

# Department of Works and Implementation

*Building the Nation for You*

Developing and Maintaining a Safe, Reliable and  
Sustainable National Road Network

## 2018 -2037 NATIONAL ROAD NETWORK STRATEGY





# **2018 -2037 NATIONAL ROAD NETWORK STRATEGY**



*Building the Nation for You*

# PNG ECONOMIC ROAD AND MAINTENANCE PL



**"Our Roads, Our Future"**  
- Prime Minister Peter O'Neill, 2018





# NETWORK DEVELOPMENT AN 2018 - 2037

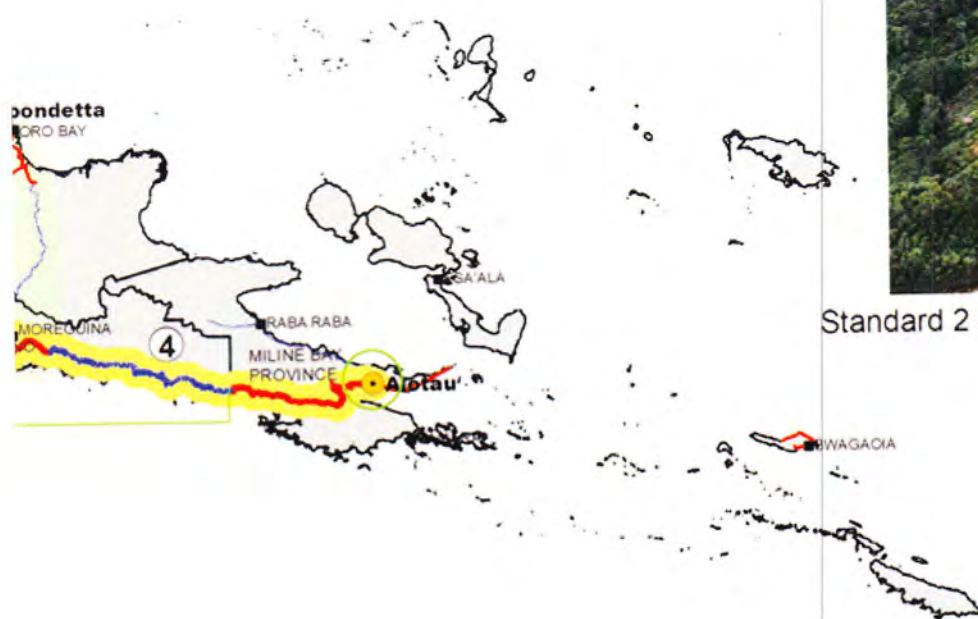
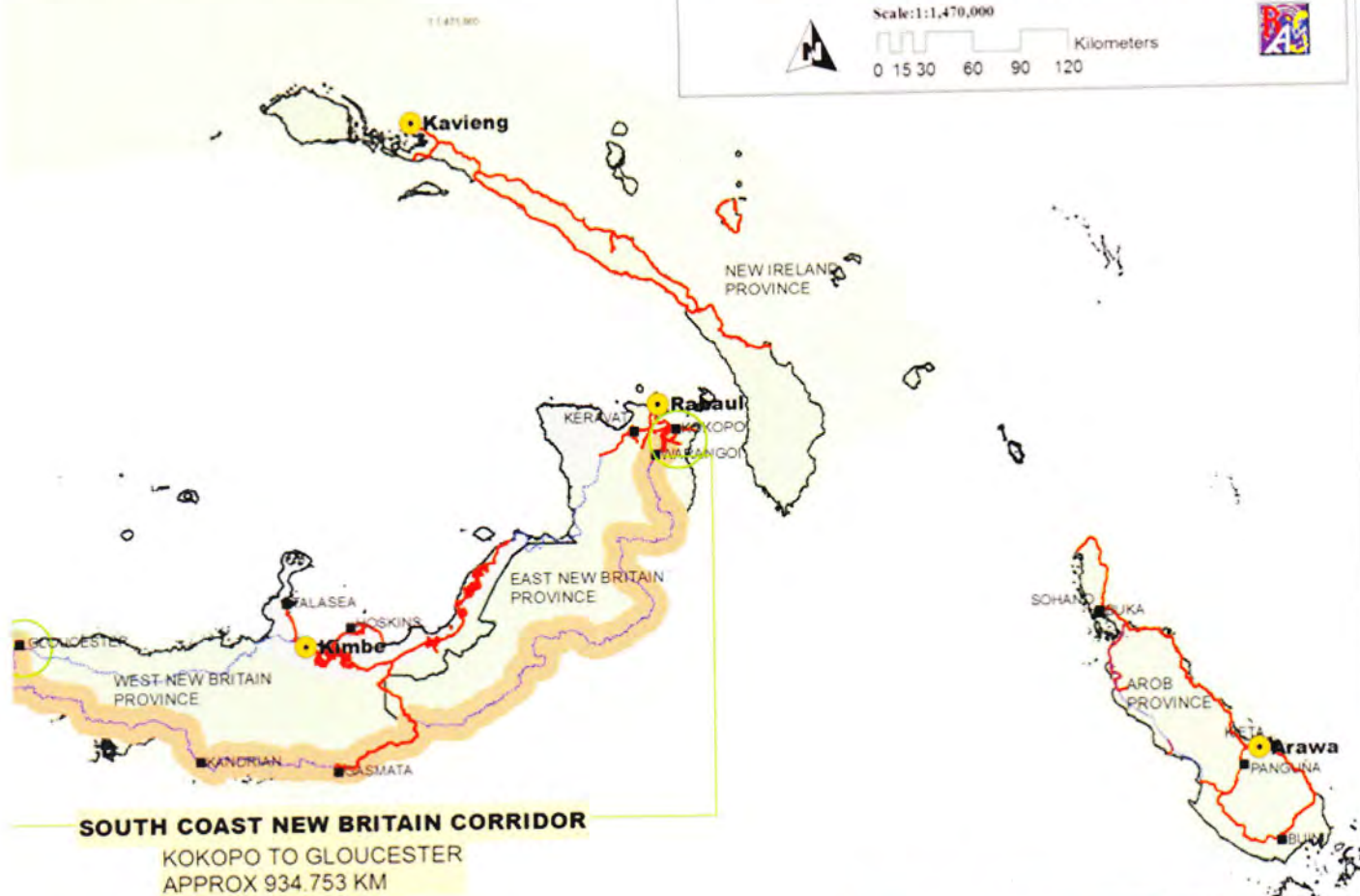


**DEPARTMENT OF WORKS**  
Strategic Road Network Planning  
Asset Management Branch  
**ROAD CORRIDORS**



Scale: 1:1,470,000

0 15 30 60 90 120 Kilometers



Standard 2 Lane Road to be applied







## ABBREVIATIONS

CORE	:	Core Roads
CSO	:	Civil Society Organizations
DNPM	:	Department of National Planning and Monitoring
DRM	:	Disaster Risk Management
DoW	:	Department of Works and Implementation
DSP	:	Development Strategic Plan, 2010-2030
GDP	:	Gross Domestic Product
GoPNG	:	Government of Papua New Guinea
HDM 4	:	Highway Development Model (Release) 4
HIMS	:	Highway Information Management System
LNG	:	Liquid Natural Gas
MTDP	:	Medium Term Development Plan
MTDP2	:	Medium Term Development Plan2
MTTP	:	Medium Term Transport Plan
NADP	:	National Agriculture Development Plan, 2007-2016
NDRMP	:	National Disaster Risk Management Plan
NHP	:	National Health Plan
NRA	:	National Roads Authority
NRN	:	National Road Network
NRNS	:	National Road Network Strategy
NRSC	:	National Road Safety Council
NSO	:	National Statistics Office
NTS	:	National Transport Strategy
ODA	:	Official Development Assistance
PNG	:	Papua New Guinea
PR	:	Priority Roads
PWU	:	Provincial Works Unit
RAMS	:	Road Asset Management System
RTA	:	Road Traffic Authority
TIPS	:	Transport Infrastructure Priorities Study
TMP	:	Tourism Master Plan







## MESSAGE FROM THE PRIME MINISTER



*Our country's road network will continue to play a significant role in the future development of our country. The declining state of our road infrastructure assets accumulated over the years is already proving to be insufficient to deliver the economic and social services needed to drive faster economic growth and improve human development.*

*Our government in the last 7 years from 2012-2017 has made a record investment of K3.8 billion in reducing the maintenance backlog and developing high standard roads and bridges on key strategic roads in the country.*

*This level of government commitment on a long-term investment plan will be continued through The PNG National Road Network Strategy (NRNS) for the sustainable maintenance of our road network over the next 20 years from 2018-2037. The Department of Works will use the Strategy to guide them in the future management of our road network.*

*The Government's vision is for the country's strategic national road network to be maintained through long-term performance-based contracts. This strategy ensures the alignment of our socio-economic development objectives of health, education and business.*

*We have made inroads but there is still more to do. I am sure that by working together we can realize the benefits of improved road access, which is necessary to drive our industries, businesses and service delivery programs and increase employment opportunity.*

*I am proud to endorse the National Road Network Strategy and I look forward to its successful implementation.*



**Hon. Peter O'Neill, CMG, MP**  
**Prime Minister**







## MESSAGE FROM THE MINISTER FOR WORKS AND IMPLEMENTATION



*As Minister for Works & Implementation, I fully endorse this National Road Network Strategy as the necessary vision for managing the National Road Network in Papua New Guinea.*

*The O'Neill/Abel government remains committed to supporting infrastructure development as a priority policy. We will continue to provide the necessary funding to ensure our national road network meets the targets set out in this strategy.*

*This document is a clear plan to meet the challenges of providing an appropriate level of service in a tight fiscal environment.*

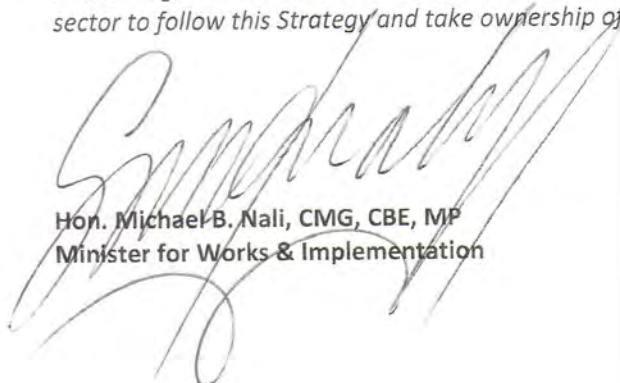
*The Strategy is a blueprint for the business of managing roads and bridges. And contains the principles of maintaining and improving PNG's national road network over the next 20 years.*

*My department has developed a rational, evidence-based strategy to make road maintenance and management work in the national interest. I am pleased that this new long-term approach has the understanding and full backing of the whole government and central agencies and provides clear direction to our development partners.*

*The Strategy has a sharp focus on ensuring accessibility on the National Road Network which connects businesses and communities. In Papua New Guinea 89% of transport needs depend on road infrastructure; a driver for economic and social development for inclusive growth.*

*I reaffirm my commitment to the government's "maintenance first" policy implemented in the most effective and sustainable way.*

*I encourage all the stakeholders from across government, development partners and the private sector to follow this Strategy and take ownership of infrastructure development in this country.*



**Hon. Michael B. Nali, CMG, CBE, MP**  
**Minister for Works & Implementation**







## MESSAGE FROM THE SECRETARY FOR WORKS AND IMPLEMENTATION



*A properly developed and sustained road network in Papua New Guinea will contribute significantly towards providing that enabling environment to grow the economy of the country. The current network is estimated to carry 89% of all nationwide passenger and freight traffic and ensures connectivity between transport modes. Our most important roads consist of the 7,840 km national road network (NRN), which connect our major cities and economic growth centres to markets, seaports and airports. The national road network is crucial to PNG's social and economic development and to the delivery of services to population centres. As our economy and population grows, demand for road transportation also grows, and we must keep pace with this demand, by ensuring that our roads are adequately maintained and fit for purpose.*

*However, funding has not kept pace with the growing cost of maintenance and decades of minimal maintenance has seen the condition of the national road network decline steadily. The maintenance backlog has grown to a stage, where we must start investing properly in roads, because the business as usual will see the steady loss of our road infrastructure and the inevitable collapse of the national road network. The first step is to cut wastage by getting out of the build, neglect and rebuild cycle that has been the practice over the past decades and introduce preventative maintenance programmes to extend the life of our roads, to the full 20 to 25 years of useful service. Preventative maintenance provide a much better return on investment than rehabilitation of neglected infrastructure. Since 2012, government investment in roads and bridges totalled K 3.2 billion. This significant investment has contributed to the current 3,336 km of roads, including urban roads, in good condition across the nation. However, the investment will go to waste, if we do not maintain these assets.*

*We will always be faced with constrained funding for the maintenance of our roads, however with the right funding of the right treatments, in the right locations, at the right timing, we can maximise the benefits of the money spent. The Department of Works (DoW) have developed the National Road Network Strategy (NRNS) that sets out a pathway towards a more safe, reliable and sustainable National Road Network (NRN). The strategy promotes life-cycle maintenance with long-term performance-based contracting as its main procurement model. It adopts a network and evidence-based approach, with a "Maintenance First" policy, as the guiding principle, whilst advocating for improved road standards to keep up with increasing traffic volumes and the effects of climate change. The Strategy will depend on reliable and adequate multi-year funding to be successful in bringing our national road network, back to 50% 'Good' and 50% 'Fair' condition level, within the 20-years period beginning in 2018.*

*Good roads will reduce the cost of road transportation, reducing the cost of travel, works, goods and services around the country and promotes business, employment, development and reduces poverty. The alternative offers higher cost of business and economic production, which reduces our competitiveness and investment, which eventually translate to greater poverty. The NRNS is a holistic, rational, and pragmatic approach to the maintenance of our roads. However, the network can only be fit for purpose if funding is at appropriate levels and delivered with this network approach.*

*I strongly recommend this strategy for our National Road Network and look forward to working together with all key stakeholders to achieve our shared goals.*

**David Werah**

Secretary, Department of Works









PAPUA NEW GUINEA GOVERNMENT

NATIONAL EXECUTIVE COUNCIL

Decision No: **128/2018**

Special Meeting No: **11/2018**

Subject: **PNG NATIONAL ROAD NETWORK STRATEGY 2018 - 2037**

On 21<sup>st</sup> May 2018, Council:

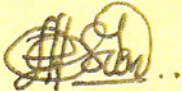
1. noted the content of Policy Submission No. 97/2018;
2. approved to adopt the *National Road Network Strategy* as the blueprint for securing the National Roads and Bridges Network, aligned with the *Medium Term Development Plan* and the *National Transport Strategy* and endorsed the "**maintenance first**" guiding principle for the preservation of the Road Network;
3. approved to acknowledge the minimum investment needed for the first five year phase from 2018 to 2022 of the *National Road Network Strategy*, of K4,739 million for the rehabilitation of the Core Road Network (2,309 km), the ongoing maintenance of the remaining (Non-Core) parts of the National Road Network (6,431 km), and the continued support for ongoing 'Missing-link' road projects; and in order to achieve the 50% 'Good' and 50% 'Fair' condition of the Core Road Network by 2022, recognized that:
  - (i) the K365 million budgeted for road maintenance and rehabilitation in 2018 should be fully disbursed in FY2018 and should any additional funding become available, that priority is given to funding the outstanding K518 million balance, required in 2019;
  - (ii) funding for the amounts of: K887 million (indexed) for 2019; K897 million (indexed) for 2020; K907 million (indexed) for 2021; and K916 million (indexed) for 2022 will be required in-line with the Department of Works' 5-Years Road Recovery and Maintenance Work Plan (Appendix 10); and



- (iii) funding for the National Road Network expansion (Missing-link roads) of K50 million (indexed) annually during Phase 1 (Years 1 to 5), is important to safeguarding past and current investments.
- 4. directed the Department of Treasury, the Department of Finance and the Department of National Planning and Monitoring to explore funding options, including concessional loans and the Tax Credit Scheme, to meet the national road maintenance funding requirements for 2019 and beyond, as a matter of priority;
- 5. directed the Department of Works to investigate the road maintenance cost recovery, through the implementation of road user charges, as a primary source of sustainable road maintenance funding, going forward; and submit a proposed policy on the establishment and operation of road user charges, for NEC's approval;
- 6. directed the Department of Works to publish an annual progressive report on the implementation of the *National Road Network Strategy* and to review the *National Road Network Strategy* and its annual funding in the fifth, tenth and fifteenth years of implementation;
- 7. directed that the Department of National Planning and Monitoring's consultative approach, whereby road agencies are responsible for identifying the road and bridges infrastructure targets for inclusion in the Medium-Term Development Plan 3 is supported;
- 8. directed the Department of National Planning and monitoring to ensure that all future ODA grant contributions, international loans and Tax Credit Scheme funding, intended for the maintenance and development of the National Road Network, are aligned with the *National Road Network Strategy* priorities;
- 9. directed the Department of Works to conduct the necessary institutional reforms to ensure efficient and effective implementation of the *National Road Network Strategy* as described in Section F for approval by NEC;
- 10. directed the Department of Works to immediately commence the development of a *Subnational Road Networks and Rural Infrastructure Management Strategy*, in consultation with the relevant National Government Agencies, Provincial and Local-level Governments and other key stakeholders.



