, siltation, sediment controls and related damage. The plan will also require the D-B contractor to perform temporary work items including, but not limited to:
    - Providing ditches, berms, culverts, and other measures to control surface water.
    - Providing a dewatering plan for work at minus water levels. The dewatering plan shall be reviewed and approved by the U.S. Government and GOI prior to construction.
    - Building dams, settling basins, energy dissipaters, and other measures, to control downstream flows.
    - Controlling underground water found during construction.
    - Covering or otherwise protecting slopes until permanent erosion-control measures are operational.
  - No construction will commence until the CSC has approved and provided written acceptance of the ESC plan.
  - Apply temporary erosion and sediment control measures and practices during construction when ground and materials are exposed to weather and other factors. The following list cites six general construction practices from manuals and handbooks pertaining to erosion and sediment control measures, runoff solutions, highway design and BMPs.
    - <u>Minimize earth movement.</u> Fit the road to the terrain and minimize cuts and fills.
    - <u>Minimize impervious coverage.</u> Make paved widths consistent with existing needs.
    - <u>Minimize vegetation removal.</u> Preserve trees, grass and vegetation for site stability.
    - <u>Avoid steep slopes.</u> Confine construction activities to the least critical parts of the site.
    - <u>Align roads along slope contours.</u> Locate roads parallel to slope contours.
    - <u>Retain the natural drainage system.</u> Avoid confining any natural drainage system or forcing it to a new location, except as needed to cross the

system. Accommodate all drainages entering the construction area. Span larger streams with bridges.

- Treat cut/fill slopes as early as possible. Grading and permanent erosion control should immediately follow clearing and grubbing. Possible treatment methods include hydromulching and/or seeding with native species of grasses, sedges, ferns, shrubs and trees; topsoil application; stone blankets; or special treatments in problem areas. The area of excavation, borrow, and embankment work shall not exceed the ability to meet the schedule for finish grading, mulching, seeding, and other permanent erosion control work.
- Use proper excavation and embankment construction operations. This includes early installation of interceptor and toe of slope ditches, adequate roadway crowning to allow lateral drainage in both cuts and fills, maintaining side ditches in cut areas at a lower elevation than the main body of the cut, and proper embankment compaction. If natural elements rut or erode the slope, restore and repair the damage, with the eroded material where practicable, and clean up any remaining material in ditches and culverts.
- Implement proper road and drainage crossing construction practices. This minimizes sediment transport to surface waters from activities that disturb soil, rock and vegetation. Proper road design and construction can prevent road fill and road backslope failure. These failures can result in mass movements and severe sedimentation. Design of adequate road drainage prevents water from concentrating on road surfaces, thereby inhibiting saturation, which can lead to rutting, road slumping, and channel washout.
- Temporary control measures. These may be required if it appears pollution or erosion may result from weather, the nature of the materials, or progress on the work. Furthermore, if conditions prevent immediate scheduling of treatment, temporary control measures will be required between work stages.

- A system of non-structural and structural erosion and sediment controls helps to reduce adverse impacts associated with unavoidable erosion and soil loss during road construction activities. Erosion controls reduce the amount of sediment transported off-site, thereby reducing the need for sediment controls. Erosion controls used in conjunction with sediment controls can reduce the size of sediment control structures and associated maintenance, thereby decreasing overall treatment costs. Below is a list of non-structural controls.
  - Schedule grading and clearing to avoid high rainfall events.
  - Phase construction clearance such that only the area under construction is exposed.
  - Clear essential areas only and keep adjacent areas undisturbed.
  - Retain natural drainage systems.
  - Locate potential polluting sources away from areas that drain directly into waterways.
  - Keep construction traffic to existing roads and disturbed areas of construction activity.
  - Protect the natural vegetation from damage by construction equipment.

- Stockpile and protect salvageable topsoil or soil for use in reclamation of cleared surfaces and to prevent erosion.

- Structural controls protect watersheds and associated natural resources by design. These controls prevent the formation or advancement of rills and gullies; reduce flow velocity in watercourses or provide structures capable of withstanding high flow velocity; stabilize the grade and control cutting in natural or artificial channels; convey water from one elevation to another; divert water away from unstable slopes; and filter and retain sediment. Three categories of structural controls are listed: vegetation, diversions and sediment retention.
  - Structural Controls – Vegetation
    a. Mulch/Mats
    b. Sodding
    c. Filter strips
    d. Grassed waterways and outlets
  - Structural Controls – Diversions
    a. Runoff interceptor trench or swale
    b. Diversion dike
    c. Level spreader
  - Structural Controls – Sediment Retention
    a. Siltation or filter berms
    b. Silt fences
    c. Sediment barriers
    d. Sediment basins
    e. Rock-lined ditch or swale

- *Contamination due to Spills or Hazardous Materials.* Develop and implement a Spill Prevention, Control and Countermeasures (SPCC) plan as discussed under the mitigation measures in Section 5.1.6 – *Debris and Hazardous Materials*.

5.1.3 Seismic and Geological Characteristics

Potential Impacts. Other than a demand for quarried construction materials, the Proposed Action is unlikely to have an impact on the area's geological characteristics. The Proposed Action will not add appreciably to the human risk due to seismic events. Seismic and geologic hazards will always exist and humans have little control over the frequency and intensity of these natural events. However, bridges and roads can be designed to reduce the threats to humans resulting from these natural events. Design standards for bridges and roads will need to fully take into account the area's seismic, liquefaction, and geological fault conditions.

According to the Mining Agency in Aceh, the Proposed Action area is well-suited geologically for the development of the road. Some materials will need to be brought in for use as road substrate in the lowland areas. However, the Ministry believes these materials are readily available in the area.

Mitigation Measures. In order to minimize and avoid impacts to seismic and geologic characteristics, the D-B contractor will implement standard BMPs including, but not limited to:

- Construct slope stabilizers consisting of riprap or retaining walls to control or prevent landslides.
- Minimize the impacts from earthquakes by incorporating appropriate seismic features in the design and construction of roads and bridges in earthquake prone areas.

5.1.4 Hydrology and Surface Water Quality

Potential Impacts. Potential impacts to hydrological conditions and water quality resulting from road reconstruction may include:

- *Surface Hydrology.* Surface hydrological impacts could occur based on roadway design or construction activities. Impacts would be associated with exacerbated erosion and sedimentation during construction or from impaired hydrologic flow based on the placement of water crossings and drainage structures. In addition, the location of ancillary construction activities could similarly impair surface hydrology. The Proposed Action is expected to result in minimal alterations to hydrological systems. The maintenance of the existing road, water crossings and rebuilding the two bridges will be maintaining the existing hydrological systems. There could be minor changes in order to minimize flooding of the road or from the placement of the bridge foundations. However, any resultant alterations would be localized and ultimately inconsequential to the overall function of the natural hydrological system. For the new 10-km road alignment, there would be some alterations due to the increased size of the road and the impervious surface created. As with the maintenance, the impervious surface created by road pavement will increase localized runoff and decrease total time of concentration; however, these effects would be insignificant in the context of the entire system.

- *Water Quality.* Runoff, and its effects on water quality, is one of the main concerns with any road construction project. Adverse impacts from changes in water quality may occur at considerable distances from the actual area of activity. Pollutants originating from a construction area could be carried by water flow (such as by streams and rivers) and distributed down-slope and down-current of the activity area. These indirect impacts could potentially continue in the long term after construction and during operation of the road. Secondary impacts from erosion and sediment transport may include oxygen depletion, nutrient enhancement, pH reduction and habitat alteration. The roadway design and the implementation of control measures that prevent the transport of pollutants and sediments can influence the degree and severity of potential impacts to water quality.

  Short-term impacts to water quality during construction activities (e.g., during grubbing and grading) typically generate stream water impacts such as increased turbidity. Other impacts to water quality from clearing activities include deposition of fine sediments; increased organic debris; increased stream flow, harmful effects in receiving waters from the transportation of nutrients such as nitrogen and phosphorus; and contamination of water bodies from releases of fuels, oils, and coolants from construction sites and equipment.

Long-term impacts to water quality are anticipated from pollutant sources such as vehicles, windborne dust, and storm water runoff. Accidental spills of oil, gasoline and other materials may also contribute pollutants on a less frequent basis. Pollutant constituents and concentrations are influenced by traffic characteristics, atmospheric conditions and location-specific conditions.

- *Wetlands*. As discussed in Section 4.0 – Affected Environment, the wetlands are outside of the Proposed Action area. Wetland vegetation, hydrology, and soils have been significantly disturbed by the December 2004 tsunami. Inadequate road designs could impair hydrologic flow and impede the wetlands from naturally recovering. However, there are no significant wetland areas in the vicinity of the Proposed Action.

- *Subsurface Hydrology*. No impacts to groundwater resources are anticipated as a result of the Proposed Action assuming good engineering and construction practices are utilized. There are likely to be wells and hand pumps in the vicinity of construction camps and other ancillary activities.

- *Flooding*. As discussed under Section 5.1.1 – *Topography*, a primary hydrological concern is the placement of stream crossings to ensure that they do not impair formation of new river channels; and conversely, that new river channels and floodplains do not impair the maintenance of new stream crossings.

- *Riverbed and Fisheries Sediments*. As discussed previously, rivers appear to be re-forming in the highly silted environment. Much of this reformation is likely to occur during the floods in the rainy season as the systems "flush out" excess sediment.

  Within the vicinity of the Proposed Action, there may be aquaculture beds or *tambak*. Communities are working to re-establish many of these *tambak* and increased sediment from erosion or flood events could hamper these efforts and impair these aquaculture beds.

Mitigation Measures. In order to minimize or avoid impacts to hydrology, the D-B contractor shall implement standard BMPs including, but not limited to the following:

- *Surface Hydrology*. Incorporate mitigation measures identified in Section 5.1.1 – *Topography* and Section 5.1.2 – *Soils*, addressing erosion concerns, as well as the following:
  - Include appropriate drainage structures in the roadway design to ensure that surface water hydrology, hydrology for wetlands, and floodplain protection is not impaired.
  - Design bridges and other water crossings so that they do not impair development of river channels and do not substantially obstruct water flow, flow patterns and velocities.
  - Restrict the clearing of riparian habitat to the immediate area of the crossing and minimize disturbance of the stream bank and streambed.

- Use small, temporary check-dams only for intermittent streams, providing no upstream damage would occur.
- Intercept eroded material via sandbags or temporary berms with drainage pipes before it reaches streams and river crossings.
- Provide stone or rip-rap protection between catch basin outlets and the stream.
- Dispose temporary bridge construction supports as soon practicable to prevent obstructed water flow.

- *Water Quality.*
  - Monitor water quality during construction for short-term impacts. Among other things, field measurements and sampling shall be conducted once a month during construction. Data will be subject to laboratory analysis and results will be compared with applicable Indonesian water quality guidelines/standards.
  - Implement environmentally conscious roadway design as well as erosion, sedimentation, siltation and runoff control for long-term impacts. Mitigation of potentially adverse impacts to water quality due to runoff is discussed in more detail in Section 5.1.1 – *Topography* and Section 5.1.2. – *Soils*.
  - The CSC shall ensure that surface water quality monitoring is conducted in compliance with the provisions set forth in the UPL.

- *Wetlands.* No mitigation is required since there are no significant wetlands in the area of the Proposed Action.

- *Subsurface Hydrology*.
  - All ancillary features shall be located and designed to ensure there are no impacts to subsurface hydrology.
  - Coordinate with the GOI and appropriate local agencies and community leaders when construction camps plan to draw from existing wells or hand pumps to ensure that the camps do not draw water at a large enough volume as to impair the subsurface hydrology.

- *Flooding*. BMPs identified for surface hydrology would address floodplain hydrology as well.

- *Riverbed and Fisheries Sediments*.
  - Incorporate proper drainage during design and construction to ensure that rivers can reform properly.
  - Design and construction activities will incorporate appropriate erosion and sediment control measures to minimize impacts to any *tambak* located within the vicinity of the Proposed Action, especially where the community has or is actively in the process of re-establishing the *tambak*.
  - Design bridges and stream crossings to enable fish passage and to maintain natural in-stream structures, such as large culverts.
  - Design bridges and stream crossings so they do not impair navigation of fishing vessels on the waterways.

5.1.5 Climate and Air Quality

Potential Impacts. Potential air quality impacts are likely in both the construction and operational stages of the Project.

- *Climate Change*. As stated above, Indonesia's tropical forests play an important role in the GOI's plan for preventative measures to minimize climate change. No direct impacts to climate are anticipated as a result of the Proposed Action. Minimal to no deforestation will occur as a result of the Proposed Action as it will entail maintenance of the existing unpaved road, and the new 10-km segment will not traverse any primary forests. Therefore, it is anticipated that the Proposed Action will not contribute to significant cumulative impacts of increased illegal logging.

- *Construction Stage – Air Quality***.** Short-term impacts to air quality during bridge and road construction are anticipated due to emissions from construction vehicles and from fugitive dust generated in and around construction sites. Construction activities anticipated to generate fugitive dust include land clearing, cutting and filling, stripping, and laying down of the various courses. Activities related to the production of road-building material (i.e., asphalt, aggregate for asphalt, base course crushed stone and subbase course crushed stone) are also anticipated to generate air quality impacts.

- *Operational Stage – Air Quality*. Potential long-term air quality impacts during the road's operational stage are most appropriately measured against a "base case" that estimates the likely ambient air quality without the Proposed Action (taking all other foreseeable changes into account) versus the most likely situation with the Proposed Action. With implementation of the Proposed Action, future traffic volume is anticipated to remain relatively similar to present traffic volume, thus it is anticipated that there will be only minor changes to air quality due to increased traffic volume. Furthermore, the Proposed Action is merely the reconstruction of two bridges and a realignment and reconstruction of a previously existing roadway segment, as well as maintenance of temporary roads and water crossings, thus long-term impacts to air quality should not vary significantly from what occurred prior to the tsunami.

Mitigation Measures. In order to minimize or avoid impacts to climate and air quality, the D-B contractor shall adhere to the following guidelines and implement standard BMPs including, but not limited to the following:

- *Climate Change*. Avoid forested areas that would require clearing when choosing the alignment of the new 10-km road corridor to the full extent practicable,.

- *Construction Stage – Air Quality***.** Potential air quality impacts due to emissions and dust generating activities will be mitigated through avoidance strategies combined with construction controls and monitoring. Ensure that construction and construction-related activities will comply with air quality standards, emission quality standards, and motor vehicle exhaust emission limits as established by the GOI such as. but not limited to:
    - Asphalt and hot-mix plants will be located at least 500 m away from sensitive receptors such as schools, hospitals, and sensitive/important habitats.

- Operators will be required to install emission controls.
- Gas and diesel engines will be properly maintained and operated.
- Blasting, if any, will be carried out using small charges.
- Dust-generating items will be conveyed under cover.
- Machinery and equipment will be fitted with pollution control devices, which will be checked at regular intervals to ensure that they are in working order. Best available pollution control technologies will be required.
- Open burning will be prohibited.
- During dry conditions, which could promote fugitive dust, water sprays/sprinklers will be used as a control measure to reduce dust emissions.
- Requirements for water-spraying, covering, and related dust control measures, and the proper use of solvents and volatile materials will be incorporated in the contract provisions.
- Routine air quality monitoring will be required during the construction phase of the Proposed Action in areas of high potential impact such as asphalt plants and construction camps.
- Paving should be conducted as soon as practicable after the subbase and base material are laid down.
- Develop and implement a Fugitive Dust Control (FDC) Plan. The plan shall focus on reducing fugitive dust in order to minimize short-term air quality impacts to construction workers and to adjacent populated areas. Where no populated areas are in close proximity, control measures may focus more on safety equipment for construction workers (such as face masks). When work is conducted near populated areas the plan will identify activities that cause dust and which could affect people living in adjacent areas; identify measures to prevent fugitive dust; provide for inspections to ensure dust prevention measures are successful; identify staff responsible to implement the plan; and include procedures for tracking and reporting of air quality issues related to fugitive dust and how incidents were mitigated. The plan will include, but not be limited to, the following measures:
    - Trucks carrying soil, sand, or stone will be covered with tarps to avoid spilling.
    - Potential significant adverse impacts to adjacent residents or site employees during construction will be mitigated by either discontinuing activities until favorable conditions are restored, or, if warranted, sites may be water-sprayed to prevent dust generation, particularly at crushing and screening plants.
    - Pre-construction monitoring of existing ambient air quality will be undertaken in conjunction with each construction package in areas of high risk for worker or public health to provide a baseline for air quality impacts during construction.
- In the short term, air quality will be monitored during construction as per the provisions set forth in the UPL. Among other things, field measurements and sampling should be conducted once a month during construction. Data would be subject to laboratory analysis and results compared with applicable Indonesian air quality guidelines/standards.

- No construction activities may commence until the CSC has accepted and provided written approval of the FDC plan.
- Comply with the air quality monitoring program as per the provisions set forth in the UPL.

5.1.6 Debris and Hazardous Materials

Potential Impacts. When construction occurs in areas where natural debris, urban debris and potentially hazardous materials need to be removed from the construction area, materials will be disposed in such a manner as to minimize additional impacts from the disposal.

The construction of highways and bridges can involve the use of hazardous materials. The use of these materials can adversely impact the environment through inadequate storage, improper application, air emissions of volatile chemical compounds, and accidental or deliberate releases. There also exists the potential for generation of toxic waste.

Mitigation Measures. The D-B contractor shall adhere to the following guidelines and implement standard BMPs including, but not limited to:

- *Natural Debris*. Natural debris will be used for road construction or offered to the adjacent community for reuse to the full extent practicable. Where the natural debris is unsuitable for reuse, the material will be disposed in a location so as not to interfere with road construction activities or result in other inadvertent impacts such as, but not limited to, impairing the areal hydrology.

- *Urban Debris*. Urban debris will be used for road construction or offered to the adjacent community for reuse to the full extent practicable. Where the debris is not suitable for reuse or has the potential to be contaminated, these materials will be disposed of in accordance with GOI regulations and in consultation with the GOI.

- *Hazardous Materials.*
  - The Proposed Action should avoid to the extent feasible, the procurement, excessive storage, and disposal of hazardous materials, including, for example, ,petroleum products, VOCs such as solvents and paints, explosives and blasting materials, acutely hazardous materials like chlorine gas for water treatment, and pesticides.
  - If hazardous materials are procured, the minimum amount should be procured. Perishable construction materials, such as paints, should be procured incrementally to reduce spoilage of unused materials.
  - Hazardous materials should be managed in accordance with GOI standards and other best management practices.
  - Appropriate worker training, manifest and record keeping must be performed. Ensure that all employees follow appropriate design and management procedures concerning hazardous materials, including hazardous materials training, adhering to the Site Safety and Health Plan (SSHP), posting and access of material safety data sheets, storage, use, monitoring, and record keeping.
  - If pesticides and other chemicals designed to kill animals and plants are procured or used, develop and implement an approved Pesticide Evaluation Report and

Safe Use Action Plan (PERSUAP) before purchase in accordance with 22 CFR 216. If pesticides and other chemicals are to be used, usage will be controlled and only the least amount necessary will be applied to accomplish the desired action.

- Develop and implement an SPCC plan for the duration of the Proposed Action. A copy of the SPCC plan with any updates shall be maintained at the work site. The SPCC plan shall identify construction planning elements and recognize potential spill sources at the site; outline responsive actions in the event of a spill or release, and identify notification and reporting procedures; and outline management elements such as personnel responsibilities, project site security, site inspections, and training. Applicable equipment and material designated in the SPCC plan shall be maintained at the jobsite. Additional measures that should be included in the SPCC include:
  - Require on-site spill response equipment adequate to deal with the full range of possible spills and for the types of hazardous materials being used and stored at the site.
  - Identify sensitive shorelines for protective booming and the locations of boom anchors and attachment points in advance. Provide for practice drills to adequately train personnel in the deployment of booms.
  - Provide for sufficient containers/storage areas to deal with the huge quantities of oily waste and oily water that would result from cleaning up a large marine spill.
  - Outline final cleanup and restoration activities.
  - Contain a brief response manual that can be quickly read and easily used during training exercises and real response events. (The manual should be a single volume that contains response instructions in bullet format, a response flow chart, a map identifying sensitive resources and features, a list of contact telephone numbers and other relevant information).
- Staging areas, where fuel and other sources of petroleum, oil, and lubricants are stored and where equipment is refueled, shall be located away from coastal waters and wetlands. On-site fuel storage and refueling should be minimized, and secondary containment measures such as berms and absorbent materials will be used at fueling points. Under no circumstances will refueling occur over or along streams or riverbanks.
- A spill kit will be present at staging areas to contain any fuel releases. The flow of product shall be stopped at its source, the released product contained, and the site cleaned up to the extent feasible consistent with the respondent's training in hazardous materials emergency response, should a fuel release occur.
- No procurement or use shall take place until the CSC has accepted and provided written approval of the PERSUAP plan.
- No construction activities shall commence until the CSC accepts and provides written approval of the SPCCplan.

5.2 NATURAL/BIOLOGICAL RESOURCES

5.2.1 Flora

Potential Impacts. The area of the Proposed Action has been largely denuded of vegetation by the tsunami. Construction activities may impact some vegetation within the proposed 10-km road corridor, adjacent to the existing roadway, and at borrow areas, quarries, worker camps, and equipment staging areas. Vegetation could be affected by the roadside activities, bridges, or ancillary features such as asphalt plants, construction camps, and borrow areas. In keeping with the goal of locating the road alignment as far away from the shoreline as practicable, some secondary forest tree removal may be required for the proposed 10-km road corridor when the road is cut near or into the mountainside. Other impacts may include introduction of invasive plants species that out-compete native species or upset the existing native species habitat equilibrium.

Mitigation Measures. Impacts to flora during construction will be mitigated through proper siting of features. To minimize or avoid potential impacts, the D-B contractor shall implement standard BMPs including, but not limited to the following:

- Align the road along existing road corridors and other areas already denuded of vegetation to the extent practicable.
- Minimuze the clearing of trees and forests to the extent practicable.
- Replant disturbed areas after construction. To the extent practicable, native species shall be used for re-vegetation efforts. If native species seed source is unavailable, non-invasive plant species shall be used. Plant species should also be as resistant to grazing as is practicable.
- Implement monitoring during construction, especially during clearing and grubbing operations to ensure compliance with applicable environmental protection measures.

5.2.2 Fauna

Potential Impacts. The areas in the vicinity of the Proposed Action around Kr. Raba and Kr. Lambeseu bridges and the temporary unpaved road are largely denuded of vegetation and wildlife habitat. Vegetation and wildlife habitats of other Proposed Action areas are largely intact. Based on field investigations discussed above in Section 4.0, the only species of concern are sea turtles, egrets, and terns. The Proposed Action is not expected to result in significant adverse impacts to the areal fauna and wildlife habitat.

- *Habitat Loss*. Realignment of the road segment further from the shoreline may disturb some wildlife habitats though with no significant impact to egret or tern habitats. Ancillary functions such as borrow areas and quarries may also result in some habitat loss. Lowland areas where the majority of the Proposed Action will occur are not likely to support sensitive fauna.

- *Sea Turtle Habitat*. Sea turtles are known to frequent the sandy beaches in the vicinity of the Proposed Action. The tsunami has eroded up to 250 m of beach, limiting sea turtle habitat along Sumatra's western coast. With the loss of prime habitat areas, additional impacts to these beaches could have an exponential impact on the sea turtles. Specific to the Proposed Action, the sandy beach near the km 14 road marker, proximal to the

proposed reconstruction of Kr. Raba Bridge, is a known sea turtle habitat. The Proposed Action may require some shoreline stabilization where the existing road is threatened by erosion. Some small-scale shoreline activities may occur during bridge reconstruction, which may result in some direct and indirect loss of sea turtle habitat. .

- *Habitat Fragmentation*. Habitat fragmentation occurs when a road cuts through an ecosystem, fragmenting an area into weaker sub-units that are not able to fully support the species population. For the Proposed Action, habitat fragmentation will be minimal since the proposed 10-km segment will mainly follow an existing road, and the temporary unpaved road to be maintained is already largely denuded of vegetation.

- *Wildlife Migrations*. Most animal species tend to follow established patterns in their daily and seasonal movements. A road traversing a wildlife corridor could result in either cessation of its use because animals are reluctant to cross the road, increase in mortality due to collisions, or delay in migration. For the Proposed Action, impacts to wildlife migration will be minimal since the proposed 10-km segment will mainly follow an existing road, and maintenance will occur on and along a currently utilized temporary unpaved road.

- *Accidents Involving Wildlife*. Traffic accidents involving wildlife attempting to cross the road are a potential impact faced by road projects. No documentation is readily available on traffic accidents involving wildlife in the vicinity of the Proposed Action. However, the Proposed Action is not anticipated to significantly increase traffic volume.

Consideration will be given to potential indirect wildlife impacts as follows:

- *Ecological Disequilibrium*. Opening a transport corridor can result in the introduction of new plant and animal species along the roadway, upsetting the dynamic balance that exists in the ecosystem and altering predatory-prey relationships. In addition, construction activities may disturb seasonal mating patterns. Because most of the Proposed Action will occur in existing road corridors, it is not expected to result in a significant increase in ecological disequilibrium.

<u>Mitigation Measures</u>.

- *Habitat Loss*. In order to minimize or avoid impacts to habitat, the D-B contractor shall implement standard BMPs including, but not limited to the following:
    - Re-vegetate disturbed areas with non-invasive species using native species to the full extent practicable when construction is completed.
    - Avoid protected egret and tern habitats.
    - Restore borrow areas and ancillary functions after construction in compliance with the accepted BERP..

- *Sea Turtle Habitat.* In order to minimize or avoid impacts to sea turtle habitats:
    - Confirm the presence of, or the re-establishment of sea turtle habitat on any sandy beaches in the vicinity of the Proposed Action prior to undertaking any construction activities in the area.

- At areas where sea turtle habitats are known or suspected such as the beach area proximal to the Kr. Raba Bridge:
  - Restore and replenish any sand disturbed by construction activities. No sand removal shall be permitted from this area.
  - Retain a biologist for advice regarding measures to avoid disturbance of the habitat unique to this location, and to implement a monitoring program to identify the beginning of the typically 6-month sea turtle nesting season at this location. Most female turtles return to the nest on the beach where they were born (natal beach) and it is conceivable that the tsunami activity did not affect the nesting cycle of the sea turtles from this beach.
- Minimize disturbance to the beach by construction activity or equipment during normal construction activity. Barriers, signage and work practices shall be instituted to prohibit the movement of equipment and work personnel on the beach during the sea turtle nesting period once identified. As a further precaution, no storage of construction materials or equipment shall be allowed on the beach at any time.

- *Ecological Disequilibrium*. To minimize or avoid ecological disequilibrium, implement standard BMPs including, but not limited to the following:
  - Avoid construction periods that would adversely impact seasonal mating patterns of sensitive species, where practicable.

5.2.3 Sensitive Habitat and Protected Areas

Potential Impacts. As mentioned in Section 4.2.3, six terrestrial protected areas of international importance have been identified within the tsunami impact area. None of these designated protected areas are within the immediate vicinity of the Proposed Action, and therefore, impacts to these protected areas are not expected.

The goal of the Proposed Action is to relocate the proposed 10-km road as far from the shoreline as practicable. Relocating the road closer to the mountains may require some clearing of forested areas. Clearing of forested areas will be avoided to the full extent practicable; however, if any impacts to sensitive habitats are unavoidable, all approvals necessary will be first obtained from the GOI before such activities occur.

Mitigation Measures.

- *Clearing in Protected Area*s. In order to minimize or avoid impacts to sensitive habitats, the D-B contractor shall implement standard BMPs including, but not limited to the following:
  - Locate ancillary construction activities away from sensitive habitats and protected areas to avoid species disturbance.
  - Check construction equipment, machinery and containers transported from urban areas and abroad to ensure that they are not harboring alien and/or nuisance species that may affect sensitive habitats.
  - Abide by all UKL-UPL requirements.

5.2.4 Coastal and Marine Resources

Potential Impacts. Activities that could impact coastal resources are primarily indirect impacts including increased sedimentation flowing into coral reefs and coastal areas and spillage or improper disposal of hazardous materials. The sedimentation would be produced by erosion during construction. In addition, non-point source storm water runoff during the operational phase could potentially introduce contamination or excessive fresh water that could adversely impact coral reefs and other habitat.

A potentially sensitive coral reef is present offshore near the mouth of the Kr. Raba River and where bridge reconstruction is proposed. Coral reefs are also present offshore in other areas of the Proposed Action. The current condition of these coral reef areas is not known for certain; however, they likely have incurred severe tsunami-related damage. The GOI has assumed the coral reefs around Lhok Nga-Banda Aceh to be destroyed.[44] Construction of bridges and other water crossings have the potential to impact water circulation patterns, water current velocities, and benthic habitats as a result of sand and sediment scouring. Any erosion resulting from the Proposed Action is not anticipated to cause significant impacts to coral reefs as compared to the sediment damage cause by the tsunami. The Proposed Action may require some shoreline protection measures that can potentially impact coastal and marine resources. Implementing appropriate mitigation measures should reduce any temporary, construction-related impacts to less than significant levels.

Mitigation Measures. In order to minimize or avoid impacts to coastal and marine resources, the D-B contractor shall implement standard BMPs including, but not limited to the following:

- *Erosion and Sedimentation*. These are discussed in Section 5.1.2 – *Soils*.
- *Hazardous Materials*. These are discussed in detail under Section 5.1.6. – *Debris and Hazardous Materials*.
- *Storm-water Runoff*. These are discussed in Section 5.1.2 – *Soils*.
- *Bridges and other water crossings*. Bridges and water crossings shall be designed and constructed to minimize or prevent alterations to the marine environment.
- *Road Construction/Maintenance*. No dredging of coral beds will occur, and no in-water coral material will be used for road construction or maintenance.

5.3 OTHER ENVIRONMENTAL CONCERNS NOTED BY 22 CFR PART 216

5.3.1 Land Use/Development Policies and Controls

Potential Impacts. Potential land use impacts vary between the construction and operational phases of the Proposed Action. Potential construction impacts include:

[44] Republic of Indonesia, Table 2.11: Location & Level of Damages to Coral Reefs.

- *Construction Phase – Creation of construction camps*. Construction workers constitute a temporary land use change and raise issues related to activities such as unauthorized tree felling for firewood even when alternative fuel is available, poaching of edible animals and birds of the locality in spite of prohibitions, poor sanitation arrangements, and improper methods used for disposal of solid wastes and effluent.

- *Construction Phase – Traffic disruptions and detours on existing land uses*. Construction activities will require detours and intermittent traffic disruptions. The placement of detours could result in short-term land use impacts and long-term impacts if the detours are not appropriately sited or the areas are not restored after the detours are removed.

- *Construction Phase – Impacts resulting from base yard locations and operations*. The temporary siting of base yards and operations may impact land use in the short-term if the locations are sited in areas important for agricultural or other activities. If the areas are not restored after base yards are removed, long-term land use may be affected.

- *Operational Phase – Changes to land use*. For the Proposed Action, indirect changes to land use are expected to be minimal. The proposed 10-km road's realignment further inland, closer to the mountains may result in some relocation of the community and agricultural practices. In addition, other indirect impacts need to be considered including, but not limited to, how the Proposed Action will be integrated with Phase II activities along with consideration for access roads and intersections that may be attached to the road later. Land acquisition to establish the road ROW is a major concern and is being addressed by the GOI.

Mitigation Measures. In order to minimize or avoid impacts to land use and development policies and controls, the D-B contractor shall implement standard BMPs including, but not limited to the following:

- *Construction Phase – Creation of construction camps*. Coordinate construction activities with neighboring land users. Construction operators will be required to attend to the health and safety of their workers, maintain and cleanup campsites, and respect the rights of local landowners. If located outside the ROW, written agreements with local landowners for temporary use of the property will be required. Restore sites to a level acceptable to the property owners within a predetermined time period.

- *Construction Phase – Traffic disruptions and detours on existing land uses.*
  - Diversions and accommodations of traffic during construction will require approval of the CSC.
  - Consult with adjacent landowners to minimize interference with landowner activities to the full extent practicable.

- *Construction Phase – Impacts resulting from base-yard locations and operations*. The mitigation measures identified under construction camps shall be applied to base yard as well as other ancillary functions and facilities.

- *Operational Phase – Changes to land use*. As stated earlier, many of the coastal communities were destroyed by the tsunami and will likely relocate based on the location of road improvements and realignments. Villages may have little option but to redevelop in areas that were once agricultural lands or other land uses. The GOI, through the BRR and other agencies, is working with local villages on the planning of new villages and their associated impacts on land use.

5.3.2 Energy and Conservation

Potential Impacts. For the Proposed Action, the activities will improve road transportation but at such a small level that any positive or negative impacts to energy use and consumption are likely to be minimal. Furthermore, the Proposed Action is merely a reconstruction of two bridges, a previously existing roadway and maintenance of temporary roads and water crossings. Long-term impacts to energy use should not vary significantly than from what occurred prior to the tsunami.

Mitigation Measures. None

5.3.3 Use of Natural/Depletable Resources

Potential Impacts. Reconstruction of roads and bridges could facilitate economic development of Sumatra's other natural resources in the long term, by improving transport. Of concern are resources such as "sweet or non-salt" sand, concrete, coral from offshore reefs, and substrate materials for road construction. The Proposed Action is at a small enough level however, that impacts to depletable resources should be minimal.

Mitigation Measures. See Section 5.2.4 – Coastal and Marine Resources.

5.3.4 Urban Quality/Design of the Built Environment

Potential Impacts. Activities related to the Proposed Action are relatively small in nature. The activities may influence growth proximal to the proposed 10-km road segment to be constructed, such as improving access and thereby contributing to economic recovery of areal villages. Overall urban growth is anticipated to be minimal. Land uses and potential impacts near the reconstructed facilities are discussed above.

Mitigation Measures. None

5.3.5 Historic and Cultural Resources

Potential Impacts. No intact historic or cultural sites have been identified in the Proposed Action area. If these resources are inadvertently discovered in the vicinity of the Proposed Action, potential direct and indirect impacts could occur from the construction and operation of the road if the alignment cannot avoid these resources. The areal extent of potential impacts generally would be restricted to a relatively narrow linear band consisting of the road ROW and its immediate surroundings. Additional impacts may result from the siting of ancillary construction facilities.

Mitigation Measures. In order to minimize or avoid potential impacts to historic and cultural resources, the D-B contractor shall implement standard BMPs including, but not limited to the following:

- *Impacts to Known Resources*.
  - Confer with an archaeological specialist in the area to determine the likelihood of historic and cultural resources in the vicinity of the Proposed Action.
  - Conduct intensive surveys of areas that have been determined as having a high likelihood for historic and cultural resources prior to construction.
  - Coordinate with the GOI and implement mitigation measures as directed if historic and cultural resources are discovered, and impacts to the resources cannot be avoided through design and engineering measures.

- *Impacts to Unknown Resources.* Develop and implement an "inadvertent discovery plan." The plan will identify measures for monitoring during construction, develop procedures to be followed if there is an inadvertent discovery, and mitigate the impacts to any inadvertent discoveries. Contact USAID and GOI immediately if inadvertent discoveries occur, and implement the measures identified in the unanticipated discovery plan.

- No construction activities will commence until the CSC has accepted and provided written approval of the inadvertent discovery plan.

5.3.6 Reuse and Conservation

Potential Impacts. As discussed under Section 5.1.6 – *Debris and Hazardous Materials*, the Proposed Action will beneficially use natural and urban debris to the full extent practicable. Unused materials will be offered to adjacent communities for reuse. Reasonable efforts shall be made to conserve the use of construction materials and to minimize production of construction waste.

Mitigation Measures. To promote reuse and conservation, the D-B contractor shall implement the following BMPs:

- Perishable construction materials should be purchased incrementally to reduce spoilage of unused material.
- Durable, long-lasting materials that will not need frequent replacement shall be used to reduce the amount of construction waste generated over time.
- Provisions shall be made for the reuse or recycling of waste materials.

5.4 ADDITIONAL ENVIRONMENTAL CONCERNS NOTED FOR CONSIDERATION

5.4.1 Socio-Economic Considerations

Potential Impacts. In the short-term, potentially adverse socio-economic impacts may occur to communities and farmers that have been in the process of re-establishment. If the road is either realigned away from or widened into areas where energy and resources have been expended for re-establishment, an impact may occur to those that have expended the resources. Impacts may

also occur with land acquisition. The GOI is working with land use agencies and communities on issues of determining land ownership and land acquisition associated with the Proposed Action.

The Proposed Action is anticipated to have positive short-term and long-term impacts. In the short-term, unskilled and semi-skilled labor from nearby villages and districts may be recruited to work on the Proposed Action. Furthermore, other persons that may be unemployed due to the direct and indirect impacts of the tsunami may find temporary employment with the Proposed Action. In the long term, construction of the proposed 10-km road and maintenance of the existing temporary road will contribute to improvement of the regional economy impacted by the December 2004 tsunami.

