PART IV

COST ESTIMATES AND TENDER DOCUMENTS

CHAPTER 13

PREPARATION OF CONSTRUCTION PLAN

13.1 BASIC PRINCIPLES

Major requirements in construction are as follows:

1) In principle, construction works shall be done in accordance with the "DPWH Standard Specifications for Public Works and Highways, 1988".

2) Since the Study Road is the only trunk road connecting Surigao and Davao and there is no alternative road, road traffic shall be maintained during construction within the existing road width in principle, except in case of constructing a short detour road as needed in some bridge rehabilitation works.

13.2 MAINTENANCE OF TRAFFIC

1) Roadway Rehabilitation/Improvement

In principle, roadway rehabilitation/improvement works are executed side by side. During the construction of one side, the other side is open to traffic in one-way operation controlled by signal (by traffic signal or manual). Construction length is determined depending on traffic volume. The longer construction length causes the more reduction of capacity because of loss time necessary to clear the way. Standard construction length is as follows:

AADT	Construction length
below 4,000	300m
4,000 - 7,000	200m
over 7,000	100m

2) Bridge Rehabilitation/Improvement

There are three ways as follows:

Method A : Detour road construction

Prior to rehabilitation/reconstruction work, a detour road is constructed including a temporary bridge, usually adjacent to the existing bridge.

Method B : Usage of existing road in full width

Existing road is used in full width if rehabilitation/reconstruction work does not affect the traffic like in case of constructing a new bridge adjacent to the original bridge and re-aligning the road after completion of the new bridge.

Method C : Usage of existing road in partial width

When work is executed side-by-side or in a limited portion, a portion not occupied by the construction work is open to traffic, usually in one-way operation.

Application of the methods is shown in Table 13.2-1.

TABLE 13.2-1 APPLICATION OF METHOD FOR MAINTENANCE OF TRAFFIC

Type of Works	Method			Remarks
	A	B	C	
Total Reconstruction *	O	O		Method A is applied unless the construction of a temporary bridge is very costly because of long bridge and/or soft ground.
Partial Reconstruction	O		O	- do -
Major Repair			O	
Minor Repair			O	
Protection from scour		O		The work does not affect the traffic.
Approach road protection			O	
River control		O		The work does not affect the traffic.

* including widening and extension

3) Slope protection

The work area is limited on one side of the road, maintaining traffic on the other side.

4) Countermeasures against Flood

Traffic is maintained in the following manner:

Location of Work	Type of Countermeasures	Maintenance of Traffic
Along the road	1. Protection of road 2. Installation of flood interception canal 3. Raise of road	Work area is limited on one side, maintaining traffic on the other side.
Along the river	4. Riverbed dredging 5. Construction of dike 6. Provision of cut-off channel	The work does not affect the traffic.
Outside the road	7. Construction of bypass	Mentioned below.

Monkayo Bypass Construction

As shown in Figure 13.2-1, Monkayo Bypass is divided into two sections: Section A and Section B.

Section A is a new construction section and Section B is a widening section of the existing barangay road. The barangay road is being used by the inhabitants of Barangay San Jose as the access road to the Pan-Philippine Highway. To maintain the said access, Section A shall be constructed first and open to traffic prior to commencement of the construction of Section B.

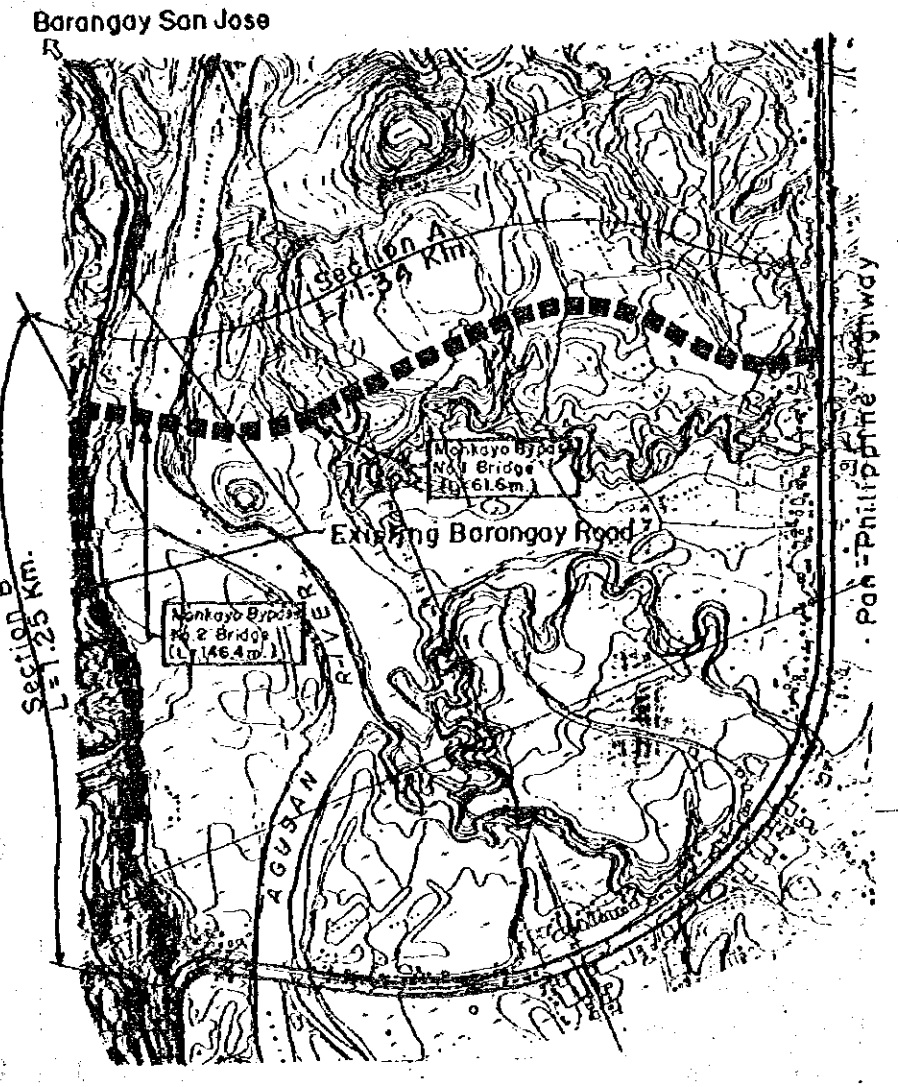


FIGURE : 13.2 - 1 MONKAYO BYPASS

13.3 CONSTRUCTION METHODS

Major works involved in the project are shown in Table 13.3-1.

TABLE 13.3-1 MAJOR WORKS

Works \ Type of rehabilitation/ improvement	Roadway rehabilitation/ improvement	Drainage improvement	Bridge rehabilitation/ improvement	Slope protection	Countermeasures against flood other than bypass construction	Bypass construction
Clearing and grubbing					O	O
Removal of existing pavement	O					
Excavation		O		O		O
Structural excavation			O			O
Embankment	O			O	O	O
Subgrade preparation	O					O
Subbase/base courses	O					O
Portland cement concrete pavement	O					O
Bituminous concrete surface course	O					
Concrete side ditch		O				O
Subsurface drainage		O				O
Pipe culvert		O		O	O	O
Box culvert		O		O	O	O
Temporary bridge			O			
Temporary jetty			O			O
Cofferdam			O			O
Pile driving			O			O
Cast-in-place piles			O			
Structural concrete			O		O	O
Fabrication of precast girder			O			O
Hauling and erection of girder			O			O
Crack sealing			O			
Temporary shoring			O			
Grouted riprap			O	O	O	O
Gabion			O	O		O
Riverbed dredging			O		O	
Cut-off channel construction					O	

All works will be done by ordinary methods commonly used in the Philippines and described in detail in the DPWH Standard Specifications for Public Works and Highways. Major equipment/plants used for each work are shown in Table 13.3-2.

TABLE 13.3-2 MAJOR EQUIPMENT USED FOR WORK

Works \ Major Equipment	Bulldozer	Wheel loader	Backhoe	Dumptruck	Motorized Grader	Macadam Roller	Tandem Roller	Vibratory Roller	Pneumatic Roller	Sheepfoot Roller	Asphalt Sprayer	Transit Mixer	Asphalt Paver	Concrete Breaker	Screening and Washing Plant	Batching Plant	Crushing Plant	Water Truck	Diesel Pile Hammer	Vibrating Hammer	Drilling Rig	Cargo Truck	Bentonite Plant	Air compressor	Crawler Drill Unit	Truck Crane	Crawler Crane	Cable Cutter	Hydraulic Jack	Giant Breaker	Asphalt Kettle	Presetressing Machine	Trailer Truck	Pumpcrete
Cleaning & grubbing	O																					O												
Removal of existing pavement		O	O	O										O								O								O				
Excavation			O	O										O				O						O										
Structural excavation			O	O										O																				
Embankment		O		O						O														O										
Subgrade preparation		O		O	O	O	O											O																
Subbase/base courses		O		O	O	O	O	O	O						O		O																	
Portland cement concrete pavement								O	O			O			O	O	O																	
Bituminous concrete surface course				O			O	O	O		O		O			O	O																	
Concrete side ditch																O	O	O																
Subsurface drainage		O	O	O																														
Pipe culvert		O	O	O																		O												
Box culvert		O	O	O												O																		
Temporary bridge				O															O			O				O								
Temporary jetty																			O	O		O				O							O	
Cofferdam																			O	O		O				O							O	
Pile driving																			O			O												
Cast-in-place pile														O							O		O			O								
Structural concrete												O			O	O	O	O					O											
Fabrication of precast girder												O			O	O	O	O																O
Hauling and erection of girder																						O				O							O	
Crack sealing																															O			
Temporary shoring																													O					
Grouted riprap				O																														
Gabion				O																														
Riverbed dredging		O	O	O																														
Cut-off channel construction		O	O	O																														

13.4 CONSTRUCTION MATERIALS

Construction materials required for the project are classified into two categories: goods on the market and materials to be obtained from sources/quarries near the project sites.

Goods on the market include portland cement, bituminous materials, structural steel, reinforcing steel, prestressing steel, fuel, lumber, steel mesh for gabion etc. All goods are procurable within the country.

Materials from sources/quarries include borrow materials, aggregates for subbase course, base course, asphalt concrete, portland cement concrete pavement and structural concrete, and boulders for riprap and gabion. Material sources have been identified for each package as shown in Table 13.4-1. Figures 13.4-1 and 13.4-2 show their location.

TABLE 13.4-1 MATERIAL SOURCES (1/2)

Contract Package	Borrow Materials		Subbase/Base Course Materials		Aggregates and Boulders	
	Source	HD (km)	Source	HD (km)	Source	HD (km)
1	Mabuhay River	20	Anao-aon River	35	Anao-aon River	35
	Magtiaco River	25	Magtiaco River	27	Magtiaco River	27
2	Magtiaco River	16	Magtiaco River	16	Magtiaco River	16
	Puyo River	12	Puyo River	12	Puyo River	12
3	Puyo River	16	Puyo River	16	Puyo River	16
	Guinoyoran River	8	Guinoyoran River	8	Guinoyoran River	8
4	Cabadbaran River	24	Cabadbaran River	24	Cabadbaran River	24
	Taguibo River	25	Taguibo River	25	Sta. Ana River	21
5	Taguibo River	31	Taguibo River	31	Wawa (Noli) River	22
	Wawa (Noli) River	22	Mabuhay River	18	Mabuhay River	18
	Sagmonie River	22				
6	Sagmonie Quarry	7	Wawa (Noli) River	7	Mabuhay River	7
	Wawa (Noli) River	7	Andanan River	9	Maog River	31
	Andanan River	9			Wawa (Noli) River	7
7	Andanan River	15	Andanan River	17	Maog River	16
	New Leyte Quarry	10	Salimbogawon River	18	Azpitia River	17
	Sagmonie Quarry	15				
8	New Leyte Quarry	9	Salimbogawon River	17	Maog River	15
	Bah-Bah Quarry	6	Algeria River	20	Azpitia River	16
	Ormaca River	18				
9	Bah-Bah Quarry	22	Algeria River	16	Maog River	32
	Ormaca River	9	Upper Boan River	18	Azpitia River	33
	Upper Boan River	18				
10	Ormaca River	23	Upper Boan River	14	Upper Boan River	14
	Upper Boan River	14	Bahayan River (Salvacion)	36	Bahayan River (Salvacion)	36
			Bahayan River (Trento)	35	Bahayan River (Trento)	35
11	Upper Boan River	28	Upper Boan River	28	Bahayan River (Salvacion)	16
	Bahayan River (Trento)	13	Bahayan River (Trento)	13	Bahayan River (Trento)	15
	Lankilaan River	20			Lankilaan Creek	22

Note: HD = Hauling distance

TABLE 13.4-1 MATERIAL SOURCES (2/2)

Contract Package	Borrow Materials		Subbase/Base Course Materials		Aggregates and Boulders	
	Source	HD (km)	Source	HD (km)	Source	HD (km)
12	Bahayan River (Trento)	4	Bahayan River (Trento)	6	Simulao River	17
	Lankilaan Creek	6	Lankilaan Creek	8	Bahayan River (Salvacion)	5
					Bahayan River (Trento)	6
13	Lankilaan Creek	12	Lankilaan Creek	12	Simulao River	30
	Olaycon Quarry	16	Gabanan River	9	Bahayan River (Salvacion)	18
					Ulip River	15
14	Olaycon Quarry	8	Gabanan River	7	Ulip River	7
			Ulip River	7	Naboc River	19
15	Olaycon Quarry	12	Ulip River	23	Ulip River	23
	Mawab Quarry	29	Mawab River	31	Mawab River	31
	Pandapan River	39	Tagmanok Quarry		Tagmanok Quarry	
					Naboc River	26
16	Mawab Quarry	8	Mawab River	10	Hijo River	19
	Pandapan River	12	Tagmanok Quarry		Mawab River	10
			Pandapan River	14	Tagmanok Quarry	
					Pandapan River	14
17	Mawab Quarry	22	Mawab River	24	Hijo River	9
	Pandapan River	13	Tagmanok Quarry		Mawab River	24
			Pandapan River	15	Tagmanok Quarry	
					Pandapan River	15
18	Bud-Bod River	11	Hijo River	29	Hijo River	44
			Mabuhay River	17	Pandanan River	35
					Mabuhay River	24
					Pandanan River	26
19	Bud-Bod Quarry	18	Mabuhay River	19	Mabuhay River	19