I Certify the above to be a correct record of the  
Decisions reached by the National Executive Council



GRACE SO-ON Acting Secretary, NEC

Date: 23<sup>rd</sup> May 2018

  
PETER O'NEILL, CMG Chairman

Distribution: PRIME MINISTER/MINISTER FOR JUSTICE & ATTORNEY GENERAL/MINISTER FOR WORKS & IMPLEMENTATION/DEPUTY PRIME MINISTER & MINISTER FOR TREASURY/MINISTER FOR TRANSPORT & INFRASTRUCTURE/MINISTER FOR FINANCE & RURAL DEVELOPMENT/MINISTER FOR NATIONAL PLANNING/WORKS/TRANSPORT/TREASURY/FINANCE/NATIONAL PLANNING & MONITORING/PMNEC/JUSTICE & ATTORNEY GENERAL/







## Table of Contents

### EXECUTIVE SUMMARY

<b>I. OBJECTIVES IN FORMULATING THE NATIONAL ROAD NETWORK STRATEGY</b>	<b>1</b>
1.1. CURRENT SITUATION .....	1
1.2. OBJECTIVES .....	1
1.3. METHODOLOGY.....	1
<b>II. THE NATIONAL ROAD NETWORK (NRN)</b>	<b>2</b>
2.1. NATIONAL ROAD NETWORK .....	2
2.1.1 ROAD CLASSIFICATION .....	2
2.1.2 ROAD HIERARCHY .....	2
2.1.3 ROAD CONDITION .....	2
2.2. LENGTH AND CONDITION OF THE NRN .....	2
2.2.1. NRN DESCRIPTION .....	3
2.2.2. MANAGEMENT OF THE NRN .....	9
2.3. THE DEPARTMENT OF WORKS (DoW) .....	9
2.4 THE NATIONAL ROADS AUTHORITY (NRA) .....	9
<b>III. DEVELOPMENT VISION, MISSION, PLANS AND STRATEGIES</b>	<b>13</b>
3.1 VISION 2050 AND MISSION STATEMENT .....	13
3.2 DEVELOPMENT STRATEGIC PLAN (DSP), 2010-2030 .....	13
3.2.1. THE ECONOMIC CORRIDOR .....	14
3.2.2. DSP ROAD STRATEGY .....	17
3.3 PNG'S MEDIUM TERM DEVELOPMENT PLAN2 (MTDP2), 2016-2017 .....	17
3.4 NATIONAL TRANSPORT STRATEGY (NTS) .....	18
3.4.1 SECTOR VISION AND GOALS .....	19
3.5 DoW CORPORATE STRATEGIC PLAN, 2015-2019 .....	19
3.5.1 VISION AND MISSION STATEMENTS .....	19
<b>IV. ROADS AS CATALYST FOR ECONOMIC GROWTH AND SUSTAINABLE DEVELOPMENT</b>	<b>21</b>
1.1 SECTOR/SUBSECTOR ACCESS REQUIREMENTS .....	21
1.1.1 AGRICULTURE .....	21
1.1.2 NATURAL RESOURCES .....	22
1.1.3 TOURISM .....	23
1.1.4 SOCIAL SECTOR .....	24
1.1.5 HEALTH .....	24
1.1.6 EDUCATION .....	24
1.2 DISASTER SUSCEPTIBILITY AND RESPONSE .....	25
1.3 GOVERNANCE .....	25
<b>V. THE NATIONAL ROAD NETWORK STRATEGY (NRNS)</b>	<b>29</b>
2.1 CONTEXT .....	29
2.2 NRNS ASSUMPTIONS .....	29
2.3 NRNS OBJECTIVES .....	30
2.3.1 KEY STRATEGIES FOR THE NRN .....	30
2.3.2 PRIORITIZING NRN MAINTENANCE FUNDING .....	35
2.3.3 ROAD NETWORK EXPANSION .....	36
2.3.4 SUBNATIONAL (PROVINCIAL AND DISTRICT) ROADS .....	38
2.3.5 DoW 5-YEARS ROAD RECOVERY AND MAINTENANCE WORKPLAN, 2018 TO 2022 .....	38



<b>VI. NRN MAINTENANCE FUNDING REQUIREMENTS</b>	<b>41</b>
3.1 ESTIMATE OF NRN MAINTENANCE FUNDING REQUIREMENTS.....	41
3.1.1 MAINTENANCE ACTIVITIES	41
3.1.2 UNIT COSTS	41
3.1.3 MAINTENANCE BACKLOG [ROAD REHABILITATION/RECONSTRUCTION]	41
3.1.4 ROAD CONDITION	42
3.1.5 ESTIMATED COSTS FOR IMPLEMENTING THE “MAINTENANCE FIRST” POLICY	42
3.1.6 ESTIMATED COSTS FOR ROAD NETWORK EXPANSION	46
<b>VII. FINANCING THE NRN STRATEGY</b>	<b>47</b>
7.1 GOPNG REVENUE AND EXPENDITURE SITUATION.....	47
7.2 HISTORICAL AND RECOMMENDED ROAD MAINTENANCE SPENDING .....	47
7.3 FUNDING SOURCES FOR IMPLEMENTING THE NRN STRATEGY.....	47
7.3 ROAD COST RECOVERY POLICY .....	50
<b>VIII. MONITORING AND EVALUATION FRAMEWORK</b>	<b>53</b>
<b>APPENDICES</b>	<b>55</b>
APPENDIX A: PHASE I FUNDING REQUIREMENT – CORE ROADS.....	57
APPENDIX B: PHASE II FUNDING REQUIREMENT – PRIORITY NON-CORE ROADS .....	59
APPENDIX C: PHASE III FUNDING REQUIREMENT – NON-PRIORITY ROADS .....	61
APPENDIX D: MISSING-LINK ROADS – DEVELOPMENT COST ESTIMATE .....	63
APPENDIX E: INDICATIVE DOW 5-YEARS ROAD RECOVERY & MAINTENANCE WORKPLAN, 2018-2022 .....	65



## EXECUTIVE SUMMARY

### Background

The Department of Works (DoW) is faced with the challenge of maintaining the country's National Road Network (NRN) comprised of approximately 8,738 km of roads in various condition. The condition of the NRN has shown continuous deterioration, imposing huge costs to the economy in terms of high vehicle operating costs, longer travel time and poor accessibility to markets and social services.

The economic and social sectors depend on a NRN in good condition, reliable and demand-responsive, to achieve sector objectives and implement priority projects dependent on good road access. The "quality of the road infrastructure" is indicative of a country's competitiveness, infrastructure, in general, being one of the pillars of competitiveness.

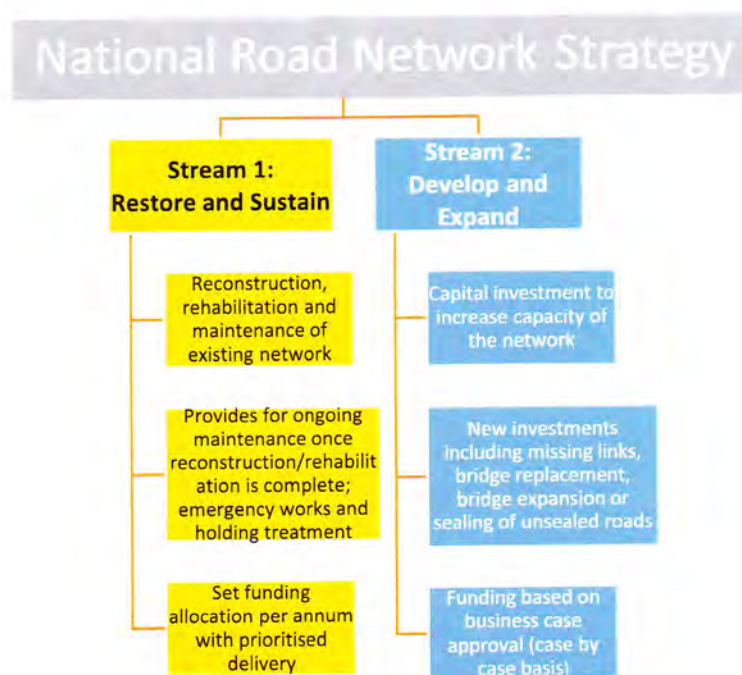
### Objectives of the National Road Network Strategy (NRNS)

The objectives in the formulation of the NRNS document are:

- (1) To impress upon the country's national leadership that roads serve an essential role in achieving sector development objectives;
- (2) To emphasize the need for certainty, sufficiency and consistency of maintenance funding for the NRN including resolving the maintenance backlog;
- (3) To formulate the NRNS implementing "Maintenance-First" Policy of the DoW, at the same time considering GoPNG funding constraints; and
- (4) To ensure that the NRN attains "good to fair condition" status within the strategy implementation period.

The vision of the NRNS is delivering to Papua New Guinea a sustainable and well managed National Road Network by putting the maintenance of our existing roads and bridges as a first priority.

The NRNS has been developed around two distinct streams. The "Restore and Sustain" stream being the priority, focussing on rehabilitation and maintenance of the existing network. And the "Develop and Expand" stream which focuses on new infrastructure.





## Current Situation

### The National Road Network (NRN)

PNG roads have developed around the provincial centres of population, many of which are on the coast and linked nationally by coastal shipping. Local road networks have developed from these coastal centres, along the coastal plains where these exist and along river valleys to penetrate inland. The Highlands Region is landlocked, with the main centres connected by air, spurring the development of the Highlands Highway. This highway connects the five inland provinces with the coast and PNG's Lae port.

This pattern of development resulted in 12 separate road networks plus roads on the smaller islands, linked by sea and air transport. There is aspiration to link the networks on the mainland together, but these linkages would involve long lengths of high cost roads through less populated areas and difficult mountainous or swampy terrain.

As of 2017, the National Road Network (NRN) is comprised of approximately 8,738 km, with 38% in 'Good', 30% in 'Fair', and 31% in 'Poor' condition. Sealed roads comprise 38% of the NRN, with 18% of sealed roads in 'Good', 12% in 'Fair' and 8% in 'Poor' condition. Unsealed roads comprise 62% of the NRN, with 21% of unsealed roads in 'Good', 18% in 'Fair' and 23% in 'Poor' condition.

The NRN is wholly managed by the DoW, which has responsibility for its planning, management, operation, management and monitoring. There are other national government agencies with roles in NRN maintenance, namely: (i) National Roads Authority (NRA); (ii) Department of National Planning and Monitoring (DNPM); and (iii) Selected other national institutions, i.e., agriculture, tourism and mining.

### Management of the NRN

DoW is the primary implementing agency for infrastructure. It started as the Office of Works and Supply during pre-independence. It has offices – regional and provincial works manager - in each province of PNG. DoW's responsibilities include:

- Owns the PNG road network on behalf of the National Government;
- Planning of the management and maintenance of the road network and implementing maintenance activities on the national network in conjunction with the National Roads Authority;
- Establishing and enforcing standards for engineering and maintenance of roads and bridges throughout the country;
- Ensure that quality standards are maintained for the road network, including undertaking technical audits for road construction projects;
- Oversight of building infrastructure in Papua New Guinea through establishment and management of Building Boards; and
- Provide technical assistance to provincial, district and local level governments to develop infrastructure.

### PNG, Sector and DoW Vision Statements

The NRNS is consistent with previous development visions crafted. The overarching vision is Papua New Guinea's Vision 2050. Other planning and development documents for the sector and DoW are aligned with PNG Vision 2050.

The NRNS has a strategic role in GoPNG's planning process and defines how DoW fulfils its functions in support of the objectives of other sectors. How DoW responds to the needs of other sectors for good, reliable and efficient road access is limited by the availability of funding from GoPNG. This is further affected by the use of DoW funding for less urgent projects, straining the maintenance



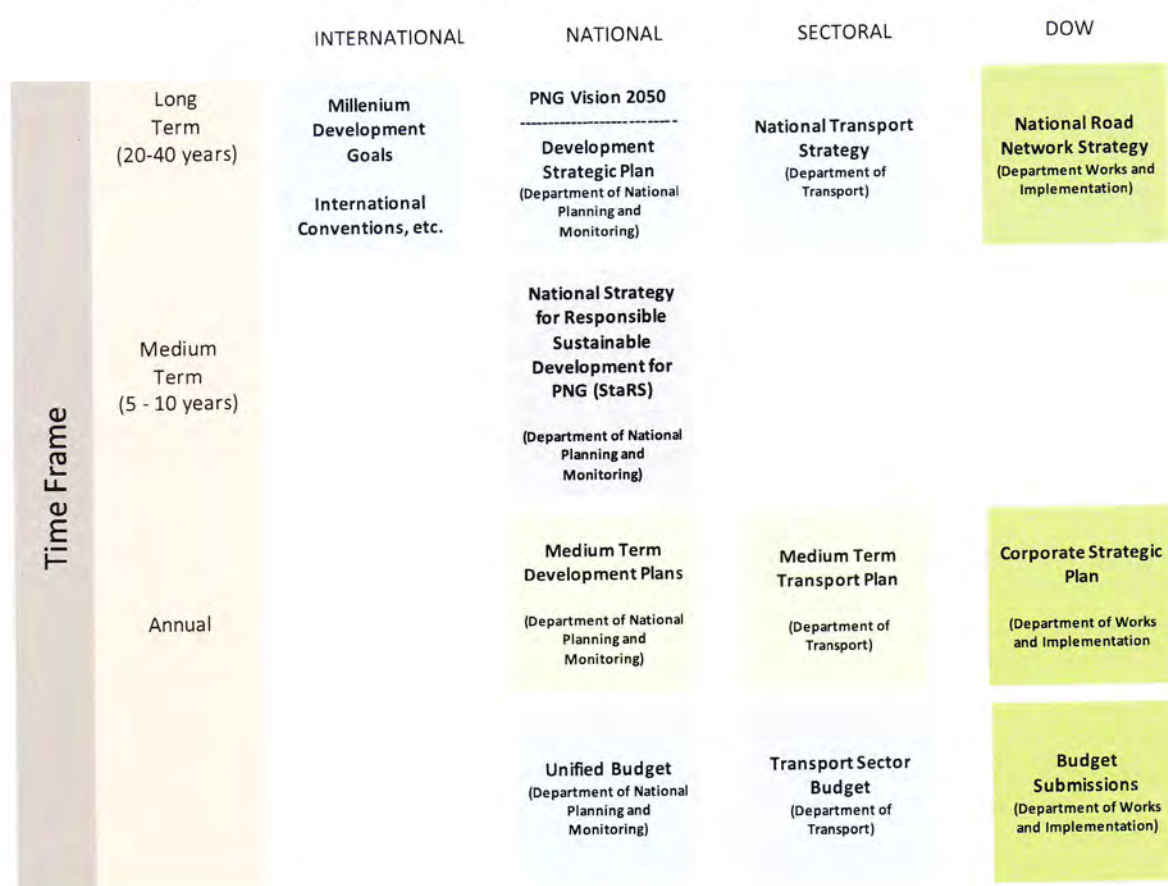
funding for the NRN even further. **Figure ES-1** shows the importance of the NRNS in the overall GoPNG planning process.

### Roads as Catalyst for Inclusive Growth and Sustainable Development

Transport and the NRN in particular are essential in achieving GoPNG's development goals and objectives. The NRN is the means to achieve inclusive growth, with a well-maintained, and reliable NRN ensuring sustainable development. The NRN condition is a barometer of economic growth: a NRN in poor condition stifles growth in trade and agricultural production. The high prices of commodities are in-part the effect of high transport costs due to poor road condition – vehicle operating costs are high, travel time is excessive, resulting in reduction in truck capacity and the economic life of vehicles severely shortened.

An improved quality of life, income and employment opportunities and increased price competitiveness of products can be achieved if the condition of the NRN is improved. This supports the hypothesis that roads are essential in achieving economic growth and inclusive development. The economic and social sectors rely on the NRN and the achievement of sector objectives is endangered by its poor condition. These sectors include agriculture, forestry, mining, oil and gas, trade and industry, education, tourism, and health.

