

Project Administration Manual

Project Number: 43200

Loan Number: LXXXX

September 2011

Papua New Guinea: Bridge Replacement for Improved Rural Access Sector Project

Contents

ABBREVIATIONS

I.	PROJECT DESCRIPTION	1
A.	Impact and Outcome	1
B.	Outputs	1
II.	IMPLEMENTATION PLANS	3
A.	Project Readiness Activities	3
B.	Overall Project Implementation Plan	3
III.	PROJECT MANAGEMENT ARRANGEMENTS	6
A.	Project Implementation Organizations – Roles and Responsibilities	6
B.	Key Persons Involved in Implementation	8
C.	Project Organization Structure	9
D.	Bridge Replacement Program – Prioritization and Selection Criteria	10
IV.	COSTS AND FINANCING	25
A.	Detailed Cost Estimates by Expenditure Category	25
B.	Allocation and Withdrawal of Loan Proceeds	26
C.	Detailed Cost Estimates by Financier	27
D.	Detailed Cost Estimates by Outputs	28
E.	Detailed Cost Estimates by Year	29
F.	Contract and Disbursement S-curve	29
G.	Fund Flow Diagram	30
V.	FINANCIAL MANAGEMENT	31
A.	Financial Management Assessment	31
B.	Disbursement	31
C.	Accounting	33
D.	Auditing	33
VI.	PROCUREMENT AND CONSULTING SERVICES	34
A.	Advance Contracting	34
B.	Procurement of Goods, Works and Consulting Services	34
C.	Procurement Plan	35
D.	Consultant's Terms of Reference	39
VII.	SAFEGUARDS	53
VIII.	GENDER AND SOCIAL DIMENSIONS	57
IX.	PERFORMANCE MONITORING, EVALUATION, REPORTING AND COMMUNICATION	59
A.	Project Design and Monitoring Framework	59
B.	Monitoring	61
C.	Evaluation	61
D.	Reporting	61
E.	Stakeholder Communication Strategy	62
X.	ANTICORRUPTION POLICY	63
XI.	ACCOUNTABILITY MECHANISM	65
XII.	RECORD OF PAM CHANGES	66

Project Administration Manual Purpose and Process

The project administration manual (PAM) describes the essential administrative and management requirements to implement the project on time, within budget, and in accordance with Government and Asian Development Bank (ADB) policies and procedures. The PAM should include references to all available templates and instructions either through linkages to relevant URLs or directly incorporated in the PAM.

The Department of Works (DOW) is wholly responsible for the implementation of ADB financed projects, as agreed jointly between the borrower and ADB, and in accordance with Government and ADB's policies and procedures. ADB staff is responsible to support implementation including compliance by DOW of their obligations and responsibilities for project implementation in accordance with ADB's policies and procedures.

At Loan Negotiations, the borrower and ADB shall agree to the PAM and ensure consistency with the Loan agreement. Such agreement shall be reflected in the minutes of the Loan Negotiations. In the event of any discrepancy or contradiction between the PAM and the Loan Agreement, the provisions of the Loan Agreement shall prevail.

After ADB Board approval of the project's report and recommendation of the president (RRP), changes in implementation arrangements are subject to agreement and approval pursuant to relevant Government and ADB administrative procedures (including the Project Administration Instructions) and upon such approval, they will be subsequently incorporated in the PAM.

Abbreviations

ADB	–	Asian Development Bank
AP	–	affected persons
BAMS	–	Bridge Asset Management System
CPS	–	Country Partnership Strategy
CSP	–	Country Strategy and Program
DEC	–	Department of Environment and Conservation
DNPM	–	Department of National Planning and Monitoring
DOLPP	–	Department of Lands and Physical Planning
DOT	–	Department of Transport
DOW	–	Department of Works
DSP	–	Development Strategic Plan
DT	–	Department of Treasury
EA	–	executing agency
EARF	–	Environmental Assessment and Review Framework
EMP	–	Environmental Management Plan
EOI	–	expression of interest
ESS	–	Environmental Safeguards Specialist
IA	–	implementing agency
ICB	–	International Competitive Bidding
IEE	–	initial environmental examination
km	–	kilometer
m	–	meter
NCB	–	National Competitive Bidding
NRSC	–	National Road Safety Council
NTDP	–	National Transport Development Plan
O&M	–	operations and maintenance
PAM	–	project administration manual
PATE	–	Transport, Energy and Natural Resources Division
PCC	–	Project Coordinating Committee
PIU	–	project implementation unit
PMU	–	project management unit
PNG	–	Papua New Guinea
PPTA	–	project preparatory technical assistance
PSC	–	program steering committee
QBS	–	Quality-Based Selection
QCBS	–	Quality- and Cost-Based Selection
RAMS	–	Road Asset Management System
RF	–	Resettlement Framework
RFT	–	Request for Tender
RP	–	resettlement plans
RRP	–	report and recommendation of the president
SSS	–	single source selection
TOR	–	terms of reference
TSSP	–	Transport Sector Support Programme

I. PROJECT DESCRIPTION

1. The Bridge Replacement for Improved Rural Access Sector Project (the Project) offers a comprehensive bridge replacement program. A sector approach is adopted to provide flexibility in implementation. Detailed selection criteria have been developed to assign priority to bridges that are to be replaced. Based on available financing and ease of contract packaging, bridges will be selected from the prioritized list. The project is the first phase of implementation of the program and will include five priority national roads identified by the Department of Works (DOW). It is envisaged that the scope of the project will be up-scaled to include all 16 priority roads by financing subsequent phases under ADB's *Additional Financing Policy*.

2. The Bailey bridges removed from the national roads and are in useable condition will be reassembled on selected rural roads that lack bridges for crossing streams and rivers. This will enhance accessibility of the rural population to markets, livelihood opportunities, education and health facilities. The improved connectivity of rural roads with the national roads will enhance the effectiveness of the overall road network bringing higher economic returns from increased traffic. The project will develop capacity of DOW bridge asset management system (BAMS) and improve road safety awareness in rural areas of PNG where accident rate is high.

A. Impact and Outcome

3. The project will improve access to market and social services for the rural population in selected provinces of PNG. The outcome will be better connected, more efficient, and safer road network in rural areas of selected provinces.

B. Outputs

4. The project will have four key outputs:

- (i) **Bridge Replacement.** The project will replace about 20-30 Bailey bridges on five priority national roads with permanent two-lane bridges. The bridges are prioritized for each road following a detailed selection criteria based on (a) traffic, (b) condition, (c) residual life, (d) availability of alternate routes, (e) safety of road users, and (f) population served. The bridges will be selected considering priority ranking, availability of funds, safeguards and economic due diligence requirements and contract packaging.
- (ii) **Improving Rural Access.** For the Bailey bridges that have been removed from the five priority national roads and are in usable condition, the project will finance their installation on rural roads that lack bridges. The provincial governments will identify priority rural roads, following selection guidelines, preferably in the vicinity of the location from where the bridges were removed. The dismantling, transportation and reassembly of Bailey bridges will be part of the main civil works contract for construction of permanent bridges.
- (iii) **Capacity Development of DOW's BAMS.** The project will support BAMS to engage staff, train them and undertake inventory and condition surveys on the 16 priority national roads and update the database on bridges. The work will be carried out in close coordination with the provincial units of DOW.

- (iv) **Road Safety Awareness in Rural Areas.** The project will finance road safety campaigns in rural areas along the five priority national roads. The activities will include training for school children and communities in rural areas complemented by media campaigns. DOW will engage NRSC under a contract to carry out road safety awareness in rural areas.

II. IMPLEMENTATION PLANS

A. Project Readiness Activities

5. The project will finance additional staff, equipment and office furnishing to supplement the existing PIU resources for implementing the project. The additional staffing will consist of a project engineer, an accountant, a community development officer to oversee implementation of the gender action plan and resettlement plans. Expressions of interests have been received and consultant selection process for the detailed design, implementation and supervision commenced in July 2011. Overall program readiness activities are in Table 2.1:

Table 2.1 Project Readiness Activities

Indicative Activities	2011							Who is responsible
	Jun	July	Aug	Sept	Oct	Nov	Dec	
Advance action/Advance contracting	✓	✓	✓	✓	✓	✓	✓	DOW and ADB
Establish project implementation arrangements	✓	✓						DOW
Government counterpart funds allocation and budget inclusion	✓	✓	✓	✓				DNPM/DOT/DOW
ADB Board approval				✓				ADB
Loan signing						✓		DT and ADB
Issuance of legal opinion						✓		DT/OSS
Loan effectiveness							✓	DT and ADB

ADB = Asian Development Bank, DNPM = Department of National Planning and Monitoring, DOW = Department of Works, DT = Department of Treasury, OSS = Office of the State Solicitor.

B. Overall Project Implementation Plan

6. The project is expected to be implemented over a period of 5 years for completion by 31 December 2016. Overall project implementation plan is shown in Figure 2.1. The overall project implementation plan will be updated annually by DOW and ADB based on actual physical progress.

III. PROJECT MANAGEMENT ARRANGEMENTS

A. Project Implementation Organizations – Roles and Responsibilities

Project Implementation Organizations	Management Roles and Responsibilities
Department of Works	<p>Project Executing Agency (EA)</p> <ul style="list-style-type: none"> • Provide strategic guidance, policy directions, and overall oversight to the project; • Coordinate with provincial governments the preparation and implementation of the project including for identification of reusable bridge sites and land acquisition and land compensation. • The Independent State of Papua New Guinea will be 'The Employer.' • The Secretary of DOW will be the 'The Employer's Representative.' • Establish and maintain imprest account for the project.
Department of Works, supported by Project Implementation Unit (PIU)	<p>Project Implementing Agency (IA)</p> <ul style="list-style-type: none"> • On behalf of the EA, manage the day-to-day implementation of project outputs, at the national, provincial and local level. The PIU will also be responsible for the overall financial management and administration of the project. This includes the timely preparation of annual work plans and budgets; submission of withdrawal applications; the retention of supporting documents; the submission of quarterly and annual reports and the preparation of annual audit reports and financial statements. • Provide overall guidance to the implementation of the project at the provincial and local levels of government, including for site identification for reusable bridges and land acquisition and land compensation.
National Roads Authority	<ul style="list-style-type: none"> • Maintain new bridges on priority national roads.
Provincial Government	<ul style="list-style-type: none"> • Participate in partnership meetings and carry out agreed outputs including for site identification for reusable Bailey bridges and land acquisition and land compensation. • Provides financing for maintaining Bailey bridges on rural roads.
The Consultants	<ul style="list-style-type: none"> • Provide technical support to the implementation of project outputs. • The Consultant will be 'The Engineer'.

7. DOW will be the executing agency and the implementing agency for the project. The existing project implementation unit (PIU) within DOW that is responsible for all ADB financed projects will implement this project. The PIU, headed by a Project Director for ADB loans, will be strengthened with additional staff to manage day-to-day implementation activities. The PIU will be responsible for engaging all consulting services and civil works contracts.

8. A Project Steering Committee (PSC) will oversee implementation, monitor progress, provide guidance to the executing agency, and endorse bridges to be replaced on selected priority national roads as well as sites on rural roads where reusable Bailey bridges will be reassembled. The PSC will meet at least quarterly and will be chaired by the Secretary, DOW. The members of PSC will comprise of representatives from the National Roads Authority, Department of Transport, NRSC, Department of National Planning and Monitoring, and Department of Treasury. Representatives of Department of Environment and Conservation, Department of Lands and Physical Planning and Provincial Governments may be invited to PSC meetings to discuss specific issues.

9. The project will finance additional staff, equipment and office furnishing to supplement the existing PIU resources for implementing the project. The additional staffing will consist of a project engineer, an accountant, a community development officer to oversee implementation of the gender action plan and resettlement plans. ADB financing for PIU support is justified because (i) of the limited capacity of PIU, and (ii) this is an integral part of ADB's support for capacity development. The Government has given assurance that upon completion of the project, the additional PIU staff will be integrated into DOW for future projects.

10. The PIU will use operational procedures and guidelines developed under previous ADB infrastructure projects so that transfers of responsibility for specified tasks and functions shall occur according to agreed periodic milestones. Such procedures and guidelines shall:

- (i) assist DOW to coordinate with the DOLPP, Provincial Governments, affected communities and other stakeholders to ensure that site identification for reusable bridges is undertaken and all land acquisition, land compensation and resettlement is carried out in accordance with the Government and ADB policies; and
- (ii) envision periodic meeting between consultant and PIU staff.

11. To ensure process efficiency in terms of the project output produced on time and within budget, and effectiveness in achieving the project's outcome, the PIU will be responsible for:

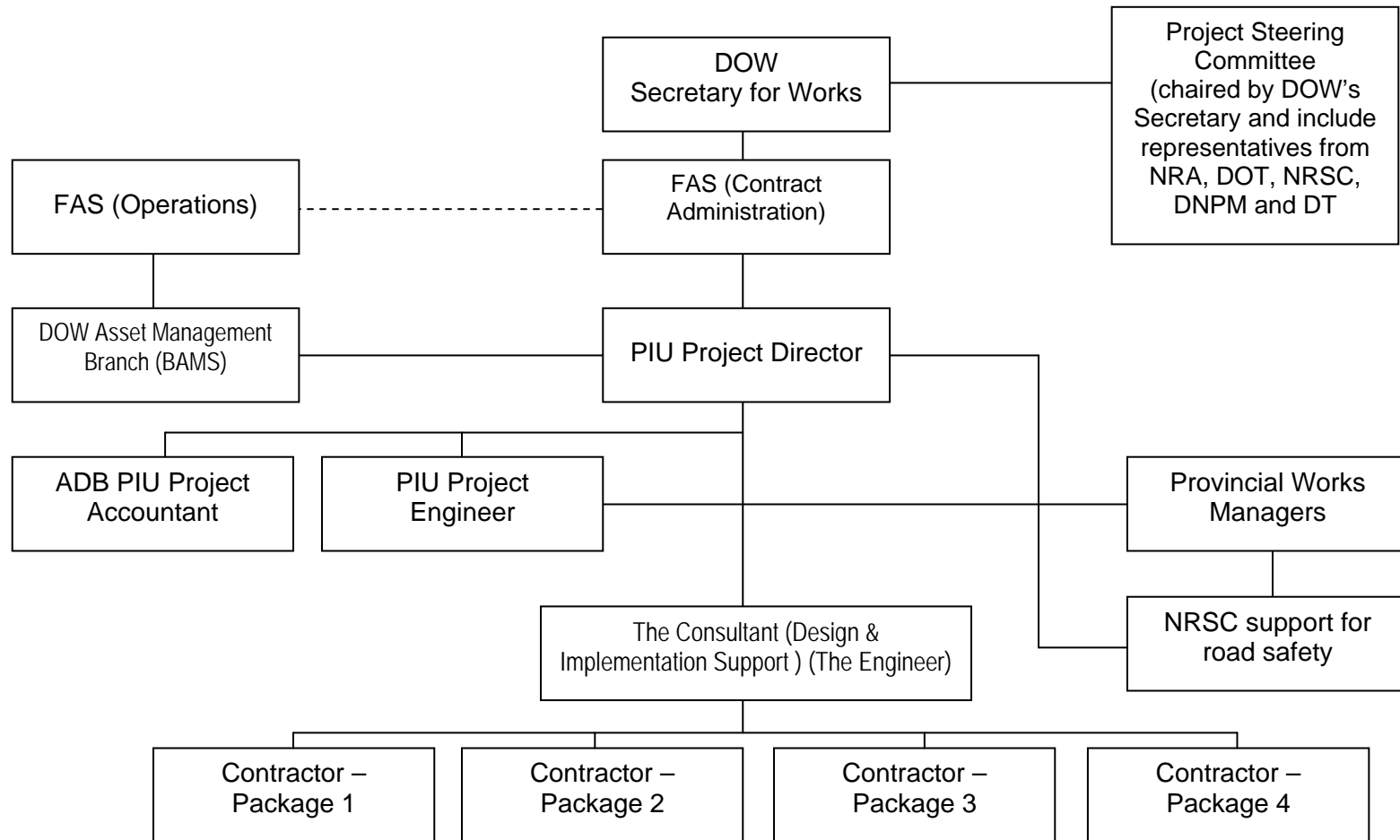
- (i) managing the planning and implementation of the project;
- (ii) project management including coordination within DOW and with outside stakeholders;
- (iii) engaging and managing the Consultant (for Detailed Design and Implementation Support);
- (iv) managing project financing and accounting;
- (v) managing project auditing;
- (vi) monitoring and reporting of project progress;
- (vii) monitoring key project approvals; and
- (viii) establishing and maintaining a project performance management system with support of the consultants.

12. DOW will establish and maintain an imprest account for the project. The imprest account will be managed, replenished, and liquidated in accordance with ADB's *Loan Disbursement Handbook* (2007, as amended from time to time), and detailed arrangements agreed on between the Government and ADB.

B. Key Persons Involved in Implementation

Executing Agency	
Department of Works	Officer's Name: Joel Luma Position: Secretary Telephone: (675) 324-1114/1110/1107 Email address: jluma@daltron.com.pg
	Officer's Name: Gabriel Tomtai Position: First Assistant Secretary, Contract Management Telephone: +675 324 1252 Email address: gtomtai@works.gov.pg
Implementing Agency	
Department of Works (Project Implementation Unit)	Officer's Name: Steven Pup Position: Project Implementation Unit Director Telephone No. +675 324 1471 Email address: spup@online.net.pg
ADB	
Division Director	Staff Name: Robert Guild Position: Director, PATE, PARD Telephone No. +63 2 632 6109 Email address: rguild@adb.org
Mission Leader	Staff Name: Mr. Hasan Masood Position: Lead Project Administration Specialist, PATE Telephone No. +63 2 632 6818 Email address: hmasood@adb.org

C. Project Organization Structure



D. Bridge Replacement Program – Prioritization and Selection Criteria

1. Bridge Replacement on National Roads

1.1. Bridge Inclusion Criteria

13. Bridges are selected for inclusion in the bridge replacement program based on the following criteria:

- (i) Bailey bridges.
- (ii) Other bridges assessed as deteriorated (bad or poor condition) as assessed by an experienced bridge engineer and the deterioration cannot be economically addressed by periodic maintenance of the existing bridge.
- (iii) Single-lane bridges that are assessed as bottle necks to traffic flow as assessed by an experienced traffic engineer.
- (iv) Bridges that are assessed to be of low load capacity; i.e., less than T33 load capacity.
- (v) Bridges that are assessed as *black spots* due to a high level of documented fatal road accidents at the bridges due to poor alignment or other features.
- (vi) Bridges on the sixteen priority national roads of PNG.¹

1.2. Bridge Prioritization Criteria

14. A multi-criteria analysis approach is adopted to prioritize the bridges accepted for inclusion in the bridge replacement program. The criteria are described in the following section.

1.2.1. Road Traffic

15. The level of traffic across a bridge has been adopted as one of the selection criteria as bridges carrying more traffic should attract higher priority than bridges carrying little traffic. The traffic factors are listed in Table 1-1.

Table 1-1: Traffic Factors

Traffic Level	Indicated Traffic (vehicles per day)	Traffic Factor
Very high	Over 1,400	5
High	800 – 1,399	4
Moderate	500 – 799	3
Low	250 – 499	2
Very low	Under 250	1

16. Indicated traffic volumes shall be assessed using the latest traffic survey data available from the DOW.

¹ See PNG's National Transport Development Plan (2006-2010).

1.2.2. Bridge Condition

17. The bridge condition has been adopted as one of the selection factors as bridges in a deteriorated condition should be replaced before bridges that remain in a good condition. Bridge condition shall be assessed under two headings:

- (i) Localized deterioration that could or should be addressed by routine or periodic maintenance and is generally non-critical to the integrity of the bridge, and
- (ii) Widespread deterioration that could not be economically rectified by routine or periodic maintenance.

18. Bridge deterioration that should be addressed by maintenance shall not be considered in the assessment of bridge condition. This includes such things as the painting of steel bridges. For Bailey bridges, missing components are not accepted as grounds for bridge replacement as these can be readily replaced. Bailey bridge deck deterioration was also not considered as critical. The bridge condition factors are listed in Table 1-2.