Mitigation Measures. In order to minimize and avoid adverse impacts, the D-B contractor shall implement standard BMPs including, but not limited to the following:

- Consider where houses or agricultural fields have been re-established or are actively in the process of re-establishing to minimize impacts to these areas to the full extent practicable. If feasible, and considering other engineering and environmental objectives, the road alignment should remain adjacent to these areas.
- Work closely with P2JJ and other GOI agencies to address community concerns in determining the final road realignment by preparing and implementing community outreach and public involvement plans.
- Repair community property damaged during road construction or maintenance.
- Hire members of the local community to the extent practicable. Recruitment of personnel shall be accomplished within a transparent process to allay public criticism and negative perceptions of the project. Salary structures should be standardized and distinctions should not exist between workers of the same level.

5.4.2 Public Health and Education

Potential Impacts. Negative short-term impacts may occur from potential contamination of water supplies from construction camps, additional air pollution and noise levels during construction, and potential disease transmission including hygiene issues and STDs among construction crews. Construction camps may adversely impact water quality and sanitation if sanitation facilities are not properly sited, installed or managed, and sewage from the construction camps is allowed to enter the surrounding surface or groundwater without appropriate treatment. Section 5.1.5 – *Climate and Air Quality* discusses potential impacts and mitigation measures from air pollution and Section 5.4.4 – *Noise*, addresses potential impacts and mitigation measures from noise impacts.

The Proposed Action is expected to have long-term and cumulative positive effects on public health due to improved response times in emergency situations and improved access to health care facilities. Potential negative cumulative effects include an increase in illicit activities such as human trafficking and child labor as a consequence of the influx of people and disposable income to otherwise impoverished areas.

Mitigation Measures. To mitigate potential impacts to public health, the following measures shall be implemented:

- *STD Awareness and Education*.
  - The D-B contractor shall coordinate with USAID in the establishment of an STD awareness program for its employees as part of the requisite Site Safety and Health Plan (SSHP).
  - USAID will develop and implement its STD awareness and education program and services to assist affected communities prior to and during the construction process.

- *Provide adequate health care, water, and sanitation.* The D-B contractor will provide:
  - Adequate health care and immunizations for its employees.
  - Potable water for employees and camps.
    - Drinking water will be tested periodically in general accordance with GOI water quality standards.
  - Adequate sanitation and personal hygiene facilities.
    - If wastewater is to be discharged into a potential water supply, treated wastewater must be tested while in process and at the discharge location, initially and periodically for sanitary engineering parameters, including coliform bacteria, to assure that the water meets appropriate wastewater discharge standards.
    - Wastewater discharged to a receiving water body should be (sufficiently treated beforehand to avoid adversely affecting sensitive aquatic or marine life,) de-chlorinated before discharge to avoid adverse effects on chlorine-sensitive aquatic life, and the outfall shall extend a sufficient distance and depth offshore.
    - Wastewater sludges should be tested prior to use as a soil amendment such as compost and compared to general industry and GOI standards to assure that hazardous constituents are not use-limiting.
    - Assure appropriate design and management procedures concerning treated wastewater and sludge quality testing and reporting are followed.

- *Solid Waste Disposal*. The D-B contractor shall be responsible for collecting all solid waste generated from road reconstruction activities, including waste generated at temporary construction camps. Solid waste shall be collected at regular intervals and disposed of at a GOI-approved solid waste management units. If no such units exist, (refer to discussion in Section 4.1.6 – Debris and Hazardous Materials), the D-B contractor shall work with the GOI to establish an appropriate facility that meets internationally accepted standards.

- *Education*. The D-B contractor shall develop and implement an initiative to encourage children and young adults to pursue formal education or vocational training at higher education or community learning centers with the objective of eventual gainful employment by the contractor.
  - The D-B contractor shall not hire underage workers in association with the road construction.

5.4.3 Safety

Potential Impacts. Potential safety issues are as follows:

- *Civil unrest and crime*. Construction activities in areas with potential civil unrest may place construction workers at risk. While no specific baseline information for crime in Aceh is available, it is likely that increased temporary populations associated with the Proposed Action will increase the potential for petty crime.

- *Conflicts with pedestrian and NMT*. Construction and operational activities could impair pedestrian and NMT safety in the area of the Proposed Action. During construction, large construction vehicles have restricted peripheral vision and may inadvertently risk the safety of construction workers or other pedestrians and NMT traffic. During operation, improved roads will facilitate increased traffic speeds and thereby increase the potential for accidents with other motorized vehicles, pedestrians and NMT.

- *Traffic Safety*. Heavy equipment will be mobilized by road transport from Malahayati Harbor through Banda Aceh to the heavy vehicle storage area located at the construction base camp. Mobilization could potentially impact traffic flow and traffic safety, especially in Banda Aceh. Identified areas within Banda Aceh where traffic and traffic safety may be impacted are the Jambo Tape intersection, the Surabaya intersection, along Teuku Umar Street, near the Lambaro traditional market and near the Keutapang morning market.

- *Safety issues due to construction-related traffic impediments*. Diversions and detours are an inevitable impact of road and bridge construction. Diversions and detours that are inappropriately designed, marked or controlled can result in accidents for construction workers, other motorized vehicles, pedestrians and NMT.

- *Safety impacts due to excessive speed*. The Proposed Action can inadvertently and adversely affect road and bridge safety due to excessive speeds encouraged by improved road and bridge conditions.

- *Unexploded Ordnance (UXO)*. Because of the history of civil unrest in the area, there is the potential for UXO to be present in the area of the Proposed Action. However, no information has been identified to indicate UXO is likely to be encountered at a high frequency within the Proposed Action area.

- *Worker safety*. Construction activities often put workers, especially untrained, inexperienced, and inadequately protected workers at occupational safety risk.

- *Public Safety*. The public should be protected from unsafe practices during construction and operations and at ancillary construction activities such as construction camps, borrow areas, and staging areas during daytime and nighttime hours.

Mitigation Measures. To minimize or avoid impacts to safety, the D-B contractor shall implement standard BMPs including, but not limited to the following:

- *Civil unrest and crime*. Address security issues, logistics, and the need for security escorts for worker safety in the requisite SSHP. In addition, measures to educate workers and limit the potential for petty theft shall also be addressed in the SSHP.

- *Conflicts with Pedestrian and NMT.*
    - Identify and implement measures such as hard hats, signage, reverse lighting and beepers in the SSHP for worker safety.
    - Provide appropriate signage, traffic control personnel, fencing, crosswalks, etc. to protect workers, vehicles, pedestrians, and NMT during construction Special attention shall be paid to pedestrian and NMT safety near school zones, hospital clinics, and villages.
    - Institute appropriate safety measures into the roadway design and construction, including, but not limited to, appropriate signage, pedestrian walkways along bridges and road shoulders, turn-around areas, fencing, crosswalks, speed limits, and other traffic safety measures. Special attention shall be made to school zones, hospital clinics, and villages.

- *Traffic Safety*
    - Mobilization of heavy equipment will be limited to non-peak traffic hours to the extent practicable.
    - Provide a field officer to regulate traffic as warranted to facilitate mobilization of heavy equipment, particularly in urbanized or heavily trafficked areas.

- *Safety issues due to construction-related traffic impediments.* Address safety issues for construction workers and the public for diversions and detours in the SSHP. Provide a field officer to regulate traffic at crossings and contra-flow lanes.

- *Safety Impacts due to Excessive Speed.* Appropriate speed limits will be adhered to during construction when mobilizing through or operating within populated areas. Speed bumps may be used to control speeding along long stretches of roadway. Incorporate appropriate safety warnings and speed limits in the roadway design, especially in school zones, near hospital clinics, and in villages.

- *Unexploded Ordnance (UXO).* Develop and implement an "inadvertent discovery plan" in the event that UXO is discovered during construction activities. The plan will detail the minimum training for D-B contractor personnel to identify UXO, require appropriately trained and experienced personnel to monitor for UXO in high risk areas, measures to avoid UXO, and processes for responding to and safely removing a UXO hazard from the project area.

- *Worker Safety.*
    - Develop and implement an SSHP.
    - Provide periodic training, daily pre-work safety meetings, appropriate worker protection equipment, and ongoing real-time in-the-field monitoring of worker activities to improve worker awareness in safety.
    - Provide a safe working environment to the extent feasible.
    - Maintain daily site safety records on-site.

- Identifies exit strategies for prompt emergency medical care.
- Post proper signage in appropriate languages and symbols.
- Fence and close off work areas for worker safety including access procedures and trenching strategies.

- *Public Safety*.
  - Address public safety during road construction in the SSHP.
  - Post proper signage in appropriate languages and symbols.
  - Fence and close off areas to prevent public access.
  - Prevent unauthorized on-site access.
  - Public safety shall be addressed for both daytime and nighttime hours.
  - Implement on-site lighting, reflective coatings, and signs as appropriate.
  - Address public safety during road operation through design and engineering measures.
  - Public safety shall be addressed for both daytime and nighttime hours.

- The CSC shall:
  - Review and approve the SSHP prior to commencing with construction activities.
  - Review daily site safety records and accident reports.
  - Review and approve training and daily pre-work safety meetings.
  - Review and approve necessary detours and traffic re-routing schemes.
  - Review and approve the UXO inadvertent discovery plan prior to commencing with construction activities.

5.4.4 Noise

Potential Impacts. Potential noise impacts are identified in both the construction and operational stages as follows:

- *Construction Stage*. Short-term temporary impacts in the immediate vicinity of the Proposed Action may occur due to construction activities. Generally, this includes audible construction noise throughout the duration of the Proposed Action due to activities involving heavy equipment mobilization and use. The magnitude of impact, generally intermittent, will depend on specific types of equipment used, length of time, construction methods, and work schedules. Excessively noisy work is expected to shift from one location to another over the duration of the Proposed Action. Therefore, any potential receptor would not be exposed to construction noise over the course of the entire Proposed Action, but rather only during those periods when construction occurs within the vicinity of the receptor.

  Due to available mitigation measures and the temporary and intermittent nature of the work, construction noise impacts are not anticipated to be significantly adverse. Furthermore, short-term noise impacts are expected to be offset by the long-term benefits of a reconstructed coastal highway.

- *Operational Stage*. Noise sources during the operational stage generally include: vehicle noise, road noise, driver behavior, construction and maintenance, human activity,

vibration, wildlife disturbance, and incidental noises. As the Proposed Action is only the reconstruction of two bridges and a previously existing roadway segment along with maintenance of temporary roads and water crossings, long-term noise impacts during the operational stage are anticipated to be fairly similar to those that occurred along the coastal highway prior to the tsunami.

Mitigation Measures. The D-B contractor shall implement the following standard BMPs including, but not limited to:

- Limit construction noise during sensitive hours, including but not limited to, near schools and during school hours, near hospital clinics, near village areas, and near mosques during times of worship (e.g., Friday mid-day prayers).

- Design measures such as signs and speed reduction zones shall be incorporated to minimize noise during these sensitive hours as well.

- *Construction Stage*.
  - Incorporate provisions to mitigate potential noise and vibration impacts during construction, emphasizing: control of noise sources; site controls; time and activity constraints; community awareness through notification and signage in appropriate languages and symbols; and baseline and routine noise monitoring as part of construction supervision.
  - Provide noise control measures to protect construction workers' health and safety (e.g., provide ear protection for activities that exceed 90 dB).
  - When construction activity is to occur near sensitive receptors, job site requirements should include the use of carefully muffled construction equipment, quieted portable generators and diesel equipment, and the imposition of noise limits and curfew times. To the extent possible, heavy truck and equipment staging areas should be sited at least 200 m from sensitive noise receptors.
  - In the short term, noise impacts will be monitored during construction as per the provisions set forth in the UPL. Among other things, field measurements and sampling will be conducted once a month during construction. Data will be subject to laboratory analysis and results will be compared with applicable Indonesian noise pollution guidelines/standards.
  - The CSC shall ensure compliance with D-B contract provisions regarding noise control. Additionally, the CSC shall ensure that monitoring of noise impacts are conducted in compliance with the provisions set forth in the UPL.

- *Operational Stage*. Incorporate measures to minimize noise to primary noise receptors, paying particular attention to schools when children are present, hospital clinics, mosques or other religious structures during times of worship, and habitat for wildlife species of concern.

5.4.5 Other Infrastructure Systems

Potential Impacts. The Proposed Action will have little to no impact on infrastructure since the work is in the coastal lowlands where all infrastructure were lost or damaged by the tsunami.

Mitigation Measures. In order to minimize or avoid potential impacts to infrastructure, the D-B contractor will confirm the existence or non-existence of any utilities and other infrastructure such as, but not limited to, water supply, wastewater, water-harvesting, irrigation, electric power lines, petroleum pipelines, and other fixed utilities or features in either a planned or inadvertent way. If any of these issues exist in the area, the D-B contractor will be responsible for notifying the CSC and coordinating with P2JJ and other appropriate GOI agencies, local communities, and property owners. If any infrastructure facilities are damaged during construction, the D-B contractor will repair such facilities to the level of its previous condition.

5.5 OTHER IMPACT STATEMENTS REQUIRED BY 22 CFR PART 216

5.5.1 Adverse Impacts That Cannot Be Avoided

Lesser impacts deemed non-significant may occur before, during and after road reconstruction activities. Inherent to construction activities are incidental impacts on air quality, ambient noise levels, inconveniences to local population, traffic delays, and detours cited that generally cannot be avoided. While such impacts would be most acute during construction activities and resultant activities, their impacts can be lessened through good construction practices, such as fugitive dust reduction through more frequent water spraying, proper functioning of equipment and good field judgments by the construction contractor.

5.5.2 Short-Term Use Versus Long-Term Productivity

In the short term, proposed road reconstruction activities would most likely result in minor inconveniences to the people within the vicinity of the project area, especially in the present context. In the long term, the Proposed Action is expected to result safe and reliable, transportation from Banda Aceh to Lamno. The Proposed Action is therefore viewed as a benefit to the people of the Indonesia and would facilitate economic and social growth, urban development, and improved living standards for the inhabitants of the area.

5.5.3 Irreversible Commitment of Resources

The proposed reconstruction of the road will result in the irretrievable commitment of local resources used for construction activities. Resource commitments of construction materials also may be imported specifically for the project from non-local sources. Local aggregate from terrestrial locations and other construction materials such as timber will be used. The Proposed Action is expected to require no other irretrievable or irreversible resource commitments from the GOI.

Energy requirements of Proposed Action include fuel for equipment and the generation of electricity. Manpower or actual physical labor would also be spent during proposed activities.

6.0 COMPLIANCE PROCEDURES

INTRODUCTION

This chapter discusses major mitigation measures and the responsibilities of the D-B contractor and the CSC in regards to those measures. Implementation of these measures will ensure compliance with Indonesia's environmental standards and guidelines.

6.1 COMPLIANCE WITH THE UKL-UPL

The D-B contractor will be responsible for complying with procedures stipulated in the UKL-UPL. As discussed in the Chapter 1, the UKL-UPL spells out environmental management and monitoring efforts specific to the Proposed Action. The UKL provides guidelines and methodology for preventing, controlling, and mitigating potential adverse impacts that may arise during the course of implementing the Proposed Action. The UPL explicitly details monitoring activities including: monitored environmental component, impact source, monitoring method, monitoring location, monitoring period and frequency, monitoring authorities, monitoring supervisor, and monitoring result reporting. Tables 6.1 and 6.2 summarize management and monitoring measures contained in the UKL-UPL. The final draft UKL-UPL is attached to this EA as Appendix C.

Table 6.1: Summary of UKL Management Measures

POTENTIAL IMPACT	MITIGATION OBJECTIVE	MANAGEMENT AND MONITORING MEASURES	APPROVING AUTHORITY	ASSOCIATED ACTIVITIES
Pre-Construction				
Public Concerns and Public Perception	◆Minimize negative perceptions of the project. ◆Allay public concerns regarding land acquisition.	◆Hold direct discussions with the local government, community leaders, and villagers. Discussion should be held at accessible meeting places and during times when locals are not busy. ◆Land acquisition will follow a transparent process. ◆Gain public endorsement of land acquisition plan and have it signed by the village head. ◆Give the public an opportunity to voice their opinions or perceptions at public meetings.	USAID and P2JJ	◆Survey and Measurement ◆Land Acquisition
Construction				
Public Concerns and Public Perception	◆Minimize negative perceptions of the project. ◆Allay public concerns about losing work.	◆Hire unskilled and semi-skilled labor from local villages. ◆Recruit personnel within a transparent process. ◆Implement a standard salary	USAID and P2JJ	◆Personnel Mobilization

POTENTIAL IMPACT	MITIGATION OBJECTIVE	MANAGEMENT AND MONITORING MEASURES	APPROVING AUTHORITY	ASSOCIATED ACTIVITIES
		scale, and no distinction should be made between workers of the same level. ◆Issue at least 3 warnings prior to terminating an employee.		
Traffic Congestion and Traffic Disturbance.	Minimize impacts to traffic flow.	◆Do not conduct mobilization during busy hours. ◆Check condition of bridges to ensure they can support heavy equipment. ◆Provide security personnel during mobilization. ◆Provide field officer to regulate traffic. ◆During breaks, equipment should be parked so as not to interrupt other activities. ◆Conduct field surveys and provide descriptive analysis of traffic conditions in the vicinity of the Proposed Action, once a month starting when construction commences.	USAID and P2JJ	◆Equipment Mobilization ◆Base Camp ◆Stripping ◆Cut and Fill ◆Subgrade ◆Subbase Course ◆Base Course ◆Laying Asphalt ◆Gutter and Culvert ◆Construction ◆Bridge Construction
Traffic Safety	Minimize potential for traffic accidents.	◆Bring accident victims to the nearest health facility and report the accident to authorized personnel. ◆Drivers should hold valid drivers license. ◆Follow speed limits near residences and markets. ◆Use frequent speed bumps along long stretches of road.	USAID and P2JJ	◆Cut and Fill ◆Land Clearing ◆Stripping ◆Subgrade ◆Subbase Course ◆Base Course ◆Laying Asphalt
Noise Pollution	Control and reduce noise levels resulting from construction and related activities.	◆Stop all activities during Friday Prayer. ◆Prohibit sounding of car horns near mosques during prayer time. ◆Conduct field measurements and sampling at Base Camp, once a month starting when construction commences.	USAID and P2JJ	◆Base Camp ◆Stripping ◆Cut and Fill ◆Subgrade ◆Subbase Course ◆Base Course ◆Laying Asphalt ◆Side Ditching ◆Bridge Construction
Air Pollution	Minimize fugitive dust resulting from construction activities.	◆Spray water on the entrance/exit road to the base camp. ◆Use enclosed vehicle for material transport.	USAID and P2JJ	◆Land Clearing ◆Stripping ◆Subgrade ◆Subbase Course ◆Base Course

POTENTIAL IMPACT	MITIGATION OBJECTIVE	MANAGEMENT AND MONITORING MEASURES	APPROVING AUTHORITY	ASSOCIATED ACTIVITIES
		◆Lay down pavement as soon practicable after subbase and base are laid. ◆Conduct field measurements and sampling at Base Camp, once a month starting when construction commences.		
Water Pollution	Minimize impacts to surface water quality from erosion and sedimentation, and contamination.	◆Prohibit discharge of oil waste. ◆Keep vehicles in good condition to avoid leaks and spills of oil into waterways. ◆Use good quality fill material to ensure bridge integrity. ◆Conduct field measurements and sampling at Base Camp, once a month starting when construction commences.	USAID and P2JJ	◆Base Camp ◆Bridge Construction
Flooding	Minimize potential for flooding.	◆Appropriately site culverts for effective direct drainage. ◆Temporary bridge construction supports should be removed as soon as possible to prevent obstructed water flow.	USAID and P2JJ	◆Gutter and Culvert Construction
Erosion and Sedimentation	Minimize the potential for erosion and sedimentation.	◆Appropriately design culvert layouts to prevent erosion near outlets.	USAID and P2JJ	◆Land Clearing
Local Drainage Patterns	Minimize localized flooding.	◆Side ditch elevation should be lower than the surrounding surface. ◆Gutters should allow natural drainage.	USAID and P2JJ	◆Side Ditching
Inconvenience to Community	Minimize inconvenience to local communities caused by construction activities.	◆If operator impacts vegetation or kills domestic animals, resolution should be discussed with owner and authorized organization. ◆Waste should be disposed as soon as possible. ◆Build pedestrian bridges over side ditches as soon as possible to connect homes and pathways. ◆Any community property damage will be repaired with equivalent construction quality.	USAID and P2JJ	Base Camp ◆Side Ditching ◆Subgrade ◆Subbase Course ◆Base Course ◆Laying Asphalt

POTENTIAL IMPACT	MITIGATION OBJECTIVE	MANAGEMENT AND MONITORING MEASURES	APPROVING AUTHORITY	ASSOCIATED ACTIVITIES
		◆Public facilities damaged during construction will be repaired to its previous condition. ◆Prohibit placement of building materials in house yards or public access roads.		
Social Cultural Impacts		◆Activities must be stopped during Friday prayer time (12:00 – 13:30). ◆Allow personnel to pray at times according to their religion. ◆Perform local ritual feast before start of construction. ◆Provide electricity, water, first aid, enclosed bathrooms and other facilities such as prayer rooms.	USAID and P2JJ	◆Base Camp
Post-Construction/Operation				
Speeding	Reduce speeding.	◆Use frequent speed bumps along long stretches of road.	USAID and P2JJ	◆Operation
Social Cultural Impacts	Minimize conflicts	◆Hold farewell event and distribute appreciation certificates.	USAID and P2JJ	◆Worker Demobilization

Table 6.2: Summary of UPL Monitoring Measures

ACTIVITY	MONITORED IMPACT	MONITORING METHOD	FREQUENCY	MONITORING AUTHORITIES
Pre-Construction				
Surveying and Land Acquisition	◆Public Perception	Interview local community leaders and villagers in the vicinity of the Proposed Action to gauge public perception and concerns.	Once every 3 months up to the start of construction.	P2JJ and USAID
Construction				
Workforce Mobilization	◆Public Perception	Interview local community leaders and villagers in the vicinity of the Proposed Action to gauge public perception and concerns.	Once a month up to the end of personnel mobilization.	P2JJ and USAID
Equipment Mobilization	◆Traffic Congestion and Disturbance	Conduct field surveys and provide descriptive analysis of traffic conditions in the vicinity of the Proposed Action.	Once a month starting from the beginning of the construction stage.	P2JJ and USAID
Base Camp	◆Noise Pollution ◆Air Pollution ◆Water Pollution	Conduct field measurements and sampling for noise, air quality and water quality, comparing analytical results with applicable Indonesian guidelines/standards.	Once a month starting from the beginning of the construction stage.	P2JJ and USAID
Land Clearing, Stripping, and Cut and Fill	◆Noise Pollution ◆Air Pollution ◆Water Pollution ◆Public Perception	Conduct field measurements and sampling for noise, air quality and water quality, comparing analytical results with applicable Indonesian guidelines/standards. Interview local community leaders and villagers in the vicinity of the Proposed Action to gauge public perception and concerns.	Once every 3 months starting from the beginning of the construction stage up to completion of earthworks.	P2JJ and USAID
Laying Down of Subgrade, Subbase Course, Base Course, and Asphalt.	◆Noise Pollution ◆Air Pollution ◆Traffic Disturbance	Conduct field measurements and sampling for noise and air quality, comparing analytical results with applicable Indonesian guidelines/standards. Conduct field surveys and provide descriptive analysis of traffic conditions in the vicinity of the Proposed Action.	Once every 3 months starting from the beginning of the construction stage to the completion of construction.	P2JJ and USAID
Side Ditching	◆Noise Pollution ◆Public Perception ◆Local Water Drainage	Conduct field measurements and sampling for noise, comparing analytical results with applicable Indonesian guidelines/standards.	Once every 3 months starting from the beginning of	P2JJ and USAID

	◆Public Comfort	Data for public perception, local water drainage, and public comfort will be gathered by field observation and interviews.	construction to the completion of construction.	
Gutter and Box Culvert Construction	◆Public Comfort ◆Local Water Drainage ◆Public Perception	Data for public perception, local water drainage, public comfort, and public perception will be gathered by field observation and interviews.	Once every 3 months starting from the beginning of construction to the completion of construction.	P2JJ and USAID
Bridge Construction	◆Traffic Disturbance ◆Public Perception ◆Water Pollution	Conduct field measurements and sampling for water quality, comparing analytical results with applicable Indonesian guidelines/standards. Data for public perception and traffic disturbance will be gathered by field observation and interviews.	Once every 3 months starting from the beginning of construction to the completion of construction.	P2JJ and USAID
Post-Construction				
Workforce Demobilization	Public Perception	Data for public perception will be gathered by field observation and interviews.	Once a month starting from the end of construction to the completion of workforce demobilization.	P2JJ and USAID

6.2 MAJOR MITIGATION MEASURES

In addition to the procedures stipulated in the UKL-UPL, the D-B contractor shall implement the mitigation measures contained in this EA, and which may be included in contract provisions, to ensure compliance with applicable GOI regulations and standards. Major mitigation measures are reiterated below.

6.2.1 Air Quality

The D-B contractor shall ensure that air quality impacts resulting from the Proposed Action do not exceed Indonesia's national ambient air quality standards as enumerated in Government Regulation No. 41, Year 1999. To facilitate meeting those standards, the D-B contractor shall:

- Develop and implement an FDC plan to minimize fugitive dust, to include requirements for water-spraying, conveyance under cover, and other dust control measures.
- Blasting, if any, will be carried out using small charges.
- Install emission controls on construction equipment.
- Properly maintain and operate gas and diesel equipment.
- Prohibit open burning.

- Conduct routine air quality monitoring during construction.

6.2.2 Water Quality

The D-B contractor shall ensure that water quality impacts resulting from the Proposed Action do not exceed Indonesia's water quality standards as enumerated in Government Regulation No.82, Year 2001.

- Develop and implement an ESC plan to prevent and minimize the potential for soil erosion, runoff, sediment and siltation to adversely effect surface water bodies.
- Develop and implement a SPCC plan to minimize the potential for inadvertently spilled materials, in particular petroleum-related products, from reaching surface water bodies.
- Conduct routine water quality monitoring during construction.

6.2.3 Topography and Soils

The tsunami caused a significant loss to fertile agricultural soils. Any additional damage or loss of agricultural soils could have an exponential impact in the area. The D-B contractor shall make all reasonable attempts to reduce the further loss of fertile agricultural soils.

- Minimize cut and fill activities to the extent practicable.
- Minimize construction activities and its ancillary functions in areas that still support fertile agricultural soils, especially where communities have begun to reestablish agricultural fields.
- Develop and implement a BERP to minimize impacts from borrow areas.
- Develop and implement an ESC plan to prevent and minimize the further loss of topsoil.
- Where topsoil has been removed for construction activities, and is not needed for restoration purposes, it shall be reused to enhance adjacent agricultural fields.
- Develop and implement an SPCC plan to prevent and minimize soil contamination from inadvertent spillage of hazardous materials.

6.2.4 Noise

The D-B contractor shall ensure that noise impacts resulting from the Proposed Action do not exceed the established nuisance level standards and noise limits, as provided for in Government Regulation No. 82, Year 2001.

- During construction the D-B contractor shall minimize noise impacts by controlling noise sources, employing time and activity constraints, and promoting community awareness through notification and appropriate signage.
- The D-B contractor shall pay particular attention to mitigating noise impacts when in the vicinity of sensitive receptors such as schools, hospital clinics, and mosques, particularly during times of worship.
- Conduct routine noise monitoring during construction.

6.2.5 Socio-Economic

The majority of communities and villages along Aceh's western coast were severely damaged or destroyed. Most residents in the region derived their livelihoods from agriculture, which also was severely impacted by the tsunami. Survivors are in the process of re-establishing those communities and their agricultural fields. The D-B contractor shall implement measures to minimize impacts to survivors re-establishing communities and agricultural fields.

- The D-B contractor will work with P2JJ and other GOI agencies to address community concerns in determining the final road alignment.
- The D-B contractor shall consider where houses and agricultural fields have been established, or are in the process of re-establishing, and will minimize impacts to these areas.
- If property is damaged during road construction, the D-B contractor will repair the property with equivalent construction quality.
- The D-B contractor is encouraged to hire members of the local community.

6.2.6 Public Health and Safety

The D-B contractor shall implement measures to minimize impacts to public health and safety resulting from construction activities.

- Provide a field officer to regulate traffic during mobilization of heavy equipment and at construction-related traffic detours and diversions.
- Provide appropriate fencing and signage around construction areas and related ancillary functions.
- Implement mitigation measures to minimize impacts to air quality, water quality, and noise.

6.2.7 Worker Safety

- Develop and implement a SSHP.
- Include a STD awareness component in the SSHP.
- Provide adequate drinking water and sanitation at the construction camps.
- Provide periodic worker training, daily pre-work safety meetings, appropriate worker protection equipment, and ongoing real-time in-the-field monitoring of worker activities.
- Develop and implement an "inadvertent discovery plan" to be used in the event that UXO are discovered during construction activities.

6.3 ROLE AND RESPONSIBILITIES OF THE CSC

The CSC shall ensure that mitigation measures are included in the procurement process. In addition, the CSC shall oversee the D-B contractor. Such oversight shall include reviewing and approving all mitigation plans and ensuring that the D-B contractor utilizes the BMPs spelled out in this EA and complies with the environmental management and monitoring efforts stipulated in the UKL-UPL (summarized above in Tables 6.1 and 6.2). The following mitigation plans are subject to review and written approval by the CSC prior to commencement of the relevant activity:

- Site Safety and Health Plan.
  - The CSC shall review daily site safety records and accident reports.
  - The CSC shall review and approve training programs and daily pre-work safety meetings.
- Borrow Area Excavation and Restoration plan.
  - The CSC must confirm that the D-B contractor has restored borrow areas in compliance with the BERP prior to payment.

- Erosion and Sedimentation Control plan.
- Spill Prevention, Control and Countermeasures plan.
- Pesticide Evaluation Report and Safe Use Action Plan.
- Fugitive Dust Control plan.
- Historic and Cultural Resources inadvertent discovery plan.
- UXO inadvertent discovery plan.
- Traffic detours and re-routing schemes.

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Ms. Trigeany Linggoatmodjo	Office of Water and Environment Program Specialist
Mr. Edi Setianto	Office of Economic Growth Program Specialist

Wil Chee – Planning, Inc.

Mr. Wil Chee	Principal Investigator
Mr. Derek Yasaka	Project Manager
Ms. Kellese Cheung	Planner
Mr. Richard Gouijn-Stook	NEPA Specialist
Ms. Celia Shen	Planner
Mr. Clayton Sugimoto	GIS Specialist

ADDITIONAL INFORMATION PROVIDED BY:

ERM Indonesia

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APPENDIX A: MAPS

Location Map **Figure A-1**

E.A. for the Proposed Phase I Banda Aceh to Meulaboh Road Reconstruction and Rehabilitation

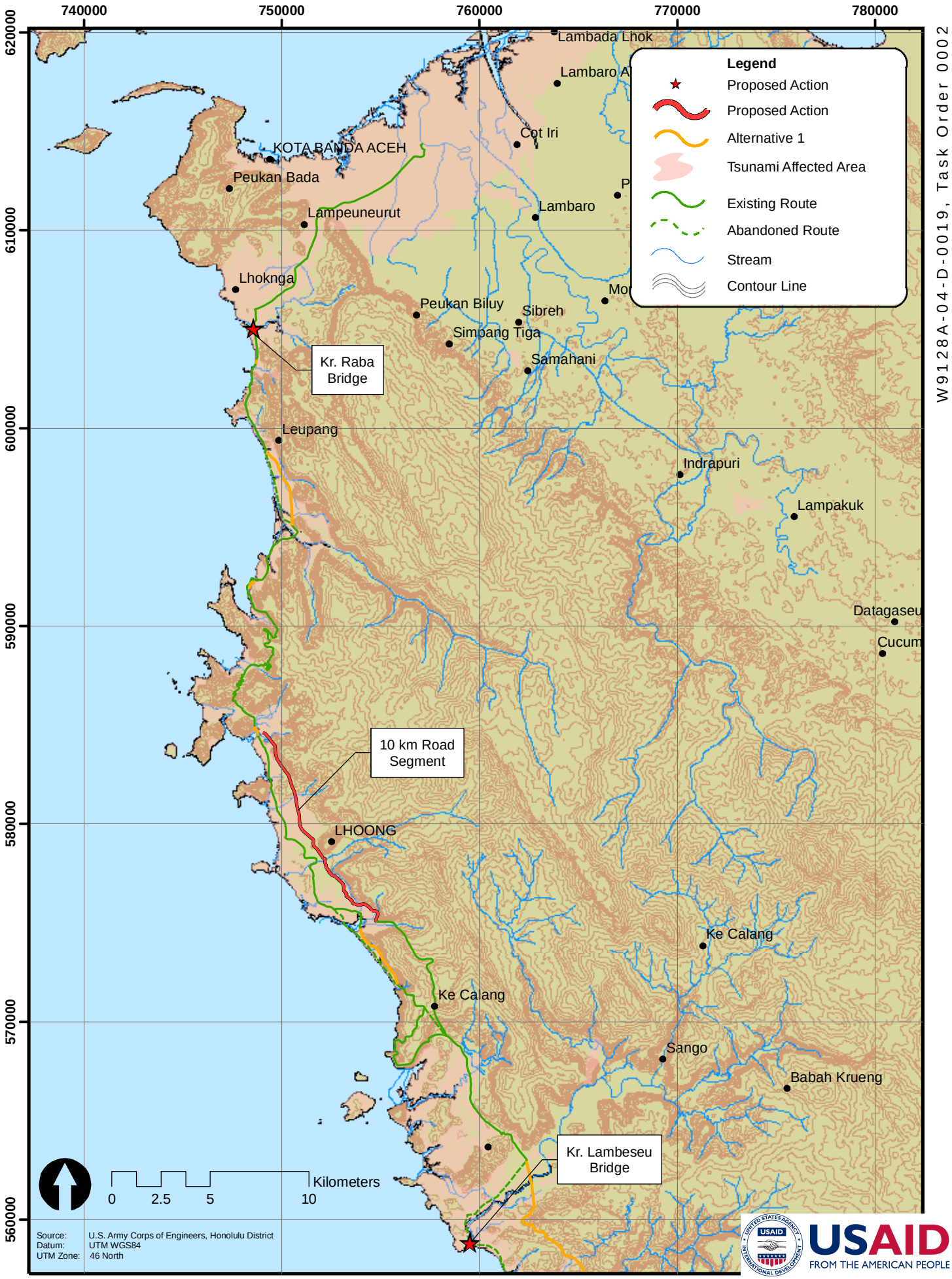
Banda Aceh, Sumatra, Indonesia

W9128A-04-D-0019, Task Order 0002

Project Phasing **Figure A-2**

E.A. for the Proposed Phase I Banda Aceh to Meulaboh Road Reconstruction and Rehabilitation

Banda Aceh, Sumatra, Indonesia



W9128A-04-D-0019, Task Order 0002

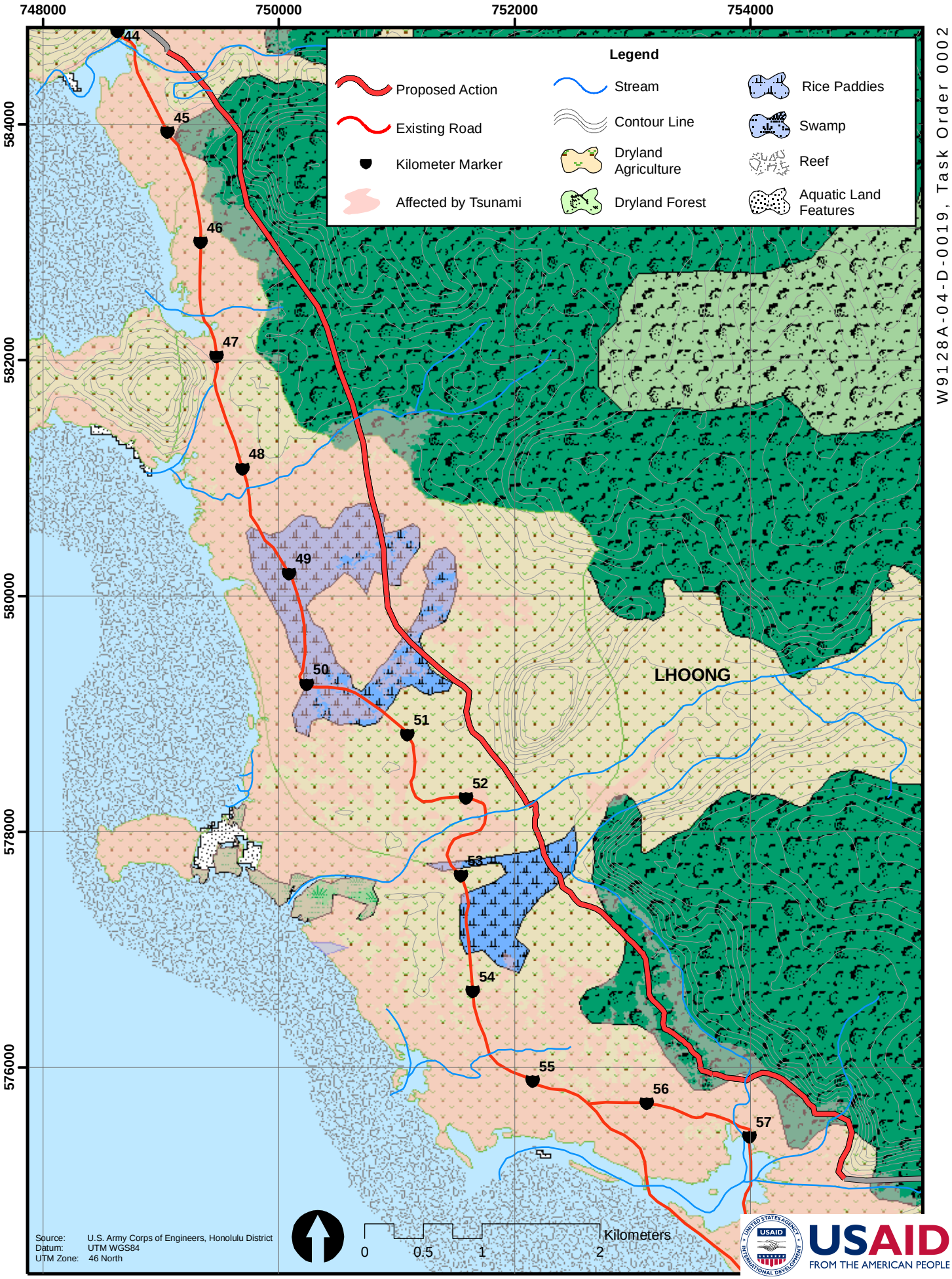
Proposed Action and Alternative 1 **Figure A-3**