Figure ES – 1 The NRNS in PNG's Planning, Strategy and Budgeting Process





## *The National Road Network Strategy (NRNS)*

### Assumptions

*The assumptions in the formulation of the NRNS are as follows:*

- *The Government's financial situation will continue to be constrained in the next five (5) – ten (10) years. The DoW budget envelope will be restricted and the overall condition of the NRN (roads/bridges) will deteriorate further;*
- *The current practice of allocating the limited DoW maintenance budget to the NRN is not tenable and results in the further deterioration of NRN condition;*
- *Given the limited funding for NRN maintenance, DoW should focus on a shorter network length to be maintained in "fair to good" condition. This ensures that: (i) major economic activities have access to inputs and output markets; (ii) delivery of GoPNG health and education services continue; and (iii) access during natural disasters are assured, with GoPNG enabled to provide emergency response and assistance to affected communities; and*
- *Road maintenance funding should be consistent, reliable and sufficient. Any decrease in funding results in fewer kilometers maintained and continued deterioration of roads.*

### Key Objectives of the National Road Network Strategy (NRNS)

*The key objectives of the NRNS are to:*

- (a) Support sustainable and inclusive economic growth;*
- (b) Provide access to as many people possible within the maintainable sections of the NRN;*
- (c) Improved management of NRN assets; and*
- (d) Improved road safety along the NRN.*

### The NRNS

The 4 key strategies under the NRNS are summarized in **Table ES-1** and are discussed below:

*"Maintenance First" as the Focal Strategy.* GoPNG has made substantial investments on the NRN. The primary strategy focus should be to provide the required maintenance and to ensure that these assets attain their economic life and provide the level of service (LOS) to contribute to national economic growth. The NRN supports sector objectives, economic corridor development, access to employment and job opportunities, and seamless connection to provincial and district roads.

#### Prioritizing NRN Maintenance Funding Under GoPNG Financial Constraints

*Given the maintenance funding shortfall over the years, DoW needs to focus on a smaller, compact and maintainable road network. The committed/sustained funding GoPNG should provide DoW for maintenance over the next 5-20 years at the least should be assured. However, the NRNS has flexibility for utilizing available funds appropriated by GoPNG, but the less the funds, the shorter the length and the longer the time to achieve targeted road condition. This in turn translates to higher road maintenance and restoration costs; and significantly higher costs to businesses, major industries, government and society generally, from reduced mobility and road safety, higher vehicle operating costs, loss of business opportunities, etc. The prioritization scheme is shown in **Figure ES-2**.*

*Ensuring a committed focus on the maintenance of the NRN avoids the huge expenditures to restore roads in "poor" to "fair" condition. It is common knowledge that K1.00 spent on road maintenance per year saves K3.00 in future expenditures to restore a road in "poor" to "good" condition.*

*It is not possible to raise the NRN to "good" condition, unless sufficient funding is made consistently available, for the maintenance requirements of the NRN. The practice of allocating limited maintenance funds to the whole NRN resulted in the unabated deterioration of the NRN. Matching limited Government funding with network length requires disaggregating the NRN into sub-networks*



and keeping a minimum network, referred to as the “core” or “backbone”, in good trafficable condition, to mitigate disruption to economic, social and GoPNG activities.

Table ES – 1 Key Strategies for NRN Management

KEY STRATEGIES	
1.	<p>Maintain the NRN to support sector objectives, economic corridor development, access to employment and job opportunities, and to connect with provincial and district roads. The NRN is operated and maintained on a least cost basis within the financial capacity of GoPNG, reduces whole of life asset costs and ensures value for money:</p> <p>1.1 Implement “Maintenance First” policy to ensure that the maintainable road sections are kept in “fair to good” condition;</p> <p>1.2 Match the available DoW funding envelope with the length of the road network to be maintained. DoW to identify the Core Roads that will have priority in budget allocation; and</p> <p>1.3 NRN road sections in “fair to good” condition outside of the Core Roads in the NRNS’ initial phases shall be provided with minimum levels of maintenance subject to availability of funds.</p>
2.	<p>Reconstruct/rehabilitate Core Roads in “poor condition” to “fair or good” condition initially. It is expected that within five (5) years or more, depending on actual available funding, all Core Roads will be in “fair to good” condition:</p> <p>2.1 Rehabilitate/reconstruct road sections in “poor” condition as a priority considering economic viability and key projects of other sectors. It is envisaged that this “maintenance backlog” would be cleared within five (5) years for Core Roads.</p>
3.	<p>Provide a NRN or a sub-network that is safe for all users through the regular conduct of road safety audits, installation of traffic signs and safety barriers and correction of identified accident black spot locations:</p> <p>3.1 Ensure that the core roads have the appropriate signage, traffic calming measures and lane markings for safe operations;</p> <p>3.2 Subsequently, as funding is made available, all other roads in the NRN will also have the appropriate traffic safety measures;</p>
4.	<p>Provide technical assistance and capacity-building to the provincial and district governments on all aspects of road construction, operation and management:</p> <p>4.1 Assist the provinces in the formulation, implementation and monitoring of their Road Network Maintenance and Investment Plans through the conduct of capacity-building programs and on-site coaching of their engineering and planning staff (if any); and</p> <p>4.2 Assist the provinces in the design, tender, contracting, supervision and monitoring of road/bridge projects funded through direct government funding to the provinces.</p>

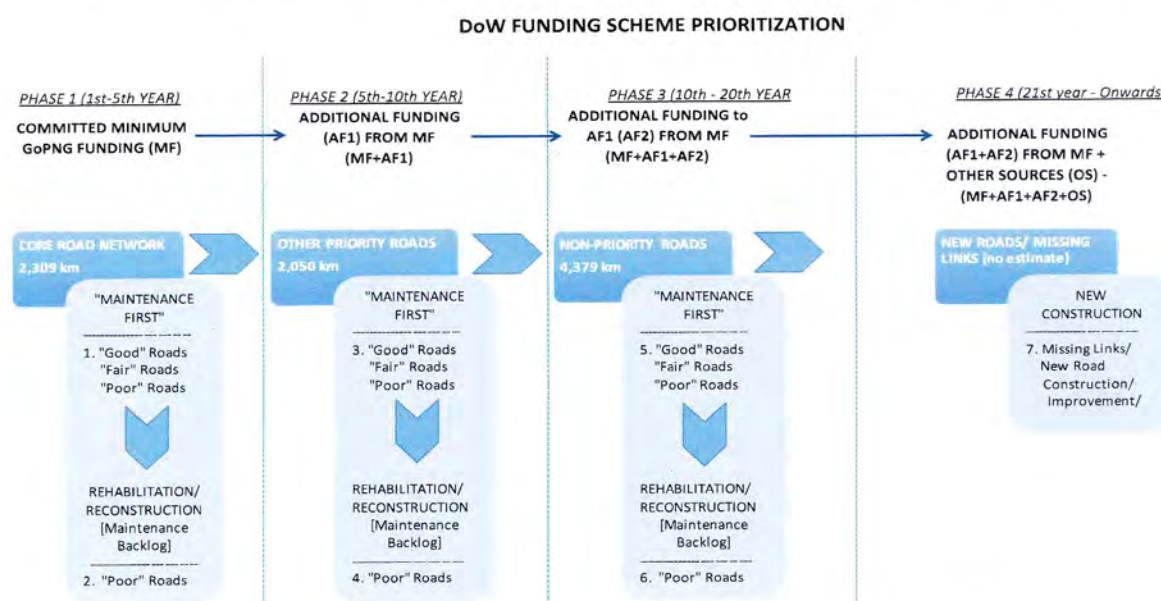
## The Core Roads

Priority Roads (PRs) had been previously identified and evaluated under the PNG Transport Infrastructure Priorities Study (TIPS). It is comprised of about 4,217 km, connecting provincial capitals and major urban centres. The Priority Road Network (PRN) includes bridges, culverts and other river/spring crossings along the PRN. The assessment criteria in PR selection included a set of quantified key criteria and a qualitative priority scale. The priority roads comprise the priority subnetwork of the NRN.

The maintenance cost of the total length of the PRN requires significantly more GoPNG funding than what is available. For this reason, a smaller network length, to serve as the initial set of NRN roads for implementing NRN phased improvement, should be considered. This sub-network is comprised of the “Core Roads with the following characteristics:



Figure ES – 2 Funding Prioritization Scheme for NRN Maintenance, Improvement and Expansion



URGENT/UNPLANNED MAINTENANCE/ MAINTENANCE OF OTHER NRN ROADS IN GOOD/FAIR CONDITION

NOTE: As discussed, the lengths of the phases depend on when the specific targets for each phase are achieved.

- The "Core Roads" retain the existing NRN links between the provincial capitals, district centres, and the priority economic corridors; and
- The "Core Roads" are vital links to the intermodal transfer nodes, such as ports, wharves, airports and airstrips. Ports, wharves, airports and airstrips can serve as alternatives to the "Core Roads" in the event of road closures due to natural disasters.

The "Core Roads" shall have priority over other road sections of the NRN in the allocation of maintenance funding (routine and periodic) for "fair and good" roads and for rehabilitation/improvement of "poor" roads to "fair or good" condition. The preliminary list of the Core Roads is given in **Table ES-2**.

Table ES-2 Priority and Core Roads

No.	Name of National Road	Core Roads	Non-core Roads	Priority Roads
		Length (km)	Length (km)	Length (km)
1	Highlands Highway	611	-	611
2	Boluminsky Highway	122	216	338
3	Koroba to Mendi Road	195	-	195
4	Pogera Road	-	70	70
5	Enga Highway	90	-	90
6	Wabag-Mendi Highway	144	-	144
7	New Britain Highway <sup>1</sup>	271	41	273
8	Sepik Highway	99	159	258
9	Coastal Highway	73	678	751
10	Baiyer Road	-	60	60
11	Hiritano Highway	296	-	296
12	Kokoda and Northern Highways	58	105	163

<sup>1</sup> Includes strategically important 'intermodal' sections of non-priority roads - Talasea and Hoskins roads, totalling 39km



No.	Name of National Road	Core Roads	Non-core Roads	Priority Roads
		Length (km)	Length (km)	Length (km)
13	Wau Road	102	26	128
14	Buka Road	-	183	183
15	Magi Highway	67	316	383
16	Ramu Highway	181	-	181
17	West Coast Road	-	198	198
<b>TOTAL</b>		<b>2,309</b>	<b>2,052</b>	<b>4,322</b>

### Road Network Expansion

There are 25 identified “missing link” national roads, with total length of 4,557 kilometres, of which 1,279 kilometres consist of roads prioritised in the Alotau Accord II, for development in the 5-years period from 2018 to 2022. The list of the “missing link” and alternative roads are given in **Table ES-3**.

Table ES-3 Missing Link National Roads and Alternative Routes

No.	Alotau Accord II	Missing Link Road	Est. Length (km)
1		Kiunga-Aiambak-Obo-Morehead-Malam-Daru	476
2		Kiunga-Mendi	400
3	<b>a. Gulf/Southern Highlands</b>	Kerema-Ihu-Kopi	295
4		<b>Kagua-Erave-Samberigi-Kopi Road</b>	<b>170</b>
5		<b>Malalaua-Wau</b>	<b>300</b>
6		Kupiano-Gadaisu	184
7		Bubuletta-Motau-Lavora-Raba Raba-Agaun	159
8		Bariji-Safia-Moreguina	96
9		Wau-Garaina-Morobe Patrol Post	136
10		Lae-Finschhafen Road	98
11	<b>c.d. Madang/Baiyer (Middle Ramu) Road</b>	<b>Baiyer River-Aiome-Amele</b>	<b>160</b>
12	<b>e. Kiunga/Teleformin</b>	<b>Kopiago-Oksapmin-Telefomin-Tabubil</b>	<b>153</b>
13		Saidor-Wasu-Sialum	97
14	<b>j. Madang/East Sepik Highway</b>	Bogia-Angoram	76
15		Pagwi-Ambunti-Kuvenmas-Laiagam	193
16	<b>i. East/West Sepik Highway</b>	<b>Vanimo-Aitape-East Sepik Border</b>	<b>82</b>
17		Bewani-Imonda-Amanab-Green River-Telefomin	305
18	<b>b. East/West New Britain</b>	<b>Bialla-Kerevat</b>	<b>242</b>
19		Kimbe-Gloucester	200
20		<b>Rabaul-Tol-Pomio-Gasmata-Kandrian-Gloucester</b>	<b>425</b>
21		Siara Junction-Soraken-Kunua-Koripobi-Torokina-Boku	39
22	<b>f. Ungai/Chuave Road</b>		56
23	<b>g. Ramu/Bena Road</b>		50
24	<b>h. Mendi/Tambul Road</b>		74
25	<b>k. Dona/Kerowagi Road</b>		91
		<b>Total:</b>	<b>4,557</b>
		<b>Alotau Accord II Total:</b>	<b>1,279</b>

The NRNS proposes to expand the national road network, through: (a) reclassification of important provincial and district roads to national road category; and (b) through the construction of new



roads, prioritising the identified 'Missing-Link' roads considered to be of significant strategic importance to the nation.

There are clear overlaps between the missing links and the new roads to link the economic corridors. The prioritization of these roads shall depend on the business cases for each. The initial 5-years of NRNS implementation will progress/complete current network expansion works and include the preparation of feasibility studies, pre-construction technical investigations, and land acquisition for identified projects awaiting funding decision. Missing-link roads currently in progress include:

- (a) Karamui – Gumine Missing-link
- (b) Kopiam – Baiyer Missing-link
- (c) Pomio – Kokopo Missing-link
- (d) Teleformin – Tabubil Missing-link
- (e) Gulf-Southern Highlands Missing-link (Samberigi to Erave)
- (f) East-West New Britain Highway Missing-link
- (g) Baiyer – Madang Missing-link

### Subnational Road Networks

PNG's subnational road network is 21,000km in length. These roads are classified by the DoW as provincial and district roads. Development and maintenance of provincial and district roads including other rural infrastructure, such as health centres/clinics, schools, water supplies, electricity supplies, office buildings, etc., are the shared responsibility of Provincial and Local Level Governments (LLGs) and the National Government, through the Department of Works. Funding for rural infrastructure development and maintenance are provided by the national government through the Provincial Support Investment Program (PSIP) and the District Support Investment Program (DSIP). These funds are managed separately by the Provincial and Local Level Governments.

The condition of the provincial and district road networks and other key infrastructure have not been measured through a detailed survey. The Provincial Governments and LLGs have limited technical capacity to manage and maintain their infrastructure and as a result much of the key services in the districts are neglected and in poor condition. DoW estimates that 64% of the provincial and district road networks are in poor or failed condition.

The need for good provincial and district infrastructure is very great, given that about 80% of the population live in rural communities, district centres and provincial towns. DoW will continue to provide support to Provincial Governments and LLGs for the maintenance and development of their roads and other rural infrastructure. However, the need for a long-term strategy to recover and maintain the subnational road networks is obvious.

The Department of Works, in consultation with DPLLGA, the Provincial Governments and LLGs, will develop a separate strategy proposal for the recovery and maintenance of subnational roads, long-term management and operational arrangements including the proposed role and functions of the DoW Plant and Transport Division.

### Estimating the NRNS Funding Requirements

#### Maintenance Activities

The basic scope of maintenance activities consists of:

- (a) Routine Maintenance

Routine maintenance activities are carried out throughout the year on a cyclical basis and includes the following activities: (i) Vegetation clearing; (ii) Crack sealing; (iii) Pothole repairs in



sealed roadways; (iv) Edge Repair; (v) Filling of potholes - unsealed roadways; (vi) Drain cleaning; (vii) Culvert cleaning; (viii) Bridge cleaning; (ix) Culvert and headwall maintenance; and (x) Maintenance of road furniture.

(b) Periodic Maintenance

Periodic maintenance includes the following activities: (i) Shoulder grading; (ii) Patrol grading; (iii) Team grading; (iv) Pavement repairs - sealed roadways; (v) Pavement repairs - unsealed roadways; (vi) Resealing of road surface; (vii) Line markings; (viii) Re-gravelling - unsealed roads; (ix) Culvert headwall replacement; (x) Culvert repairs; (xi) Bridge repairs; and (xii) Drainage repairs.

(c) Urgent/Emergency Maintenance

Urgent maintenance includes responses to flooding, spillage, land slips, wilful damage and any other occurrence that closes the road to vehicular traffic. Works undertaken are of a temporary nature. Emergency maintenance includes responses to major events such as cyclones and generally cover a wider area than the roadway. As previously practiced in PNG, budget allocation for emergency works is 10% of the routine maintenance budget.

