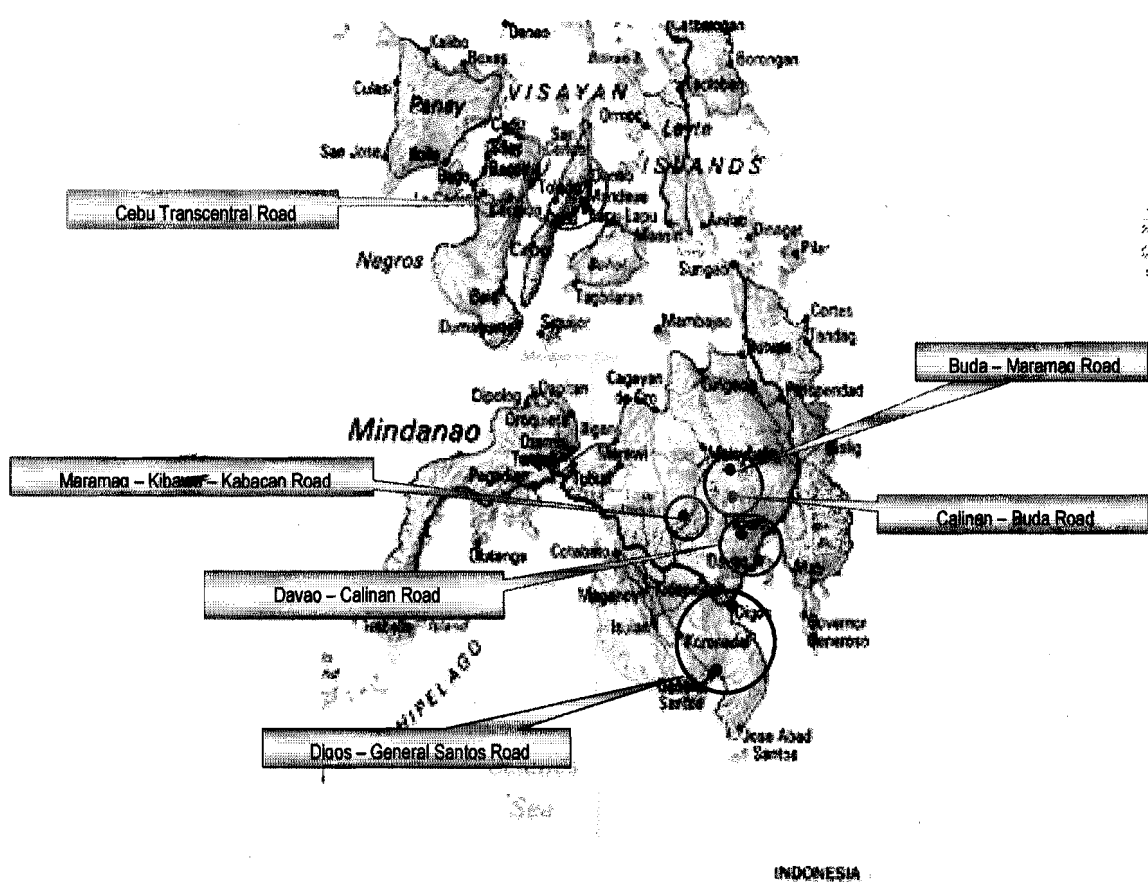


REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
BONIFACIO DRIVE, PORT AREA, MANILA

FEASIBILITY STUDIES AND DETAILED ENGINEERING DESIGN OF REMEDIAL
WORKS IN SPECIFIED LANDSLIDE AREAS AND ROAD SLIP SECTIONS
IBRD-Assisted National Road Improvement and Management Program
Loan No. 7006-PH

Draft Final Report on the
Environmental and Social Components

DAVAO-CALINAN-BUDA-MARAMAG-
KIBAWE-KABACAN ROAD



JSC JAPAN OVERSEAS CONSULTANTS CO., LTD.