Note: HD = Hauling distance

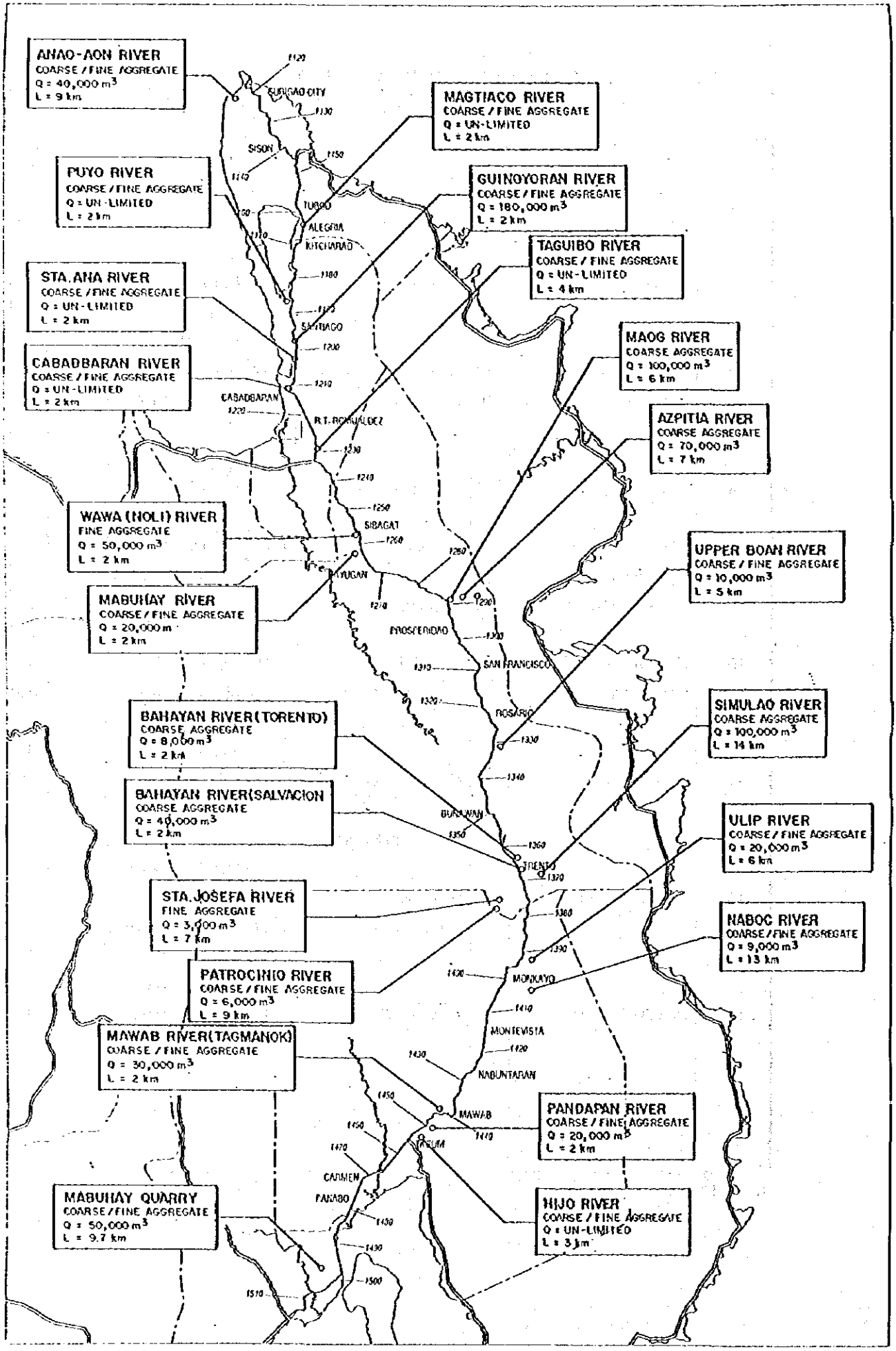


FIGURE 13.4-1 MATERIAL SOURCES: AGGREGATE FOR CONCRETE

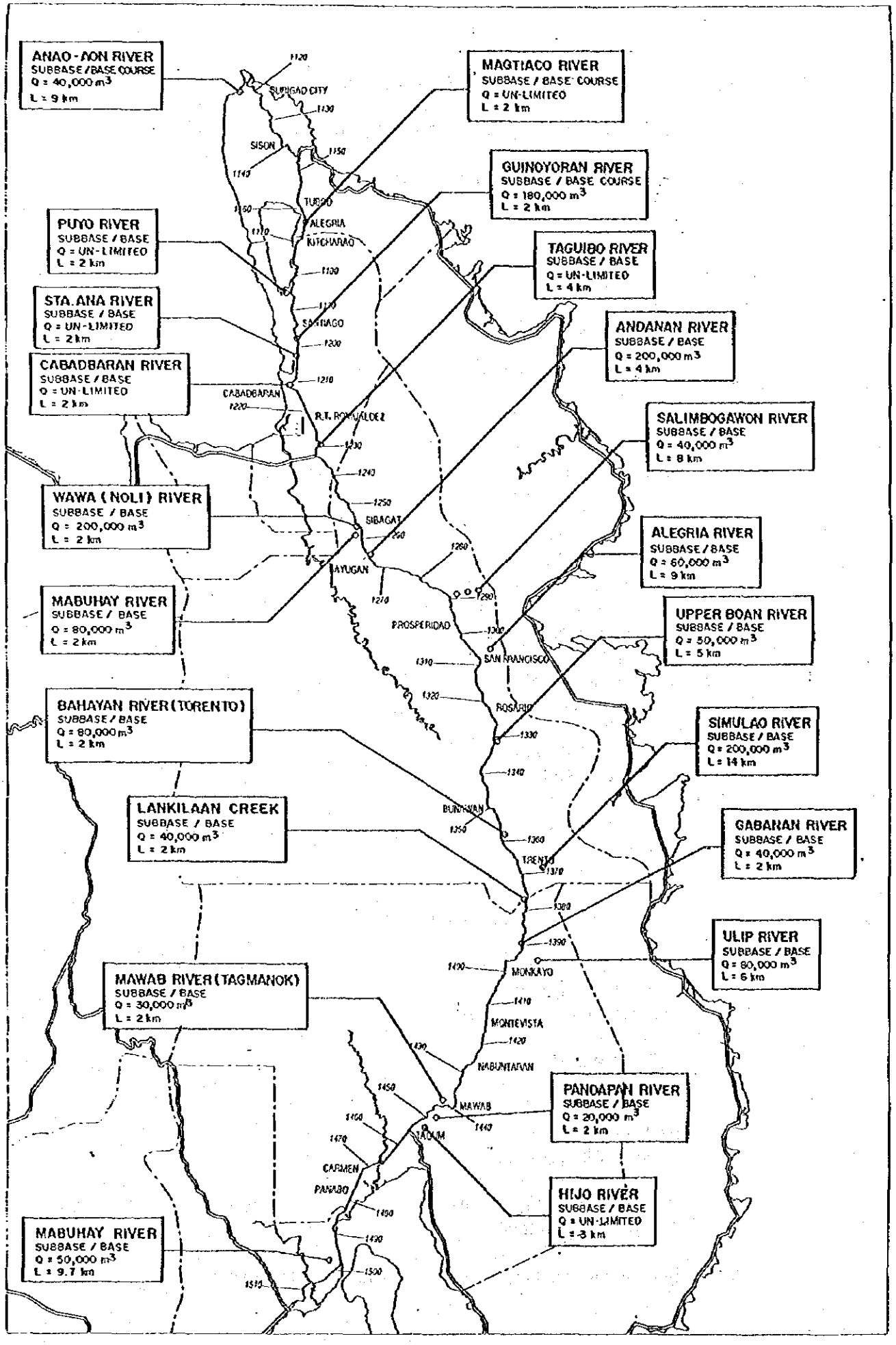


FIGURE 13.4-2 MATERIAL SOURCES: SUBBASE/BASE COURSE

13.5 CONSTRUCTION EQUIPMENT/PLANTS

Major equipment and plants required for the project are as follows:

1) Equipment/Plants Common to All Packages

- Earthwork
  - Bulldozer
  - Shovel
  - Backhoe
  - Wheel and Crawler Loaders
  - Motor Grader
- Subbase and Base Courses
  - Bulldozer
  - Motor Grader
  - Water Truck
  - Vibratory Roller
  - Pneumatic Tired Roller
  - Aggregate Crusher
  - Power Broom
- Concrete Work
  - Concrete Batching Plant
  - Washing and Screening Plant
  - Transit Mixer
  - Concrete Mixer
- Asphalt Pavement
  - Asphalt Plant
  - Asphalt Paver/Finisher
  - Asphalt Distributor
  - Vibratory Roller
- Common Use
  - Truck Crane
  - Air Compressor
  - Cargo Truck

2) Particular Equipment for Each Package

- Packages 2, 13, 14, 15 and 18
  - Diesel Pile Hammer
  - Crawler Crane
- Package 6
  - Diesel Pile Hammer
  - Crawler Crane
  - Vibratory Hammer
- Package 17
  - Diesel Pile Hammer
  - Crawler Crane
  - Drilling Rig, ϕ1200mm
  - Vibratory Hammer

All equipment and plants are procurable within the country.

13.6 WORK PROGRAM AND CONSTRUCTION PERIOD

13.6.1 Assumptions on Construction Rates of Major Works

Major critical works in the work program are roadway rehabilitation/improvement and reconstruction of bridge. The construction rates of major works are assumed as follows:

1) Roadway Rehabilitation/Improvement

- Workable Days

  - 20 days in dry season (5 months/year)
  - 10 days in rainy season (7 months/year)
  - 14 days in average through the year

- Construction Rate

- Removal of existing pavement	:	65 m/day = 0.9 km/month
- Subbase course	:	130 m/day = 1.8 km/month
- Base course	:	130 m/day = 1.8 km/month
- PCC Slab (t=23cm)	:	65 m/day = 0.9 km/month
- PCC Slab (t=25cm)	:	60 m/day = 0.8 km/month
- PCC Slab (t=28cm)	:	50 m/day = 0.7 km/month
- AC surface course (t=8cm)	:	50 m/day = 0.7 km/month
- AC surface course (t=10cm)	:	40 m/day = 0.6 km/month
- AC surface course (t=12cm)	:	30 m/day = 0.4 km/month

2) Reconstruction of Bridge

The necessary period for reconstruction of bridge is estimated as follows:

- Short bridge (L<30m) : 5 months (see Table 13.6-1)
- Middle bridge (L=30-60m) : 6 months (see Table 13.6-2)
- Long bridge (L>100m)
  - Andanan Bridge (L=180m) : 10 months (see Table 13.6-3)
  - Monkayo Bypass No. 2 Bridge (L=146m) : 10 months (see Table 13.6-4)
  - New Gov. Miranda Bridge (L=650m) : 18 months (see Table 13.6-5)

TABLE 13.6-1 WORK SCHEDULE FOR RECONSTRUCTION OF SHORT BRIDGE (L<30m)

Work Item	Month 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mobilization																								
Detour road																								
Removal of Existing Bridge																								
Piling																								
Footing																								
Substructure																								
Fabrication of precast girder																								
Erection of girder																								
Diaphragm & slab																								
Approach road																								
Demobilization																								

TABLE 13.6-2 WORK SCHEDULE FOR RECONSTRUCTION OF MIDDLE BRIDGE (L=30~60m)

Work Item	Month 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mobilization																								
Detour road																								
Removal of Existing Bridge																								
Piling																								
Footing																								
Substructure																								
Fabrication of precast girder																								
Erection of girder																								
Diaphragm & slab																								
Approach road																								
Demobilization																								

TABLE 13.6-3 WORK SCHEDULE FOR RECONSTRUCTION OF ANDANAN BRIDGE (L=180m)

Work Item	Month 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mobilization																								
Piling																								
Footing																								
Substructure																								
Fabrication of precast girder																								
Erection of girder																								
Diagphragm & slab																								
Approach road																								
Removal of Existing Bridge																								
Demobilization																								

TABLE 13.6-4 WORK SCHEDULE FOR CONSTRUCTION OF MONKAYO BYPASS NO. 2 BRIDGE (L=146m)

Work Item	Month 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mobilization																								
Piling																								
Footing																								
Substructure																								
Fabrication of precast girder																								
Erection of girder																								
Diagphragm & slab																								
Demobilization																								

TABLE 13.6-5 WORK SCHEDULE FOR CONSTRUCTION OF GOV. MIRANDA BRIDGE (L=650m)

Work Item	Month 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mobilization																								
Temporary jetty																								
Piling																								
Cofferdam																								
Footing																								
Substructure																								
Fabrication of precast girder																								
Erection of girder																								
Diaphragm & slab																								
Approach road																								
Removal of Existing Bridge																								
Demobilization																								

13.6.2 Work Program for Each Contract Package

Work Program for each contract package is shown in Tables 13.6-6 to 13.6-24. Based on the work program, the construction period is determined as follows:

Contract Package	Construction Period
1	24 months
2	23
3	16
4	15
5	22
6	22
7	30
8	22
9	20
10	26
11	18
12	17
13	21
14	17
15	25
16	27
17	33
18	19
19	14

TABLE 13.6-6 WORK PROGRAM OF CONTRACT PACKAGE 1

Total Construction Period = 24 months

Work Item	Quantity	Month 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33
Mobilization		
Roadway Rehabilitation/Improvement		
- Removal of Existing Pavement	15.6 km	
- Embankment	6.2 km	
- Subbase Course	15.6 km	
- Base Course	-	
- PCC Slab	15.6 km	
- AC Surface Course	-	
- Shoulder & Others		
Drainage Improvement		
Bridge Rehabilitation/Improvement		
- Total Reconstruction	-	
- Partial Reconstruction	3	
- Other Rehabilitation	3	
Slope Protection	1	
Countermeasures against Flood		(Included in roadway rehabilitation/improvement and drainage improvement)
Demobilization		

TABLE 13.6-7 WORK PROGRAM OF CONTRACT PACKAGE 2

Total Construction Period = 23 months

Work Item	Quantity	Month 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33
Mobilization		
Roadway Rehabilitation/Improvement		
- Removal of Existing Pavement	5.0 km	
- Embankment	1.0 km	
- Subbase Course	5.0 km	
- Base Course	-	
- PCC Slab	5.0 km	(2 parties)
- AC Surface Course	22.4 km	
- Shoulder & Others		
Drainage Improvement		
Bridge Rehabilitation/Improvement		
- Total Reconstruction	2	
- Partial Reconstruction	2	
- Other Rehabilitation	4	
Slope Protection	4	
Countermeasures against Flood		(Included in roadway rehabilitation/improvement and drainage improvement)
Demobilization		

TABLE 13.6-8 WORK PROGRAM OF CONTRACT PACKAGE 3

Total Construction Period = 16 months

Work Item	Quantity	Month 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33
Mobilization		
Roadway Rehabilitation/Improvement		
- Removal of Existing Pavement	4.2 km	
- Embankment	1.7 km	
- Subbase Course	4.2 km	
- Base Course	-	
- PCC Slab	4.2 km	
- AC Surface Course	-	
- Shoulder & Others		
Drainage Improvement		
Bridge Rehabilitation/Improvement		
- Total Reconstruction	1	
- Partial Reconstruction	2	
- Other Rehabilitation	4	
Slope Protection	-	
Countermeasures against Flood		(Included in roadway rehabilitation/improvement and drainage improvement)
Demobilization		

TABLE 13.6-9 WORK PROGRAM OF CONTRACT PACKAGE 4

Total Construction Period = 15 months

Work Item	Quantity	Month 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33
Mobilization		
Roadway Rehabilitation/Improvement		
- Removal of Existing Pavement	4.9 km	
- Embankment	0.5 km	
- Subbase Course	4.9 km	
- Base Course	-	
- PCC Slab	4.9 km	
- AC Surface Course	-	
- Shoulder & Others		
Drainage Improvement		
Bridge Rehabilitation/Improvement		
- Total Reconstruction	2	
- Partial Reconstruction	3	
- Other Rehabilitation	3	
Slope Protection	-	
Countermeasures against Flood		(included in roadway rehabilitation/improvement and drainage improvement)
Demobilization		

TABLE 13.6-10 WORK PROGRAM OF CONTRACT PACKAGE 5

Total Construction Period = 22 months

Work Item	Quantity	Month 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33
Mobilization		
Roadway Rehabilitation/Improvement		
- Removal of Existing Pavement	9.4 km	
- Embankment	-	
- Subbase Course	9.4 km	
- Base Course	-	
- PCC Slab	9.4 km	
- AC Surface Course	9.6 km	
- Shoulder & Others		
Drainage Improvement		
Bridge Rehabilitation/Improvement		
- Total Reconstruction	-	
- Partial Reconstruction	-	
- Other Rehabilitation	-	
Slope Protection	15	
Demobilization		

TABLE 13.6-11 WORK PROGRAM OF CONTRACT PACKAGE 6

Total Construction Period = 22 months

Work Item	Quantity	Month 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33
Mobilization		
Roadway Rehabilitation/Improvement		
- Removal of Existing Pavement	9.3 km	
- Embankment	-	
- Subbase Course	9.3 km	
- Base Course	-	
- PCC Slab	9.3 km	
- AC Surface Course	8.9 km	
- Shoulder & Others		
Drainage Improvement		
Bridge Rehabilitation/Improvement		
- Total Reconstruction	2	
- Partial Reconstruction	3	
- Other Rehabilitation	1	
Slope Protection	-	
Demobilization		

TABLE 13.6-12 WORK PROGRAM OF CONTRACT PACKAGE 7

Total Construction Period = 30 months

Work Item	Quantity	Month 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Mobilization																																		
Roadway Rehabilitation/Improvement																																		
- Removal of Existing Pavement	19.7 km																																	
- Embankment	-																																	
- Subbase Course	19.7 km																																	
- Base Course	19.7 km																																	
- PCC Slab	19.7 km																																	
- AC Surface Course	-																																	
- Shoulder & Others																																		
Drainage Improvement																																		
Bridge Rehabilitation/Improvement																																		
- Total Reconstruction	-																																	
- Partial Reconstruction	6																																	
- Other Rehabilitation	-																																	
Slope Protection	18																																	
Demobilization																																		

TABLE 13.6-13 WORK PROGRAM OF CONTRACT PACKAGE 8

Total Construction Period = 22 months

Work Item	Quantity	Month 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Mobilization																																		
Roadway Rehabilitation/Improvement																																		
- Removal of Existing Pavement	15.8 km																																	
- Embankment	-																																	
- Subbase Course	15.8 km																																	
- Base Course	-																																	
- PCC Slab	15.8 km																																	
- AC Surface Course	-																																	
- Shoulder & Others																																		
Drainage Improvement																																		
Bridge Rehabilitation/Improvement																																		
- Total Reconstruction	-																																	
- Partial Reconstruction	-																																	
- Other Rehabilitation	1																																	
Slope Protection	4																																	
Demobilization																																		

TABLE 13.6-14 WORK PROGRAM OF CONTRACT PACKAGE 9

Total Construction Period = 20 months

Work Item	Quantity	Month 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Mobilization																																		
Roadway Rehabilitation/Improvement																																		
- Removal of Existing Pavement	8.3 km																																	
- Embankment	-																																	
- Subbase Course	10.2 km																																	
- Base Course	1.9 km																																	
- PCC Slab	8.3 km																																	
- AC Surface Course	10.3 km																																	
- Shoulder & Others																																		
Drainage Improvement																																		
Bridge Rehabilitation/Improvement																																		
- Total Reconstruction	2																																	
- Partial Reconstruction	1																																	
- Other Rehabilitation	3																																	
Slope Protection	8																																	
Demobilization																																		

TABLE 13.6-15 WORK PROGRAM OF CONTRACT PACKAGE 10

Total Construction Period = 26 months

Work Item	Quantity	Month 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33
Mobilization		
Roadway Rehabilitation/Improvement		
- Removal of Existing Pavement	12.6 km	
- Embankment	-	
- Subbase Course	13.7 km	
- Base Course	1.1 km	
- PCC Slab	12.6 km	
- AC Surface Course	14.0 km	
- Shoulder & Others		
Drainage Improvement		
Bridge Rehabilitation/Improvement		
- Total Reconstruction	1	
- Partial Reconstruction	3	
- Other Rehabilitation	2	
Slope Protection	1	
Demobilization		