W9128A-04-D-0019, Task Order 0002

Site Map (Kr. Raba Bridge) **Figure A-4**

E.A. for the Proposed Phase I Banda Aceh to Meulaboh Road Reconstruction and Rehabilitation

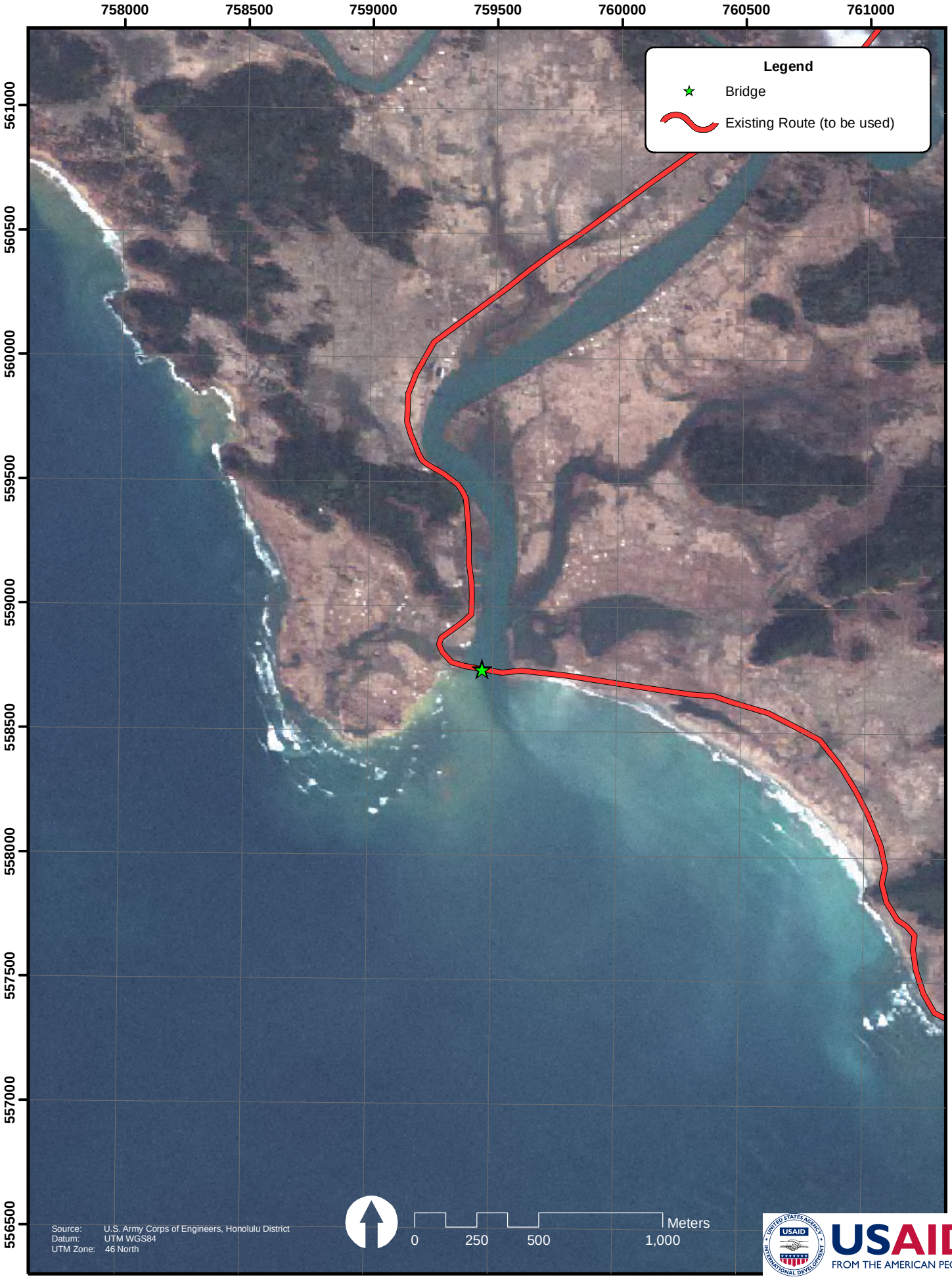
Banda Aceh, Sumatra, Indonesia



W9128A-04-D-0019, Task Order 0002

10 km Road Segment

Figure A-5

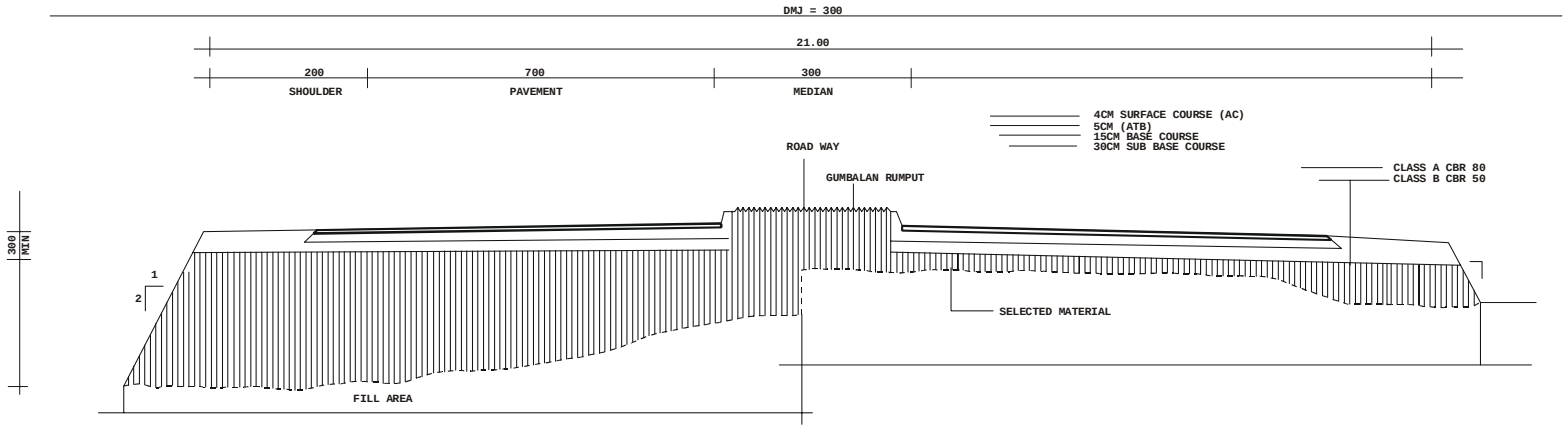


W9128A-04-D-0019, Task Order 0002

Site Map (Kr. Lambeseu Bridge)

Figure A-6

APPENDIX B: TYPICAL CROSS SECTIONS

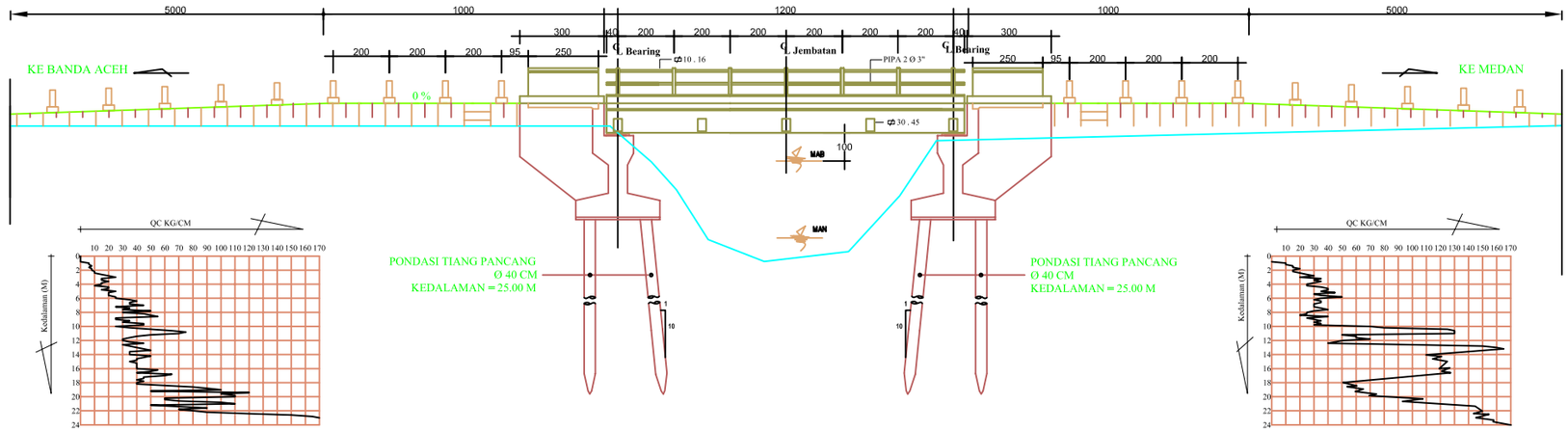


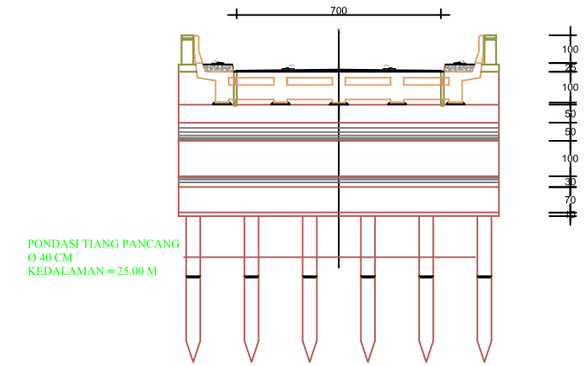
TAMPAK MEMANJANG JALAN

Typical Cross Section

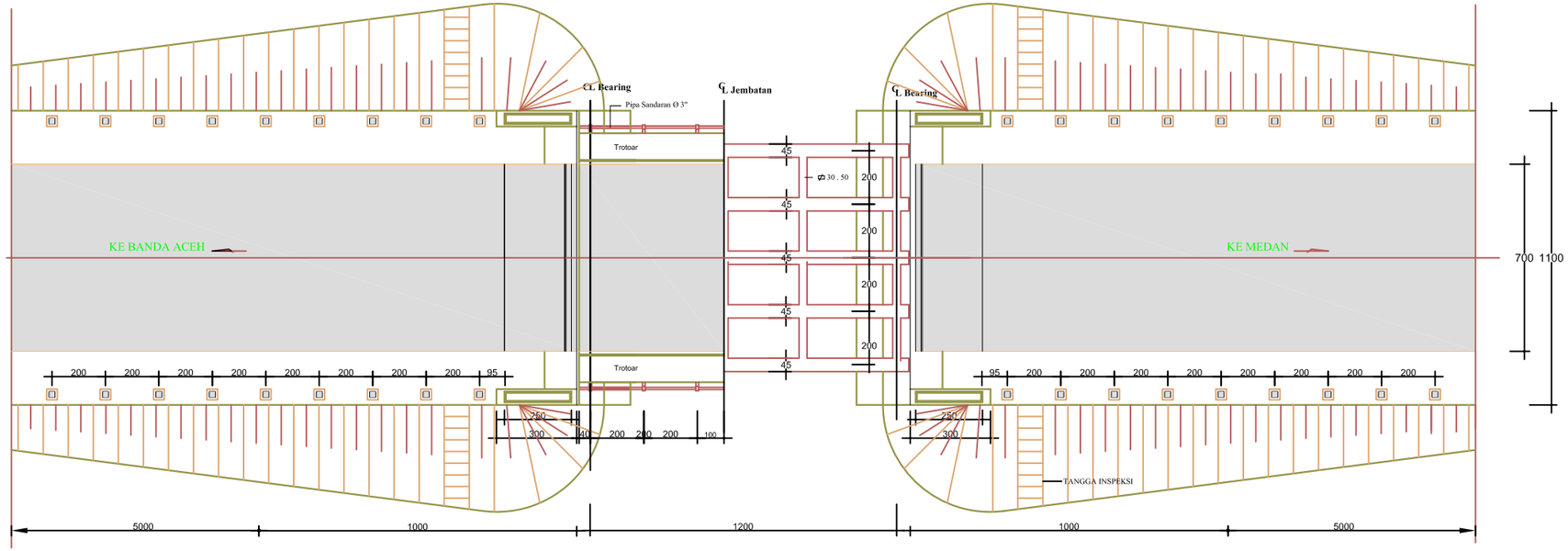
Catatan : Desain ini adalah contoh desain
dari kegiatan yang sejenis
bukan desain yang direncanakan

Figure B-1





POTONGAN
SKALA 1 : 100



DENAH
SKALA 1 : 100

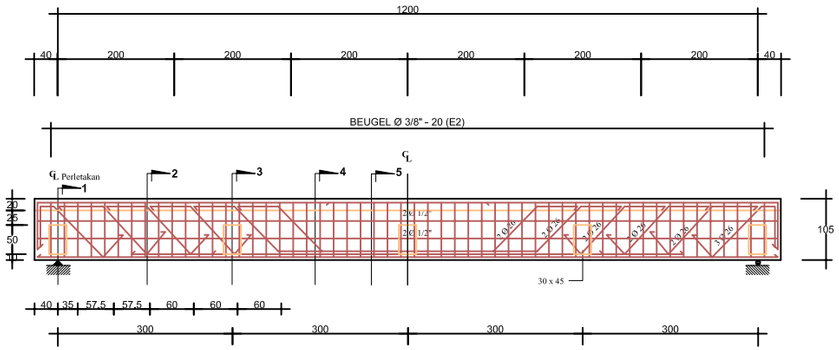
DINAS PRASARANA WILAYAH
PROVINSI NANGGROE ACEH DARUSSALAM
SUB DINAS PENGENDALIAN PROGRAM

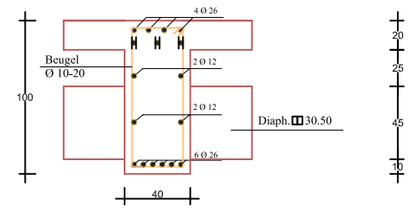
PROYEK : JEMBATAN TGK. ASYEK KM. 359+600

BAGIAN : TAMPAK, POTONGAN DAN DENAH

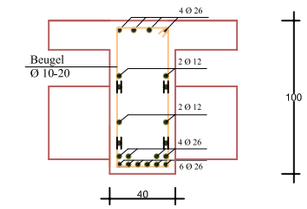
KETERANGAN	N A M A	TANDA TANGAN	TANGGAL	SKALA	NO. LBR
DIGAMBAR	IJAL			1 : 100	01
DIRENCANA	Ir. AGUS HERI PRIYANTO				JLH. LBR
DI PERIKSA	FAISAL, ST				08
DI SETUJUI	Ir. ZAHRUDDIN, M.Si				

Figure B-2

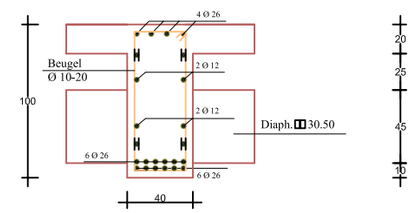




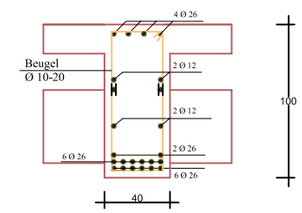
POT. 1
SKALA 1 : 20



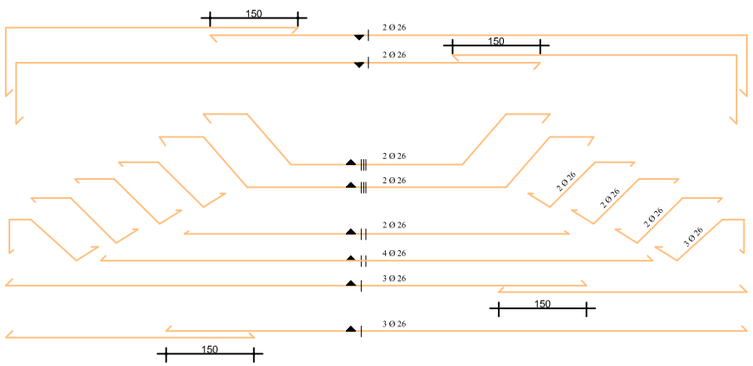
POT. 2
SKALA 1 : 20



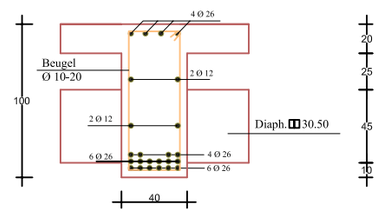
POT. 3
SKALA 1 : 20



POT. 4
SKALA 1 : 20



PENULANGAN GELAGAR INDUK
SKALA 1 : 50



POT. 5
SKALA 1 : 20

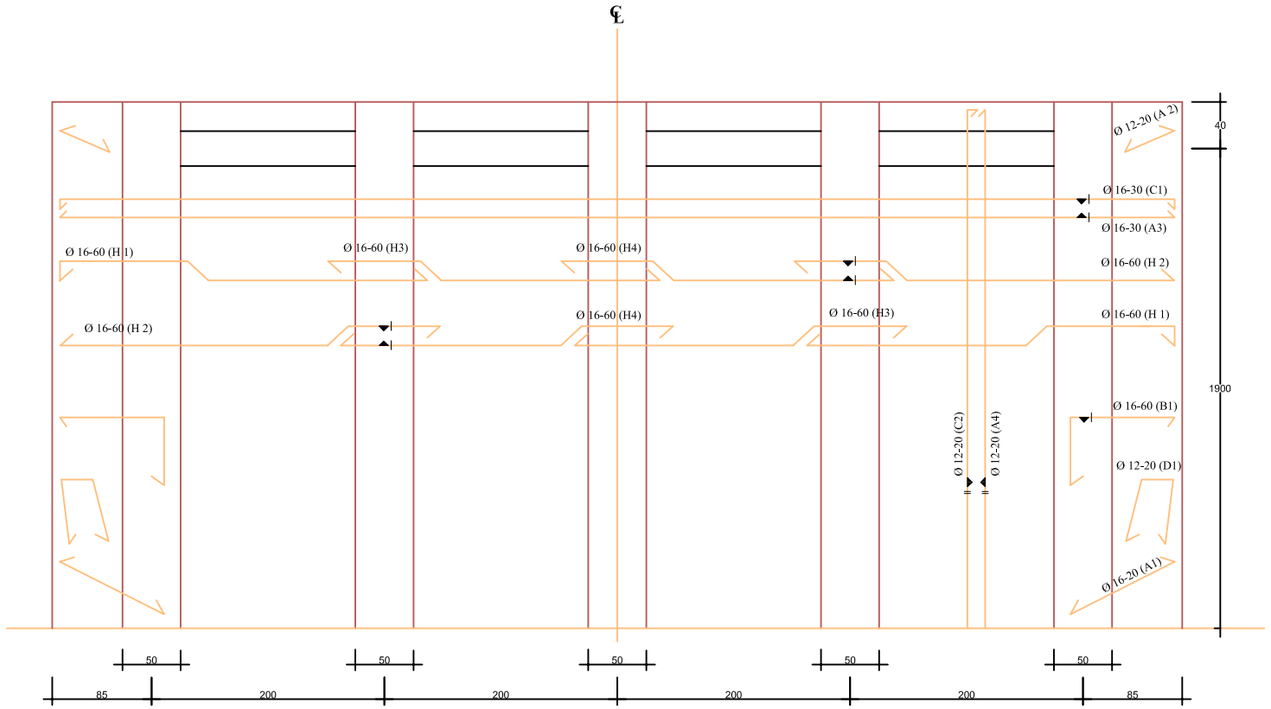
DINAS PRASARANA WILAYAH
PROVINSI NANGGROE ACEH DARUSSALAM
SUB DINAS PENGENDALIAN PROGRAM

PROYEK : JEMBATAN TGK. ASYEK KM. 359+600

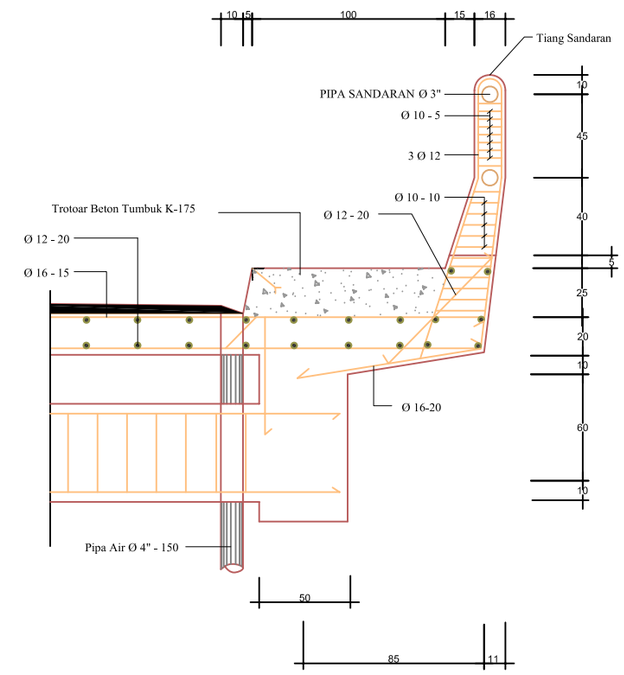
BAGIAN : PENULANGAN GELAGAR INDUK DAN POTONGAN

KETERANGAN	N A M A	TANDA TANGAN	TANGGAL	SKALA	NO. LBR
DIGAMBAR	IJAL			1 : 20 1 : 50	02
DIRENCANA	Ir. AGUS HERI PRIYANTO				JLH. LBR
DI PERIKSA	FAISAL, ST				08
DI SETUJUI	Ir. ZAHRUDDIN, M.Si				

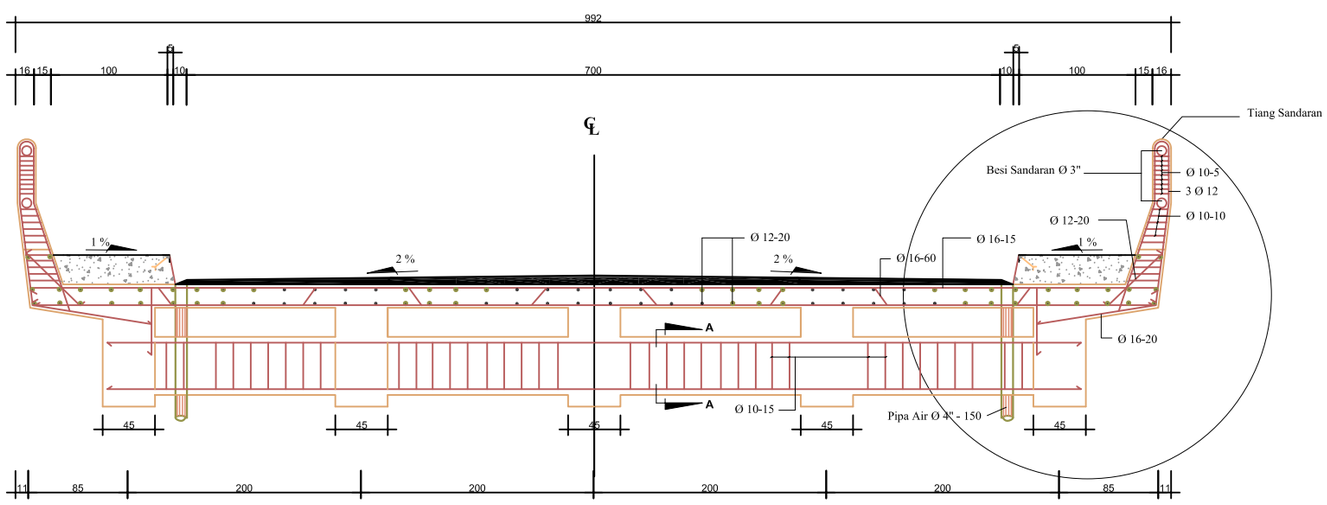
Figure B-3



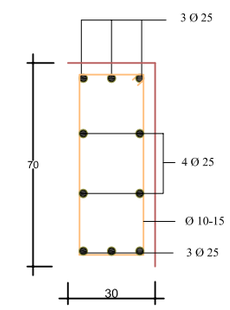
PENULANGAN LANTAI
SKALA 1 : 25



DETAIL B (TIANG SANDARAN)
SKALA 1 : 15



POTONGAN MELINTANG
SKALA 1 : 25



POTONGAN A-A
SKALA 1 : 10

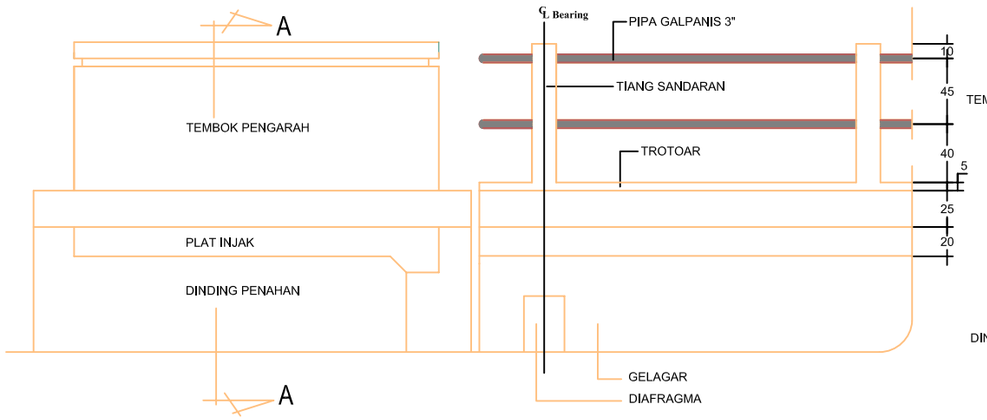
DINAS PRASARANA WILAYAH
PROVINSI NANGGROE ACEH DARUSSALAM
SUB DINAS PENGENDALIAN PROGRAM

PROYEK : JEMBATAN TGK. ASYEK KM. 359+600

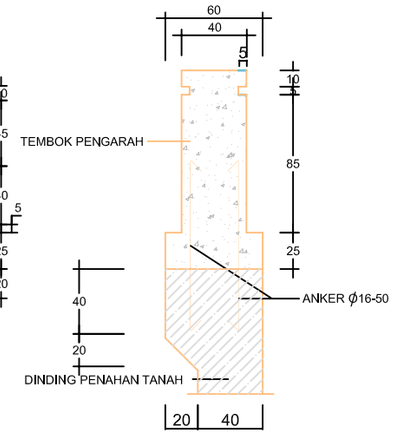
BAGIAN : POTONGAN MELINTANG, PENULANGAN LANTAI DAN DETAIL TIANG SANDARAN

KETERANGAN	N A M A	TANDA TANGAN	TANGGAL	SKALA	NO. LBR
DIGAMBAR	IJAL			1 : 10 1 : 15 1 : 25	03
DIRENCANA	Ir. AGUS HERI PRIYANTO				JLH. LBR
DI PERIKSA	FAISAL, ST				08
DI SETUJUI	Ir. ZAHRUDDIN, M.Si				

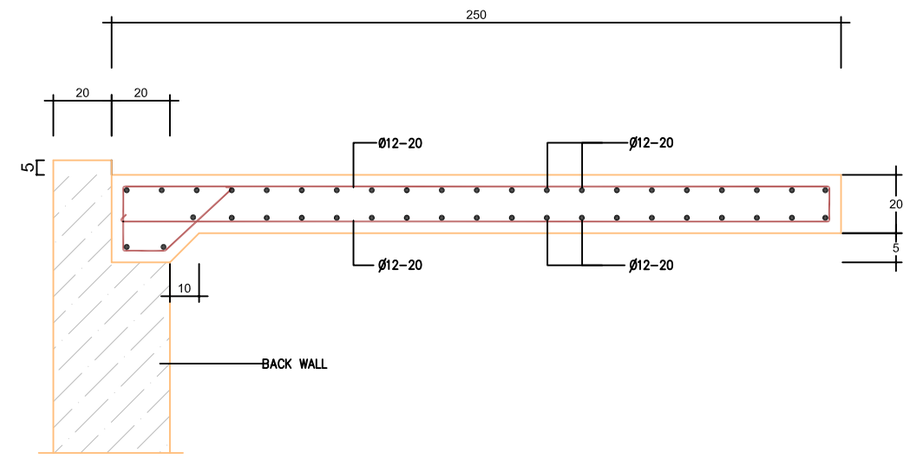
Figure B-4



DETAIL TEMBOK PENGARAH
SKALA 1 : 20

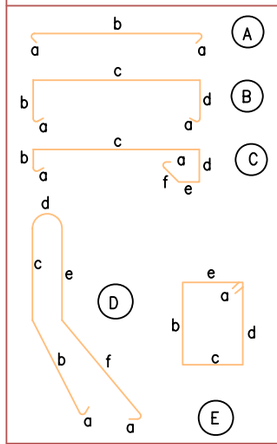


POT. A - A
SKALA 1 : 20



PENULANGAN PLAT INJAK
SKALA 1 : 10

DAFTAR PEMBESIAN PLAT INJAK DAN TIANG SANDARAN



BENTUK TULANGAN	TYPE		A		B	C	D			E
			A1	A2	B	C	D1	D2	D3	E
	DIAMETER (mm)		12	12	12	12	10	10	10	12
	PANJANG (mm)	a	12	12	12	12	10	10	10	12
		b	295	245	16	16	16	16	16	70
		c			295	245	16	20	23	55
		d			16	26	16	16	16	16
		e				20	16	20	23	55
		f				16				75
	PANJANG TOTAL (mm)		319	65	85	200	167	134	100	940
	JUMLAH BATANG		26	30	26	30	108	108	60	12
	BERAT (KG/M)		0.888	0.888	0.888	0.888	0.617	0.617	0.617	0.888
	TOTAL BERAT (KG)		73.65	71.7	81.04	92.44	55.97	61.31	36.30	31.44

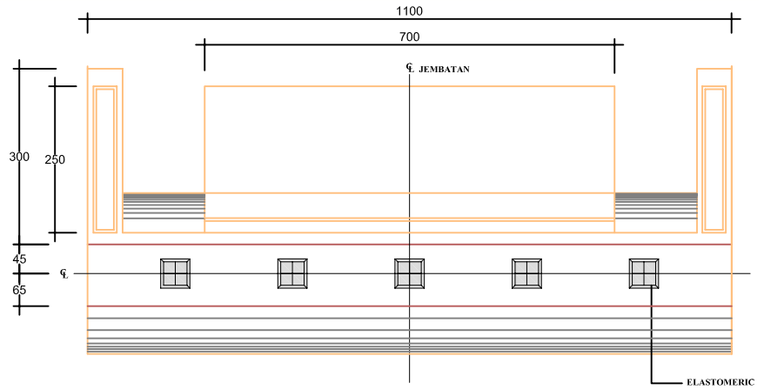
DINAS PRASARANA WILAYAH
PROVINSI NANGGROE ACEH DARUSSALAM
SUB DINAS PENGENDALIAN PROGRAM

PROYEK : JEMBATAN TGK. ASYEK KM. 359+600

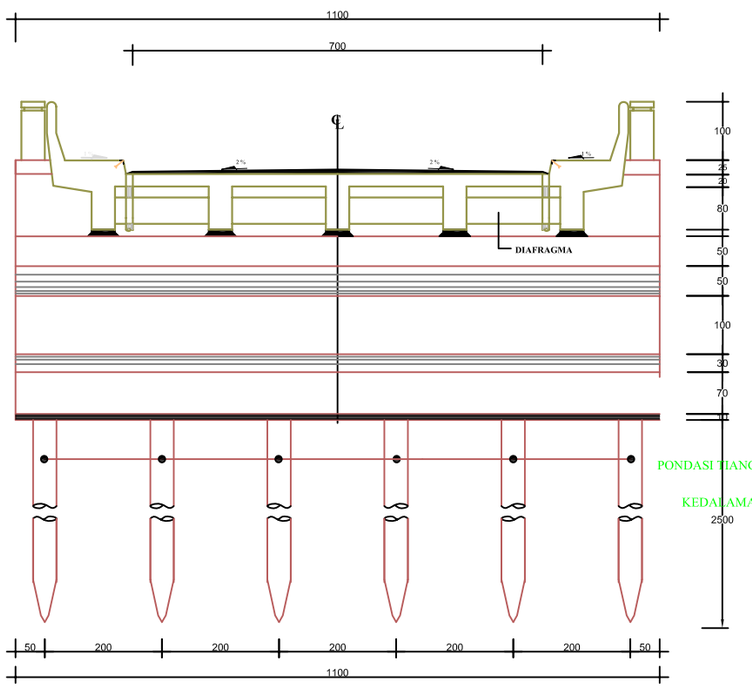
BAGIAN : DETAIL TEMBOK PENGARAH DAN PENULANGAN PLAT INJAK

KETERANGAN	N A M A	TANDA TANGAN	TANGGAL	SKALA	NO. LBR
DIGAMBAR	IJAL			1 : 20 1 : 10	07
DIRENCANA	Ir. AGUS HERI PRIYANTO				JLH. LBR
DI PERIKSA	FAISAL, ST				08
DI SETUJUI	Ir. ZAHRUDDIN, M.Si				

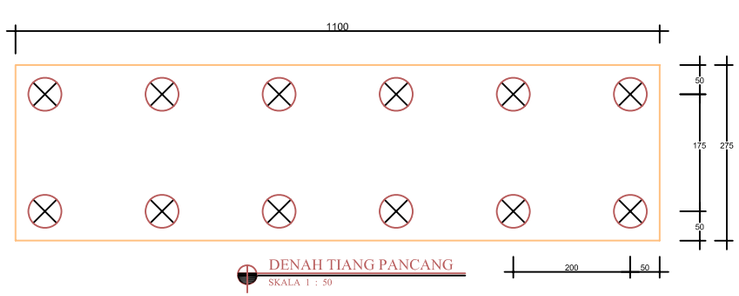
Figure B-5



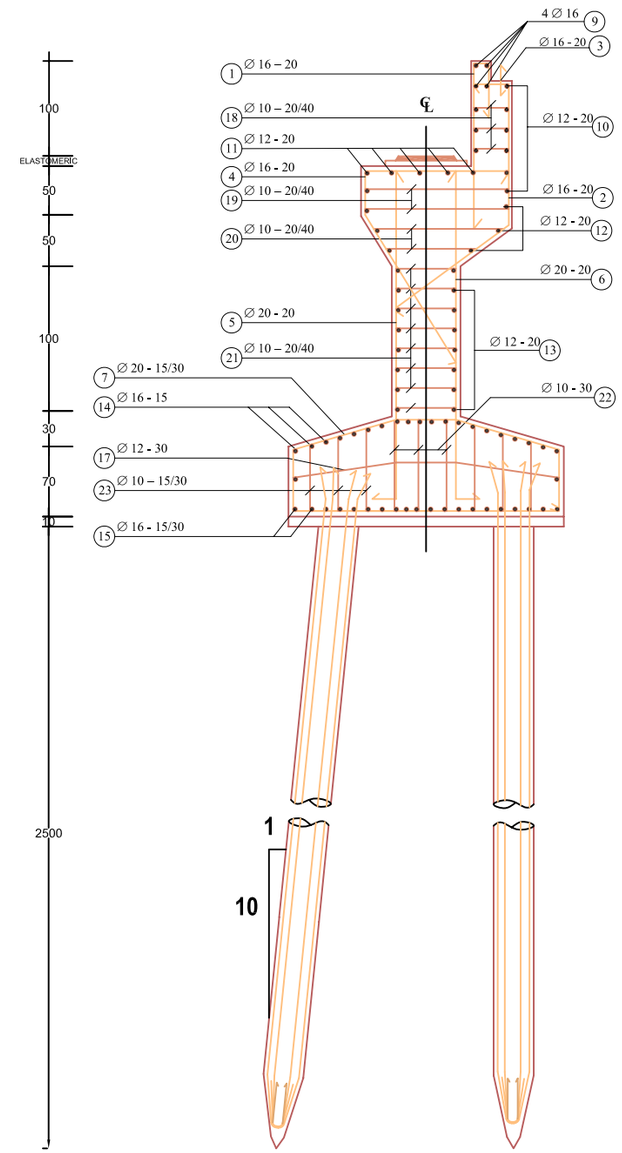
DENAH
SKALA 1 : 50



TAMPAK MELINTANG ABUTMENT
SKALA 1 : 50

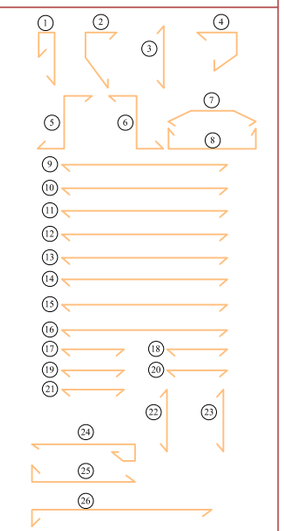


DENAH TIANG PANCANG
SKALA 1 : 50



PEMBESIAN ABUTMENT
SKALA 1 : 10

STR	NO	Ø (mm)	L (m)	JLH BTG	TOTAL PANJANG				BENTUK TULANGAN
					10	12	16	20	
	1	16							
	2	16							
	3	16							
	4	16							
	5	20							
	6	20							
	7	20							
	8	20							
	9	16							
	10	12							
	11	12							
	12	12							
	13	12							
	14	16							
	15	16							
	16	20							
	17	12							
	18	10							
	19	10							
	20	10							
	21	10							
	22	10							
	23	10							
	24	12							
	25	12							
	26	12							
TOTAL PANJANG (m)									
BERAT PER UNIT (Kg/m)									
JUMLAH BERAT (Kg0									
TOTAL BERAT (Kg)									