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TECHNIKS GROUP CORPORATION

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CONSULTING ENGINEERS CONSTRUCTION MANAGERS

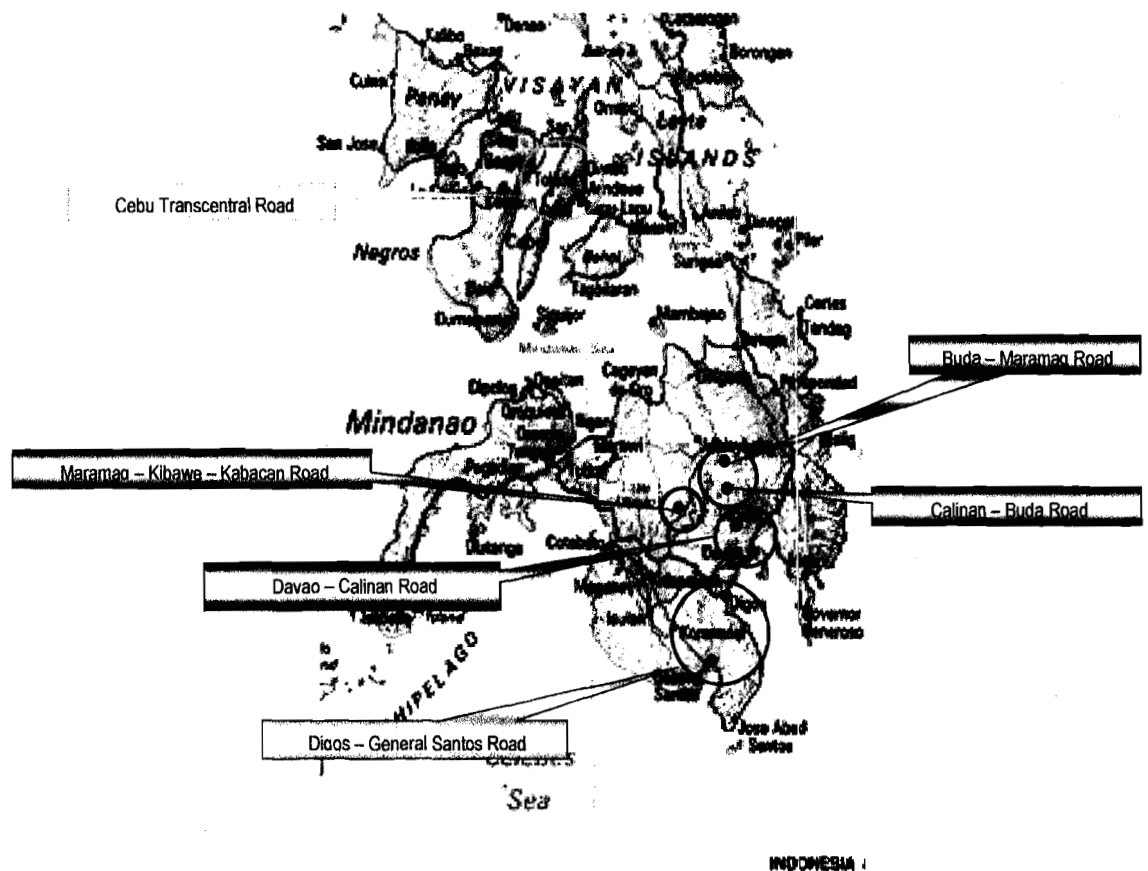


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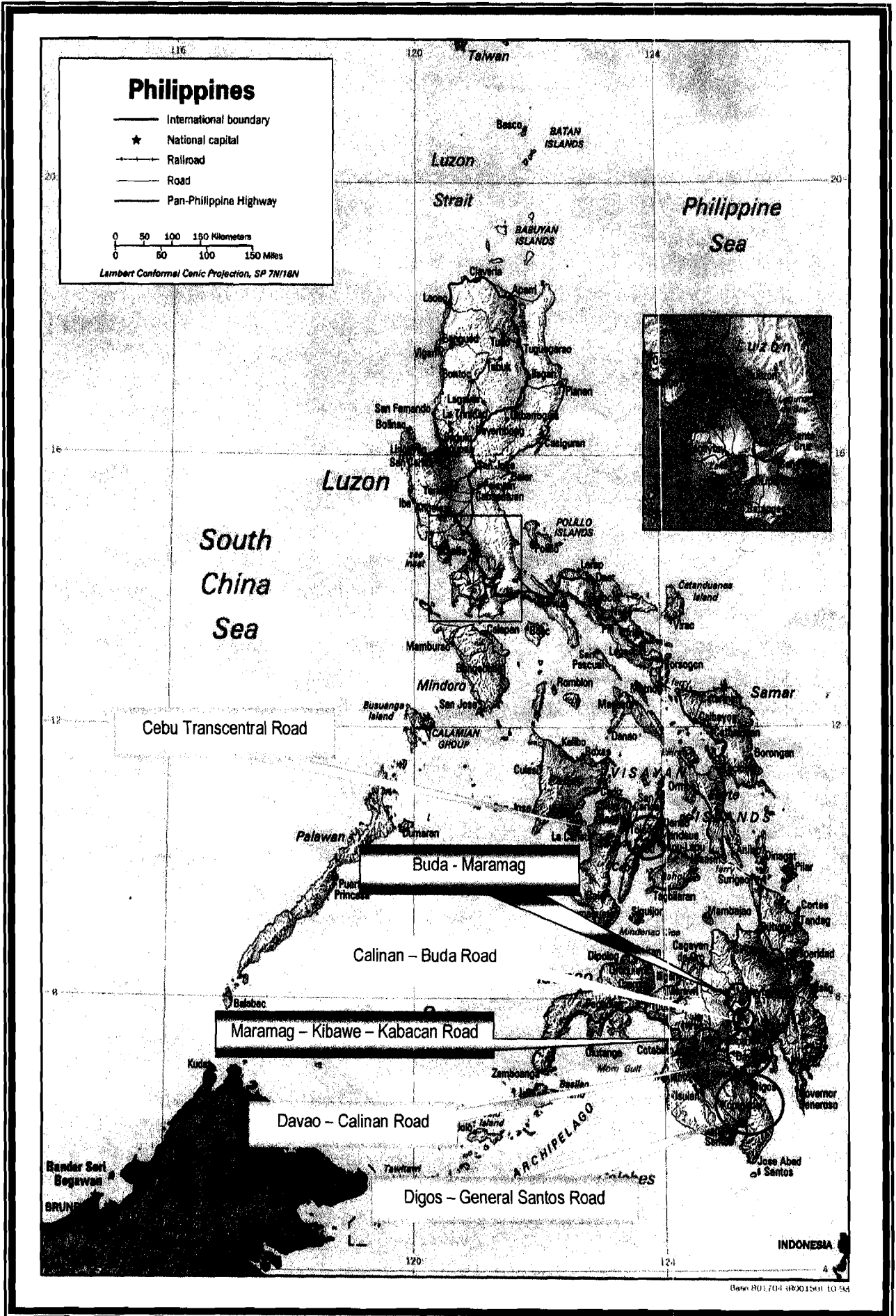
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KEY MAP

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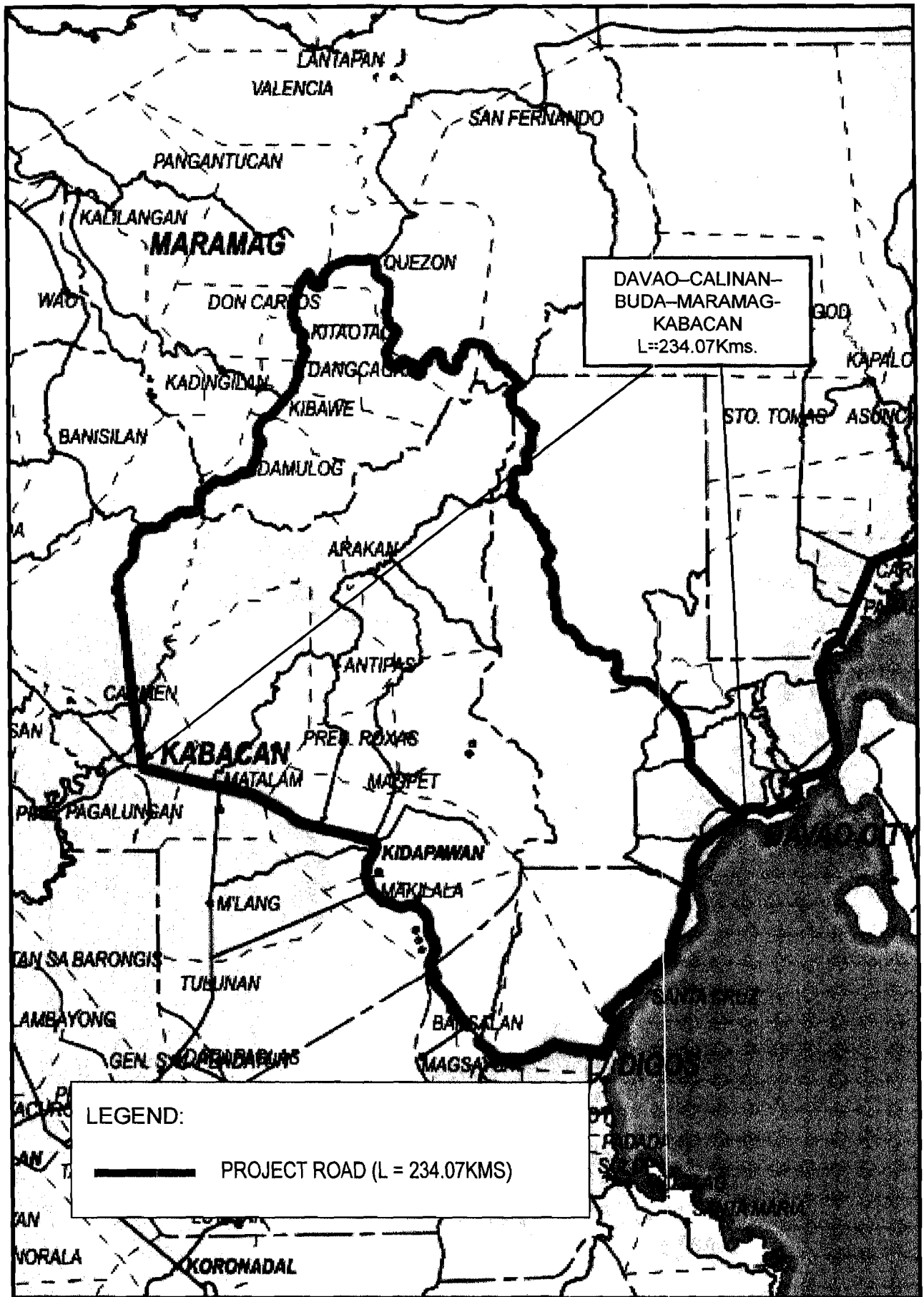


FIGURE 1
DAVAO-CALINAN-BUDA-MARAMAG-KIBAWE-
KABACAN ROAD

1.0 GENERAL STATEMENT

**FINAL REPORT ON THE
ENVIRONMENTAL AND SOCIAL COMPONENTS
OF THE REMEDIAL WORKS IN SPECIFIED LANDSLIDE AREAS
AND ROADSLIP SECTIONS**
(An IBRD-Assisted First National Road Improvement and Management Program)

1.0 GENERAL STATEMENT

On September 12, 2003, the Government of the Philippines, through the Department of Public Works and Highways (DPWH) committed to undertake the "Feasibility Studies and Detailed Engineering Design of Remedial Works in Specified Landslide Areas and Roadslip Sections" as an integral component of the IBRD - Assisted First National Road Improvement and Management Project. This undertaking is financed by Loan Agreement 2006-PH between the Government of the Philippines (GOP) and the International Bank for Reconstruction and Development (IBRD). The implementation of the Project is the responsibility of the IBRD Project Management Office (PMO).

During the implementation of the civil works component of the HMP, there were sections/segments of the project roads that experienced or have been noted as disaster prone areas due to landslides and road slips. In order to address these problems and establish mitigating measures, the DPWH is initiating the conduct of in-depth study which includes comprehensive investigation and analysis of landslide areas and road slip sections, and detailed design and documentation and contract packaging for appropriate remedial works including slope protection and slope stabilization works.

2.0 PROJECT DESCRIPTIONS

2.0 PROJECT DESCRIPTIONS

Davao-Calinan-Buda Road has an approximate length of 81.0 kms. It plays an important role in assuring the economic progress of Davao City and its neighboring province of North Cotabato. It functions as a strategic link connecting Regions X and XI, The Davao-Calinan-Buda Road is the most practical route compared to the old route, which use the northern circumferential highway via Butuan City. The old route is about 486 km. from Davao City to Cagayan de Oro City, as against this new route which is only 309 km.

Maramag-Kibawe-Kabacan Road connects the provinces of Bukidnon and North Cotabato and as a strategic link of Regions X and XII.

During the implementation of the civil works component of the Highway Management Program (HMP), there were segments/sections of the Davao-Calinan-Buda Road and Maramag-Kibawe-Kabacan Road that experienced landslides and road slips. These segment/sections need immediate remedial works to ensure continuous accessibility between Davao City and neighboring provinces in Mindanao.

There are 12 sections along the road that have been designed for slope protection, improvement of drainage system, and other engineering measures that would address the problem on landslides and road slips areas.