Table 1-2: Bridge Condition Factors

Bridge Condition	Description	Condition Factor
Bad	The bridge has severe structural damage and/or deterioration, or severe corrosion, or is likely to fail due to stream washout. Bridges with a very low load capacity (less than T33) would also be listed in this category.	4
Poor	The bridge has moderate structural damage and/or deterioration, or limited corrosion. The bridge has significant deterioration but the structure remains sound.	3
Fair	The bridge has minor structural damage and/or deterioration, or minor corrosion. Bridges with a load capacity less than the current T44 would also be listed in this category.	2
Good	Structure in a sound condition with a low risk that the structure would collapse or be washed out.	1

1.2.3. Bridge Residual Life Factor

19. While related to the bridge condition, a separate factor based on the residual life of each bridge is included to differentiate those bridges that were more at risk of failure as bridges that are likely to fail in service should attract more priority than bridges that retain residual life.

20. This assessment considers such items as fatigue failure of old Bailey bridges, extent of impact damage to bridges, failure of bridge foundations due to washout and loss of bridge superstructures due to flooding or debris loads. The risk that a bridge would be rendered useless by stream channel relocation due to unstable streams should also be included in this assessment. Design deficiencies, for example a bridge that had not been designed with seismic resistance, would also be assessed as appropriate. The bridge risk of failure factors are listed in Table 1-3.

Table 1-3: Bridge Failure Factors

Bridge Residual Life	Description	Condition Factor
1-year	Bridges with a very high risk of failure, for example an older model Bailey bridge of a high traffic road where a fatigue failure could occur, or a bridge with substantial structural damage that may not survive a heavy vehicle impact.	5
5-years	Bridges with a high risk of failure, for example a bridge where stream channel relocation is likely to wash out the bridge abutment.	4
10-years	Bridges where there is some risk of failure, for example impact damage on narrow Bailey bridges or bridges with gabion abutments that are likely to wash out in flood events.	3
20-years	Bridges where there are minor risk factors that could result in bridge failure such as the lack of seismic design features.	2
50 years	There are no factors that would result in loss of the bridge.	1

1.2.4. Alternative Routes

21. A further factor was included to allow for the availability of alternative routes for traffic, or the ease of construction of a temporary crossing, in the event of bridge failure as bridges that are critical to the normal functioning of the region served by a road should be given priority for replacement. The alternative route factors are listed in Table 1-4.

Table 1-4: Bridge Alternative Route Factors

Alternative Route	Description	Alternative Route Factor
Very high impact	Bridges where there is no alternative crossing available and it would be very difficult to construct a temporary stream crossing. A Bailey bridge would be required to reopen the stream crossing.	5
High impact	Bridges where there is no alternative crossing available and where the stream is large enough that a timber bridge would be necessary to reopen the stream crossing.	4
Moderate impact	Bridges where there is no alternative crossing available and where a wet crossing is available that can be readily upgraded to a dry crossing by causeway or minor timber bridge construction.	3
Low impact	An alternative stream crossing is available that require a significant traffic deviation or has poor road conditions.	2
Very low impact	An alternative stream crossing is available that does not require an excessive traffic deviation.	1

1.2.5. User Safety Factor

22. A further factor is included to allow for the safety of vehicles and pedestrians using the bridges, based on width of the bridge deck, the number of traffic lanes, the presence and usability of pedestrian footways, the alignment of the approach roads and the type of bridge superstructure. The bridge user safety factors are listed in Table 1-5.

Table 1-5: User Safety Factors

Safety Risk	Description	Safety Factor
Very high	This would apply to standard width single-lane Bailey bridges with no footways on a long straight road.	5
High	This category would apply for a Bailey bridge where separate suitable footways were provided. This would also apply to an over-width Bailey bridge.	4
Moderate	A narrow width of bridge deck may apply in this classification.	3
Low	A higher-speed road alignment would increase the safety factor	2
Very low	This category applies to two-lane bridges on high-traffic roads or single-lane bridges on low-traffic roads for short bridges.	1

1.2.6. Population Factors

23. A factor is included to consider the population served by the bridges as a way to include the social benefits accruing from the proposed replacement bridges. The population factors are listed in Table 1-6.

Table 1-6: Population Factors

Description	Population Factor
Population served greater than 200,000 persons	5
Population served between 150,000 and 200,000 persons	4
Population served between 100,000 and 150,000 persons	3
Population served between 50,000 and 100,000 persons	2
Population served less than 50,000 persons	1

1.2.7. Sub-Project Additional Works

24. A factor was included to consider the extent of the additional works such as road deviations or major river training required for the more difficult sub-projects in the selection process to reduce the inclusion of contentious bridges in the project and to enable the spread of the sub-projects across the nominated five roads. This factor considers the inclusion of major river training works, significant road deviations, the population of area affected by the project and the need for temporary bridges during construction. The bridge additional works factors are listed in Table 1-7.

Table 1-7: Subproject Additional Works Factors

Extent of Additional Works	Description	Additional Works Factor
Very high	This factor would apply to permanent crossing across major unstable streams requiring a major road deviation to an alternative stable bridge site and/or major river training works.	5
High	This factor may apply where a significant road deviation is required outside the road corridor to relocate the stream crossing to a stable or improved bridge site.	4
Moderate	This factor may apply when considerable river training is required outside the road corridor.	3
Low	This factor may apply where the replacement bridge would be located on the same alignment as the existing bridge and a temporary bypass road and stream crossing is required impacting outside the road corridor.	2
Very low	This factor would apply to a simple bridge replacement where the new bridge is constructed alongside the existing bridge and with minimal approach road works located within the existing road corridor.	1

1.3. Assessment and Priority

25. The bridges along each road shall be analyzed based on the bridge selection factors outlined above. The score for each bridge shall be assessed using the following formula:

$$\text{Score} = \text{TF}/5 + \text{BF}/4 + \text{FF}/5 + \text{AF}/5 + \text{SF}/5 + \text{PF}/5 - \text{CF}/5$$

TF Road traffic factor
 BF Bridge condition factor
 FF Bridge risk of failure factor
 AF Alternative route factor
 SF User safety factor
 PF Population factor
 CF Additional works factor

26. The score shall be calculated for each bridge and the bridges ranked for priority based on score with the bridges with the highest score attracting the highest priority.

1.4. Typical Bridge Assessment

27. The selection criteria were applied to a typical bridge as set out below to demonstrate the application and for guidance to future bridge engineers.

Bridge Details:	Koloi Bridge / New Britain Highway / Km49.0
Inclusion Criteria:	
Bailey bridge	Yes
Deteriorated bridge	Yes

Single-lane bridge	Yes
Low load capacity	Yes
<i>Black spot</i> bridge with poor safety record	No
Bridge on one of the 16 priority roads	Yes
	Bridge accepted on replacement program

Bridge Selection Criteria:	
Road traffic	Traffic assessed at 450vpd based on DOW traffic data TF = 2
Bridge condition	Bridge condition assessed as bad BF = 4
Bridge residual life factor	Bridge assessed that failure could occur at any time FF = 5
Alternative route factor	Bridge was assessed as having no alternative route and requiring the construction of a temporary timber bridge to restore traffic flow after failure AF = 4
User safety factor	The bridge was assessed as having a high risk to road users due to single-lane bridge, lack of a footway, and high vehicle speeds on a relatively straight sealed road. SF = 5
Population factor	The population served by the bridge was assessed to be 40,000 based on the population of the district. PF = 1
Sub-project additional works	The bridge replacement was assessed as requiring no additional works as the stream was stable and the existing road alignment suitable for replacement. CF = 1
Bridge Score:	
	The calculated score is 4.20

1.5. Prioritization of Bridges on Five Selected Priority National Roads

28. The criteria were applied on all bridges on the five project roads to rank them according to priority. Bridges that did not meet the inclusion criteria are marked with 'no replacement needed'. The following is the result of the analysis.

Table 1-8: Bridges on Hiritano Highway

Km	Road	Bridge Name	TF	BF	FF	AF	SF	PF	CF	Score	Ranking
0.0	Hiritano	Laloki Bridge	3	2	3	5	4	5	3	4.30	1
13.8	Hiritano	Rubulogo	No replacement needed								
22.5	Hiritano	Brown River	2	3	3	5	4	5	3	3.95	2
29.5	Hiritano	Veikabu	No replacement needed								
37.5	Hiritano	Vanapa	No replacement needed								
43.1	Hiritano	Kuriva	No replacement needed								
47.8	Hiritano	Veimauri	No replacement needed								

Km	Road	Bridge Name	TF	BF	FF	AF	SF	PF	CF	Score	Ranking
63.3	Hiritano	Mariboi	No replacement needed								
65.7	Hiritano	Baubau	No replacement needed								
84.1	Hiritano	Aroa	No replacement needed								
114.6	Hiritano	Aropokina	No replacement needed								
125.1	Hiritano	Ama Ama	No replacement needed								
141.2	Hiritano	Angabanga	1	3	4	4	4	2	3	3.15	3
158.3	Hiritano	Taiena	No replacement needed								
161.0	Hiritano	Angobino	No replacement needed								
162.4	Hiritano	Ungogo	No replacement needed								
180.5	Hiritano	Apanaiapi	No replacement needed								
191.3	Hiritano	Kapore	No replacement needed								
198.5	Hiritano	Lakekamu	No replacement needed								
200.0	Hiritano	Tauri	No replacement needed								
207.3	Hiritano	Makara	No replacement needed								
208.6	Hiritano	Sapeharo	No replacement needed								
285.0	Hiritano	Meporo	1	1	1	4	3	2	2	2.05	8
286.6	Hiritano	Karama	1	2	3	4	4	2	2	2.90	5
294.6	Hiritano	Lakikepi	New bridge is under construction								
298.0	Hiritano	Umai	New bridge is under construction								
303.4	Hiritano	Silo	1	2	3	4	2	2	2	2.50	7
308.0	Hiritano	Wara Kerema	New bridge is under construction								
312.8	Hiritano	Uriri Bridge	1	2	3	5	2	2	2	2.70	6

Table 1-9: Bridges on Magi Highway

Km	Road	Bridge Name	TF	BF	FF	AF	SF	PF	CF	Score	Ranking
0.0	Magi	Bautama	No replacement needed								
10.7	Magi	Konereke	No replacement needed								
15.4	Magi	Barakau	No replacement needed								
23.5	Magi	Vailala	No replacement needed								
30.7	Magi	Sabuia	No replacement needed								
51.5	Magi	Gomore	1	3	1	5	3	2	5	2.15	15
62.7	Magi	Dogona	1	2	2	4	4	2	1	2.90	2
68.4	Magi	Kwikila No 1	1	1	2	4	3	2	3	2.05	16
70.7	Magi	Kwikila No 2	New box culvert is under construction								
71.8	Magi	Kwikila No 3	New box culvert is under construction								
74.5	Magi	Kemp Welch	No replacement needed								
77.6	Magi	Kokebagu	1	2	3	4	4	2	2	2.90	3
80.7	Magi	Sivatana	1	4	4	4	4	2	2	3.60	1

Km	Road	Bridge Name	TF	BF	FF	AF	SF	PF	CF	Score	Ranking
105.0	Magi	Ibunatou	1	1	2	4	4	1	3	2.05	17
108.1	Magi	Wavira	1	1	2	4	4	1	2	2.25	12
119.8	Magi	Ormond	1	3	3	4	4	1	3	2.75	4
134.4	Magi	Lako	1	1	3	4	5	1	4	2.25	13
141.0	Magi	Upulima	1	1	2	4	4	1	1	2.45	11
148.4	Magi	Imila	1	1	3	5	4	1	2	2.65	9
158.6	Magi	Hane	1	1	3	4	4	1	3	2.25	14
196.3	Magi	Bomguina	1	3	2	4	4	1	2	2.75	5
204.7	Magi	Mori	1	2	2	4	4	1	1	2.70	6
212.1	Magi	Amou	1	2	3	4	4	1	2	2.70	7
218.0	Magi	Unei	1	2	2	4	4	1	2	2.50	10
221.8	Magi	Gadoguina	1	2	2	5	4	1	2	2.70	8

Table 1-10: Bridges on Ramu Highway

Km	Road	Bridge Name	TF	BF	FF	AF	SF	PF	CF	Score	Ranking
7.1	Ramu	Nippon	No replacement needed								
17.2	Ramu	Gusap	3	1	3	4	4	2	1	3.25	6
20.6	Ramu	Bora	3	2	4	4	4	2	1	3.70	4
25.9	Ramu	Lanu	No replacement needed								
30.7	Ramu	Warias	No replacement needed								
34.4	Ramu	Pompaquato	No replacement needed								
36.9	Ramu	Biwi	No replacement needed								
42.1	Ramu	Surinam	No replacement needed								
57.2	Ramu	Faria	No replacement needed								
58.2	Ramu	Dry Wara	3	3	4	4	5	2	3	3.75	2
61.0	Ramu	Menia	3	2	3	4	4	2	3	3.10	8
63.9	Ramu	Yokia	3	2	3	4	4	2	3	3.10	9
69.0	Ramu	Bokia	3	1	4	4	4	2	4	2.85	16
73.6	Ramu	Kohu	3	2	3	4	4	2	1	3.50	5
79.4	Ramu	Yakura	3	2	3	4	4	2	3	3.10	10
81.9	Ramu	Omea	3	2	3	3	4	2	3	2.90	13
85.6	Ramu	Yanama	No replacement needed								
90.4	Ramu	Boku	3	1	3	4	3	2	4	2.45	17
94.3	Ramu	Yakumbu	3	1	3	4	4	2	2	3.05	12
100.7	Ramu	Erae	No replacement needed								
112.1	Ramu	Mea	4	2	4	4	4	2	4	3.30	6
122.9	Ramu	Yakina	3	2	3	3	4	1	2	2.90	14
134.2	Ramu	Yabour	No replacement needed								

Km	Road	Bridge Name	TF	BF	FF	AF	SF	PF	CF	Score	Ranking
142.9	Ramu	Nuru	3	2	3	4	4	1	3	2.90	15
143.7	Ramu	Mupu	3	2	3	4	4	1	2	3.10	11
154.2	Ramu	Wasigo	3	3	4	4	4	1	1	3.75	3
159.5	Ramu	Tapo	3	5	5	4	5	1	3	4.25	1
172.1	Ramu	Gogol	No replacement needed								
185.3	Ramu	Gum	No replacement needed								
173.6	Ramu	Wagol	No replacement needed								

Table 1-11: Bridges on New Britain Highway

Km	Road	Bridge Name	TF	BF	FF	AF	SF	PF	CF	Score	Ranking
0.0	New Britain	Nuau	2	2	3	4	4	1	3	2.70	22
8.4	New Britain	Ulamona	2	4	4	4	3	1	1	3.60	8
20.0	New Britain	Ibana	2	3	3	4	4	1	1	3.35	12
20.4	New Britain	Big Navo	2	1	2	3	3	1	1	2.25	24
25.7	New Britain	Sabala	2	1	2	3	3	1	1	2.25	25
27.2	New Britain	Kabaiya	2	1	2	3	3	1	1	2.25	26
30.7	New Britain	Pika	2	4	5	5	5	2	1	4.60	1
35.3	New Britain	Soi	2	4	4	4	3	1	1	3.60	9
38.7	New Britain	Bamus	2	1	3	4	3	1	1	2.65	23
44.5	New Britain	Balima	No replacement needed								
45.5	New Britain	Peham	2	2	3	4	4	1	1	3.10	15
49.0	New Britain	Koloi	2	4	5	4	5	1	1	4.20	3
52.5	New Britain	Lobu	2	1	3	4	5	2	1	3.25	14
85.2	New Britain	Siali/Tiaru	2	4	5	4	5	2	4	3.80	4
88.2	New Britain	Kiava	2	2	3	4	5	2	1	3.50	10
93.3	New Britain	Aliai	2	1	2	4	3	2	3	2.25	27
94.1	New Britain	Aleeeu	2	4	3	4	4	2	3	3.40	11
96.1	New Britain	Ivule	2	4	5	4	5	2	4	3.80	5
101.1	New Britain	Yamule	2	3	5	5	4	3	4	3.75	6
107.1	New Britain	Obutabu	2	2	3	4	3	3	2	3.10	16
118.0	New Britain	Ala	2	1	3	4	4	3	2	3.05	19
129.6	New Britain	Kai	2	3	4	2	4	3	4	2.95	21
129.6	New Britain	Gavuvu	No replacement needed								
135.1	New Britain	Marapu	2	2	3	4	4	3	2	3.30	13
141.2	New Britain	Kuremu	2	2	3	4	3	3	2	3.10	17
143.3	New Britain	Bilomi	No replacement needed								
147.6	New Britain	Giriti	2	2	3	4	3	3	2	3.10	18
150.7	New Britain	Ubai	2	3	4	4	4	3	2	3.75	7

Km	Road	Bridge Name	TF	BF	FF	AF	SF	PF	CF	Score	Ranking
157.1	New Britain	Korori	2	4	5	5	3	3	1	4.40	2
158.6	New Britain	Galuku	2	1	3	4	3	3	1	3.05	20
167.3	New Britain	Pisi	No replacement needed								
177.4	New Britain	Kapiura	No replacement needed								
179.6	New Britain	Aum	No replacement needed								
207.8	New Britain	Ganuka	No replacement needed								
211.9	New Britain	Henderson	No replacement needed								

Table 1-12: Bridges on Sepik Highway

Km	Road	Bridge Name	TF	BF	FF	AF	SF	PF	CF	Score	Ranking
2.4	Sepik	Nagum	No replacement needed								
22.9	Sepik	Pasik	2	2	1	3	5	5	2	3.30	4
27.6	Sepik	Wara Sawa	2	1	1	3	4	5	2	2.85	8
40.2	Sepik	Ogama	2	2	3	3	3	5	2	3.30	5
43.1	Sepik	Potohu	2	2	1	3	4	5	2	3.10	6
46.7	Sepik	Hagama	2	1	1	3	4	5	2	2.85	9
58.5	Sepik	Wara Bung #1	2	1	1	3	3	5	2	2.65	11
61.5	Sepik	Katik	No replacement needed								
75.5	Sepik	Parchee	2	1	1	3	2	4	3	2.05	19
85.6	Sepik	Binik	No replacement needed								
101.5	Sepik	Nimbrim	2	1	1	5	3	4	2	2.85	10
107.4	Sepik	Ninam	1	1	1	3	3	4	2	2.25	15
113.8	Sepik	Amuk	1	2	3	3	4	4	2	3.10	7
120.2	Sepik	Malas	1	3	3	3	4	4	2	3.35	3
125.1	Sepik	Nanu	1	1	1	3	3	3	2	2.05	20
133.7	Sepik	Maiabong	1	1	1	5	3	3	2	2.45	13
152.0	Sepik	Yawatong	1	1	1	3	4	3	2	2.25	16
162.1	Sepik	Warasikau	1	1	1	3	4	3	2	2.25	17
170.0	Sepik	Kiagen	1	2	2	2	4	3	2	2.50	12
179.1	Sepik	Palpal	1	1	1	2	4	2	2	1.85	23
191.0	Sepik	Milak	1	1	1	3	3	2	2	1.85	24
194.7	Sepik	Wagasu	1	1	1	3	3	2	2	1.85	25
195.0	Sepik	Sunu	1	1	1	3	4	2	2	2.05	21
203.5	Sepik	Asini	1	4	3	3	5	2	2	3.40	1
212.5	Sepik	Nopan	1	1	3	2	4	1	2	2.05	22
214.7	Sepik	Waikar	1	1	3	2	4	1	3	1.85	26
220.5	Sepik	Mesi	1	1	3	4	4	1	2	2.45	14
226.7	Sepik	Yelbu	1	2	3	2	4	1	3	2.10	18

Km	Road	Bridge Name	TF	BF	FF	AF	SF	PF	CF	Score	Ranking
228.3	Sepik	Kefange	1	4	5	3	5	1	3	3.40	2

1.6. Other Factors

1.6.1. Connectivity

29. Bridges may gain additional priority if their construction improves the connectivity along a road, for example by reducing the frequency of road closures due to flooding. Recommended bridges where additional connectivity benefits will accrue are list in Table 1-13.