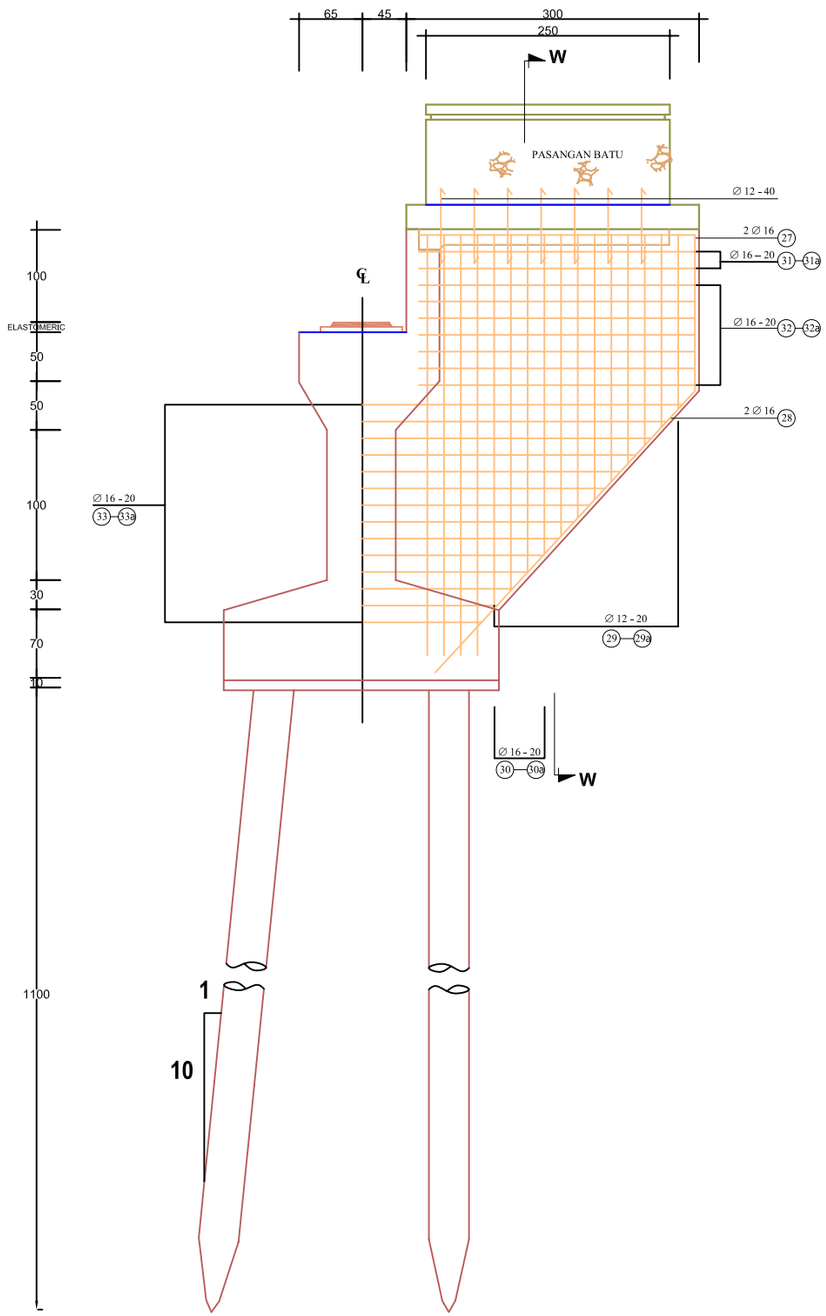
DINAS PRASARANA WILAYAH
PROVINSI NANGGROE ACEH DARUSSALAM
SUB DINAS PENGENDALIAN PROGRAM

PROYEK : JEMBATAN TGK. ASYEK KM. 359+600

BAGIAN : DENAH TIANG PANCANG DAN DETAIL PENULANGAN ABUTMENT

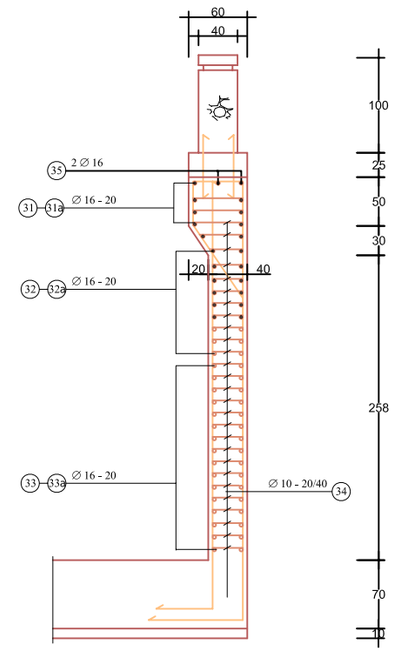
KETERANGAN	N A M A	TANDA TANGAN	TANGGAL	SKALA	NO. LBR
DIGAMBAR	IJAL			1 : 50	06
DIRENCANA	Ir. AGUS HERI PRIYANTO			1 : 30	JLH. LBR
DI PERIKSA	FAISAL, ST				
DI SETUJUI	Ir. ZAHRUDDIN, M.Si				

Figure B-6



DETAIL PENULANGAN TEMBOK SAYAP

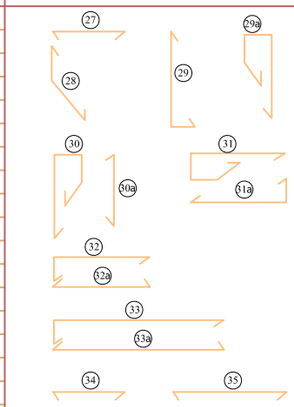
SKALA 1 : 30

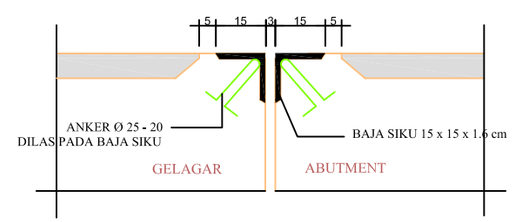


POTONGAN W - W

SKALA 1 : 30

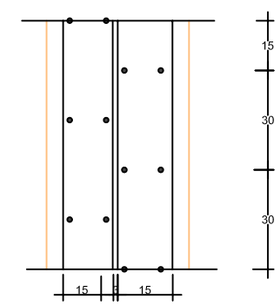
STR	NO	Ø (mm)	L (m)	JLH BTG	TOTAL PANJANG				BENTUK TULANGAN
					10	12	16	20	
	27	16							
	28	16							
	29	12							
	29a	16							
	30	16							
	30a	16							
	31	16							
	32	16							
	33	16							
	34	10							
	35	16							
TOTAL PANJANG (m)									
BERAT PER UNIT (Kg/m)									
JUMLAH BERAT (Kg0									
TOTAL BERAT (Kg)									





EXPANSION JOINT ABUTMENT

SKALA 1 : 10



DINAS PRASARANA WILAYAH

PROVINSI NANGGROE ACEH DARUSSALAM

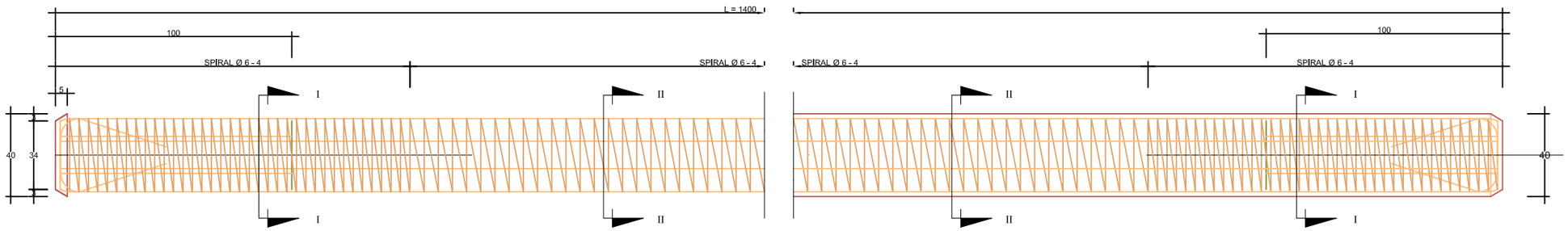
SUB DINAS PENGENDALIAN PROGRAM

PROYEK : JEMBATAN TGK. ASYEK KM. 359+600

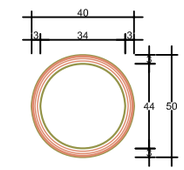
BAGIAN : DETAIL PENULANGAN TEMBOK SAYAP DAN EXPANTION JOINT

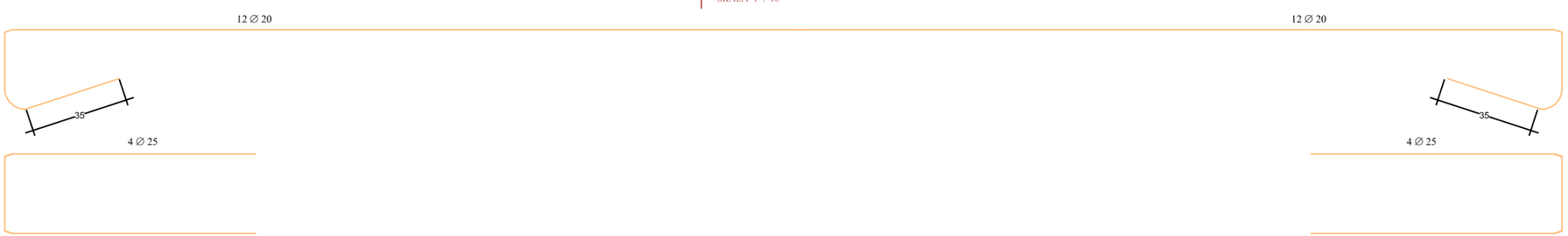
KETERANGAN	N A M A	TANDA TANGAN	TANGGAL	SKALA	NO. LBR
DIGAMBAR	IJAL			1 : 30	05
DIRENCANA	Ir. AGUS HERI PRIYANTO				JLH. LBR
DI PERIKSA	FAISAL, ST				
DI SETUJUI	Ir. ZAHRUDDIN, M.Si				

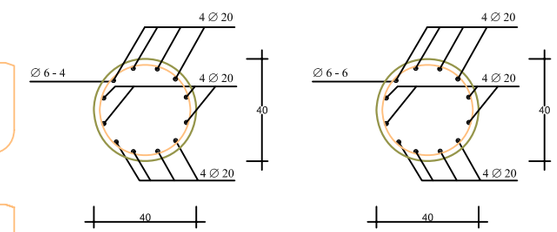
Figure B-7



TYPE I
SKALA 1 : 10

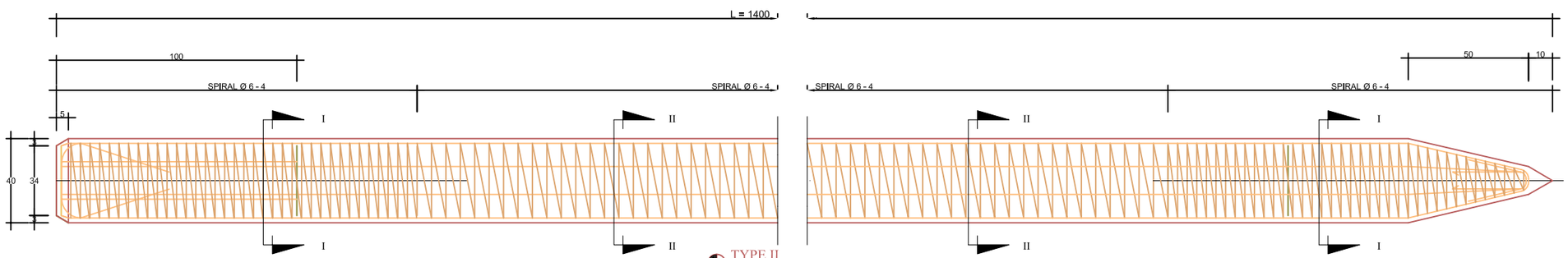




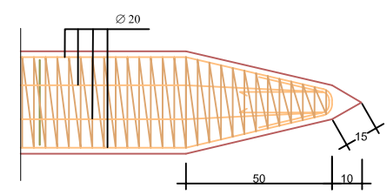


POT. I - I
SKALA 1 : 10

POT. II - II
SKALA 1 : 10



TYPE II
SKALA 1 : 10



DETAIL SEPATU TIANG PANCANG
SKALA 1 : 10

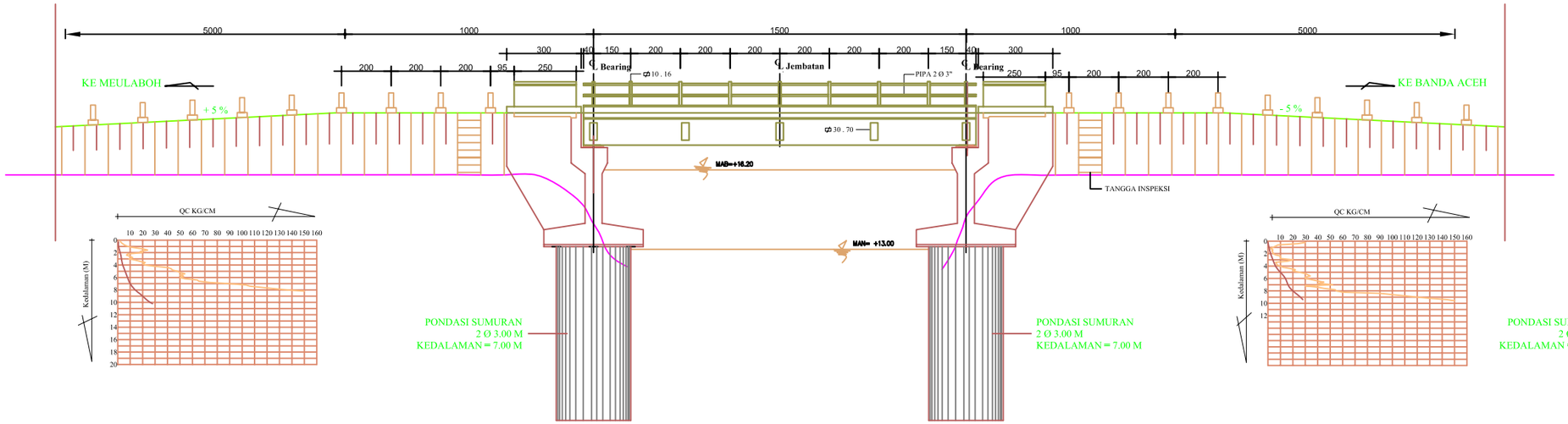
DINAS PRASARANA WILAYAH
PROVINSI NANGGROE ACEH DARUSSALAM
SUB DINAS PENGENDALIAN PROGRAM

PROYEK : JEMBATAN TGK. ASYEK KM. 359+600

BAGIAN : PEMBESIAN TIANG PANCANG

KETERANGAN	N A M A	TANDA TANGAN	TANGGAL	SKALA	NO. LBR
DIGAMBAR	IJAL			1 : 20	07
DIRENCANA	Ir. AGUS HERI PRIYANTO			1 : 10	JLH. LBR
DI PERIKSA	FAISAL, ST				08
DI SETUJUI	Ir. ZAHRUDDIN, M.Si				

Figure B-8

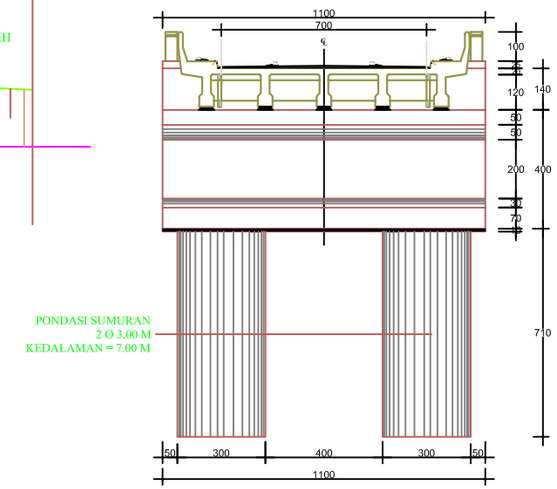


BIDANG PERS. + 6.00 m

J A R A K (m)	2.5		5.3	1.5	3.5	3.2	2.6
ELEVASI SUNGAI DASAR	17.805	14.621	12.102	12.043	11.824	14.447	17.992

TAMPAK DAN POTONGAN MEMANJANG

SKALA 1 : 100



POTONGAN

SKALA 1 : 100

DINAS PRASARANA WILAYAH

PROVINSI NANGGROE ACEH DARUSSALAM
SUB DINAS PENGENDALIAN PROGRAM

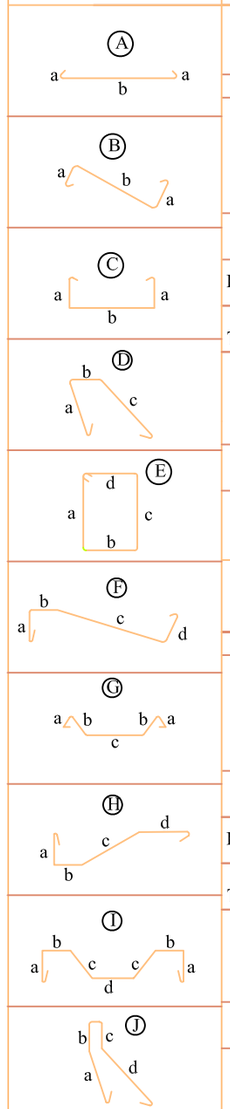
PROYEK : JEMBATAN ALUE BABAH NIPAH STA. 121+000

BAGIAN : TAMPAK, POTONGAN DAN DENAH

KETERANGAN	N A M A	TANDA TANGAN	TANGGAL	SKALA	NO. LBR
DIGAMBAR	NAZRIN			1 : 100	01
DIRENCANA	FAISAL, ST				JLH. LBR
DI PERIKSA	IR. KHALIDIN, M.Sc				08
DI SETUJUI	Ir. ZAHRUDDIN				

Figure B-9

BENTUK TULANGAN



DAFTAR TULANGAN

TYPE		A											B	C			D	
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	B1	C1	C2	C3	D1	D2
DIAMETER (mm)		16	12	16	12	19	25	25	25	25	12	12	16	16	12	25	12	12
PANJANG (mm)	a	830	510	9850	16400	8500	8000	10000	18000	16400	18000	1220	500	200	200	1000	350	
	b												730	9850	16400	1800	150	
	c													200	200	1000	400	
	d																	
	e																	
PANJANG TOTAL (mm)		830	510	9850	16400	8500	8000	10000	18000	16400	18000	1220	1230	10250	16800	20000	900	4376
KOREKSI (+/- mm')													- 40	- 70	- 120	- 60	- 60	- 60
PANJANG PER TULANGAN (mm')		830	510	9850	16400	8500	8000	10000	18000	16400	18000	1220	1190	10180	16740	19880	840	4316
JUMLAH TULANGAN (st.)		50	50	50	50	30	18	18	36	36	24	108	50	50	50	24	150	108
		2 x 25	2 x 25	1 x 50	1 x 50	5 x 6	3 x 6	3 x 6	6 x 6	6 x 6	4 x 6	6 x 18	2 x 25	1 x 50	1 x 50	4 x 6	2 x 75	6 x 18
TOTAL PANJANG TULANGAN (m')		41,50	25,50	492,50	820	255	144	180	648	590,40	432	131,76	59,50	509	837	477,12	126	466,13
CATATAN																		

TYPE		E				F		H			I							
		E1	E2	E3	E4	F1	F2	H1	H2	H3	I1	I2						
DIAMETER (mm)		10	10			25	25	16	16	16	25	25						
PANJANG (mm)	a	400	1000			0	1000	0	0	0	0	0						
	b	200	350			500	400	1825	1875	825	800	800						
	c	400	1000			1100	1100	280	280	280	1100	1100						
	d	200	350			400	300	1815	825	1815	6000	7500						
	e										1100	1100						
PANJANG TOTAL (mm)		1200	2700			2000	2800	2920	2980	2920	9000	10500						
KOREKSI (+/- mm')		+ 90	+ 90			- 110	- 400	- 20	- 20	- 20	- 120	- 120						
PANJANG PER TULANGAN (mm')		1290	2790			1890	2400	2900	2960	2900	8880	10380						
JUMLAH TULANGAN (st.)		225	450			108	36	50	50	150	12	12						
		4 x 45	6 x 75			6 x 18	6 x 6	2 x 25	2 x 25	6 x 25	2 x 6	2 x 6						
TOTAL PANJANG TULANGAN (m')		290,25	1255,50			204,12	86,40	145	148	435	106,56	124,56						
CATATAN																		

DINAS PRASARANA WILAYAH

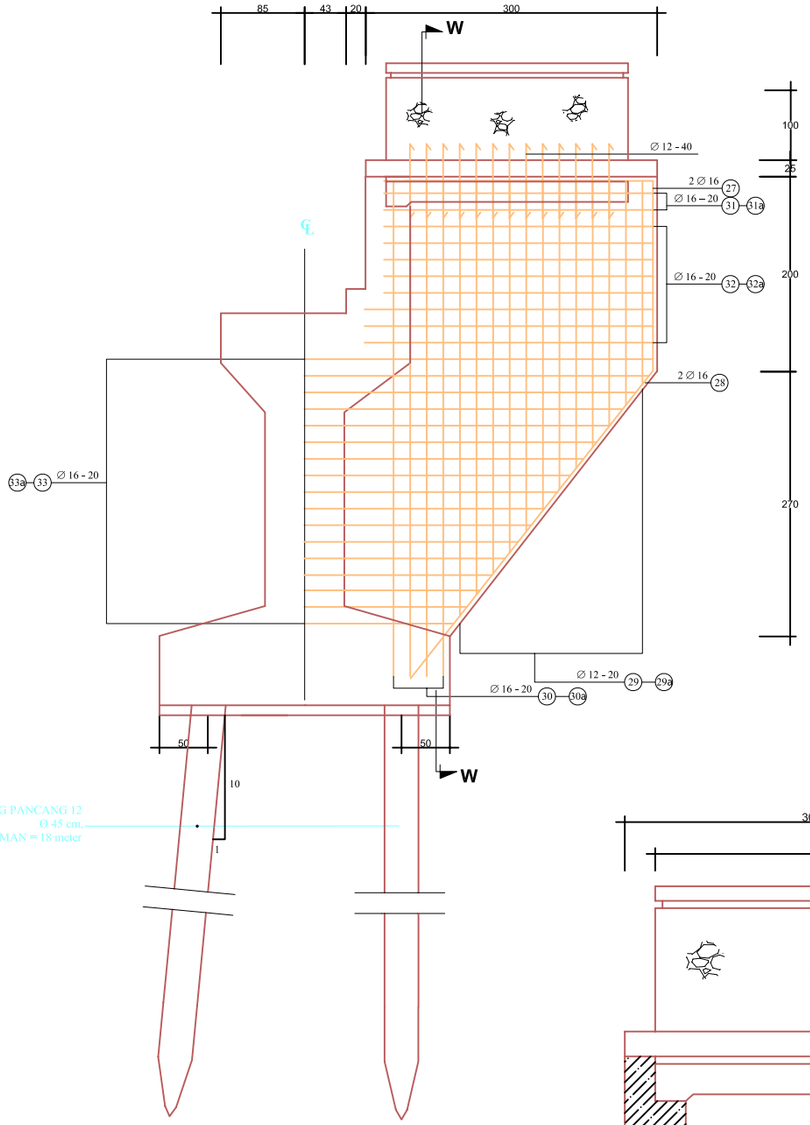
PROVINSI NANGGROE ACEH DARUSSALAM
SUB DINAS PENGENDALIAN PROGRAM

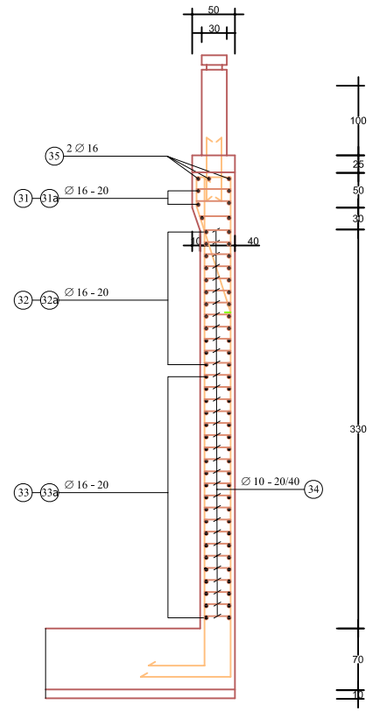
PROYEK : JEMBATAN LEUNG IE (SESUAI DENGAN DATA DI LAPANGAN)

BAGIAN : DAFTAR TULANGAN

KETERANGAN	N A M A	TANDA TANGAN	TANGGAL	SKALA	NO. LBR
DIGAMBAR	FITRIANI				04
DIRENCANA	FAISAL, ST				JLH. LBR
DI PERIKSA	IR. KHALIDIN, M.Sc				08
DI SETUJUI	Ir. ZAHRUDDIN, M.Si				

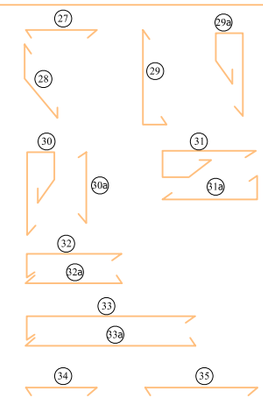
Figure B-10

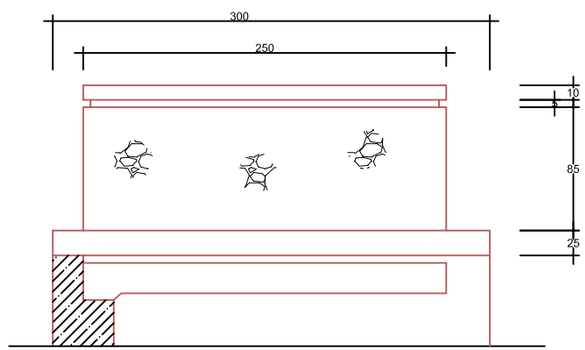




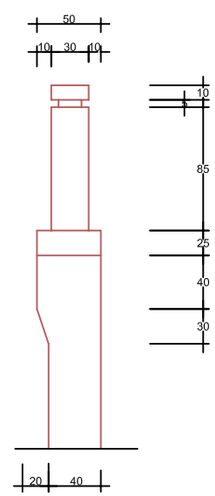
POTONGAN W-W
SKALA 1 : 30

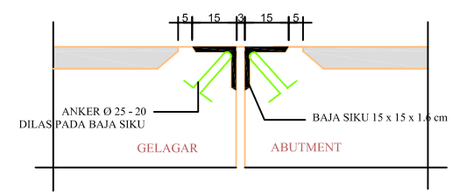
STR	NO	Ø (mm)	L (m)	JLH BTG	TOTAL PANJANG				BENTUK TULANGAN
					10	12	16	20	
	27	16							
	28	16							
	29	12							
	29a	16							
	30	16							
	30a	16							
	31	16							
	31a	16							
	32	16							
	32a	16							
	33	16							
	33a	16							
	34	10							
	35	16							
TOTAL PANJANG (m)									
BERAT PER UNIT (Kg/m)					0.620	0.880	1.578	2.466	
JUMLAH BERAT (Kg)									
TOTAL BERAT (Kg)									



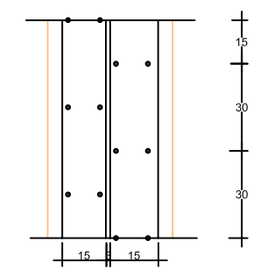


TEMBOK PENGARAH
SKALA 1 : 20





EXPANSION JOINT ABUTMENT
SKALA 1 : 10



DETAIL PENULANGAN TEMBOK SAYAP
SKALA 1 : 30

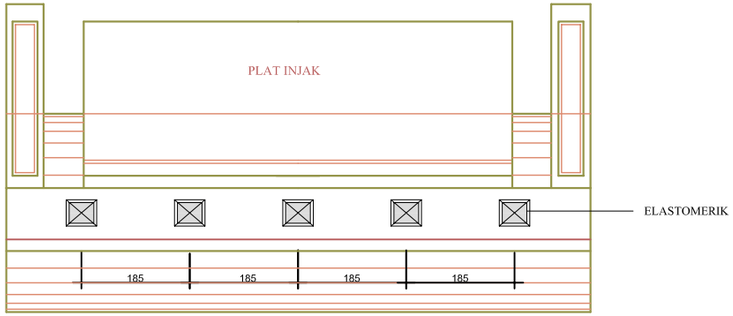
REPUBLIK INDONESIA
DEPARTEMEN PEMUKIMAN DAN PRASARANA WILAYAH
DIREKTORAT JENDERAL PRASARANA WILAYAH
PROYEK PERENCANAAN DAN PENGAWASAN
JALAN DAN JEMBATAN PROVINSI NAD

PROYEK : JEMBATAN TGK. ASYIK STA. BNA 359+600

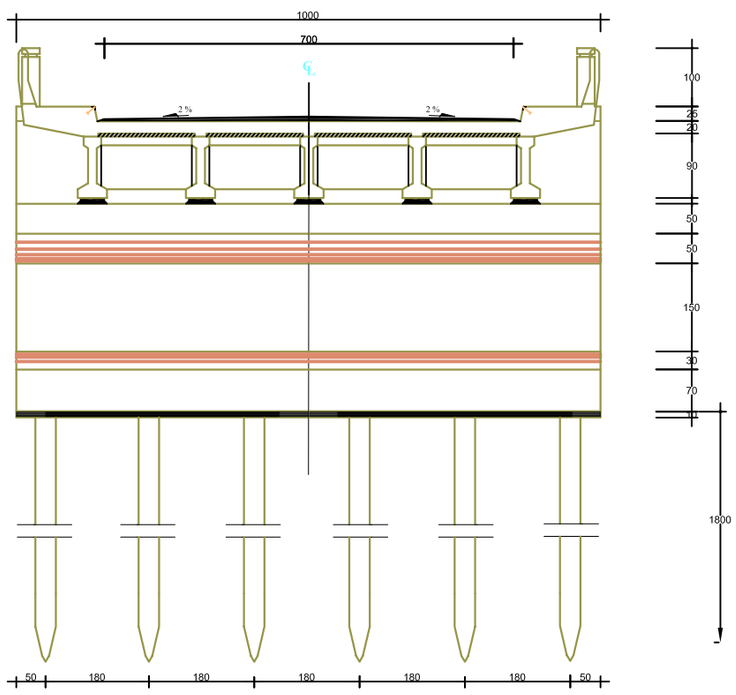
BAGIAN : DETAIL PENULANGAN TEMBOK SAYAP, TEMBOK PENGARAH DAN EXPANSION JOINT

KETERANGAN	N A M A	TANDA TANGAN	TANGGAL	SKALA	NO. LBR
DIGAMBAR	SAFRIZAL, ST			1 : 10 1 : 20 1 : 30	03
DIRENCANA	Ir. AGUS HERI PRIYONO				JLH. LBR
DI PERIKSA	FAISAL, ST				05
DI SETUJUI	Ir. ZAHRUDDIN, MSi				

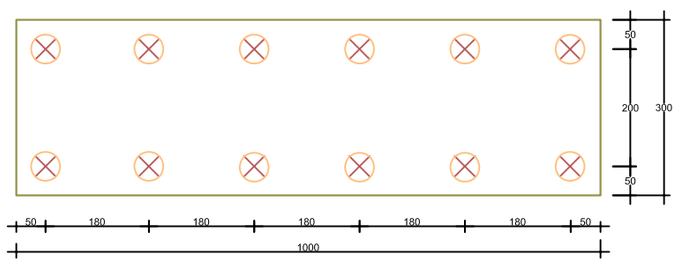
Figure B-11



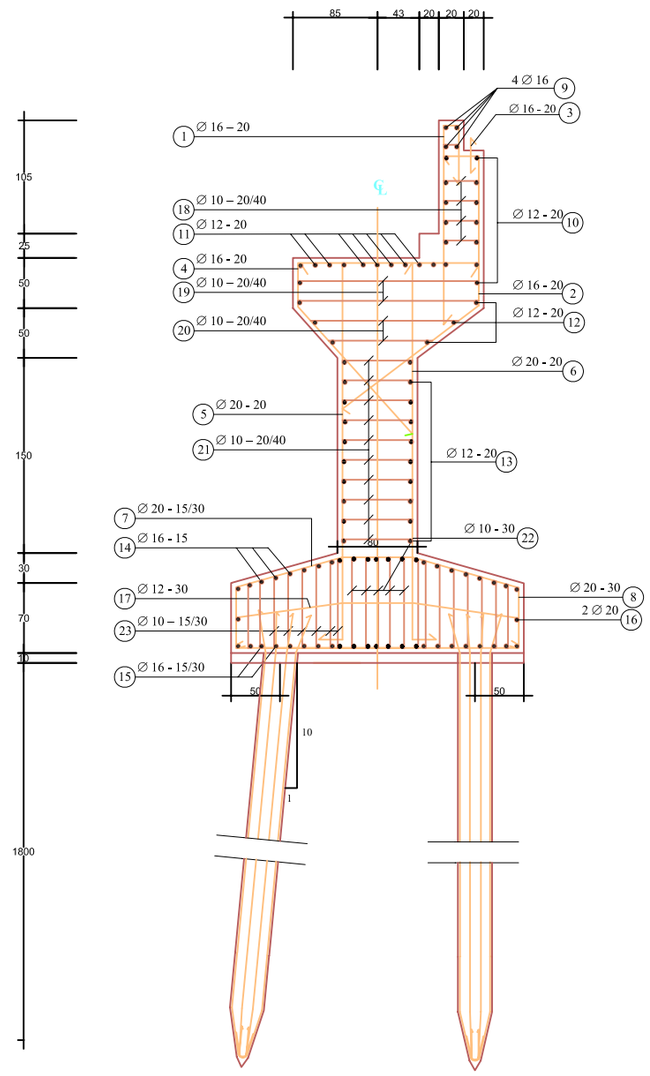
DENAH
SKALA 1 : 50



TAMPAK MELINTANG
SKALA 1 : 50



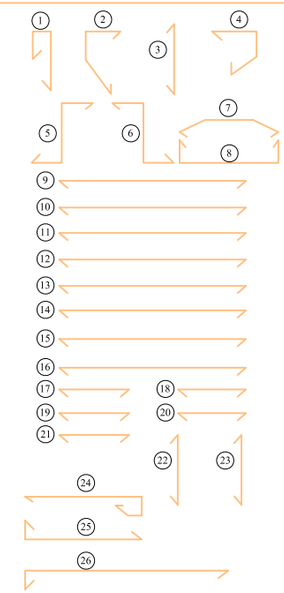
DENAH SUMURAN
SKALA 1 : 50

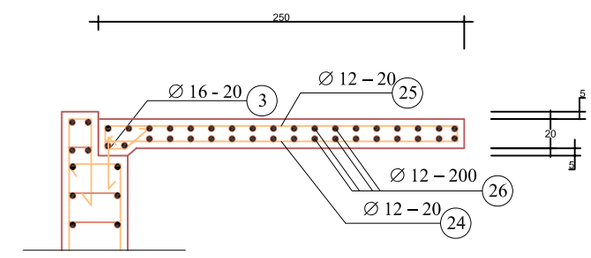


TAMPAK MELINTANG ABUTMENT
SKALA 1 : 30

STR	NO	Ø (mm)	L (m)	JLH BTG	TOTAL PANJANG			
					10	12	16	20
	1	16						
	2	16						
	3	16						
	4	16						
	5	20						
	6	20						
	7	20						
	8	20						
	9	16						
	10	12						
	11	12						
	12	12						
	13	12						
	14	16						
	15	16						
	16	20						
	17	12						
	18	10						
	19	10						
	20	10						
	21	10						
	22	10						
	23	10						
	24	12						
	25	12						
	26	12						
TOTAL PANJANG (m)								
BERAT PER UNIT (Kg/m)					0.620	0.880	1.578	2.466
JUMLAH BERAT (Kg)								
TOTAL BERAT (Kg)								