2.1 OBJECTIVES

The objective of the project is to remediate and prevent the occurrence of landslide on high cut side slopes and road slip sections along the project road. It aims: a) to provide driving safety to motorists all the time; b) to provide continuous flow of traffic; c) to promote and sustain growth of regional industries and agricultural activities; d) to encourage and promote tourism; growth of e) to provide time safety

of the roadside residents; f) to prolong the life span of the roadway facilities; and g) to promote economic growth of roadside communities.

2.2 SCOPE OF WORK

The Remedial Works in Specified Landslide Areas and Roadslip Sections along the Davao-Calinan-Buda-Maramag-Kibawe-Kabacan Road are divided into two (2) phases, namely: Phase I-Feasibility Study and Phase II-Detailed Design.

The Feasibility Study cover the technical, economic and environmental aspects of the project road. It includes:

- a) inspection and preliminary assessment of the hazard, risk and mechanisms of failure;
- b) identification of remedial options and countermeasures for evaluation;
- c) definition of scope for detailed engineering design.
- d) cost estimation of countermeasures;
- e) cost/benefit analysis; and
- f) preliminary environmental assessment and environmental scoping

The Detailed Design covers the technical, economic, environmental and tendering aspects of the civil works. It includes:

- a) comprehensive investigation and analysis of the landslide areas and roadslip sections;
- b) detailed design and costing of countermeasures;
- c) detailed documentation and contract packaging of remedial works, slope protection and stabilization works;
- d) environmental and social assessment;
- e) preparation of EIS and RAP reports; and
- f) development of Environmental Management Plan and Environmental Monitoring Program

The items d, e and f of the Detailed Design are summarized in this report.

**3.0 ECOLOGICAL AND SOCIAL
PROFILES OF ROAD INFLUENCE
AREA**

3.0 ECOLOGICAL AND SOCIAL PROFILES OF ROAD INFLUENCE AREA

The Davao-Calinan-Buda-Maramag-Kibawe-Kabacan Road traverses the provinces of Davao and Bukidnon. The Davao-Calinan-Buda segment serves the ecological and social interests of Davao City. The Buda-Maramag-Kibawe-Kabacan segment on the other hand caters to the ecological and social needs of Bukidnon Province.

3.1 DAVAO-CALINAN-BUDA ROAD SEGMENT

3.1.1 Local Geography and Landuse

Davao-Calinan-Buda Road segment is located in Davao City.

Davao City is located in the southeastern part of Mindanao. The project road is bounded on the north by Davao Province; on the east partly by Davao Gulf; on the south by Davao del Sur; and on the west by North Cotabato. Davao City proper is approximately 946 aerial kilometers or 580 statute miles southeast of Manila

A substantial part of Davao City is mountainous characterized by extensive mountain ranges with uneven distribution of plateaus and lowlands. The mountain range delimits the western boundary of the city extends as far down to North Cotabato. This mountain range host Mount Apo, the highest peak in the Philippines that marks the boundaries of North Cotabato, Davao del Sur and Davao City. Mount Apo has an elevation of about 10,311 feet (3,144 meters) above sea level.

The Davao City has an aggregate area of 98,151 hectares developed for agricultural use for coconuts, rice, corn, vegetables, fruit trees, bananas, pineapples, citrus, rambutan, pomelo, coffee and cacao. The agricultural areas are in the districts of Toril, Calinan, Baguio, Marilog and portions of Talomo, Buhangin and Bunanwan with slopes from 3% to 35%.

3.1.2 Soil Type

The variation of soil types in Davao City differ in terms of color, texture, depth, drainage, relief, permeability, fertility, location and parent rock. The soils are classified into seven series and categorized into three groups based on the topographic position occupies in the landscape. The three soil groups includes: (1) soils of the plains and valleys; (2) soils in the intermediate uplands; (3) soil of hills and mountains. The groupings are shown in Table 3-1 with the main characteristics of the various soil types.

Table 3-1 Soil Types in Davao City

	Parent Material	Dominant Relief
A. Plains and Valley		
San Miguel Silty Clay Loam	Alluvium from weathering of igneous	Nearly flat to level
Matina Clay Loam	Alluvium from limestones, shale and sandstones	Flat to gently undulating
B. Intermediate Upland		
Tugbok Clay	Igneous Rock Andesite	Undulating to gently.
Faraon Clay	Soft Coralline Limestone	Undulating to gently rolling
Cabantian Clay	Soft Shale with mixtures of weathered gravels and pebbles	Undulating to hilly
C. Hills & Mountains		
Camansa Sandy Clay Loam	Shale & sandstones with weathered gravel and sand	Hilly, Mountains
Mountain Soils, undifferentiated	Different kinds of igneous and metamorphic rocks	These soils are generally shallow and stony with excessive drainage; inaccessible and not suited to agriculture.

3.1.3 Climate

Davao City enjoys a mild tropical climate with no distinct hot and wet season. It enjoys a climate where the days are sunny and mild followed by nights of rain. The city is outside the typhoon belt which excludes the effects of tropical depressions.

Records from 1984 to 1994 showed the average monthly temperature varied from 32.3⁰C (highest) in April to 20.8⁰C (lowest) in January. The average monthly rainfall during the same ten-year period recorded highest during the month of

September with 235 mm, and the lowest in the month of February with 78 mm. The humidity is regular between 77% and 83%.

3.1.4 Population

In 1990, Davao City's population is 849,947, or about 19% of Region XI's figure of 4.457 Million. It reached 1 Million in 1995 following an annual growth rate of 3.45%. In year 2000 census, the City's population rose to 1.147 Million, with an annual growth of 2.64%. Population density in 2000 was 470 percent per square kilometer as shown in Table 3-2.

Table 3-2
Population of Davao City

	Population			Total Land Area	Pop. Density (Year 2000; pop/sq.Km.)
	1990	1995	2000		
Davao City	849,947	1,006,840	1,147,116	2,440	470

The other dialects spoken in the city are Hiligaynon, Ata, Davaowefio, Tausog, Ilocano, Maranao, Kalagan, Maguindanao, Waray, Chavacano, Mandaya, Pangasinan, Pampango, Surigaonon, Bunukid, Batak, Binisaya, Manobo, Badjao, Ibanag, Aklanaon, Bilaan and Tagakaulo.

3.1.5 Indigenous People

Davao City has a rich collage of indigenous people. West of the city from upper Bangkal to Catalunan, Ula and Biao are concentration of the Bagobos. Towards the boundary of Cotabato-Bukidnon still reside the Obos (also known as Guiangans), a sub-group of the Bagobos.

Areas surrounding the approaches to Mt. Apo are still populated by Tagabawa, another sub-tribe of the Bagobos. This is the most numerous of the Bagobo tribe and occupies the Catigan, Toril, Sirib, Sibulan, Sta. Cruz and down to Bansalan.

In the northern highlands west of Davao del Norte are the Atas, while along the shores on the mouths of rivers such as Lasang, Tuganay, Bincungan, Libuganon and Hijo are occupied by the Muslims identified as Kalagans, (i.e.those who are not

fully Islamized in their religious beliefs). The Kalagans are also present at Sirawan, and the sitios of Mandug and Ma-a.

The Mansakas occupies the the uplands of Maragusan Valley. Further up north and to the west of Compostela-Butuan Rivers are the Manobos and the Dibabaons with some Mandayas. Towards the east of Northern Davao down to the coast line of Davao Oriental from Cateel to Mati are concentrations of the Mandayas, considered the most numerous of the Davao lumads. The mountains between Mati to Sigaboy are inhabited by remnants of Manobo and Mansaka tribes.

3.1.6 Literacy and Education

Davao City's have high literacy rate with 96.40 %t or 600,510 of the population 10 years old and above are literate. Literate urban population on the same ages has been registered at 98.23 while rural population on the other hand has posted a literacy rate of 90.98 %.

Out of the 687,662 household population seven (7) years old and over in Davao City, 42.15 percent have attended elementary education, 30.89 percent reached secondary education, 11.58 percent are college undergraduates, 8.93 percent are college graduates, while 3.86 percent have no grade completed.

Davao City has 265 public and private elementary schools but only 229 public schools offers complete elementary education. The city also has 72 high schools, where 35 are run by the government, while 37 are privately run. There are 35 colleges and universities in the city where 34 % are sectarian while non-sectarian schools account for 66 %.

3.1.7 Health and Nutrition

Davao City pursued a vigorous primary health care approach and continued to implement all the DOH National Programs. While morbidity and mortality rates for all ages shortened, heart disease ranks as the number one cause of death with a rate of 81.3 per 100,000 populations. Poverty related disease such as malnutrition, anemia, pneumonia, diarrhea, septicemia also registered an incidence rise. Other causes are cancer, vascular diseases and accidents.