TABLE 13.6-16 WORK PROGRAM OF CONTRACT PACKAGE 11

Total Construction Period = 18 months

Work Item	Quantity	Month 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33
Mobilization		
Roadway Rehabilitation/Improvement		
- Removal of Existing Pavement	2.5 km	
- Embankment	-	
- Subbase Course	6.0 km	
- Base Course	3.5 km	
- PCC Slab	2.5 km	(2 parties)
- AC Surface Course	14.7 km	
- Shoulder & Others		
Drainage Improvement		
Bridge Rehabilitation/Improvement		
- Total Reconstruction	-	
- Partial Reconstruction	-	
- Other Rehabilitation	1	
Slope Protection	4	
Countermeasures against Flood		(included in roadway rehabilitation/improvement and drainage improvement)
Demobilization		

TABLE 13.6-17 WORK PROGRAM OF CONTRACT PACKAGE 12

Total Construction Period = 17 months

Work Item	Quantity	Month 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33
Mobilization		
Roadway Rehabilitation/Improvement		
- Removal of Existing Pavement	12.7 km	
- Embankment	-	
- Subbase Course	12.7 km	
- Base Course	-	(1.5 parties)
- PCC Slab	12.7 km	
- AC Surface Course	-	
- Shoulder & Others		
Drainage Improvement		
Bridge Rehabilitation/Improvement		
- Total Reconstruction	-	
- Partial Reconstruction	-	
- Other Rehabilitation	-	
Slope Protection	3	
Demobilization		

TABLE 13.6-18 WORK PROGRAM OF CONTRACT PACKAGE 13

Total Construction Period = 21 months

Work Item	Quantity	Month 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Mobilization																																		
Roadway Rehabilitation/Improvement																																		
- Removal of Existing Pavement	3.8 km																																	
- Embankment	-																																	
- Subbase Course	4.1 km																																	
- Base Course	0.3 km																																	
- PCC Slab	3.8 km																																	
- AC Surface Course	18.1 km																																	
- Shoulder & Others																																		
Drainage Improvement																																		
Bridge Rehabilitation/Improvement																																		
- Total Reconstruction	1																																	
- Partial Reconstruction	1																																	
- Other Rehabilitation	-																																	
Slope Protection	4																																	
Demobilization																																		

(2 parties)

TABLE 13.6-19 WORK PROGRAM OF CONTRACT PACKAGE 14

Total Construction Period = 17 months

Work Item	Quantity	Month 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Mobilization																																		
Roadway Rehabilitation/Improvement																																		
- Removal of Existing Pavement	0.4 km																																	
- Embankment	-																																	
- Subbase Course	0.4 km																																	
- Base Course	-																																	
- PCC Slab	0.4 km																																	
- AC Surface Course	-																																	
- Shoulder & Others																																		
Construction of Section A																																		
- Clearing & Grubbing	1.1 km																																	
- Earthwork	1.1 km																																	
- Subbase Course	1.1 km																																	
- PCC Slab	1.1 km																																	
- Drainage																																		
- Shoulder & Others																																		
- Monkayo Bypass No. 1 Bridge	L=62m																																	
- Monkayo Bypass No. 2 Bridge	L=146m																																	
Construction of Section B																																		
- Clearing & Grubbing	1.3 km																																	
- Earthwork	1.3 km																																	
- Subbase Course	1.3 km																																	
- PCC Slab	1.3 km																																	
- Drainage																																		
- Slope Protection																																		
- Shoulder & Others																																		
Demobilization																																		

TABLE 13.6-20 WORK PROGRAM OF CONTRACT PACKAGE 15

Total Construction Period = 25 months

Work Item	Quantity	Month 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Mobilization																																		
Roadway Rehabilitation/Improvement																																		
- Removal of Existing Pavement	5.7 km																																	
- Embankment	-																																	
- Subbase Course	5.7 km																																	
- Base Course	-																																	
- PCC Slab	5.7 km																																	
- AC Surface Course	18.0 km																																	
- Shoulder & Others																																		
Drainage Improvement																																		
Bridge Rehabilitation/Improvement																																		
- Total Reconstruction	2																																	
- Partial Reconstruction	2																																	
- Other Rehabilitation	-																																	
Slope Protection	4																																	
Demobilization																																		

(2 parties)

TABLE 13.6-21 WORK PROGRAM OF CONTRACT PACKAGE 16

Total Construction Period = 27months

Work Item	Quantity	Month 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33
Mobilization		
Roadway Rehabilitation/Improvement		
- Removal of Existing Pavement	5.5 km	
- Embankment	-	
- Subbase Course	5.9 km	
- Base Course	0.4 km	
- PCC Slab	5.5 km	(2 parties)
- AC Surface Course	25.1 km	
- Shoulder & Others		
Drainage Improvement		
Bridge Rehabilitation/Improvement		
- Total Reconstruction	-	
- Partial Reconstruction	-	
- Other Rehabilitation	3	
Slope Protection	5	
Demobilization		

TABLE 13.6-22 WORK PROGRAM OF CONTRACT PACKAGE 17

Total Construction Period = 33 months

Work Item	Quantity	Month 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33
Mobilization		
Roadway Rehabilitation/Improvement		
- Removal of Existing Pavement	2.5 km	
- Embankment	1.2 km	
- Subbase Course	2.5 km	
- Base Course	-	
- PCC Slab	2.5 km	
- AC Surface Course	-	
- Shoulder & Others		
Drainage Improvement		
Bridge Rehabilitation/Improvement		
- Total Reconstruction (Liboganon Bridge)	L=31m	
- Total Reconstruction (New Gov. Miranda Bridge)	L=650m	
Countermeasures against Flood		
- Right Side Dike	1.5 km	
- Left Side Dike	1.0 km	
- Cut-off Channel	1.9 km	
Demobilization		

TABLE 13.6-23 WORK PROGRAM OF CONTRACT PACKAGE 18

Total Construction Period = 19 months

Work Item	Quantity	Month 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33
Mobilization		
Roadway Rehabilitation/Improvement		
- Removal of Existing Pavement	10.2 km	
- Embankment	-	
- Subbase Course	10.2 km	
- Base Course	-	
- PCC Slab	10.2 km	
- AC Surface Course	-	
- Shoulder & Others		
Drainage Improvement		
Bridge Rehabilitation/Improvement		
- Total Reconstruction	1	
- Partial Reconstruction	3	
- Other Rehabilitation	-	
Slope Protection	2	
Demobilization		

TABLE 13.6-24 WORK PROGRAM OF CONTRACT PACKAGE 19

Total Construction Period = 14 months

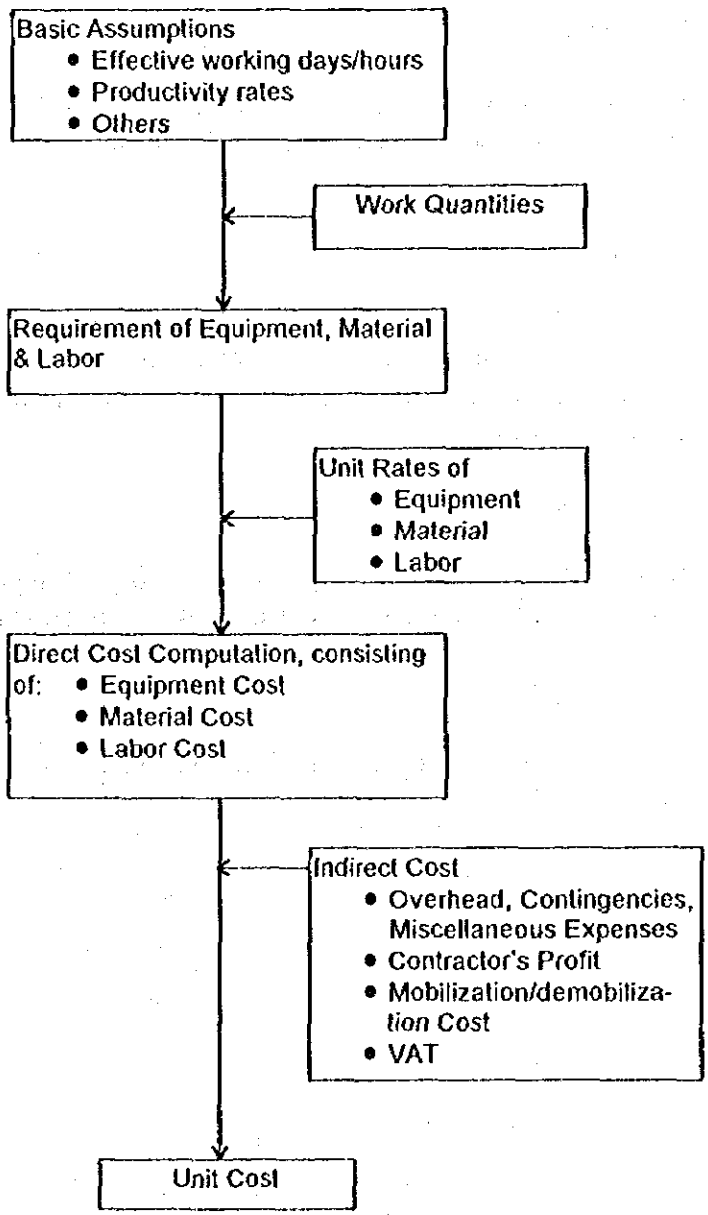
Work Item	Quantity	Month 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Mobilization																																		
Roadway Rehabilitation/Improvement																																		
- Removal of Existing Pavement	2.6 km																																	
- Embankment	-																																	
- Subbase Course	2.6 km																																	
- Base Course	-																																	
- PCC Slab	2.6 km																																	
- AC Surface Course																																		
- Shoulder & Others																																		
Drainage Improvement																																		
Bridge Rehabilitation/Improvement																																		
- Total Reconstruction	-																																	
- Partial Reconstruction	-																																	
- Other Rehabilitation	2																																	
Slope Protection	-																																	
Demobilization																																		

CHAPTER 14

COST ESTIMATES

14.1 UNIT COST ANALYSIS

The unit cost analysis was undertaken in accordance with the following procedure:



14.1.1 Basic Assumption

1) Work Schedule

The work schedule was based on the following:

- The overall working hours per day are 9 hours (including the delivery of labor and other time losses).
- The net working hours per day are 8 hours.
- Working days per year are the total calendar days per year minus national holidays, Sundays, non-working days due to rainfall. Number of rainy days were based on PAG-ASA records for each area.

2) Work Hours

Where 100% production rates are used as a base, a normal working hours are considered as 50 minutes (85%), except for such works that require continuous operation.

3) Field Efficiency

Where 100% production rates are used as a base, the normal field efficiency is considered between 100% and 25% due to the obstructions and various type of delays caused by public traffic. Further adjustment was made as may be deemed necessary.

4) Hauling Distance

Hauling distances of borrow, subbase, base and aggregate materials were determined based on the material sources investigation results.

5) Cost Component

Cost components, i.e. foreign, local and tax, were assumed as shown in Table 14.1-1.

TABLE 14.1-1 COST COMPONENT FOR SELECTED CONSTRUCTION ITEMS

ITEM NO.	DESCRIPTION	FOREIGN (Percent)	LOCAL (Percent)	TAXES (Percent)
1.0	Heavy Equipment	65	5	30
2.0	Light Equipment	65	5	30
3.0	Reinforcing Steel	54	35	11
4.0	Structural Steel	85	4	11
5.0	Lumber	0	90	10
6.0	Asphalt	76	2	22
7.0	Diesel Fuel	60	13	27
8.0	Engine Oil	12	70	18
9.0	Tires	47	44	9
10.0	Imported Miscellaneous Materials	64	7	29
11.0	Locally Produced Miscellaneous Materials	17	69	14
12.0	Skilled Foreign Labor	65	25	10
13.0	Skilled Local Labor	0	87	13
14.0	Unskilled Labor	0	95	5
15.0	Royalty	0	90	10

14.1.2 Direct Cost

1) Equipment Cost

The operated rental rates per hour of the construction equipment were based on the Associated Construction Equipment Lessors (ACEL), Inc. Equipment Rental Rates as of November 1992. Minor equipment's and tools which are not reflected in the 1992 ACEL were taken from the latest rental rate schedule of the Department of Public Works and Highways (DPWH) - Bureau of Equipment. (See Table 14.1-2)

2) Material Cost

The current market prices of construction materials were gathered/collected by canvassing/market price survey. Quotations from various suppliers were taken for major construction materials i.e., cement, asphalt and reinforcing steel bars etc.. Existing plants within the vicinity of the project site were also taken into consideration. The cost included processing, crushing, stockpiling, loading, royalties on quarries, local taxes, hauling cost, wastage or losses and others. (See Table 14.1-3)

3) Labor Cost

Labor cost includes wages and all fringe benefit such as vacation and sick leave, bonuses, SSS contributions, medicare and workmen compensation.

The various government agencies were sources of data being considered:

- National Wages and Productivity Commission
- Department of Labor and Employment
- Social Security System
- Several Local Contractor

Comparison of the data gathered were made to develop the final rate applicable to the project. (See Table 14.1-4)

14.1.3 Indirect Cost

Indirect cost was computed in conformity with DPWH Department Order No. 30 series of 1991 " Preparation of Agency Estimate" dated January 30, 1991, as follows:

- Overhead, Contingencies, Miscellaneous Expenses: 10% of direct cost
- Contractor's Profit : 10% of direct cost
- Mobilization and demobilization : 7% of direct cost
- Value Added Tax : 10% for direct equipment and labor cost

TABLE 14.1 - 2 (1) EQUIPMENT RENTAL RATES (ACEL RATES AS OF NOVEMBER 1992)

REF. NO.	DESCRIPTION	COST COMPONENTS			OPERATED COST (P/Hr.)
		FOREIGN (P/Hr.)	LOCAL (P/Hr.)	TAXES (P/Hr.)	
E101	Concrete Batch Plant , 30 cu.m.	713.57	54.89	329.34	1,097.80
E103	Asphalt Batch Plant, 60 - 80 tph.	724.69	55.75	334.46	1,114.90
E111	Aggregate Crusher, 100 - 120 tph.	1,436.50	110.50	663.00	2,210.00
E112	Washing and Screening Plant	602.55	46.35	278.10	927.00
	HEAVY EQUIPMENT				
E201	Bulldozer, 180 hp.	647.40	49.80	298.80	996.00
E202	Bulldozer, 140 hp.	464.10	35.70	214.20	714.00
E203	Bulldozer, 220 hp.	1,337.05	102.85	617.10	2,057.00
E204	Hydraulic Ripper	46.41	3.57	21.42	71.40
E211	Wheel Loader, 1.53 cu.m.	589.55	45.35	272.10	907.00
E212	Crawler Loader, 1.40 cu.m.	505.05	38.85	233.10	777.00
E221	Hydraulic Excavator, 0.90 cu.m.	941.85	72.45	434.70	1,449.00
E221a	Hydraulic Crane, 10 - 12.5 tons	535.18	41.17	247.01	823.36
E221b	Hydraulic Crane, 3.5 - 4.5 tons	315.02	24.23	145.40	484.65
E222	Backhoe, 50 hp.	456.30	35.10	210.60	702.00
E223	Backhoe w/ Hydraulic Breaker, 120 - 150 hp.	988.63	76.05	456.29	1,520.97
E224	Mobile Hydraulic Hammer	1,014.63	78.05	468.29	1,560.97
E231	Motor Grader, 150 hp.	1,194.05	91.85	551.10	1,837.00
E232	Motor Grader, 125 hp.	1,016.60	78.20	469.20	1,564.00
E241	Truck Mounted Crane, 11 - 15 tons	473.85	36.45	218.70	729.00
E242	Truck Mounted Crane, 16 - 20 tons	584.35	44.95	269.70	899.00
E243	Truck Mounted Crane, 21 - 25 tons	689.65	53.05	318.30	1,061.00
E244	Crawler Crane, 16 - 20 tons	441.35	33.95	203.70	679.00
E245	Crawler Crane, 21 - 25 tons	495.30	38.10	228.60	762.00
	LIGHT EQUIPMENT				
E301	Transit Mixer, 6 - 7 cu.m.	757.25	58.25	349.50	1,165.00
E311	Pumpcrete, 11 - 18 cu.m.	644.80	49.60	297.60	992.00
E321	Concrete Mixer, 3 Bagger	88.40	6.80	40.80	136.00
E322	Concrete Mixer, 1 Bagger	64.29	4.95	29.66	98.90
E324	Concrete Vibrator	48.30	3.72	22.28	74.30
E325	Concrete Cutter w/ Blade	98.28	7.56	45.36	151.20
E326	Concrete Paver / Finisher, 120 hp.	583.05	44.85	269.10	897.00
E331	Asphalt Paver / Finisher, 4 m. width	731.25	56.25	337.50	1,125.00
E332	Asphalt Paver / Finisher, 10 ft. width	731.25	56.25	337.50	1,125.00
E333	Asphalt Distributor, 3000 gal.	427.70	32.90	197.40	658.00
E334	Power Broom Self Propelled	157.11	12.09	72.50	241.70
E335	Chips Spreader, 12 ft. wide	187.27	14.41	86.42	288.10
E341	Vibratory Tamping Foot Roller, 8 tons	668.85	51.45	308.70	1,029.00
E342	Vibratory Tandem Roller, 7 tons	467.35	35.95	215.70	719.00
E343	Vibratory Tandem Roller, 10 tons	675.35	51.95	311.70	1,039.00
E344	Pneumatic Tired Roller, 14 tons	234.65	18.05	108.30	361.00
E345	Pneumatic Tired Roller, BW20R, 8 Wheels	633.75	48.75	292.50	975.00
E346	Vibratory plate Compactor, 7 hp.	63.70	4.90	29.40	98.00
E347	Vibratory plate Compactor, 12 hp.	72.15	5.55	33.30	111.00
E348	Tamping Rammer, 7 hp.	55.51	4.27	25.62	85.40
E349	Tandem Smo Drum Roller, Vib. 2 tons, 35 hp.	232.70	17.90	107.40	358.00
E351	Mobil Air Compressor, 456 - 500 cfm.	421.85	32.45	194.70	649.00
E352	Mobil Air Compressor, 161 - 185 cfm.	205.40	15.80	94.80	316.00
E353	Jack Hammer / Pneumatic Breaker	85.28	6.56	39.36	131.20
E361	Bar Bender, 10 hp.	22.75	1.75	10.50	35.00
E362	Bar Shear, 10 hp.	22.75	1.75	10.50	35.00
E371	Water Pump, 3 1/2" - 4" (Low Pressure)	60.97	4.69	28.14	93.80
E376	Welding Machine, Diesel Driven	71.76	5.52	33.12	110.40
E377	Oxy / Acetylene Cutting Outfit	15.60	1.20	7.20	24.00
E381	Paint Stripping Machine	66.95	5.15	30.90	103.00
E382	Crawler Drilling Unit	234.55	18.04	108.25	360.84
E386	Chainsaw w/ Blade, 24" Length	249.41	19.19	115.10	383.70
E387	Trencher, Type 16" Bokts, 74 hp.	200.98	15.46	92.76	309.20