Table 1-13: Bridges that Provide Connectivity Benefits

Road	Bridges	Comment
Hiritano Highway	All bridges	No improvement in connectivity
Magi Highway	All bridges	No improvement in connectivity
New Britain Highway	Tiaru, Aliai Ivule, Yamule	These four bridges are frequently washed out and the road closed for indefinite periods due to flooding, effectively cutting the highway in two and disrupting road travel between Bialla and Kimbe
Ramu Highway	Tapo Ford Mea	This ford is frequently closed by flooding, disrupting travel between Madang and the Ramu valley to Lae. This bridge is now affected by inundation due to rising of the stream bed
Sepik Highway	Numerous causeways	The causeways are frequently closed by flooding, disrupting travel between Wewak, Maprik and Lumi

30. Connectivity considerations provide benefits in economic analysis due to the economic costs of temporary road closures, both in extended travel time and losses if produce cannot be delivered to markets prior to spoilage. Connectivity was considered but did not alter the selection of bridges.

1.6.2. Location

31. The location of the bridges should also be considered in a final selection of bridges to be constructed to maximize the benefits accrued from the project. Bridges that are remote from a major centre with port facilities will be more difficult to construct and therefore more expensive that will provide reduced benefits until the bridges closer to the major center are also upgraded. It is considered that provided the assessed priorities are similar, bridges closer to the main centre or bridges located on the sections of road with higher traffic volumes should be developed first. Bridge location issues for each of the five project roads are listed in Table 1-14.

Table 1-14: Bridge Location Issues

Road	Comment
Hiritano Highway	Bridges between Loloki and Bereina should be constructed first to complete this major artery. The road between Malalaua and Kerema will become a Kerema access road when the Trans Island missing link and the Kikori Road are constructed.
Magi Highway	At present, the Magi Highway is a Port Moresby feeder road and bridges closer to Port Moresby should be constructed initially. The more remote bridges will gain priority when the Milne Bay missing link is constructed.
New Britain Highway	Traffic is generally high along the full length of the road with focuses at Kimbe and Bialla. Bridges could be constructed along the full length.
Ramu Highway	The Ramu Highway along the Ramu Valley services a rapidly expanding agricultural area and should receive priority. The link from the Ramu Valley to Madang is also important and should experience traffic growth related to road improvements.
Sepik Highway	At present, the Sepik Highway is a Wewak feeder road servicing the high population around Maprik and Lumi. Bridges between Passam and Maprik should be constructed initially. The more remote bridges should be constructed later when the road conditions have improved.

1.7. Proposed Selection of Bridges

32. The proposed selection of bridges is based on the assessed bridge priority with selection modified to enable efficient civil works contracts packaging. The efficiency of bridge construction contracts will be maximized if contracts include bridges located in a small geographical area and the bridges in each contract are of a similar design enabling repetition in construction and standardization of construction equipment. The following changes were included to improve the likely outcomes of the project:

1.7.1. Sepik Highway

- (i) The Asini and Kefange bridges in Sandaun Province were omitted in favour of the Pasik, Ogama and Potohu bridges in East Sepik Province closer to Wewak as these bridges would have a greater economic return due to higher traffic and were seen as easier to construct compared to the more remote area with poor road access.

1.7.2. Hiritano Highway

- (i) The Angabanga River Bridge was included at the express request of the DOW because of the importance of this bridge to economic activity west of Bereina in the light of the significant risk of failure of the existing bridge.

1.7.3. Magi Highway

- (i) The Sivitatana Bridge is the only included bridge on the Magi Highway as the ranking of most bridges on this road were low

due to the low traffic density on this road. Two additional bridges were included on this road; the priority of these bridges is low but their construction together with the Sivitatana Bridge may have construction benefits.

- (ii) The Bomguina Bridge was replaced by the Ormond Bridge as an additional bridge as the Ormond Bridge is closer to Port Moresby and seen as more critical to the road network.

1.7.4. Ramu Highway

- (i) The Gusap River Bridge was included in preference to the Mea River Bridge on the Ramu Highway as it is adjacent to the high priority Bora River Bridge and it is logical that these two very similar bridges should be constructed together.
- (ii) The Mea River was omitted as the existing site is not suitable for a replacement bridge and as a long ill-defined deviation across steep terrain and slip prone land would be required.
- (iii) The Menia Bridge was included in lieu of the Mupu Bridge as the Mupu River is adjacent to the Nuru River and the preferred solution for the Nuru River crossing is at a more stable site downstream of the existing bridge that eliminates a crossing of the Mupu River.

1.7.5. New Britain Highway

- (i) The Tiaru, Ivule and Yamule crossings were deferred to a future stage as they require significant road deviations to suitable bridge sites.

33. The proposed selection of bridges is in Table 1–15.

Table 1-15: Proposed Bridges for Replacement

Road	Province	Bridge	Chainage (km)	Bridge Length (m)	Est. Cost ² (\$ million)
Hiritano	Central	Laloki	0.0	75.0	5.4
		Brown	22.5	75.0	4.8
		Angabanga	141.1	140.0	8.4
Magi	Central	Dogona	62.7	10.0	1.0
		Sivitatana	80.7	22.0	1.8
		Kokebagu	77.6	16.0	1.3
New Britain	WNB	Ulamona	8.4	6.0	0.7
		Ibana	20.0	40.0	3.1
		Pika	30.7	40.0	3.4
		Soi	35.3	24.0	2.0

² Include costs of replacing existing Bailey bridges with two-lane permanent bridges and re-assembling useable Bailey bridges on rural roads.

Road	Province	Bridge	Chainage (km)	Bridge Length (m)	Est. Cost ² (\$ million)
		Koloi	49.0	40.0	3.7
		Lobu	52.5	30.0	3.3
		Kiava	88.2	24.0	2.9
		Aleeeu	94.1	9.0	1.1
		Otutabu	107.1	36.0	3.2
		Marapu	135.1	6.0	0.9
		Ubai	150.6	16.0	1.5
		Korori	157.1	30.0	2.9
Ramu	Madang	Gusap	17.2	40.0	4.8
		Bora	20.6	45.0	5.3
		Dry Wara	58.2	40.0	3.6
		Kohu	73.6	9.0	1.1
		Wasigo	154.2	40.0	4.2
		Tapo Ford	159.5	40.0	3.1
Sepik	East Sepik	Pasik	22.9	30.0	2.7
		Ogama	40.2	30.0	2.4
		Potohu	43.1	20.0	1.8

34. Table 1-16 includes an additional list of bridges that can be used to provide flexibility in the final selection of bridges for replacement. The additional bridges can be added to the project if some of the proposed bridges cannot be constructed due to land acquisition and safeguards issues or if there are loan savings.

Table 1-16: Additional Bridges for Replacement

Road	Province	Bridge	Chainage (km)	Bridge Length (M)	Est. Cost (USD m)
Magi	Central	Ormond	119.8	96.0	7.2
New Britain	WNB	Peham	45.5	22.0	2.0
		Kai	129.6	20.0	2.2
		Kuremu	141.2	20.0	2.0
		Giriti	147.6	16.0	1.5
		Galuku	158.6	28	2.8
Ramu	Madang	Menia	61.0	40.0	3.4
		Yokia	63.9	36.0	3.3
		Yakura	79.4	30.0	2.7
Sepik	East Sepik	Malas	120.2	20.0	1.7

2. Guidelines for Selecting Bridge Sites on Rural Roads

35. An important aspect of the bridge replacement program involves reassembly of usable Bailey bridges at bridge sites on rural roads. These sites will be identified in consultation with

the DOW and the provincial governments during implementation. The number of Bailey bridges that can be used on rural roads will be based on the number and lengths of Bailey bridges that are replaced.

36. The proposed bridge sites on rural roads will be selected for consideration under the project based on the following criteria:

- (i) The bridge sites will be located on existing rural roads where streams have not been bridged or the prior bridges have failed.
- (ii) The bridge sites shall be suitable for the construction of bridges and shall provide stable sites without major road relocations or extensive river training.
- (iii) The bridge sites shall be generally located in the same province as the replacement bridges from where they will be released, and road access suitable for transport of the Bailey bridging and construction of the reuse bridge shall be available without major road construction or maintenance.
- (iv) The bridges will improve year-round access for the rural population, particularly women, to health centers, schools and markets.
- (v) The bridge sites shall be suitable for bridges constructed using a single-span Bailey bridge with a maximum length of 30 m.
- (vi) The Provincial Governments will provide the land required for the construction of the reuse bridges free of any compensation from the project.
- (vii) The sites selection must reflect local priorities as reflected by documented participation of all stakeholders.

37. The reuse bridges to be constructed will be selected, where the identified number of bridge sites is greater than the number of Bailey bridges that will be released from the permanent bridge sites, based on the following criteria in consultation with the Provincial Government concerned:

- (i) Availability of alternative methods of crossing the stream,
- (ii) Distance between the reuse bridge site and the replacement bridge from where the Bailey bridging will be released.
- (iii) Frequency and duration of periods when stream crossing is not possible due to flooding,
- (iv) Assessed personal safety of crossing the stream without the bridge,
- (v) Population served by the proposed bridge, and
- (vi) Condition and maintenance level of the approach road to the bridge site.

38. The bridges will be ranked for priority based on the above criteria. The process for selection of the reuse bridge sites will include:

- (i) Assessment of quantity of Bailey bridging that will be released from the replacement bridges in each province. This will include the assessment of the condition of the Bailey bridging, the assessment of the requirement for replacement or additional parts and the determination of the number and/or length of Bailey bridging that can be reused. For long-span existing bridges, the acquisition of additional members such as transoms may enable the length of Bailey to be maximized and minimize wastage of unused parts.
- (ii) Assessment of the requirement for reuse bridges in the province and preparation of a list of possible prioritized reuse bridges, as described above.
- (iii) Allocation of the reuse bridges to be constructed under each contract and in the province.

IV. COSTS AND FINANCING

39. The Project is estimated to cost \$100.00 million. The total cost includes physical and price contingencies, and interest and other charges during implementation. The ADB loan will fund ADB-financed civil works, related consulting services, equipment, and project management totaling \$90.00 million, including interest during construction. Counterpart funds (\$10 million) will be allocated for civil works, resettlement and taxes and duties.

A. Detailed Cost Estimates by Expenditure Category

40. The total cost of the project is estimated at \$100.00 million equivalent including taxes, duties, physical and price contingencies, interest, and other charges. The summary of cost estimates for the project is in Table 4.1.

Table 4.1. Detailed Cost Estimate by Expenditure Category
(\$000's)

I. Investment Costs	Kina			US\$			% of Total Cost
	Local	Foreign	Total	Local	Foreign	Total	
A. Civil Works	23,450	159,550	183,000	9,380	63,820	73,200	73%
B. Resettlement	1,550	0	1,550	620	0	620	1%
C. Consulting services							
1. International Consultants	0	18,124	18,124	0	7,250	7,250	7%
2. National Consultants	0	1,850	1,850	0	740	740	1%
3. International Travel	0	370	370	0	148	148	0%
4. Domestic Travel	0	906	906	0	363	363	0%
Subtotal Consulting Services	0	21,250	21,250	0	8,500	8,500	8%
D. Road Safety Awareness in Rural Areas	0	1,375	1,375	0	550	550	1%
E. Capacity Development of DOW's BAMS	0	1,625	1,625	0	650	650	1%
Total Investment Costs	25,000	183,800	208,800	10,000	73,520	83,520	
II. Recurrent Costs							
A. Project Administration	0	1,750	1,750	0	700	700	1%
Total recurrent costs	0	1,750	1,750	0	700	700	1%
Total Project Base Costs	25,000	185,550	210,550	10,000	74,220	84,220	84%
III. Contingencies			0	0	0	0	
A. Physical Contingencies	0	18,227	18,227	0	7,291	7,291	7%
B. Price Contingencies	0	15,221	15,221	0	6,088	6,088	6%
Sub - total contingencies	0	33,449	33,449	0	13,379	13,379	13%
IV. Loan Financing Charges							
A. Interest during implementation	0	5,376	5,376	0	2,151	2,151	2%
B. Commitment Charge	0	626	626	0	250	250	0%
Total project costs (II+III+IV)	25,000	225,001	250,001	10,000	90,000	100,000	100%

Source: Asian Development Bank estimates.

B. Allocation and Withdrawal of Loan Proceeds

41. Table 4.2 shows allocation and withdrawal of funds under all the categories of the Project.

Table 4.2. Allocation and Withdrawal of Loan Proceeds

Category		ADB Financing	
No	Item	ADB Financing \$000's	Percentage and Basis for Withdrawal from the Loan Account
1	Civil Works	63,885	87 percent of total expenditure claimed
2	Consulting Services	8,500	100 percent of total expenditure claimed ^a
3	Road Safety Awareness in Rural Areas	495	100 percent of total expenditure claimed ^a
4	Capacity Development of DOW's BAMS	640	100 percent of total expenditure claimed ^a
5	Project Administration	700	100 percent of total expenditure claimed ^a
6	Financing (ADF Loan Interest)	1,419	100 percent of amounts due
7	Financing (OCR Loan Interest)	732	100 percent of amounts due
8	OCR Loan Commitment Charge	250	100 percent of amounts due
9	Unallocated	13,379	
Total		90,000	

^a Excluding local taxes and duties.

Category		ADB Financing ADF Loan	
No	Item	ADB Financing \$000's	Percentage and Basis for Withdrawal from the Loan Account
1	Civil Works	24,867	34 percent of total expenditure claimed
2	Consulting Services	8,500	100 percent of total expenditure claimed ^a
3	Road Safety Awareness in Rural Areas	495	100 percent of total expenditure claimed ^a
4	Capacity Development of DOW's BAMS	640	100 percent of total expenditure claimed ^a
5	Project Administration	700	100 percent of total expenditure claimed ^a
6	Financing (ADF Loan Interest)	1,419	100 percent of amounts due
7	Unallocated	13,379	
Total		50,000	

^a Excluding local taxes and duties.

Category		ADB Financing OCR Loan	
No	Item	ADB Financing \$000's	Percentage and Basis for Withdrawal from the Loan Account
1	Civil Works	39,018	53 percent of total expenditure claimed
2	Financing (OCR Loan Interest)	732	100 percent of amounts due
3	OCR Loan Commitment Charge	250	100 percent of amounts due
Total		40,000	

C. Detailed Cost Estimates by Financier

Amounts in \$000	Government		ADB ADF		ADB OCR		ADB Total		
	Total	Amount	%	Amount	%	Amount	%	Amount	%
I. Investment Costs									
A. Civil Works	73,200	9,315 ^a	13%	24,867	34%	39,018	53%	63,885	87%
B. Resettlement	620	620	100%	0	0%	0	0%	0	0%
C. Consulting services									
1. International Consultants	7,250	0	0%	7,250	100%	0	0%	7,250	100%
2. National Consultants	740	0	0%	740	100%	0	0%	740	100%
3. International Travel	148	0	0%	148	100%	0	0%	148	100%
4. Domestic Travel	363	0	0%	363	100%	0	0%	363	100%
Subtotal Consulting Services	8,500	0	0%	8,500	100%	0	0%	8,500	100%
D. Road Safety Awareness in Rural Areas	495	0	0%	495	100%	0	0%	495	100%
E. Capacity Development of DOW's BAMS	640	0	0%	640	100%	0	0%	640	100%
II. Taxes and Duties^b	65	65	100%	0	0%	0	0%	0	0%
Total Investment and Taxes and Duties Costs	83,520	10,000	12%	34,502	41%	39,018	47%	73,520	88%
III. Recurrent Costs									
A. Project Administration	700	0	0%	700	100%	0	0%	700	100%
Total recurrent costs	700	0	0%	700	100%	0	0%	700	100%
Total Project Base Costs	84,220	10,000	12%	35,202	42%	39,018	46%	74,220	88%
IV. Contingencies									
A. Physical Contingencies	7,291	0	0%	7,291	100%	0	0%	7,291	100%
B. Price Contingencies	6,088	0	0%	6,088	100%	0	0%	6,088	100%
Sub - total contingencies	13,379	0	0%	13,379	100%	0	0%	13,379	100%
V. Loan Financing Charges									
A. Interest during implementation	2,151	0	0%	1,419	66%	732	34%	2,151	100%
B. Commitment Charge	250	0	0%	0	0%	250	100%	250	100%
Total project costs (I+II+III+IV+V)	100,000	10,000	10%	50,000	50%	40,000	40%	90,000	90%

^a Inclusive of taxes and duties of \$7.28 million.

^b All other taxes and duties (excluding civil works) of \$0.65 million.

Source: Asian Development Bank estimates.

D. Detailed Cost Estimates by Outputs

Amount in \$000	Outputs 1 and 2			Output 3		Output 4		Project Administration		Total
	Total	Amount	% of Cost	Amount	% of Cost	Amount	% of Cost	Amount	% of Cost	
I. Investment Costs^a										
A. Civil Works	73,200	73,200	100%	0	0%	0	0%	0	0%	73,200
B. Resettlement	620	620	100%	0	0%	0	0%	0	0%	620
C. Consulting services										
1. International Consultants	7,250	7,250	100%	0	0%	0	0%	0	0%	7,250
2. National Consultants	740	740	100%	0	0%	0	0%	0	0%	740
3. International Travel	148	148	100%	0	0%	0	0%	0	0%	148
4. Domestic Travel	363	363	100%	0	0%	0	0%	0	0%	363
Subtotal Consulting Services	8,500	8,500	100%	0	0%	0	0%	0	0%	8,500
D. Road Safety Awareness in Rural Areas	550	0	0%	0	0%	550	100%	0	0%	550
E. Capacity Development of DOW's BAMS	650	0	0%	650	100%	0	0%	0	0%	650
Total Investment Costs	83,520	82,320	99%	650	1%	550	1%	0	0%	83,520
II. Recurrent Costs										
A. Project Administration	700	0	0%	0	0%	0	0%	700	0%	700
Total recurrent costs	700	0	0%	0	0%	0	0%	700	0%	700
Total Project Base Costs	84,220	82,320	98%	650	1%	550	1%	700	1%	84,220
III. Contingencies										
A. Physical Contingencies ^b	7,291	7,127	98%	56	1%	48	1%	61	1%	7,291
B. Price Contingencies ^c	6,088	5,951	98%	47	1%	40	1%	51	1%	6,088
Sub - total contingencies	13,379	13,077	98%	103	1%	87	1%	111	1%	13,379
IV. Loan Financing Charges^d										
A. Interest during implementation	2,151	2,102	98%	17	1%	14	1%	18	1%	2,151
B. Commitment Charge	250	250	100%	0	0%	0	0%	0	0%	250
Total project costs (I+II+III+IV+V)	100,000	97,749	98%	770	1%	651	1%	829	1%	100,000
% of Total Project Cost		97.75%		0.77%		0.65%		0.83%		

^a In mid-2011 prices.

^b Computed at 10% for civil works and 5% for equipment and services.

^c based on cost escalation factors for PNG for local currency costs, there is a devaluation offset included in the price contingency based on the US\$ inflation rate of 1%.

^d Includes interest during implementation computed at 1% on the ADF loan and five year LIBOR rate plus spread on the OCR loan.

Source: Asian Development Bank estimates.