The City Health Office has 24 physicians, 54 nurses, 103 midwives, 16 medical technologist, 14 dentists, 15 sanitary inspectors and 116 barangay health workers. The ideal ratio of health workers to population has not been attained. Physician to population ratio is placed at 1:52,686, while the nurses-population ratio is 1:18,538, way below the standard ratios of 1:20,000 and 1:10,000, respectively. The city still needs 31 more physicians, 46 nurses to provide better services to the people.

3.1.8 Labor Force and Employment

Based from the NSO Employment Statistics in 2000, Davao City has a total labor force of 618,000 persons. This constitutes a labor participation rate of 70.2%. Of the total labor force, 91.5% are fully employed while 8.3% are unemployed. Approximately 68% of those employed are in the urban areas while 32% are in the rural areas. Major employment is generated by the agriculture, industry, and service sectors.

Table 3-3
Employment Status
Davao City

Employment Status	Year 2000	%
Total 15 Years Old and Over	618,000	
In the Labor Force	434,000	70.2
- Employed	397,000	91.5
- Unemployed	37,000	8.3
Not in the Labor Force	184,000	29.8

3.1.9 Commerce and Trade

Davao City has 1,554 licensed business establishments ranging from services, manufacturing, processing, cottage industry, retail/wholesale, transportation, education, construction and financial institutions.

3.1.10 Agriculture

Table 3-4. The area and production of different crops planted within the influence area. It shows that coconut covers the 39% of the total land area; cultivated next is corn and rice with 18% and 13%, respectively. Other crops are coffee, cacao, banana, mango, vegetables and root crops.

Table 3-4 Production by Commodity, 2002

Commodity	Production (in Metric Ton)
Rice	
Irrigated	32,681
Non-Irrigated	5,534
Corn	
White	10,612
Yellow	3,135
Coconut	349,737
Coffee/Cacao	13,698
Banana	560,070
Mango	8,292
Vegetables	58,728
Root Crops	21,482

Source: Bureau of Agriculture Statistics, Davao City

3.1.11 Livestock and Poultry:

Table 3-5 shows that there are enough supply of livestock and poultry within the road influence area. There are four dairy cooperatives and two private farms engaged in milk production. The total yield of milk is 56,944 liters with an average daily yield of 1,836.9 liters.

3.1.12 Fishery

The fishery industry covers the major three subsectors namely: the municipal fishing, commercial fishing and inland fishing. The municipal fishing sector refers to small-scale fishermen using boats of 3 gross tons or less, employing fishing gears not requiring the use of motor boats. Around 22% of the city's fishery output are contributed by the municipal fishing sector.

The commercial fishing sector which contributes 70% of the total fish output, refers to fishing operations using fishing boats more than 3 gross tons. The inland fishing, which is comprised of brackish and freshwater fishpond system contributes around 8% to the city's output.

3.1.13 Industry

The city has abundant raw agricultural products. Most profitable are fruits, vegetables, handicrafts, furniture and wood products. The city is famous in the global market for producing and exporting commodities like bananas, coconut oil, coconut, oil cake and other solid residues from copra, rubber, builder joinery, carpentry and wood charcoal. The goods comprised 63% of the region's total export, which makes Davao City as the region's top exporter.

Davao is also the region's major importer. The city accounts the biggest share in the region's imports comprising 56% of the total. The major imported commodities vary from agricultural products such as woods, gifts and donations bovine animals, activated carbon and coal.

3.2 BUDA-MARAMAG-KIBAWE-KABACAN ROAD SEGMENT

The Buda-Maramag-Kibawe-Kabacan Road Segment provides arterial access to Bukidnon Province, which is a rich table land. This province occupies the extensive plateau that is bounded on the north and northeast by Misamis Oriental;

on the east by Agusan Province; on the south and southeast by Davao Province; and on the southwest and west by Lanao and Cotabato provinces.

3.2.1 Location and Land Area

The impact area of Buda-Maramag-Kibawe-Kabacan Road cuts across the geographical borders of Bukidnon Province between latitudes 7°25' and 8°38' North and longitudes 124°03' and 125°16' East. This road serves Malaybalay City, which is the capital town. It is about 850 kilometers by air from Manila and 91 kilometers by road from Cagayan de Oro City.

Bukidnon Province has an area of 829,378 hectares representing 2.8 percent of the country's total land area and 59.10 percent of the total regional area. It is the largest province in Region 10 and the eighth largest in the entire country in terms of land area. It is comprised of 22 municipalities and one city.

3.2.2 Topography

The Buda-Maramag-Kibawe-Kabacan Road traverses the greater part of gently rolling plateau of Bukidnon Province with an average elevation of 915 meters above sea level. About 49% is composed of rugged hills and mountains, 3% is undulating to rolling landscape, 8% is nearly level, 5% is alluvial lowland and 4% are canyons and gorges.

Bukidnon Province is blessed with beautiful and important mountain ranges. The most prominent is the Mount Kitanglad that peaks at 2,380 meters above sea level in the central portion of Bukidnon. It is known as the watershed of Mindanao. It is endowed with five major river systems, namely: Pulangi, Tagoloan, Manupali, Muleta and Bobonawan.

3.2.3 Climate

Due to its elevation and mountainous physiography, the climate of Bukidnon is relatively cool and moist throughout the year. The province has two prevailing types of climate. The northern part falls under the third of intermediate A-type characterized by no pronounced maximum rain period with a short dry season lasting only for one to three months. The southern part falls under the fourth type of intermediate B-type with no pronounced maximum rain period and no dry seasons. The province is outside the path of typhoons.

Together with the Bukidnon Province, the Buda-Maramag-Kibawe-Kabacan Road enjoys an annual average monthly rainfall of 204.18 mm from 1998 to 2002 as shown in Figure 3.1. Table 3-5 shows the rainy months from May to October with monthly rainfall of more than 150 mm. Other months experience drier seasons with mean monthly rainfall from 50 to 150 mm. Maximum annual temperature averages at 33°C and minimum at 16.3°C. Mean annual average temperature is 24.4°C (Fig.4-2; Table 4-6)

Rainfall Distribution
(in mm)

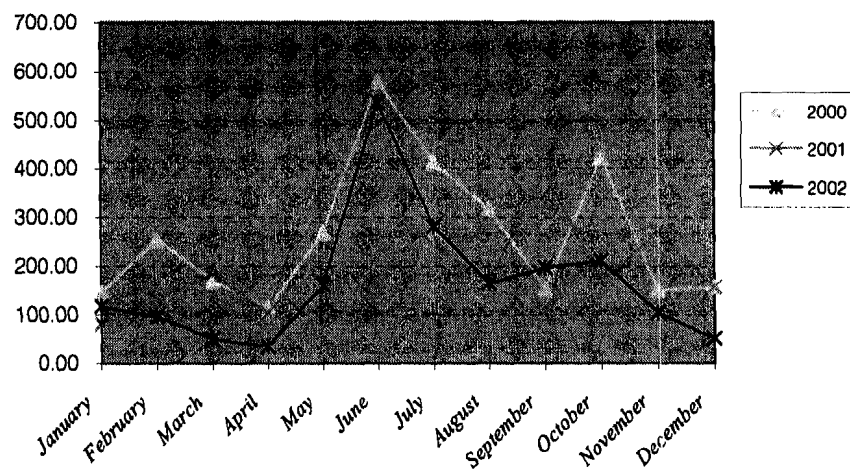


Figure 3-1

TABLE 3-5
MONTHLY RAINFALL DISTRIBUTION (mm)
PAGASA MALAYBALAY STATION, BY MONTH
1998 - 2002

Month	Y E A R				
	1998	1999	2000	2001	2002
1 January	68.30	336.60	146.80	81.10	117.20
2 February	20.20	191.30	253.60	132.70	96.60
3 March	12.50	340.80	171.20	183.30	50.70
4 April	7.40	609.00	114.40	103.80	35.00
5 May	150.50	252.00	267.70	422.10	161.70
6 June	239.60	269.90	579.00	348.60	537.30
7 July	361.10	274.60	413.00	242.50	280.20
8 August	184.60	303.70	317.20	168.00	165.20
9 September	236.70	500.70	153.60	391.80	197.80
10 October	201.10	180.80	421.50	167.60	211.70
11 November	241.10	160.40	151.60	269.50	104.60
12 December	141.80	182.10	157.50	157.20	51.00
ANNUAL AVE.	155.40	300.16	262.26	222.35	167.41

SOURCE: PAGASA Station, Malaybalay, Bukidnon

MINIMUM & MAXIMUM TEMPERATURE
(in degree Celsius)