TABLE 14.1 - 2 (2) EQUIPMENT RENTAL RATES (ACEL RATES AS OF NOVEMBER 1992)

REF. NO.	DESCRIPTION	COST COMPONENTS			OPERATED COST (P/Hr.)
		FOREIGN (P/Hr.)	LOCAL (P/Hr.)	TAXES (P/Hr.)	
	TRUCKS				
E401	Dump Trucks, 9 - 10 cu.m.	417.30	32.10	192.60	642.00
E402	Dump Trucks, 6.1 - 8.41 cu.m.	326.30	25.10	150.60	502.00
E403	Dump Trucks, 5 - 6 cu.m.	318.50	24.50	147.00	490.00
E411	Water Tank Truck w/ Pump, 1001 - 3000 gal.	685.10	52.70	316.20	1,054.00
E412	Water Tank Truck w/ Pump, 500 - 1000 gal.	489.45	37.65	225.90	753.00
E421	Trailer Truck w/ Tractor, 25 tons High Bed	1,131.00	87.00	522.00	1,740.00
E422	Trailer Truck w/ Tractor, 25 tons Low Bed	1,415.05	108.85	653.10	2,177.00
E423	Cargo Truck, 9 - 10 tons	391.95	30.15	180.90	603.00
E424	Service Pick-up (Light Truck)	200.98	15.46	92.76	309.20
	MISCELLANEOUS EQUIPMENT				
E501	Pile hammer Kobe, K25 - DSL	647.86	49.84	299.00	996.70
E502	Rotary Rig	1,608.75	123.75	742.50	2,475.00
E503	Prestressing Machine	137.80	10.60	63.60	212.00
E504	Tug Boat, 600 hp. Twin Crew	1,014.00	78.00	468.00	1,560.00
E505	Split Barge, 1000 dwt.	1,267.50	97.50	585.00	1,950.00
E506	Flat Barge, 400 dwt.	942.50	72.50	435.00	1,450.00
E507	LCT Barge Self Propelled, 1200 dwt.	2,223.00	171.00	1,026.00	3,420.00
E508	Crane Barge, 60 tons	1,462.50	112.50	675.00	2,250.00
E509	Crane Barge, 30 tons	1,157.00	89.00	534.00	1,780.00
E510	Crane Barge, 25 tons w/ Lead	1,274.00	98.00	588.00	1,960.00
E511	Generator Set, 101 - 150 kw.	153.40	11.80	70.80	236.00
E512	Vibrating Hammer	276.25	21.25	127.50	425.00
E513	Bentonite Plant	260.00	20.00	120.00	400.00
E514	Mud Pump	227.50	17.50	105.00	350.00
E515	Water Pump 4" diameter, High Pressure	72.15	5.55	33.30	111.00
E516	Grouting Pump, Air Driven	142.35	10.95	65.70	219.00
E517	Hydraulic Jack, 100 tons	19.50	1.50	9.00	30.00
E518	Cable Cutting Tools	37.70	2.90	17.40	58.00
E519	Plate Loading Equipment	222.30	17.10	102.60	342.00

TABLE 14.1-3 COST OF COMMERCIAL MATERIALS

ITEM NO.	DESCRIPTION	UNIT	COST COMPONENT			BASIC PRICE
			FOREIGN	LOCAL	TAXES	
M01	MC-70 Cutback Asphalt	Tonne	7,514.99	197.76	2,175.39	9,700.00
M02	Emulsified Asphalt SS-1	Tonne	8,692.99	228.76	2,516.39	11,250.00
M03	Asphalt Cement Pen. 60-70	Tonne	7,514.99	197.76	2,175.39	9,700.00
M04	Asphalt Cement Pen. 85-100	Tonne	7,514.99	197.76	2,175.39	9,700.00
M05	Filler	Lit.	155.53	4.09	45.02	16.50
M06	Portland Cement, 40 kgs.	Bag	45.03	50.66	16.89	105.00
M07	Reinforcing Steel Bar, Grade 40	Kgs.	10.76	6.98	2.19	18.00
M08	Reinforcing Steel Bar, Grade 60	Kgs.	11.30	7.33	2.30	19.00
M09	Structural Steel	Kgs.	26.29	1.24	3.40	29.00
M10	Steel Piles (Tubular Type)	Kgs.	17.00	0.80	2.20	20.00
M11	Tendons, 12t 12.7, 1450 kn.	Kgs.	54.40	5.95	24.65	85.00
M12	Anchorage Cone, Cable w/ Accessories	Set	1,280.00	140.00	580.00	2,000.00
M13	Steel Casing, w/ coupling	Kgs.	6.12	24.84	5.04	36.00
M14	Steel Shell	L.m.	1,275.00	60.00	165.00	1,500.00
M15	Lumber, (Yakal or Equal)	Bd.ft.	0.00	34.20	3.80	38.00
M16	Lumber, (Apitong or Equal)	Bd.ft.	0.00	18.90	2.10	21.00
M17	Coco Form Lumber / Falsework	Bd.ft.	0.00	6.30	0.70	7.00
M18	Plywood, 1/4" thk. ordinary	Ea.	38.25	155.25	31.50	225.00
M19	Plywood, 1/2" thk. marine	Ea.	108.80	441.60	89.60	640.00
M20	Plywood, 3/4" thk. marine	Ea.	115.60	469.20	95.20	680.00
M21	Untreated Round Timber	Ea.	0.00	562.50	62.50	625.00
M22	Common Wire Nails	Kgs.	4.76	19.32	3.92	28.00
M23	Tie Wire #16	Kgs.	5.10	20.70	4.20	30.00
M24	Welding Electrode	Kgs.	7.48	30.36	6.16	44.00
M25	Curing Compound	Gal.	18.87	76.59	15.54	111.00
M26	Concrete Paint	Gal.	38.25	155.25	31.50	225.00
M27	Structural Paint	Gal.	42.50	172.50	35.00	250.00
M28	Reflectorized Paint	Gal.	144.50	586.50	119.00	850.00
M29	Thinner	Gal.	13.60	55.20	11.20	80.00
M30	Metal Beam Guardrail w/ Accessories	L.m.	92.82	376.74	76.44	546.00
M31	Metal Beam Guardrail, End Piece	Ea.	238.00	966.00	196.00	1,400.00
M32	Warning Sign, 900 mm. Triangle	Ea.	1,167.22	4,737.54	961.24	6,866.00
M33	Regulatory Sign, 600 mm. Circular	Ea.	940.95	3,819.15	774.90	5,535.00
M34	Informatory Sign (450mm. x 700mm.)	Ea.	1,048.22	4,254.54	863.24	6,166.00
M35	Ref. Pavement Studs (Raised Profile Type)	Ea.	384.00	42.00	174.00	600.00
M36	Ref. Pavm't. Chatter Bar (w/ Lense on One Side)	Ea.	992.00	108.50	449.50	1,550.00
M37	Dynamite	Kg.	12.75	51.75	10.50	75.00
M38	Blasting Caps	Ea.	3.40	13.80	2.80	20.00
M39	Safety Fuse	L.m.	4.76	19.32	3.92	28.00
M40	G.I. Pipe 3" diameter sch. 40	L.m.	31.96	129.72	26.32	188.00
M41	Perforated PVC Pipe 150mm. diameter	L.m.	26.35	106.95	21.70	155.00
M42	Filter Cloth	Sq.m.	12.75	51.75	10.50	75.00
M43	Gabion Steel Mesh, (2.0m. x 1.0m. x 1.0m.)	Ea.	353.94	1,436.58	291.48	2,082.00
M44	Elastomeric Bearing Pad	Ea.	408.00	1,656.00	336.00	2,400.00
M45	Oxygen	Cyl.	43.52	176.64	35.84	256.00
M46	Acetylene	Cyl.	107.44	436.08	88.48	632.00
M47	Slurry, Bentonite / Supermud	Cu.m.	476.00	1,932.00	392.00	2,800.00
M48	Concrete Bonding Epoxy	Gal.	765.00	3,105.00	630.00	4,500.00
M49	Carbolineum Hot Tar	Gal.	49.40	1.30	14.30	65.00
M50	Carabao Grass	Sq.m.	8.50	34.50	7.00	50.00
M51	Seed	Kgs.	37.40	151.80	30.80	220.00
M52	Concrete Hollow Blocks, 100mm. thick	Pcs.	0.77	3.11	0.62	4.50
M53	Concrete Hollow Blocks, 150mm. thick	Pcs.	1.11	4.49	0.90	6.50
M59	Ready Mix Concrete, 3000 psi.	Cu.m.	263.50	1,069.50	217.00	1,550.00
M60	Ready Mix Concrete, 4000 psi.	Cu.m.	302.60	1,228.20	249.20	1,780.00
M61	Royalty for Quarry	Cu.m.	0.00	9.00	1.00	10.00

TABLE 14.1 - 4 LABOR RATES

ITEM NO.	CATEGORY	LABOR INDEX	BASIC WAGE		MONTHLY BENEFITS						TOTAL MONTHLY	HOURLY RATE
			DAILY	MONTHLY	LEAVE	BONUS	PAG-IBIG	S.S.S.	M'CARE	E.C.C.		
L11	Foreman	2.14	297.46	7,436.50	619.71	619.71	159.43	354.70	37.50	10.00	9,237.55	46.19
L12	Capataz	1.98	275.22	6,880.50	573.38	573.38	133.97	329.30	37.50	10.00	8,538.03	42.69
L13	Heavy Equipment Operator	1.90	264.10	6,602.50	550.21	550.21	107.18	278.70	37.50	10.00	8,136.30	40.68
L14	Light Equipment Operator	1.65	229.35	5,733.75	477.81	477.81	97.80	253.30	37.50	10.00	7,087.97	35.44
L15	Driver	1.45	201.55	5,038.75	419.90	419.90	82.39	202.70	37.50	10.00	6,211.14	31.06
L16	Skilled Laborer	1.74	241.86	6,046.50	503.88	503.88	82.39	202.70	37.50	10.00	7,386.85	36.93
L17	Unskilled Laborer	1.00	139.00	3,475.00	289.58	289.58	66.99	177.30	37.50	10.00	4,345.95	21.73

LEGEND :

Monthly wages are based on twenty five (25) days per month and eight hours a day.

Leave = Basic Monthly Pay / 12 - Representing vacation and sick leave benefits
Bonus = Basic Monthly Pay / 12 - Representing 13th month pay
S.S.S. = Graduated Scale - Amount representing employer's contribution
Medicare = Graduated Scale - Amount representing employer's contribution
Employer's Compensation Contribution (ECC) = Graduated Scale - Amount representing employer's contribution
Rate Per Hour = Total monthly pay / (25x8)

SOURCE OF DATA :

National Wages and Productivity Commission (D.O.L.E.)
Social Security System
Local Contractor

14.2 ESTIMATED CONSTRUCTION COST

The quantity of each pay item is multiplied by respective unit cost and their sum gives the construction cost.

The construction cost of each package and priority group is summarized in Table 14.2-1.

TABLE 14.2-1 SUMMARY OF CONSTRUCTION COST

(At 1996 Prices)

PACKAGE	CONSTRUCTION COST (Million Pesos)			
		Cost Component		
	Total	Foreign	Local	Tax
1	281.7	115.6	110.0	56.0
2	278.9	140.1	81.1	57.7
3	131.4	63.2	39.8	28.4
4	114.6	53.8	37.2	23.6
5	254.6	115.4	87.4	51.9
6	269.4	118.8	98.2	52.4
7	384.1	164.7	142.3	77.1
8	255.7	109.0	94.8	52.0
9	222.7	109.9	67.4	45.4
10	323.0	158.3	96.4	68.3
11	169.2	84.6	49.1	35.5
12	149.3	62.9	56.8	29.6
13	244.2	123.1	70.4	50.6
14	149.3	63.6	59.3	26.4
15	301.0	149.9	88.3	62.8
16	348.4	184.1	89.2	75.0
17	453.6	216.2	141.4	95.9
18	208.5	91.6	76.7	40.2
19	97.5	39.1	39.5	18.9
Total	4,637.0	2,163.9	1,525.4	947.7
Priority A (Packages 5, 6, 7, 8, 13 & 17)	1,861.6	847.2	634.5	379.9
Priority B (Packages 9,11, 14, 15 & 16)	1,190.6	592.1	353.3	245.1
Priority C (Packages 4, 10, & 12)	586.9	275.0	190.4	121.5
Priority D (Packages 1, 2, 3, 18 & 19)	998.0	449.6	347.1	201.2

14.3 RIGHT-OF-WAY ACQUISITION AND COMPENSATION COST

Right-of-way acquisition is required as shown in Table 14.3-1.

TABLE 14.3-1 ROW AND COMPENSATION COST

Location	Contract Package No.	Land Area to be acquired (m2)	No. of houses affected
Bridge reconstruction site			
New Camalig Bridge	2	1,000	-
Sanghan Bridge	4	1,000	4
Andanan Bridge	6	1,000	4
Lagcogangan Bridge	9	1,000	5
Tagbayagan Bridge	9	1,000	5
Gabanan Bridge	13	1,000	4
Tina Bridge	15	1,000	5
Banlag Bridge	15	1,000	5
Libóganon Bridge	17	4,000	-
Monkayo Bypass	14	66,000	32
Libóganon River Bank	17	124,000	-
Total		202,000	64

14.4 CONSULTANCY SERVICES COST FOR CONSTRUCTION SUPERVISION

The consultancy services cost is estimated assuming 9.5% of the construction cost.

14.5 PROJECT COST

The project cost is summarized in Table 14.5-1.

TABLE 14.5-1 SUMMARY OF PROJECT COST

(Unit: Million pesos at 1996 price)

Package	Construction Cost Total	Foreign	Local	Tax	ROW Cost	Consultancy Cost	Total
1	281.7	115.6	110.0	56.0	-		
2	278.9	140.1	81.1	57.7	0.1		
3	131.4	63.2	39.8	28.4	-		
4	114.6	53.8	37.2	23.6	0.3		
5	254.6	115.4	87.4	51.9	-		
6	269.4	118.8	98.2	52.4	0.3		
7	384.1	164.7	142.3	77.1	-		
8	255.7	109.0	94.8	52.0	-		
9	222.7	109.9	67.4	45.4	0.7		
10	323.0	158.3	96.4	68.3	-		
11	169.2	84.6	49.1	35.5	-		
12	149.3	62.9	56.8	29.6	-		
13	244.2	123.1	70.4	50.6	0.3		
14	149.3	63.6	59.3	26.4	7.4		
15	301.0	149.9	88.3	62.8	0.7		
16	348.4	184.1	89.2	75.0	-		
17	453.6	216.2	141.4	95.9	25.6		
18	208.5	91.6	76.7	40.2	-		
19	97.5	39.1	39.5	18.9	-		
Total	4,637.0				35.4	440.5	5,112.9
Cost Component							
Foreign	2,163.9				-	277.5	2,441.4
Local	1,525.4				35.4	149.8	1,710.6
Tax	947.7				-	13.2	960.9

CHAPTER 15

PREPARATION OF TENDER DOCUMENTS

15.1 PREQUALIFICATION DOCUMENTS

The prequalification documents are organized with the following:

- **INVITATION TO PREQUALIFY AND TO BID** states that the Government of the Philippines invites interested contractors to apply for prequalification and, if prequalified, to bid for the project.
- **SECTION I INTRODUCTION** presents the project background, objective of prequalification, and definitions of terms and abbreviations.
- **SECTION II GENERAL PROJECT DESCRIPTION** summarizes the *project description and scope of work*.
- **SECTION III GENERAL INFORMATION ON CONTRACT** prescribes the type of contract, financial conditions, duties and taxes, and bond and guarantee.
- **SECTION IV GENERAL INSTRUCTIONS AND CONDITIONS FOR PREQUALFICATION** provides for prequalification time schedule, eligibility of applicants, clause on consortium, joint venture and sub-contractors, clause on subsequent change of partner-company or subcontractor, clarification and addendum, matters relevant to documents, and selection and notification of tenderers.
- **SECTION V INSTRUCTIONS TO APPLICANTS FOR PREQUALIFICATION** includes the instructions as to submittals and exchange rate to be adopted.
- ***SECTION VI PREQUALIFICATION FORMS*** shows all forms of the documents.