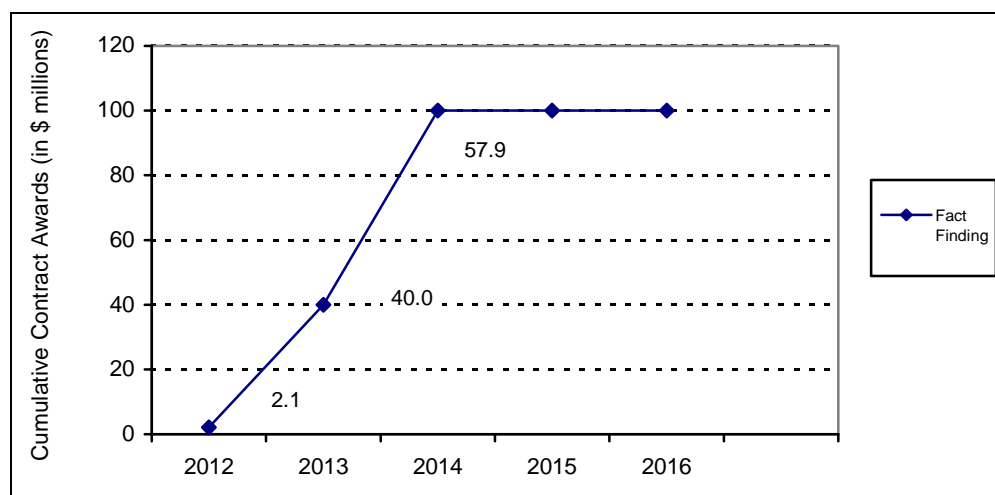
E. Detailed Cost Estimates by Year

Amounts in \$000's	2012	2013	2014	2015	2016	Total
I. Investment Costs						
A. Civil Works	0	7,320	21,960	21,960	21,960	73,200
B. Resettlement	0	62	186	186	186	620
C. Consulting services						0
1. International Consultants	725	1,450	1,812	1,812	1,450	7,250
2. National Consultants	74	148	185	185	148	740
3. International Travel	15	30	37	37	30	148
4. Domestic Travel	36	73	91	91	73	363
Subtotal Consulting Services	850	1,700	2,125	2,125	1,700	8,500
D. Road Safety Awareness in Rural Areas	0	138	138	138	138	550
E. Capacity Development of DOW's BAMS	0	163	163	163	163	650
Total Investment Costs	850	9,382	24,571	24,571	24,146	83,520
II. Recurrent Costs						
A. Project Administration	70	140	175	175	140	700
Total recurrent costs	70	140	175	175	140	700
Total Project Base Costs	920	9,522	24,746	24,746	24,286	84,220
III. Contingencies						
A. Physical Contingencies	80	824	2,142	2,142	2,102	7,291
B. Price Contingencies	24	463	1,561	1,881	2,160	6,088
Sub - total contingencies	104	1,287	3,703	4,023	4,262	13,379
IV. Loan Financing Charges						
A. Interest during implementation	8	94	317	597	1,135	2,151
B. Commitment Charge	59	59	59	53	21	250
Total project costs (I+II+III+IV+V)	1,091	10,962	28,825	29,419	29,703	100,000
Expenditure per year (%)	1%	11%	29%	29%	30%	100%

Source: Asian Development Bank estimates.

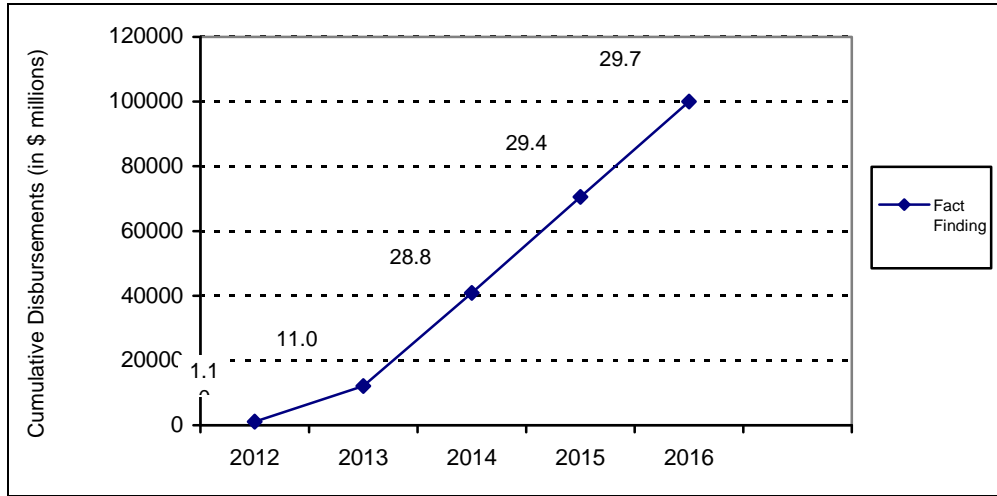
F. Contract and Disbursement S-curve

a. Contract Awards Projection



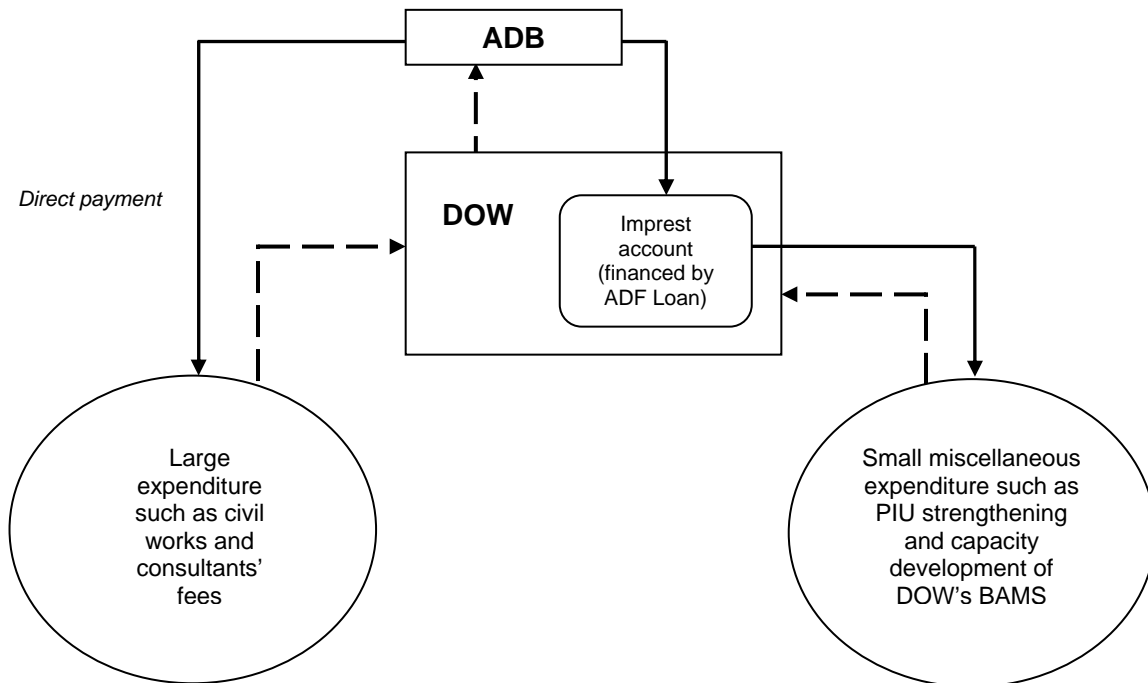
Year	2012	2013	2014	2015	2016
\$'000	2,104	40,000	100,000	100,000	100,000

b. Loan Disbursement Projections



Year	2012	2013	2014	2015	2016
\$'000	1,091	12,053	40,878	70,581	100,000

G. Fund Flow Diagram



Flow of funds
 Flow of documents (withdrawal applications and claims)

ADB = Asian Development Bank, DOW = Department of Works.

V. FINANCIAL MANAGEMENT

42. The Department of Works (DOW) has implemented several development partner funded projects, including projects financed by ADB and accordingly this project will be managed through the existing DOW Project Implementation Unit (PIU) structure.³

A. Financial Management Assessment

43. An assessment was undertaken of the current PIU with recommendations identified for strengthening this for the current project. That assessment concluded that project management arrangements are reasonably robust, though some reorganization and strengthening for this project is recommended. At the project management level, it is recommended the project Director report to the First Assistant Secretary – Contract Administration rather than directly to the DOW Secretary. This change had been previously identified by DOW. A Project Engineer – Bridges, reporting to the Project Director, will be recruited. Finally, some additional support for the Project Accountant will be required.

44. There have been no significant financial management issues raised in external audit reports, or in other reports used by DOW and key stakeholders for monitoring existing PIU projects. It is envisaged that the financial management arrangements currently in place by the PIU will continue to be followed for this project.

45. The PIU will ensure project outputs are produced on time and within budget, and ensure effectiveness in achieving the project's outcome by (i) managing the planning and implementation of the project, (ii) undertaking project management including coordination within DOW and with outside stakeholders, (iii) engaging and managing consultants (for detailed design and implementation support), (iv) managing project financing, accounting and auditing, (v) undertaking monitoring, evaluation and reporting of project progress, (vi) monitoring key project approvals, and (vii) planning expanding the project in phases to cover PNG's ongoing bridge replacement needs.

46. Reflecting the need for coordination across all aspects of the project, DOW will establish a Project Steering Committee (PSC), to be chaired by the DOW Secretary and include representatives from NRA, DOT, NRSC, DNPM and DT. The PSC will meet quarterly, or more frequently as required, for the duration of the project.

47. Major risks and mitigating measures were identified and described in detail in the risk assessment and risk management plan. Financial management risks should be considered and updated throughout the life of the project. Risk mitigation measures should also be updated accordingly.

B. Disbursement

48. The Loan proceeds will be disbursed in accordance with ADB's *Loan Disbursement Handbook* (2007, as amended from time to time),⁴ and detailed arrangements agreed upon between the Government and ADB.

³ The PIU is currently responsible for (i) MFF–Facility Concept–0029 PNG: Multitranches Financing Facility – Highlands Region Road Improvement Investment Program, and (ii) Loan 2242/2243 PNG: Road Maintenance and Upgrading (Sector) Project.

⁴ Available at: http://www.adb.org/Documents/Handbooks/Loan_Disbursement/loan-disbursement-final.pdf.

49. Pursuant to ADB's *Safeguard Policy Statement (2009)* (SPS),⁵ ADB funds may not be applied to the activities described on the ADB Prohibited Investment Activities List set forth at Appendix 5 of the SPS. All financial institutions will ensure that their investments are in compliance with applicable national laws and regulations and will apply the prohibited investment activities list (Appendix 5) to subprojects financed by ADB.

50. Procedures for withdrawal of loan proceeds will either follow (i) **direct payment** procedure or (ii) **imprest fund** procedure.⁶ Commitment procedure, reimbursement procedure, and statement of expenditures procedure will not be used. Under direct payment procedure ADB, at the borrower's request, pays a designated beneficiary directly. Under imprest fund procedure ADB makes an advance disbursement from the loan account for deposit to an imprest account to be used exclusively for ADB's share of eligible expenditures. In the case of this project, direct payment procedure will be used for large civil works, progress payments, consultants' fees, and procurement of goods. Imprest fund procedure will be used for small miscellaneous expenditure including the expenditure associated with the capacity development of the bridge asset management system and the road safety awareness campaigns in rural areas. The PIU in DOW will be responsible for (i) preparing disbursement projections, (ii) collecting supporting documents, and (iii) preparing and sending withdrawal applications to ADB.

51. One imprest account will be established and administered by DOW financed by the ADF loan. The imprest account will be held in US dollars at a commercial bank acceptable to ADB. The maximum ceiling of the imprest account will not at any time exceed the estimated ADB financed expenditures to be paid from the imprest account for the next 6 months or 10% of the respective loan amount, whichever will be lower. The request for initial advance to the imprest account should be accompanied by an Estimate of Expenditure Sheet⁷ setting out the estimated expenditures for the first six (6) months of project implementation, and submission of evidence satisfactory to ADB that the imprest account has been duly opened. For every liquidation and replenishment request of the imprest account, the borrower will furnish to ADB (a) Statement of Account (Bank Statement) where the imprest account is maintained, and (b) the Imprest Account Reconciliation Statement (IARS) reconciling the above mentioned bank statement against the EA's records.⁸

52. Before the submission of the first withdrawal application, DT should submit to ADB sufficient evidence of the authority of the person(s) who will sign the withdrawal applications on behalf of the Borrower, together with the authenticated specimen signatures of each authorized person. The minimum value per withdrawal application is US\$100,000, unless otherwise approved by ADB. DOW is to consolidate claims to meet this limit for imprest account claims. Withdrawal applications and supporting documents will demonstrate, among other things that the goods, and/or services were produced in or from ADB members, and are eligible for ADB financing.

53. Procedures for the disbursement and liquidation of government funds will follow the Public Finances (Management) Act 1995, the Financial Management Manual and Finance Instructions. The government contribution to project costs will be budgeted for in each project year.

⁵ Available at: <http://www.adb.org/Documents/Policies/Safeguards/Safeguard-Policy-Statement-June2009.pdf>.

⁶ Available at: http://www.adb.org/documents/handbooks/loan_disbursement/chap-06.pdf.

⁷ Available in Appendix 29 of the *Loan Disbursement Handbook*.

⁸ Follow the format provided in Appendix 30 of the *Loan Disbursement Handbook*.

C. Accounting

54. DOW and PIU will maintain separate project accounts and records by funding source for all expenditures incurred on the project. Project accounts will follow international accounting principles and practices.

D. Auditing

55. DOW will cause the detailed consolidated project accounts to be audited in accordance with International Standards on Auditing by an auditor acceptable to ADB. The audited accounts will be submitted in the English language to ADB within 6 months of the end of the fiscal year by the executing agency. The annual audit report will include a separate audit opinion on the use of the imprest account. The Government and DOW have been made aware of ADB's policy on delayed submission, and the requirements for satisfactory and acceptable quality of the audited accounts. ADB reserves the right to verify the project's financial accounts to confirm that the share of ADB's financing is used in accordance with ADB's policies and procedures.

VI. PROCUREMENT AND CONSULTING SERVICES

56. An EA procurement capacity assessment was completed by PPTA consultants and was largely based on the recently completed AusAID Transport Sector Procurement Diagnostic Draft Report (dated 4 March 2011) carried out for DOW, as well as Country Procurement Assessment Review (CPAR) report for PNG which was concluded in October 2010 using the OECD – DAC benchmark assessment methodology. The results of the EA procurement capacity assessment have been linked with the Risk Assessment and Management Plan that is attached to the MOU.

57. Implementation of the project will be undertaken through an expanded PIU currently located in DOW and supporting several other ADB projects.

A. Advance Contracting

58. **Advanced Recruitment of Consultants.** The Government in consultation with ADB has initiated advance contract action for engagement of implementation support consultant (the consultant) for detailed design, construction supervision and overall implementation support. Depending on the performance of the Consultant during detailed design, Single Source Selection can be used to engage the Consultant for implementation support including contract supervision. All advance contracting will be undertaken in accordance with ADB's *Guidelines on the Use of Consultants* (April, 2010, as amended from time to time) (ADB's *Guidelines on the Use of Consultants*).⁹ The issuance of request for proposal under advance contracting will be subject to ADB approval. The borrower, executing and implementing agencies have been advised that approval of advance contracting does not commit ADB to finance the project.

B. Procurement of Goods, Works and Consulting Services

59. **Procurement of Goods and Civil Works** will be undertaken in accordance with ADB's Procurement Guidelines (April 2010, as amended from time to time).

60. The planned procurement will comprise four civil works packages as follows: (i) replacement of bridges on Hiritano and Magi Highways; (ii) replacement of bridges on New Britain Highway; (iii) replacement of bridges on Ramu Highway; and (iv) replacement of bridges on Sepik Highway. The usable Bailey bridges will be reassembled on rural roads identified by participating provinces. In addition, one goods supply package for IT equipment related to an inventory update of DOW Bridge Asset Management System (BAMS).

61. The project supports the use of local contractors where capacity exists. Where capacity does not exist, ADB strongly encourages local contractors to form joint venture (JV) with more experienced international contractors. Where JV arrangements are proposed, a key element should be gradual development of local capacity.

62. **Procurement of Civil Works** will follow a combination of National Competitive Bidding (NCB) and International Competitive Bidding (ICB). NCB will be used for procurement packages between US\$100,000-US\$3 million. International competitive bidding (ICB) will be used for civil works contracts exceeding US\$3 million. The procurement method will be confirmed after detailed bridge designs and estimates are completed. All 4 civil works bridge replacement contracts will allow for alternative bids offering alternative technical design solutions.

⁹ Available at: <http://www.adb.org/Documents/Guidelines/Consulting/Guidelines-Consultants.pdf>.

63. A procurement plan indicating threshold and review procedures, goods, works, and consulting service contract packages and national competitive bidding guidelines is in **Section C**.

64. **Consulting Services:** All recruitment of consultants will be conducted in accordance with ADB's Guidelines on the Use of Consultants (April 2010, as amended from time to time).¹⁰ The planned procurement will comprise one package for design, supervision of civil works, and overall implementation support. The quality- and cost-based selection (QCBS) method will be used with a standard quality cost ratio of 80:20 and the use of Full Technical Proposals. Depending on the performance of the Consultant during detailed design, Single Source Selection can be used to engage the same Consultant for the downstream assignment of implementation support including contract supervision subject to satisfactory performance of the first phase of the assignment. An estimated 63 person-months (51 international and 12 National) are anticipated to undertake detailed design and 204 person-months (108 international and 96 National) are anticipated to undertake implementation support including contract supervision.

65. Consultant recruitment will also include one package of Road Safety awareness in rural areas. The National Road Safety Council (NRSC) will be recruited for this assignment using SSS in accordance with para 1.13 c of the ADB Guidelines on the Use of Consultants (2010, as amended from time to time) which allows government owned entities to be recruited on a case by case basis if their participation is critical to project implementation.

66. The terms of reference for all consultants are detailed in Section D.

67. Before the start of any procurement, ADB and the Government will review the public procurement laws of the central and state governments to ensure consistency with ADB's *Procurement Guidelines*.

C. Procurement Plan

68. This procurement plan shows the thresholds and particular contracts required to carry out the project. Project information for the procurement plan is in **Table 1**.

Table 1: Project Information

Country	Papua New Guinea
Name of Borrower	Independent State of Papua New Guinea
Project Name	Bridge Replacement for Improved Rural Access Sector Project
Project No.	43200
Date of Effectiveness	
Amount	US\$100 million
Executing Agency	Department of Works
Approved Date of Original Procurement Plan	29 June 2011
Approval of Most Recent Procurement Plan	2 September 2011
Publication for Local and International Advertisements - Consultant	Target 2 nd Qtr 2011
Publication for Local and International Advertisements - Contractor	Target 4 th Qtr 2012
Period Covered by this Plan	Until 31 December 2012

¹⁰ Checklists for actions required to contract consultants by method available in e-Handbook on Project Implementation at: <http://www.adb.org/documents/handbooks/project-implementation/>.

1. Process Thresholds, Review and Procurement Plan

69. Equipment, materials and goods, and services financed under the loan will be procured in accordance with the Asian Development Bank's *Procurement Guidelines* (April 2010, as amended from time to time) and follow ADB procedures.

1.1. Project Procurement Thresholds for Goods and Works

70. Except as ADB may otherwise agree, the following process thresholds in **Tables 2** and **3** shall apply to procurement of goods and works.

Table 2: Procurement of Goods and Works

Procurement Method	To Be Used Above (Value US\$)
Goods	
International Competitive Bidding (ICB)	>1,000,000
National Competitive Bidding (NCB)	>100,000 and <= 1,000,000
Shopping	Usage subject to the provisions of NCB annex <= 100,000
Works	
ICB	>3,000,000
NCB	>100,000 and <= 3,000,000
Shopping	Usage subject to the provisions of NCB annex <=100,000

ICB = international competitive bidding, NCB = national competitive bidding.

1.2. Procurement Thresholds for Consulting Services

Table 3: Procurement of Consultancy Services

Procurement Method	To be used above (Value US\$)
Quality- and Cost-Based Selection (QCBS) will be used for the procurement of Consultancy Services Single-source Selection (SSS) may be used for the procurement of the Consultant to undertake Implementation Support and for the recruitment of Road Safety awareness campaign consultants Individual Consultant recruitment	International and national consultants recruited through a firm will be engaged through QCBS and SSS depending on specific circumstances.

1.3. ADB Prior or Post Review

71. Except as ADB may otherwise agree, the following prior or post review requirements in **Table 4** apply to the various procurement and consultant recruitment methods used for the project.

Table 4: ADB Prior or Post Review

Procurement Method	Prior or Post	Comments
Procurement of Goods and Works		
ICB Works	Prior	
ICB Goods	Prior	
NCB Works	Prior	
NCB Goods	Prior	
Shopping for Works	Prior	
Shopping for Goods	Post	
Recruitment of Consulting Firms and NGO		
Quality- and Cost-Based Selection (QCBS)	Prior	(80:20)
Other selection method: Single Source Selection(SSS)	Prior	
Recruitment of Individual Consultants		
Individual Consultants	Prior	

1.4. Consulting Services Contracts Estimated to Cost More Than US\$100,000

72. The following table lists consulting services contracts for which procurement activity is either ongoing or expected to commence within the next 18 months.