### Maintenance Backlog (Reconstruction/Rehabilitation of NRN Roads in "Bad" Condition)

The maintenance backlog is the level of maintenance required to return the road to a condition profile that is acceptable, sustainable and manageable. Expressed in monetary terms, it is the total costs which must be spent to bring the road assets in "backlog" condition to predefined standards (total monetary backlog) or the absolute value irrespective of the available budget. The maintenance backlog is treated as the estimated cost for rehabilitation/reconstruction of portions of the NRN in "poor condition" starting with the "Core Roads" to "fair or good" condition. A phased strategy is proposed wherein, annually, 20% of the "Core Roads" in "poor condition" are rehabilitated/reconstructed to "fair or good condition". After five (5) years, all "Core roads should be in "fair (50%) or good (50%)" condition.

### Estimated Costs for Implementing the "Maintenance First" Policy

Based on the NRNS, the assumptions for estimating the cost requirements for the phased implementation of the "Maintenance First" Policy inclusive of reconstruction/rehabilitation of roads in "bad" condition are summarized below.

#### Phase 1 (1<sup>st</sup> – 5<sup>th</sup> Year)

- All "Core Roads" (sealed and unsealed) in "fair to good" condition provided routine and periodic maintenance (without resealing/regraveling). Twenty percent (20%) of sealed and unsealed roads in "fair and good" condition are resealed/regraveled annually;
- All sealed "Core Roads" in "poor" condition are rehabilitated/reconstructed to "fair (50%) or good (50%)" condition by the 5<sup>th</sup>-year of Phase 1;
- All unsealed CORE roads in "poor" condition are rehabilitated/reconstructed to "fair (50%) and good (50%)" condition by the 5<sup>th</sup>-year of Phase 1, and  
All Non-Core roads (sealed and unsealed) in fair and good condition are provided routine maintenance.

#### Phase 2 (6<sup>th</sup> – 10<sup>th</sup> Year)

- All sealed/unsealed Priority and Core Roads in "fair to good" condition are provided routine and periodic maintenance (without resealing/regraveling). Twenty percent (20%) of sealed and unsealed roads in "fair and good" condition are resealed/regraveled annually;
- All sealed Priority Non-Core roads in "poor" condition are in "fair (50%) or good (50%) condition by the 10<sup>th</sup>-year;



- All unsealed Priority Non-Core roads in “poor” condition are in “fair (50%) or good (50%) condition by the 10<sup>th</sup>-year; and
- All Core and Priority Non-Core sealed roads will be in fair (50%) or good (50%) condition by the 10<sup>th</sup>-year;
- All Core and Priority Non-Core unsealed roads will be in fair (50%) or good (50%) condition by the 10<sup>th</sup>-year; and
- All routine maintenance costs for the Non-Priority roads are included in the Phase 2 budget requirements.

Phase 3 (11<sup>th</sup> – 20<sup>th</sup> year)

- All sealed Non-Priority Roads in “poor” condition are brought to “fair (50%) or good (50%) condition by the 20<sup>th</sup>-year;
- All unsealed Non-Priority Roads in “poor” condition are brought to “fair (50%) or good (50%) condition by the 20<sup>th</sup>-year;
- All routine and periodic maintenance costs for the Core and Priority Non-Core Roads are included in the Phase 3 budget requirement;
- All NRN sealed roads will be in “fair (50%) or good (50%)” condition by the 20<sup>th</sup>-year; and
- All NRN unsealed roads will be in “fair (50%) or good (50%)” condition by the 20<sup>th</sup>-year;

Phase 4 (21<sup>st</sup> year - onwards)

- Estimated costs of missing link roads, new road construction and upgrading are subject to results of the business case analysis to be undertaken for each road. These roads may be implemented subject to availability of funds, with Phases 1-3 funding requirements allocated first.

**Table ES-5** summarizes the estimated NRN Maintenance and Reconstruction/Rehabilitation costs per implementation phase.

Table ES-5 Estimated NRN Maintenance and Reconstruction/Rehabilitation Costs  
Phases 1-3, in million Kina

Description	Phase 1 (5 yrs)	Phase 2 (5 yrs)	Phase 3 (10 yrs)	Total (20 yrs)
<b>Operational Works (Maintenance)</b>	<b>3,841</b>	<b>4,454</b>	<b>9,638</b>	<b>17,933</b>
National Roads (Routine & Periodic)	3,591	4,204	9,138	<b>16,933</b>
Emergency (unplanned) works	250	250	500	<b>1,000</b>
<b>Capital Works</b>	<b>649</b>	<b>356</b>	<b>2,181</b>	<b>3,186</b>
National Roads (Rehab/Reconst)	466	184	1,825	<b>2,474</b>
Bridges Major (Rehabilitation) Works	80	71	152	<b>303</b>
Minor CDS rehab/replacement	15	13	28	<b>57</b>
New Bridge (Const/Replacement)	88	88	176	<b>353</b>
<b>Grand Total:</b>	<b>4,489</b>	<b>4,810</b>	<b>11,819</b>	<b>21,119</b>
<b>Annual CASHFLOW (20 YRS Strategy)</b>				
Operational Works	768	891	964	
Capital Works	130	71	218	
<b>Total Cashflow</b>	<b>898</b>	<b>962</b>	<b>1,182</b>	

Note: Detailed computations are given in Appendix A.



## DoW 5-Years Road Recovery and Maintenance Workplan, 2018 to 2022

**Appendix E** shows DoW's **5-Years Road Recovery and Maintenance Workplan from 2018 to 2022**. This workplan is a live document, depicting a snapshot of DoW's implementation plan for the period of the NRNS Phase 1. The plan is aligned with the National Road Network Strategy, incorporating current on-going projects, whilst emphasising the use of road rehabilitation and long-term (performance based) maintenance contracting model, as the main methodology to achieve 50% 'Good' and 50% 'Fair' conditions in the Core Road Network (2,309 km) by 2022.

### Estimated Costs for Network Expansion

Based on the current list of roads the length of identified 'Missing-link roads amount to 4,557 km. The estimated total construction cost is K5,579 million. To complete all these roads within the 20-years strategy period will require expenditure of: K246 million per year, in the first 5-years phase; K253 million per year in the second 5-years phase; and K308 million per year in the third 10-years phase. Table ES-6, shows the expected cost of network expansion construction.

Given the current financial constraints, expenditure should be kept at affordable levels. It is important that investment decisions for the Missing-Link roads is informed by comparative assessment, endorsed by DoW to ensure underlying estimates and assumptions are realistic. It is recommended that the government should continue to fund existing network expansion projects to protect past investment and continue to expand the network at an affordable budget of K50M per year for the duration (5 years) of Phase 1 of the NRN Strategy.

Table ES-6: Estimated Cost of 'Missing-Link' Roads

Description	Phase: Period:	Phase 1 <sup>2</sup>	Phase 2	Phase 3	Total
		Years 1-5	Years 6-10	Years 11-20	
Unsealed <sup>3</sup> Length Constructed (km)		1,279	1,093	2,185	4,557
Construction Cost Kina (million)		1,162	993	1,986	4,141
Routine Maintenance Cost Kina (million)		66	223	871	1,160
Periodic Maintenance Cost Kina (million)		-	50	227	277
Routine & Periodic Maintenance Total Kina (million)		66	273	1,098	1,438
<b>Total Cost</b> Kina (million)		<b>1,229</b>	<b>1,266</b>	<b>3,084</b>	<b>5,579</b>
<b>Annual Cost</b> Kina (million)		<b>246</b>	<b>253</b>	<b>308</b>	

### Financing the NRN Strategy

In 2016, GoPNG recorded a budget deficit of K3,086.9 million, compared to the 2015 deficit of K2,532.6 million. This represented 4.6% of nominal gross domestic product (GDP). Total revenue, including foreign grants, in 2016 was K10,485.5 million, 4.4% lower than 2015. This represented 89.5% of the revised budgeted revenue for 2016. Total expenditure in 2016 was K13,572.4 million, 0.6% higher than 2015 and represented 98.1% of the 2016 revised budget. Recurrent expenditure increased, while development expenditure declined in 2016 compared to 2015. GoPNG budget deficit was financed from external and domestic sources amounting to K1,448.9 million and K1,638.0 million, respectively.<sup>4</sup>

Given the impact of NRN condition on the country's economy, GoPNG should provide the sufficient level of road maintenance funding to ensure the "fair or good condition" of the NRN. Road maintenance expenditures should range between 1.5% and 3.3% of GDP for developing countries<sup>5</sup>,

<sup>2</sup> Alotau Accord II Missing-Link Roads

<sup>3</sup> Completed to subbase-level standard

<sup>4</sup> Bank of Papua New Guinea. 2016. *December 2016 – Quarterly Economic Bulletin (QEB)*. Port Moresby

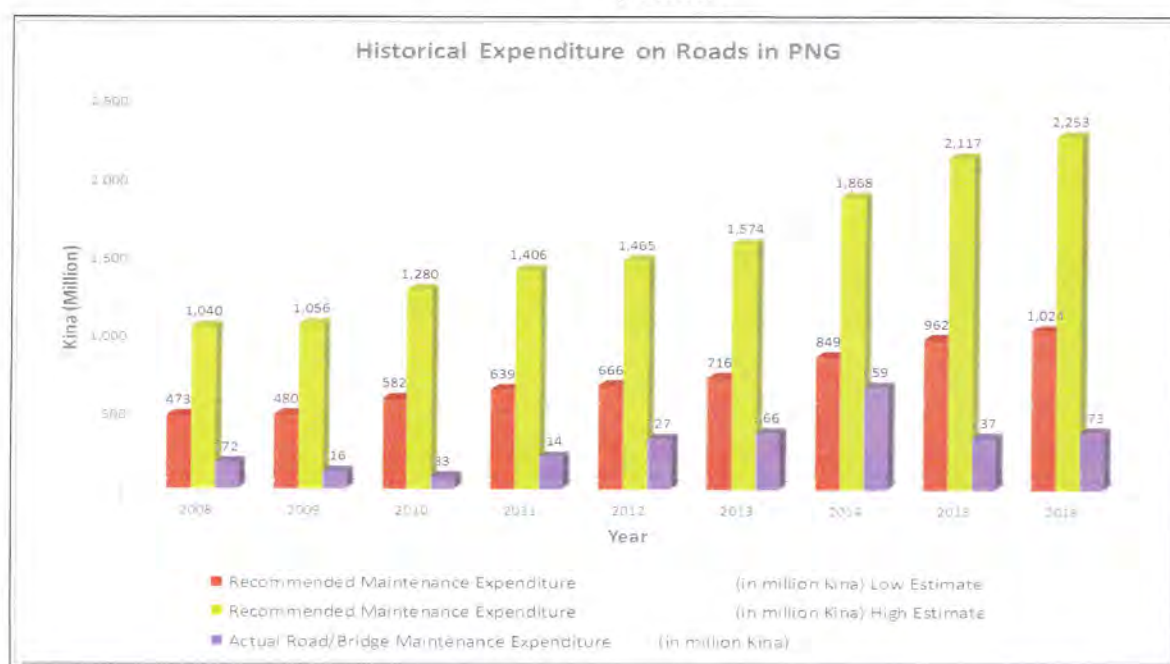
<sup>5</sup> Felix Rioja, *What Is the Value of Infrastructure Maintenance? A Survey*. Presented at the 7th Annual Land Policy Conference: Infrastructure and Land Policies, sponsored by Lincoln Institute of Land Policy, June 4–5, 2012.



depending on current network condition. GoPNG's cumulative underspending for road maintenance ranged from K3,745.1 million to K 11,413.5 million for the period 2008-2016. The amount is the cost of the NRN maintenance backlog. **Figure ES-3** shows a comparison of historical expenditure on roads in PNG (2008 – 2016) with recommended expenditure (high and low estimates) based on GDP.

Current GoPNG spending for road and bridge maintenance are primarily sourced from GoPNG budget appropriations. This is complemented by other funding sources – tax credits, donor funding, fuel levy and GoPNG appropriations for roads to other sector/subsector agencies. The amount of GoPNG appropriations to DoW has been unpredictable and insufficient to fund all the maintenance activities for the NRN, where the actual amount released is substantially less than the approved budget. There are years where DoW was given a high allocation, but, on other times, the allocation has been minimal and insufficient to undertake maintenance activities on even a small section of the NRN. There is need to ensure that DoW gets a predictable, consistent and sufficient appropriation for roads and bridge maintenance annually.

*Figure ES – 3 Comparison of Historical Expenditure on Roads in PNG and Recommended Expenditure*



DoW depends on GoPNG to fund the major portion of its road maintenance expenditures including rehabilitation/reconstruction. To have better control over the funds earmarked for the NRN, GoPNG should aggregate all funds for road maintenance and rehabilitation/ reconstruction including the fuel levy and tax credits and focus maintenance expenditure on the Core Roads. The aggregated funds should be earmarked to fund Phases 1 to 3 of the NRN Strategy implementation. A rolling annual road maintenance program is prepared, where road sections are prioritized according to their economic internal rates of return (EIRR).

Donor funding for roads, when available, should be utilized to support government priorities, as defined under the NRN strategy. Given GoPNG's financial situation and continued deterioration of the NRN, the funding requirement for road maintenance including rehabilitation/reconstruction is now substantial due to the maintenance backlog, and donor support is crucial.

Table ES-7 below shows the indicative funding arrangement for Phase 1 of the NRN Strategy implementation. It is expected that GoPNG will be the major source of road maintenance and rehabilitation/ reconstruction funding from annual budgetary allocation, tax credits and fuel levy.



The ADB, WB, Australia's DFAT, JICA and EIB will provide supplementary donor funding for both roads and bridges' maintenance and rehabilitation/reconstruction. While donor funding may not be aligned to DoW priorities, overall, these would cover a considerable part of the NRN and impact the total funding requirement for NRN maintenance and rehabilitation/reconstruction.

Given the current financial environment, whatever the budget allocation for roads, it will most likely be insufficient to maintain the whole NRN, for the foreseeable future and other revenue sources are needed. The levy currently imposed on fuel is inadequate and not representative of a direct fee for service charge for road usage<sup>6</sup>. A major component of road maintenance expenditure is for the repair of damage to road pavements, caused mostly by heavy vehicles. A cost recovery policy that apply road user charges (RUC), representative of the cost of repair of roads damaged by heavy vehicle traffic, should be adopted. The revenues collected from the RUC should be placed in an off-budget road maintenance fund and would be used to pay for road maintenance costs only.

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<sup>6</sup> The fuel levy also applies to fuels purchased for non-road use purposes, such as fuel for power generators, etc.



Table ES-7: Indicative Funding for NRN Strategy, Phase 1, 2018 - 2022

in million Kina												
Year	Department of Works Budget				NRA 2/	Other Sources		Total - All Sources	Req. Maint Spend/year 3/	Additional Funding Required for NRNS	Additional Funding required for Missing-Link Roads 5/	Total Additional Funding required for Phase 1
	Bridges 2/	Priority Road Maintenance 2/		Tax Credits 4/		Dev. Partner 1/						
		Recurrent	Periodic				Rehab/Recon					
2018	12.00	171.00	19.00	163.00	34.16	50.00	363.30	812.46	882.62	70.16	50.00	120.16
2019	12.00	171.00	19.00	163.00	34.16	50.00	291.40	740.56	887.24	146.68	50.00	196.68
2020	12.00	171.00	19.00	163.00	34.16	50.00	305.35	754.51	896.88	142.37	50.00	192.37
2021	12.00	171.00	19.00	163.00	34.16	50.00	305.35	754.51	906.51	152.00	50.00	202.00
2022	12.00	171.00	19.00	163.00	34.16	50.00	305.35	754.51	916.14	161.63	50.00	211.63

Note:

1/ Amount for TSSP and ADB-funded Sustainable Highlands Investment Program only. Assumes all funding is for Core Roads. TSSP funding only up to 2019.

2/ Assumes 2018 budget allocation for all years of Phase 1

3/ Based on estimate for Core Roads Maintenance Expenditure - Phase 1 of NRN Strategy

4/ Assumes K50.0 million in Tax Credits towards national road network expansion projects

5/ Constructed to sub-base standard. Assumes expenditure on Missing-links and other new roads, limited to K50.00 million per year.



# I. OBJECTIVES IN FORMULATING THE NATIONAL ROAD NETWORK STRATEGY

## 1.1. Current Situation

Papua New Guinea's (PNG) Department of Works and Implementation (DoW) faces the challenge of maintaining the country's National Road Network (NRN) comprised of approximately 8,738 km of roads in various conditions. The NRN has continuously deteriorated, resulting in huge financial and economic costs to the PNG economy in higher vehicle operating costs, longer travel time and poor accessibility to international and domestic markets and social services.

The Government of Papua New Guinea (GoPNG) had not fully funded the maintenance requirements of the NRN, focusing instead on road projects of low priority and unproven economic feasibility, and selected based on political expediency and localized concerns. This misallocation of scarce financial resources has aggravated the poor condition of the NRN. The target condition of the NRN under the Development Strategic Plan 2010-2030 (DSP), the Medium-Term Development Plans (MTDP), the National Transport Strategy (NTS) and the Medium-Term Transport Plan is far from being achieved.