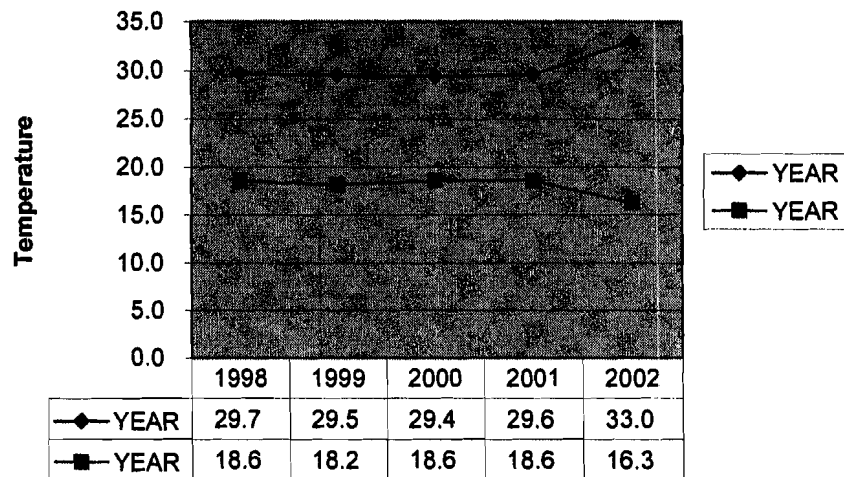


Figure 3-2

TABLE 3-6
MAXIMUM AND MINIMUM TEMPERATURE (In Deg. Cel.)
BY MONTH, BY YEAR

Moht	1998 Average		1999 Average		2000 Average		2001 Average		2002 Average	
	Max.	Min.	Max.	Min.	Max	Min	Max.	Min	Max	Min
1 January	28.1	18.4	28.6	17.7	28.7	17.6	29.5	18.1	32.2	14.4
2 February	28.5	18.2	27.8	18.2	29.5	17.9	29.3	18.1	35.2	15.0
3 March	30.5	17.6	29.6	17.0	29.7	18.5	30.2	18.0	33.1	13.5
4 April	31.0	18.9	31.4	17.7	30.5	18.7	31.7	18.4	35.0	16.0
5 May	30.2	19.2	30.5	18.6	30.1	19.3	30.1	19.1	34.0	17.5
6 June	30.1	19.0	29.2	19.1	29.9	19.2	29.4	18.8	32.0	17.6
7 July	29.6	18.9	27.8	19.0	28.9	18.8	28.8	18.6	32.0	16.0
8 August	29.6	18.3	28.9	18.7	28.5	18.4	28.2	19.1	30.0	17.5
9 September	29.6	18.8	29.2	18.8	30.1	18.4	30.4	18.6	32.8	18.0
10 October	29.6	19.3	30.3	18.2	28.9	19.3	30.3	18.9	33.0	17.5
11 November	28.9	18.6	30.6	17.9	28.9	18.8	29.1	18.9	33.5	17.3
12 December	29.5	17.6	30.1	17.8	28.9	18.8	28.5	33.6	33.6	15.0
ANNUAL AVE.	29.7	18.6	29.5	18.2	29.4	18.6	29.6	33.0	33.0	16.3

SOURCE: PAGASA Station, Malaybalay, Bukidnon

3.2.4 Soil Types

Majority of the soils in Bukidnon Province is reddish to yellowish brown clays. These soils are essentially derived from the deep weathering of sedimentary and pyroclastic rocks. The soils are generally of medium fertility. Areas, where weathered pyroclastic rocks dominate, have high soil fertility.

3.2.5 Landuse

Grassland areas in the Bukidnon Province account for 36.87%. This is followed by woodland areas having 32.71%; agricultural areas with 30.08%; built-up area with 0.24%; water bodies with 0.10%. Alienable and Disposable lands cover 321,576 hectares or 39%, while forestlands account for 507,802 hectares or 61%.

3.2.6 Geohazards

The province of Bukidnon is susceptible to various geologic hazards. Shown in Figure 3-3 the geologic hazards are: volcanic eruptions, earthquakes, landslides,

mass movements, flooding and erosion. Active and inactive volcanoes include: Kitanglad, Kalatungan and Calayo.

Bukidnon is frequently shocked by significantly strong earthquakes particularly Malaybalay and Valencia areas. Most of these tremors are tectonic in origin, where epicenters are usually located along structural lines belonging and sympathetic to the Philippine Fault Zone.

Slumping and creeping are common forms of mass wasting in the province. They occur prominently on old mass movement zones and on slopes covered by thick regosols and saprolite on highly fragmented and disintegrated meta-rocks. Along the Buda-Maramag-Kibawe-Kabacan Road, where road cuts are very critical, these mass movements have accelerated into landslides.

Flooding is being experienced in and around the low-lying areas of Bukidnon Province. Several of these geologic hazards associate prominently with the flood regimes and floodbasins of Pulangi, Tagoloan, Manupali, Muleta and Bobonawan rivers.

Soil erosion in Bukidnon has the most devastating effect on areas where slopes are above 18%. This geologic situation as shown in figure 3-4 is a serious threat, because about 78% of the province's total land area has slope above 18%.