Table 5: Consulting Services Contracts Estimated to Cost More than US\$100,000

General Description	Contract Value (US\$ millions)	Procurement Method	Advertisement Date (Quarter/Year)	International or National Assignment
Project Implementation	2.5	QCBS	Q2 11	Both
Support - Detailed Design	6.0	SSS or QCBS	Q3 12	Both
Road Safety Awareness in Rural Areas	0.5	SSS	xxxx	National
Project Administration/ Additional PIU Staff		Individual	xxxx	National

1.5. Works Contracts Estimated to Cost More Than US\$1 Million

73. The following table lists works contracts for which procurement activity is either ongoing or expected to commence within the next 18 months.

Table 6: Works Contracts Estimated to Cost More Than US\$ 1 Million

General Description	Contract Value (US\$ millions)	Procurement Method	Prequalification of Bidders (Yes/No)	Advertisement Date (Quarter/Year)
Reconstruction and Replacement of Bridges on Hiritano and Magi Highways	20.3	ICB	No	Q3 12
Reconstruction and Replacement of Bridges on New Britain Highway	26.2	ICB	No	Q4 12

General Description	Contract Value (US\$ millions)	Procurement Method	Prequalification of Bidders (Yes/No)	Advertisement Date (Quarter/Year)
Reconstruction and Replacement of Bridges on Ramu Highway	19.7	ICB	No	Q1 13
Reconstruction and Replacement of Bridges on Sepik Highway	7.0	ICB	No	Q1 13

1.6. Goods Contracts Estimated to Cost Less than US\$1 Million

74. The following table groups smaller-value goods contracts for which procurement activity is either ongoing or expected to commence within the next 18 months.

Table 7: Goods Contracts Estimated to Cost Less than US\$ 1 Million

General Description	Value of Contracts (US\$)	Number of Contracts	Procurement / Recruitment Method	Advertisement Date
Equipment for BAMS Inventory	0.15	1	NCB	Q4 11

2. Indicative List of Packages Required Under the Project

75. The following table provides an indicative list of all procurement (goods, works and consulting services) over the life of the project. Contracts financed by the Borrower and others should also be indicated, with an appropriate notation in the comments section.

Table 8: List of Indicative Procurement Packages

Ref No.	Contract Package Type and Description	Procurement Method	Expected Date for Advertisement	Prior Review Yes/No
1	Project Implementation Support	QCBS	Q4 11	Yes
	Road Safety Awareness Campaigns	SSS	xxx	Yes
2	Reconstruction and Replacement of Bridges on Hiritano and Magi Highways	ICB	Q3 12	Yes
3	Reconstruction and Replacement of Bridges on New Britain Highway	ICB	Q4 12	Yes
4	Reconstruction and Replacement of Bridges on Ramu Highway	ICB	Q1 13	Yes
5	Reconstruction and Replacement of Bridges on Sepik Highway	ICB	Q1 13	Yes
5	Equipment for BAMS Inventory	NCB	Q4 11	Yes

D. Consultant's Terms of Reference

1. Introduction

76. The overall scope of work includes the reconstruction and relocation of about 25 bridges on five major roads in PNG focus on five priority national road corridors. These are: (i) Hiritano Highway; (ii) Magi Highway; (iii) New Britain Highway; (iv) Ramu Highway; and (v) Sepik Highway.

77. The contract between PNG government and the consultant will consist of two parts, the first for the investigation, detailed design, and procurement support to the point at which civil works contracts have been finalized and are ready for signature, and the second for implementation support, including supervision of the civil works contracts and other implementation-related activities. The second part will be subjected to a second notice to commence, which will be dependent on the consultant's performance under the first part, and also on each of the project's financier's confirming its financing for the project's implementation.

78. The Consultant will be an international consulting firm, or a consortium of international and national consulting firms, or an international consulting firm in association with national consultants. The approximate consulting inputs for the detailed design including procurement and overall implementation support, will be about **54** person-months of international consultants and **19** person-months of national consultants. The inputs for construction supervision will be approximately **119** person-months of international consultants and **129** person-months of national consultants.

2. Scope of Work — Principal Activities

79. The **detailed design and procurement support** scope of work covers the following principal activities.

- (i) Reviewing all aspects of the PPTA study to determine the optimal solutions for preliminary and detailed design;
- (ii) Completing preliminary and detailed design of the bridges and other associated works, based generally on the PPTA study and other studies, including site surveys and investigations – traffic, topographic, hydraulic and hydrologic, geotechnical, materials, morphological, and river studies;
- (iii) Identifying sources of construction materials;
- (iv) Preparing cost estimates;
- (v) Preparing detailed procurement and construction schedules;
- (vi) Preparing bidding documents;
- (vii) Assisting Project Implementation Unit (PIU) with procuring contractors to construct the works;
- (viii) Assisting PIU and the Department of Lands and Physical Planning (DOLPP) and provincial agencies in the updating, implementation, and monitoring of the resettlement plans based on detailed design;
- (ix) Ensuring that the project design complies with the environmental management plan (EMP) and that procurement documents include relevant EMP provisions;
- (x) Assisting PIU in the detailed planning and implementation of the Social Action Plan in close collaboration with relevant agencies and organizations;
- (xi) Undertaking a baseline study for the project's benefit monitoring program;

- (xii) Include bridge design recommendations in Gender Action Plan involving concrete stairways and pedestrian walkway;
- (xiii) Preparing a management and operations strategy for the project when complete, including an appropriate asset management program for the project during its service life; and
- (xiv) Providing general project implementation support to PIU during the detailed design phase, including for Project Coordinating Committee meetings for which PIU will be the secretariat.

80. The **implementation support** scope of work will include the following activities:

- (i) As the Engineer for the contracts, as defined in the International Federation of Consulting Engineers (FIDIC) Conditions of Contract under which the contracts will be administered¹¹, supervise all construction activities to ensure that the contracts are implemented, and the works completed, in accordance with the contract provisions;
- (ii) Ensuring that the civil works contractors comply with the contracts' environmental management plan;
- (iii) Undertaking environmental monitoring and reporting based on the EMP;
- (iv) Ensuring that contract payments are certified, and payments made, in accordance with the contracts;
- (v) Progressively updating the project's monitoring and evaluation information, based on the baseline study completed during the detailed design phase;
- (vi) Assisting with implementing the project's Social Action Plan;
- (vii) Implementing the capacity development plan prepared under the detailed design phase;
- (viii) Assisting PIU with administering the project's Anti-Corruption Action Plan¹²;
- (ix) Providing PIU and ADB with progress and other reporting in the form and to the frequency required; and
- (x) Providing general project implementation support to PIU during the implementation phase, also including for Project Coordinating meetings for which PIU will be the secretariat.

81. The investigation and detailed design of all project components will take into account the possible impacts of climate change on water levels, rain and flood frequency and intensity, and on other characteristics of the area within which the project is located. Specific attention will be given to bridge and waterway clearances, road profile elevations, and possible changes in the behavior of river channels over which the bridges are to be constructed. This aspect of the design process will reflect studies undertaken by ADB, the Government's Department of Environment and Conservation (DEC), and others, of the possible impacts of climate change on PNG.

82. The detailed bridge design requirements are in Bridge Design Brief attached as Appendix 1.

¹¹ADB's Standard Procurement Documents, under which the civil works contract will be procured are based on the FIDIC (MDB harmonized construction contracts) document.

¹²The Anti-Corruption Action Plan will be developed by ADB during its preparation of the financing for the project.

3. Inspection and Maintenance Manual

83. The design task will also include making appropriate provision in the design for future maintenance of the bridges. This should include facilities that provide adequate access to all parts of the structures and the provision of utilities, such as electric power and water outlets, and telephones. This aspect of the design task will also include preparation of an Inspection and Maintenance Manual for the bridges. This will have provision for updating when construction is complete to reflect as-constructed changes to the design.

4. Involuntary Resettlement

84. Based on the agreed resettlement plans (RPs) prepared under the PPTA and the detailed designs for all components of the project, the consultant will work with the PIU and the DOLPP for the provinces within which the project is located, which are responsible for land and resettlement, to prepare updated resettlement plans, and assist the PIU and the DOLPP with their implementation.¹³ The consultant will carry out resettlement workshops and training for PIU and the DOLPP prior to or during RP updating. Specific tasks will include the following:

- (i) Review and assess the consultation and disclosure programs undertaken during the original RP preparation and prepare and implement a consultation and disclosure program during RP updating and implementation to ensure continuous and active involvement of project affected people (APs). Particular attention is to be given to poor and vulnerable APs who may be at risk of impoverishment; measures are to be proposed to ensure that the process of land acquisition and resettlement does not disadvantage them;
- (ii) Working with the DOLPP, and their district resettlement committees, and in consultation with PIU, review the results of the census and inventory of losses included in the original RPs prepared under the PPTA, and finalize the census of APs, and carry out a detailed measurement survey (DMS) of assets to be acquired or that will have restricted access, in full or in part, permanently or temporarily, regardless of tenure status; review baseline socioeconomic and perception surveys;
- (iii) Engage the services of a qualified appraiser to carry out the replacement cost survey for land and non-land assets, and submit the replacement cost survey report to the DOLPP and PIU for review and approval. Assist the district resettlement committees in applying the DOLPP-approved unit rates based on the replacement cost survey for affected land and non-land assets.
- (iv) Assist PIU with obtaining endorsement of the updated RPs from the PSC and in disclosing the Updated RPs to the APs prior to submission to ADB for review and concurrence. Assist PIU and the DOLPP with implementing the project's resettlement in accordance with the agreed updated RPs.
- (v) Ensure that updated RPs are discussed with the provincial agencies to ensure that resettlement implementation is undertaken properly and effectively;
- (vi) Include the status of RP updating and implementation in the overall project reports.

¹³ Responsibility for Land Acquisition lies with DOLPP.

5. Social

85. As part of the detailed design part, the consultant will review and update the Summary Poverty Reduction and Social Strategy (SPRSS) and Gender Action Plan (GAP) prepared during the PPTA.

86. As part of the implementation support, the consultant will assist the provincial/district agencies or institutions with the implementation of the SPRSS and GAP, and include the status in the project's overall reporting.

6. Environment

87. Initial environmental examinations (IEEs) have been prepared for bridges to be replaced under the PPTA. Sites for bridges to be re-erected will be determined at the time of detailed design and IEEs will need to be prepared for these sites. The consultant will undertake the following activities during detailed design:

- (i) Ensure that the recommendations contained in the IEE EMP are incorporated into the detailed design;
- (ii) Update the EMP as necessary to revise or incorporate revised or additional environmental mitigation and monitoring measures, budget, institutional arrangements, etc., that may be required based on the detailed design;
- (iii) If required, prepare a new or supplementary environment assessment report for additional components or changes in the project during detailed design (for example if there is a substantial change in alignment) that would result in adverse environmental impacts not within the scope of the PPTA IEE;
- (iv) Prepare IEEs as required for Bailey bridges to be re-erected at new locations that will be advised by DOW. This assessment will be based on the EARF that was prepared during the PPTA.
- (v) Obtain timely approval for the IEEs and in keeping with the project timelines.
- (vi) Ensure that the bidding documents and civil works contracts contain provisions requiring contractors to comply with the mitigation measures in the EMP and that relevant sections of the project EMP (or updated EMP, if prepared) are incorporated in the bidding and contract documents;
- (vii) Assist the Bid Evaluation Panel in the evaluation and ranking of the bids with regard to complying with the environmental specifications.
- (viii) Based on the environmental training and capability building component described in the IEE, design the following: (i) a training program for the PIU environmental staff and for relevant contractors' staff, (ii) an information disclosure program for affected persons regarding the project's environmental impacts and corresponding mitigation and monitoring measures; and (iii) a grievance redress mechanism for environmental issues.

7. Procurement/Contract Management Support

88. The consultant will assist PIU and DOW with procurement of the project's civil works. This assistance will be provided under the detailed design and procurement support part of the services, with the exception of the last tasks – assisting with signing of civil works contracts and assisting with the management and administration of the civil works contracts – which will be under the implementation support part of the services.

- (i) Develop civil works contract packages;

- (ii) Assist PIU with developing a procurement approach for each of the contract packages, which may include (i) the one stage two envelope bidding process detailed in ADB's Procurement Guidelines; and (ii) a lump sum contract in preference to a schedule of rates contract. The two-stage approach will allow PIU and DOW to assess technical aspects of bidders' proposals prior to receiving final financial bids;
- (iii) Prepare bidding documents for each of the packages, based on the adopted procurement approach, in accordance with ADB's Procurement Guidelines (2010, as amended from time to time). Bidding documents will comprise prequalification invitation documents, prequalification evaluation documents, and bidding documents for the civil works, including the tolling and traffic control systems. Bidding documents will also include all environmental mitigation measures specified in the EMP, and HIV/AIDS awareness and prevention programs;
- (iv) Assist PIU with obtaining ADB's approval of the procurement documents, and with amending them as necessary in accordance with ADB's requirements;
- (v) Assist PIU and DOW with (a) evaluating bids, and preparing bid evaluation reports; and (b) answering inquiries from bidders during the bidding processes;
- (vi) Assist PIU and DOW with preparing formal contracts for each of the packages;
- (vii) Assist PIU and DOW with arranging and completing the signing of the project's civil works contracts; and
- (viii) Assist PIU and DOW in the management and administration of the civil works contracts.

8. Construction Supervision

89. The civil works will be executed under ADB's standard bidding documents (*Procurement of Civil Works, latest version available on www.adb.org*), which are based on the Fédération Internationale des Ingénieurs-Conseils (FIDIC, MDB harmonized construction contracts) *Conditions of Contract*. Following the FIDIC Conditions of Contract, the Employer will be the Independent State of Papua New Guinea, the Employer's Representative will be the Secretary of Works, the Engineer will be the consultant, and the Engineer's Representative will be the consultant's team leader for the supervision task. In accordance with the FIDIC based contract between GOPNG and the civil works contractor, the Engineer will undertake the responsibilities defined in the Conditions of Contract, which will include the following:

- (i) represent the interest of PIU, DOW and the contractor in any matters related to the construction contract and the proper execution thereof;
- (ii) review and recommend for approval of PIU and DOW the contractor's working schedule or revisions thereto and any such plans or programs that the contractor is obliged to furnish for the Engineer's approval, and prepare and submit a disbursement schedule to PIU and DOW;
- (iii) assess the adequacy of all inputs such as materials, labor and equipment provided by contractor and its methods of work in relation to the required rate of progress of the work; when required, take appropriate action in order to expedite the work progress; keep and regularly update a list of contractor's equipment and its condition to ensure compliance with the list of equipment which the contractor provided in its bid;
- (iv) examine and make recommendations to PIU and DOW on all claims from contractors for time execution, additional payments, work or expenses or other similar matters;

- (v) compute quantities of approved and accepted work and materials; check, certify and make recommendations to PIU and DOW on the contractor's interim and final payment certificates;
- (vi) prepare and submit reports to PIU and DOW periodically as required on the progress of the work, contractors' performance, quality of the works, and the financial status and forecasts;
- (vii) propose and present to PIU and DOW for approval any changes deemed necessary for the completion of the works including information on any effect of changes on the contract amount and the time of completion, and prepare all necessary variations including altering plans and specifications and other details; inform PIU and DOW of any problems or potential problems which may arise in connection with the contract and make recommendation to PIU and DOW for possible solutions;
- (viii) prepare contract reports including records of inspection, progress and performance of the works;
- (ix) review the contractor's working drawings, shop drawings, erection drawings, and drawings for temporary works;
- (x) verify the contractor's surveys for centerline alignment, structure location surveys, and vertical control bench marks;
- (xi) assess the adequacy of the materials testing arrangements provided by the contractor, and oversee their operation;
- (xii) prior to commencement of site works, ensure that the contractors prepare construction EMPs based on the project EMP contained within the PPTA IEE;
- (xiii) review and approve the construction EMPs prepared by the contractors before site works commence;
- (xiv) before the contractor commences work, arrange for the induction of the contractor to the site to confirm compliance with the construction EMP;
- (xv) conduct environmental effects/ambient baseline sampling and monitoring (air quality, noise, vibration, water quality, etc.) specified in the EMP, undertake monitoring of the contractor's implementation of all environmental mitigation measures set out in the approved IEE/EMP and construction EMPs, and produce monthly environmental monitoring reports as part of the regular Progress Reports for the PIU;
- (xvi) consolidate monthly environmental monitoring reports to produce semi-annual environmental monitoring reports which will include status of project implementation, status of implementation of all mitigation measures; results and interpretation or analysis of ambient environmental measurements on air quality, noise, water quality, soil quality, etc., carried out by the contractors; environmental complaints and actions taken; status of environmental capacity training activities; environmental issues identified and corresponding actions taken/to be taken, recommendations, photo-documentation, laboratory analysis certificates and other documents to support findings. This report is to be attached to the Project's quarterly monitoring report;
- (xvii) conduct the environmental training/capacity building and orientation/information disclosure program formulated during the detailed design phase for PIU and DOW staff, contractors and affected people;
- (xviii) monitor resettlement impacts caused during construction and include these impacts and mitigation measures in the quarterly progress reports;
- (xix) finalize the PPTA social action plan for the entire project in close consultation with relevant agencies that will be responsible for implementing the plan;

- (xx) assist PIU and DOW and the provincial agencies with implementing the project's social action plan;
- (xxi) inspect the safety aspects of the construction and construction methods and procedures to ensure that all reasonable measures have been taken to protect life and property; and
- (xxii) perform any and all other items of the works not specifically mentioned above but which are necessary and essential to successfully supervise and control the construction activities in accordance with the plans, specifications and terms of contract.

9. Social Development, Gender, HIV/AIDS Awareness and Prevention Program and Human Trafficking Prevention Programs

90. The consultant will pay particular attention to the role of women in the project and the impact of project activities on women, in particular arising from involuntary resettlement. The consultant will:

- (i) work with the DOLPP, with the involvement of community organizations and affected persons, to develop the gender strategy for the project and support implementation of the strategy;
- (ii) address the links between gender and HIV/human trafficking, and ensure the gender strategy for the project includes activities to reduce vulnerability and establishes effective links with the project's HIV/AIDS Awareness and Prevention Program and the Human Trafficking Prevention Program;
- (iii) develop capacity building training modules and conduct workshops and capacity building training on resettlement activities as indicated in the project gender strategy for District Resettlement Committees of the project provinces;
- (iv) conduct Gender Sensitization training on resettlement activities for District Resettlement Committees, selected staff of the Provincial, District and Commune Resettlement Committees, and others;
- (v) conduct workshops and training for men and women from households affected by resettlement (with separate workshops and training for ethnic minority women, if any) on: (a) the commune and village level consultation process for resettlement, entitlement and compensation processes, (b) leadership skills, (c) relocation related resettlement issues, and (d) planning of livelihood activities;
- (vi) ensure that ethnic minority people, women headed households, and women from the affected households have access to fair compensation and livelihood activities as set out in the project's resettlement plan;
- (vii) assist with facilitating joint registration of land use rights in the names of husband and wife in instances where land will be acquired;
- (viii) establish appropriate mechanisms for consultation and grievance process with regard to resettlement programs for women from the affected households;
- (ix) with regard to construction activities, ensure that (a) men and women are paid equally for construction work of equal value, (b) basic facilities (for example, proper water and sanitation) are provided in labor camps and child care facilities (on-site day care) are provided for women laborers by the project's contractors, and (c) camp facilities and work arrangements are safe for women and address women's potential vulnerability to HIV and sexual violence; and
- (x) develop disaggregated monitoring indicators by gender and ethnic groups, conduct periodic field visits and prepare reports on the implementation of gender and social issues.

10. Project Performance Monitoring

91. The consultant will develop comprehensive project performance monitoring systems based on the design and monitoring framework. Specifically, the consultant will:

- (i) provide and maintain a computerized project management system that will assist PIU and DOW to implement the project and provide information on project progress for routine reports, review missions, and project coordination meetings;
- (ii) prepare a quarterly project performance monitoring program that will enable the effectiveness of implementation activities for all components of the project to be assessed, giving particular consideration to (a) the precise description, timeliness, cost and quality of physical infrastructure implemented in the project, (b) the integrity of resettlement and related programs, (c) the effectiveness of capacity building activities, (d) the extent to which the project's social action plan, gender action and resettlement plans are implemented; and (e) the environmental monitoring program.
- (iii) submit the proposed project performance monitoring program to PIU and, through PIU, to DOW and ADB for review and approval; and
- (iv) implement the approved monitoring and evaluation program using 'before' and 'after' studies and other forms of survey and analysis, giving regard to the project's anticipated effect on economic and social development as indicated in the Design and Monitoring Framework for the Project including (a) per capita income in the project provinces, (b) the volume and type of freight and number of passengers using the road network in the project area, (c) passenger and freight vehicle operating costs on the project road and on the project area road network between key locations, (d) tariffs for freight and passenger movement between selected locations that indicate the impact of the project on target groups in the community, (e) the quantity and type of traffic on roads that form the network within which the project road will be constructed; (f) the origin and destination of vehicles and traffic at selected locations within the project area; and (g) the effectiveness of capacity building programs for PIU and DOW staff associated with the Project.