The mindset of "business as usual" cannot persist and DoW needs to explore innovative strategies in restoring the NRN to "fair" or "good" condition.

The different economic and social sectors depend on a good to fair condition NRN to achieve their objectives in implementing priority projects dependent on good road access. The "quality of the road infrastructure" is indicative of a country's competitiveness, infrastructure, being one of the pillars of competitiveness. PNG is not ranked in The Global Competitiveness Report 2016-2017, which would have indicated how competitive PNG's economy is compared to other countries.<sup>7</sup>

## 1.2. Objectives

The objectives in the formulation of the NRN strategy document are:

- (5) To impress upon the national leadership that roads serve a fundamental and strategic role in achieving the development objectives of the various sectors;
- (6) To emphasize the need for the certainty, sufficiency and consistency of maintenance funding for the NRN or parts thereof including resolving the maintenance backlog;
- (7) To formulate the strategy for implementing the "**Maintenance-First**" Policy considering current Government funding constraints; and
- (8) To ensure that the NRN or parts thereof attains "fair to good condition" status within a specific period.

## 1.3. Methodology

In developing DoW's NRN Strategy, the methodology involved utilizing information already available through the numerous plan and strategy documents, consultation with selected economic and social sectors, road network condition and parametric costs data from DoW's Asset Management Branch (AMB), and estimate of the funding envelope and possible financial sources to complement the limited funds available from GoPNG.

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<sup>7</sup> The Report presents the rankings of the Global Competitiveness Index (GCI). The GCI is based on 12 pillars of competitiveness, providing a comprehensive picture of the competitiveness landscape in countries around the world at different stages of economic development. The Report contains detailed profiles highlighting competitive strengths and weaknesses for each of the 144 economies featured, as well as an extensive section of data tables displaying relative rankings for more than 100 variables. *World Economic Forum*



## II. THE NATIONAL ROAD NETWORK (NRN)

### 2.1. National Road Network

Papua New Guinea's roads had developed around the provincial population centres, many of which are on the coast and linked nationally by coastal shipping. Local road networks had devolved from these coastal centres, along the coastal plains where these exist and along river valleys to penetrate inland. The Highlands Region is landlocked, with the main centres connected by air, and spurring the development of the Highlands Highway. This highway connects the five inland provinces with the coast and PNG's main port at Lae.

This development pattern had resulted in twelve separate road networks and roads on the smaller islands, linked by sea and air transport. There is aspiration to link the networks on the mainland together, but this will involve long lengths of high cost roads through low populated parts of the country and difficult mountainous or swampy terrain.<sup>8</sup>

#### 2.1.1 Road Classification

The NRN is classified into four categories: (i) national routes (NR), the main inter-provincial connecting routes; (ii) national main roads (NM); (iii) national district roads (ND); and (iv) national institutional roads (NI), the access roads serving state institutions.<sup>9</sup>

#### 2.1.2 Road Hierarchy

The National Transport Strategy's (NTS) functional hierarchy for the transport network classifies each link (road, air route, sea route) and terminal (towns, airports, seaports) according to its importance as a connecting link in the NRN.

The DoW considers a set of national roads and some provincial roads as priority roads based on their economic role and the adjacent population covered. These priority<sup>10</sup> national roads represent a total length of about 4,256 km.

#### 2.1.3 Road Condition

The condition of the NRN was measured using visual and equipment-based collection methods. This categorizes the collected data into 6 condition categories and reduced to three categories (**Table 2.1-1**). The Highway Information Management System (HIMS) of the Road Asset Management System (RAMS), was developed using a five-scale classification from the three (3) currently in use.

### 2.2. Length and Condition of the NRN

The road condition classification and condition grade characteristics of the NRN are given in **Tables 2.1-1 – 2.1-2**.

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<sup>8</sup> Department of Transport.2013. National Transport Strategy Volume I. Strategy Summary. NCD Papua New Guinea

<sup>9</sup> *National Route*: Main roads that link population centres in two or more provinces and/or main road traversing the entire length of an island province that acts as a collector road. Roads in this category are of major economic and strategic importance (Highlands Highway) and link multiple provinces. *National Main* – Roads that link major population centres and districts to national routes, and/or strategically important centres (main towns, harbours, and airports). *National District*: Roads within a single district that link population centres (villages) to areas of importance (large town centres, harbours, airports, markets, and hospitals) within the district. *National Institutional*: Roads within national institutions (army barracks road or university compound roads etc. These roads can include roads required for reasons of national defence and/or security reasons.

<sup>10</sup> The priority standing of primarily national roads are assessed using a set of quantified criteria such as value of export flows supported by the infrastructure asset; traffic level; strategic role; population and income potential indices; road condition and works in progress. The leading contender roads are then assigned a qualitative priority on a scale from "1" to "5", where 1 indicates priority.



**Table 2.1-1 Road Condition Classification**

Collected Condition	Reported Condition	HIMS Condition Classification
Very Good	Good	Very Good
Good		Good
Fair +	Fair	Fair
Fair -		
Poor	Poor	Poor
Very Poor		Very Poor

SOURCE: DoW Road Statistics Report 2011

**Table 2.1-2 Road Condition Grade Characteristics**

Grade	Description	Accessibility	Economic	Maintainability
Good PCI>7	Very few minor defects (if any) with appropriate road shape (camber) for sealed and unsealed roads	Road user able to travel at speed limit	General increase in road users	General decrease in maintenance unit cost inputs and decrease in frequency of maintenance activities required
Fair PCI 4-7	Occasional major defects and patch repairs. Some loss of pavement shape	Minor interruption to road users that limit the ability to travel at speed limit	No consistent benefits identified, reduced travel speeds	No consistent benefits identified
Poor PCI<4	Numerous minor and major defects, some patch repair failures. Shape loss more frequent	Significant disruption to road users with some roads impassable.	Some negative impacts in terms of road users, travel speeds (decrease in road users)	General negative impacts in terms of maintenance unit costs and frequency

Note: PCI – Pavement Condition Index

SOURCE: 2014 Visual Road Condition Survey.

### 2.2.1. NRN Description

As of 2012, the NRN is comprised of approximately 8,733 km. **Table 2.2-1** gives the length, type (sealed or unsealed) and condition of the roads, as of 2012. Sealed roads comprise 38.9% of the NRN with 28.6% in good, 10% in fair and 1.3% in poor condition. Unsealed roads comprise 61.1% of the NRN with 3.8% in good, 35.6% in fair and 21.7% in poor condition.

**Table 2.2-1 Length, Sealed and Unsealed and Condition of the NRN by Road Classification as of 2012**

Classification	Sealed (in km)				Unsealed (in km)				TOTAL (km)	% of total
	Good	Fair	Poor	Total	Good	Fair	Poor	Total		
National Roads	1,649	459	49	2,157	33	847	290	1,170	3,327	38.1%
National Main	519	172	18	709	241	778	534	1,553	2,262	25.9%
National District	297	48	42	387	41	769	1,068	1,878	2,265	25.9%
National Institute	30	106	15	151	21	710	4	735	886	10.1%
<b>Total</b>	<b>2,495</b>	<b>785</b>	<b>124</b>	<b>3,404</b>	<b>336</b>	<b>3,104</b>	<b>1,896</b>	<b>5,336</b>	<b>8,733</b>	<b>100.0%</b>
<b>% of Total NRN</b>	<b>28.5</b>	<b>9.0</b>	<b>1.4</b>	<b>38.9</b>	<b>3.8</b>	<b>35.5</b>	<b>21.7</b>	<b>61.1</b>	<b>100.0</b>	

SOURCE: PNG Road Statistics 2012

Note: Difference in total lengths of NRN from Tables 1-3 & 1-5 due to rounding.



Table 2.2-2 gives the length and condition of the NRN priority and non-priority roads, as of 2012.

**Table 2.2-2 Condition of the NRN Priority and Non-Priority, Sealed and Unsealed Roads, as of 2012**

Network	SEALED (in km)				UNSEALED (in km)				TOTAL
	Good	Fair	Poor	Total	Good	Fair	Poor	Total	
Priority	1,908	487	43	2,438	164	1,409	242	1,815	4,253
	22.3%	5.7%	0.5%	28.5%	0.4%	17.9%	2.8%	21.2%	49.6%
Non-Priority	587	298	74	959	172	1,695	1,654	3,521	4,315
	6.8%	3.5%	0.9%	11.2%	2.0%	19.8%	17.4%	39.1%	50.4%
<b>TOTAL</b>	<b>2,495</b>	<b>785</b>	<b>117</b>	<b>3,397</b>	<b>336</b>	<b>3,105</b>	<b>1,896</b>	<b>5,336</b>	<b>8,733</b>
<b>NRN:</b>	<b>28.6%</b>	<b>10.0%</b>	<b>1.3%</b>	<b>38.9%</b>	<b>3.8%</b>	<b>35.6%</b>	<b>21.7%</b>	<b>61.1%</b>	<b>100%</b>

SOURCE: PNG Road Statistics 2012

The PNG Road Network, which includes the provincial and district roads, is shown in **Figure 2.2-1**. The NRN is shown in **Figure 2.2-2**, while the priority roads are shown in **Figure 2.2-3**.

The PNG road network has about 7,200 drainage structures including bridges, large culverts, fords, minor culverts and wet crossings as shown in **Table 2.2-3**.

**Table 2.2-3 Number and Types of Cross Drainage Structures on the NRN**

Structure Type	No.
Bridge	1,590
Major Culvert	589
Culvert	4,888
Causeway	47
Ford	38
Multiple Plate Structure	24
Wet Crossing	60
Total	7,236

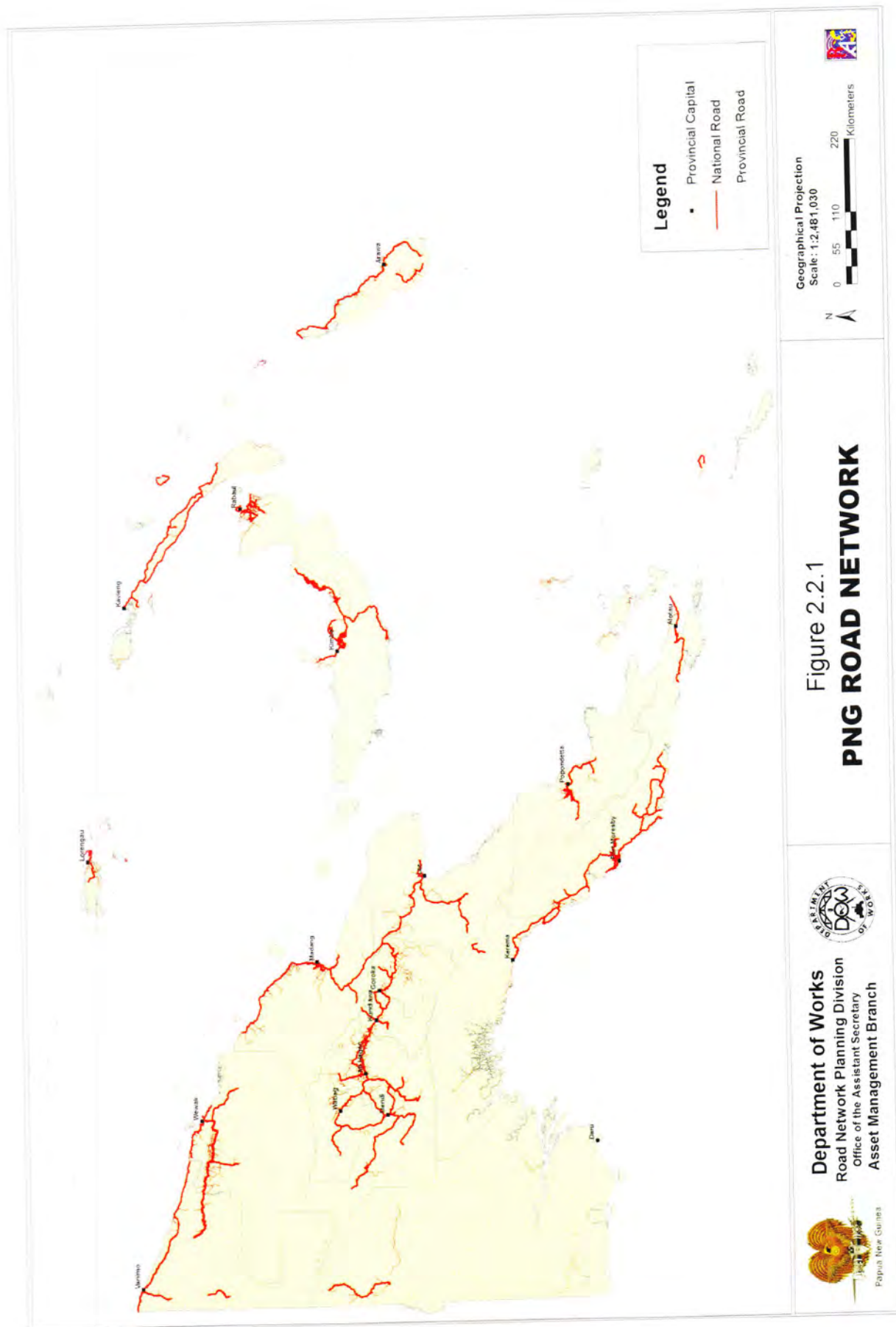
Source: DoW. National Roads Maintenance Plan, 2016-2020

Table 2.2-4 shows the estimated length of the provincial and district roads.

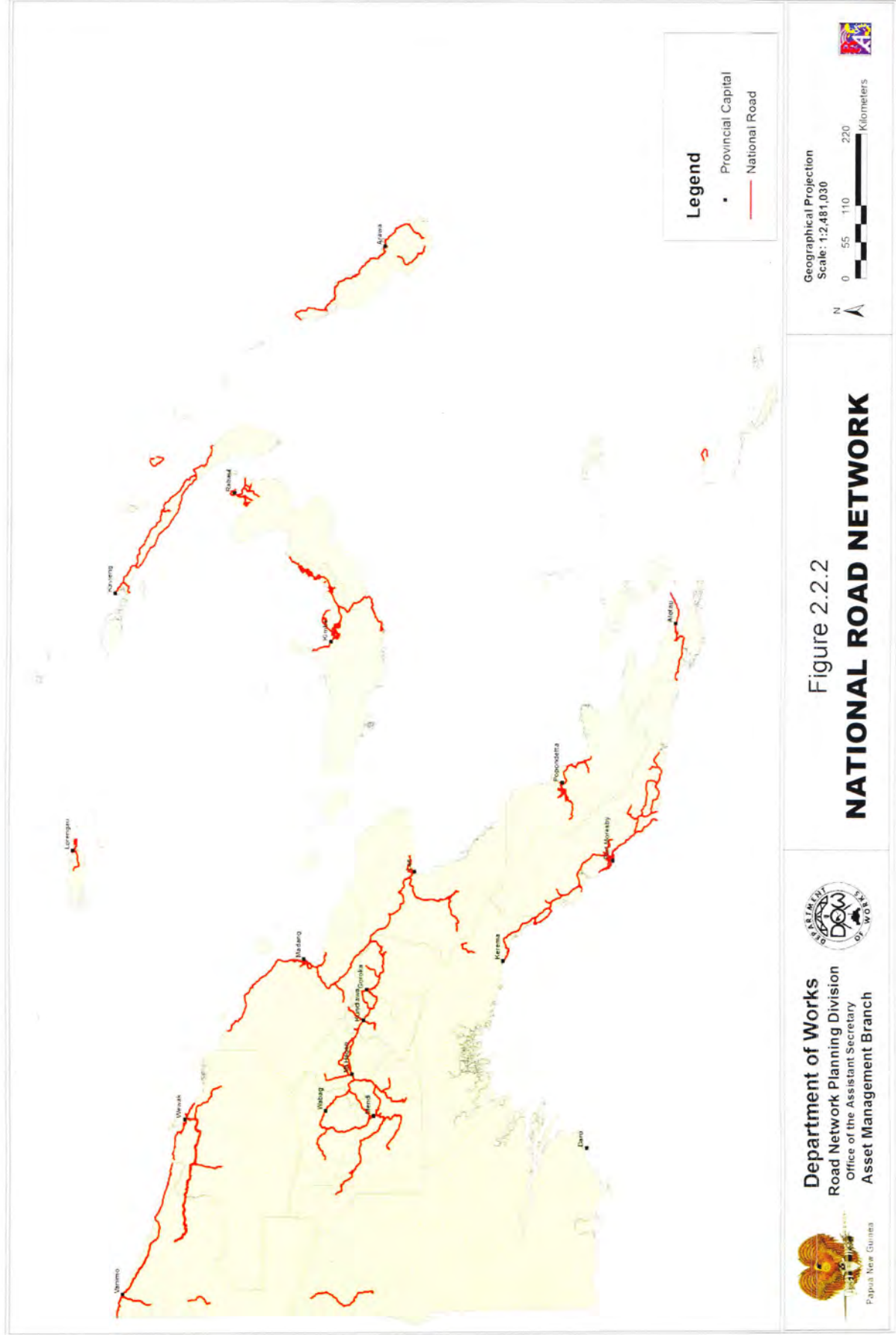
**Table 2.2-4 Estimated Length of District and Provincial Roads**