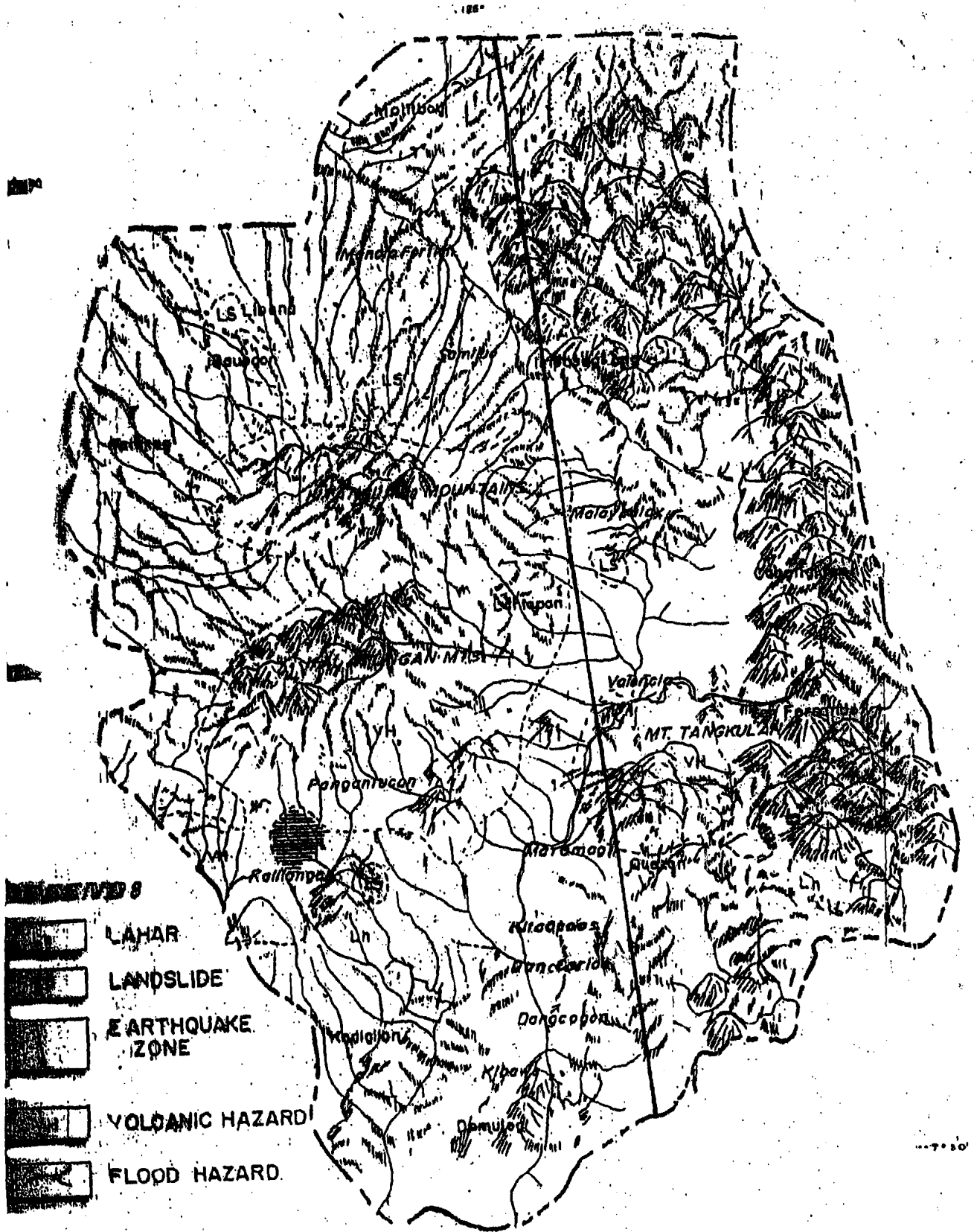


FIGURE 3-3 HAZARDS TYPES AND THEIR DISTRIBUTION

MAPPING SYMBOL	DESCRIPTION
EQ	<ul style="list-style-type: none"> - No apparent Erosion - Usually in gently sloping lands with than 8% slope or higher. If the lands bounded or terraced, maybe subjected to runoff flooding.
E i	<ul style="list-style-type: none"> - Slight Erosion - Usually in sloping and steep uplands and hilly lands that are covered by protective vegetation or in sloping cultivated lands that generally have sheet rill with frequency occurrence of less than 3 per linear meter
B 2	<ul style="list-style-type: none"> - Moderate Erosion - Usually steeply sloping uplands and hilly lands with generally grassy and shrubs vegetation or cultivated farmlands that generally have more than 3 rill per linear meter and where gullies have storm to form
B 3	<ul style="list-style-type: none"> - Severe Erosion - Generally gullied with exposed sub-soils/rock subjected to constant cultivated or with sparse vegetation or maybe forested areas with unstable soils subjected to landslides/rockslide and have density or dirt roads
E u	<ul style="list-style-type: none"> - Unclassified Erosion - Mostly under miscellaneous land types, e.g. quarry, urban settlements or town sites.

3.2.7 Flora and Fauna

The Buda-Maramag-Kibawe-Kabacan Road provides access to rich biodiversity of Bukidnon Province. The road associates with the 106 families in 512 genera and 996 species of the province. There are six types of forests, that the road traverses in the province namely: 1) mixed dipterocarp forest, 2) limestone forests; 3) secondary forests; 4) moisture forests; 5) mossy forests and 6) grasslands.

Mixed Dipterocarp Forests cover the greater part of Bukidnon and occurs up to 1,000 m above sea level. It encompasses the lanan-apidong tangile associate. These forests thrive in well-drained ridges and in deep silty clay areas.

Limestone forests are relatively large in Bukidnon. Their abundance in this province is largely due to widespread occurrence of limestone formation. Large area of limestone forests occur in Manolo Fortich, Dalirig, Maloko, Linabo, Don Carlos, Kitaotao and some parts of Quezon. These forests, which are popularly known as "molave forests", are now highly degraded due to illegal logging and ranching.

The secondary forest includes all senile types of forest; from thickets to old secondary forests. These forests are products of the destruction of the primary forest either by logging or shifting cultivation. The characteristic species are Macaranga, Adinandra, Endospermum, Mallotus, Cratoxylon, Elaeocarpus, Vitex, etc.

Montane forest occurs between elevation of 1,000 and 1,500 meters. It is characterized by a strongly mixed species composition. The ground layer comprises mostly of herbaceous plants. The characteristic species of molave forests are Subila Agsabaluses, Agathes Alba, etc.

Mossy forest dominates at 1,000 to 2,400 meters above sea level. Its smallest canopy ranges from 8 to 20 meters. Trees are usually dense and crooked consisting of few species. Typical and common species are Rhododendron, Podocarpus, Vaccinium, Arcuecaria, some grasses and cushion plants.

Imperata cylindrica are grass species occurring extensively in Bukidnon. These grasses are anthropogenic in nature. They are products of forest destruction, shifting agriculture and repeated burnings. The imperata grassland occurs in well drained soils up to 2,000 meters above sea level.

Bukidnon has a share of good number of the endemic fauna mostly habitating the hills and peaks of Mt. Kitanglad. Prominent are: bats, shrews, foxes, squirrels,

rats and eagle. Bukidnon is home of the Philippine Eagle which is the most endangered species. Philippine Eagle nests in the precipitous cliffs of Mt.Kitanglad and Balatokan Mountains.

3.2.8 Population

The 1995 census placed the population of Bukidnon at 940,403 which constitutes 37.9% of Region X's population 9.4% of the country's total population. The 1995 population of the province has increased to about 11.6% from its 1990 level of 842,296 or an average annual growth rate of 2.3%

The average population density of the province is 127,83 persons per sq.km. in year 2000.

4.2.9 Education

The highest education level achieved by the majority of the households is elementary education at 55.3 percent, while 21.6 percent have reached high school. Only 3.4 percent have academic degrees.

Fourteen (14) institutions of higher learning provide tertiary education. Seven colleges, a state university and six other schools operate to serve the 20 municipalities and two cities. These institutions are administered by government, private entities, as well as religious organizations.

3.2.10 Employment

Based on the NSO 2002 Employment Statistics, the province has a total labor force of 677,000 persons (15 years old and over). This constitutes a labor force participation rate of 82.8 percent. Of the total labor force, 96.5 percent are fully employed, while 3.5 percent are unemployed.

Majority of 77.7 percent of the total employed workers are in the agriculture, hunting and forestry industries. A small percentage, (13.4%), is working in Personal Services. Only 0.1 percent are employed in electricity, gas and water services as shown in Table 3-7.

TABLE 3-7
HOUSEHOLD POPULATION 15 YEARS & OVER WHO WORKED AND
TIME IN THE PAST YEAR BY INDUSTRY GROUP, BUKIDNON 2000

Major Industry Group	Total	Percent
1 Agri., Hunting & Forestry	459,614	77.70
2 Fishing	1,183	0.20
3 Mining and Quarrying	1,183	0.20
4 Manufacturing	6,507	1.10
5 Electricity, Gas and Water	591	0.10
6 Construction	7,098	1.20
7 Trade	33,714	5.70
8 Services	79,264	13.40
9 Not Stated	2,366	0.40
Total	591,520	100.00

Source: PPDO Computed Ratio and Proportion based on 1995 NSO Census

3.2.11 Agriculture

Reports from the Bureau of Agricultural Statistics Office revealed that 42.90 percent of the total agricultural crop area cultivated by Bukidnon farmers are devoted to corn. Corn crops cover an area of about 134,408 hectares in the year 2002. It is followed by palay of only 66,399 hectares or 21.19 percent of the total area.

Other major agricultural crops included: sugarcane with a total crop area of 44,005 hectares; pineapple with a total crop area of 16,565 hectares; and coffee with a total crop area of 22,451 hectares.

3.2.12 Commerce and Trade

Being an agricultural province influenced primarily by its geography, fertile soil and cool climate, entrepreneurial opportunity for Bukidnon are mostly agri-industrial based. As such, industrial crops like sugarcane, rubber and pineapple, contribute mainly to the province's economy in terms of bulk trading and

processing. The Del Monte Pineapple Plantation and Processing Plant located in the province is considered as the biggest pineapple plantation in the Far East. Likewise, sugarcane milling companies and rubber processing plants are operating in the province. The production of rubber has made a big contribution to the economy of Bukidnon.

Various establishments ranging from commercial, industrial, educational as well as institutional are mostly concentrated in urban areas or municipal centers.

3.2.13 Tourism

The province is endowed with natural and rich potential tourist attractions. The Kitanglad National Park in North Central Bukidnon being the second highest mountain in the country is rich with flora and fauna typical to that of genuine virgin forest.

In Guinoyoran, Valencia lies Lake Apo, dubbed as the cleanest and greenest inland body of water in the region. Similarly, a peculiar guitar shaped measuring to about 890 hectares planted with Gemelina and Mahogany trees along its shore is the Pinamalay Lake at Poblacion, don Carlos. Caves are also one of the most frequently visited natural tourist attractions in the province and most notable of which is the Sumalsag Cave in Brgy. Kilabong, Sumilao. The cave stretches about 1,850 meters with abundant stalactites and stalagmites.

3.2.14 Transport System

Bukidnon has extensive road connections and with regular bus lines plying to six adjoining provinces including Cagayan de Oro City. It has important trade routes to Davao and Cotabato City. Although landlocked, it has access to the sea through a first class national highway to Cagayan de Oro City where there are modern port facilities for export and domestic cargo shipment. Transportation available are buses, vans, public utility jeeps, multicabs and tricycles. Buses regularly ply the Cagayan de Oro-Bukidnon-Davao, Cagayan de Oro-Bukidnon-Cotabato and

Cagayan de Oro-Bukidnon-Wao routes. Public Utility jeeps provide service to commuters to and from the different municipalities and barangays of the province. Multicabs and tricycles, on the other hand, are the means of transportation with most of the Poblacions.

The road system of the province of Bukidnon is a conventional hierarchy of roads classified into national, provincial and municipal roads. The national roads serve as the main trunk lines and are supplemented by the network of local roads. As of 2002, the combined lengths of the national and provincial roads add up to 1,382.48 kilometers. This is almost divided equally between national and provincial roads. The latter measures 650.70 kilometers, while the former adds up to 731.78 kilometers.