BENTUK TULANGAN





DETAIL PENULANGAN PLAT INJAK
SKALA 1 : 20

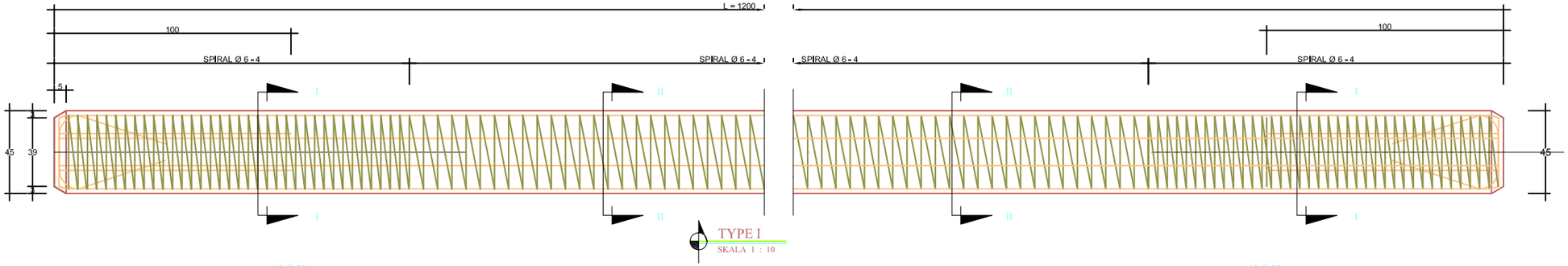
REPUBLIK INDONESIA
DEPARTEMEN PEMUKIMAN DAN PRASARANA WILAYAH
DIREKTORAT JENDERAL PRASARANA WILAYAH
PROYEK PERENCANAAN DAN PENGAWASAN
JALAN DAN JEMBATAN PROVINSI NAD

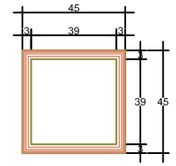
PROYEK : JEMBATAN TGK. ASYIK STA. BNA 359+600

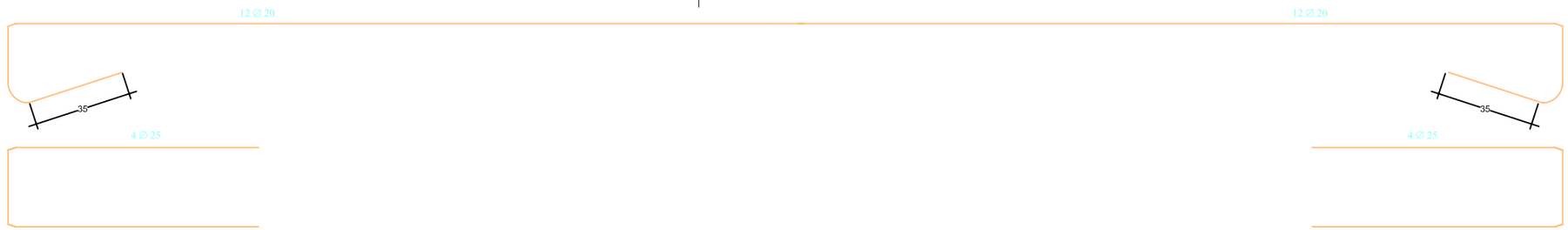
BAGIAN : DETAIL PENULANGAN ABUTMENT DAN PLAT INJAK

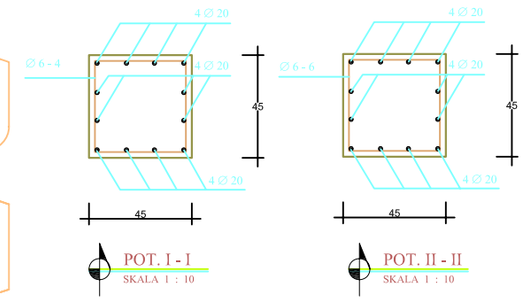
KETERANGAN	N A M A	TANDA TANGAN	TANGGAL	SKALA	NO. LBR
DIGAMBAR	SAFRIZAL, ST			1 : 20 1 : 30 1 : 50	02
DIRENCANA	Ir. AGUS HERI PRIYONO				JLH. LBR
DI PERIKSA	FAISAL, ST				05
DI SETUJUI	Ir. ZAHRUDDIN, MSi				

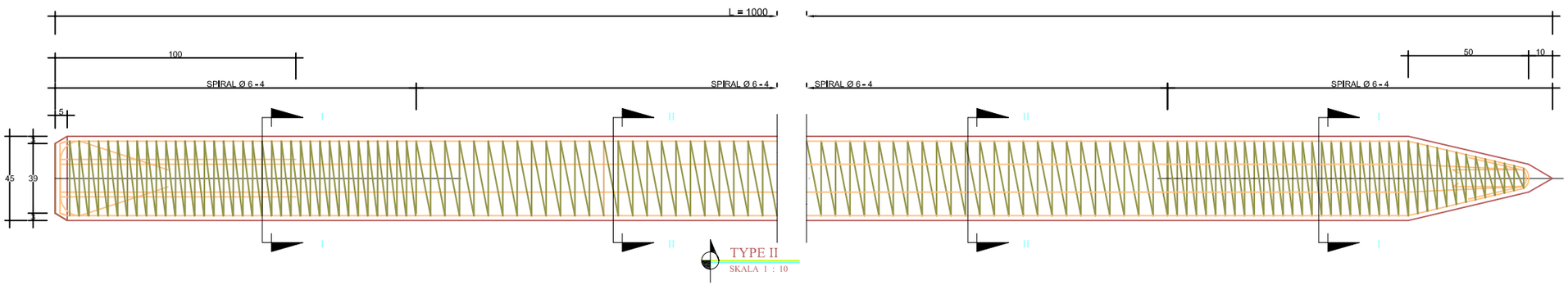
Figure B-12

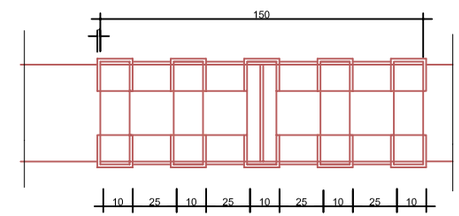


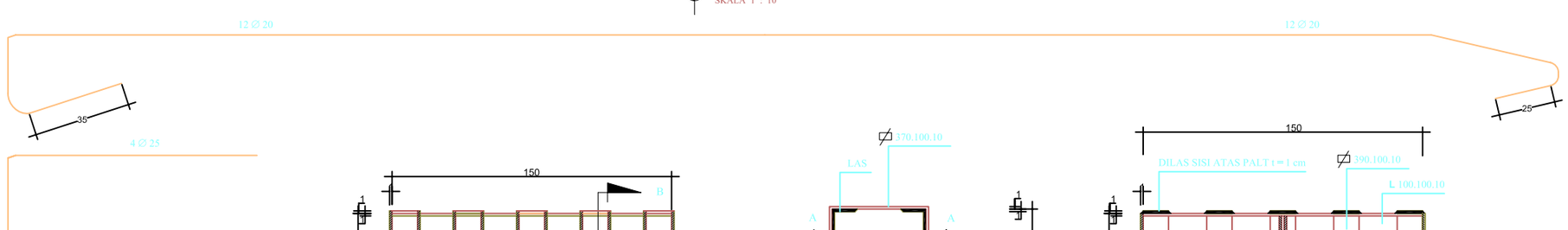


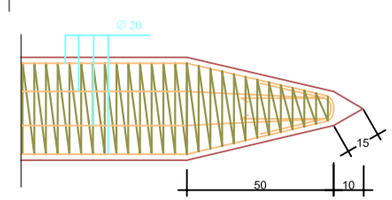


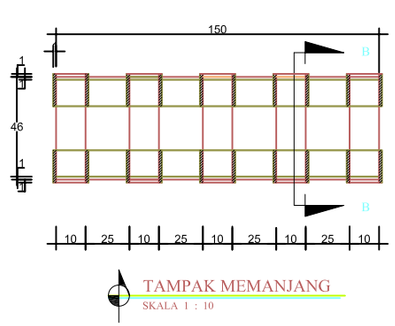


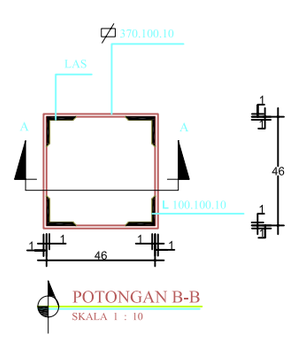


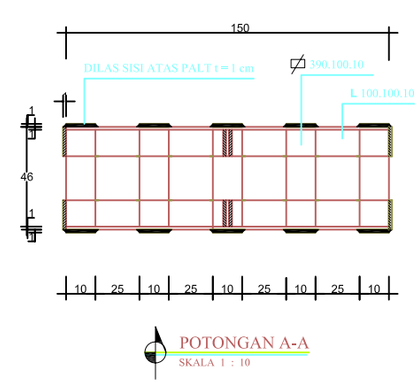












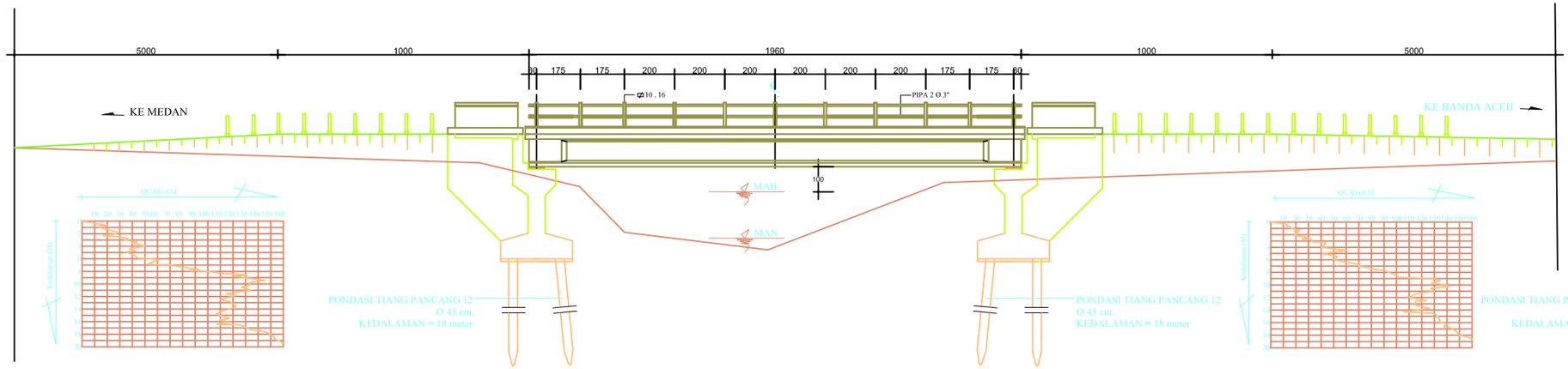
REPUBLIK INDONESIA
DEPARTEMEN PEMUKIMAN DAN PRASARANA WILAYAH
DIREKTORAT JENDERAL PRASARANA WILAYAH
PROYEK PERENCANAAN DAN PENGAWASAN
JALAN DAN JEMBATAN PROVINSI NAD

PROYEK : JEMBATAN TGK. ASYIK STA. BNA 359+600

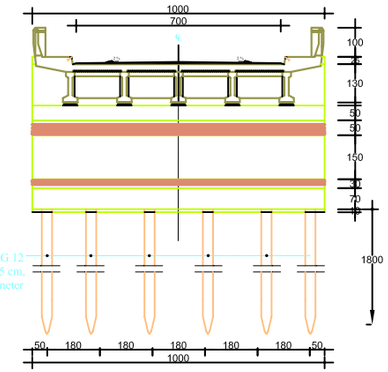
BAGIAN : PEMBESIAN TIANG PANCANG

KETERANGAN	N A M A	TANDA TANGAN	TANGGAL	SKALA	NO. LBR
DIGAMBAR	SAFRIZAL, ST				05
DIRENCANA	Ir. AGUS HERI PRIYONO				JLH. LBR
DI PERIKSA	FAISAL, ST				05
DI SETUJUI	Ir. ZAHRUDDIN, MSi				

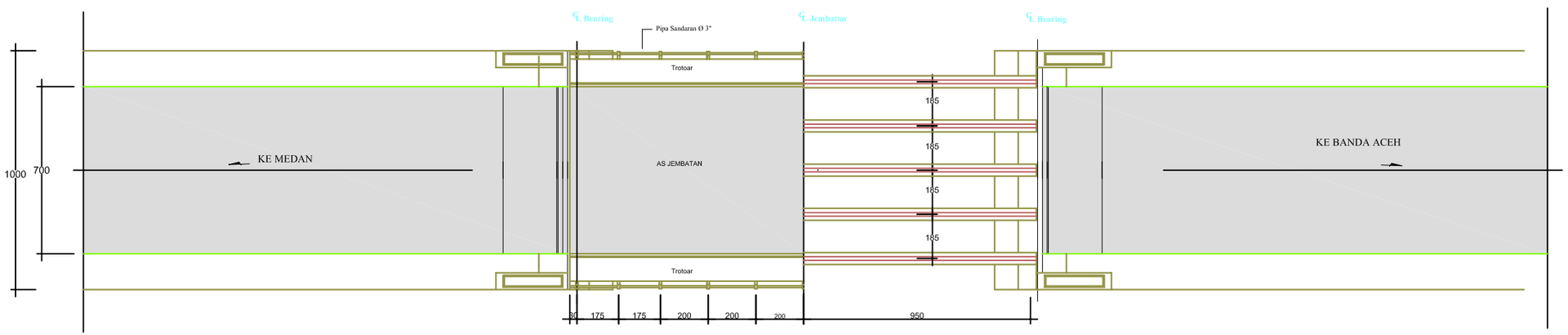
Figure B-13



TAMPAK DAN POTONGAN MEMANJANG
SKALA 1 : 100



POTONGAN
SKALA 1 : 100



DENAH
SKALA 1 : 100

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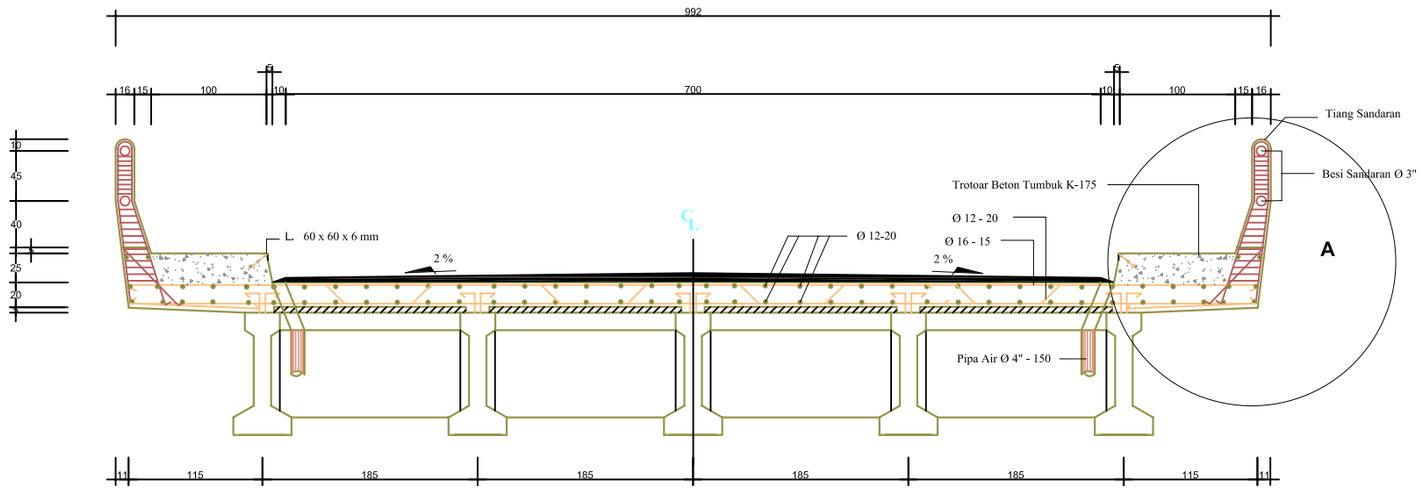
PROYEK PERENCANAAN DAN PENGAWASAN
JALAN DAN JEMBATAN PROVINSI NAD

PROYEK : JEMBATAN TGK. ASYIK STA. BNA 359+600

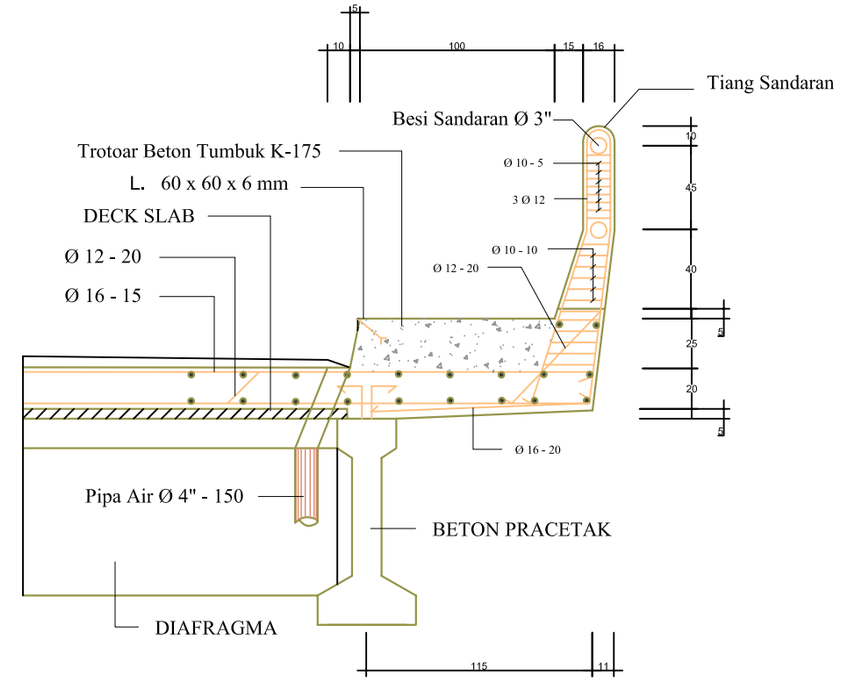
BAGIAN : TAMPAK, POTONGAN DAN DENAH

KETERANGAN	N A M A	TANDA TANGAN	TANGGAL	SKALA	NO. LBR
DIGAMBAR	SAFRIZAL, ST			1 : 100	01
DIRENCANA	Ir. AGUS HERI PRIYONO				JLH. LBR
DI PERIKSA	FAISAL, ST				05
DI SETUJU	Ir. ZAHRUDDIN, MSi				

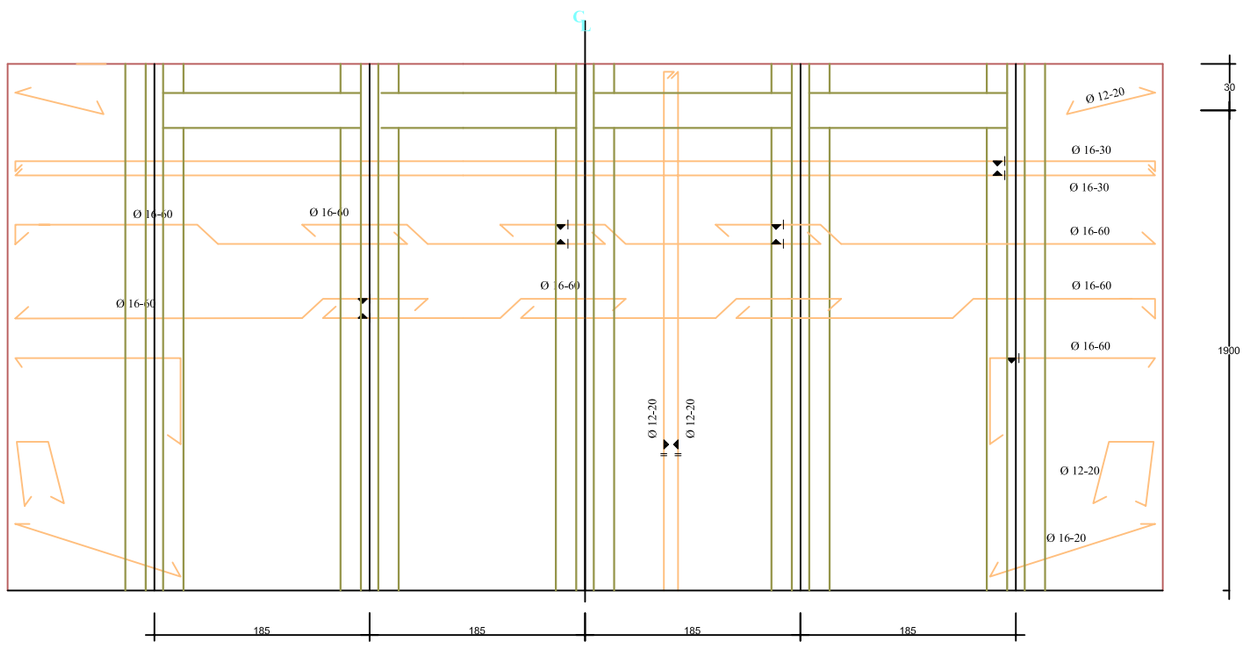
Figure B-14



POTONGAN MELINTANG
SKALA 1 : 25

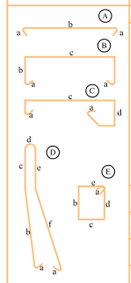


DETAIL A (TIANG SANDARAN)
SKALA 1 : 15



PENULANGAN LANTAI
SKALA 1 : 25

DAFTAR PEMBESIAN PLAT INJAK DAN TIANG SANDARAN

BENTUK TULANGAN	TYPE		A		B	C	D			E
			A1	A2	B	C	D1	D2	D3	E
	DIAMETER (mm)		12	12	12	12	10	10	10	12
	PANJANG (mm)	a	12	12	12	12	10	10	10	12
		b	295	245	16	16	16	16	16	70
		c			295	245	16	20	23	55
		d			16	26	16	16	16	16
		e				20	16	20	23	55
		f				16				75
	TOTAL PANJANG (m)		319	65	85	200	167	134	100	940
	BERAT PER UNIT (Kg/m)		26	30	26	30	108	108	60	12
	JUMLAH BERAT (Kg)		0.888	0.888	0.888	0.888	0.617	0.617	0.617	0.888
	TOTAL BERAT (Kg)		73.65	71.7	81.04	92.44	55.97	61.31	36.30	31.44

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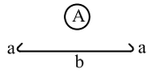
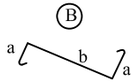
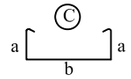
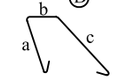
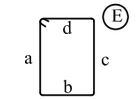
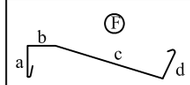
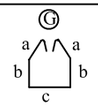
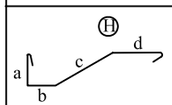
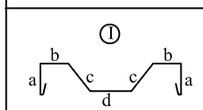
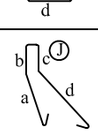
PROYEK PERENCANAAN DAN PENGAWASAN
JALAN DAN JEMBATAN PROVINSI NAD

PROYEK : JEMBATAN TGK. ASYIK STA. BNA 359+600

BAGIAN : POTONGAN MELINTANG, DETAIL TIANG SANDARAN DAN PENULANGAN LANTAI

KETERANGAN	N A M A	TANDA TANGAN	TANGGAL	SKALA	NO. LBR
DIGAMBAR	SAFRIZAL, ST			1 : 10 1 : 15 1 : 25	04
DIRENCANA	Ir. AGUS HERI PRIYONO				JLH. LBR
DI PERIKSA	FAISAL, ST				05
DI SETUJU	Ir. ZAHRUDDIN, MSi				

Figure B-15

BENTUK TULANGAN	DAFTAR TULANGAN																							
	TYPE		A												B			C		D	E		F	G	
			A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	B1	B2	B3	C1	C2	D1	E1	E2	F1	G1	H1
	DIAMETER (mm)		16	16	12	12	32	32	32	32	32	32	12	25	16	32	10	16	12	12	10	10	10	10	16
	PANJANG (mm)	a	7630	1500	650	20800	14000	7800	9800	12000	6800	8500	20800	7000			900	2x110	2x110	340	1270	650	1200	2x260	
		b													1450	4600	1300	7630	20800	200	220	220	400	2x310	1640
		c													650	1400	1000			440	1200	600	1350	440	200
		d																			270	260	690		1700
		e																							
	PANJANG TOTAL (mm)		7630	1500	650	20800	14000	7800	9800	12000	6800	8500	20800	7000	2100	6000	3200	7850	21020	980	2960	1730	3640	1580	3540
	KOREKSI (+/- mm')																								
	PANJANG PER TULANGAN (mm')		7630	1500	650	20800	14000	7800	9800	12000	6800	8500	20800	7000	2100	6000	3200	7850	21020	980	2960	1730	3640	1580	3540
	JUMLAH TULANGAN (st.)		66	198	198	39	12	16	28	16	20	20	16	50	66	16	16	66	39	198	480	105	16	480	66
			1X66	2X99	2X99	1X39	3X4	4X4	7X4	4X4	5X4	5X4	4X4	10X5	2X33	2X2X4	2X2X4	1X66	1X39	2X99	120X4	7X3X5	2X2X4	120X4	2X33
	TOTAL PANJANG TULANGAN (m')		328.10	297.00	128.70	811.20	168.00	124.80	274.40	192.00	136.00	170.00	332.80	350.00	138.60	96.00	51.20	518.10	819.78	194.04	1420.80	181.65	58.24	758.40	233.64
	CATATAN																								
	TYPE		H																						
			H2	H3																					
	DIAMETER (mm)		16	16																					
	PANJANG (mm)	a																							
		b	1000	950																					
		c	200	200																					
		d	2420	2420																					
		e																							
	PANJANG TOTAL (mm)		3620	3570																					
	KOREKSI (+/- mm')																								
	PANJANG PER TULANGAN (mm')		3620	3570																					
	JUMLAH TULANGAN (st.)		66	33																					
			2X33	1X33																					
	TOTAL PANJANG TULANGAN (m')		238.92	117.81																					
	CATATAN																								

REPUBLIK INDONESIA
DEPARTEMEN PEMUKIMAN DAN PRASARANA WILAYAH
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PROYEK PERENCANAAN DAN PENGAWASAN
JALAN DAN JEMBATAN PROVINSI NAD

PROYEK : JEMBATAN SERETA STA. 61+800

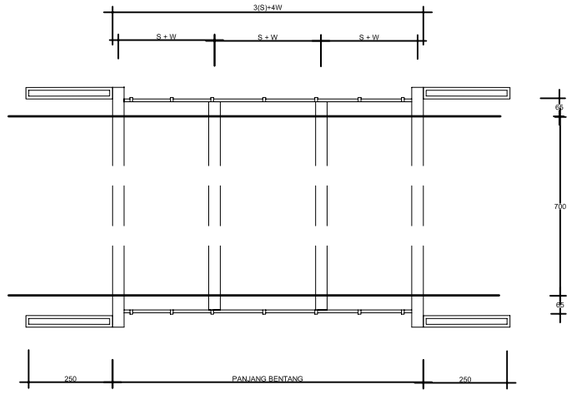
BAGIAN : DAFTAR TULANGAN

KETERANGAN	N A M A	TANDA TANGAN	TANGGAL	SKALA	NO. LBR
DIGAMBAR	SAFRIZAL, ST				06
DIRENCANA					JLH. LBR
DI PERIKSA	FAISAL, ST				
DI SETUJUI	Ir. ZAHRUDDIN				09

Figure B-16

STANDAR BOX CULVERT TIGA SPAN

DIMENSI (CM)					BOX CULVERT BETON BERTULANG																					WING WALL						TOTAL					KET
					1			2			3			4			5			6			7			8			9								
SPAN (S)	TINGGI (H)	TIMB. (C)	DINDING (W)	LANTAI (D)	∅	L	JH.BTG	∅	L	JH.BTG	∅	L	JH.BTG	∅	L	JH.BTG	∅	L	JH.BTG	∅	L	JH.BTG	∅	L	JH.BTG	∅	L	JH.BTG	∅	L	JH.BTG	BETON	K-225	K-225 A	K-175	K-125	
240	180	0 - 3	20	20	16	8,41	56 X 2	16	8,11	56 X 2	12	2,51	56 X 2	16	2,31	56 X 6	12	0,92	56 X 12	16	13,25	112 X 2	19	8,74	244	16	2,86	34 X 4	12	3,32	28 X 4						
		3 - 6	27	27		8,88			8,39			2,68			2,48			1,22			13,65									3,46							
		6 - 9	30	30		9,06			8,51			2,74			2,54			1,34			13,85									3,52							
	210	0 - 3	20	20	16	8,41	56 X 2	16	8,11	56 X 2	12	2,84	56 X 2	16	2,64	56 X 6	12	0,92	56 X 12	16	13,25	112 X 2	19	8,74	252	16	2,86	36 X 4	12	3,62	28 X 4						
		3 - 6	27	27		8,88			8,39			2,88			2,78			1,22			13,67									3,76							
		6 - 9	30	30		9,06			8,51			3,04			3,84			1,34			13,85									3,62							
	240	0 - 3	20	20	16	8,41	56 X 2	16	8,11	56 X 2	12	3,14	56 X 2	16	2,94	56 X 6	12	0,92	56 X 12	16	13,25	112 X 2	19	8,74	268	16	2,86	40 X 4	12	3,92	28 X 4						
		3 - 6	27	27		8,88			8,39			3,28			3,08			1,22			13,67									4,06							
		6 - 9	30	30		9,06			8,51			3,34			3,14			1,34			13,85									4,12							
	275	0 - 3	20	20	16	8,41	56 X 2	16	8,11	56 X 2	12	3,49	56 X 2	16	3,29	56 X 6	12	0,92	56 X 12	16	13,25	112 X 2	19	8,74	276	16	2,86	44 X 4	12	4,27	28 X 4						
		3 - 6	27	27		8,88			8,39			3,63			3,43			1,22			13,65									4,41							
		6 - 9	30	30		9,06			8,51			3,69			3,49			1,34			13,85									4,47							
300	210	0 - 3	22	22	16	8,41	56 X 2	16	9,99	56 X 2	12	2,88	56 X 2	16	2,68	56 X 6	12	1,0	56 X 12	16	15,43	112 X 2	19	8,74	288	16	2,86	38 X 4	12	3,66	28 X 4						
		3 - 6	30	30		8,88			10,31			3,04			2,84			1,34			15,91									3,82							
		6 - 9	36	36		9,06			10,55			3,16			2,96			1,59			16,23									3,94							
	240	0 - 3	22	22	16	8,41	56 X 2	16	9,99	56 X 2	12	3,18	56 X 2	16	2,98	56 X 6	12	1,0	56 X 12	16	15,43	112 X 2	19	8,74	3,04	16	2,86	42 X 4	12	3,96	28 X 4						
		3 - 6	30	30		8,88			10,31			3,34			3,14			1,34			15,91									4,12							
		6 - 9	36	36		9,06			10,55			3,56			3,26			1,59			16,23									4,24							
	275	0 - 3	22	22	16	8,41	56 X 2	16	9,99	56 X 2	12	3,53	56 X 2	16	3,33	56 X 6	12	1,0	56 X 12	16	15,43	112 X 2	19	8,74	3,12	16	2,86	46 X 4	12	4,31	28 X 4						
		3 - 6	30	30		8,88			10,31			3,69			3,49			1,34			15,91									4,47							
		6 - 9	36	36		9,06			10,55			3,81			3,61			1,59			16,27									4,59							
	300	0 - 3	22	22	16	8,41	56 X 2	16	9,99	56 X 2	12	3,78	56 X 2	16	3,58	56 X 6	12	1,0	56 X 12	16	15,43	112 X 2	19	8,74	3,28	16	2,86	48 X 4	12	4,56	28 X 4						
		3 - 6	30	30		8,88			10,31			3,94			3,74			1,34			15,91									4,72							
		6 - 9	36	36		9,06			10,55			4,06			3,86			1,59			16,23									4,84							
360	240	TIDAK	24	30	16	12,42	56 X 2	16	11,97	56 X 2	12	3,34	56 X 2	16	3,14	56 X 6	12	1,25	56 X 12	16	17,36	112 X 2	19	8,74	3,44	16	2,86	42 X 4	12	4,12	28 X 4						
	275	TIDAK	24	30	16	12,42	56 X 2	16	11,97	56 X 2	12	3,69	56 X 2	16	3,49	56 X 6	12	1,25	56 X 12	16	17,36	112 X 2	19	8,74	3,52	16	2,86	46 X 4	12	4,47	28 X 4						
	300	TIDAK	24	30	16	12,42	56 X 2	16	11,97	56 X 2	12	3,94	56 X 2	16	3,74	56 X 6	12	1,25	56 X 12	16	17,36	112 X 2	19	8,74	3,68	16	2,86	48 X 4	12	3,72	28 X 4						
	360	TIDAK	26	32	16	12,54	56 X 2	16	11,95	56 X 2	12	4,58	56 X 2	16	4,38	56 X 6	12	1,34	56 X 12	16	17,48	112 X 2	19	8,74	3,92	16	2,86	54 X 4	12	5,24	28 X 4						
400	275	TIDAK	30	35	16	14,0	56 X 2	16	13,31	56 X 2	12	3,79	56 X 2	16	3,59	56 X 6	12	1,48	56 X 12	16	19,55	112 X 2	19	8,74	3,80	16	2,86	46 X 4	12	4,57	28 X 4						
	300	TIDAK	30	35	16	14,0	56 X 2	16	13,31	56 X 2	12	4,04	56 X 2	16	3,82	56 X 6	12	1,48	56 X 12	16	19,55	112 X 2	19	8,74	3,96	16	2,86	48 X 4	12	4,82	28 X 4						
	360	TIDAK	32	35	16	14,08	56 X 2	16	13,39	56 X 2	12	4,64	56 X 2	16	4,44	56 X 6	12	1,48	56 X 12	16	19,55	112 X 2	19	8,74	4,24	16	2,86	50 X 4	12	5,30	28 X 4						
	400	TIDAK	32	35	16	14,08	56 X 2	16	13,39	56 X 2	12	5,04	56 X 2	16	4,84	56 X 6	12	1,48	56 X 12	16	19,55	112 X 2	19	8,74	4,36	16	2,86	60 X 4	12	5,82	28 X 4						



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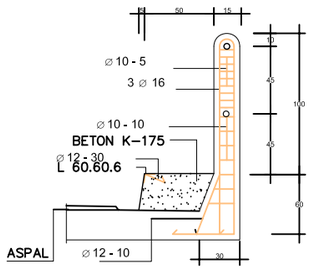
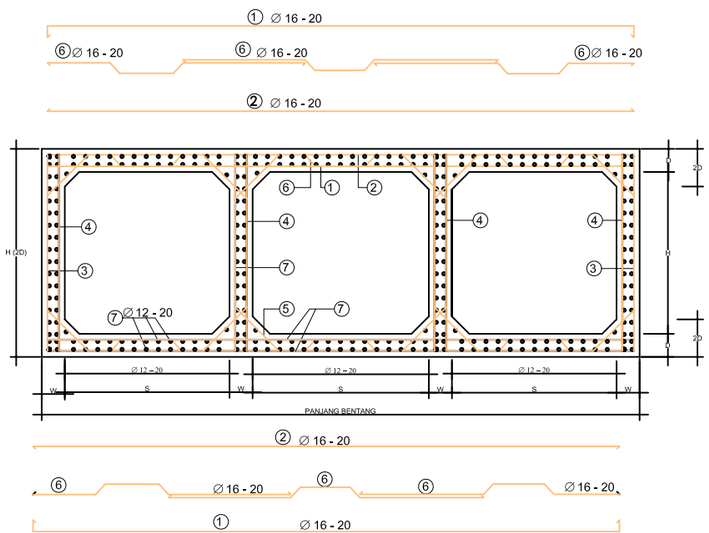
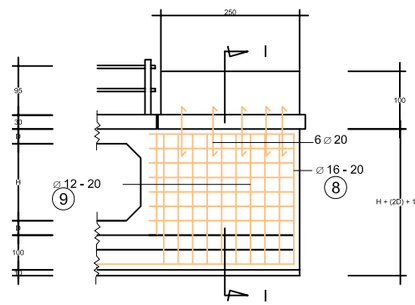
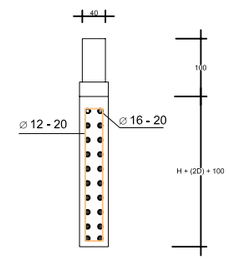