15.2 TENDER DOCUMENTS

The tender documents consist of the following five volumes:

- **VOLUME I** **PROPOSAL BOOK**
  - Invitation to Bid
  - Instruction to Bidders
  - Bid Form and Appendices to the Bid
  - Bill of Quantities
  - Draft Contract Agreement and Sample Forms

- **VOLUME II** **CONDITIONS OF CONTRACT**
  - Part I Conditions of Contract for Works of Civil Engineering Construction, FIDIC, Fourth Edition 1987; Part 1-General Conditions
  - Part II Conditions of Particular Application

- **VOLUME III TECHNICAL SPECIFICATIONS**
  - Part I DPWH Standard Specifications for Public Works and Highways 1988, Volume II
  - Part II Special Provisions

- **VOLUME IV CONTRACT DRAWINGS**
- **VOLUME V SUPPLEMENTAL NOTICES/ADDENDA TO THE BIDDING DOCUMENTS**

The bidders are required to obtain copies of FIDIC (to be used as VOLUME II, Part I) and DPWH Standard Specifications (to be used as VOLUME III, Part I) and VOLUME V will be prepared in the course of bidding. Therefore, issued to the bidders in the beginning are VOLUME I, Part II of VOLUME II, Part II of VOLUME III and VOLUME IV.

PART V

PREPARATION FOR PROJECT IMPLEMENTATION

CHAPTER 16

ENVIRONMENTAL IMPACT STATEMENT

16.1 ECC ALONG THE EXISTING ALIGNMENT

As the scope of work of the project along the existing alignment is rehabilitation/improvement, the project was exempted from PD1586 (Environmental Impact Statement System) and Environmental Compliance Certificate (ECC) was issued by respective Regional Offices of the Department of Environment and Natural Resources (DENR) as follows:

Region	Certificate of Exemption/ECC Issued on:
Region X	June 8, 1995
Region XI	May 26, 1995

16.2 EIS ALONG NEW ALIGNMENT: MONKAYO BYPASS

Monkayo Bypass was planned and designed as the major countermeasures against flood at Monkayo, Davao del Norte. The outline of Monkayo Bypass is shown in Figure 16.2-1. The first section from Monkayo Resettlement Project Site to Agusan River (L1 = 1.34 km) traverses the cultivated area composing of rice field, corn field and bamboo plantation area and the remaining section (L2 = 1.25 km) follows the existing barangay road.

Environmental Impact Statement (EIS) was prepared in accordance with the guidelines of DENR. All impacts were assessed their level, effect, and duration. For items of negative impact, mitigating measures were proposed. Table 16.2-1 summarizes probable impacts and proposed mitigating measures.

No serious negative impact was assessed. Some moderate negative impacts during the construction stage such items as surface water, sedimentation, air quality, noise, erosion, etc. were assessed, however, these impacts are short in duration and careful construction work will mitigate these impacts.

Dislocation of 32 households is required. Their resettlement area will be designated in the Monkayo Resetttlement Area which will be constructed by National Housing Authority (NHA).

Environmental Impact Statement Report was submitted to the Environmental Management Bureau (EMB), DENR on November 5, 1996 and is being evaluated by EMB.

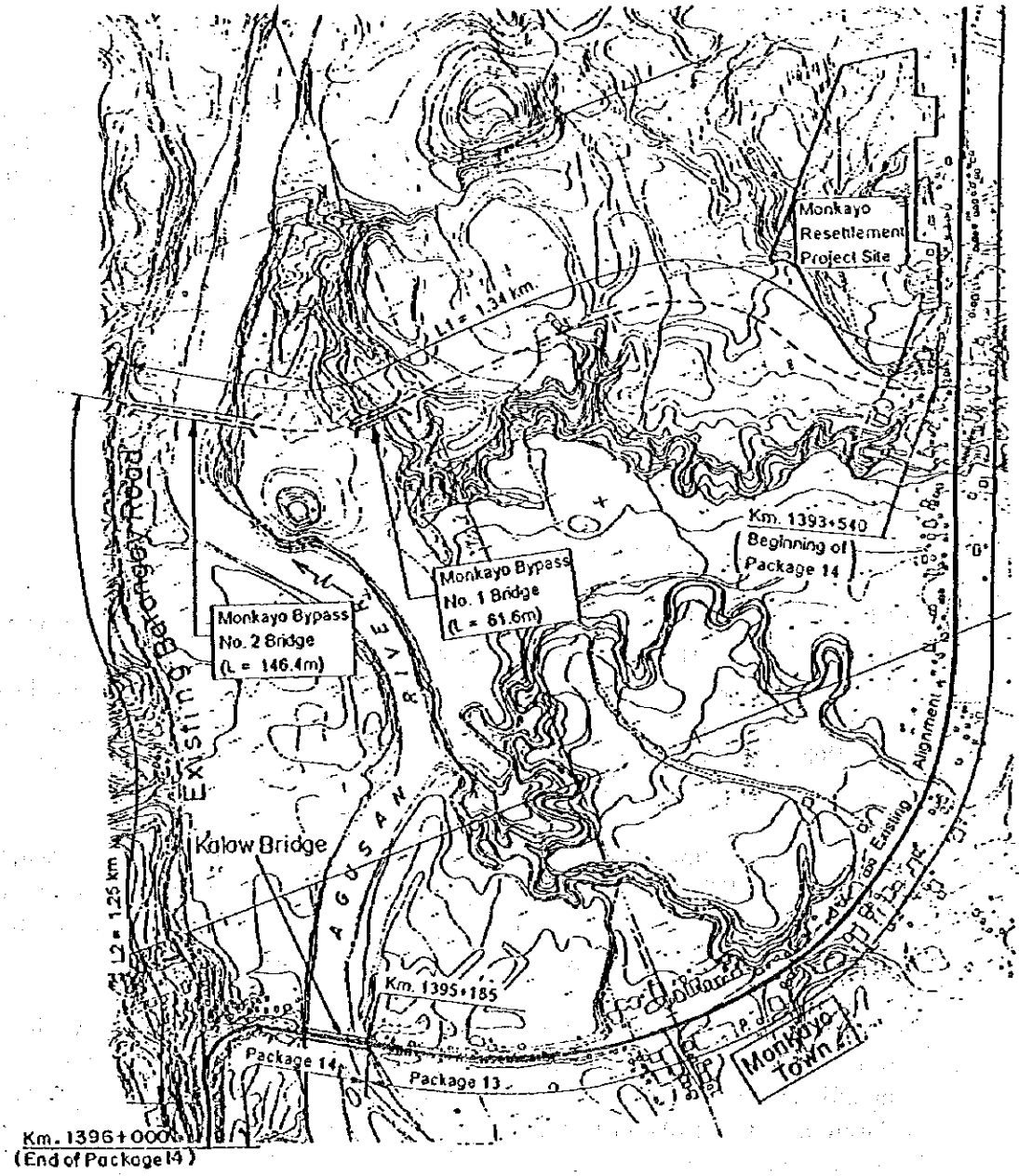


FIGURE 16.2-1 OUTLINE OF MONKAYO BYPASS

TABLE 16.2-1(1) PROBABLE IMPACTS AND PROPOSED MITIGATING MEASURES

ENVIRONMENTAL EFFECTS	Level	Effect	Duration	PROBABLE IMPACTS	MITIGATING MEASURES
PHYSICO-CHEMICAL					
Surface Water	Moderate	Negative	Short term	Increased in amount of suspended solids and artificial decrease in water flow along Malubog Creek	Oil contaminated waste water must pass through oil traps before discharge into natural drainage system. Waste oil and petroleum-based material will be collected and recycled.
Sedimentation	Moderate	Negative	Short term	Increase in sediment load and decrease in water quality of the Malubog Creek and Agusan River	Minimized through land/soil compaction, construction of sediment traps. Proper siting and maintenance of excavated materials.
Run-off and Floods	Low	Negative	Short term Long term	Increase in surface water run-off	
Ambient Air Quality	Moderate	Negative	Short term	Exhaust gas emission from heavy equipment and dust due to earthworks	Gaseous pollutants can be minimized through proper maintenance of heavy equipment. Dust generation can be minimized by water sprinking Minimum clearing of vegetation.
	Low	Negative	Long term	Increased exhaust gas emission from vehicles passing along Monkayo Bypass	
Noise	Moderate Low	Negative Negative	Short term Long term	Noise generation from heavy equipment in construction phase Increase noise levels by vehicles passing along Monkayo Bypass after opening to traffic.	Handle heavy equipment properly by checking noise levels and obeying allowable working hours.
Topography	Moderate	Negative	Short term Long term	Alteration of topography of the place by cut slopes and embankments	Revegetation of cut slopes and embankments with fast growing plants.
Erosion	Moderate	Negative	Short term	Increase erosion rate	Stabilize slopes by structures such as rip raps, retaining walls, gabions, drains in combination of terracing and revegatation.
Biological Aspects					
Flora and Fauna	Low	Negative	Short term	Removal of natural and cultivated vegetation	
Aesthetic Aspects					
Land Use Effects	Moderate	Negative	Long term	Change in land use from natural vegetation to build-up area	Proper rehabilitation through landscaping and proper land use planning.
Aesthetic Value	Moderate	Negative	Short term	Earth moving activities create eye sores	Revegetation of cut/fill areas.
Historic Spot, Cultural Assets	None	None	None	None	
Socio-economic Effects					
Dislocation and Resettlement	High	Negative	Short term	Dislocation of 32 households	Dislocated household will be properly compensated.

TABLE 16.2-1(2) PROBABLE IMPACTS AND PROPOSED MITIGATING MEASURES

ENVIRONMENTAL EFFECTS				PROBABLE IMPACTS	MITIGATING MEASURES
	Level	Effect	Duration		
PHYSICO-CHEMICAL					
					Owners of cultivated crops will be properly compensated. Government has already set aside a relocation site across the proposed road alignment, at the Monkayo Resettlement Area, which is beng implemented by NHA. The mayor of Monkayo assured that those who are affected by this project are given priority to resettle in the said resettlement area.
Land Development	High	Positive	Long term	Land Development Opportunities	
Economic Effects	Moderate	Positive	Long term	Increase in land values	
Livelihood	Moderate	Positive	Short term	Increase in job opportunity	
Major Product	Low Moderate	Negative Positive	Short term Long term	Loss of cultivated crops Enhancement in the agricultural and agro-forestry production	
Water Supply	Moderate	Negative	Short term	Decrease in quality and flow of the source of water of the Sitio Libuton community	Installation of deep well for Sitio Libuton community. Strict compliance to sanitation and discipline. Construction of toilets with septic tank; proper garbage disposal.
Sanitation	Moderate	Negative	Short term	Improper domestic waste disposal along construction sites	Proper siting of barracks, equipment yard and other construction facilities away from natural drainage system. These facilities will be provided with adequate drainage facilities and waste disposal facilities.
Health	Moderate	Negative	Short term	Introduction of diseases from outsiders	Applicants for construction will be screened for diseases.
Social Services	Moderate	Positive	Long term	Improved accessibility to social services	
Accessibility to Barangay San Jose	Moderate	Negative	Short term	Inconvenience for residents along existing provincial road during construction	The first segment of the Monkayo Bypass will be opened to traffic to ensure accessibility for residents in Bgy. San Jose.
Transport	High	Positive	Long term	No traffic interruption caused by flood	
Traffic Accidents	High	Negative	Long term	Traffic accidents occurrence at intersection between Proposed Road and the existing segment of the Highway	Installation of traffic safety devices such as safety island, traffic signs, etc. can minimize accidents.

CHAPTER 17

PROJECT IMPLEMENTATION PROGRAM

17.1 CURRENT STATUS ON PREPARATION FOR PROJECT IMPLEMENTATION

Current status on preparation for project implementation is as follows:

Approval of the Project for Implementation

Inter-agency Coordinating Committee - Cabinet Committee (ICC-CC) approved and recommended the project for implementation on July 5, 1995.

The NEDA Board approved the project on July 11, 1995.

Financing

The Overseas Economic Cooperation Fund (OECF) of Japan appraised the project in June, 1996. Minutes of Discussion was exchanged between DPWH and OECF and recommended the inclusion of Priority A packages (Packages 5, 6, 7, 8, 13 and 17) in the 21st OECF Yen Loan Packages.

Financing of Priority A packages of the project under the 21st OECF Yen Loan Packages was pledged by OECF and the loan agreement is scheduled to be signed in February 1997.

The project is now ready for implementation.

17.2 IMPLEMENTATION PROGRAM

17.2.1 Implementing Agency

The Department of Public Works and Highways is the implementing agency for this project. Project Management Office - Philippine-Japan Highway Loan Projects (PMO-PJHL) of DPWH is the executing office.

17.2.2 Implementing Organization

1) Bidding Stage

All contract packages are tendered by the DPWH Central Office Prequalification, Bids and Award Committee (PBAC) with the initiation of PMO-PJHL and assistance of the consultant.

2) Construction Stage

PMO-PJHL is responsible for overall project management, administrative matters, and monitoring.

The consultant provides the field construction supervision services under the control of PMO-PJHL.

17.2.3 Procurement Method

1) Civil Work

Civil work is implemented by contract. Contractors are selected through the International Competitive Bidding (ICB).

2) Consulting Services

The consultant may be selected through the direct appointment method.

3) Procurement of Equipment

Civil work of this project is executed by contract, therefore, procurement of equipment for this project is not required.

17.2.4 Implementation Priority of Contract Packages

During the feasibility study stage, implementation priority of contract packages was studied in due consideration of the following:

- Physical condition of road
- Traffic volume
- Continuity of construction between adjacent contract packages
- Implementation status of related projects
- Budgetary framework for this project.

Contract packages were classified into four priority groups (A to D) as follows:

Priority A	: 6 contract packages (Packages 5,6,7,8,13 & 17)
Priority B	: 5 contract packages (Packages 9,11,14,15 & 16)
Priority C	: 3 contract packages (Packages 4,10 & 12)
Priority D	: 5 contract packages (Packages 1,2,3,18 & 19)

As there were no major changes in the condition and project circumstances between the feasibility study stage and the detailed design stage, the same priority was adopted.

17.2.5 Implementation Schedule

Implementation schedule was prepared based on the implementation priority of contract packages, construction period required for each package, present status of preparation for project implementation and budgetary framework for the project (maximum 1.6 Billion pesos per year). As the contract packages included in the Priority Group A are ready for implementation, it was assumed that the selection of contractors for Priority Group A starts soon after the completion of the detailed design. Implementation schedule is as follows (also see Table 17.2-1):

Priority Group	Right-of-Way Acquisition	Selection of Contractors	Construction
A	Apr. 1997-Feb. 1998	Apr. 1997-Feb. 1998	Mar. 1998-Nov. 2000
B	Apr. 1998-Feb. 1999	Apr. 1998-Feb. 1999	Mar. 1999-May 2001
C	Apr. 1999-Feb. 2000	Apr. 1999-Feb. 2000	Mar. 2000-Apr. 2002
D	Apr. 2000-Feb. 2001	Apr. 2000-Feb. 2001	Mar. 2001-Feb. 2003

17.2.6 Annual Fund Requirement

Based on the implementation schedule, construction cost and other project costs, annual fund requirement was computed and presented in Table 17.2-1.

TABLE 17.2-1 IMPLEMENTATION SCHEDULE AND ANNUAL FUND REQUIREMENT

(Unit: Million Pesos at 1996 price)

			1997	1998	1999	2000	2001	2002	2003	Total Cost	Cost Component		
											Foreign	Local	Tax
Implementation Schedule	Selection of Contractor	Group A Group B Group C Group D							ROW Cost ↓	Const. Cost ↓			
	ROW Acquisition ( ) and Construction ( )	Package 1 (D)							-	281.7	115.6	110.0	56.0
		Package 2 (D)							0.1	278.9	140.1	81.1	57.7
		Package 3 (D)							-	131.4	63.2	39.8	28.4
		Package 4 (C)							0.3	114.6	53.8	37.2	23.6
		Package 5 (A)							-	254.6	115.4	87.4	51.9
		Package 6 (A)							0.3	269.4	118.8	98.2	52.4
		Package 7 (A)							-	384.1	164.7	142.3	77.1
		Package 8 (A)							-	255.7	109.0	94.8	52.0
		Package 9 (B)							0.7	222.7	109.9	67.4	45.4
		Package10 (C)							-	323.0	158.3	96.4	68.3
		Package11 (B)							-	169.2	84.6	49.1	35.5
		Package12 (C)							-	149.3	62.9	56.8	29.6
		Package13 (A)							0.3	244.2	123.1	70.4	50.6
		Package14 (B)							7.4	149.3	63.6	59.3	26.4
		Package15 (B)							0.7	301.0	149.9	88.3	62.8
		Package16 (B)							-	348.4	184.1	89.2	75.0
		Package17 (A)							25.6	453.6	216.2	141.4	95.9
		Package18 (D)							-	208.5	91.6	76.7	40.2
		Package19 (D)							-	97.5	39.1	39.5	18.9
	Consultancy Services									440.5	277.5	149.8	13.2
Annual Fund Requirement	ROW Acquisition		26.2	8.8	0.3	0.1	-	-	-	35.4	-	35.4	-
	Construction		-	736.2	1,414.4	1,089.3	849.5	512.0	35.6	4,637.0	2,163.9	1,525.4	947.7
	Consultancy Services		11.0	74.0	131.9	104.1	72.6	43.8	3.1	440.5	277.5	149.8	13.2
	Total		37.2	819.0	1,546.6	1,193.5	922.1	555.8	38.7	5,112.9	2,441.4	1,710.6	960.9

CHAPTER 18

PROJECT EVALUATION AND RECOMMENDATIONS

18.1 PROJECT EVALUATION

The project is feasible from every aspect as summarized below:

- Technical Aspect

  All proposed works can be completed by usual construction methods commonly used in the Philippines and all necessary equipment and materials are easily obtained at sites. Thus, no technical problem is expected in the project implementation.