**4.0 ENVIRONMENTAL AND SOCIAL
MANAGEMENT PLAN (EMP)**

4.0 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (EMP)

The landslides and roadslips in the identified segments of the Davao-Calinan-Buda-Maramag-Kibawe Road posed environmental hazards to the motorists and the general public. Often, as observed in the past, the landslides obstruct the smooth traffic flow of goods and motorist.

The remedial and rehabilitation roadworks listed in Table 4-1(a) to Table 4-1(h) intend to mitigate the adverse effects of landslides and roadslips in identified segments of the Davao-Calinan-Buda-Maramag-Kibawe-Kabacan Road. Through the use of a checklist of various environmental conditions, the levels of probable impacts of the project to these conditions are enumerated in Table 4-2.

4.1 CONSTRUCTION RELATED IMPACTS

Although the Davao-Calinan-Buda-Maramag-Kibawe-Kabacan Road already exists and the roadway project intends to mitigate the adverse effects of landslides and slippages on identified segments, a number of impacts are expected to be encountered particularly during construction works. The pre-identified possible adverse impacts include but are not limited to the following:

- a) generation of spoils from cuts and excavation works;
- b) transit of sediments and spoil materials to creeks and stream channels by surface runoffs;
- c) damage of existing vegetation cover on selected construction sites;
- d) disturbance of wild life due to noise from equipment operation;
- e) construction related health and safety hazards poised to construction crew and motorist;
- f) generation of dust and smoke emissions from hauling of materials and operation of construction equipment;
- g) generation of construction and domestic waste; and
- h) oil, petroleum and lubricant spillage from equipment maintenance

Table 4-1(a) : Summary of Selected Option of Countermeasures in Davao-Calinan Road

2	28 + 300 to 28 + 470	R	Grouted Riprap, Reshaping of Slope with Vegetation, Gabion Toe Wall, Vertical Realignment of Road (full), AC Pavement (full), Concrete Lined Canal with/without Cover (L/R), AC Shoulder (L/R)
1*	28 + 470 to 28 + 740	R	Landslide Prevention Pile with Ground Anchor, Vegetation, Vertical Realignment of Road (full), AC Pavement (full), Concrete Lined Canal (L/R), Concrete Chute Canal, Hand Laid Boulders, AC Shoulder (L/R)

Table 4-1(b) : Summary of Selected Option of Countermeasures in Calinan-Buda Road

32A	63 + 200 to 63 + 310	L	Landslide Prevention Pile with Ground Anchor, Vegetation, AC Pavement (full), Concrete Lined Canal (L/R), Curb and Gutter (R), Concrete Lined Canal with/without Cover (L/R), Concrete Chute Canal, Hand Laid Boulders
32	63 + 310 to 63 + 520	L	Landslide Prevention Pile, Horizontal Drain, Vegetation, Vertical Realignment of Road (full), AC Pavement (full), Concrete Lined Canal (L/R), Curb and Gutter (R), Concrete Lined Canal with Cover, Concrete Chute Canal (L/R), Hand Laid Boulders (L/R), AC Sh
26	69 + 020 to 69 + 140	R	Landslide Prevention Pile with Ground Anchor, Vegetation, AC Pavement (full), Curb and Gutter, Concrete Lined Canal, Concrete Chute Canal, Hand Laid Boulders, AC Shoulder (L/R)

Table 4-1(c) : Summary of Selected Option of Countermeasures in Buda-Maramag Road

1	85 + 860 to 86 + 090	FW	Vertical Realignment of Road, AC Pavement, Counterweight Fill/Reshaping of Embankment (L), Vegetation (L), Concrete Lined Canal (L/R), Curb and Gutter (L), Concrete Chute Canal (L/R), Hand Laid Boulders (L/R), Extension of RCPC, AC Shoulder (L/R)
2A	89 + 640 to 89 + 820	L	Concrete Crib with Vegetation (Type A/Type AC), Reshaping of Slope, Vegetation, Concrete Lined Canal (L/R), Concrete Chute Canal, Hand Laid Boulders, AC Shoulder (L/R), Cleaning of RCPC
2B	89 + 820 to 89 + 960	L	Concrete Crib with Vegetation (Type A/Type AC), Reshaping of Slope, Vegetation, Concrete Lined Canal (L/R), Concrete Chute Canal, Hand Laid Boulders, AC Shoulder (L/R)
3	106 + 660 to 106 + 820	R	Horizontal Drain, Concrete Chute Canal, Hand Laid Boulders, Concrete Lined Canal (L), Curb and Gutter (L), Vegetation (L), Concrete Chute Canal, AC Shoulder (L/R)
4	106 + 980 to 107 + 198.62	L	Horizontal Drain, Concrete Chute Canal, Hand Laid Boulders, Concrete Lined Canal (R), AC Shoulder (L/R)
5	109 + 310 to 109 + 400	R	Vegetation, AC Shoulder (L/R)

Table 4-1(d) : Summary of Selected Option of Countermeasures in Maramag-Kibawe-Kabacan Road

1	1608 + 760 to 1609 + 180	L/R	Landslide Prevention Pile (R), Horizontal Drain (L), AC Pavement (full), Concrete Lined Canal, Concrete Chute Canal, Hand Laid Boulders (R), AC Shoulder

Table 4-1(e) : Remedial Works in Davao-Calinan Road

Location No.	Stations	Side	REMEDIAL WORKS											
			Landslide Prevention Pile	Realignment	Sodding with Coconut	Pavement	AC Cover on Shoulder	Drainage/Side Ditch	Underdrain Pipe	Ground Anchor	Gabion	Refilling	Riprap	
2	28 + 300 to 28 + 470	R		X	X	X	X	X	X			X	X	X
1	28 + 470 to 28 + 740	R	X	X	X	X	X	X	X	X	X			

Table 4-1(f) : Remedial Works in Calinan-Buda Road

Location No.	Stations	Side	REMEDIAL WORKS										
			Landslide Prevention Pile	Realignment	Pavement	AC Cover on Shoulder	Concrete Lined and Concrete Chute Canal	Drainage/Underdrain in Pipe	Horizontal Drain	Ground Anchor	Crib and Gutter	Sodding with Coconut	
32A	63 + 200 to 63 + 310	L	X	X	X	X	X	X	X		X	X	X
32	63 + 310 to 63 + 520	L	X	X	X	X	X	X	X	X		X	X
26	69 + 020 to 69 + 140	R	X		X	X	X	X	X		X	X	

Table 4-1(g) : Remedial Works in Buda-Maramag Road

Location No.	Stations	Side	REMEDIAL WORKS													
			Realignment	Pavement	Crib Works	Gabions	Underdrain Pipe	Curb and Gutter	AC Shoulder	Drainage/Side Ditch	Horizontal Drain	Counterweight Fill	Sodding with Coconut	Vegetation with Coconut	Sodding	
1	85 + 860 to 86 + 090	FW	X	X					X	X	X		X	X		
2A	89 + 640 to 89 + 820	L			X	X				X	X			X	X	
2B	89 + 820 to 89 + 960	L			X					X	X				X	X
3	106 + 660 to 106 + 820	R				X		X	X	X	X		X			
4	106 + 980 to 107 + 198.6	L				X	X		X	X	X					
5	109 + 310 to 109 + 400	R								X	X		X			

Table 4-1(h) : Remedial Works in Maramag-Kibawe-Kabacan Road

Location No.	Stations	Side	REMEDIAL WORKS									
			Landslide Prevention Pile	Realignment	Pavement	Crib Works	Gabions	Ground Anchor	Curb and Gutter	AC shoulder	Drainage/Side Ditch	Horizontal Drain
1	1608 + 760 to 1609 + 180	L/R	X		X		X			X	X	X