Road Class	Road Length (km)
District Feeder	2,137
Local Access	733
Local Trunk	165
Other Roads	61
Provincial Trunk	2,143
Provincial Undefined	2,831
<b>TOTAL</b>	<b>8,070</b>

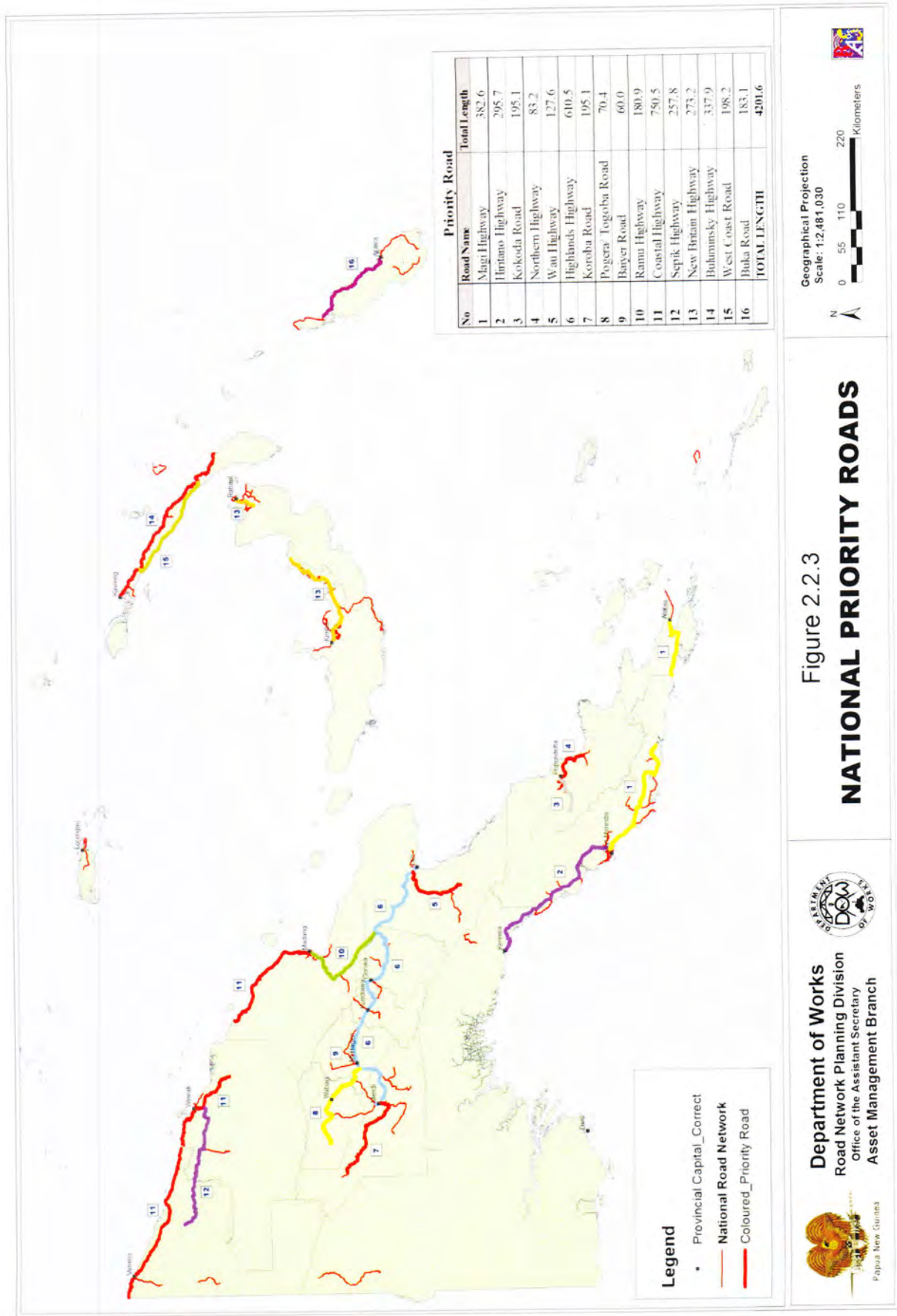


















### 2.2.2. Management of the NRN

The NRN is wholly managed by the DoW, which has responsibility for planning, management, operation, management and monitoring. There are two other national government agencies with roles in the maintenance of the NRN, namely: (i) The National Roads Authority (NRA) and the (ii) Department of National Planning and Monitoring (DNPM).

### 2.3. The Department of Works (DoW)

DoW is the primary government implementing agency for road infrastructure. It has four (4) regional offices and a provincial office in each province. DoW's responsibilities include:

- *Owns the PNG road network on behalf of the National Government;*
- *Planning of the management and maintenance of the road network and implementing maintenance activities on the national network in conjunction with the National Roads Authority;*
- *Establishing and enforcing standards for engineering and maintenance of roads and bridges throughout the country;*
- *Ensure that quality standards are maintained for the road network, including undertaking technical audits for road construction projects;*
- *Oversight of building infrastructure in Papua New Guinea through establishment and management of Building Boards; and*
- *Provide technical assistance to provincial, district and local level governments to develop infrastructure.*

*Extract from DoW Corporate Plan 2015-2019*

The DoW has an approved complement of 1,526 positions. The DoW organizational chart is shown in **Figure 2.3-1**.

### 2.4 The National Roads Authority (NRA)

The National Roads Authority Act of 2003 created the NRA to assist the DoW with the maintenance only of gazetted sections of the NRN. It has the following organizational objectives: (i) Raise funds for the maintenance of public roads; (ii) Ensure the efficient preparation of effective annual road maintenance programs; and (iii) Ensure that routine, periodic and emergency maintenance of roads funded by the NRA are executed in a transparent, effective and efficient manner, in order to optimize the contribution of road assets to the economic and social development of PNG.

The NRA's functions include:

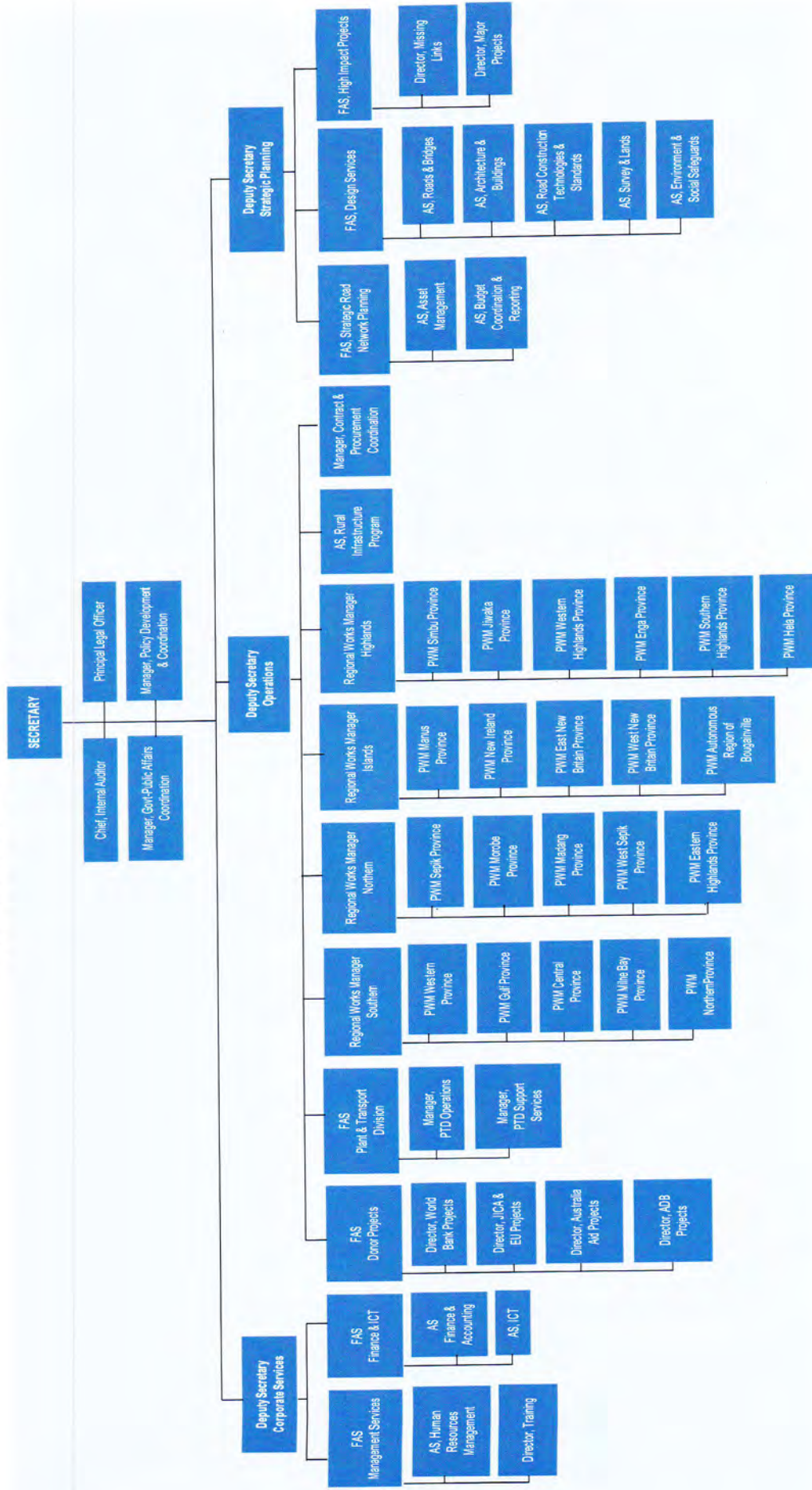
- *To establish and operate a Road Fund from road user charges, budget and other sources;*
- *To maintain and manage updated data on asset conditions using the Road Asset Management System, Bridge Inventory and Bridge Maintenance and other approved systems;*
- *To formulate and determine prioritized annual road maintenance plans and programs using the Road Asset Maintenance System, Bridge Inventory and Bridge Maintenance and other approved systems to be supported by the road sector cost recovery revenue;*
- *To determine and implement road user charges in accordance with the financial resource requirements of the annual road maintenance plans;*
- *To deliver the required routine, specific and emergency road maintenance in accordance with the maintenance service levels established for each class or type of road, through the contracting of independent contractors, and to monitor and supervise the contracts as they are executed; and*
- *To report publicly and transparently on collection of user charges, revenues, and in detail on the use of the revenues on the road maintenance programs in accordance with internationally accepted accounting principles.*







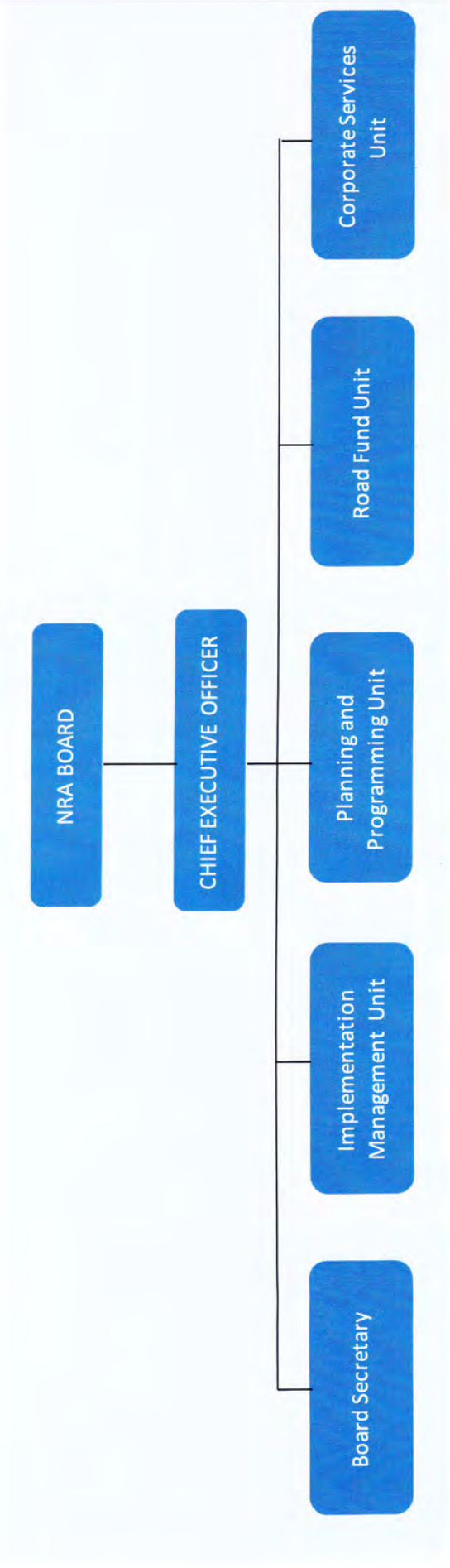
Figure 2.3-1 DoW Organizational Chart





The organizational chart of the NRA is shown in Figure 2.3-2.

Figure 2.3-2 NRA Organizational Chart





### III. DEVELOPMENT VISION, MISSION, PLANS AND STRATEGIES

#### 3.1 Vision 2050 and Mission Statement

From the National Strategic Plan Framework, PNG's Vision 2050<sup>11</sup> envisages to transform the people and the nation through reforms of its mind-set and attitudes, and provide the direction to reform and align PNG's institutions and systems.

##### Vision 2050

*"PNG will be a Smart, Wise, Fair, Healthy and Happy Society by 2050."*

##### Mission Statement

*"PNG will be ranked in the top 50 countries in the United Nations Human Development Index by 2050, creating opportunities for personal and national advancement through economic growth, smart innovative ideas, quality service and ensuring a fair and equitable distribution of benefits in a safe and secure environment for all citizens."*

Figure 3.1-1 shows the seven pillars forming the focus areas of Vision 2050.

Figure 3.1-1 Seven Strategic Focus Areas of Vision 2050



The three core program areas are: Institutional Development and Service Delivery, Wealth Creation, and Human Capital Development. All other strategic focus areas support the core program areas.

The development foundation for Institutional Development and Service Delivery is infrastructure. The urgent rehabilitation, prioritization and sustained support to maintenance programs ensure that infrastructure assets are kept in good condition and their useful life achieved. Infrastructure is the main catalyst for service delivery and programs to sustain people's livelihoods. Infrastructure development is therefore vital and should be prioritize in the government's development agenda.<sup>12</sup>

#### 3.2 Development Strategic Plan (DSP), 2010-2030

PNG's Development Strategic Plan 2010-2030<sup>13</sup> has the following goal and vision statements:

Goal *"A high quality of life for all Papua New Guineans."*

Vision *"Papua New Guinea will be a prosperous middle-income country by 2030."*

The DSP envisions a PNG by 2030 and how it will achieve its development targets through four 5-year Medium Term Development Plans (MTDP) with priorities and directions guiding the

<sup>11</sup> Government of Papua New Guinea.2009. *Papua New Guinea Vision 2050*. National Capital District

<sup>12</sup> Government of Papua New Guinea.2009. *Papua New Guinea Vision 2050*. National Capital District

<sup>13</sup> Government of Papua New Guinea.2010. *Papua New Guinea Development Strategic Plan 2010-2030*. Port Moresby



development of sector policies, plans and strategies. The DSP framework provides policy clarity, cohesiveness, certainty, and predictability so that development partners align their strategies in support of PNG's development priorities and goals.

### 3.2.1. The Economic Corridor

The DSP envisaged the establishment of economic corridors - regions where government provides well-planned zoning system, comprehensive and effective network of transport and utilities, and quality education and health services.

Within the economic corridors, businesses operate at low cost and under well-designed incentives, encouraging foreign and domestic private sector investments. The approach takes advantage of economies of scale and scope associated with large service sector infrastructure. Effective sequential and spatial planning helps expand economic activities like agriculture, tourism and manufacturing.

The economic corridors are characterized by: electricity grid, utilities such as water and sewerage, telecommunications, and broadband internet; transport infrastructure comprising *a network of roads*, maritime and air facilities integrated into the national network; social infrastructure including health and education programs; agricultural, forestry and/or fishery based industries, livestock, fish processing and plantation forests; and industrial estates and residential estates.

The ten (10) economic corridors are named in **Table 3.2-1** and illustrated in **Figure 3.2-1**.