92. To commence the performance monitoring activity, which will be done under the detailed design part of the services, the consultant will conduct socio-economic and baseline surveys. The consultant will assemble appropriate data, including data obtained during PPTA implementation and from other similar and relevant studies undertaken with the project area, and carry out such additional socioeconomic and other baseline surveys that are required to ensure that the project's impacts can be effectively identified and monitored. Specifically, the consultant will:

- (i) ensure that monitoring and evaluation specialists liaise with all other technical staff to develop and implement a comprehensive and effective monitoring and evaluation program;
- (ii) establish systems for recording data and statistics for such monitoring;
- (iii) design surveys and identify the collection of other required data needed for the monitoring and evaluation program, drawing on for example traffic and travel surveys, household socioeconomic sample surveys, participatory rapid appraisals, social and environmental impact assessments and indicators, and secondary data from government sources. Where relevant, indicators shall be disaggregated by gender and socioeconomic status;

- (iv) produce baseline and subsequent reports; and
- (v) evaluate the benefits of the project at completion in accordance with a schedule and terms of reference to be mutually agreed by PIU, DOW and ADB prior to project completion.

11. Reporting Requirements

93. **Inception Report (at the inception of design and procurement support part).** This brief report will be submitted within four weeks of the commencement of the services. It will update, based on initial findings and discussions with PIU, DOW, and ADB, the approach, methodology, and work plan for the services originally submitted by the consultant in its proposal for the services.

94. **Progress Reports (quarterly throughout contract duration).** These brief reports, to be submitted each month, will inform PIU and DOW, and ADB of progress to the reporting date, identify emerging difficulties in implementation, and outline proposed solutions. The reports will provide, in clear presentations, the status of implementing the assignment, performance status, and personnel schedule, and provide plans for the next month's work. These reports will be to the extent possible graphical in format, using a suitable project management application, with the preference being for Microsoft Project.

95. **PSC Report.** This report, which will include PowerPoint and other presentations as appropriate, will be prepared at least 2 weeks before the scheduled date for each PCC meeting.

96. Design Reports.

- (i) **Investigation Phase Report.** The designers shall submit the Investigation Phase Report for each bridge to the DOW for approval prior to proceeding with the detailed design.
- (ii) **Final Design Report.** The Final Design Report for each bridge shall be submitted to the DOW for approval when the design for each is complete.
- (iii) **Drawings.** The design drawings shall include drawings, as appropriate, to fully document the works to be completed. All drawings shall be drawn at scales suitable to show the required details. A full and complete set of drawings shall be prepared for each bridge.

97. **Draft Final Report – Detailed Design and Procurement part.** This report will be submitted in two parts, one at the conclusion of the design work and the second, as an addendum to the first part, at the conclusion of the procurement activity. The report will summarize all work done during the period of the detailed design services, and will include detailed design information for all components of the project, status of safeguards activities, outstanding and/or relevant tasks for the subsequent construction of the project, and other information as appropriate.

98. **Final Report – Detailed Design and procurement part.** This report will be submitted one month after receipt of the comments on the draft final report, including the procurement addendum, from PIU, DOW, and ADB.

99. **Baseline Environmental, Social and Performance Monitoring Reports and Quarterly Updates.** The baseline report will be prepared during the detailed design part and updated on a quarterly basis during project implementation. Environmental and social safeguards compliance reports will be included with the relevant progress report for the quarter.

100. **Final Project Completion Report.** This report will be submitted within 2 months of the completion of the civil works, and will include a complete history of the implementation of the civil works and the consulting contract.

101. The Consultant is to develop a schedule of required reports during the detailed design and procurement activity. The schedule is to be included as an Annex to the Inception Report.

12. Individual Terms of Reference for Key Individuals

12.01. Qualification and Experience Requirements for Selected Personnel

102. The requirements described below are to broadly define the minimum qualifications and experience to be possessed by a selection of nominated personnel of the Consultant.

103. The Project Manager/Chief Resident Engineer should have at least 15 years of professional experience and have managed at least two projects of similar nature and complexity. For international and national experts should have at least a bachelor degree in the respective field, and having an overall experience of five years and at least two projects of similar nature.

104. All engineers should be eligible to become a member of the Institution of Professional Engineers PNG and have a minimum ten years experience in the supervision of road and bridge construction, preferably in a developing country.

105. Where the same position is required for both Detailed Design and Implementation Support including Construction Supervision, it is anticipated that the Consultant will ensure continuity of consultants subject to satisfactory performance.

106. **Project Manager/Chief Resident Engineer (International: part-time, 36 person-months – 12 months Detailed Design, 24 months Implementation Support)**

- (i) Is an experienced senior engineer with sufficient experience as a team leader of a large, multi-disciplinary consultant team to provide strategic direction, mentor and advise team members, prepare detailed design and project implementation plans for major construction projects of magnitude and nature similar to those of the project and to ensure contractual obligations are delivered.
- (ii) Experience in working as part of a team managing several construction contracts, including progress and cost reporting.
- (iii) Is an experienced senior engineer with sufficient experience in preparing detailed designs for bridges and structures of magnitude and nature similar to those of the project.
- (iv) Is an experienced senior engineer with sufficient experience in supervising major bridge and structures construction works in PNG.
- (v) Experience in piling, earthworks, concrete works, structural steelwork, unbound pavements and bitumen surfacing.
- (vi) Is familiar with all bridge construction codes and standards in PNG.
- (vii) Is familiar with FIDIC Conditions of Contract, and possesses experience in managing preparation or execution phases of construction projects.
- (viii) The Engineer's Duties and Authority are as per FIDIC, Conditions of Contract for Construction, Multilateral Development Bank Harmonised Edition, For

Participating Bank use only, General Conditions, Released 30 June 2010, Para 3.1 refers.

- (ix) Is responsible for the overall quality assurance for the detailed design in compliance with international quality assurance standards.
- (x) Is experienced in providing critical inputs to the design teams timely and to the satisfaction of the client.
- (xi) Experience in quality control, environmental management, and social and gender awareness would be well regarded.

107. Bridge Engineer (International: part-time, 24 person-months – 12 months Detailed Design, 12 months Implementation Support)

- (i) Is an experienced senior engineer with sufficient experience in bridge design for bridges and structures of magnitude and nature similar to those of the project.
- (ii) Is an experienced senior engineer with sufficient experience in designing bridges and structures in PNG.
- (iii) Experience in piling, earthworks, concrete works, structural steelwork, unbound pavements and bitumen surfacing.
- (iv) Is experienced in providing critical inputs to the design teams timely and to the satisfaction of the client.
- (v) Experience in quality control, environmental management, and social and gender awareness would be well regarded.

108. Civil Engineer/Resident Engineer (International: full-time, 24 person-months – 24 months Implementation Support)

- (i) Is an experienced engineer with sufficient experience in bridge design for bridges and structures of magnitude and nature similar to those of the project.
- (ii) Is an experienced senior engineer with sufficient experience in supervision of infrastructure projects, including roads and bridges in PNG.
- (iii) Experience in working as part of a team managing several construction contracts, including progress and cost reporting.
- (iv) Experience in piling, earthworks, concrete works, structural steelwork, unbound pavements and bitumen surfacing.
- (v) Is familiar with all bridge construction codes and standards in PNG.
- (vi) Is familiar with FIDIC Conditions of Contract, and possesses experience in managing preparation or execution phases of construction projects.
- (vii) Is responsible to The Engineer for the overall quality assurance for the construction supervision services in compliance with international quality assurance standards.
- (viii) Is experienced in providing critical inputs to the design teams timely and to the satisfaction of the client.
- (ix) Experience in quality control, environmental management, and social and gender awareness would be well regarded.

109. Hydrologist (International: part-time, 15 person-months – 8 months Detailed Design, 7 months Implementation Support)

- (i) Is an experienced senior engineer with sufficient experience in hydraulic engineering for bridges and structures of magnitude and nature similar to those of the project.

- (ii) Is an experienced senior engineer with sufficient experience in hydraulic engineering for bridges and structures in PNG.
- (iii) Is experienced in leading hydraulic investigations and providing critical inputs to the design teams timely and to the satisfaction of the client.
- (iv) Is experienced in leading supervising teams and familiar with hydrological conditions in PNG, particularly in river morphology.
- (v) Is experienced in providing critical inputs to the design teams timely and to the satisfaction of the client.

110. Geotechnical Engineer (International: part-time, 18 person-months - 6 months Detailed Design, 12 months Implementation Support)

- (i) Is an experienced senior engineer with sufficient experience in geotechnical engineering for bridges and structures of magnitude and nature similar to those of the project.
- (ii) Is an experienced senior engineer with sufficient experience in supervising geotechnical engineering works for similar bridges and structures in PNG.
- (iii) Is experienced in leading geotechnical investigations and providing critical inputs to the design teams timely and to the satisfaction of the client.
- (iv) Is experienced in leading supervising teams and familiar with geotechnical conditions in PNG, particularly in riverine environments.
- (v) Is experienced in providing critical inputs to the design teams timely and to the satisfaction of the client.

111. Environmental Specialist (International: part-time, 9 person-months - 3 months Detailed Design, 6 months Implementation Support; National: part-time, 20 person-months - 4 months Detailed Design, 16 months Implementation Support)

- (i) Is an experienced specialist with sufficient experience in conducting environment studies and preparing EMPs to comply with the *ADB Safeguard Policy Statement, 2009* and relevant PNG requirements for construction projects with environmental impacts similar to those of the project.
- (ii) Is an experienced specialist with sufficient experience in monitoring contractors' compliance with environmental provisions of the contract and preparing required documentation for construction projects in PNG.
- (iii) Capacity to train staff and contractors in environmental safeguards.
- (iv) Is experienced in providing critical inputs to the design teams timely and to the satisfaction of the client.

112. Resettlement Specialist (International: part-time, 8 person-months - 4 months Detailed Design, 4 months Implementation Support; National: part-time, 20 person-months - 3 months Detailed Design, 17 months Implementation Support)

- (i) Is an experienced specialist with sufficient experience in conducting social and resettlement studies and preparing required documentation for construction projects with social and resettlement impacts similar to those of the project.
- (ii) Is an experienced senior specialist with sufficient experience in managing and implementing resettlement, social and gender specific and HIV/AIDS specific action plans and preparing required documentation for construction projects in PNG.
- (iii) Capacity to train staff and contractors in social/resettlement safeguards.
- (iv) Is experienced in providing critical inputs to the design teams timely and to the satisfaction of the client.

113. Social and Gender Specialist (International: part-time, 9 person-months – 3 months Detailed Design, 6 months Implementation Support)

- (i) Refine GAP of the project and prepare detailed implementation work plans in collaboration with project design team and other implementation consultants.
- (ii) Conduct gender awareness training for project staff at all levels.
- (iii) Monitor the incorporation of GAP in bridge designs and in the site selection of reusable bridge locations.
- (iv) Help organize awareness training or education programs, including HIV/AIDS, gender awareness, and road safety education programs, by overseeing the design and content of training programs. Monitor the impact of training programs.
- (v) Facilitate equal participation, consultation, and training of women participating in project activities, including construction work, maintenance activities, road safety programs. Pay particular attention to potential resistance to women's participation, and facilitate conflict resolution, as required.
- (vi) Develop monitoring and evaluation indicators of GAP and ensure that community engagement and gender issues are properly addressed in all project activities.
- (vii) Collect sex-disaggregated data for baseline, mid-term, and final monitoring surveys and analyze the progress of GAP and other gender issues in monitoring reports.
- (viii) Ensure regular project progress reports include the progress of GAP implementation.

114. Procurement/Contract Management Specialist (International: part-time, 6 person-months - 6 months Detailed Design)

- (i) Is an experienced senior specialist with sufficient experience in procurement for engineering structures of magnitude and nature similar to those of the project.
- (ii) Is familiar with FIDIC Conditions of Contract, and possesses experience in procurement for construction projects financed by multilateral development banks.
- (iii) Possesses experience in dispute resolution and claims management for construction projects.
- (iv) Is experienced in providing critical inputs to the design teams timely and to the satisfaction of the client.

115. Bridge Engineer (National: full-time, 36 person-months – 12 months Detailed Design, 24 months Implementation Support)

- (i) Is an experienced engineer with sufficient experience in bridge design for bridges and structures of magnitude and nature similar to those of the project.
- (ii) Is an experienced engineer with sufficient experience in designing bridges and structures in PNG.
- (iii) Experience in piling, earthworks, concrete works, structural steelwork, unbound pavements and bitumen surfacing.
- (iv) Is experienced in providing critical inputs to the design teams timely and to the satisfaction of the client.
- (v) Experience in quality control, environmental management, and social and gender awareness would be well regarded.

116. Site Engineers (on site x3) (National: full-time, 24 person-months - 24 months Implementation Support)

- (i) Has broad experience in design, scoping and supervision of infrastructure projects, including roads and bridges in PNG.
- (ii) Experience in working as part of a team managing several construction contracts, including progress and cost reporting.
- (iii) Experience in piling, earthworks, concrete works, structural steelwork, unbound pavements and bitumen surfacing.
- (iv) Is familiar with FIDIC Conditions of Contract, and possesses experience in managing preparation or execution phases of construction projects.
- (v) Is familiar with all bridge construction codes and standards in PNG.
- (vi) Is responsible to The Engineer for the overall quality assurance for the construction supervision services in compliance with international quality assurance standards.
- (vii) Is experienced in supervising road maintenance and civil engineering works in PNG.
- (viii) Is experienced in providing critical inputs to the design teams timely and to the satisfaction of the client.
- (ix) Experience in quality control, environmental management, and social and gender awareness would be well regarded.

VII. SAFEGUARDS

117. **Social Safeguards.** The project has been classified as category B for involuntary resettlement and indigenous peoples. Resettlement Plans (RPs) have been prepared for five road corridors based on the assessment of impacts and consultations with affected landowners. The RPs include adequate measures to compensate for affected land and assets and to assist affected persons to restore or improve their livelihoods. A Resettlement Framework (RF) has been prepared providing guidelines on screening, assessment and preparation of RPs, if needed, for replacement of bridges on national highways and placement of bridges on provincial roads that will be selected during implementation. Since indigenous peoples are sole majority of the project beneficiaries, the overall project design, including the RF and RPs, integrates the elements of indigenous peoples to ensure that they receive culturally appropriate benefits and actively participate in the project activities.

118. The Department of Works (DOW) will update RPs prepared under PPTA for the replacement of bridges in the five road corridors after the detailed design. If any additional bridges are selected on the national highways, DOW will prepare additional RPs following the RF. While the placement of Bailey bridges on provincial or district roads is not expected to require acquisition of land, DOW will undertake due diligence to screen potential impacts and prepare RPs, if needed, following the RF once their locations are finalized.

119. DOW will coordinate with the Department of Lands and Physical Planning (DLPP) and the provincial governments for activities related to land acquisition and resettlement. DOW will coordinate with other line agencies or non-government agencies, as needed. The RF and RPs include detailed steps required for land acquisition and resettlement process and roles of different agencies to be involved in the project implementation.

120. DOW and provincial governments will assign land officers, including a Land Officer within the PIU, to manage land acquisition and resettlement activities. The project management consultants will include an international resettlement specialist and a national resettlement specialist to assist DOW and provincial governments to manage social safeguard aspects.

121. The project management consultants will support in building capacity within DOW, DLPP, and provincial governments to prepare, implement, and monitor RPs. They will conduct/organize necessary trainings on social safeguards and other necessary skills (e.g., surveys) to the relevant staff from DOW, DLPP, provincial/district land offices, and any other organizations that might be involved in land acquisition and resettlement activities.

122. **Environment.** Initial environmental examinations have been completed for replacing bridges along five road corridors. Where Bailey bridges will be dismantled for replacement bridges these will be re-erected in new sites. Sites for re-erection of Bailey bridges and any additional replacement bridges will be determined during Loan drawdown. An Environmental Assessment and Review Framework (EARF) has been prepared to guide the assessment and review process which includes the replacement of bridges and the re-erection of any dismantled Bailey bridges in rural areas in PNG. These investments, will be dispersed along five national highways. Apart from some minor concerns with water quality where work in the river channel may be required, construction is not expected to cause any other significant impacts. All impacts are expected to be small-scale and repetitive in nature. Once sites are selected, specific details on how to mitigate and monitor effects are provided in the EMP contained in the project's IEE. Approval of bridge replacement and re-erection is not a prescribed activity within PNG

environmental legislation and instead the IEEs will be approved by (i) the DOW PIU and (ii) the ADB. IEEs will also be copied to the DEC for their information.

123. Figure 1 outlines the major actions associated with preparation, submission and approval of environment documents to the ADB and the PIU. The responsibilities of the two management structures are; (i) the Project Implementation Unit (PIU) will be located within the DOW structure whose task is to review documents that emanate from (ii) the implementation consultant (the consultant). The consultant will prepare the safeguard documents and supervise the contractor. The PIU will have the overall responsibility for implementing safeguards and will arrange approval of the document at this level. The PIU will also arrange for a copy of the IEE to be sent to the ADB for their approval. The consultant will appoint (i) an international Environmental Safeguards Specialist, and (ii) a national Environmental Officer. They will assist the Project Engineer appointed by the consultant in supervising the implementation of the safeguards by the contractor.

Figure 1: Environmental Actions and Conditions

Environmental Management Actions		Conditions Required to Complete Actions
<p>Pre-construction Stage</p> <p>Establish environmental management system</p> <p>Supervising Consultant ESS/EO prepares additional environmental studies.</p> <ul style="list-style-type: none"> ESS/EO review EMP and extract construction section of EMP. Supervising Consultant includes construction section of EMP in tender document. Tender document submitted to PIU for review. PIU reviews tender documents to confirm that environmental management provisions are included and are sufficiently robust. <p>ESS/EO assists Bid Evaluation Committee in reviewing Bid environmental conditions. Rank contractors on their environmental abilities</p> <p>ESS/EO review and approve CEMP. Copies approval to PIU.</p> <p>ESS/EO verifies that Contractor is able to comply with CEMP at site meeting.</p>	<pre> graph TD A[Project becomes effective.] --> B[Supervising Consultant (SC) appointed. PIU formed in DOW.] B --> C[Environmental studies (EEs) prepared for additional sites.] C --> D[IEEs submitted to (i) ADB and (ii) PIU. Reviewed by ADB and PIU and if satisfactory, approved. IEE copied to DEC.] D --> E[EMP reviewed by ES and construction mitigation measures extracted and integrated into tender (Bid and Contract) documents] E --> F[Tender documents prepared by SC. Submitted to PIU.] F --> G[Tenders evaluated and Contractor appointed] G --> H[Contractor prepares CEMP] H --> I[Contractor inducted to site] </pre>	<p>Budget, facilities and staff for environmental management in PIU and SC provided according to Loan Agreement and EARF.</p> <p>Supervising Consultant appoints Environmental Safeguards Specialist (ESS) and Environmental Officer (EO) according to Loan Agreement.</p> <p>IEEs prepared according to EARF.</p> <p>IEEs approved by ADB and PIU as per EARF</p> <p>Supervising Consultant has necessary technical capacity and experience to satisfactorily integrate EMP requirements into design.</p> <p>Environmental conditions have been prepared and are integrated into tender documents</p> <p>ESS/EO included in Bid Evaluation Panel</p> <ul style="list-style-type: none"> Contractor appoints Environmental and Health and Safety Officer and Community Liaison Officer. Contractor has 14 days to prepare CEMP <p>ESS/EO induct contractor to site</p>

Environmental Management Actions		Conditions Required to Complete Actions
ESS/EO monitor contractor's mobilization.	<div style="border: 1px solid black; padding: 5px; text-align: center;">Contractor approved to start work</div>	Contractor takes possession of construction site only after (i) CEMP has been approved and (ii) safeguards induction is completed satisfactorily
<p>Construction Stage</p> <ul style="list-style-type: none"> • ESS/EO assist PE in monitoring contractor's work as required. • ESS/EO independently monitor construction activities. • ESS/EO assist ADB on supervision missions according to the Loan Agreement • If noncompliance is identified, ESS/EO issue Defect Notices. <p>ESS/EO certify that work is completed according to EMP conditions.</p>	<div style="text-align: center;">↓</div> <div style="border: 1px solid black; padding: 5px; text-align: center;">Contractor begins work.</div> <div style="text-align: center;">↓</div> <div style="border: 1px solid black; padding: 5px; text-align: center;">Environmental monitoring undertaken and reports prepared. (i) By Contractor: monthly environmental report sent to SC; (ii) Quarterly environmental report sent to ADB via PIU according to the Loan Agreement.</div> <div style="text-align: center;">↓</div> <div style="border: 1px solid black; padding: 5px; text-align: center;">Construction completed and project commissioned</div> <div style="text-align: center;">↓</div>	<p>Contractor complies with CEMP requirements for implementing and monitoring work on-site</p> <ul style="list-style-type: none"> • ESS/EO verify monitoring is completed to meet EMP requirements. • ESS/EO review and sign-off on completed work. • ESS/EO issue Defect Notices for non-compliant work. • ESS/EO submits quarterly monitoring report to ADB for review according to the Loan Agreement. <p>Project works completed in accordance with the EMP and all sites satisfactorily rehabilitated and restored.</p> <ul style="list-style-type: none"> • Payments may be withheld if sites not cleared and closed to meet EMP specifications.
Operation	<div style="text-align: center;">↓</div> <div style="border: 1px solid black; padding: 5px; text-align: center;">Submission of monitoring reports to ADB according to Loan Agreement</div>	DOW submit monitoring reports to ADB according to requirements of Loan Agreement.