Table 4-2 List of Environmental Conditions That May be Affected by the Project

ENVIRONMENTAL CONDITION	PROBABLE IMPACT					
	CONSTRUCTION PHASE			OPERATION PHASE		
	Beneficial	Adverse	None	Beneficial	Adverse	None
1.0 natural environmental condition						
1.1 Land						
1.1.1 Topography			0			0
1.1.2 Soil Quality			0			0
1.1.3 Critical Slope		2		5		
1.1.4 Controlled / Protected Areas		2			2	
1.2 Water						
1.2.1 Surface Water Quality		1			1	
1.2.2 Groundwater Quality		1			1	
1.2.3 Turbidity and Salinity		1			1	
1.2.4 Recharge Aquifers			0			0
1.3 Atmosphere						
1.3.1 Noise		2			2	
1.3.2 Vibration		2			2	
1.3.3 Air Quality		2			2	
1.4 Process						
1.4.1 Erosion		1		5		0
1.4.2 Landslide		2		5		1
1.4.3 Floods			0	5		0
1.5 Biological						
1.5.1 Wildlife		1			1	
1.5.2 Flora & Fauna		1			1	
1.5.3 Endangered Species		1			1	
1.6 Aesthetics						
1.6.1 Tourist Spots			0			0
1.6.2 Landscape		1			1	
1.6.3 Cultural Community / Settlement	2			2		
1.6.4 Archeological, Historical or Scientific Interest			0			0
2.0 Socio-Economic Condition						
2.1 Land Use and Land Values						
2.1.1 Agricultural	1			2		
2.1.2 Forestry			0			0
2.1.3 Mining & Quarrying	2					0
2.1.4 Residential	2			2		
2.1.5 Commercial	3			4		
2.1.6 Industrial	3			4		
2.2 Demography						
2.2.1 Population			0	2		
2.2.2 Migration			0	2		
2.3 Economic						
2.3.1 Income	2			3		
2.3.2 Labor & Employment	2			3		
2.4 Basic Amenities						
2.4.1 Health			0	2		
2.4.2 Education			0	2		
2.4.3 Recreation			0	2		
2.4.4 Transport & Communication		1		3		

Legend:

Measure of intensity

0 = None	1 = Very Low	2 = Low	3 = Moderate	4 = High	5 = Very High
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During the site inspection the above-listed construction related impacts were assessed to have very minimal and insignificant adversities to the receiving environment of the Davao - Calinan - Buda - Maramag - Kibawe - Kabacan Road.

4.2 OPERATION RELATED IMPACTS

More beneficial impacts as compared to the adverse effects are expected once the construction of the remedial work is completed. Completion of remedial works improves and enhances the operational performance and efficiency of the Davao-Calinan-Buda-Maramag-Kibawe-Kabacan Road.

The operation of an improved roadway contributes to the increase in population and growth in economy of the roadside communities. It caters better and efficient transportation and communication developments in and around the roadways.

Within the project area, increase in the utilization of available land for agricultural purposes is highly expected during the operation of an improved roadway. The same can be expected with other economic activities such as opening of more roadside business ventures and vending of indigenous products along selected safe sections of the roadway. All these contribute to: 1) increase in income; 2) additional revenues for the local government units; and 3) improvement of economic and social being of roadside residents.

4.3 ENVIRONMENTAL COMPLIANCE REQUIREMENT

In cognizance of the P.D. 1586 otherwise known as the "Environmental Impact System", the Remedial Works on Specified Landslide Areas and Slip Sections along Davao-Calinan-Buda-Maramag-Kibawe-Kabacan Road need to comply basic requirements. These requirements include: a) submission of project descriptions; b) resolutions from the Local Government Units; and c) issuance of Certificate of Non-Coverage (CNC).

4.3.1 Submission of Project Descriptions

As part of the environmental compliance procedure, scoping meetings were conducted with the Regional Offices of the Environmental Management Bureau (EMB) in Davao City and Cagayan de Oro City. The EMB Office in these cities has administration jurisdiction over the Davao-Calinan-Buda Segment and Buda-Maramag-Kibawe-Kabacan Segment, respectively. In the scoping meetings, the project description of the Remedial Works on Specified Landslide Areas and Roadslip Sections of the Davao-Calina-Buda-Maramag-Kibawe-Kabacan Road was presented.

The contents and substance of the project description were accepted and subjected to review and evaluation for the granting of Certificate of Non-Coverage (CNC). The prescribed coverage of the Project Description includes discussion on the following:

- a) General Information – presents the project title, name and address of project proponent, proponents contact person and the location of the project;
- b) Project Description – presents the plan/design components and activities during the construction and operation phases of the project;
- c) Description of Project Surroundings – describes the existing physical, biological and socio-economic conditions, where the project will be located; and,
- d) Predicted and Assessed Impacts and Proposed Mitigation Measures – describes the possible impacts that are likely to occur in various stages of the project development and the corresponding mitigation and enhancement measures to prevent and/or minimize the occurrence of adverse impacts and strengthen the positive effects of the project.

4.4 CONTINGENCY RESPONSE STRATEGY

During the Construction Phase of the Remedial Works in Specified Landslide Areas and Slip Sections of Davao-Calinan-Buda-Maramag-Kibawe-Kabacan Road, the Constructors / Contractor must ensure that:

- a) Adequate warning signs, barricades, warning lights including traffic aides are provided at all timed during construction'
- b) Vehicles for emergency cases are provided;
- c) All equipment are in good working condition;
- d) Crews follow safety procedures and are equipped with safety paraphernalia;
- e) Safety and emergency contingency programs are formulated and coordinated at all times;
- f) Temporary stockpiles and disposal sites are properly protected and secured; and
- g) Construction spoils are properly hauled to designated disposal sites.

4.5 ABANDONMENT STRATEGY

Abandonment measures must be implemented immediately after the construction activities. Upon completion of the project, all parties concerned, such as the DPWH, DENR, NCIP and the LGUs must inspect the area to check if:

- a) Temporary structures are properly dismantled and disposal;
- b) Facilities, utilities and service connections are properly re-installed or re-commissioned in the usual functioning condition;
- c) Construction equipment and waste materials are properly accounted and transported back to the Contractors' and
- d) Temporary camps and facilities are properly cleared of debris

4.6 ENVIRONMENTAL MONITORING STRATEGY

4.6.1 Monitoring Activities

The EMB-DENR and DPWH are expected to conduct monitoring on the progress and performance of the roadway project.

The following will be monitored during the Construction Phase:

- a) Implementation of approved plan/program on structural, engineering design, drainage, waste disposal, noise pollution control, tree-cutting etc.
- b) Prevention of dust build-up by water spraying;
- c) Sustenance of good water quality and clean waterways; BOD, TSS, oil and grease must be regularly checked.
- d) Compliance to occupational health and safety regulations by the contractor;
- e) Waste reduction, recovery re-use and recycling activities on-site;
- f) Sanitary conditions at worker camps;
- g) Adequacy and reliability of safety features on site; and
- h) Implementation of tree planting, road maintenance and landslide remediation scheme

4.6.2 The Multi-Partite Monitoring Team (MMT):

As stipulated in DAO 96-37, a Multi-Monitoring Team (MMT) must be formed immediately before the start of construction and after the issuance of the Certificate of Non-Coverage (CNC). The main goal of the MMT is to monitor the DPWH as well as the Contractor's compliance to the CNC conditions, the Environmental Management Plan (EMP) and other applicable laws, rules and regulations. In addition to these, the MMT shall also:

- a) Gather relevant data to determine possible causes of unavoidable and residual adverse impacts and validity of Public Complaints or concerns about the project; and,

Table 4-3 Environmental Monitoring Program

CONSTRUCTION PHASE						
Parameters to be Monitored	Stations to be Monitored	Frequency of Monitoring	Method of Analysis/Execution	DENR Standard	Implementor	
PHYSICAL						
Water Quality BOD, TSS, and oil and Greases of surface	All remedial works, in specified Landslide areas and slip sections	Quarterly during construction	Standard EMPASS-EQD Water quality analysis	Class "C" BOD < 10 mg/L TSS < 30 mg/L increase Oil & Grease < 3mg/L	DENR - EMB Region - XI / X	
BIOLOGICAL						
Tree Cutting	Entire alignment where there are trees to be Cut	Daily	Monitoring team must ensure that tree cutting is limited within the required ROW only	N.A.	DENR/DPWH	
Waste management and disposal	All portions of project sites with excavation and fill activities	Weekly during construction	Site Inspection	Based on EMP	DENR - EMB - Region XI / X	
SOCIAL						
Compliance of Contractor to occupational Health and safety rules and regulation	All construction areas.	Weekly	Site inspection of work areas including sanitation facilities	Based on EMP	DENR/DPWH	
Road Safety	Signages and detour routes	Quarterly	Site inspection	Based on DPWH Standard Operating Procedures	DPWH	
OPERATIONAL PHASE						
BIOLOGICAL						
Tree planting and its maintenance on both Sides of the highway, and possibly at Areas designated for construction	Designated environmental belts/zones, and R-O-W for construction	Monthly	Site inspection	Based on EMP	DENR/DPWH	
SOCIAL						
Informal setting/squatting	Acquired R-O-W for Construction	Weekly	Site inspection	Based on EMP	DENR/DPWH	
Illegal conversion of prime agricultural Land	Areas adjacent to the project	Weekly	Site inspection	Based on EMP	DENR/DPWH	
Road condition	Road pavement, drainage system, embankments, Bridge shoulders, etc.	Based on standard DPWH Maintenance procedures	Standard DPWH road and Bridges maintenance works	Based on DPWH Standard Operating Procedures	DPWH/DENR	