DETAIL TIANG SANDARAN

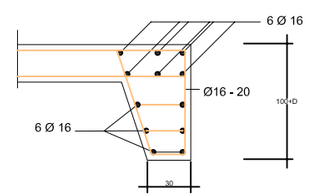




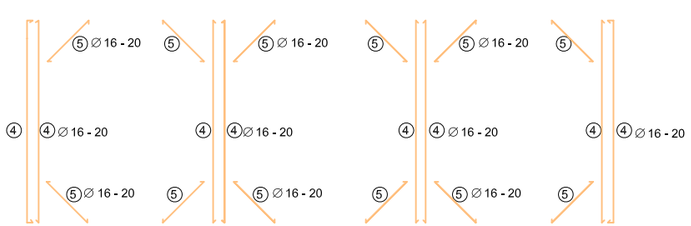
PEMBESIAN WING WALL



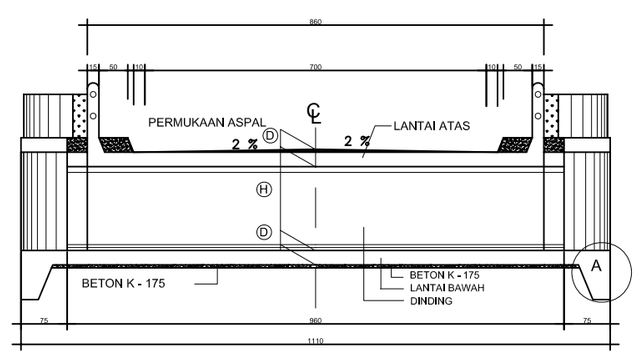
POTONGAN I - I



DETAIL A



PEMBESIAN BOX CULVERT



CROSS SECTION

REPUBLIK INDONESIA
DEPARTEMEN PEMUKIMAN DAN PRASARANA WILAYAH
DIREKTORAT JENDERAL PRASARANA WILAYAH
PROYEK PERENCANAAN DAN PENGAWASAN
JALAN DAN JEMBATAN PROVINSI NAD

PROYEK :

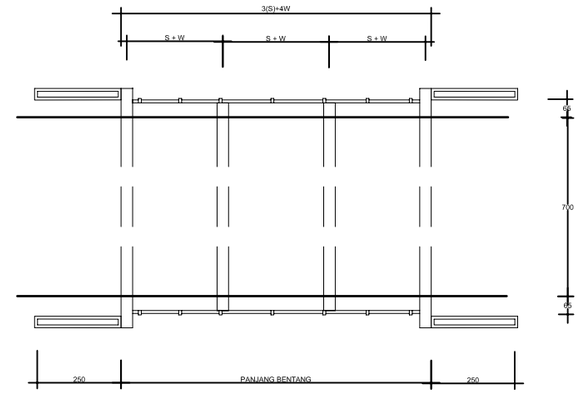
GAMBAR : STANDARD BOX CULVERT

KETERANGAN	N A M A	TANDA TANGAN	TANGGAL	SKALA	NO. LBR
DIGAMBAR	DENNY. F				
DIRENCANA					JLH. LBR
DI PERIKSA	FAISAL, ST				
DI SETUJUI	Ir. ZAHRUDDIN				

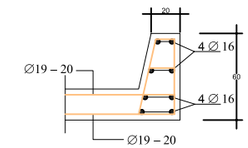
Figure B-17

STANDAR BOX CULVERT TIGA SPAN

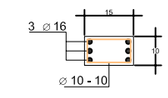
DIMENSI (CM)					BOX CULVERT BETON BERTULANG																					WING WALL						TOTAL					KET
SPAN (S)	TINGGI (H)	TIMB. (C)	DINDING (W)	LANTAI (D)	1			2			3			4			5			6			7			8			9			BETON	K-225	K-225 A	K-175	K-125	
					∅	L	JH.BTG	∅	L	JH.BTG	∅	L	JH.BTG	∅	L	JH.BTG	∅	L	JH.BTG	∅	L	JH.BTG	∅	L	JH.BTG	∅	L	JH.BTG	∅	L	JH.BTG						
240	180	0 - 3	20	20	16	8,41	56 X 2	16	8,11	56 X 2	12	2,51	56 X 2	16	2,31	56 X 6	12	0,92	56 X 12	16	13,25	112 X 2	19	8,74	244	16	2,86	34 X 4	12	3,32	28 X 4						
		3 - 6	27	27		8,88			8,39			2,65			2,48			1,22			13,65									3,46							
		6 - 9	30	30		9,06			8,51			2,74			2,54			1,34			13,85									3,52							
	210	0 - 3	20	20	16	8,41	56 X 2	16	8,11	56 X 2	12	2,84	56 X 2	16	2,64	56 X 6	12	0,92	56 X 12	16	13,25	112 X 2	19	8,74	252	16	2,86	36 X 4	12	3,62	28 X 4						
		3 - 6	27	27		8,88			8,39			2,98			2,78			1,22			13,67									3,76							
		6 - 9	30	30		9,06			8,51			3,04			3,84			1,34			13,85									3,82							
	240	0 - 3	20	20	16	8,41	56 X 2	16	8,11	56 X 2	12	3,14	56 X 2	16	2,94	56 X 6	12	0,92	56 X 12	16	13,25	112 X 2	19	8,74	268	16	2,86	40 X 4	12	3,92	28 X 4						
		3 - 6	27	27		8,88			8,39			3,28			3,08			1,22			13,67									4,06							
		6 - 9	30	30		9,06			8,51			3,34			3,14			1,34			13,85									4,12							
	275	0 - 3	20	20	16	8,41	56 X 2	16	8,11	56 X 2	12	3,49	56 X 2	16	3,29	56 X 6	12	0,92	56 X 12	16	13,25	112 X 2	19	8,74	276	16	2,86	44 X 4	12	4,27	28 X 4						
		3 - 6	27	27		8,88			8,39			3,53			3,43			1,22			13,65									4,41							
		6 - 9	30	30		9,06			8,51			3,69			3,49			1,34			13,85									4,47							
300	210	0 - 3	22	22	16	8,41	56 X 2	16	9,99	56 X 2	12	2,88	56 X 2	16	2,68	56 X 6	12	1,0	56 X 12	16	15,43	112 X 2	19	8,74	2,88	16	2,86	38 X 4	12	3,66	28 X 4						
		3 - 6	30	30		8,88			10,31			3,04			2,84			1,34			15,91									3,82							
		6 - 9	36	36		9,06			10,55			3,16			2,96			1,59			16,23									3,94							
	240	0 - 3	22	22	16	8,41	56 X 2	16	9,99	56 X 2	12	3,18	56 X 2	16	2,98	56 X 6	12	1,0	56 X 12	16	15,43	112 X 2	19	8,74	3,04	16	2,86	42 X 4	12	3,96	28 X 4						
		3 - 6	30	30		8,88			10,31			3,34			3,14			1,34			15,91									4,12							
		6 - 9	36	36		9,06			10,55			3,56			3,26			1,59			16,23									4,24							
	275	0 - 3	22	22	16	8,41	56 X 2	16	9,99	56 X 2	12	3,53	56 X 2	16	3,33	56 X 6	12	1,0	56 X 12	16	15,43	112 X 2	19	8,74	3,12	16	2,86	46 X 4	12	4,31	28 X 4						
		3 - 6	30	30		8,88			10,31			3,69			3,49			1,34			15,91									4,47							
		6 - 9	36	36		9,06			10,55			3,81			3,61			1,59			16,27									4,59							
	300	0 - 3	22	22	16	8,41	56 X 2	16	9,99	56 X 2	12	3,78	56 X 2	16	3,58	56 X 6	12	1,0	56 X 12	16	15,43	112 X 2	19	8,74	3,28	16	2,86	48 X 4	12	4,56	28 X 4						
		3 - 6	30	30		8,88			10,31			3,94			3,74			1,34			15,91									4,72							
		6 - 9	36	36		9,06			10,55			4,06			3,86			1,59			16,23									4,84							
360	240	TIDAK	24	30	16	12,42	56 X 2	16	11,97	56 X 2	12	3,34	56 X 2	16	3,14	56 X 6	12	1,25	56 X 12	16	17,36	112 X 2	19	8,74	3,44	16	2,86	42 X 4	12	4,12	28 X 4						
	275	TIDAK	24	30	16	12,42	56 X 2	16	11,97	56 X 2	12	3,69	56 X 2	16	3,49	56 X 6	12	1,25	56 X 12	16	17,36	112 X 2	19	8,74	3,52	16	2,86	46 X 4	12	4,47	28 X 4						
	300	TIDAK	24	30	16	12,42	56 X 2	16	11,97	56 X 2	12	3,94	56 X 2	16	3,74	56 X 6	12	1,25	56 X 12	16	17,36	112 X 2	19	8,74	3,68	16	2,86	48 X 4	12	4,72	28 X 4						
	360	TIDAK	26	32	16	12,54	56 X 2	16	11,95	56 X 2	12	4,58	56 X 2	16	4,38	56 X 6	12	1,34	56 X 12	16	17,48	112 X 2	19	8,74	3,92	16	2,86	54 X 4	12	5,24	28 X 4						
400	275	TIDAK	30	35	16	14,0	56 X 2	16	13,31	56 X 2	12	3,79	56 X 2	16	3,59	56 X 6	12	1,48	56 X 12	16	19,55	112 X 2	19	8,74	3,80	16	2,86	46 X 4	12	4,57	28 X 4						
	300	TIDAK	30	35	16	14,0	56 X 2	16	13,31	56 X 2	12	4,04	56 X 2	16	3,82	56 X 6	12	1,48	56 X 12	16	19,55	112 X 2	19	8,74	3,96	16	2,86	48 X 4	12	4,82	28 X 4						
	360	TIDAK	32	35	16	14,08	56 X 2	16	13,39	56 X 2	12	4,64	56 X 2	16	4,44	56 X 6	12	1,48	56 X 12	16	19,55	112 X 2	19	8,74	4,24	16	2,86	56 X 4	12	5,30	28 X 4						
	400	TIDAK	32	35	16	14,08	56 X 2	16	13,39	56 X 2	12	5,04	56 X 2	16	4,84	56 X 6	12	1,48	56 X 12	16	19,55	112 X 2	19	8,74	4,36	16	2,86	60 X 4	12	5,82	28 X 4						



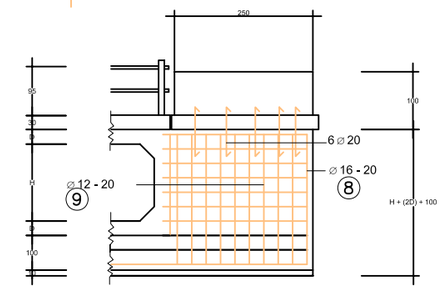
DENAH



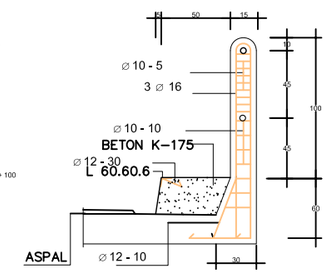
DETAIL A



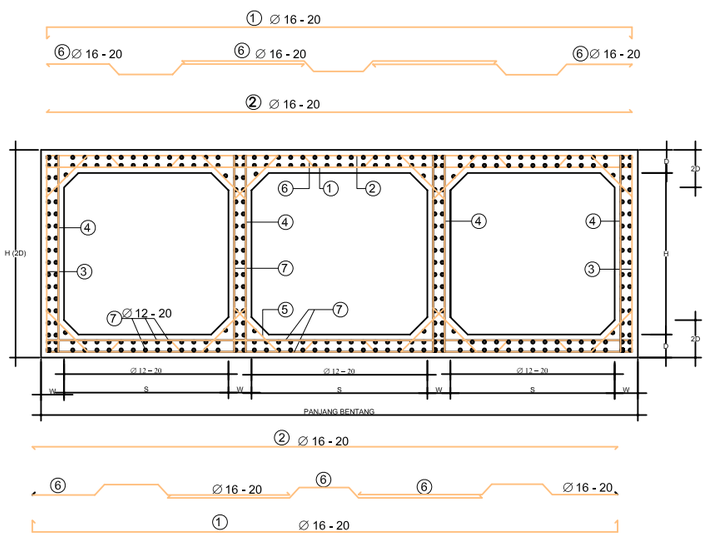
POTONGAN

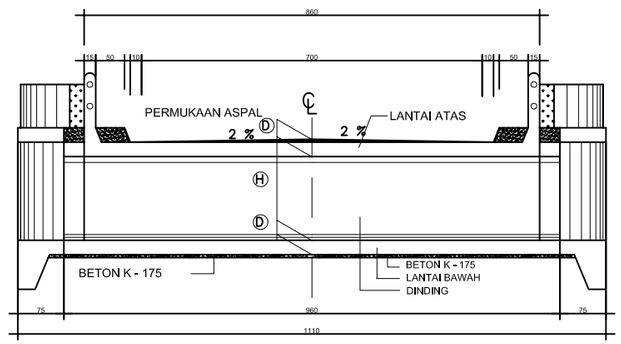


PEMBESIAN WING WALL

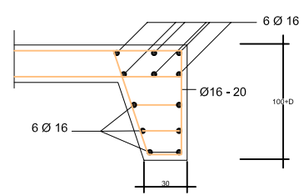


DETAIL TIANG SANDARAN

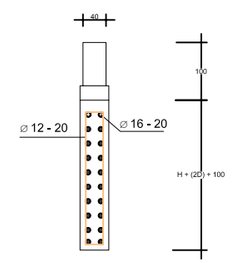




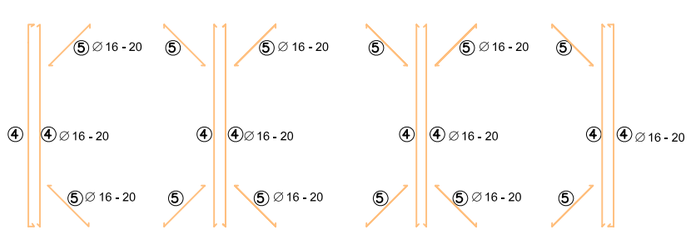
CROSS SECTION (TYPE 1)



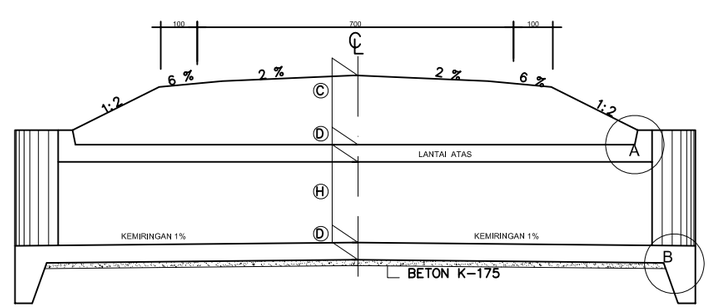
DETAIL B



POTONGAN



PEMBESIAN BOX CULVERT



CROSS SECTION (TYPE 2)

REPUBLIK INDONESIA
DEPARTEMEN PEMUKIMAN DAN PRASARANA WILAYAH
DIREKTORAT JENDERAL PRASARANA WILAYAH
PROYEK PERENCANAAN DAN PENGAWASAN
JALAN DAN JEMBATAN PROVINSI NAD

PROYEK : JALAN LAMBARO - KM. 77

GAMBAR : STANDARD BOX CULVERT

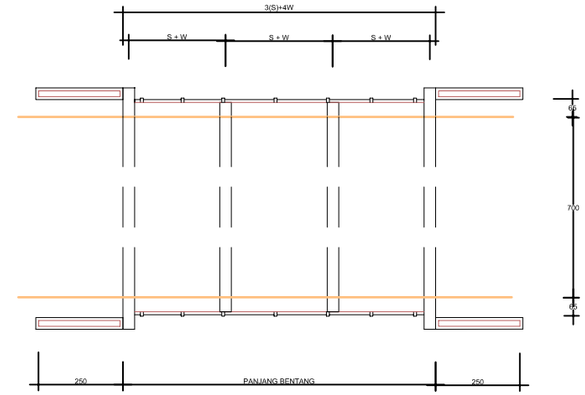
KETERANGAN	N A M A	TANDA TANGAN	TANGGAL	SKALA	NO. LBR
DIGAMBAR	DENNY. F				
DIRENCANA					JLH. LBR
DI PERIKSA	FAISAL, ST				
DI SETUJUI	Ir. ZAHRUDDIN				

Figure B-18

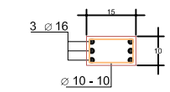
PROYEK	KODE PROYEK/TH	PROVINSI	JUMLAH LEMBAR	LEMBAR NO..
P3JJ	2004	N A D		
STANDAR BOX CULVERT TIGA SPAN				

STANDAR BOX CULVERT TIGA SPAN

DIMENSI (CM)					BOX CULVERT BETON BERTULANG																					WING WALL						TOTAL					KET
					1			2			3			4			5			6			7			8			9								
SPAN (S)	TINGGI (H)	TIMB. (C)	DINDING (W)	LANTAI (D)	∅	L	JH.BTG	∅	L	JH.BTG	∅	L	JH.BTG	∅	L	JH.BTG	∅	L	JH.BTG	∅	L	JH.BTG	∅	L	JH.BTG	∅	L	JH.BTG	∅	L	JH.BTG	BETON	K-225	K-225 A	K-175	K-125	
240	180	0 - 3	20	20	16	8,41	56 X 2	16	8,11	56 X 2	12	2,51	56 X 2	16	2,31	56 X 6	12	0,92	56 X 12	16	13,25	112 X 2	19	8,74	244	16	2,86	34 X 4	12	3,32	28 X 4						
		3 - 6	27	27		8,88			8,39			2,68			2,48			1,22			13,65									3,46							
		6 - 9	30	30		9,06			8,51			2,74			2,54			1,34			13,85									3,52							
	210	0 - 3	20	20	16	8,41	56 X 2	16	8,11	56 X 2	12	2,84	56 X 2	16	2,64	56 X 6	12	0,92	56 X 12	16	13,25	112 X 2	19	8,74	252	16	2,86	36 X 4	12	3,62	28 X 4						
		3 - 6	27	27		8,88			8,39			2,98			2,78			1,22			13,67									3,76							
		6 - 9	30	30		9,06			8,51			3,04			3,84			1,34			13,85									3,62							
	240	0 - 3	20	20	16	8,41	56 X 2	16	8,11	56 X 2	12	3,14	56 X 2	16	2,94	56 X 6	12	0,92	56 X 12	16	13,25	112 X 2	19	8,74	268	16	2,86	40 X 4	12	3,92	28 X 4						
		3 - 6	27	27		8,88			8,39			3,28			3,08			1,22			13,67									4,06							
		6 - 9	30	30		9,06			8,51			3,34			3,14			1,34			13,85									4,12							
	275	0 - 3	20	20	16	8,41	56 X 2	16	8,11	56 X 2	12	3,49	56 X 2	16	3,29	56 X 6	12	0,92	56 X 12	16	13,25	112 X 2	19	8,74	276	16	2,86	44 X 4	12	4,27	28 X 4						
		3 - 6	27	27		8,88			8,39			3,63			3,43			1,22			13,65									4,41							
		6 - 9	30	30		9,06			8,51			3,69			3,49			1,34			13,85									4,47							
300	210	0 - 3	22	22	16	8,41	56 X 2	16	9,99	56 X 2	12	2,88	56 X 2	16	2,68	56 X 6	12	1,0	56 X 12	16	15,43	112 X 2	19	8,74	2,88	16	2,86	38 X 4	12	3,66	28 X 4						
		3 - 6	30	30		8,88			10,31			3,04			2,84			1,34			15,91									3,82							
		6 - 9	36	36		9,06			10,55			3,16			2,96			1,59			16,23									3,94							
	240	0 - 3	22	22	16	8,41	56 X 2	16	9,99	56 X 2	12	3,18	56 X 2	16	2,98	56 X 6	12	1,0	56 X 12	16	15,43	112 X 2	19	8,74	3,04	16	2,86	42 X 4	12	3,96	28 X 4						
		3 - 6	30	30		8,88			10,31			3,34			3,14			1,34			15,91									4,12							
		6 - 9	36	36		9,06			10,55			3,56			3,26			1,59			16,23									4,24							
	275	0 - 3	22	22	16	8,41	56 X 2	16	9,99	56 X 2	12	3,53	56 X 2	16	3,33	56 X 6	12	1,0	56 X 12	16	15,43	112 X 2	19	8,74	3,12	16	2,86	46 X 4	12	4,31	28 X 4						
		3 - 6	30	30		8,88			10,31			3,69			3,49			1,34			15,91									4,47							
		6 - 9	36	36		9,06			10,55			3,81			3,61			1,59			16,27									4,59							
	300	0 - 3	22	22	16	8,41	56 X 2	16	9,99	56 X 2	12	3,78	56 X 2	16	3,58	56 X 6	12	1,0	56 X 12	16	15,43	112 X 2	19	8,74	3,28	16	2,86	48 X 4	12	4,56	28 X 4						
		3 - 6	30	30		8,88			10,31			3,94			3,74			1,34			15,91									4,72							
		6 - 9	36	36		9,06			10,55			4,06			3,86			1,59			16,23									4,84							
360	240	TIDAK	24	30	16	12,42	56 X 2	16	11,97	56 X 2	12	3,34	56 X 2	16	3,14	56 X 6	12	1,25	56 X 12	16	17,36	112 X 2	19	8,74	3,44	16	2,86	42 X 4	12	4,12	28 X 4						
	275	TIDAK	24	30	16	12,42	56 X 2	16	11,97	56 X 2	12	3,69	56 X 2	16	3,49	56 X 6	12	1,25	56 X 12	16	17,36	112 X 2	19	8,74	3,52	16	2,86	46 X 4	12	4,47	28 X 4						
	300	TIDAK	24	30	16	12,42	56 X 2	16	11,97	56 X 2	12	3,94	56 X 2	16	3,74	56 X 6	12	1,25	56 X 12	16	17,36	112 X 2	19	8,74	3,68	16	2,86	48 X 4	12	3,72	28 X 4						
	360	TIDAK	26	32	16	12,54	56 X 2	16	11,95	56 X 2	12	4,58	56 X 2	16	4,38	56 X 6	12	1,34	56 X 12	16	17,48	112 X 2	19	8,74	3,92	16	2,86	54 X 4	12	5,24	28 X 4						
400	275	TIDAK	30	35	16	14,0	56 X 2	16	13,31	56 X 2	12	3,79	56 X 2	16	3,59	56 X 6	12	1,48	56 X 12	16	19,55	112 X 2	19	8,74	3,80	16	2,86	46 X 4	12	4,57	28 X 4						
	300	TIDAK	30	35	16	14,0	56 X 2	16	13,31	56 X 2	12	4,04	56 X 2	16	3,82	56 X 6	12	1,48	56 X 12	16	19,55	112 X 2	19	8,74	3,96	16	2,86	48 X 4	12	4,82	28 X 4						
	360	TIDAK	32	35	16	14,08	56 X 2	16	13,39	56 X 2	12	4,64	56 X 2	16	4,44	56 X 6	12	1,48	56 X 12	16	19,55	112 X 2	19	8,74	4,24	16	2,86	56 X 4	12	5,30	28 X 4						
	400	TIDAK	32	35	16	14,08	56 X 2	16	13,39	56 X 2	12	5,04	56 X 2	16	4,84	56 X 6	12	1,48	56 X 12	16	19,55	112 X 2	19	8,74	4,36	16	2,86	60 X 4	12	5,82	28 X 4						



DENAH



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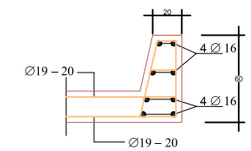
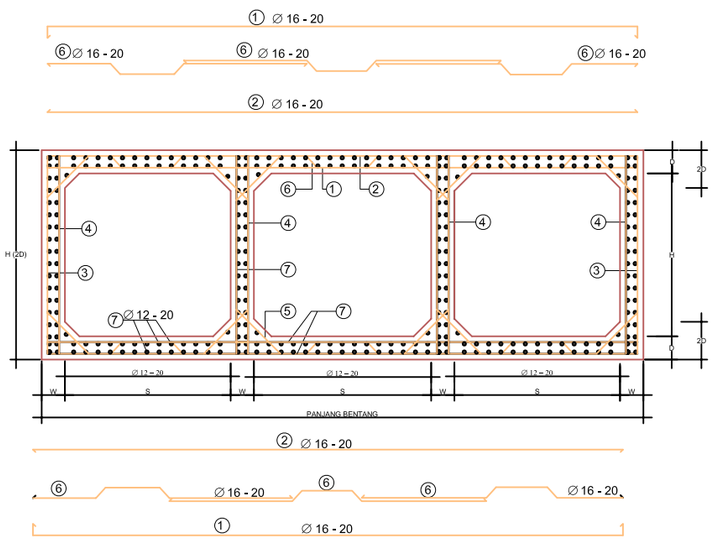
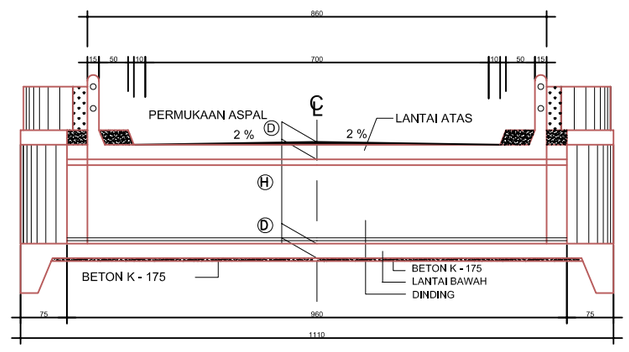


DETAIL A





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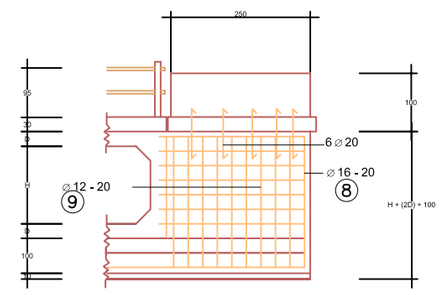
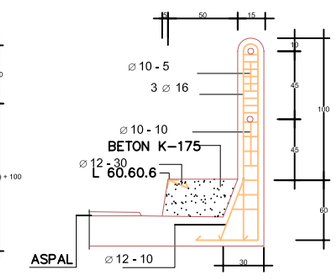
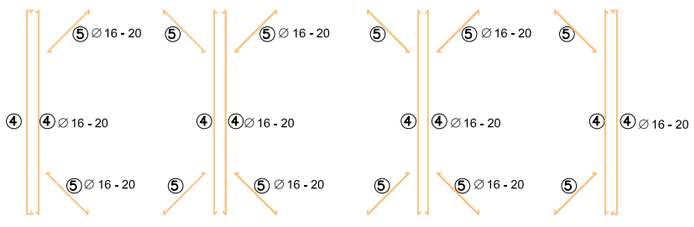


PEMBESIAN WING WALL



DETAIL TIANG SANDARAN



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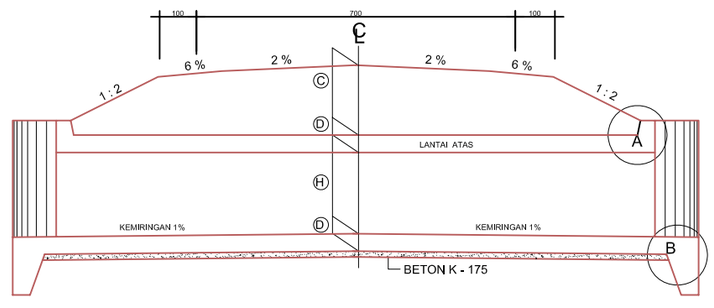

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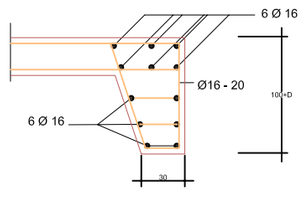

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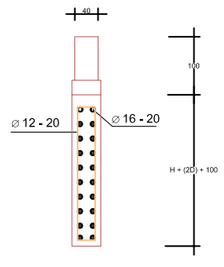

POTONGAN

Figure B-19

APPENDIX C: UKL-UPL

FOREWORD

Thank you to God The Only One for completion Study of Environmental Management Effort (UKL) and Environmental Monitoring Effort (UPL) Banda Aceh – Lamno Reconstruction and Rehabilitation Nanggroe Aceh Darussalam Province. This Report meets with the environmental design development program.

Enclosed is our best effort on the draft UKL/UPL. However, we know nothing is perfect. Your input will greatly improve the quality of this report.

Finally, we thank you in advance and greatly appreciate any assistance you can provide on this report and your efforts to help fulfill the aim of the environmental design development program.

Banda Aceh, 28 June 2005

Proponent,

Road and Bridges Planning and Monitoring
Public Work Department
Nanggroe Aceh Darussalam Province

IR. K H A L I D I N, MT
NIP. 390013175

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Chapter I
Introduction

1.1. Background

In December 2004, a 8.9 Richter scale earthquake followed by the biggest Tsunami wave in the last 200 years killed more than 200,000 people and destroyed various parts of the infrastructure along the west coast and a part of the north coast of the Nanggroe Aceh Darussalam Province in Indonesia. Many countries around the world expressed their sympathy and donated funds during the emergency period and for the rehabilitation and reconstruction of Aceh. The United States, through the U.S. *Agency for International Development (USAID)*, is providing financial and technical support for the road reconstruction and rehabilitation between Banda Aceh – Meulaboh. The road, damaged by the tsunami, is approximately 240 km long.

On May 8, 2005, the Indonesian government, through the Department of Public Works, signed a Memorandum of Understanging (MOU) with the U.S. government via USAID to rebuild the road from Banda Aceh to Meulaboh.

The implementation of road reconstruction and rehabilitation will be done in two stages. The first stage covers 80 km of road between Banda Aceh and Lamno. The proposed work includes relocating up to 10 km of road from its original position. The remaining road and all its water crossings from Banda Aceh to Lamno will be maintained as a temporary road under this first stage. Based upon existing regulations, AMDAL (Environmental Impact Analysis) is not mandatory for this size of project. However, a UKL (Environmental Management Effort) and UPL (Environmental Monitoring Effort) report is required.

The second stage of the project covers the full length of road from Banda Aceh to Meulaboh, approximately 240 km. Under the second stage, the entire road and water crossings will be improved, incorporating the 10 km area constructed in the first phase. For this stage, an AMDAL (Environmental Impact Analysis) is mandatory because more than 90% of the road (primarily the segments from Calang to Meulaboh) will be relocated from its original position. To ensure that the rehabilitation and reconstruction of the first stage takes into account the environmental issues, the environmental document is prepared in the form of the UKL and UPL.

1.2. OBJECTIVES AND FUNCTIONS OF UKL AND UPL

1.2.1. UKL Objective

The objective of the UKL is to prevent, control and mitigate the negative impacts that may arise from reconstruction and rehabilitation activities of the first stage of the road construction from Banda Aceh to Lamno and to identify and develop potential positive impacts.

1.2.2. UPL Objective

The objective of the UPL is:

a. To monitor the implementation of the environmental management measures of the UKL during the reconstruction and rehabilitation of the Banda Aceh – Lamno road section by looking at the environmental changes resulting from the performed activities.
b. To provide input to related parties with regard to the implementation of the environmental management measures if there are changes related to environmental issues during the reconstruction and rehabilitation activities of the Banda Aceh to Lamno road.

1.2.3. UKL Function

The function of the UKL is:

a. To provide direction on the method of handling potential environmental impacts so that negative impacts may be prevented and addressed as early as possible.
b. To inform the project management team and related parties of their duties and responsibilities with regard to implementing environmental management measures.

1.2.4. UPL Function

The function of the UPL is to monitor and provide input on the effectiveness of the implementation of the environmental management measures outlined in the UKL.

1.3. LEGISLATION

The following legistlation is used as a basis for preparing the UKL andUPL documents for the reconstruction and rehabilitation activities of Banda Aceh – Lamno road:

a. Act No. 5 Year 1960 regarding Agricultural Base Regulation (Peraturan Dasar Pokok-Pokok Agraria)
b. Act No. 11 Year 1974 regarding Irrigation

c. Act No. 13 Year 1980 regarding Roadway
d. Act No. 5 Year 1990 regarding Conservation of Natural Flora Resources and Its Ecosystem
e. Act No. 4 Year 1992 regarding Housing
f. Act No. 14 Year 1992 regarding Traffic and Road Transportation
g. Act No. 24 Year 1992 regarding Spacing Layout
h. Act No. 23 Year 1997 regarding Environmental Management
i. Government Regulation No. 26 Year 1985 regarding Roadway
j. Government Regulation No. 27 Year 1991 regarding Wetlands
k. Government Regulation No. 26 Year 1991 regarding Rivers
l. Government Regulation No. 27 Year 1999 regarding Environmental Impact Analysis
m. Government Regulation No. 41 Year 1999 regarding Air Pollution Management
n. Government Regulation No. 25 Year 2000 regarding Governmental Authority and Provincial Authority as Autonomous Area
o. Government Regulation No. 82 Year 2001 regarding Water Quality and Water Pollution Management
p. Presidential Decree No. 55 Year 1993 regarding Land Acquisition for the Development related to Public Interest.
q. Ministry of Public Work Decree No. 296/KPTS/1996, Guideline for Conducting Environmental Management Effort and Environmental Monitoring Effort
r. Ministry of Public Work Decree No. 377/KPTS/1996, Guideline for the Implementation of Environmental Management Effort and Environmental Monitoring Effort
s. Ministry of Public Work Decree No. 481/KPTS/1996, List of Activities in Public Work Area to be complemented with Environmental Impact Analysis
t. State Ministry of Environmal Decree No. 17/2001 regarding Business Type and/or Activities to be Complemented with AMDAL
u. State Ministry of Environmental No. 86 Year 2002 regarding the Implementation of Environmental Management Effort and Environmental Monitoring Effort
v. Ministry of Facilities and Housing Decree No. 17/KPTS/M 2003, regarding Determination of Business Type and/or activities in Housing Sector and Mandatory Regional Facilities to be Complemented by Environmental Management Effort and Environmental Monitoring Effort

Chapter II.
ENVIRONMENTAL MANAGEMENT EFFORT (UKL) AND ENVIRONMENTAL MONITORING EFFORT (UPL)

In accordance with the Decree of the Ministry of Environment Number 86 Year 2002 regarding the Environmental Management Effort (UKL) and Environmental Monitoring Effort (UPL), following is a description of the applicable UKL and UPL elements for the reconstruction and rehabilitation of the Banda Aceh –Lamno road:

1.4. INITIATOR IDENTITY

Project Name :	Banda Aceh to Lamno Road Rehabilitation and Reconstruction, NAD Province
Project Manager:	Department of Public Works, Road and Bridge Planning and Monitoring, Temporary Work Head, NAD Province
Offce Address :	Jalan Sudirman No. 1 Banda Aceh Telephone/Fax : 0651 (41750)
Sponsor:	USAID

1.5. Committee Identity

1. Company Name:	PT. ERM Indonesia
2. Address:	Wisma Aldiron Dirgantara 2nd Flour Suite 238-239 Jl. Jenderal Gatot Subroto Kav. 72 Jakarta 12780 Tel./Fax (021) 79181904 / 79181905
3. Project Director :	Dr. Karlheinz Spitz

The decription of the UKL and UPL Study Committee for the Banda Aceh to Lamno Road Rehabilitation and Reconstruction is provided below:

No.	Name		Specialist
1.	Hasbullah Hasan	:	Physical Chemist, Amdal A and B Certified
2.	Steven Brown	:	Civil Engineer
3.	Rafeldy Noviar	:	Biologist, Amdal A Certified
4.	Syarif Bastaman	:	Social Economist, Amdal A and B Certified

1.6. Purpose of Project

a. Project Name: Banda Aceh to Lamno Rehabilitation and Reconstruction, NAD Province

b. Project Location: Banda Aceh – Lamno, approximately 60 Km, NAD Province (Road relocation up to 10 km). Details are shown in **Figure 2.1**.