VIII. GENDER AND SOCIAL DIMENSIONS

124. PNG ranks 149 out of 179 countries in the United Nations Development Programme's Human Development Index. With 87% of the population living in rural areas, the poverty incidence is higher in rural than urban areas. Given the reliance on subsistence farming in most rural areas, the nature of rural poverty relates more to a lack of access to quality essential social services such as education and health facilities, and lack of income earning opportunities, rather than extreme hunger or destitution. Access to basic social services is especially constrained in rural areas due to poor infrastructure coverage, including road connectivity and transport services.

125. The project will contribute to poverty reduction and socio-economic development in the project areas by improving access of rural population to livelihood opportunities and basic social services, reducing their travel time, and making these essential trips safer. The improved accessibility will increase economic opportunities of poor rural households, promote school attendance among children, and improve health outcomes among women and children by facilitating access to health facilities.

Outputs and Activities	Proposed Gender Mainstreaming Activities (Target)	Primary Responsibility
Output 1. Bridges replaced on national highways to reduce bottlenecks and improve safety		
20-30 bridges replaced in five national road corridors	<ul style="list-style-type: none"> • Ensure standardized designs for reconstructed bridges include measures to remove physical barriers to, and constraints on, access by women and children. • Ensure bridge design incorporates measures to enhance road safety, including pedestrian access with guard-rails and footpaths on bridge approaches and abutments and steps down to water bodies. • Concrete stairways will be provided on each bridge extending from the roadway level to the normal water level below. A single handrail will be provided on the outside of the staircase. Two stairways will be provided for each abutment. • Ensure participation of women (at least 50%) in community consultations and meetings; if necessary, organize separate meetings for men and women. • Give preference to bidding documents which include provisions to hire local labor for construction work, including at least 30% women. • Ensure equal pay for equal work between male and female workers, and payment for women is to be paid directly to them. • Provide HIV/AIDS and gender awareness training for all construction workers and neighboring community members. 	<p>DOW and International SGDS</p> <p>DOW and International SGDS</p> <p>DOW and International SGDS</p> <p>PIU and national SGDS</p> <p>PIU and national SGDS</p> <p>PIU and national SGDS</p> <p>PIU and national SGDS</p>

Output 2. Reusable Bailey bridges installed on rural roads to reduce travel time		
Reconstruction of up to 27 reusable Bailey bridges on rural roads	<ul style="list-style-type: none"> • Ensure selection criteria for reusable bridge subprojects include women's access to social services such as education, health facilities, and market access. • Ensure Bailey bridges are fitted with pedestrian footpaths and guard-rails for safety of women and children. • If land needs to be acquired for the installation of reusable bridges, ensure that affected females are compensated at the same rate of payment as affected males, and provided adequate arrangements to maintain livelihoods. • Ensure that any agreement for maintenance activities of bridges provides equal opportunities for men and women in communities. • Ensure that all subprojects include guidelines addressing the risk of HIV/AIDS and STIs among construction workers and communities. • Ensure community consultations regarding bridge maintenance plans include at least 50% of women participants; if necessary, organize separate meetings for women and men in communities. • Ensure routine maintenance activities engage at least 50% of women to provide income-earning opportunities. 	<p>DOW and International SGDS</p> <p>DOW and International SGDS</p> <p>PIU and national SGDS</p> <p>PIU and national SGDS</p> <p>DOW, PIU and national SGDS</p>
Output 3. Road safety awareness in rural areas improved		
Development and implementation of a Rural Road Safety Education Program	<ul style="list-style-type: none"> • Ensure that road safety education programs include specific modules addressing (i) road safety issues of school children, and (ii) personal safety concerns of women and young children. • Ensure that both males and females equally participate in road safety awareness training which addresses personal safety concerns of women and young girls (at least 50% male participants). • Ensure women are represented in the implementation of road safety programs at the community level (at least 50% are female). 	<p>DOW, PIU, international SGDS, national SGDS</p> <p>PIU and national SGDS</p> <p>PIU and national SGDS</p>
Output 4. Project implementation unit administers implementation		
Effective and efficient project implementation	<ul style="list-style-type: none"> • Ensure the employment of SGDS in the PIU to manage the implementation of gender action plans, community consultations, and awareness training. • Provide gender awareness training to project staff at PIU and provincial offices. • Develop a project performance system that includes indicators measuring the implementation and progress of the gender action plan. • Ensure the inclusion of sex-disaggregated data in the baseline, progress, monitoring and evaluation reports. • Ensure regular progress reports include the progress of GAP implementation. 	<p>DOW</p> <p>PIU and international SGDS</p> <p>PIU and international SGDS</p> <p>PIU and international SGDS</p> <p>PIU and national SGDS</p>
IMPLEMENTATION ARRANGEMENTS		
<p>The GAP will be implemented by the PIU that will include one full-time national SGDS for the duration of project implementation under the supervision of international SGDS (intermittent). The specialists will be responsible for incorporating the GAP into project planning and implementation programs, including awareness training and establishment of sex-disaggregated indicators for project performance and monitoring. The progress of GAP activities will be included in regular progress reports on overall project activities submitted to ADB and the Government of PNG.</p>		

IX. PERFORMANCE MONITORING, EVALUATION, REPORTING AND COMMUNICATION

A. Project Design and Monitoring Framework

Design Summary	Performance Targets and Indicators with Baselines	Data Sources and Reporting Mechanisms	Assumptions and Risks
<p>Impact The rural population in selected provinces has improved access to markets and social services</p>	<p>By 2020: Enrollment at primary schools increases from 53% to 90%^a Primary education completion increases from 45% to 78%^a Proportion of pregnant women receiving antenatal care increases from 59% to 75%^a Reduction in under-5 child mortality from 75/1,000 to 44/1,000^a</p>	<p>Household income and expenditure surveys MDG monitoring surveys Project performance monitoring reports Demographic and health surveys National health information system</p>	<p>Assumption The Government continue to support and implement its Development Strategic Plan (2010–2030) and Strategic Vision 2050</p> <p>Risk Political instability</p>
<p>Outcome The road network in rural areas of selected provinces is better connected, more efficient, and safer</p>	<p>By 2016: Traffic on rural roads increases annually by 8% Average time for access to markets, schools and clinics reduced by 25%^b No. of accidents on national highways reduced by 15%</p>	<p>Quarterly project reports Project performance monitoring reports Loan reviews</p>	<p>Assumption Sustainable financing of Bailey bridge maintenance on rural roads by the provinces</p> <p>Risk Provincial Governments may lose interest in the project as they do not directly implement or benefit</p>
<p>Outputs 1. Single-lane Bailey bridges are replaced with permanent two-lane structures on five priority national roads 2. Reusable Bailey bridges installed on rural roads</p>	<p>By 2016: 20-30 two-lane bridges completed Improved bridge design involving concrete stairways to provide women access to water 25-40 Bailey bridges completed Improved system for women and children through specially constructed pedestrian walkways in Bailey bridges Routine maintenance of Bailey bridges by benefiting communities include at least</p>	<p>Quarterly project reports Project performance monitoring reports Loan reviews</p>	<p>Assumptions Continued Government's support to the bridge replacement program Sustainable counterpart financing</p> <p>Risks Communities do not show interest in maintaining bridges</p>

Design Summary	Performance Targets and Indicators with Baselines	Data Sources and Reporting Mechanisms	Assumptions and Risks																						
<p>3. Capacity of DOW to implement the BAMS improved</p> <p>4. Road safety awareness in rural areas improved</p> <p>5. Project implementation unit administers implementation</p>	<p>50% women</p> <p>Bridge inventory and condition reported annually</p> <p>Road safety awareness of rural population increased by 50% in selected provinces</p> <p>Road safety awareness programs have at least 50% women participation</p> <p>Projects outputs delivered on time and within budget</p>																								
<p>Activities with Milestones</p> <p>1.1 Consulting services engaged for design, construction supervision, and overall implementation support (2011)</p> <p>1.2 Design and bid documents completed (2012)</p> <p>1.3 Civil works contracts awarded for replacing existing Bailey bridges with wider new bridges (2013)</p> <p>1.4 New bridges completed (2016)</p> <p>2.1 Civil works contracts awarded for installation of reusable Bailey bridges on rural roads (2013)</p> <p>2.2 Bailey bridges completed on rural roads (2016)</p> <p>2.3 Capacity development of benefiting communities in maintaining Bailey bridges (2015)</p> <p>3.1 DOW's BAMS Unit engages and train staff to undertake bridge inventory and condition surveys (2012)</p> <p>3.2 Field work conducted (2013)</p> <p>3.3 BAMS database updated (2014)</p> <p>4.1 DOW engages NRSC to improve awareness of rural communities in road safety in Project area (2012)</p> <p>4.2 NRSC plan and develop campaigns (2013)</p> <p>4.3 NRSC undertake safety awareness campaigns (2014)</p> <p>5.1 DOW administers the project through PIU and implements the gender action plan (2016)</p>		<p>Inputs</p> <p>ADB: \$90 million</p> <table border="1" data-bbox="834 877 1442 1409"> <thead> <tr> <th data-bbox="834 877 1159 919">Item</th> <th data-bbox="1159 877 1442 919">Amount (\$ million)</th> </tr> </thead> <tbody> <tr> <td data-bbox="834 919 1159 968">Civil Works</td> <td data-bbox="1159 919 1442 968">63.82</td> </tr> <tr> <td data-bbox="834 968 1159 1045">Capacity Development of DOW's BAMS</td> <td data-bbox="1159 968 1442 1045">0.65</td> </tr> <tr> <td data-bbox="834 1045 1159 1123">Road Safety Awareness in Rural Areas</td> <td data-bbox="1159 1045 1442 1123">0.55</td> </tr> <tr> <td data-bbox="834 1123 1159 1171">Project Administration</td> <td data-bbox="1159 1123 1442 1171">0.70</td> </tr> <tr> <td data-bbox="834 1171 1159 1220">Contingencies</td> <td data-bbox="1159 1171 1442 1220">13.38</td> </tr> <tr> <td data-bbox="834 1220 1159 1268">Loan Financing Charges</td> <td data-bbox="1159 1220 1442 1268">2.40</td> </tr> <tr> <td data-bbox="834 1268 1159 1409">Consulting Services (about 173 person-months of international and 148 person-months of national)</td> <td data-bbox="1159 1268 1442 1409">8.50</td> </tr> </tbody> </table> <p>Government: \$10 million^c</p> <table border="1" data-bbox="834 1457 1442 1598"> <thead> <tr> <th data-bbox="834 1457 1159 1499">Item</th> <th data-bbox="1159 1457 1442 1499">Amount (\$ million)</th> </tr> </thead> <tbody> <tr> <td data-bbox="834 1499 1159 1547">Civil Works</td> <td data-bbox="1159 1499 1442 1547">9.38</td> </tr> <tr> <td data-bbox="834 1547 1159 1598">Resettlement</td> <td data-bbox="1159 1547 1442 1598">0.62</td> </tr> </tbody> </table> <p>Technical Assistance: \$800,000</p>		Item	Amount (\$ million)	Civil Works	63.82	Capacity Development of DOW's BAMS	0.65	Road Safety Awareness in Rural Areas	0.55	Project Administration	0.70	Contingencies	13.38	Loan Financing Charges	2.40	Consulting Services (about 173 person-months of international and 148 person-months of national)	8.50	Item	Amount (\$ million)	Civil Works	9.38	Resettlement	0.62
Item	Amount (\$ million)																								
Civil Works	63.82																								
Capacity Development of DOW's BAMS	0.65																								
Road Safety Awareness in Rural Areas	0.55																								
Project Administration	0.70																								
Contingencies	13.38																								
Loan Financing Charges	2.40																								
Consulting Services (about 173 person-months of international and 148 person-months of national)	8.50																								
Item	Amount (\$ million)																								
Civil Works	9.38																								
Resettlement	0.62																								

^a PNG Government's Development Strategic Plan (2010–2030).

^b PNG Country Partnership Strategy (2011–2015).

^c Includes taxes and duties of \$7.35 million.

Source: ADB estimates.

B. Monitoring

126. **Project Performance Monitoring.** DOW has agreed to a set of indicators for evaluating project performance in relation to its impacts, outcomes, outputs, and conditions. At the beginning of project implementation, DOW will establish baseline and target values for the indicators. The indicators will be measured at project inception, project completion, and 3 years after project completion and compared with the baseline. Data will be disaggregated by gender. The consultants will provide support for monitoring and evaluation. The main sources of data will include (i) secondary data from the Borrower's sources, (ii) traffic counts, (iii) traffic accident database, and (vi) producer and price surveys. DOW shall submit a report to ADB summarizing the findings of monitoring at inception, project completion, and 3 years after project completion.

127. **Compliance Monitoring.** The ADB project team will field a minimum of 2 review missions per year (1 full and 1 short) to review and monitor the compliance of covenants—policy, legal, financial, economic, environmental, and others.

128. **Safeguards Monitoring:** DOW shall regularly monitor the contractor's environmental performance based on the provisions of the EMP. DOW shall submit environmental monitoring reports to ADB on a semi-annual basis. The new DOW Social and Environmental Unit will be responsible for this. Resettlement issues, if any, will also be regularly monitored by the Consultant under its regular reporting requirements.

129. **Labor, Gender, and Social Dimensions Monitoring:** DOW will monitor labor, gender and other social development aspects described in Section VIII, similar to safeguards monitoring. The national labor and gender consultant will set up these monitoring systems and build capacity of the EA in this area. The PMU will incorporate labor and gender monitoring in quarterly progress reports to ADB and the Government of PNG. Gender and social issues will also be regularly monitored by the Consultant under its regular reporting requirements.

C. Evaluation

130. In addition to regular quarterly reviews by ADB staff, the Government and ADB will jointly undertake a midterm review of the project in late 2013 to assess (i) the status of implementation, (ii) the design and construction standards, (iii) the performance of consultants and contractors, (iv) the impacts of the project, (v) the status of compliance with the covenants stipulated in the Loan Agreement, and (vi) the need for any changes in the project scope or schedule to achieve the project's outputs and outcomes. Within 6 months of physical completion of the project, DOW will submit a project completion report to ADB.¹⁴

D. Reporting

131. DOW will provide ADB with (i) quarterly progress reports in a format consistent with ADB's project performance reporting system; (ii) semi-annual environmental monitoring reports on progress of EMP implementation, compliance issues and corrective actions, if any; (iii) consolidated annual reports including: (a) progress achieved by output as measured through the indicator's performance targets, (b) key implementation issues and solutions; (c) updated procurement plan and (d) updated implementation plan for next 12 months; and (iv) a project completion report within 6 months of physical completion of the project.

¹⁴ Project completion report format available at: <http://www.adb.org/Consulting/consultants-toolkits/PCR-Public-Sector-Landscape.rar>.

132. DOW will monitor project implementation in accordance with the implementation schedule and will keep ADB informed of any significant deviations from the schedule. The quarterly report will include basic data on utilization of funds, achievement of immediate development objectives, compliance with covenants, implementation progress, land acquisition, resettlement progress, and major issues and problems.

133. DOW will submit to ADB annual contract awards and disbursement projections. This requirement is effective in monitoring project implementation and will help identify impediments to implementation progress. The annual projections are submitted to ADB on 15 December of each year.

134. The project completion will provide a detailed evaluation of the project design, costs, contractors' and consultants' performance, social and economic impact, economic rate of return, and other details as may be requested by ADB.

E. Stakeholder Communication Strategy

135. All relevant project documents will be uploaded in DOW and ADB websites. The resettlement framework and semi-annual environmental monitoring reports submitted by DOW shall be posted on ADB website upon receipt. The project will also implement a community-based road safety campaign, an HIV/AIDS awareness and prevention program to mitigate the potential HIV-related impacts of road construction in rural communities, and a human trafficking awareness and prevention program.

X. ANTICORRUPTION POLICY

136. ADB reserves the right to investigate, directly or through its agents, any violations of the Anticorruption Policy relating to the project.¹⁵ All contracts financed by ADB shall include provisions specifying the right of ADB to audit and examine the records and accounts of the executing agency and all project contractors, suppliers, consultants and other service providers. Individuals and entities on ADB's anticorruption debarment list are ineligible to participate in ADB-financed activity and may not be awarded any contracts under the project.¹⁶

137. To support these efforts, relevant provisions are included in the loan and project agreements, and will be included in the bidding documents for the project.

138. The government and the provincial governments shall ensure that (i) the project is carried out in compliance with all applicable PNG anticorruption regulations and ADB's Anticorruption Policy, including cooperating fully with any investigation by ADB directly or indirectly of any alleged corrupt, fraudulent, collusive or coercive practices relating to the project, and (ii) when offered, all relevant staff will actively participate in training in PNG's anticorruption regulations and ADB's Anticorruption Policy.

A. Anticorruption measures

139. In accordance with ADB requirements, a governance risk assessment in the areas of public financial management, procurement and anticorruption was undertaken and significant risks and associated mitigating measures identified in each. In addition, risks and associated mitigating measures in human resource management and project implementation were identified. Refer to linked document 24 of the Report and Recommendation of the President to the Board of Directors for the risk assessment and risk management plan.

140. As identified in the risk assessment and risk management plan certain anticorruption safeguards have, or will be, incorporated into the project to mitigate the risk of diversion of funds and to enhance and strengthen governance, accountability and transparency.

141. **Project website.** A project website will be established within the existing DOW website where the borrower will disclose key project related information including the audited project financial accounts, project progress, and procurement activities including the publishing of short-lists, invitation for bids and contract awards.

142. **Supervision consultants.** Supervision consultants will monitor civil works and operational activities.

143. **Audit requirements.** As indicated above, contracts financed from ADB funds will include provisions specifying the right of ADB to audit and examine the records and accounts of all contractors, suppliers, consultants and other service providers. In addition, contracts, project accounts and financial statements will be independently audited and forensic audits will be conducted of suspected corruption cases. An internal audit of the project shall be included in the work plan of the internal audit unit of DOW.

¹⁵ Available at: <http://www.adb.org/Documents/Policies/Anticorruption-Integrity/Policies-Strategies.pdf>.

¹⁶ ADB's Integrity Office web site is available at: <http://www.adb.org/integrity/unit.asp>.

144. **Ombudsman.** The existing PNG Ombudsman institution may be called upon to investigate any irregularities or complaints.

145. **Grievance redress mechanism.** Within 3 months of the effective date, the project implementation staff shall prepare a grievance redress mechanism, acceptable to ADB, and appoint an officer to receive and resolve complaints or grievances or act upon reports from stakeholders on misuse of funds and other irregularities, including relating to interactions with communities. The project implementation staff shall inform stakeholders of their right to submit complaints or grievances relating to the project.