- Economical Aspect

  Economic evaluation indicators are as follows:
  - Internal rate of return (IRR) : 29.6%
  - Net present value (NPV) : 4,156.3 million pesos
  - Benefit/cost ratio (B/C) : 2.29

  Thus, the Project is concluded to be highly feasible from the economic point of view.

- Financial Aspect

  The project can be implemented within reasonable financial framework in accordance with the proposed schedule.

- Environmental Aspect

  Because of the nature of the project which is to rehabilitate/improve the existing road, positive impacts are expected to be significantly big, while negative impacts are negligibly small except resettlement of a few inhabitants and traffic interference during construction. These negative impacts will, however, be easily solved/mitigated.

- Social and Developmental Aspects

  The project will contribute to improvement of social environment and promote the regional development by providing reliable means of transport.

18.2 RECOMMENDATIONS

- Early Implementation

It is highly recommended to implement the project in the earliest possible time. The proposed implementation schedule is prepared taking into account the reasonably estimated fund availability for each year. The implementation should, however, be hastened if there is a fair prospect of increased fund for the project.

- Mitigation Measures of Environmental Impact

Due considerations should be given to mitigate adverse environmental impacts. Possible adverse impacts and their mitigation measures are as follows:

- Resettlement of inhabitants

A proper relocation plan should be prepared including provision of resettlement area in the vicinity.

- Traffic interference during construction

Mitigation measures such as opening of at least one lane to traffic and maintenance thereof in comfort and safety, proper traffic control, provision of safety devices, etc. should be taken.

- Maintenance Requirements

The future maintenance should focus on:

- Maintenance of the sections where no rehabilitation work is proposed.
- Minor repair works of the bridges not covered by the project.
- Cleaning of drainage facilities, especially side ditches and cross drainages in flood sections and mountainous sections.
- Periodic dredging of riverbed sediments, especially for the bridges where dredging is proposed in the project.

APPENDICES FOR CHAPTER 6

APPENDIX 6.5-1

PEAK DISCHARGE FROM SMALL CATCHMENT AREA

PEAK DISCHARGE FROM SMALL CATCHMENT AREA IN PACKAGE 1

24-Jan-97

Area No.	Station Km.		Catchment Area	Elevation (m)		Length	Lag Time	10-year R.P. Rainfall Intensity	10-year R.P. Peak Discharge	25-year R.P. Rainfall Intensity	25-year R.P. Peak Discharge
	Start	End	(km²)	Min.	Max.	(m)	(min.)	(mm/hr)	(m³/s)	(mm/hr)	(m3/s)
1- 1	1124+550	1125+230	0.750	10	80	1,120	12.3	239.1	34.90	294.9	43.05
1- 2	1125+230	1125+940	0.125	10	80	220	1.9	621.0	15.11	780.5	18.99
1- 3	1125+940	1126+400	0.125	10	80	400	3.8	437.3	10.64	545.9	13.28
1- 4	1126+400	1126+750	0.182	10	50	400	4.7	391.8	13.88	488.1	17.29
1- 5	1126+750	1127+240	0.150	10	60	480	5.3	367.9	10.74	457.6	13.36
1- 6	1127+240	1127+470	0.437	10	50	700	8.9	282.2	24.00	349.2	29.70
1- 7	1127+470	1127+850	0.250	10	50	440	5.2	370.5	18.03	461.0	22.43
1- 8	1127+850	1128+120	0.187	10	40	700	9.9	266.7	9.71	329.7	12.00
1- 9	1128+120	1128+740	0.225	10	40	580	8.0	297.8	13.04	368.9	16.15
1- 10	1128+740	1128+920	0.312	10	150	1,100	9.2	276.9	16.81	342.5	20.80
1- 11	1128+920	1129+600	0.625	10	100	600	5.4	362.2	44.06	450.5	54.79
1- 13	1129+600	1130+160	0.412	10	70	500	5.1	372.3	29.85	463.2	37.14
1- 14	1130+160	1130+950	0.187	10	80	600	6.0	344.8	12.55	428.4	15.59
1- 15	1130+950	1131+600	0.375	10	80	800	8.3	291.3	21.25	360.7	26.32
1- 16	1131+730	1132+300	0.175	10	140	400	3.0	493.9	16.82	617.9	21.04
1- 17	1132+300	1132+870	0.162	10	130	600	4.9	383.3	12.08	477.2	15.04
1- 18	1132+870	1133+230	1.000	10	169	1,100	8.8	283.9	55.24	351.3	68.37
1- 19	1133+230	1134+230	0.750	10	125	1,240	11.4	248.3	36.24	306.5	44.74
1- 20	1134+230	1134+700	0.125	10	120	580	4.8	384.4	9.35	478.5	11.64
1- 21	1134+700	1135+050	0.162	10	100	400	3.4	459.5	14.48	574.1	18.10
1- 22	1135+050	1135+750	0.125	10	30	350	5.4	363.8	8.85	452.4	11.01
1- 23	1136+100	1136+750	0.125	10	80	860	9.1	279.2	6.79	345.4	8.40
1- 23'	1136+750	1137+600	0.250	10	165	860	6.7	326.3	15.88	405.0	19.70
1- 23"	1137+600	1138+400	0.175	10	100	860	8.2	293.3	9.99	363.2	12.37
1- 24	1138+400	1139+585	0.080	20	65	300	3.2	474.7	7.39	593.5	9.24
1- 25	1139+585	1140+080	0.125	40	88	400	4.3	406.1	9.88	506.2	12.31
1- 26	1140+080	1140+440	0.125	40	88	520	5.9	348.2	8.47	432.7	10.53
1- 27	1140+440	1141+280	0.600	16	220	1,300	9.6	270.3	31.56	334.2	39.02
1- 28	1141+280	1141+480	0.375	16	220	800	5.5	359.3	26.22	445.8	32.60
1- 29	1142+420	1143+200	0.800	10	130	2,400	23.9	170.0	26.46	208.3	32.43
1- 30	1143+200	1143+900	0.750	70	96	1,300	21.3	180.4	26.32	221.3	32.29
1- 31	1143+900	1145+400	0.950	70	120	1,000	12.3	239.2	44.22	295.1	54.55
1- 32	1147+820	1148+600	1.150	90	350	1,900	13.6	226.9	50.78	279.6	62.57
1- 33	1148+600	1149+380	0.250	100	182	520	4.8	386.8	18.82	481.7	23.43
1- 34	1149+640	1150+100	0.270	60	140	940	9.5	272.0	14.29	336.4	17.67
1- 35	1150+100	1150+500	0.375	60	140	1,240	13.1	231.2	16.87	285.0	20.80
1- 36	1150+500	1151+000	0.400	60	160	1,640	16.6	205.0	15.96	252.2	19.63
1- 37	1151+000	1151+200	TAMAMANA BRIDGE								
1- 38	1151+200	1151+800	MOTORPOOL BRRIDGE								
1- 39	1151+800	1152+200	PINGANPING BRIDGE								
1- 40	1152+200	1153+420	0.370	60	120	700	7.6	305.6	22.09	378.8	27.27
1- 41	1153+420	1153+780	MASGA BRIDGE								
1- 42	1153+780	1154+720	1.200	40	300	2,240	16.4	206.0	48.11	253.4	59.17
1- 43	1154+900	1155+720	1.050	40	150	1,820	18.0	196.5	40.16	241.5	49.35
1- 44	1155+720	1156+700	1.800	40	500	3,540	22.3	176.2	61.72	216.0	75.68
1- 45	1156+700	1157+000	TUBOD BRIDGE								
1- 46	1157+000	1157+800	SIANA BRIDGE								
1- 47	1158+550	1159+600	1.120	40	107	800	8.5	289.8	62.94	357.5	77.92
1- 48	1159+600	1160+610	0.370	40	140	700	6.2	337.8	24.32	419.6	30.21
1- 49	1160+610	1161+100	0.450	40	160	680	5.6	356.1	31.19	442.8	38.77
1- 50	1161+100	1161+400	0.300	40	160	800	6.8	323.8	18.90	401.8	23.45
1- 51	1161+400	1162+140	0.628	40	160	1,000	8.7	284.1	34.71	351.6	42.97
1- 52	1162+140	1162+340	ALIMPATAYAN BRIDGE								
1- 53	1163+600	1164+000	0.970	40	474	2,000	11.8	243.5	45.96	300.5	56.71
1- 54	1164+000	1164+580	0.250	40	320	1,320	8.7	285.1	13.87	352.8	17.17
1- 55	1165+560	1166+300	SAN PEDRO BRIDGE								
1- 56	1166+300	1167+600	1.400	40	100	2,720	36.1	137.9	37.56	168.2	45.83

PEAK DISCHARGE FROM SMALL CATCHMENT AREA IN PACKAGE 2

24-Jan-97

Area No	Station Km.		Catchment Area	Elevation (m)		Length	Lag Time	10-year R.P Rainfall Intensity	10-year R.P Peak Discharge	25-year R.P Rainfall Intensity	25-year R.P Peak Discharge
	Start	End	(km^2)	Min.	Max.	(m)	(min.)	(mm/hr)	(m^3/s)	(mm/hr)	(m^3/s)
2- 1	1170+350	1170+800	0.125	100	187	240	1.9	511.6	14.68	760.5	18.50
2- 2	1170+800	1171+000	0.300	120	300	1,100	8.4	221.7	12.94	267.6	15.62
2- 3	1171+000	1171+880	0.425	80	368	900	5.5	294.5	24.36	358.5	29.65
2- 4	1171+880	1172+120	0.125	60	280	600	3.9	378.2	9.20	463.8	11.28
2- 5	1172+120	1172+400	0.150	60	280	600	3.9	378.2	11.04	463.8	13.54
2- 6	1172+400	1173+240	1.425	50	300	1,520	10.7	187.1	51.90	224.8	62.35
2- 7	1173+240	1173+520	0.435	50	262	1,100	7.8	231.5	19.60	279.9	23.69
2- 8	1173+520	1174+220	0.750	50	100	840	10.0	195.4	28.51	235.0	34.30
2- 9	1174+220	1175+100	0.225	50	60	480	9.8	198.6	8.70	239.0	10.47
2- 10	1175+300	1176+460	0.200	50	80	340	4.3	349.6	13.61	427.7	16.65
2- 11	1176+460	1177+280	0.350	50	300	860	5.5	294.1	20.03	358.0	24.38
2- 12	1177+280	1177+500	0.650	50	440	1,700	10.2	192.7	31.88	231.7	38.33
2- 12	1177+500	1177+640	1.100	50	413	1,750	10.9	184.8	39.55	221.9	47.50
2- 13	1177+640	1178+800	0.150	50	180	400	3.0	453.7	13.24	559.3	16.33
2- 14	1178+800	1178+900	0.420	60	240	740	5.3	303.6	24.82	369.9	30.24
2- 15	1178+900	1179+400	0.135	40	200	500	3.5	401.6	10.55	493.4	12.96
2- 16	1179+400	1180+080	0.150	60	200	520	3.9	375.8	10.97	450.7	13.45
2- 17	1180+080	1180+220	0.750	60	340	1,120	7.2	245.7	35.87	297.6	43.43
2- 18	1180+220	1181+000	0.125	60	227	4,800	46.8	67.5	1.64	78.7	1.92
2- 19	1181+000	1181+700	0.130	60	120	160	1.4	764.4	19.34	956.7	24.20
2- 20	1182+300	1183+180	0.950	40	220	920	6.3	269.3	49.78	328.9	60.44
2- 22	1183+180	1183+760	0.400	40	140	700	8.2	271.4	21.13	329.6	25.66
2- 23	1183+720	1184+310	0.270	40	140	620	5.4	298.9	15.70	364.0	19.12
2- 24	1184+310	1184+900	1.050	40	300	1,500	10.4	191.1	39.05	229.7	46.94
2- 25	1184+900	1185+900	0.300	40	140	500	4.2	354.5	20.70	433.9	25.33
2- 26	1185+900	1186+750	0.500	60	180	800	6.8	256.3	24.93	310.7	30.23
2- 27	1187+140	1188+000	0.600	40	200	980	7.7	235.5	27.49	284.8	33.25
2- 28	1188+380	1189+500	1.630	40	540	2,600	16.5	138.6	43.95	165.0	52.34
2- 29	1189+500	1189+740	0.650	40	400	2,100	13.5	159.5	20.18	190.8	24.13
2- 30	1189+740	1190+560	1.370	40	480	2,800	17.3	133.9	35.70	159.4	42.48

PEAK DISCHARGE FROM SMALL CATCHMENT AREA IN PACKAGE 3

24-Jan-97

Area No	Station Km.		Catchment Area	Elevation (m)		Length	Lag Time	10-year R.P Rainfall Intensity	10-year R.P Peak Discharge	25-year R.P Rainfall Intensity	25-year R.P Peak Discharge
	Start	End	(km^2)	Min.	Max.	(m)	(min.)	(mm/hr)	(m^3/s)	(mm/hr)	(m^3/s)
3- 1	1190+560	1191+120	1.120	40	400	2,000	12.7	165.8	36.14	198.5	43.27
3- 2	1191+120	1192+080	0.425	40	220	850	6.2	272.0	22.50	330.4	27.32
3- 2'	1192+080	1192+300	0.725	40	426	1,650	9.9	196.8	27.76	236.8	33.41
3- 3	1192+300	1192+800	0.438	40	380	1,500	9.3	205.2	17.49	247.2	21.07
3- 3'	1192+800	1193+200	0.500	40	380	1,300	7.9	229.9	22.37	277.9	27.04
3- 3"	1193+200	1193+960	0.273	40	230	750	5.3	304.7	16.19	371.3	19.73
3- 4	1194+100	1195+380	0.620	40	300	1,000	6.5	263.6	31.81	319.9	38.60
3- 5	1195+380	1196+280	0.670	40	326	1,500	10.0	196.0	25.55	235.8	30.74
3- 6	1196+280	1196+820	1.000	40	280	1,650	11.9	173.5	33.75	207.9	40.46
3- 7	JAGUPIT BRIDGE		2.470	40	838	3,800	18.7	127.0	81.06	150.9	72.54
3- 8	1196+900	1197+580	0.135	40	100	900	10.1	194.1	5.10	233.5	6.13
3- 9	1197+600	1198+600	0.400	30	255	9,400	90.4	42.9	3.34	49.3	3.84
3- 10	1198+600	1199+300	1.800	30	340	2,100	14.2	153.3	53.71	183.1	64.15
3- 10'	1199+300	1200+600	6.000	30	960	4,320	21.4	115.8	135.23	137.2	160.22
3- 12	1200+600	1201+400	1.960	25	260	2,200	16.7	137.3	52.36	163.5	62.35
3- 13	1201+400	1202+120	0.425	20	260	1,400	9.9	197.6	16.34	237.8	19.67
3- 14	1202+120	1202+620	0.975	20	100	2,000	22.7	111.2	21.10	131.6	24.97