Figure 2.1. Location of Project

c. Scale of Project :

1. Road construction.

Road construction activities are described in **Table 2.1.** below:

Table 2.1. Road Construction Activities

No	Description	Dimension	
1.	Length of road	10	km
2.	Width of Right of Way	30	M
3.	Width of road from center line	7	M
4.	Width of Sholder	2 x 2	M
5.	Thickness of Subbase coarse	45	C m
6.	Thickness of Base coarse	30	C m
7.	Thickness of Pavement	10	C m
8.	Width of Side Ditch	1,5	m

Source :
For details please see **Figure 2.2.** (R*oad design example*)

2. Bridges : 3 (three) Locations

The description of the planned bridge construction is shown below in **Table 2.2.**:

Table 2.2. Description of Bridge Construction

No	Name of bridge	Type	Length (m)	Width (m)	Fondation
1.	Krueng Raba	Concrete			
2.	Krueng Cundien	Concrete			
3.	Krueng Pudeng	Concrete			

Source :
For details please see **Figure 2.3.** *(Bridge design example)*

3. Box culverts:

The description of any necessary box culverts is as follows:

- Type Concrete: K 350 and pre-fabricated culvers (ARMCO)

For details please see **Figure 2.4.** *(Pipe Culvert design example)*

4. Soil Investigation :

The major components of resource material for road construction and bridge planning are shown below:

Table 2.3. Description of Construction's Essentials

No	Materials	Amount (M^3)
1.	Excavate soil	
2.	Stone	
3.	Lime stone	
4.	Sand	
5.	Gravel	

Source :

5. Type and amount of equipment

The following equipment is considered essential for the project construction:

Table 2.4. Description of Equipment Essentials

No	Type of Equipment	Unit
1.	Excavator	1
2.	Dump truck. 8 ton	4
3.	Flat Bed Truck, 4 ton	1
4.	Buldozer	2
5.	Grader	1
6.	Roller	1
7.	Shovel	1
8.	Tire Roller	1
9.	Dozer	1
10.	Aspalt Spayer	1
11.	Concrete Mixer	2
12.	Generator 200 KVA	1
13.	Aspalt Finisher	1
14.	Tandem Roller	1
15 .	Stone Crusher	1
16.	Aspalt Mixing Plant (AMP)	1
17.	Water Tank	1

Note : Data from activity analogy

6. Qualification and amount of labor:

The description of the disicipline, minimum qualifications and number of essential personnel needed for the project is listed in Table 2.5 below:

Table 2.5. Description of the Discipline, Educational Qualifications and Number of Essential Personnel.

No	Discipline	Minimum Educational Qualifications	Number of People
1.	Field Engineer	Civil Engineer/S1	2
2.	Quality Engineer	Civil Engineer /S1	4
3.	Quality Engineer/Chief Inspector	Civil Engineer /S1	4
4.	Lab Technician	Bachelor's of Civil Engineering/D3	2
5.	Surveyor	STM	4
6.	Supervisor	Bachelor's of Civil Engineering/D3	4
7.	Administrator	Bachelor's of Economics/Business/D3	2
8.	Draftsperson	STM or equivalent	2
9.	Supervisor	STM or equivalent	2
10.	Skilled driver	-	10
11.	Equipment Operator	STM or equivalent	6
12.	Skilled labor	STM or equivalent	10
13.	Unskilled labor	-	30
Total			82

Note : Data from activities analogy

Chapter III
ACTION PLAN GUIDELINES

1.7. Pre-Construction Phase:

The activities on for the pre-construction phase include the following:

a. Survey and Measurements

These activities are conducted during the initial construction phase to establish the route of the road design including the placement of the the road divider and shoulders, the lane dividers, gutter designs, box culverts and bridges, borrow location areas, and disposal areas. The survey will also determine the base camp location and project site location. Due to the urgency and emergency nature of the project, the survey will be conducted simultaneously with the design and planning of the road. Therefore, these activities will be different from normal pre-construction phase work.

b. Land Acquisition

Rehabilitation and reconstruction of the road activities will require land acquisition of the surrounding road area. The proposed road will be designed to ASEAN Class II standards. The ASEAN standards recomment a right of way (ROW) of 30 m. In the areas where the proposed road segment is in tsunami damaged zones, the people of within the project area have been relocated to safer terrain, the need for land acquisition will be minimized and in some locations not required. Some of the road segment goes through a village and undamaged areas. Land acquisition may be necessary in these areas. Areas of economic activity such as agriculture production, industrial areas and plantations should comply with the corridor standards as they are reestablished in the area. It will be important to have an effective outreach and communication plan with these commercial stakeholders to minimize potential disadvantages for the surrounding communities.

3.2 CONSTRUCTION PHASE

a. Labor and Personnel Mobilization

The rehabilitation and reconstruction of the Banda Aceh – Lamno road will require civil and transportation experts, supervisors and laborers. The supervisors and laborers will be recruited from the local population to the extent practicable.

b. Equipment Mobilization and Demobilization

Most of the heavy equipment will come from outside of Nanggroe Aceh Darussalam Province and enter through the Malahayati Krueng Raya Harbor, located approximately 40 km from Banda Aceh. This equipment will be transported to the base camps situated throughout the project area.

c. Base Camp Construction

A base camp would be located in the Leupung area, approximately ± 25 km from Banda Aceh. Leupung is located near the proposed project areas and near construction material resources. A recent survey indicates that sand, stone and gravel would be available inKrueng Sarah River. Leupung would also be a good location for the heavy equipment staging area, a temporary work shop, and the project office. The Aspalt Mixing Plants and Stone Crushers would likely be located near each other and the Base Camp to facilitate more efficient material processing and transportation.

d. Land Clearing

Grading equipment would clear land as needed for the length of the 10km road to be relocated and alongside portions of the existing road, as necessary. The current road is 4.50 – 6.00 m wide whereas the paved portion of the new road would be 7.00 m wide. To meet ASEAN Class II standards, an average width of 30.00 m for the road corridor and ROW would be cleared.

e. Stripping

The proposed 10 km relocated road will require bulldozers to strip the land up to 50 cm in depth. Stripping material will be transported to a disposal area by a dump truck and excavator or shovel. Pavement and foundation work for the existing and new road segments will follow AASHTO (*American Association of States Highway and Trasportation Officials*) standards.

f. Cut and Fill

The existing road (4.5 m in width) will be widened to approximately 7.00 m wide. The road incline and decline areas will need to be cut and filled in order to meet the width requirements. However, the 10 km segment is a relatively flat area and minimal cut and fill will be required. The estimated amount of fill is 13,972 m^3. Appropriate land cutting technique and standards will be used to fill lower locations used for higher bridges, gutters, or box culverts. The deficit will be sourced from the nearest borrow area.

g. Subgrade Activity

Land compaction will occur for the length of the 10 km road relocation area.. Heavy equipment such as vibro rollers, sheepfoot and compactors will be used for the subgrade work.

h. Coarse Subbase activity

Soil material will be transported from borrow areas that meet the Regional Infrastructure NAD Province laboratory soil quality requirements, such as water contents porosity and density. The heavy equipment to support this activity consists of graders, compactors and vibro rollers. To check the layer thickness and the hardness of the soil, core samples will be taken from predetermined locations for analysis in Regional Infrastructure NAD Province laboratory.

i. Coarse Base Activity

The coarse base activities are done after the subbase coarse activities. The crushed stone material will meet AASHTO quality and size standards and will be used after approval from the project manager and supervisory engineers. The equipment to support this activity consists of graders, compactors and vibro rollers. To check the layer thickness and the hardness of the soil core samples will be taken from predetermined locations for analysis in Regional Infrastructure NAD Province laboratory.

j. Pavement

Bituminous hot asphalt from *Asphalt Mixing Plants* (AMP) will be used for the pavement. Obtaining material from the AMPs will insure the composition and quality of the mixture meets relevant standards. The equipment for this activity includes tide rollers, asphalt finishers, compactors and compressors. To confirm the layer thickness and hardness of the soil, core sample will be taken from predetermined locations for analysis in Regional Infrastructure NAD Province laboratory.

k. Side Ditch Activity

Even though side ditch activity is a relatively small activity, the function of the activity is very important to avoid standing water from rain or mountain seepage. This will help insure that the road will remain in good condition. The dimension of the side ditches depends upon the site and size and quantity of the seepage channels. The side ditch contruction will be made from mountain rock.

l. Gutter and Box Culvert Activity

Prevailing water channels will often require the construction of gutters or box culverts. The dimensions of the gutters and box culverts will be determined based on water velocity. Gutters will also be required to discharge water into and from the side ditches. The gutter outlets will have a sill to avoid damaging the road body. The sill would eliminate erosion impacts from surges in water energy or from sudden high water flows. Gutter construction will typically consist of pre-fabricated (ARMCO) gutters to facilitate quality and installation. Box culverts will be typically constructed of concrete to comply with K350 standards.

m. Bridge Activity

There are a number of bridges out of order due to the December 26, 2004 tsunami. In most cases, the locations of the bridges are near river estuaries such as Raba River, Lhoknga, Lepung River, and Lhok-seudo. There are also many small bridges such as Rieteng River and Kala River. The large bridges will be built out of concrete with pre-tension concrete blocks while small bridges will use conventional concrete.

n. Traffic Sign Installation and Others Activity

Traffic signs will be placed at appropriate locations on the roadside to prevent traffic accidents. The dimensions, color and other requirements will be accordance with Indonesian standards.

3.3 Operation Phase

a. Equipment and Personnel Demobilization

Equipment demobilization will be done upon completion of road construction. Not all equipment will be demolized since the contractor(s) will also be responsible for the road maintenance. The maintenance program will either require the contractor to spend 180 working days maintaing the road or will require the contractor to follow a written performance contract. Additional personnel may also be required for related administrative work.

b. Road Maintenance

The period of maintenance will depend on the contract. During the maintence period, the contractors will be responsible for all road damage. The common maintenance period is from 6-12 months. Upon completion of the maintenance period, the Government of Indonesia will be responsible for road maintenance. The road from Banda Aceh-Meulaboh is a national road. As such, the central government would be primarily responsible for long-term maintenance, though it may be delegated to the regional level. The Gross National Revenue (Anggaran Pendapatan Belanja Negara/ APBN) would need to be adjusted to include a budget for the maintenance of the road. The regional government (Regional Infrastructure Body of NAD Province) would need to propose a yearly budget figure to the central government through the designated "Working Public Body" to address the maintenance budget.

Chapter IV
INITIAL ENVIRONMENTAL BASELINE

1.8. Physical-Chemical Components

1.8.1. Climate

Nanggroe Aceh Darussalam Province generally follows a monsoon climate pattern. This monsoon climate involves a change in season every six months between wet and dry seasons. From data obtained from the Iskandar Muda Meteorology and Geophysics Station, the climate type for the study area is Type C with Q = 50.1%.

1.8.2. Temperature

Temperature in the study area is similar to temperature conditions throughout most of Indonesia. From the available data, the average monthly temperatures range from 25^0C to 28^0C with a minimum temperature of 23^0C and a maximum of 30^0C.

1.8.3. Rainfall

Nanggroe Aceh Darussalam Province experiences a maximum monthly rainfall of 693 mm in December, with an average rainfall between 6 to 21 days. The lowest monthly rainfall was 3 mm in March, with an average rainfall of 2 days. Average monthly rainfall ranges from 33 mm to 291 mm.

1.8.4. Topography & Geology

a. Morphology

Banda Aceh and its surrounding area is characterized by flat areas with gradient slopes of 0 – 3%. The elevation ranges from 0 – 3 m above sea level. The morphological unit is dominated by alluvial flood plains and beaches.

b. Geology

The geological structure underlying Banda Aceh is dominated by alluvial sediments consisting of gravels, pebbles and clays that are unconsolidated, and generally range in color from grey to brown. To the west of Banda Aceh and towards Lamno, the geological structure is Lho'nga Formation - a formation of limestone, Lhong Formation and Lamno rock formation. In general, the geotechnical strength of these formations is low to medium, meaning that the risk of landslides is high, especially on slopes and near rivers. This condition can be overcome by constructing slope stabilizers, consisting of riprap or retaining walls for the control or prevention of landslides after construction is finished.

1.8.5. Air Quality

The air quality parameters that were measured were carbon monoxide (CO), Sulfure Dioxide (SO_2), Nitrogen Oxide (NO_x), Dust (TSP), Lead (Pb), Ozone (O_3) & Hydrocarbon (HC). The results of air quality analysis can be seen in the following table.

Table 4.1 Air Quality Analysis Results

No.	Parameter	Unit	BML *)	Result	Method
1.	Dust	µg/m³	230	157	SNI 19-4840-1998
2.	Hydrocarbon (HC)	µg/m³	160	150	SNI 19-2879-1992
3.	Carbon Monozide(CO)	µg/m³	10.000	1.371	Cox meter ex Sibata
4.	Nitrogen Dioxide (NO_2)	µg/m³	150	15,81	SNI 19-4841-1996
5.	Sulfure Dioxide (SO_2)	µg/m³	365	8,08	SNI 19-4174-1996
6.	Ozone (O_x)	µg/m³	235	74,18	SNI 19-4842-1998
7.	Lead(Pb)	µg/m³	2	0,14	SNI 19-2966-1992
8.	Ammonia(NH_3)	µg/m³	1.360**)	6,63	JIS K 009919-1995
9.	Hydrolgen Sulfide(H_2S)	µg/m³	28**)	< 1	SNI 19-4818-1998

Source : Unilab Perdana Laboratory, Jakarta (2005)

Key :

*) BML = Government Regulation No. 41 of 1999 regarding national ambient air standards

**) BML = Decree KepMenLH No. 50 of 1996 regarding odor level standards
Location: Simpang Lampuuk, Kec. Lhok Nga, Kab. Aceh Besar

From the air quality data results, the air quality parameters are all below the relevant standard levels, and therefore air quality is considered to presently be in good condition.

1.8.6. Noise

The noise level baseline was based on the number of motor vehicles operating in the study area. The results of the noise measurements in the project area are shown in Table 4.2, below:

Table 4.2 Noise Level Measurement

No.	Location	Result (dBA) *)	Standard (dBA)**)
1.	Simpang Lampuuk – Lhok Nga	59.2	70.0

Source : Unilab Perdana Laboratory, Jakarta (2005)
Key:
*) The noise level is the equivalent level for a measurement period of 10 minutes with 5 minute intervals
**) Standard = Decree Number KEP. 48/MENLH/11/1996,

Based on the noise results, the noise level was significantly below the standard level. This is because of the relatively low number of vehicles active during the sampling event.

1.9. Biological Components

1.9.1. Terrestrial Flora

Terrestrial flora that was identified in the project area along the Banda Aceh to Lamno road consists of mangroves, beach ecosystems, mixed agricultural systems and secondary forest ecosystems.

a. Mangrove Vegetation

Mangrove ecosystems are unique ecosystems that occur in coastal areas dominated by brackish waters. Field observations indicated that mangrove ecosystems have been severely damanaged by the tsunami. Damaged mangroves are visible along the coast from the Banda Aceh to Lamno road. Remaining species include nipa palm (*Nypa fructicans*), and mangrove (*Rhizopora sp*). A non-governmental organization is sponsoring re-planting of mangroves along the coast, however the re-planting is not occurring in optimal mangrove habitat locations.

Figure 4.1 Condition of Mangrove Vegetation and Replating Activities

b. Coastal Vegetation

Coastal ecosystems along the proposed road have also experienced significant damage due to the tsunami. Field observations indicated that the coastal area have been destroyed with only a very small number of living coastal plants remaining. Many dead plants were observed in the coastal area. Remaining species included sea hibiscus (*Hibiscus tiliaceus*), beach shoak (*Casuarina equisetifolia*) and the Weeping Fig (*Ficus benjamina*). Remnants of coconut trees occur along the beach, (*Cocos nucifera*) including both living and dead trees.

Figure 4.2 Condition of Coastal Vegetation

c. Mixed Agricultural and Cultivated Vegetation

The mixed agricultural and cultivated vegetation ecosystems basically consist of cultivated plants that are intentionally planted by the community, both for economic value and as protection. From field observations, the dominant species in area not affected by the tsunami were mangoes (*Mangifera indica*), jackfruit (*Arthocarpus heterophylla*), cashew apple (*Anacardium ocidentale*), coconut (*Cocos nucifera*), banana (*Musa paradisiaca*), rambutan (*Nephelium lappaceum*), paw paw (*Carica papaya*), Durian (*Durio zibethinus*), areca nut (*Arecha* catechu), and Gnetum Gnetum (*Gnetum gnemon*). Apart from these cash-crop plants, other plants that function as roadside protection were also found, including mahogany (*swietenia mahagoni*), acacia (*Acacia auriculiformis*), narra tree (*Pterocarpus indica*), tropical almond (*Terminalia catappa*), Chinese Albizia (*Albizzia chinensis*) and tamarind (*Tamarindus indica*). At a few locations, community rice fields were also found.

d. Secondary Forest Vegetation

Secondary forest exists along the Banda Aceh – Lamno road, and in general has not been affected by the tsunami. From field observations, the most common plant species in the study area were teak (*Tectona grandis*), *Samanea samans*, durian (*Durio Zibethinus*), sea hibiscus (*Hibiscus tiliaceus*), *Erythrina sp*, petai (*Parkia speciosa*), macaranga (*Macaranga sp)*, areca nut (*Arecha catechu*), tropical almond (*Terminalia catappa)*, Chinese Albizia (*Albizzia chinensis*) and bamboo (*Bambussa sp*).

An overview of vegetation conditions can be seen in **Figure 4.3.**

1.9.2. Terrestrial Fauna

The condition of vegetation along the Banda Aceh to Lamno road corridor has affected wildlife habitats. The results of field obersvations can be seen in the following table.

Table 4.3 Inventory of Fauna Observed in the Study Area

No.	Species Name	Common Name	Remarks*)
	MAMALS		
1.	*Canis sp*	Cat	
2.	*Canis familiaris*	Dog	
3.	*Bos sp*	Cow	
4.	*Bubalus bubalus*	Water Buffalo	
5.	*Capricornis sp*	Goat	
6.	*Macaca fasculiformis*	Long-tailed tree Monkey	
	BIRDS		
1.	*Egretta sp*	Kuntul/Egret	Protected
2.	*Paser montanus*	Tree sparrow	
3.	*Cisticola juncidis*	Fan-tailed warbler	
4.	*Dicaeum sp*	Flowerpecker	
5.	*Pycnonotus aurigaster*	Sooty-headed bulbul	
6.	*Dendrocygna*	Whistling duck	
7.	*Hirundo tahitica*	Pacific swallow	
8.	*Columba livia*	Rock dove/pidgeon	
9.	*Collokalia esculenta*	Glossy swiftlet	
10.	*Sterna sp*	Tern	Protected
11.	*Gallus gallus*	Chicken	
12.	*Anas sp*	Duck	
	REPTILES		
1.	*Varanus sp*	Monitor	

Source : Primary Data (2005)
Explanation : *) Government Regulation No. 7 of 1999 regarding Flora and Fauna Preservation

Figure 4.3 Terestrial Flora Condition (after tsunami)

From the wildlife observations, the terrestrial fauna typically included 6 species of mammals, 12 species of birds, and 1 species of repile. For mammals, of the six species, most (five species) were domesticated. The only wild species found was the the long-tail monkey (*Macaca fascicularis*), occurring in the area around Mount Grotee (Figure 4.4). For all wildlife, only two species were protected species (based on Government Regulation No. 7 of 1999) - the egret (*Eggreta sp.)* and the tern (*Sterna sp*.).

Figure 4.4 Long Tail Monkeys (*Macaca Fasciculuris*) in Mount Grotee Area

Chapter 5
PREDICTED ENVIRONMENTAL IMPACT

1.10. Pre-Contruction Phase

a. Survey and Measurement

Potential impacts due to survey and measurement activities include:

1. There may be some public concern with the survey and measurement activities as early information would already have been released to the public. The pubic could assume that the survey activities will result in alignments that will adversely affect them. This public concern may be heightened by the fact that most of their land was lost in the tsunami. Impacts from public disturbances and civil unrest may impede or even hinder the survey team. There may also be landowners that leverage the public concerns for their own personal (or group) gain.
2. Public concern due to negative rumours that the government will use their power to take their lands under "public trust", without compensation or giving compensation lower than the appropriate value according to the regulations.
3. Public concerns that their livestock will not be safe due to the increased traffic.

Based on the above description, the environmental impacts from survey and measurement activities are public concerns about potential impacts to land value and ownership and public perception.

b. Land Acquisition

1. The public may become worried and concerned that their land and crops are not going to be appropriately compensated, preventing them from acquiring replacement land at another location. This may lead to disruptions to the road reconstruction.
2. The public may become worried that they will lose their work due to the loss of their land, which leads to unemployment and a decline in public welfare.

Therefore environmental impacts from land acquisition activities include public concern of losing land and livelihood and public perception.

1.11. Construction Phase

a. Personnel Mobilization

During the mobilization of personnel, social jealousy could occur toward mid-level workers and laborers from the general public. This could impede the project construction activities. The project proponent should consider this issue carefully in the socialization of the project with the communities.

Environmental impacts expected from the mobilization of personnel include public concern over lost of job opportunities and public perception.

b. Equipment Mobilization

Heavy equipment would be transported via the road from Malahayati harbor through Banca Aceh and to the staging and storage areas at the project base camp (likely Leupung). Potential impacts include traffic jams during heavy equipment convoys through Banda Aceh especially at the Jambo Tape intersection, Surabaya intersection and along Teuku Umar Street. Heavy traffic jams are to be expected on these roads and on the alternate secondary roads from Surabaya intersection to Elak Lambari – Keutapang Street during work days. In addition, traffic jams are likely to occur at Lambaro traditional market and Keutapang morning market.

c. Base Camp / Workers Barracks

Environmental impacts that may occur during base camp operation/ workers barracks are: high noise level and traffic disturbances in front of the base camp due to project vehicles entering and exiting; noise from electrical generator operations; and noise associated with workshop activities. In addition, pollution could occur due to oil disposal and spills. Social-cultural impacts could arise due to the outside work force bringing their own culture and habits, which may be in disharmony with the local culture.

d. Land Clearing

Land clearing will occur throughout the ROW area. During the field restoration process, the impacts could be air pollution due to dust and particulate, traffic disturbance along the streets, and high noise levels. Equipment used for the activities are bulldozers and hand tools such as chainsaws and axes. Vegetation along the adjacent roadway could inadvertently be damaged. If the waste of the land clearing is disposed (or pushed) into the water, water flow would be disturbed, resulting in erosion and sedimentation problems downstream.

However, these impacts are expected to be relatively insignificant because of the sever damage already incurred by the tsunami.

e. Stripping

Stripping is done to a depth of 30 – 50 cm along the proposed 10 km road segment to be relocated. This will remove surface objects that may reduce the quality of the road. Potential impacts are air pollution by dust and traffic disturbance when transporting the stripping waste to the disposal area, especially when the dump truck is traveling at higher speeds. Other impacts include the noise pollution from the combination of equipment, i.e. bulldozer and excavator (*back hoe*).

f. Cut and Fill

Cut and fill activities are necessary to obtain the correct elevation of the road (*grade*) according to the design and construction drawings. Potentail environmental impacts include noise pollution, traffic disturbance due to dump trucks, and landslides on sloping areas. The landslides may result in air pollution by dust. Soil deposition on the road from landslides may also occur. The soil could lead to traffic hazards as the road surface becomes more slippery when it rains. Where possible, soil from cut areas is used as fill in the lower elevation areas. Borrow areas provide additional soil when needed.

g. Subgrade

Before the subbase is covered by subbase material, it has to be compacted acoording to AASHTO (*American Association of States Highway and Trasportation Officials*) standards. The equipment used depends on the subbase soil condition. Usually a combination of vibro rollers, sheepfoot rollers and compactors will be used. A water tank is also used to ensure that the water content is adequate to achive a minimum of 90% optimum density.

The potential environmental impacts include noise pollution, vibration, air pollution and traffic disturbance.

h. Subbase Coarse Construction

The subbase coarse construction can only be done if the subgrade is completed in accordance with to the predetermined requirements.

Material for the subbaes coarse is excavated from the borrow area. The equipment used is a combination of vibro roller, compactor and grader. Potential environmental impacts are increased noise levels, air emission, vibration, and traffic disturbance.

i. Base Coarse Construction

This work is done if the subbase coarse contruction is completed and its quality can be justified technically. Material for the base coarse is taken from a stone crusher with size according to the specifications of the ASSHTO standard. Equipment used for compaction is the same as for the lower layer foundation, however the base coarse density is greater than of the subbase coarse.

Environmental impacts that will occur are air pollution (dust), noise pollution (high noise level) and traffic disturbance due to dump trucks transporting the materials.

j. Laying of Asphalt

Asphalt can only be layed when base coarse construction activities are completed. The raw material is taken from the Asphalt Mixing Plant (AMP) and the equipment used for this work is a combination of various equipment such as compressor, asphalt finisher, tide roller, asphalt sprayer and watertank vehicle. Potential environmental impacts include noise pollution and traffic disaturbance.

k. Side Ditching

The side ditch is excavated simultaneously with the roadway construction. In this case way puddles will not form on the road during rain. According to the project plan the width of the side ditch is 1.50 m. The side ditch is to be excavated along the whole length of the roadway, both for the existing and relocated roadways because not all parts of the existing roadway is provided with a side ditch. The excavation activities are done with an excavator (*backhoe)* and other auxiliary tools such as spade, hoe, etc. The potential enrionmental impacts are noise pollution, and smaal changes to local drainage patterns. Some utilities like the electrical and telephone poles, especially in the urban areas might have to be moved or modified according to the situation. Hence, public comfort might be temporarily disturbed.

l. Gutter and Box Culvert Construction

This work is done at locations where water drainage patterns require water to cross the roadway. The potential environmental impacts are traffic disturbance and flooding of upstream flow due to blockage of the culvent.

m. Bridge Construction

A combination of heavy equipment is used for the bridge construction, i.e. excavator, crane, and compactor. The potential environmental impacts are traffic disturbance, noise pollution and water pollution by oil and sediments.

n. Installation of Traffic Signs and Safety Devices

Some special signs or devices to be installed along the roadway may not be a common thing to the local communities. For instance, mirrors will be mounted on curved sections (sharp corners) of the road. People may take these mirrors and use them in their home.

1.12. Operation Phase

In this phase, the roadway will be ready and smooth. Hence the road users may drive their vehicles with high speed, which may lead to traffic accidents.

Chapter 6
ENVIRONMENTAL MANAGEMENT EFFORT (UKL)

1.13. Pre Construction Phase

o. Impact of Land Acquisition

4. Impacted environmental component:

Public perception

5. Impact Source:

Land acquisition

6. Environmental Management Effort:

- Socialization through newspapers, especially local newspapers. Apart from that, socialization could be done through direct face-to-face at the project location with local society leaders, and village or sub-district officials.
- The days for socialization activities should be selected when the local society is not too busy with day-to-day activities and informed 7 (seven) days before socialization is to be held. Meetings should be held in each sub-district in the convention hall or village hall or in the refugee camps if the village hall was damaged by the tsunami the meeting place has to be easily accessable without car.

- The land acquisition process and limited government financial capability has to be informed to the public, explaining that the government has limited budget for compensation payments. The public should know that budget for the development of the Banda Aceh to Lamno road is totally sponsored by the United States Government through USAID and will follow a transparent process. It is expected that the public will support this project, therefore implementation of rehabilitation and reconstruction of the road could be finished on time.
- Socialization activities have to involve officials of the province and city/regency level such as Regional Environmental Impact Agency of NAD Province, National Defence Agency (BPN), Regional Environmental Impacy Agency, Local Governmental Officials (District Official, Head of Local Military and Police Force) and Rehabilitation and Reconstruction Agency (BRR).
- Public endorsement of the land acquisition plan has to be requested signed the by local village head.
- Public has to be given the opportunity to give their opinion or perception at the public meetings.
- If there is disagreement or different ideas, a resolution should be sought by discussion and approvals, including local society leaders.

7. Environmental Management Location:

Residential areas along the row.

8. Environmental Management Periode:

During period of land acquisition.

9. Environmental Management Institution:

- Environmental Monitoring proponent: Local government of NAD Province (Department of Public Work of NAD Province).
- Environmental Monitoring Supervisor: Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City of Banda Aceh, Regional Infrastructure Official of the regency of Aceh Besar, and Environmental Impact Control Official of NAD Province.
- Environmental Monitoring Result Reporting: to Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City Banda Aceh and Regional Infrastructure Official of the regency of Aceh Besar and Environmental Impact Control Official of NAD Province.

1.14. Construction Phase

Personnel Mobilitation

Impacted environmental component:

Public perception

Impact Source

Arrival of outside workforce and mixing with local peoples.

Environmental Management Effort:

- Unskilled labor shouldbe taken from local village residents where possible, while if there are no semi-shilled personnel available from that village, they could be taken from a neighbouring village in the same sub-district. If possible, all personnel should have a signed employment agreement.
- The recruitment of personnel has to be done in a transparent manner and published at the village hall or mosque, with all job requirements, which hopefully are not to stringent, except for expert (professional/ skilled worker) personnel.
- There should be a standard salary payment and no distinction should exist between workers of the same level. The salary should be appropriate according to the individual's skills and abilities and should be paid in a timely manner.
- Before any termination of employment due to lack of discipline, a warning should be issued at least three (3) times both verbally and/or in writing.
- Personnel should be allowed to pray at times according to their religion, including Friday prayer.

Environmental Management Location:

Within the activities location.

Environmental Management Period:

From the beginning of the construction stage.

Environmental Management Officials:

- Environmental Management proponent: Contractor for the construction
- Environmental Monitoring Supervisor: Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City of Banda Aceh, Regional Infrastructure Official of the regency of Aceh Besar, Regional Infrastructure Official of the regency of Aceh Besar and Environmental Impact Control Official of NAD Province and Employment Official of NAD province.
- Environmental Monitoring Result Reporting: Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City of Banda Aceh, Regional

Infrastructure Official of the regency of Aceh Besar and Environmental Impact Control Official of NAD Province and Employment Official of NAD province.

p. Equipment Mobilisation and Demobilisation

a. Impacted environmental component:

Traffic congestion

10. Impact source:

Equipment mobilization and demobilization activities

11. Environmental Monitoring Effort:

- Mobilisation is not done during busy hours,
- It is better to do mobilization and demobilization in the evening.
- The condition of bridges shall be checked in terms of its cabability to hold heavy equipment that need to be carried over the bridge.
- Transportation to base camp should be accompanied by security personnel (police).
- At the beginning of construction, it is advisable to perform a local ritual feast, i.e. animal slaughtering to be consumed together with local people.

12. Environmental Management Location:

Throughout project area.

13. Environmental Management Period:

From the beginning of construction stage.

14. Environmental Management Official:

- Environmental Management proponent: Contractor for the construction.
- Environmental Management Supervisor: Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City of Banda Aceh, Regional Infrastructure Official of the regency of Aceh Besar, Regional Infrastructure Official of the regency of Aceh Besar and Environmental Impact Control Official of NAD Province
- Environmental Monitoring Result Reporting: to Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City of Banda Aceh, Regional Infrastructure Official of the regency of Aceh Besar and Environmental Impact Control Official of NAD Province.

q. Construction and Operation of Base Camp

Impacted environmental component:

Increase of noise pollution, air pollution (dust) and water pollution.

Impact source:

Base Camp preparation and operations.

Environmental Monitoring Effort:

- During Friday Prayer (shallat) all activities should be stopped.
- It is prohibited to discharge oil waste to the ground or water (e.g. river). Oil waste should be collected in a special place and shall be disposed outside the project area to be processed further.
- Water should be spayed on the entrance/exit road to the base camp periodically for dust suppression.
- Base camp (work barrack) should be provided with electricity, water, first aid and other facilities such as praying room (mushalla), and bath room (in sufficient number and should be enclosed).
- Temporary waste bin should be available.

Environmental Management Location:

Throught the project area, wherever bese camps are established.

Environmental Management Period:

From the beginning of construction phase.

Environmental Management Official:

- Environmental Management proponent: Contractor for the construction.
- Environmental Management Supervisor: Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City of Banda Aceh, Regional Infrastructure Official of the regency of Aceh Besar and Environmental Impact Control Official of NAD Province
- Environmental Monitoring Result Reporting: Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City of Banda Aceh, Regional Infrastructure Official of the regency of Aceh Besar and Environmental Impact Control Official of NAD Province.

r. Land Clearing, Stripping and Cut and Fill

b. Impacted environmental component:

Noise pollution, air quality (dust), traffic disturbance and public vegetation damage.

15. Impact source:

Land Clearing, Stripping and Cut and Fill

16. Environmental Monitoring Effort:

- Provision of field officer to regulate the traffic crossing the area.

- Use enclosed vehicle for material transport to disposal area to avoid soil and dust release to the environment.
- Prohibited to sound the car's horn in the mosque area, during the praying time.
- Every activity must be stopped during the Friday prayer time, between 12.00 and 13.30.
- If vegetation impacted by the operator accidently a resolution should be discussed with the owner and authorized organization. This should also happen if domestic animals are accidently killed.
- If a traffic accident occurs, the victim should be brought to the nearest health facility (*Puskesmas*), and be repoted immediately to the authorized person (police). Furthermore, it should be discussed with the local people.
- Every driver should hold a valid driving lisence.

17. Environmental Managemenr Location:

Throughtout project area

18. Environmental Management Period:

During construction phase.

19. Environmental Management Institution:

- Environmental Management proponent: Contractor for the construction
- Environmantel Management Supervisor: Regional Infrastructure of NAD, Regional Infrastructure of Banda Aceh, Regional Infrastructure of. Aceh Besar Region, Regional Infrastructure of Aceh Jaya region and Environmental Impact Agency of NAD Province.
- Environmental Management Result Reporting to: Regional Infrastructure of Provinsi NAD, Regional Infrastructure of Banda Aceh, Regional Infrastructure of Aceh Besar Region and Environmental Impact Agency of NAD Province.

s. Subgrade, Subbase Coarse, Base Coarse and Asphalt Laying

Environmental component affected:

Traffic congestion, dust and noise

Source:

Construction of Subgrade, subbase coarse, base coarse, and asphalt laying.

Environmental Management Effort:

- An officer should be applicable to manage traffic.
- All vehicles should be covered, therefore it will not make the area dusty.
- Appropriate speed limits will be applied near houses and marets.

- The pavement activity must be conducted as soon as the material subbase and base are lay down in the street.
- Material from the quary should have a mining permit type C form Mining Authority.
- The unuse material shpuld be brought in the previous place and prohibited to be brought in the area except the disposal area.
- Prohibited to sound the car's horn in the mosque area, during praying time.
- Every activity should stop during the Friday prayer time between the 12.00 and 13.30.
- If the plant impacted by the operator accidently, should be discuss by the owner and authorized organization, this should be happen in the case of every infrindgement to the animal pet that belongs to the community.
- When traffic accidents occur in the community the victim should be brought to the nearest health facility (*Puskesmas*) and reported to the authorized persons (i,e. police). It should be helpful to also discuss highlights of the local culture.
- The use of Dump Trucks should not be permitted during the operation.
- During break time, operator equipment should be parked in specificed areas that do not interupt other activities.
- In the case of longs road, there should be frequent speed bumps.
- Every driver should be equipped with a valid driving license for the appropriate type of vehicle

Environmental Managemen Location:

Within vicinity of the location activity

Environmental Management Period:

During construction work

Environmental Management Institution:

- Environmental Management proponent: Contractor for the construction
- Environmantel Management Supervisor: Regional Infrastructure of NAD, Regional Infrastructure of Banda Aceh, Regional Infrastructure of. Aceh Besar Region, Regional Infrastructure of Aceh Jaya region and Environmental Impact Agency of NAD Province
- Environmental Management Result Reporting to: Regional Infrastructure of Provinsi NAD, Regional Infrastructure of Banda Aceh, Regional Infrastructure of Aceh Besar Region and Environmental Impact Agency of NAD Province.

t. Side Activity

c. Environmental components impacted:

Inconvenience to the community, water hazards and community perception

20. Impact Source:

Side Ditch Activity

21. Environmental Management Effort:

- All waste material should be disposed of as soon as possible from the construction location and should not be burden for the local communities.
- Build pedestrian bridges as soon as possible to connect homes and pathways with reinforced concrete with a minimum quality cement like K225.
- Side ditch basic elevation should be lower that the sorrunding surface, therefore the waterfall can be acess well to the discharge.
- Gutters should be built to enable natural water drainage.
- The duct should be of a strong and reliable rock construction.
- Any community property damaged by the discharge construction should be repaired with equivqlent construction quality.
- Public facilities like fresh water and electricity that damage during construction should be repaired as good as its previous condition.
- Building material for this acitivity is prohibited to be put in the house yards or in public access roads to avoid disturbing the communities.

22. Environmental Management Location:

Within the vicinity of the location activity

23. Environmental Management Period:

During the construction work

24. Environmental Management Institution:

- Environmental Management Inspirator: Contractor for the construction
- Environmantel Management Supervisor: Regional Infrastructure of NAD, Regional Infrastructure of Banda Aceh, Regional Infrastructure of. Aceh Besar Region, Regional Infrastructure of Aceh Jaya region and Environmental Impact Agency of NAD Province
- Environmental Management Result Reporting to: Regional Infrastructure of Provinsi NAD, Regional Infrastructure of Banda Aceh, Regional Infrastructure of Aceh Besar Region and Environmental Impact Agency of NAD Province

u. Pipe culvert and Box Culvert Construction

Environmental components impacted:

Inconvenience the community, water hazards and community perception

Impact Source:

Pipe culvert and box culvert construction

Environmental Management Effort:

- Pipe and box culverts should be put in appropriate places that effectively direct waste flow
- The culvert layouts must be designed appropriately to prevent erosion near the pipe culvert/ box culvert outlets.
- The building material for this activity must be put in a designated location outside of house yards or public acces roads to avoid disturbing the communities.
- Box culvert construction with reinforced concrete must have a quality minimum of K350
- All waste material should be disposal of as soon as possible after finishing the activity.