**Table 3.2-1 Ten Economic Corridors**

No.	Corridor Name	Location	Development Priority No./Year
1	Petroleum Resource Area Economic Corridor (PRAEC)	Southern Highlands, parts of Enga, Gulf and Central Provinces	1 <sup>st</sup> Priority, by 2020
2	Border Corridor	Western and Southern Highlands, and Sandaun Provinces	5 <sup>th</sup> to 10 <sup>th</sup> Priority, Post 2030
3	Central Corridor	Central, Milne Bay, Oro, and Morobe Provinces	2 <sup>nd</sup> to 4 <sup>th</sup> Priority, by 2030
4	Madang-Baiyer-Karamui-Gulf Corridor	Madang, Simbu, Gulf and Western Highlands Provinces	5 <sup>th</sup> to 10 <sup>th</sup> Priority, Post 2030
5	Morobe-Madang Corridor	Madang and Morobe Provinces	5 <sup>th</sup> to 10 <sup>th</sup> Priority, Post 2030
6	Enga-Sepik Corridor	Enga and East and West Sepik Provinces	5 <sup>th</sup> to 10 <sup>th</sup> Priority, Post 2030
7	South Coast Corridor	East New Britain and West New Britain Provinces	2 <sup>nd</sup> to 4 <sup>th</sup> Priority, by 2030
8	Momase Corridor	Madang, East Sepik, and West Sepik Provinces	2 <sup>nd</sup> to 4 <sup>th</sup> Priority, by 2030
9	Solomons Corridor	Autonomous Region of Bougainville	5 <sup>th</sup> to 10 <sup>th</sup> Priority, Post 2030
10	Free Zone Corridor	Manus, New Ireland, East Sepik, and West Sepik Provinces	5 <sup>th</sup> to 10 <sup>th</sup> Priority, Post 2030

SOURCE: PNG National Transport Strategy-Volume 3



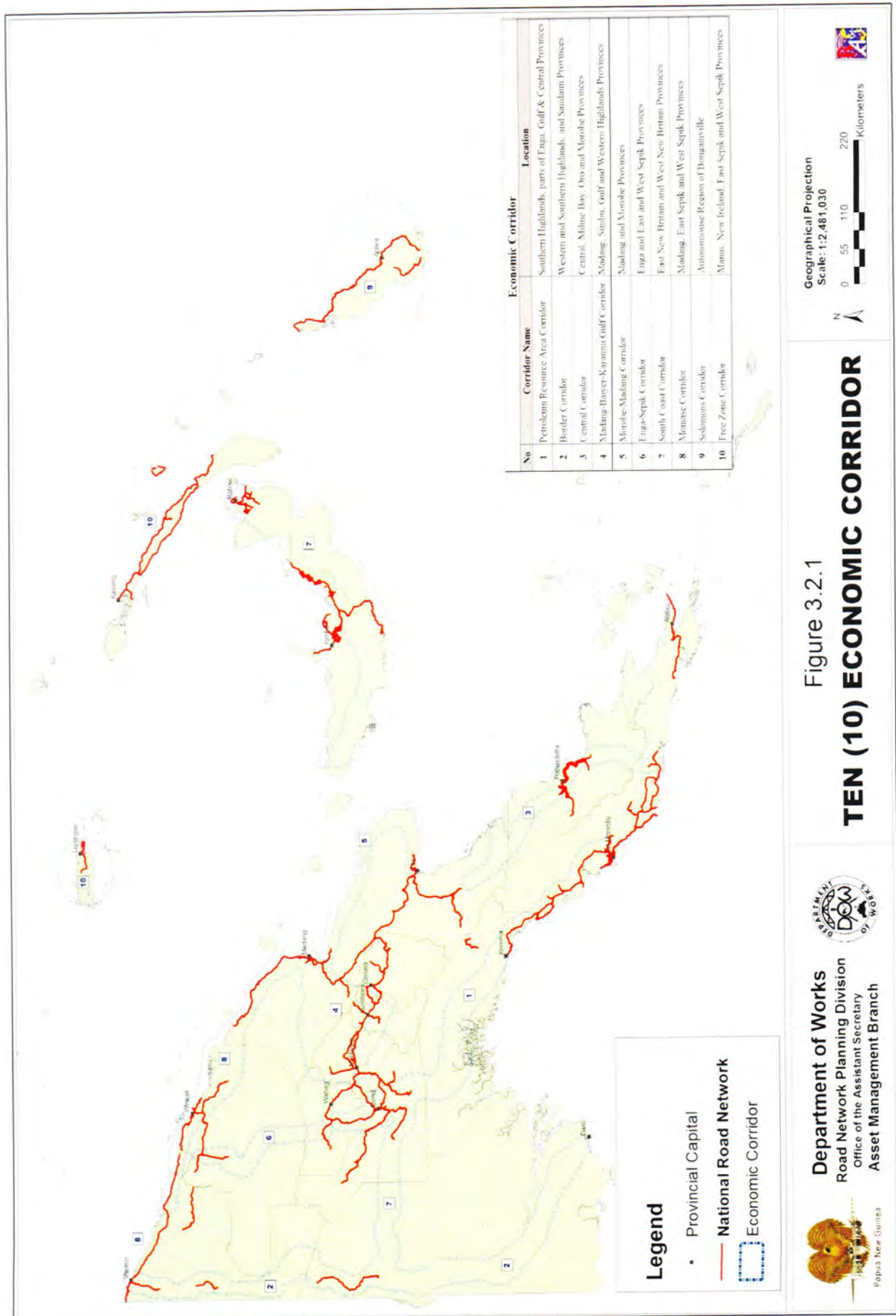


Figure 3.2.1  
**TEN (10) ECONOMIC CORRIDOR**



**Department of Works**  
Road Network Planning Division  
Office of the Assistant Secretary  
Asset Management Branch









DSP implementation would create 2 million jobs and national income growing five-fold, with growth rate projected at 8.4% per year on average. Economic development would be broad based, facilitating entrepreneurial enterprises in the rural and urban areas. Expansion in agricultural businesses would generate over 800,000 full-time rural jobs, with over two-thirds in formal agriculture. In urban areas, entrepreneurship would be encouraged to create about 49,000 informal jobs in the urban areas.

### 3.2.2. DSP Road Strategy

The DSP recognized road infrastructure upgrading and maintenance as essential. GoPNG expenditure on upgrading and rehabilitation of the NRN would be focused on the priority roads. Construction of “16 missing links” and “corridor” roads would be undertaken in the next 20 years. The “missing links” connect the country to a complete road network, while corridor roads open up productive regions supportive of development. A NRN in good condition would contribute K2.2 billion to the national income by 2030 and create 120,000 jobs.

To finance the rehabilitation and maintenance of the NRN, GoPNG would engage the private sector through the public private partnership (PPP) scheme, with different PPP modalities considered to engage private investments in roads, ports and airports. The “tax credit” scheme has been implemented on a limited scale, where the major resource companies such as oil, LNG, mining and palm oil producers undertake the maintenance of national roads within their areas of operation using tax credits.

### 3.3 PNG’s Medium Term Development Plan<sup>2</sup> (MTDP2), 2016-2017

PNG’s MTDP<sup>214</sup> provides a clear and accountable plan for investment, and implements the DSP and Vision 2050. It focuses on the enabling activities to be funded and implemented by the sector agencies, provincial governments, CSOs and development partners.

On the plan target of 25,000 kms of roads in good condition (**Table 3.3-1** and **Figure 3.3-1**), work was to commence soonest, where maintenance, rehabilitation and upgrade of the existing network would quickly deliver real improvements to citizens. The focus is on the national roads, which are strategically aligned to the country’s development and are of national importance. These roads had been selected based on population served and economic potential. For the economic corridors, feasibility studies, route identification, road surveys and design and land acquisition, would commence.

MTDP2 aimed at bringing the existing national roads to good condition and adding about 5,000 kilometers of good roads at the end of each MTDP period. Four sector strategies are consistent with the overall Plan 2010-2030 sector goal aimed at expanding the NRN to good condition, namely:

- *Rehabilitate and upgrade priority national roads and other national roads to good condition;*
- *Undertake feasibility studies and construct missing links roads to good condition;*
- *Undertake feasibility studies and construct economic corridor roads; and*
- *Provincial and District Roads*

GoPNG priority remains maintenance of existing road assets. Major new road projects could be implemented through Donor funding only if, it is demonstrated the project has high economic and social returns. Once the country’s existing road infrastructure is restored and maintained in good condition, the economic justification for expanding the network would be stronger and major new projects would gain momentum under subsequent MTDPs.

The challenge remains GoPNG’s funding priorities. Past experience has shown that resources were diverted to non-priority areas, and development plan targets were not being achieved. The other

<sup>14</sup> Department of National Planning and Monitoring. 2010. *Papua New Guinea Medium Term Development Plan 2011-2015*. Port Moresby



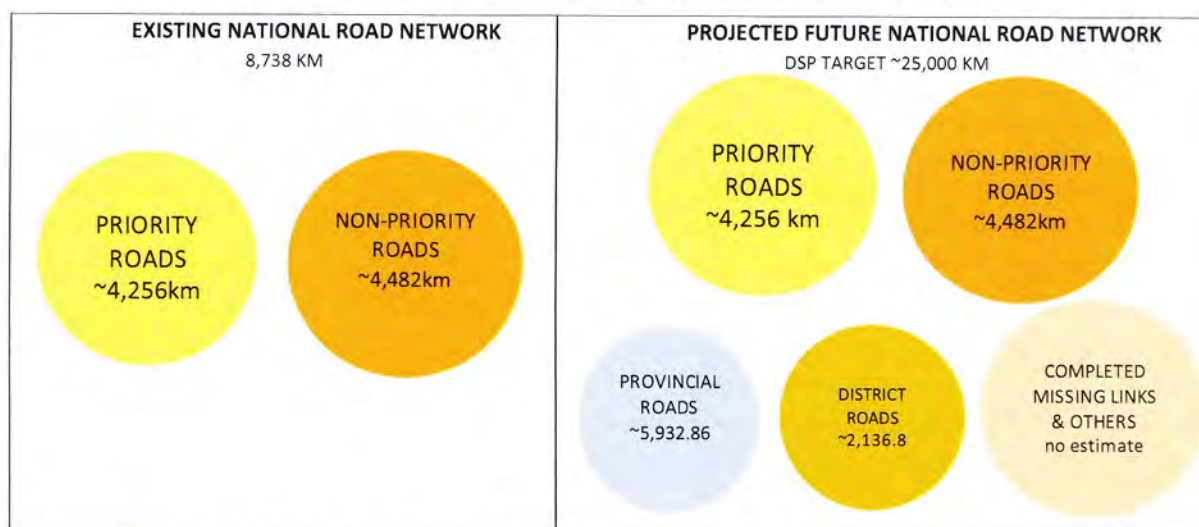
challenge is for GoPNG to demonstrate adequate funding to the roads sub-sector so that donors and the private sector would commit financial and technical resources to achieve plan deliverables by 2030.

Compensation claims and land availability is also a development constraint. GoPNG needs to ensure and gain prompt access to land for its purposes. The capacity of local contractors to implement large/multiple projects is limited and commitment to long term program funding should provide confidence for the industry to grow its capacity.

**Table 3.3-1 Road Sector Target Outputs in MTDP2**

No.	Description of Output	Output Target Under MTDP2
1	Rehabilitate and upgrade the 16 National Priority Roads to "good" condition (4,256km)	4,256 km in good condition. 2,500 km sealed
2	Rehabilitate and upgrade the remainder of the National Road Network to "good" condition (4482 km)	1000 km in good condition and sealed
3	Construct the 16 "Missing Link" roads to good condition (approx. 2,280 km)	Undertake survey and feasibility studies. Land Acquired. 1 road constructed.
4	Construct the 4 additional Economic Corridor national roads to good condition	Undertake survey and feasibility studies. Land acquired.
5	Conduct regional awareness, enforcement and road safety audits	Conduct road safety education, road safety promotion, and random vehicle inspections.

**Figure 3.3-1 Current and Projected Length of the NRN by 2030**



### 3.4 National Transport Strategy (NTS)

The NTS had set GoPNG policies for the transport sector for the medium to long term, including transport policy, development of transport institutions and the strategy for transport investment. The Medium-Term Transport Plan (MTTP) provides a short to medium term action plan for transport policy, institutional development and legislative program and a five-year rolling program for transport infrastructure spending to ensure that projects are consistent with the investment strategy.



### 3.4.1 Sector Vision and Goals

#### Vision

“A well-integrated, competitive, safe, affordable, financially and environmentally sustainable transport system that efficiently serves the economy and society of Papua New Guinea.”

#### Selected Goals

- Restore the national transport network;
- Deliver a safe and secure transport system for users and the public;
- Provide better government institutional structures to deliver transport infrastructure and services;
- Strengthen the human resource capacity of the government transport agencies;
- Develop capacity and capability of government national enterprises in the transport sector; and
- Provide well planned, regulated and operated traffic networks and urban public transport systems in the major cities.

The NTS recognized the need to prioritize restoration and full funding of maintenance requirements. For the roads subsector, the 2012 NRN condition overview for sealed roads showed that 73.5% were in good condition and 3.4% were in poor condition. For unsealed roads, only 6.5% were in good condition and 33.5% were in poor condition.

*More recent road condition surveys such as the VRCS in 2014 and DoW's updated coarse road condition survey in 2017 by the provincial works managers had shown significantly different road condition situations.*

## 3.5 DoW Corporate Strategic Plan, 2015-2019

### 3.5.1 Vision and Mission Statements

#### Vision

*Quality of life is enhanced for all sections of the community through delivery of sustainable well managed land transport and support for development of rural infrastructure*

#### Mission

*Improve opportunities for economic participation and reliability of access to core government services for all PNG citizens through an effective, safe and efficient land transport and technical infrastructure services.*

To achieve the desired outcomes of Vision 2050 and NTS, the DoW identified 13 department outputs, with the following considered as priorities to address the “poor” condition of the NRN:

**OUTPUT 1:** A strategic approach to managing the road network and effective long-term (multi-year) asset development, new road construction and maintenance planning by DoW and GoPNG partners to deliver NTS and MTTP targets for road infrastructure.

**OUTPUT 2:** GoPNG commits long-term funding for road asset management which supports multi-year planning to deliver strategic road infrastructure priorities by way of multi-year budget allocations.

**OUTPUT 4:** Standards and safeguards for road and bridge design and engineering in PNG are established and applied.



**OUTPUT 5:** MTTP goals for the road network are delivered by effective works planning and programming.

**OUTPUT 8:** Delivery of the annual works program to contractually agreed time, cost and quality standards through an operational management framework.

**OUTPUT 9:** Delivery of GoPNG strategic priorities in land transport are enhanced through ongoing review and audit of works planning and management process.

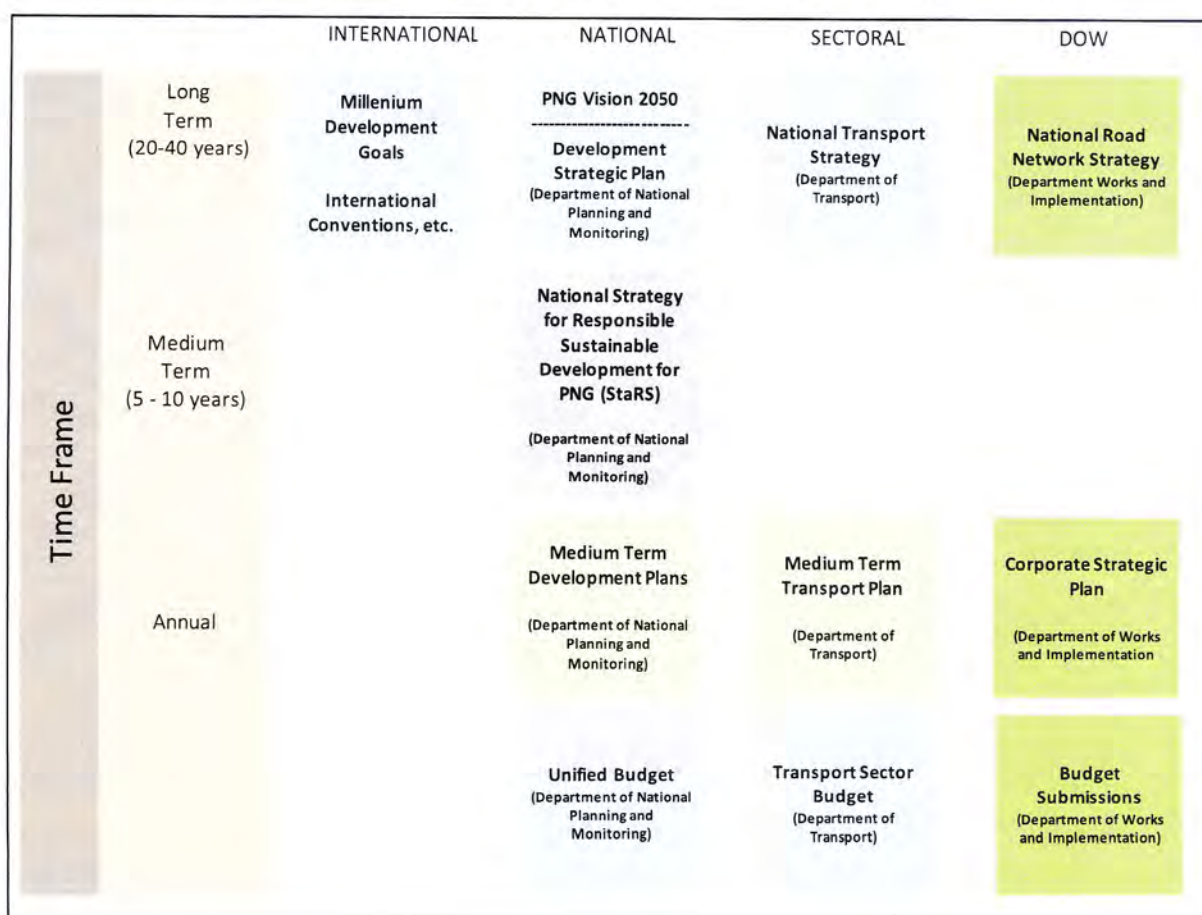
**OUTPUT 10:** An effective, accountable and transparent corporate support framework is in place to enable Department of Works to achieve GoPNG strategic priorities in land transport.