PEAK DISCHARGE FROM SMALL CATCHMENT AREA IN PACKAGE 6

24-Jan-97

Area No	Station Km.		Catchment Area	Elevation (m)		Length	Lag Time	10-year R.P Rainfall Intensity	10-year R.P Peak Discharge	25-year R.P Rainfall Intensity	25-year R.P Peak Discharge
	Start	End	(km^2)	Min.	Max.	(m)	(min.)	(mm/hr)	(m^3/s)	(mm/hr)	(m^3/s)
4- 1	1236+820	1237+360	0.150	40	80	240	2.6	497.6	14.52	615.0	17.95
4- 2	1237+360	1237+660	0.100	40	88	200	2.0	603.5	11.74	750.1	14.60
4- 3	1237+660	1238+500	0.100	40	88	200	2.0	603.5	11.74	750.1	14.60
4- 4	1237+660	1238+500	0.375	40	80	680	8.6	217.7	15.89	262.8	19.17
4- 5	1238+500	1239+980	0.670	40	248	1,200	8.7	215.0	28.03	259.3	33.81
4- 6	1238+980	1239+680	0.600	40	220	1,200	9.2	206.9	24.16	249.3	29.11
4- 7	1239+680	1240+400	0.570	40	220	1,000	7.5	239.1	26.52	289.3	32.09
5- 1	1240+180	1241+000	0.312	100	200	900	8.3	222.4	13.50	268.5	16.30
5- 2	1241+000	1242+100	0.262	110	220	300	2.3	545.3	27.80	675.6	34.46
5- 3	1242+100	1242+800	0.212	140	160	300	4.4	348.7	14.30	424.1	17.50
5- 4	1242+800	1243+750	0.400	140	220	400	3.6	368.8	31.04	489.8	38.12
5- 4a	1243+750	1244+500	0.033	160	235	350	3.1	435.9	2.80	536.6	3.45
5- 5	1244+500	1245+200	0.500	140	260	1,800	17.2	134.7	13.10	160.2	15.59
5- 6	1245+200	1246+100	0.500	120	280	940	7.3	243.4	23.68	294.7	28.67
5- 7	AFGA BRIDGE			80	318	2,900	22.9	110.6	0.00	130.9	0.00
5- 8	1246+650	1247+200	0.138	120	240	700	5.8	284.9	7.65	346.5	9.30
5- 9	1247+200	1247+300	0.225	120	318	650	4.4	345.2	15.11	422.1	18.48
5- 10	1247+300	1247+800	0.212	120	318	700	4.8	325.4	13.43	397.3	16.39
5- 11	1247+800	1248+650	0.225	100	318	1,000	7.0	251.6	11.02	304.9	13.35
5- 12	1248+650	1249+000	0.500	70	318	1,400	9.7	199.3	19.40	239.9	23.34
5- 13	1249+000	1249+500	2.450	60	320	2,200	16.1	141.0	67.23	168.0	80.12
5- 14	1249+500	1250+450	0.112	80	195	200	1.4	761.2	16.59	952.5	20.76
5- 15	12450+450	1251+750	0.550	100	265	800	6.0	278.9	29.85	339.0	36.28
5- 16	1251+750	1252+000	0.512	60	220	1,300	10.6	188.2	18.75	228.1	22.53
5- 17	1252+000	1252+450	0.238	60	239	700	5.2	307.0	14.22	374.2	17.33
5- 18	1252+450	1253+020	0.510	80	239	1,300	10.6	187.9	18.64	225.7	22.40
5- 19	1253+020	1253+500	0.362	60	200	1,400	12.1	171.2	12.06	205.2	14.46
5- 20	1253+500	1254+140	0.312	60	140	900	9.1	209.6	12.72	252.6	15.34

PEAK DISCHARGE FROM SMALL CATCHMENT AREA IN PACKAGE 6

24-Jan-97

Area No.	Station Km.		Catchment Area	Elevation (m)		Length	Lag Time	10-year R.P. Rainfall Intensity	10-year R.P. Peak Discharge	25-year R.P. Rainfall Intensity	25-year R.P. Peak Discharge
	Start	End	(km^2)	Min.	Max.	(m)	(min.)	(mm/hr)	(m^3/s)	(mm/hr)	(m^3/s)
6- 1	1254+150	1254+700	0.765	60	237	1,800	14.8	149.3	22.23	178.2	26.53
6- 2	1254+700	1254+920	0.250	60	120	850	9.5	203.2	9.88	244.7	11.90
6- 3	1255+400	1255+750	0.125	40	200	650	4.8	326.2	7.93	393.2	9.69
6- 4	1255+750	1256+000	0.400	80	220	1,000	8.2	223.7	17.41	270.1	21.02
6- 5	1256+000	1256+500	0.500	100	280	1,600	12.8	164.7	16.02	197.1	19.16
6- 6	1256+500	1256+850	0.912	80	280	1,800	14.1	154.2	27.37	184.3	32.70
6- 7	1256+850	1257+400	0.200	40	100	700	7.6	237.0	9.22	286.7	11.16
6- 8	1257+750	1258+750	0.412	110	263	1,000	8.0	229.0	18.36	276.7	22.19
6- 9	1259+530	1260+150	0.400	80	140	750	8.2	224.4	17.46	271.0	21.09
6- 10	1260+150	1260+420	0.800	60	300	1,900	14.0	155.1	24.14	185.3	28.85
6- 11	1260+420	1261+120	0.220	40	162	560	4.5	341.6	14.62	417.6	17.88
6- 12	1261+120	1261+950	1.112	60	180	2,200	21.7	114.8	24.85	136.0	29.44
6- 13	1262+600	1263+250	0.600	46	60	130	1.9	612.4	71.50	761.4	88.90
6- 14	1263+250	1264+300	1.315	49	70	1,800	33.0	65.8	21.96	100.8	25.79
6- 15	1264+300	1265+610	1.188	48	70	2,000	37.3	78.9	18.25	92.5	21.38
6- 16	1270+500	1271+000	0.225	30	105	700	7.0	251.5	11.01	304.7	13.34

PEAK DISCHARGE FROM SMALL CATCHMENT AREA IN PACKAGE 7

24-Jan-97

Area No.	Station Km.		Catchment Area	Elevation (m)		Length	Lag Time	10-year R.P Rainfall Intensity	10-year R.P Peak Discharge	25-year R.P Rainfall Intensity	25-year R.P Peak Discharge
	Start	End	(km^2)	Min.	Max.	(m)	(min.)	(mm/hr)	(m^3/s)	(mm/hr)	(m^3/s)
7- 1	1271+000	1271+350	0.350	30	165	800	8.1	226.2	15.41	273.2	18.61
7- 2	1272+050	1272+700	0.425	70	284	1,700	12.9	164.3	13.59	196.7	16.27
7- 3	1272+700	1273+400	0.300	70	140	750	7.7	233.7	13.65	282.6	16.50
7- 4	1273+400	1273+800	0.512	70	230	1,100	8.7	214.8	21.41	259.2	25.82
7- 5	1274+400	1276+250	0.387	100	120	400	6.1	276.0	20.78	335.3	25.25
7- 6	1277+350	1278+050	0.450	100	200	1,200	11.6	177.0	15.50	212.3	18.59
7- 7	PANAYTAYAN BRIDGE		1.000	97	240	1,600	14.0	154.9	30.14	185.1	36.02
7- 8	1279+020	1279+700	0.200	175	220	700	8.5	219.6	8.55	265.0	10.31
7- 9	1288+600	1289+200	0.750	109	110	600	30.7	90.3	13.17	106.2	15.50
7- 10	1290+400	1290+700	0.350	70	159	200	1.5	183	1.24	22.8	1.55

PEAK DISCHARGE FROM SMALL CATCHMENT AREA IN PACKAGE 8

24-Jan-97

Area No.	Station Km.		Catchment Area	Elevation (m)		Length	Lag Time	10-year R.P Rainfall Intensity	10-year R.P Peak Discharge	25-year R.P Rainfall Intensity	25-year R.P Peak Discharge
	Start	End	(km^2)	Min.	Max.	(m)	(min.)	(mm/hr)	(m^3/s)	(mm/hr)	(m^3/s)
8- 1	1291+000	1292+000	0.468	70	80	1,200	28.1	44.9	4.27	53.0	5.03
8- 2	1292+000	1292+300	0.775	70	80	1,150	26.7	44.3	6.68	52.2	7.87
8- 3	1292+300	1293+450	0.112	60	70	350	6.8	29.0	0.63	35.1	0.77
8- 4	1293+450	1294+000	0.250	70	80	750	16.4	38.0	1.65	45.3	2.20
8- 5	1295+200	1296+250	0.175	60	70	200	3.6	23.7	0.81	29.1	0.99
8- 6	1297+500	1298+100	0.360	50	90	720	9.2	31.7	2.22	38.3	2.68
8- 7	1300+150	1300+850	0.075	50	55	200	4.7	25.8	0.38	31.5	0.46
8- 8	1301+600	1302+000	0.410	50	65	1,200	24.0	42.8	3.42	50.6	4.04
8- 9	1302+750	1303+020	0.025	45	50	400	10.4	33.0	0.16	39.7	0.19
8- 10A	1303+020	1304+200	0.838	50	70	1,300	23.6	42.6	6.94	50.3	8.21
8- 10B	1304+200	1305+300	3.000	40	70	2,600	44.8	51.9	30.31	60.6	35.39
8- 11	1305+350	1305+750	0.125	37	45	450	9.9	32.5	0.79	39.1	0.95
8- 12	1305+750	1306+650	0.200	37	45	500	11.2	33.8	1.31	40.5	1.58

PEAK DISCHARGE FROM SMALL CATCHMENT AREA IN PACKAGE 9

24-Jan-97

Area No	Station Km.		Catchment Area	Elevation (m)		Length	Lag Time	10-year R.P Rainfall Intensity	10-year R.P Peak Discharge	25-year R.P Rainfall Intensity	25-year R.P Peak Discharge
	Start	End	(km^2)	Min.	Max.	(m)	(min.)	(mm/hr)	(m^3/s)	(mm/hr)	(m^3/s)
9- 1	1308+400	1309+280	1.680	35	558	3,000	17.6	132.7	48.57	157.9	57.77
9- 2	1309+280	1309+800	1.020	35	360	1,920	12.6	166.7	33.09	199.6	39.62
9- 3	1309+800	1310+250	0.650	35	400	1,700	10.5	189.3	23.95	227.6	28.79
9- 4	1310+250	1310+350	1.050	35	550	1,800	9.8	198.3	40.52	238.6	48.76
9- 5	1310+350	1310+700	0.370	35	260	940	6.4	268.5	19.19	323.4	23.29
9- 6	1310+700	1311+400	0.950	50	530	1,640	9.1	209.5	38.74	252.6	46.69
9- 7	1311+400	1312+050	0.500	40	343	900	5.4	298.5	29.04	363.5	35.37
9- 8	1312+050	1312+300	0.300	50	320	1,020	6.6	262.1	15.30	318.0	18.57
9- 9	1312+300	1312+850	0.630	40	420	1,360	8.0	228.5	28.01	276.1	33.85
9- 10	1312+850	1313+500	0.250	60	140	280	2.4	529.3	25.75	655.4	31.88
9- 11	1313+500	1314+200	0.620	70	340	1,400	9.4	203.9	24.60	245.6	29.63
9- 12	Bayugan Bridge		1.000	40	110	1,600	18.5	128.1	24.93	152.3	29.63
9- 13	1315+250	1316+000	0.380	40	92	700	8.0	228.2	16.87	275.7	20.39
9- 14	1316+000	1316+450	0.130	60	80	360	5.4	300.0	7.59	365.4	9.24
9- 15	1318+350	1318+800	0.300	30	35	720	20.4	119.8	6.99	142.0	8.29
9- 16	1318+800	1319+450	0.280	30	40	440	8.9	212.8	11.60	256.6	13.98
9- 17	1319+450	1320+250	0.950	30	55	1,400	23.6	108.4	20.03	128.1	23.69
9- 18	1321+750	1322+400	0.370	30	40	700	15.1	147.2	10.60	175.7	12.65
9- 19	1322+400	1322+950	0.250	30	40	780	17.1	135.1	6.57	160.8	7.82
9- 20	1322+950	1324+300	0.820	30	40	860	19.1	125.0	19.95	148.5	23.70

PEAK DISCHARGE FROM SMALL CATCHMENT AREA IN PACKAGE 10

24-Jan-97

Area No	Station Km.		Catchment Area	Elevation (m)		Length	Lag Time	10-year R.P Rainfall Intensity	10-year R.P Peak Discharge	25-year R.P Rainfall Intensity	25-year R.P Peak Discharge
	Start	End	(km^2)	Min.	Max.	(m)	(min.)	(mm/hr)	(m^3/s)	(mm/hr)	(m^3/s)
10- 1	1324+300	1324+800	0.100	30	40	200	3.6	397.9	7.74	488.6	9.51
10- 2	1325+400	1326+000	0.475	30	120	700	6.5	263.9	24.40	320.3	29.61
10- 3	1326+000	1326+350	0.370	30	125	920	8.7	215.6	15.52	260.0	18.72
10- 4	1326+350	1326+520	0.500	35	198	1,000	7.8	232.9	22.66	281.6	27.40
10- 5	1326+520	1327+300	0.470	35	198	720	5.3	302.2	27.64	368.2	33.67
10- 6	1327+300	1327+420	0.850	35	313	1,000	6.3	268.4	44.39	325.8	53.89
10- 7	1327+420	1327+800	0.360	40	230	700	4.9	321.9	22.55	392.9	27.52
10- 8	1327+800	1328+350	0.270	40	145	500	4.2	359.1	18.87	439.7	23.10
10- 9	1328+350	1329+200	0.300	35	145	340	2.6	493.8	28.83	610.1	35.62
10- 10	1329+200	1329+590	2.800	35	315	1,900	13.2	161.6	68.03	193.3	105.32
10- 11	1329+590	1330+290	2.200	35	315	2,900	21.5	115.5	49.45	136.9	58.59
10- 12	1330+290	1330+750	0.430	35	70	1,500	22.4	112.2	9.39	132.8	11.11
10- 13	1331+900	1333+400	1.250	35	100	1,400	16.3	139.7	33.97	166.4	40.47
10- 14	1334+040	1334+500	1.050	40	450	2,100	12.8	165.1	33.74	197.7	40.39
10- 15	1334+500	1335+220	0.250	35	160	300	2.2	564.2	27.45	699.8	34.05
10- 16	1335+220	1335+700	0.270	35	210	700	5.0	314.9	16.55	384.1	20.18
10- 17	1335+700	1336+370	0.850	30	450	1,700	9.9	196.5	32.51	236.5	39.11
10- 18	1336+370	1336+590	0.800	30	450	1,900	11.3	179.9	28.01	215.9	33.62
10- 19	1336+590	1337+720	0.420	30	262	600	3.8	383.6	31.35	470.6	38.46
10- 20	1337+720	1338+000	2.300	10	450	1,600	9.1	208.8	93.45	251.6	112.63
10- 21	1338+000	1338+630	0.450	10	200	1,060	7.8	231.6	20.28	280.0	24.52
10- 22	1338+630	1339+140	0.300	10	270	740	4.6	334.8	19.54	409.0	23.88
10- 23	1339+140	1339+920	0.300	10	120	600	5.0	314.6	18.37	383.7	22.40
10- 24	1339+920	1340+340	0.280	20	120	1,000	9.4	204.5	11.14	246.4	13.42
10- 25	1340+340	1340+780	0.120	20	80	500	5.1	309.5	7.23	377.3	8.81
10- 26	1340+780	1341+150	0.350	20	130	1,200	11.2	181.5	12.36	217.9	14.84
10- 27	1341+150	1341+460	2.525	20	270	2,700	20.7	118.6	58.29	140.6	69.11
10- 28	1341+460	1341+700	0.175	10	145	1,400	12.3	169.6	5.78	203.2	6.92
10- 29	1342+300	1343+030	0.550	20	70	1,540	20.1	120.8	12.90	143.3	15.33
10- 30	1344+160	1344+680	0.700	50	110	1,420	17.1	135.2	18.42	160.9	21.92
10- 31	1344+680	1345+680	0.450	50	110	1,100	12.7	165.6	14.50	198.2	17.36
10- 32	1345+480	1346+070	0.320	50	110	700	7.6	237.0	14.76	286.7	17.85
10- 33	1347+600	1348+220	0.580	30	200	1,700	14.1	154.6	17.45	184.7	20.84
10- 34	1348+220	1349+150	0.500	30	140	1,030	9.4	204.9	19.94	246.8	24.02

PEAK DISCHARGE FROM SMALL CATCHMENT AREA IN PACKAGE 11

24-Jan-97

Area No.	Station Km.		Catchment Area	Elevation (m)		Length	Lag Time	10-year R.P Rainfall Intensity	10-year R.P Peak Discharge	25-year R.P Rainfall Intensity	25-year R.P Peak Discharge
	Start	End	(km^2)	Min.	Max.	(m)	(min.)	(mm/hr)	(m^3/s)	(mm/hr)	(m^3/s)
11- 1	1349+160	1349+770	0.370	30	250	1,100	7.7	233.8	16.84	282.7	20.36
11- 2	1349+770	1350+290	0.450	30	250	1,100	7.7	233.8	20.48	282.7	24.76
11- 3	1350+290	1350+900	0.175	30	80	360	3.8	382.7	13.03	459.4	15.99
11- 4	1350+900	1351+050	0.740	30	260	1,700	12.5	167.5	24.12	200.6	28.88
11- 5	1351+050	1351+500	0.400	30	160	700	5.6	291.0	22.65	354.2	27.57
11- 6	1351+500	1352+820	0.200	30	160	800	6.6	261.8	10.19	317.6	12.36
11- 7	1352+820	1353+150	0.275	33	175	900	7.3	244.1	13.06	295.5	15.81
11- 8	1353+150	1353+410	1.770	30	260	2,040	15.5	144.9	49.92	172.8	59.53
11- 9	1353+410	1353+820	0.550	30	240	1,960	15.5	144.9	15.50	172.8	18.49
11- 10	1353+820	1354+310	1.250	30	286	2,100	15.3	145.7	35.45	173.8	42.28
11- 11	1354+310	1354+860	0.375	30	150	1,240	11.2	181.0	13.21	217.2	15.85

PEAK DISCHARGE FROM SMALL CATCHMENT AREA IN PACKAGE 12

24-Jan-97

Area No.	Station Km.		Catchment Area	Elevation (m)		Length	Lag Time	10-year R.P Rainfall Intensity	10-year R.P Peak Discharge	25-year R.P Rainfall Intensity	25-year R.P Peak Discharge
	Start	End	(km^2)	Min.	Max.	(m)	(min.)	(mm/hr)	(m^3/s)	(mm/hr)	(m^3/s)
12- 1	1373+320	1374+270	0.325	38	60	500	7.6	237.1	15.00	288.8	18.14
12- 2	1374+270	1375+280	0.760	60	70	1,000	22.8	110.9	16.41	131.3	19.42
12- 3	1375+120	1376+060	0.375	60	172	600	5.0	316.1	23.07	385.6	28.14
12- 4	1376+060	1376+700	0.250	60	160	400	3.6	398.8	19.40	489.8	23.83