XI. ACCOUNTABILITY MECHANISM

146. People who are, or may in the future be, adversely affected by the project may address complaints to ADB, or request the review of ADB's compliance under the Accountability Mechanism.¹⁷

¹⁷ For further information see: <http://compliance.adb.org/>.

XII. RECORD OF PAM CHANGES

147. All revisions/updates during course of implementation should be retained in this Section to provide a chronological history of changes to implemented arrangements recorded in the PAM.

BRIDGE DESIGN BRIEF

1. This bridge design brief sets out the design requirements for all bridges to be constructed under the ADB Bridge Replacement Program. The use of this bridge design brief will encourage the development of standardized bridge designs across the program and the introduction of techniques new to PNG to provide cost-efficient bridge designs.
2. Box culverts as included in this bridge design brief shall be designed as bridge structures unless separately specified.

1. Bridge General Requirements

1.1. Stream Channel Stability

3. The majority of bridge failures in PNG result from stream channel changes that result in abutment washout or inundation of the bridges. Stream channels can be of several types and these relate to the regime of the streams. Streams are of many types including meandering streams, braided streams, and fan streams. The catchments of many streams in PNG are subject to earthquake induced landslides that result in very high stream sediment loads and rapid changes in stream bed level.
4. The designers shall undertake a morphology study of each stream to be crossed including a history of the prior bridges at each site to assess the stream regime, the likely changes in the stream channel with time, the overall stability of the stream channel at the bridge site, the extent and type of any river training works to maintain the stream channel at the bridge and the likely performance of a bridge constructed at the site.
5. Bridge performance in some regions may also be affected by morphology changes resulting from volcanic eruptions. The designers shall review the past earthquake, landslip and volcanic history of the bridge sites.
6. The designer shall advise the DOW if a proposed bridge site is not suitable for the proposed bridge, and the DOW will advise if a bridge design is required for the site or if the site can be removed from the design program.

1.2. Bridge Alignment

7. All replacement bridges shall be located generally on the same alignment as the existing stream crossing or on the same alignment as the prior bridge where the bridge has been removed or washed away. This shall require a temporary road crossing of the stream during construction of the new bridge.
8. For bridge sites where the cost of a temporary stream crossing would be very high, the new bridge shall be located immediately adjacent to the existing bridge subject to the approval of the DOW and the availability of the required land.

1.3. Bridge Length

9. The project costs are greatly influenced by the lengths of the bridges and therefore the bridge lengths shall be minimized as much as possible to reduce the project cost. The bridge lengths shall be determined to provide sufficient waterway area as calculated by hydrological analysis, to not constrict the streams and to provide for adequate scour protection to the abutments.

10. Reinforced concrete box culvert structures may be provided as an alternative to bridge structures on small streams. Box culverts shall be single cell and the roof of the cell shall form the roadway.

1.4. Bridge Configuration

11. The designers shall design the bridges to following configuration:

- (i) Two-lane bridges for bridges of up to 60 m overall length,
- (ii) Single-lane bridges with substructures designed for future widening to two-lanes for bridges with an overall length between 60 m and 100 m where the existing level of traffic is less than 500 vpd (vehicles per day, weekly average), otherwise two-lane bridges are to be provided.
- (iii) Single-lane bridges for bridges 100 m or longer where the existing level of traffic is less than 500 vpd, single-lane bridges with substructures designed for future widening to two-lanes where the existing level of traffic is less than 1,000 vpd, otherwise two-lane bridges are to be provided.

12. These criteria shall be assessed using the latest vehicle traffic data available from the DOW.

13. Bridge deck traffic lanes shall have a width of 3.25 m; there shall be a shoulder width of 0.5 m between the traffic lane and the kerb.

14. Concrete traffic barriers will not be used to permit pedestrians to move between the vehicle deck and the footways; non-mountable kerbs will be provided. Concrete traffic barriers will be provided at each end of the bridge to funnel the traffic onto the bridge.

15. A single walkway with a clear width of 1.2 m shall be provided on all permanent bridges except for bridges located in built-up areas where two footways shall be provided. A walk path with a clear width of 1.2 m shall be provided to connect the road formation to the walkway(s) on each bridge located behind the bridge approach protection(s).

16. Box culvert stream crossings shall be designed to provide traffic way the same width as the adjacent road formation width. A separate walkway is not required at box culvert structures.

17. All temporary (Bailey) bridges shall be designed as single-lane single-span bridges with no separate walkways.

18. Concrete stairways shall be provided on each bridge or box culvert abutment extending from the roadway level to the normal stream water level. Two stairways shall be provided to each abutment to bridges with two footways. The stairways shall have a clear width of 1.2 m. The stairways shall be designed in accordance with AS1657 except that a single rail handrail

shall be provided on the outside of the walkway. The handrail and supports shall be constructed from galvanized steel water pipe with a minimum diameter of 80 mm with fully welded joints; supports shall be at a maximum spacing of 3 m. The supports shall be built-in to concrete footings with a minimum volume of 0.15 m³.

19. Bridge decks will not have any additional surfacing. An additional thickness of 20 mm will be added to the top cover of the bridge deck as a wearing surface.

1.5. Bridge Protection

20. Permanent bridges shall be provided with a combination of flexible guard rail and concrete barriers immediately adjacent to the bridge abutments to protect the bridge and pedestrians from vehicle impact. These barriers will be designed to slow impacting vehicles down gradually rather than a sudden stop.

21. Box culvert structures shall be provided with flexible guard rail barriers adjacent to the structures.

22. Temporary bridges shall be provided with flexible guard rail barriers and impact posts in line with the bridge trusses immediately adjacent to the bridge abutments to protect the bridge and pedestrians from vehicle impact. The impact posts shall be 250 UBP sections 1.8 m long built 900 mm into concrete footings with a minimum volume of 0.3 m³.

23. All permanent bridges shall be provided with approach slabs at each abutment. The approach slabs shall be supported at the abutments but shall be free to rotate. The approach slabs shall be designed assuming that the soil support load is along the back edge of the approach slab.

24. Galvanized steel impact angles shall be provided at all concrete corners exposed to traffic loading or debris impact.

1.6. Bridge Substructures

25. All design of bridges for this project shall include substructures that will not fail if the stream banks are scoured out to the lowest stream bed level. All bridges shall be founded on piles unless a competent non-erodible material such as rock occurs at a high level. Gabion structure abutments are not acceptable for bridges.

26. All permanent bridges shall be designed for complete abutment washout to the stream bed level extending back to the piles. The superstructure may be considered to prop the abutments in this case.

27. For multi-span bridges, the abutments shall be designed as piers to permit their simple conversion to piers in the event that an abutment is washed out and a decision is made to extend the bridge.

28. Scour protection shall not be considered as providing any capacity to limit or reduce scour.

29. All piled foundations shall allow for the maximum calculated scour depth at each abutment or pier and the piles shall be designed to develop full fixity in bending below the scour

depth. This requirement requires that piles designed to be driven into ground containing boulder beds or dense materials are suitable for passing obstructions and extending into solid ground. Driven piles that are likely to reach refusal at less than the required depth shall not be acceptable.

30. Box culvert structures may be considered as pad footings and shall include measures to prevent piping through the approach backfill or foundation. Box culverts shall be designed for the maximum calculated scour downstream of the structure.

1.7. Proposed Bridges

31. The various types of bridge are listed below:

Proposed Bridge Types

Bridge Type	Description	Comment
1	Multi-span bridge	Continuous composite steel or prestressed concrete girder superstructure with articulated ductile substructures. The piers shall be ductile.
2	Single-span bridge	Composite steel or prestressed concrete girder or steel through truss superstructure with non-ductile substructures. Ductile superstructure/substructures connections shall be provided.
3	Single-span bridge for high seismic areas	Overhung continuous single-span composite steel girder supported on two piers with cantilever ends connecting to the approach road embankments. The piers shall be ductile.
4	Box culvert	Cast reinforced concrete single-cell box culverts may be adopted for small streams where appropriate. The box culvert shall be full height with the roadway on the top slab to minimize the possibility of debris blocking during floods.
5	Bailey bridge (reuse bridge)	These are used for the reuse bridges on adjacent feeder roads. Substructures shall be designed for scour and limited seismic resistance.

32. The proposed bridge cross sections are listed below:

Proposed Bridge Cross Sections

Section Type	Description	Comment
1	Two-lane	Adopted for most bridges
2	One-lane with provision for widening	Adopted for long bridges on medium traffic roads
3	One-lane	Adopted for long bridges on low traffic roads
4	Full formation width	Adopted for box culverts

33. Bridge configuration is designated by a code in which the first number designates the structure type and the second number designates the cross section type.

- (i) A 4.4 bridge is a reinforced concrete box culvert.
- (ii) A 3.1 bridge is a two-lane single span bridge in a seismic area.

34. The designer shall consider all available options for the bridge superstructures including but not limited to:

- (i) Composite steel girder
- (ii) Prestressed concrete girder
- (iii) Steel through trusses
- (iv) Single-cell reinforced concrete box culverts.

35. The designer shall consider whole-of-life costs in the comparisons of the superstructure options and the cost estimates should allow for all the construction requirements for each option considered.

36. If steel through trusses are recommended, the proposal layout should include additional end protection to protect the steel trusses from vehicle impacts.

37. Bridges less than 40 m overall length shall be designed without movement joints unless ductile superstructure/substructures connections are provided. Movement joints shall be designed to be low maintenance and shall be suitable for repair using materials available in and fabricated in PNG.

1.8. Reuse Bridges

38. The Bailey bridges recovered from the sites of replacement bridges are to be used to construct reuse bridges on feeder roads.

39. The designers shall:

- (i) Undertake a survey of the Bailey bridging to be recovered from the replacement bridge sites to determine the type, quantities, missing components, damaged components, and condition. All original and ungalvanized Bailey components shall be discarded.
- (ii) Determine the Bailey bridging requirement for the identified reuse bridge sites.
- (iii) Match the available Bailey to the reuse sites, allowing for any necessary down rating of the Bailey capacity, determine the requirement for additional components
- (iv) Document to procedure including any repair or painting of Bailey components.

1.9. Civil Works Design

40. Civil works will be designed in accordance with the DOW Road Design Manual appropriate for the class of road. DOW design standards for rural roads are below:

DOW Rural Road Design Standards

Traffic Category	Traffic (vpd)	Terrain Type	Design Speed (kph)	Width of Pavement (m)	Width of Formation (m)
Heavy	>400	Flat and rolling	80	6.5	8.5
		Hilly	50	6.5	8.0
		Mountainous	30	6.0	7.5
Medium	100-400	Flat and rolling	70	6.5	7.5
		Hilly	50	6.0	7.0
		Mountainous	25	5.5	6.5
Light	<100	Flat and rolling	60	N/A	6.5
		Hilly	45	N/A	6.0
		Mountainous	25	N/A	5.5

kph = kilometer per hour, m = meter, vpd = vehicle per day

41. All new approach roads to permanent bridges shall be designed for the heavy traffic category. All approach roads to permanent bridges shall be sealed to DOW requirements to either connect to the existing sealed roads or for a minimum length of 100 m behind each abutment where the adjacent road is unsealed.

42. All approach roads to temporary bridges shall be designed to the same standard as the existing road.

43. Drainage structures along reconstructed or new bridge approaches will be designed in accordance with the DOW Manual for the Design of Drainage Structures for Rural Roads. Drainage channels to the road verges adjacent to bridges shall be concrete lined to suitable outlet points to protect against erosion.

2. Investigations

2.1. Engineering Surveys

44. The designer shall arrange for adequate engineering surveys of the bridge sites and crossed streams.

45. All engineering surveys shall be undertaken to the requirements of the DOW Survey Section and shall be acceptable to DOW. Particular requirements of the engineering surveys shall include the following:

- (i) The surveys shall provide a complete understanding of the topography of the bridge sites, the streams and the flood plains of the streams.
- (ii) The surveys shall provide sufficient coverage and detail for the design of the bridges, scour protection, any river training and the approach road deviations.
- (iii) The surveys shall include cross sections of the stream channels at a maximum spacing of 50 m, extending at least 300 m upstream and 100 m downstream of the bridge site, to enable the stream gradient to be accurately determined.
- (iv) The surveys shall include permanent control marks (2 No. on each bank) suitable for the construction setout of the bridge.

46. All engineering surveys shall be supplied in hard (survey drawings) and soft (electronic data in approved formats) forms.

47. Copies of all survey data shall be supplied to the DOW.

2.2. Geotechnical Investigations

48. The designers shall arrange for adequate geotechnical investigations of the bridge sites to be undertaken by independent geotechnical consultants.

49. Geotechnical investigations shall include at least one bore hole at the site of each pier and abutment. Bore holes shall be drilled to a depth 5 m below the proposed pile toe levels or below any rock surface encountered. In particular, bore holes shall pass through any cobble or boulder beds encountered. All bore holes shall be logged by a geotechnical engineer and undisturbed/disturbed samples shall be taken as appropriate for laboratory testing.

50. Geotechnical investigation reports shall cover the following requirements:

- (i) The geology of the bridge site.
- (ii) The recent geological history of the bridge site.
- (iii) Foundation conditions at the bridge site.
- (iv) Foundation design parameters for piles and pad footings on encountered rock.
- (v) Liquefaction potential of the bridge foundations.
- (vi) Approach road earthworks and pavement design.

51. A separate geotechnical investigation report shall be prepared for each bridge. Copies of the geotechnical investigation reports shall be supplied to the DOW.

3. Bridge Design

3.1. Design Standards

52. Bridge design will be based on Australian Standards except for those areas where relevant PNG Standards have been published. Bridge design shall be based on AS5100 except as set out in this bridge design brief.

53. All DOW design publications will be adopted for design purposes.

54. The following thermal parameters shall be adopted:

Shade air temperature	Max 46°C	Min 0°C
Average bridge temperature	Max 50°C	Min 6°C
Bridge temperature	Max 60°C	Min 1°C
Installation temperature	30°C	
Temperature variation	-29°C to +30°C	

55. The strength of material used shall be as follows:

Material	Strength
Concrete	32MPa
Reinforcement bar	Grade 500
Structural steel	Grade 350
Steel piles	Grade 350

3.2. Design Loading

56. Permanent bridges shall be designed to the following loadings:
- (i) T44 truck loading (the L44 lane loading shall not apply).
 - (ii) W7 wheel load.
 - (iii) T66 truck overload (similar to T44 truck but axle loads increased by a factor of 1.5)
 - (iv) Non concurrent footway loading of 5kPa
 - (v) A single design truck shall be considered in each carriageway except for continuous bridges where two design trucks shall be considered, located so as to generate the highest loads.
57. Temporary (Bailey) bridges shall be designed to the following loadings:
- (i) T33 truck loading.
 - (ii) T44 truck overload.
 - (iii) A single design truck shall be considered.
58. Load factors shall be in accordance with AS5100.

3.3. Hydrology and Hydraulics

59. The design flood flows for bridges shall be calculated using the Papua New Guinea Flood Estimation Manual (1990).
60. The design flood flows shall be as follows:
- (i) Q_2 Serviceability loading
 - (ii) Q_{100} Clearance to soffit
 - (iii) $Q_{2,000}$ Ultimate loading ($Q_{2,000}$ calculated as the Q_{100} discharge multiplied by 1.65).
61. Designers shall allow for the defined variance in the flood estimation methods and calculate the flood discharges at the 90% probability point at the end of the variance.
62. Bridges shall be designed for the following clearances to the bridge soffit:
- (i) Most bridges 1.0 m
 - (ii) Bridges with stream catchment exceeding 10 km² in defined cyclonic areas 2.0 m.
63. The design clearance shall be increased where it is assessed that the stream channel may rise over the design life of the bridge.
64. The allowable Q_{100} afflux caused by a stream crossing shall not exceed the following:
- (i) Bridge 100 mm
 - (ii) Box culvert 200 mm
65. All permanent bridge superstructures shall be designed for a 10 tonne impact load at any point.

3.4. Seismic Design

66. The manual Earthquake Engineering for Bridges in Papua New Guinea (1985) shall be used for all bridge design. All bridges shall be designed to be Type B – fully ductile articulated structures. All box culvert structures shall be designed as Type C – non ductile structures.
67. The importance factor shall be 1.2.
68. The designers shall demonstrate that any proposed alternative seismic control devices such as the so-called ductile posts have insufficient ductility to resist the design earthquake.

3.5. Scour Protection and River Training Design

69. The use of the River Training Manual (1987) shall be used for the design of all scour protection and river training works.
70. Gabions if used to protect bridge abutments from erosion shall be founded below the average stream bed level if founded on erodible material. Gabions exposed to high velocity water flow shall be protected by a 100 mm concrete facing extending up to the calculated 2-year flood level.
71. Riprap will be used for scour protection where available.

4. Design Deliverables

72. The designers shall supply the design deliverables listed in the following sections.

4.1. Investigation Phase Report

73. The designers shall submit the Investigation Phase Report (IPR) for each bridge to the DOW for approval prior to proceeding with the detail design. The IPR shall include the following sections.

Introduction	A context of the project
Location	Province, road, chainage, map reference
Existing Structure	Type, condition and load capacity
Appreciation	An appreciation of the site Stream channel stability Investigations undertaken
Environment	A description of the bridge environment
Road	A description of the adjacent road
Geotechnical Evaluation	An interpretative evaluation of the geotechnical investigation report
Hydrology	Description of hydrological assessment undertaken including the calculated flood flows
Hydraulics	Description of the river hydraulics under the design flood flows based on engineering survey
Location	Proposed alignment of replacement bridge
Bridge geometry	Proposed bridge configuration
Scour and River Training	A discussion of necessary scour protection and/or river training
Substructures	Details of substructures evaluated with cost comparison
Superstructures	Details of superstructures evaluated with cost comparison
Options	Discussion of options
Traffic	Traffic management during constructions

Recommendations	Preferred form of construction
Executive summary	One page summary in a form suitable for submission to the ADB
Appendices	List of reports Geotechnical investigation reports Survey drawings Hydrological analysis calculations Hydraulic analysis calculations Photographic record of site

4.2. Final Design Report

74. The Final Design Report (FDR) for each bridge shall be submitted to the DOW for approval when the design for each bridge is complete. The FDR shall contain the following sections:

Introduction	A brief history of the project development, citing previous reports
Location	Province, road, chainage, map reference
Existing structure	Type, condition and load capacity
Appreciation	A general appreciation of the site covering topography, access, flood and scour, ground conditions, setting out, materials
Description	A description of the proposed bridge, road approaches and other works
Traffic diversion	Provision for maintaining traffic during construction
Amendments to IPR	Reasons for any changes from the IPR recommendations
Amendments to DOW Specifications	Any amendment and additions to the Standard Specification for Road & Bridge Works
Supervision	Recommendations for supervision of construction Notes on any special aspects during construction
Engineer's Estimate	Priced bill of quantities
Executive Summary	One page summary in a form suitable for submission to the ADB
Appendices	Design calculations for record purposes Schedule of documents, drawings, etc Reinforcement bending schedule Draft contract documents Bill of quantities Engineer's estimate

4.3. Drawings

75. The design drawings shall include the following drawings, as appropriate, to fully document the works to be constructed. A full and complete set of drawings shall be prepared for each bridge. All drawings shall be drawn at scales suitable to show the required details.

General Arrangement	Location Plan and elevation of proposed bridge and approaches Typical cross section
Approach Road	Plan and Elevation Cross sections
Substructure Layout	Plan of bridge location showing substructure and setting out information Bore hole locations and Elevation showing foundations and borehole logs Elevation and sections showing substructure geometry
Deck Layout	Plan and cross section
Steelwork Details	Plan, elevations, sections and details of all structural details
Piling	Details of piles

Scour Protection	Details of scour protection
River Training	Details of river training
Concrete Details	Plans, elevations and sections to show arrangement of abutments, piers, approach slab, etc.
Reinforcement Details	Details of reinforcement to piers, abutments, deck, barriers, etc.
Bridge Furniture	Parapets, guard rails, expansion joints, bearings, seismic restraints, signs, etc.
Drainage Details	Details of culverts, headwalls, lined drains, etc.
Roadworks Details	Details of earthworks, pavement, sealing, line marking, etc.