Environmental Management Location:

Within the vicinity of the activity

Environmental Management Period:

During the construction work

Environmental Management Institution:

- Environmental Management Inspirator: Contractor for the construction
- Environmantel Management Supervisor: Regional Infrastructure of NAD, Regional Infrastructure of Banda Aceh, Regional Infrastructure of. Aceh Besar Region, Regional Infrastructure of Aceh Jaya region and Environmental Impact Agency of NAD Province
- Environmental Management Result Reporting to: Regional Infrastructure of Provinsi NAD, Regional Infrastructure of Banda Aceh, Regional Infrastructure of Aceh Besar Region and Environmental Impact Agency of NAD Province

v. Bridge Construction

d. Environmental components impacted:

Traffic activity problem, inconvenience to the community and water pollution.

25. Impact Source:

Bridge construction

26. Environmental management effort:

- Putting authorized person in-charge in order to direct traffic in this area.
- The raw material for this activity should be put in the location, outside of house yards or public access roads to avois disturbing communities.
- The vehicle operators must be in the good condition to avoid oil leak and spills into the waterways.
- Pillars built temporarily for bridge construction support should be thrown away as soon as possible from the middle river to prevent obstructed water flow
- Fill material must be of good quality to insure bridge integrity.

27. Environmental Managemenr Location:

Within the vicinity of the activity

28. Environmental Management Period:

During the construction work activity

29. Environmental Management Institution:

- Environmental Management Inspirator: Contractor for the construction
- Environmantel Management Supervisor: Regional Infrastructure of NAD, Regional Infrastructure of Banda Aceh, Regional Infrastructure of. Aceh Besar Region, Regional Infrastructure of Aceh Jaya region and Environmental Impact Agency of NAD Province
- Environmental Management Result Reporting to: Regional Infrastructure of Provinsi NAD, Regional Infrastructure of Banda Aceh, Regional Infrastructure of Aceh Besar Region and Environmental Impact Agency of NAD Province

1.15. Operation Activity

Worker Demobilitation

e. Environmental Impacted:

Worker comfort and compliance.

b. Impact Source:

Worker Demobilisation

c. Environmental Management Effort:

Prior to worker demobilitation the project head should explain that company policy and workland does not require their services anymore. Farewell event and appreciated certificate to facilitate the process.

Routine road maintenance and the related budget should be in the governmental regional expenses budgetary fund (*APBN* or *APBD I*), therefore its lifetime could be achieved.

d. Envorpnmental Managemenr Location:

Within the vicinity of the activity

e. Environmental Management Period:

During and after the construction

f. Environmental Management Institution:

- Environmental Management Inspirator: Contractor for the construction
- Environmantel Management Supervisor: Regional Infrastructure of NAD, Regional Infrastructure of Banda Aceh, Regional Infrastructure of. Aceh Besar Region, Regional Infrastructure of Aceh Jaya region and Environmental Impact Agency of NAD Province
- Environmental Management Result Reporting to: Regional Infrastructure of Provinsi NAD, Regional Infrastructure of Banda Aceh, Regional Infrastructure of Aceh Besar Region and Environmental Impact Agency of NAD Province

Chapter 7
ENVIRONMENTAL MONITORING EFFORT (UPL)

1.1. Pre Construction Stage

w. Impact of Location Surveying and Land Acquisition

1. Monitored Environmental Components

Public perception

2. Impact Source

Project location surveying and land acquisition

3. Environmental Monitoring Method

- Data Acquisition and Analysis Method: interview of local society and leading figures at project location. Descriptive analysis of available data.
- Environmental Monitoring Location: in the vicinity of project location.
- Monitoring Period and Frequency: once every three months starting from location surveying upto the start of construction.

4. Environmental Monitoring Official Authorities

- Environmental Monitoring Initiator: Local government of NAD Province (Department of Public Work of NAD Province).
- Environmental Monitoring Supervisor: Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City of Banda Aceh, Regional Infrastructure Official of the Regency of Aceh Besar, Regional Infrastructure Official of the Regency of Aceh Jaya and Environmental Impact Control Official of NAD Province.
- Environmental Monitoring Result Reporting: to Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City Banda Aceh, Regional

Infrastructure Official of the Regency of Aceh Besar and Environmental Impact Control Official of NAD Province.

1.2. CONSTRUCTION STAGE

1. Impact of Workforce Mobilisation

1. Monitored Environmental Components

Public perception

2. Impact Source

Workforce mobilisation

3. Environmental Monitoring Method

- Data Acquisition and Analysis Method: interview of local society and leading figures in the project location. Descriptive analysis of available data.
- Environmental Monitoring Location: in the vicinity of project location.
- Monitoring Period and Frequency: once a month starting up to the end of workforce mobilitation.

4. Environmental Monitoring Authorities

- Environmental Monitoring Initiator: Local government of NAD Province (Department of Public Work of NAD Province).
- Environmental Monitoring Supervisor: Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City of Banda Aceh, Regional Infrastructure Official of the Regency of Aceh Besar, Regional Infrastructure Official of the Regency of Aceh Jaya and Environmental Impact Control Official of NAD Province.
- Environmental Monitoring Result Reporting: to Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City Banda Aceh, Regional Infrastructure Official of the Regency of Aceh Besar and Environmental Impact Control Official of NAD Province.

2. Impact of Equipment Mobilisation

5. Monitored Environmental Components

Traffic jam

6. Impact Source

Construction equipment mobilisation

7. Environmental Monitoring Method

- Data Acquisition and Analysis Method: Field survey. Descriptive analysis of the available data.
- Environmental Monitoring Location: in the vicinity of project location.
- Monitoring Period and Frequency: once a month starting from the beginning of construction stage.

8. Environmental Monitoring Official

- Environmental Monitoring Initiator: Local government of NAD Province (Department of Public Work of NAD Province).
- Environmental Monitoring Supervisor: Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City of Banda Aceh, Regional Infrastructure Official of the Regency of Aceh Besar, Regional Infrastructure Official of the Regency of Aceh Jaya and Environmental Impact Control Official of NAD Province.
- Environmental Monitoring Result Reporting: to Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City Banda Aceh, Regional Infrastructure Official of the Regency of Aceh Besar and Environmental Impact Control Official of NAD Province.

3. Preparation and Operations of Base Camp / Work Barrack

9. Monitored Environmental Components

Noise pollution, air quality (dust), and surface water quality

10. Impact Source

Preparation and operation of Base Camp/Workforce Accomodation

11. Environmental Monitoring Method

- Data Acquisition and Analysis Method: Field measurement and sampling. Analysis of the data in laboratory and comparison of the result with applicable Indonesian guidelines/standards.
- Environmental Monitoring Location: in the vicinity of project location.
- Monitoring Period and Frequency: once a month starting from the beginning of construction stage.

12. Environmental Monitoring Authorities

- Environmental Monitoring Initiator: Local government of NAD Province (Department of Public Work of NAD Province).
- Environmental Monitoring Supervisor: Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City of Banda Aceh, Regional Infrastructure Official of the Regency of Aceh Besar, Regional Infrastructure Official of the Regency of Aceh Jaya and Environmental Impact Control Official of NAD Province.
- Environmental Monitoring Result Reporting: to Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City Banda Aceh, Regional Infrastructure Official of the Regency of Aceh Besar and Environmental Impact Control Official of NAD Province.

4. Land Clearing, Stripping, and Cut and Fill

13. Monitored Environmental Components

Noise pollution, air quality (dust) and surface water quality and public perception.

14. Impact Source

Land Clearing, Stripping, and Cut and Fill

15. Environmental Monitoring Method

- Data Acquisition and Analysis Method: Field measurement and sampling. Analysis of the data in laboratory and comparison of the result with applicable Indonesian guidelines/ standards. Data for public perception is obtained by interview. Subsequently the data is analysed descriptively.
- Environmental Monitoring Location: in the vicinity of project location.
- Monitoring Period and Frequency: once every three months starting from the beginning of construction stage up to completion of earthworks.

16. Environmental Monitoring Authorities

- Environmental Monitoring Initiator: Local government of NAD Province (Department of Public Work of NAD Province).
- Environmental Monitoring Supervisor: Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City of Banda Aceh, Regional Infrastructure Official of the Regency of Aceh Besar, Regional Infrastructure Official of the Regency of Aceh Jaya and Environmental Impact Control Official of NAD Province.
- Environmental Monitoring Result Reporting: to Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City Banda Aceh, Regional Infrastructure Official of the Regency of Aceh Besar and Environmental Impact Control Official of NAD Province.

5. Improvement and Construction of Subgrade, Subbase Coarse, Base Coarse, and Asphalt Laying

17. Monitored Environmental Components

Noise pollution, air quality (dust), and traffic

18. Impact Source

Improvement and construction of S*ubgrade*, S*ubbase coarse*, B*ase coarse*, and Asphalt Laying.

19. Environmental Monitoring Method

- Data Acquisition and Analysis Method: Field measurement and sampling. Analysis of the data in laboratory and comparison of the result with applicable Indonesian guidelines/ standards. Data for traffic continuity is obtained by observation and the obtained data is analysed descriptively.

- Environmental Monitoring Location: in the vicinity of project location.
- Monitoring Period and Frequency: once every three months starting from the beginning of construction stage up to completion of construction.

20. Environmental Monitoring Authorities

- Environmental Monitoring Initiator: Local government of NAD Province (Department of Public Work of NAD Province).
- Environmental Monitoring Supervisor: Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City of Banda Aceh, Regional Infrastructure Official of the Regency of Aceh Besar, Regional Infrastructure Official of the Regency of Aceh Jaya and Environmental Impact Control Official of NAD Province.
- Environmental Monitoring Result Reporting: to Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City Banda Aceh, Regional Infrastructure Official of the Regency of Aceh Besar and Environmental Impact Control Official of NAD Province.

6. Side Ditch Activity

21. Monitored Environmental Components

Public comfort, local water drainage public perception and noise pollution.

22. Impact Source

Side ditch activity

23. Environmental Monitoring Method

- Data Acquisition and Analysis Method: Field measurement and sampling. Analysis of the data in laboratory and comparison of the result with applicable Indonesian guidelines/ standards. Data for public comfort, local water drainage and public perception is obtained by field observation and interview. Obtained data is analysed descriptively.
- Environmental Monitoring Location: in the vicinity of project location.
- Monitoring Period and Frequency: once every three months starting from the beginning of construction stage up to completion of construction.

24. Environmental Monitoring Authorities

- Environmental Monitoring Initiator: Local government of NAD Province (Department of Public Work of NAD Province).
- Environmental Monitoring Supervisor: Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City of Banda Aceh, Regional Infrastructure Official of the Regency of Aceh Besar, and Environmental Impact Control Official of NAD Province.

- Environmental Monitoring Result Reporting: to Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City Banda Aceh, Regional Infrastructure Official of the Regency of Aceh Besar and Environmental Impact Control Official of NAD Province.

7. Gutter and Box Culvert Construction

25. Monitored Environmental Components

Public comfort, local water drainage and public perception

26. Impact Source

Gutter and Box Culvert construction

27. Environmental Monitoring Method

- Data Acquisition and Analysis Method: field observation and interview. Descriptive analysis of the data.
- Environmental Monitoring Location: in the vicinity of project location.
- Monitoring Period and Frequency: once every three months starting from the beginning of construction stage up to end of construction.

28. Environmental Monitoring Authorities

- Environmental Monitoring Initiator: Local government of NAD Province (Department of Public Work of NAD Province).
- Environmental Monitoring Supervisor: Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City of Banda Aceh, Regional Infrastructure Official of the Regency of Aceh Besar, and Environmental Impact Control Official of NAD Province.
- Environmental Monitoring Result Reporting: to Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City Banda Aceh, Regional Infrastructure Official of the Regency of Aceh Besar and Environmental Impact Control Official of NAD Province.

8. Bridge Construction

29. Monitored Environmental Components

Public comfort, traffic, and surface water quality.

30. Impact Source

Bridge construction

31. Environmental Monitoring Method

- Data Acquisition and Analysis Method: Surface water field measurement and sampling. Analysis of the data in laboratory and comparison of the result with applicable Indonesian guidelines/standards. Data for public comfort and traffic flow is obtained by field observation and interview. Obtained data is analysed descriptively.

- Environmental Monitoring Location: in the vicinity of project location.
- Monitoring Period and Frequency: once every three months starting from the beginning of construction stage up to end of construction.

32. Environmental Monitoring Authorities

- Environmental Monitoring Initiator: Local government of NAD Province (Department of Public Work of NAD Province).
- Environmental Monitoring Supervisor: Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City of Banda Aceh, Regional Infrastructure Official of the Regency of Aceh Besar, and Environmental Impact Control Official of NAD Province.
- Environmental Monitoring Result Reporting: to Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City Banda Aceh, Regional Infrastructure Official of the Regency of Aceh Besar and Environmental Impact Control Official of NAD Province.

7.3 POST CONSTRUCTION STAGE

9. Workforce Demobilisation

33. Monitored Environmental Components

Public and perception

34. Impact Source

Workforce demobilization

35. Environmental Monitoring Method

- Data Acquisition and Analysis Method: Interview and field observation. Descriptive analysis of data.
- Environmental Monitoring Location: in the vicinity of project location.
- Monitoring Period and Frequency: once a month starting from the end of construction stage up to completion of workforce demobilitaion.

36. Environmental Monitoring Authorities

- Environmental Monitoring Initiator: Local government of NAD Province (Department of Public Work of NAD Province).
- Environmental Monitoring Supervisor: Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City of Banda Aceh, Regional Infrastructure Official of the Regency of Aceh Besar, Regional Infrastructure Official of the reg Regency of Aceh Besar and Environmental Impact Control Official of NAD Province..
- Environmental Monitoring Result Reporting: to Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City Banda Aceh and

Regional Infrastructure Official of the Regency of Aceh Besar and and Environmental Impact Control Official of NAD Province.

Chapter VIII

CONCLUSION

This document summarity the Environmental Management Efforts and Environmental Monitoring Efforts for the rehabilitation and reconstruction road plan from Banda Aceh to Lamno (about 10 km in length) and we will follow all stated requirements and obligations and permit requirements decided by related authorities.

Banda Aceh, 28 June 2005

CHIEF OF TEMPORARY WORKING GROUP

ROAD AND BRIDGE PLANNING AND SUPERVISION

IR. K H A L I D I N, MT

NIP. 390013175

1.16. TABEL 6.1 MATRIX OF ROAD REHABILITATION AND RECONSTRUCTION ACTIVITIES

1.17. BANDA ACEH – LAMNO, NANGGROE ACEH DARUSSALAM PROVINCE

Impact Source	Impacted Environmental Components	Environmental Management Efforts	Management Location	Management Period	Environmental Management Institution		
					Initiator	Supervisor	Reporting
I. RECONSTRUCTION STAGE							
x. Location survey and Land Acquisition	Communities Perception	• Direct discussion at project location with local community leader, villagers or local government. • The time of discussion will be selected when the communities have less daily activities. • Publication of land acquisition. The communities will support the road construction plan if transparent publication is done. • Publication should involve related authorities from NAD	Housing around the Banda Aceh – Lamno road segmentation	From determination of road segmentation location until land acquisition is done.	Regional government of NAD Province (Public Working Department of NAD Province)	Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of Banda Aceh City, Local Regional Infrastructure Official of Aceh Besar, Local Regional Infrastructure Official of Aceh Jaya and Local Environmental Management Agency of NAD Province.	To Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of Banda Aceh City, Local Regional Infrastructure Official of Aceh Besar and Local Environmental Management Agency of NAD Province.

Impact Source	Impacted Environmental Components	Environmental Management Efforts	Management Location	Management Period	Environmental Management Institution		
					Initiator	Supervisor	Reporting
		province level or regional level. • Supporting from communities should be requested at that time, signed by village chief that represent the communities. • Communities should be assigned to give opinion at the publication program • Different opinion should be handled by discussion and deliberation.					
II. CONSTRUCTION STAGE							
1. Construction labours mobilisation/recruitment	• Social jealousy • Communities perception	• Local labor should be recruited to the extent possible. Supervisors may be recruited from neighbor villagers if not locally present, but still from the same local regional area. Accepted	In the project location	During construction phase	Construction contractor	Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of Banda Aceh	To Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of Banda Aceh City, Local

Impact Source	Impacted Environmental Components	Environmental Management Efforts	Management Location	Management Period	Environmental Management Institution		
					Initiator	Supervisor	Reporting
		labors should be provided by working agreement. • Recruitment should be transparent and advertised in the village offices or mosques, specifying requirements. The requirements should not be too strict except for the experts/ professionals. • Salary payment should be accordance with the standard without any discrimination. However, it should be assessed based on their capabilities and payments should be made on time. • The praying for employees should be provided including Friday's praying time.				City, Local Regional Infrastructure Official of Aceh Besar Local Regional Infrastructure Official of Aceh Jaya, Local Environmental Management Agency of NAD Province and Manpower Official of NAD Province.	Regional Infrastructure Official of Aceh Besar Local Regional Infrastructure Official of Aceh Jaya, Local Environmental Management Agency of NAD Province and Manpower Official of NAD Province.
y. Equipment mobilisation and	• Traffic	• Mobilization of equipment	In the project location and	During construction	Construction contractor	Regional Infrastructure	To Regional Infrastructure

Impact Source	Impacted Environmental Components	Environmental Management Efforts	Management Location	Management Period	Environmental Management Institution		
					Initiator	Supervisor	Reporting
demobilisation		should avoid in rush hour. • Bridges should be checked before crossing with heavy equipment to determine whether heavy equipment could pass or not. • Base camp should be guarded by security/ police. • In the initial construction phase, the costume ceremonial should be done by butchering a goat/cow, which is then eaten together with local communities.	surrounding area	phase		Official of NAD Province, Regional Infrastructure Official of Banda Aceh City, Local Regional Infrastructure Official of Aceh Besar, Local Regional Infrastructure Official of Aceh Jaya, Local Environmental Management Agency of NAD Province and Transportation Official of NAD Province.	Official of NAD Province, Regional Infrastructure Official of Banda Aceh City, Local Regional Infrastructure Official of Aceh Besar, Local Regional Infrastructure Official of Aceh Jaya, Local Environmental Management Agency of NAD Province and Transportation Official of NAD Province.
z. Construction and Operation of Base Camp	• Nuisance, • Air quality (dust)	• Activities should be stopped during Friday praying time. • Used lubricants are collected in designated areas then	In the project location and surrounding area	During construction phase	Construction contractor	Regional Infrastructure Official of NAD Province, Regional	To Regional Infrastructure Official of NAD Province, Regional

Impact Source	Impacted Environmental Components	Environmental Management Efforts	Management Location	Management Period	Environmental Management Institution		
					Initiator	Supervisor	Reporting
	• Surface water quality	transported outside of project location for further processing. • The unpaved road should be sprayed periodically as required to avoid air pollution (dust). • The base camp should be equipped with electrical facilities, water, first air equipment, and other infrastructure such as mosques, sport center, necessary and closed bath rooms. • The temporary waste disposal should be provided.				Infrastructure Official of Banda Aceh City, Local Regional Infrastructure Official of Aceh Besar, Local Regional Infrastructure Official of Aceh Jaya, and Local Environmental Management Agency of NAD Province	Infrastructure Official of Banda Aceh City, Local Regional Infrastructure Official of Aceh Besar, Local Regional Infrastructure Official of Aceh Jaya, and Local Environmental Management Agency of NAD Province
aa. Land Clearing and Stripping, and cut and fill	• Nuisance, • Air quality (dust)	• The field officers should be located to control traffic condition at the project area.	In the project location and surrounding area	during construction phase	Construction contractor	Regional Infrastructure Official of NAD Province,	To Regional Infrastructure Official of NAD Province,

Impact Source	Impacted Environmental Components	Environmental Management Efforts	Management Location	Management Period	Environmental Management Institution		
					Initiator	Supervisor	Reporting
	• Transportation continuity, • Community perception	• Closed transportation should be applied to avoid spill and flying wastes during transportation to disposal location. • Prohibited to sound the car horn in mosques area during praying time. • The activities should be terminated during Friday praying time at 12.00 – 13.30 • In case of activities of heavy equipment unintentional impacting the farming area, should be solved properly by land owners/ chief of villagers/ keucik. This also applicable for pet animals • In case of accident, the victim should be carried to nearest hospital/ puskesmas and be reported to police officer.				Regional Infrastructure Official of Banda Aceh City, Local Regional Infrastructure Official of Aceh Besar, Local Regional Infrastructure Official of Aceh Jaya, and Local Environmental Management Agency of NAD Province	Regional Infrastructure Official of Banda Aceh City, Local Regional Infrastructure Official of Aceh Besar, Local Regional Infrastructure Official of Aceh Jaya, and Local Environmental Management Agency of NAD Province

Impact Source	Impacted Environmental Components	Environmental Management Efforts	Management Location	Management Period	Environmental Management Institution		
					Initiator	Supervisor	Reporting
		Then, it should be solved properly with victim's families according to local cultures. • Prohibited to transport people by Dump Truck during operations. • Drivers should be provided with a driving license (SIM) that is suitable with the type of vehicles.					
bb. Subgrade, subbase coarse; base coarse; and pavement activities	• Nuisance • Air quality (dust) • Transportation continuity	• The field officers should be located to control traffic condition at the project area • Closed transportation should be applied to avoid spill and flying wastes during transportation to disposal location • Compacting the subbase and	In the project location and surrounding area	During construction phase	Construction contractor	Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of Banda Aceh City, Local Regional Infrastructure Official of Aceh Besar, Local Regional Infrastructure Official of Aceh Jaya, and Local Environmental Management Agency of NAD	To Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of Banda Aceh City, Local Regional Infrastructure Official of Aceh Besar, Local Regional Infrastructure Official of Aceh Jaya, and Local Environmental Management Agency of NAD

Impact Source	Impacted Environmental Components	Environmental Management Efforts	Management Location	Management Period	Environmental Management Institution		
					Initiator	Supervisor	Reporting
		base materials after spreading. • The materials from quarry should be provided with excavation C material permit from local Mining Official. • Unused material should be transported to first location and prohibited to dispose unless to the disposal area. • Prohibited to sound the car horn in mosques area during praying time. • The activities should be terminated during Friday praying time at 12.00 – 13.30 • In case of activities of heavy equipment unintentional impacting the farming area, should be solved properly by land owners/ chief of villagers/ keucik. This also				Province	Province

Impact Source	Impacted Environmental Components	Environmental Management Efforts	Management Location	Management Period	Environmental Management Institution		
					Initiator	Supervisor	Reporting
		applicable for pet animal • In case of accident, the victim should be carried to nearest hospital/ puskesmas and reported to police officer. Then, it should be solved properly with victim's families according to local cultures and involved local community leader • Prohibited to transport peoples by Dump Truck during operations. • During rest time/ lunch time, operators should park the heavy equipments at proper location to avoid disturbing of public transportation. • In case of long road, there should be a speed hump to avoid the accident caused by sleepy drivers.					

Impact Source	Impacted Environmental Components	Environmental Management Efforts	Management Location	Management Period	Environmental Management Institution		
					Initiator	Supervisor	Reporting
		• Drivers should be provided with a driving license (SIM) suitable with the type of vehicles.					
cc. Side ditch activities	• Public comfort • Water hazards • Community perception • Nuisance	• The rest of cutting soil should be transported from project location so that not disturb to anyone. • The crossing bridge should be constructed between yards and road planning locations by concrete construction according to K225 concrete quality. • Elevation of the side ditch should be lower than surrounding land, therefore the rain and other puddles could be flown through that drainage.	In the project location and surrounding area	During construction phase	Construction contractor	Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of Banda Aceh City, Local Regional Infrastructure Official of Aceh Besar, Local Regional Infrastructure Official of Aceh Jaya, and Local Environmental Management Agency of NAD Province	To Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of Banda Aceh City, Local Regional Infrastructure Official of Aceh Besar, Local Regional Infrastructure Official of Aceh Jaya, and Local Environmental Management Agency of NAD Province

Impact Source	Impacted Environmental Components	Environmental Management Efforts	Management Location	Management Period	Environmental Management Institution		
					Initiator	Supervisor	Reporting
		• Crossing gutters should be provided properly to help water from drainage flowing to the lower location (river) • The water channel is made with the stone composition of 1 pc : 4 psr • In case of boundaries ore is damaged by side ditch activities, it should be re-constructed with same or better construction. • Public facilities such as drinking water pipeline or electricity pillar that damage during this activities, should be renovated properly. • The materials for this activity should not be located in the yard of public road to avoid disturbing of communities activities.					

Impact Source	Impacted Environmental Components	Environmental Management Efforts	Management Location	Management Period	Environmental Management Institution		
					Initiator	Supervisor	Reporting
dd. Gutter and Box Culverts	• Public comfort • Water hazards • Community perception	• Gutters/box culvert should be located in crossing water channel with suitable dimension so that water can flow properly and free. • The outlet should be completed by a flip construction to avoid erosion of gutters or box culvert foundation. • The materials for this activity should be located in proper area to avoid disturbing householder or public transportation. • Box culvert from concrete construction should be in accordance with K350 quality standard. • The rest of coverdam should	In the project location and surrounding area	During construction phase	Construction contractor	Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of Banda Aceh City, Local Regional Infrastructure Official of Aceh Besar, Local Regional Infrastructure Official of Aceh Jaya, and Local Environmental Management Agency of NAD Province	To Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of Banda Aceh City, Local Regional Infrastructure Official of Aceh Besar, Local Regional Infrastructure Official of Aceh Jaya, and Local Environmental Management Agency of NAD Province

Impact Source	Impacted Environmental Components	Environmental Management Efforts	Management Location	Management Period	Environmental Management Institution		
					Initiator	Supervisor	Reporting
		be disposed of properly after completion of foundation activities.					
ee. Bridge Activity	• Transportation continuity • Public comfort • Water surface quality	• The field officers should be located to control traffic condition at the project area • The materials for this activity should be located in proper area to avoid disturbing of public transportation. • The heavy equipment on the project should be in good condition to avoid oil spill to the rivers. • The temporary supporting pillars and coverdam should be removed from the rivers to avoid the disturbing of water stream • Material for oprit filling should be came from filling	In the project location and surrounding area	During construction phase	Construction contractor	Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of Banda Aceh City, Local Regional Infrastructure Official of Aceh Besar, Local Regional Infrastructure Official of Aceh Jaya, and Local Environmental Management Agency of NAD Province	To Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of Banda Aceh City, Local Regional Infrastructure Official of Aceh Besar, Local Regional Infrastructure Official of Aceh Jaya, and Local Environmental Management Agency of NAD Province

Impact Source	Impacted Environmental Components	Environmental Management Efforts	Management Location	Management Period	Environmental Management Institution		
					Initiator	Supervisor	Reporting
		good soil to avoid different level between oprit and bridge surface that potentially cause an accident and uncomfortable situatuin.					
III. OPERATION							
w. Labors demobilization	• Community • Community perception	• The project manager should announce to labors in earlier time that their working period will be completed, if possible farewell party could be done and working experience certificate could be awarded. • For periodic maintenance of the road, the budget will come from APBN or APBD I, subsequently the age planning of the road could be maintained.	In the project location and surrounding area	During construction phase	Contractor construction and Regional Infrastructure of NAD Province	Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of Banda Aceh City, Local Regional Infrastructure Official of Aceh Besar, Local Regional Infrastructure Official of Aceh Jaya, Local Environmental Management	To Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of Banda Aceh City, Local Regional Infrastructure Official of Aceh Besar, Local Regional Infrastructure Official of Aceh Jaya, Local Environmental Management Agency of NAD

Impact Source	Impacted Environmental Components	Environmental Management Efforts	Management Location	Management Period	Environmental Management Institution		
					Initiator	Supervisor	Reporting
						Agency of NAD Province, and Manpower Official of NAD Province	Province, and Manpower Official of NAD Province

1.18. TABEL 7.1 UPL SUMMARY MATRIX OF REHABILITATION AND RECONSTRUCTION ACTIVITIES BANDA ACEH – LAMNO ROADWAY, NANGGROE ACEH DARUSSALAM PROVINCE

1.18. TABEL 7.1 UPL SUMMARY MATRIX OF REHABILITATION AND RECONSTRUCTION ACTIVITIES BANDA ACEH – LAMNO ROADWAY, NANGGROE ACEH DARUSSALAM PROVINCE

Impact Source	Monitored Environmental Component	Monitoring Method			Monitoring Official/Body		
		Data acquisition and analysis	Monitoring Location	Period/Frequency	Initiator	Supervisor	Reporting
I. PRE CONSTRUCTION STAGE							
ff. Location survey	Public Perception	Interview.	In the vicinity of	Once every	Local	Regional	To Regional

Impact Source	Monitored Environmental Component	Monitoring Method			Monitoring Official/Body		
		Data acquisition and analysis	Monitoring Location	Period/Frequency	Initiator	Supervisor	Reporting
and land acquisition		Descriptive analysis of data.	project location.	three months from location survey up to completion of land acquisition.	government of NAD Province (Department of Public Work of NAD Province).	Infrastructure Official of NAD Province, Regional Infrastructure Official of the City of Banda Aceh, Regional Infrastructure Official of the Regency of Aceh Besar, Regional Infrastructure Official of the Regency of Aceh Jaya, and Environmental Impact Control Official of NAD Province	Infrastructure Official of NAD Province, Regional Infrastructure Official of the City of Banda Aceh, Regional Infrastructure Official of the Regency of Aceh Besar, Regional Infrastructure Official of the Regency of Aceh Jaya, and Environmental Impact Control Official of NAD Province, once in six months
1.18.1. II. CONSTRUCTION STAGE							
x. Mobilisation and recruitment of	• Social jealousy • Public	Interview. Descriptive analysis of data.	In the vicinity of project location.	Once in three months during construction.	Contractor for the construction.	Regional Infrastructure Official of NAD	Regional Infrastructure Official of NAD

Impact Source	Monitored Environmental Component	Monitoring Method			Monitoring Official/Body		
		Data acquisition and analysis	Monitoring Location	Period/Frequency	Initiator	Supervisor	Reporting
construction workforce	Perception					Province, Regional Infrastructure Official of the City of Banda Aceh, Regional Infrastructure Official of the regency of Aceh Besar, Regional Infrastructure Official of the regency of Aceh Jaya, and Regional Environmental Impact Agency and Employment Official of NAD Province.	Province, Regional Infrastructure Official of the City of Banda Aceh, Regional Infrastructure Official of the regency of Aceh Besar, Regional Infrastructure Official of the regency of Aceh Jaya, and Regional Environmental Impact Agency and Employment Official of NAD Province, once in six months
gg.Equipment Mobilisation and Demobilisation	• Traffic	Field observation. Descriptive analysis of data.	In the vicinity of project location.	Once every three months during construction.	Construction contractor	Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City of Banda Aceh,	To Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City of Banda Aceh,

Impact Source	Monitored Environmental Component	Monitoring Method			Monitoring Official/Body		
		Data acquisition and analysis	Monitoring Location	Period/Frequency	Initiator	Supervisor	Reporting
						Regional Infrastructure Official of the regency of Aceh Besar, Regional Infrastructure Official of the regency of Aceh Jaya, and Regional Environmental Impact Agency and Transportation Official of NAD Province	Regional Infrastructure Official of the regency of Aceh Besar, Regional Infrastructure Official of the regency of Aceh Jaya, and Regional Environmental Impact Agency and Transportation Official of NAD Province, once in six months
hh. Base Camp/ Workforce accommodation Preparation and Operations	• Noise pollution, • Air quality (dust) • Surface water quality	Field measurement and sampling. Data analysis in laboratory, comparison of the result with guidelines/ standards	In the vicinity of project location.	Once every three months during construction.	Construction contractor	Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City of Banda Aceh, Regional Infrastructure Official of the regency of Aceh	To Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City of Banda Aceh, Regional Infrastructure Official of the regency of Aceh

Impact Source	Monitored Environmental Component	Monitoring Method			Monitoring Official/Body		
		Data acquisition and analysis	Monitoring Location	Period/Frequency	Initiator	Supervisor	Reporting
						Besar, Regional Infrastructure Official of the regency of Aceh Jaya, and Environmental Impact Control Official of NAD Province	Besar, Regional Infrastructure Official of the regency of Aceh Jaya, and Environmental Impact Control Official of NAD Province, once in six months
ii. Land Clearing, Stripping, and cut and Fill	• Noise pollution, • Air quality (dust) • Traffic • Public Perception	Field measurement and sampling. Data analysis in laboratory, comparison of the result with guidelines/ standards. For public perception, interview and descriptive data analysis.	In the vicinity of project location.	Once every three months during construction.	Construction contractor	Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City of Banda Aceh, Regional Infrastructure Official of the regency of Aceh Besar, Regional Infrastructure Official of the regency of Aceh Jaya, and	To Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City of Banda Aceh, Regional Infrastructure Official of the regency of Aceh Besar, Regional Infrastructure Official of the regency of Aceh Jaya, and

Impact Source	Monitored Environmental Component	Monitoring Method			Monitoring Official/Body		
		Data acquisition and analysis	Monitoring Location	Period/Frequency	Initiator	Supervisor	Reporting
						Environmental Impact Control Official of NAD Province	Environmental Impact Control Official of NAD Province, once in six months
jj. Improvement of Subgrade, Subbase coarse, Base coarse, and Asphalt laying	• Noise pollution, • Air quality (dust) • Traffic •	Field measurement and sampling. Data analysis in laboratory, comparison of the result with guidelines/ standards. For public perception, interview and descriptive data analysis.	In the vicinity of project location.	Once every three months during construction.	Construction contractor	Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City of Banda Aceh, Regional Infrastructure Official of the regency of Aceh Besar, Regional Infrastructure Official of the regency of Aceh Jaya, and Environmental Impact Control Official of NAD Province	To Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City of Banda Aceh, Regional Infrastructure Official of the regency of Aceh Besar, Regional Infrastructure Official of the regency of Aceh Jaya, and Environmental Impact Control Official of NAD Province, once in six months

Impact Source	Monitored Environmental Component	Monitoring Method			Monitoring Official/Body		
		Data acquisition and analysis	Monitoring Location	Period/Frequency	Initiator	Supervisor	Reporting
kk. Side Ditch Activity	• Public comfort, • Locally water drainage • Public perception • Noise pollution	Field observation and interview. Descriptive analysis of data.	In the vicinity of project location.	Once every three months during construction.	Construction contractor	Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City of Banda Aceh, Regional Infrastructure Official of the regency of Aceh Besar, Regional Infrastructure Official of the regency of Aceh Jaya, and Environmental Impact Control Official of NAD Province	To Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City of Banda Aceh, Regional Infrastructure Official of the regency of Aceh Besar, Regional Infrastructure Official of the regency of Aceh Jaya, and Environmental Impact Control Official of NAD Province, once in six months

Impact Source	Monitored Environmental Component	Monitoring Method			Monitoring Official/Body		
		Data acquisition and analysis	Monitoring Location	Period/Frequency	Initiator	Supervisor	Reporting
ll. Gutter and Box Culvert Construction Activities	• Public comfort • Locally water pool formation • Public perception	Field observation and interview. Descriptive analysis of data.	In the vicinity of project location.	Once in three months during construction.	Construction contractor	Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City of Banda Aceh, Regional Infrastructure Official of the regency of Aceh Besar, Regional Infrastructure Official of the regency of Aceh Jaya, and Environmental Impact Control Official of NAD Province	To Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City of Banda Aceh, Regional Infrastructure Official of the regency of Aceh Besar, Regional Infrastructure Official of the regency of Aceh Jaya, and Environmental Impact Control Official of NAD Province, once in six months
mm. Bridge Construction	• Traffic • Public comfort • Surface water	Field water sampling. Data analysis in laboratory, comparison of the	In the vicinity of project location.	Once every three months during construction.	Construction contractor	Regional Infrastructure Official of NAD Province, Regional Infrastructure	To Regional Infrastructure Official of NAD Province, Regional Infrastructure

Impact Source	Monitored Environmental Component	Monitoring Method			Monitoring Official/Body		
		Data acquisition and analysis	Monitoring Location	Period/Frequency	Initiator	Supervisor	Reporting
	quality	result with guidelines/ standards. For traffic flow and public comfort, interview and descriptive analysis.				Official of the City of Banda Aceh, Regional Infrastructure Official of the regency of Aceh Besar, Regional Infrastructure Official of the regency of Aceh Jaya, and Environmental Impact Control Official of NAD Province	Official of the City of Banda Aceh, Regional Infrastructure Official of the regency of Aceh Besar, Regional Infrastructure Official of the regency of Aceh Jaya, and Environmental Impact Control Official of NAD Province, once in six months
II. POST CONSTRUCTION STAGE							
y. Workforce Demobilisation	• Public Perception	Field observation and interview. Descriptive analysis of data.	In the vicinity of project location.	Once every months up to completion of workforce demobilitation	Contractor and Transportation Official of NAD Province.	Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City of Banda Aceh, Regional Infrastructure	To Regional Infrastructure Official of NAD Province, Regional Infrastructure Official of the City of Banda Aceh, Regional Infrastructure

Impact Source	Monitored Environmental Component	Monitoring Method			Monitoring Official/Body		
		Data acquisition and analysis	Monitoring Location	Period/Frequency	Initiator	Supervisor	Reporting
						Official of the regency of Aceh Besar, Regional Infrastructure Official of the regency of Aceh Jaya, and Regional Environmental Impact Agency and Employment Official of NAD Province.	Official of the regency of Aceh Besar, Regional Infrastructure Official of the regency of Aceh Jaya, and Regional Environmental Impact Agency and Employment Official of NAD Province, once in six months