PEAK DISCHARGE FROM SMALL CATCHMENT AREA IN PACKAGE 13

24-Jan-97

Area No.	Station Km.		Catchment Area	Elevation (m)		Length	Leg Time	10-year R.P Rainfall Intensity	10-year R.P Peak Discharge	25-year R.P Rainfall Intensity	25-year R.P Peak Discharge
	Start	End	(km^2)	Min.	Max.	(m)	(min.)	(mm/hr)	(m^3/s)	(mm/hr)	(m^3/s)
13- 1	1376+830	1377+230	0.175	80	120	500	6.0	277.9	9.46	337.7	11.50
13- 2	Maikum Bridge		0.625	60	180	1,300	11.8	174.3	21.20	209.0	25.42
13- 3	1377+650	1378+300	0.060	60	200	1,900	17.2	134.4	2.09	159.9	2.49
13- 4	1378+300	1379+150	0.225	80	120	280	3.1	440.3	19.28	542.2	23.74
13- 5	1379+150	1379+750	1.270	60	280	1,900	14.5	151.5	37.45	181.0	44.72
13- 6	1379+750	1380+400	0.375	60	120	900	10.1	194.1	14.17	233.5	17.04
13- 7	1380+400	1381+000	0.125	80	120	300	3.3	416.8	10.14	512.5	12.47
13- 8	1382+560	1383+950	1.475	50	193	1,100	9.1	208.5	59.86	251.3	72.14
13- 9	1383+950	1384+860	1.750	50	240	2,700	23.0	110.3	37.56	130.5	44.44
13- 10	1384+860	1385+680	0.725	50	140	1,400	14.4	152.3	21.48	181.9	25.66
13- 11	1385+680	1386+400	0.375	52	120	720	7.5	239.6	17.48	289.9	21.16
13- 12	1386+680	1386+950	0.450	60	140	1,120	11.7	176.2	15.43	211.3	18.50
13- 13	1386+950	1387+750	0.375	80	100	1,020	17.8	131.3	9.58	156.1	11.39
13- 14	1387+750	1388+100	0.175	80	100	1,250	22.7	111.0	3.78	131.4	4.47
13- 15	1388+100	1388+580	0.150	80	100	500	7.9	231.2	6.75	279.4	8.16
13- 16	1388+580	1389+100	0.125	80	100	300	4.4	346.7	8.43	424.1	10.32
13- 17	1390+400	1390+600	0.825	60	140	1,600	17.6	132.8	21.31	157.9	25.35
13- 18	1391+250	1391+850	0.275	30	50	400	6.1	276.0	14.77	335.3	17.94
13- 19	1391+850	1392+680	0.500	50	80	1,000	14.9	148.5	14.45	177.3	17.25
13- 20	1392+980	1393+300	0.060	50	60	260	4.8	323.1	5.03	394.4	6.14
13- 21	1393+300	1393+600	0.100	50	60	240	4.4	344.3	6.70	421.0	8.19
13- 22	1394+500	1394+900	0.275	50	60	700	15.1	147.2	7.88	175.7	9.40

PEAK DISCHARGE FROM SMALL CATCHMENT AREA IN PACKAGE 15

24-Jan-97

Area No.	Station Km.		Catchment Area	Elevation (m)		Length	Lag Time	10-year R P Rainfall Intensity	10-year R P Peak Discharge	25-year R P Rainfall Intensity	25-year R P Peak Discharge
	Start	End	(km^2)	Min.	Max.	(m)	(min.)	(mm/hr)	(m^3/s)	(mm/hr)	(m^3/s)
15- 1	1396+092	1397+192	0.488	80	100	300	4.4	346.7	32.93	424.1	40.27
15- 2	1397+400	1397+700	0.150	60	120	600	6.3	267.8	7.82	325.1	9.49
15- 3	1397+700	1398+450	0.275	60	122	900	10.0	195.8	10.48	235.6	12.61
15- 4	1398+450	1398+900	0.120	80	122	440	5.1	311.6	7.28	379.9	8.87
15- 5	1398+900	1399+000	2.250	60	300	2,300	17.5	133.3	58.35	158.5	69.42
15- 6	1399+000	1399+200	4.725	60	300	3,200	25.5	102.5	94.29	121.1	111.32
15- 7	1399+200	1399+620	1.225	60	140	2,000	22.7	111.2	26.51	131.6	31.37
15- 8	1399+620	1400+350	0.300	60	100	500	6.0	277.9	16.22	337.7	19.72
15- 9	1400+350	1400+500	0.625	60	140	1,300	13.8	156.5	19.04	187.1	22.75
15- 10	1400+500	1401+000	0.125	60	100	500	6.0	277.9	6.76	337.7	8.22
15- 11	1401+000	1401+350	0.100	60	100	300	3.3	416.8	8.11	512.5	9.97
15- 12	1401+350	1401+700	0.120	60	80	300	4.4	346.7	8.10	424.1	9.90
15- 13A	1401+700	1402+000	0.300	60	100	1,100	14.9	148.7	8.68	177.4	10.36
15- 13B	1402+750	1403+170	3.125	60	100	5,000	85.0	44.7	27.19	51.5	31.34
15- 14	1403+170	1403+800	0.100	60	100	200	2.1	575.0	11.19	713.7	13.89
15- 15	1403+800	1404+000	0.118	60	100	360	4.1	360.7	8.28	441.6	10.14
15- 16	1404+000	1404+350	0.125	60	120	620	6.6	260.9	6.35	316.5	7.70
15- 17	1404+350	1404+800	0.500	60	120	1,000	11.4	178.6	17.38	214.3	20.85
15- 18	1404+800	1405+250	0.850	60	140	1,420	15.3	145.9	24.14	174.1	28.79
15- 19A	1405+250	1405+900	0.075	60	100	500	6.0	277.9	4.06	337.7	4.93
15- 19B	1405+900	1406+500	4.675	60	293	4,900	42.1	72.6	66.01	84.8	77.16
15- 20	1406+500	1407+050	0.450	60	120	1,100	12.7	165.6	14.50	198.2	17.36
15- 21	1407+050	1408+800	1.300	60	240	1,500	11.9	173.3	43.85	207.8	52.56
15- 22	BRIDGE						#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
15- 23	1408+850	1409+300	0.125	62	100	340	3.9	372.3	9.06	456.3	11.10
15- 24	1409+300	1409+550	0.250	72	160	680	6.3	268.5	13.06	325.9	15.86
15- 25	1409+850	1410+800	0.287	70	100	500	6.7	257.5	14.38	312.2	17.44
15- 26	1410+800	1411+400	0.500	70	140	600	8.3	222.1	21.61	268.1	26.09
15- 27	1411+400	1411+700	0.250	70	120	920	11.1	181.8	8.84	218.2	10.62
15- 28	1411+700	1411+900	0.750	70	260	1,660	13.1	162.2	23.68	194.1	28.33
15- 29	1411+900	1412+400	0.325	70	120	700	8.1	225.8	14.28	272.7	17.25
15- 30	1412+750	1413+400	0.500	70	180	1,100	10.1	194.5	18.92	233.9	22.76
15- 31	1413+400	1414+450	0.550	70	160	620	5.6	290.6	31.11	353.7	37.85
15- 32	1414+450	1414+650	2.850	70	260	2,000	16.3	139.9	77.61	166.7	92.46
15- 33A	1414+650	1416+200	0.625	70	120	700	8.1	225.8	27.46	272.7	33.17
15- 33B	1416+200	1416+700	3.125	70	300	3,200	25.9	101.4	61.66	119.7	72.78
15- 34	1416+700	1416+900	1.000	80	240	2,000	17.4	133.7	26.02	159.1	30.95
15- 35	1416+900	1417+260	0.375	80	120	800	10.3	191.4	13.97	230.1	16.79
15- 36	1417+260	1417+720	0.250	80	100	700	11.6	177.0	8.61	212.3	10.33
15- 37	1418+060	1418+350	0.875	70	220	1,700	14.8	149.5	25.46	178.5	30.39
15- 38	1418+350	1418+700	0.750	50	260	1,800	13.9	156.2	22.60	186.7	27.25
15- 39	1418+700	1419+500	1.875	70	331	2,600	19.5	123.6	45.11	146.8	53.55
15- 40	1419+500	1419+780	0.250	70	200	500	3.8	380.1	18.49	466.1	22.68
15- 41	1419+780	1421+000	0.625	70	200	680	5.4	297.8	36.22	362.6	44.11
15- 42	1421+000	1421+400	0.575	80	220	1,500	13.1	162.1	18.14	194.0	21.70
15- 43	1421+400	1422+000	1.250	80	400	1,720	11.2	181.2	44.07	217.4	52.89
15- 44	1422 + 000	1423 + 100	0.625	80	300	700	4.6	334.7	40.71	408.9	49.74
15- 45	1423 + 100	1423 + 700	0.875	80	340	1200	8.0	228.1	38.84	275.6	46.94
15- 46	1423 + 700	1424 + 600	0.75	100	240	1000	8.2	223.7	32.64	270.1	39.42

PEAK DISCHARGE FROM SMALL CATCHMENT AREA IN PACKAGE 16

24-Jan-97

Area No	Station Km.		Catchment Area	Elevation (m)		Length	Lag Time	10-year R.P. Rainfall Intensity	10-year R.P. Peak Discharge	25-year R.P. Rainfall Intensity	25-year R.P. Peak Discharge
	Start	End	(km^2)	Min.	Max.	(m)	(min.)	(mm/hr)	(m^3/s)	(mm/hr)	(m^3/s)
16- 1	NABUNTURAN BRIDGE		1.875	00	50	1,600	19.8	184.2	67.2	219.0	79.9
16- 2	1424+700	1425+200	0.250	100	120	620	10.1	191.0	9.29	227.0	11.04
16- 3	1425+200	1426+000	0.275	100	120	600	9.7	194.6	10.41	231.1	12.37
16- 4	1426+000	1426+400	0.500	100	220	1,320	12.0	175.0	17.02	208.3	20.27
16- 5	1426+400	1426+750	0.125	120	140	600	9.7	194.6	4.73	231.1	5.62
16- 6	1426+750	1427+200	0.312	120	180	800	8.8	203.6	12.36	241.6	14.67
16- 7	PUNGTOD BRIDGE		1.225	120	243	1,550	14.5	160.0	55.74	190.8	66.49
16- 8	1427+300	1427+500	0.312	120	180	1,000	11.4	179.5	10.90	213.6	12.97
16- 9	1427+500	1428+050	0.250	120	160	720	9.2	200.1	9.74	237.6	11.56
16- 10	1429+090	1429+790	0.125	80	100	400	6.1	244.5	5.95	289.1	7.03
16- 11	1429+790	1430+190	0.375	80	100	540	8.6	206.5	15.07	245.0	17.88
16- 12	1430+890	1431+510	0.375	80	100	500	7.9	215.6	15.74	255.6	18.65
16- 13	1431+860	1432+740	0.225	70	80	760	16.6	149.4	6.54	178.5	7.81
16- 14	1432+740	1433+340	0.450	70	80	1,100	25.4	121.3	10.63	145.5	12.74
16- 15	1433+340	1433+740	1.500	80	160	2,500	29.3	113.1	33.01	135.8	39.65
16- 16	1433+740	1434+740	1.750	80	180	2,200	23.2	126.8	43.17	151.9	51.73
16- 17	1435+240	1435+740	0.275	80	140	800	8.8	203.6	10.89	241.6	12.93
16- 18	1435+740	1435+840	2.000	80	280	2,300	18.7	140.9	54.84	168.5	65.57
16- 19	1435+840	1436+740	0.500	80	140	800	8.8	203.6	19.81	241.6	23.51
16- 20	1436+740	1436+890	0.625	60	180	1,120	10.0	191.9	23.35	228.1	27.74
16- 21	1436+890	1438+190	0.875	60	200	740	5.8	249.6	42.50	295.0	50.22
16- 22	1438+190	1438+990	0.250	60	180	620	5.0	267.9	13.03	316.1	15.38
16- 23	1438+990	1440+000	0.250	60	180	360	2.7	363.9	17.70	426.7	20.76
16- 24	1440+000	1441+000	0.625	60	200	1,300	11.1	181.7	22.10	216.1	26.28
16- 25	TAGMANOK BRIDGE		2.500	60	300	2,740	21.4	132.1	64.28	156.2	76.06
16- 26	1441+100	1442+200	0.437	100	260	800	6.1	245.0	20.83	289.6	24.63
16- 27	1442+200	1443+650	0.375	120	240	400	3.1	342.9	25.02	402.6	29.38
16- 28	1443+650	1444+200	0.187	160	203	380	4.3	290.8	10.58	342.6	12.47
16- 29	1444+200	1445+000	0.150	160	180	140	1.8	441.8	12.90	516.1	15.07
16- 30	1446+000	1446+500	0.300	80	100	500	7.9	215.6	12.59	255.6	14.92
16- 31	1446+500	1447+480	0.475	80	100	540	8.6	206.5	19.09	245.0	22.64
16- 32	1448+700	1449+050	0.130	60	80	360	5.4	259.5	6.56	306.4	7.75
16- 33	1449+050	1449+400	0.200	60	80	500	7.9	215.6	8.39	255.6	9.95
16- 34	1449+400	1450+620	0.100	60	80	300	4.4	287.6	5.60	338.9	6.59
16- 35	1450+620	1451+200	0.150	40	80	400	4.7	278.7	8.14	328.6	9.59
16- 36	1451+200	1451+700	0.375	40	60	800	13.5	165.5	12.08	197.2	14.39
16- 37	1452+900	1454+000	0.450	18	25	520	12.3	173.0	15.15	206.0	18.04

PEAK DISCHARGE FROM SMALL CATCHMENT AREA IN PACKAGE 18

24-Jan-97

Area No.	Station Km.		Catchment Area	Elevation (m)		Length	Lag Time	10-year R.P Rainfall Intensity	10-year R.P Peak Discharge	25-year R.P Rainfall Intensity	25-year R.P Peak Discharge
	Start	End	(km^2)	Min.	Max.	(m)	(min.)	(mm/hr)	(m^3/s)	(mm/hr)	(m^3/s)
18- 1	1487+720	1489+030	1.750	10	80	2,000	23.9	125.1	42.59	149.9	51.05
18- 2	1489+030	1489+950	2.200	10	120	2,540	26.4	119.0	50.96	142.8	61.14
18- 3	1489+950	1491+000	2.275	10	100	2,480	27.8	116.2	51.43	139.4	61.73
18- 4	1491+000	1491+270	2.100	10	120	2,300	23.6	125.9	51.44	150.8	61.65
18- 5	1491+270	1491+840	0.625	10	60	1,700	22.6	128.6	15.64	154.1	18.74
18- 6	1491+840	1492+400	1.375	10	80	2,220	26.9	117.9	31.55	141.5	37.86
18- 7	1492+400	1493+000	1.000	20	60	1,420	20.0	136.5	26.56	163.3	31.78
18- 8	1493+000	1494+310	0.875	20	50	1,400	22.0	130.3	22.19	156.1	26.57
18- 9	1494+510	1496+710	0.812	20	30	720	15.6	154.1	24.35	183.9	29.05

PEAK DISCHARGE FROM SMALL CATCHMENT AREA IN PACKAGE 19

24-Jan-97

Area No.	Station Km.		Catchment Area	Elevation (m)		Length	Lag Time	10-year R.P Rainfall Intensity	10-year R.P Peak Discharge	25-year R.P Rainfall Intensity	25-year R.P Peak Discharge
	Start	End	(km^2)	Min.	Max.	(m)	(min.)	(mm/hr)	(m^3/s)	(mm/hr)	(m^3/s)
19- 1	1501+600	1502+000	0.112	20	30	500	10.3	189.2	4.1	224.9	4.9
19- 2	1503+150	1503+800	4.088	16	90	4,200	54.9	83.2	66.2	100.5	80.0
19- 3	1504+700	1505+250	0.175	10	30	500	7.9	215.6	7.3	255.6	8.7
19- 4	1507+300	1508+150	0.288	30	60	500	6.7	232.8	13.0	275.5	15.4
19- 5	1508+150	1508+550	1.269	20	200	3,800	34.7	104.1	25.7	125.2	30.9
19- 6	1508+550	1509+000	0.980	20	100	1,350	14.4	160.0	30.5	190.9	36.4
19- 7	1509+000	1509+400	0.140	20	100	500	4.6	280.1	7.6	330.2	9.0
19- 8	1509+400	1510+000	0.650	20	110	950	9.2	199.5	25.2	236.8	30.0
19- 9	1510+000	1511+000	0.540	60	100	900	11.8	178.5	18.5	210.0	22.1
19- 10	1511+000	1512+000	0.140	50	63	200	3.2	333.2	9.1	391.4	10.7
19- 11	1512+000	1513+000	0.250	60	110	350	3.7	313.4	15.2	368.6	17.9
19- 12	1513+600	1513+900	0.110	20	60	450	5.3	260.8	5.6	307.9	6.6
19- 13	1513+900	1514+650	1.320	20	90	2,100	25.3	121.7	31.3	145.9	37.5
19- 14	1514+650	1515+650	0.450	20	60	600	7.4	221.8	19.4	262.7	23.0