**OUTPUT 11:** An effective, timely, and accountable monitoring, reporting, communication and evaluation system is in place that enables the DoW to evaluate and enhance progress towards strategic goals in the transport sector.

**OUTPUT 12:** Ongoing technical support provided to provincial and district administrations and local level governments in the delivery of infrastructure projects.

The NRN strategy implements the higher plans and sector strategies that were prepared and supports the PNG planning, strategy and budget flow as shown in **Figure 3.5-1**.

**Figure 3.5-1 The NRN Strategy in PNG's Planning, Strategy and Budget Process**





## IV. ROADS AS CATALYST FOR ECONOMIC GROWTH AND SUSTAINABLE DEVELOPMENT

### 1.1 Sector/Subsector Access Requirements

The NRN is essential to achieve PNG's development goals and objectives. It is the means to achieve economic growth, with a well-maintained, and reliable NRN ensuring sustainable development. Road condition is a barometer of economic growth. A NRN in poor condition stifles growth in investment, trade and production. The high prices of commodities may be attributed to the high land transport costs because of "poor" road condition – vehicle operating costs are high, travel time is excessive reducing truck capacity and the economic life of vehicles severely curtailed.

An improved quality of life, income and employment opportunities, and increased competitiveness of local products is achieved if the condition of the NRN is significantly improved.

#### 1.1.1 Agriculture

The goals of the National Agriculture Development Plan 2007-2016 (NADP) are: (i) Stimulate the development of agricultural production through increased exports and import product substitution and (ii) Improve the standard of nutrition, enhance food security and provide income and employment opportunities to the rural population. The major development objective was reduction in the cost of production and improved quality of agricultural produce for the domestic and international markets. Reduction in transport cost means higher income for rural households, stimulate production and expand productive agricultural land.

The NADP identified poor road condition and the high costs of sea transport as major impediments to agricultural development. Section 2.7 of the NADP states:

*"Current government and donor priorities appear to target only maintenance of major national roads or highways .... Most roads serving the rural sector are provincial roads and are the responsibility of provincial governments. Except for the few resource rich provinces, most provincial governments have very limited budget for road maintenance and almost nil for construction of new roads.*

*The priority for the national transportation policy should be maintenance and upgrading of existing roads instead of construction of new roads. Where necessary, the NADP should identify important agricultural roads that could be included as priority for maintenance to facilitate access for farm produce and funded under the NADP."*

Except for copra, coffee and palm oil, PNG's exports of major agricultural commodities have declined from 2010-2016. From 2010-2016, tea exports had declined by 23.8%, copra oil by 14.6% and rubber by 13.0%. Copra exports had the highest increase at 15.2%, palm oil by 1.8%, and coffee by 1.3%. **Table 4.1-1** shows the export volume of major agricultural commodities from 2010-2016.

**Table 4.1-1 Agricultural Exports of Major Commodities (000 tons), 2010-2016**

Year	Cocoa	Coffee	Tea	Copra	Copra Oil	Palm Oil	Rubber
2010	41.3	55.9	4.6	18.6	46.0	485.6	4.6
2011	47.4	73.5	4.0	43.7	45.2	571.9	4.2
2012	38.1	55.5	3.8	32.9	22.0	483.0	5.1
2013	38.7	48.5	2.9	15.8	13.5	487.2	3.4
2014	33.6	48.4	2.1	48.2	11.1	514.8	3.2
2015	30.9	42.8	1.3	33.6	14.6	486.9	2.2
2016p	35.6	60.5	0.9	43.5	17.9	540.7	2.4
Growth Rate (%)	-2.5	1.3	-23.8	15.2	-14.6	1.8	-13.0

*Source: Bank of Papua New Guinea. 2016. Quarterly Economic Bulletin. Port Moresby*



## 1.1.2 Natural Resources

### 4.1.2.1 Minerals Subsector

PNG is rich in mineral resources, with mine development having significant impact on the development of the road network. The DSP subsector goal for mining is to “*double mineral exports, while minimizing the adverse impact on the environment*”. Mine development creates substantial transport demand through the delivery of construction equipment and materials to the mine site, requiring high capacity roads to carry the heavy loads of transporting mining equipment. During operation, road access is essential to transport the workforce between on-site accommodation and the main urban centers or overseas for foreign workers, and the delivery of mine and workforce supplies.

Total mineral export revenue was K20,044.2 million in 2016, compared to K19,387.5 million in 2015 and was due to the increase in the export prices of gold and cobalt, and the higher export volumes of all mineral commodities.<sup>15</sup> **Table 4.1-2** shows the volume of PNG’s mineral exports from 2010-2016.

### 4.1.2.2 Oil and Gas Subsector

Petroleum (oil and gas) is one of the large contributors to PNG’s export earnings and with the start of the LNG production, it is expected to have greater impact in the future. The value of LNG exports was K8,185.6 million in 2016, compared to K9,841.4 million in 2015 and was attributed to the lower LNG world prices, despite higher LNG production and shipment. The volume of condensate exported was 11,277.1 thousand barrels in 2016, compared to 10,555.6 thousand barrels in 2015. The increase in export volume more than offset the decline in export prices, resulting in export receipts of K1,592.3 million in 2016, compared to K1,502.6 million in 2015.

The volume of crude oil exported was 9,444.1 thousand barrels in 2016, compared to 7,025.1 thousand barrels in 2015. Higher production was generated from the Kutubu, Moran and Gobe oil fields. The average export price of crude oil was K132 per barrel in 2016, compared to K142 per barrel in 2015. The increase in export volume offset the decline in export prices, with export receipts of K1,244.7 million in 2016, compared to K1,003.4 million in 2015.<sup>16</sup>

The establishment of wells, processing plants and export terminals requires the development of new transport infrastructure for construction, operation and servicing of these facilities, and/or upgrading of existing infrastructure. Laying and servicing the land-based pipelines require access by road and/or air, so a pipeline access track will commonly run close to the pipeline alignment. The construction of a pipeline with connections to oil/gas fields, airstrips, river ports and processing facilities along its length forms the basis for the development of new roads and other legacy transport infrastructure.

### 4.1.2.3 Forestry Subsector

As of 2010, PNG has a total forested area of 29 million hectares (ha) or 63% of the country’s total land area. The volume of logs exported was 3,233.0 thousand cubic meters in 2016, compared to 3,868 thousand cubic meters in 2015. There was lower shipment from major producing regions, attributed to wet weather conditions. The average export price of logs increased by 10.8 percent to K298 per cubic meter in 2016, compared to 2015. This was due to strong demand from China, Malaysia, South Korea, Taiwan and Vietnam, combined with the depreciation effect of the kina against the US dollar. The decline in export volume more than offset the increase in export price, resulting in export receipts of K964.3 million in 2016, compared to K1,040.1 million in 2015.<sup>17</sup>

<sup>15</sup> [www.bankpng.gov.pg/wp-content/uploads/2017/05/December-2016-Quarterly-Economic-Bulletin-QEB.pdf](http://www.bankpng.gov.pg/wp-content/uploads/2017/05/December-2016-Quarterly-Economic-Bulletin-QEB.pdf)

<sup>16</sup> [www.bankpng.gov.pg/wp-content/uploads/2017/05/December-2016-Quarterly-Economic-Bulletin-QEB.pdf](http://www.bankpng.gov.pg/wp-content/uploads/2017/05/December-2016-Quarterly-Economic-Bulletin-QEB.pdf)

<sup>17</sup> [www.bankpng.gov.pg/wp-content/uploads/2017/05/December-2016-Quarterly-Economic-Bulletin-QEB.pdf](http://www.bankpng.gov.pg/wp-content/uploads/2017/05/December-2016-Quarterly-Economic-Bulletin-QEB.pdf)



There have been forestry development projects in several parts of the country, mostly concentrated on lowland and lower montane forests, where there is direct access to coastal or river landings for log exports. Some logging occurs inland, requiring longer transport distances by logging trucks. While public roads can assist in timber exploitation, most new forest areas are remote and the forestry companies develop access roads and tracks suitable to log extraction, but mostly of a temporary nature.

The general outlook for forestry is continued reliance on annual round-wood exports of around 3 million m<sup>3</sup> from existing timber concessions and new developments.

#### 4.1.2.4 Overall Sector Performance

Of the resource exports, nickel had the highest growth at 225.3%, followed by condensates at 35.1% and marine products at 23.2%. Copper exports showed the highest decline at 12.2%, followed by crude oil at 1.6% and gold at 1.1%. **Table 4.1-2** shows the quantity of PNG's resource exports from 2010-2016.

**Table 4.1-2 Resource Exports – Major Commodities, 2010-2016**

Year	Logs 000m <sup>3</sup>	Marine Products 000 tons	Copper 000 tons	Gold tons	Nickel 000 tons	Cobalt 000 tons	Crude Oil 000 barrels	Condensates 000 barrels
2010	2,999	34.1	154.7	61.5			10,391.9	
2011	3,526	67.5	143.6	51.9			8,784.1	
2012	3,148	71.1	125.3	46.8	0.2		8,947.1	
2013	3,317	46.2	92.9	55.0	15.9	1.4	8,291.9	
2014	3,793	78.2	89.6	58.1	20.9	2.1	8,201.7	6,177
2015	3,868	99.4	46.4	53.5	21.6	2.1	6,584.6	10,556
2016p	3,233	119.4	71.0	57.6	22.4	2.4	9,444.1	11,277
Growth Rate (%)	1.3	23.2	-12.2	-1.1	225.3	19.7	-1.6	35.1

Source: Bank of Papua New Guinea. 2016. Quarterly Economic Bulletin. Port Moresby

#### 1.1.3 Tourism

The goal for tourism under the Tourism Master Plan 2007-2017 was to “increase the overall economic value of tourism to the nation by nearly doubling the number of tourists in PNG every five years and maximizing sustainable tourism growth for the social and environmental benefit of Papua New Guineans.” This translates into Master Plan targets of:

- Tourism would be worth K1.1 billion by 2010 and K1.78 billion in revenue terms by 2015;
- Those on holiday would spend K363 million in 2010 and K727 million in 2015; and
- Total employment in tourism would increase by 4,800 jobs by 2010 and 13,000 by 2015.

The Master Plan targets an increase in foreign visitor arrivals from 125,000 to 1.5 million/year by 2030. As of 2016, PNG visitor arrivals totaled only 197,632. With this trend, the sector would not meet the 2030 visitor target (see **Table 4.1-3**), hence the need to improve accessibility to tourist attractions. The Master Plan identified transport facilities as one necessary condition to increase visitor numbers and tourism revenues. Improvements identified focused on international transport connectivity nodes (airports, cruise ship harbor and terminal facilities, etc.), domestic airports and transport services.

Typically, tourist attractions are far from the main road network and tourism-oriented connector roads are required to link these attractions to the NRN. The identified tourism priority roads were based on the location of tourism projects from selected provinces.



**Table 4.1-3 PNG Visitor Arrivals, 2010-2016**

Year	Number of Visitors
2010	146,350
2011	165,059
2012	175,203
2013	182,188
2014	191,442
2015	198,685
2016	197,632
Growth Rate – 2010-2016	5.10%

Source: PNG Tourism Promotions Authority, 2017

#### 1.1.4 Social Sector

The NTS supports government strategies for social development by facilitating delivery of basic social services to remote rural areas and providing the rural population access to social services in district and provincial centres. Overall, the road network supports the operation of elementary and primary schools, aid posts and health centres, and provide access for rural people to centrally located secondary schools, tertiary colleges and vocational training centres and hospitals.

The delivery of social services is facilitated through good accessibility, which makes it easier to recruit, retain and support teachers and health workers in remote posts. Good accessibility makes it easier for pupils to attend school and for patients to access health services.

#### 1.1.5 Health

The National Health Plan (NHP) gave targets for disease prevention and improvement in vital statistics. Achievement of these targets depends on outreach services. The NHP and MTDP include rehabilitation, restoration and expansion of aid posts, community health posts, district health centres and hospitals.

The risks underpinning the health plan is that “access roads are built and maintained”. The NTS takes into account how the transport network performs in providing linkages for the population at the local level to access the nearest primary health facility. The location of existing health facilities and intended location of new facilities are factors in determining priorities for rural access roads, small jetties and airstrips.

#### 1.1.6 Education

The DSP deliverable of universal education access requires a sufficient number of primary, secondary and vocational schools to cover the population, and maintenance of the physical infrastructure including school buildings and teacher housing. The risks include *building and maintenance of roads* so that the facilities can be reached, supplied and sufficiently attractive to retain staff and allow contacts with higher-level institutions.

The NTS takes account of the transport network performance in providing access to the nearest primary and secondary schools. The location of existing schools and intended location of new facilities determine priorities for rural access roads, small jetties and airstrips. However, the NRN only serves primary and secondary schools adjacent to or near the NRN. Other schools are served by provincial and district roads that feed to the NRN.



## 1.2 Disaster Susceptibility and Response

PNG is prone to natural disasters including earthquakes, volcanic eruptions, tsunamis, cyclones, river flooding, coastal erosion, landslides, droughts and frost. It is under threat from the impact of global warming and changing climatic patterns.

Enacted in 1987, PNG's Disaster Management Act provides legislative and regulatory provisions for disaster management in PNG. It is supported by the 2012 National Disaster Risk Management Plan (NDRMP). There has not been much awareness with regard disaster management regulatory and legislative framework in the sub-provincial and local levels. The 2012 NDRMP lays out the Disaster Risk Management (DRM) architecture of PNG and provides guidance for DRM intervention at all levels.

The National Disaster Mitigation Policy (2010) provides a mechanism for shaping disaster mitigation and vulnerability reduction efforts as well as emergency response and reconstruction. The National Climate Compatible Development Management Policy (2014) is PNG's blueprint to achieve the vision of building a climate-resilient and carbon-neutral pathway through sustainable economic development. These strategies represent a foundation for economic development and risk mitigation.

The NRN provides emergency land access to communities affected by natural and man-made disasters, and ensures that emergency assistance is accessible. Supply chain disruptions can have significant impact on governance, national security and peace and order, and financial and operational impact on firms. Improving disaster preparedness in supply chains is critical, which depend on seamless inter-modal connectivity, with roads serving as the critical "last mile" connection to disaster affected communities. The storage of emergency supplies, equipment, and emergency disaster coordination centers in strategic provincial locations ensures disaster recovery and assistance are extended to affected communities for effective and timely response and recovery.<sup>18</sup>

The NRN itself is susceptible to changing climatic patterns, the intensity of climate conditions, and natural and man-made disasters for which the NRN has not been designed. Landslides and landslips due to intense rain and sea current result in road closures that affect economic activity and access. This further impacts on road expenditures, as funding is required to restore and reconstruct the roads to good condition. **Figure 4.2-1** shows the location of the NRN vis-à-vis PNG's seismic hazard areas.

## 1.3 Governance

Aside from social services such as health and education, communities desire access to national and local government offices for their transaction requirements. This includes payment of taxes, application for building licenses, driving license, access to elected officials and the police. The nature of roads is that these initially connect national and provincial capitals where government services are concentrated and explains the framework of the NRN, which links the provincial capitals with districts and with intermodal transfer points to provide seamless transport connections.

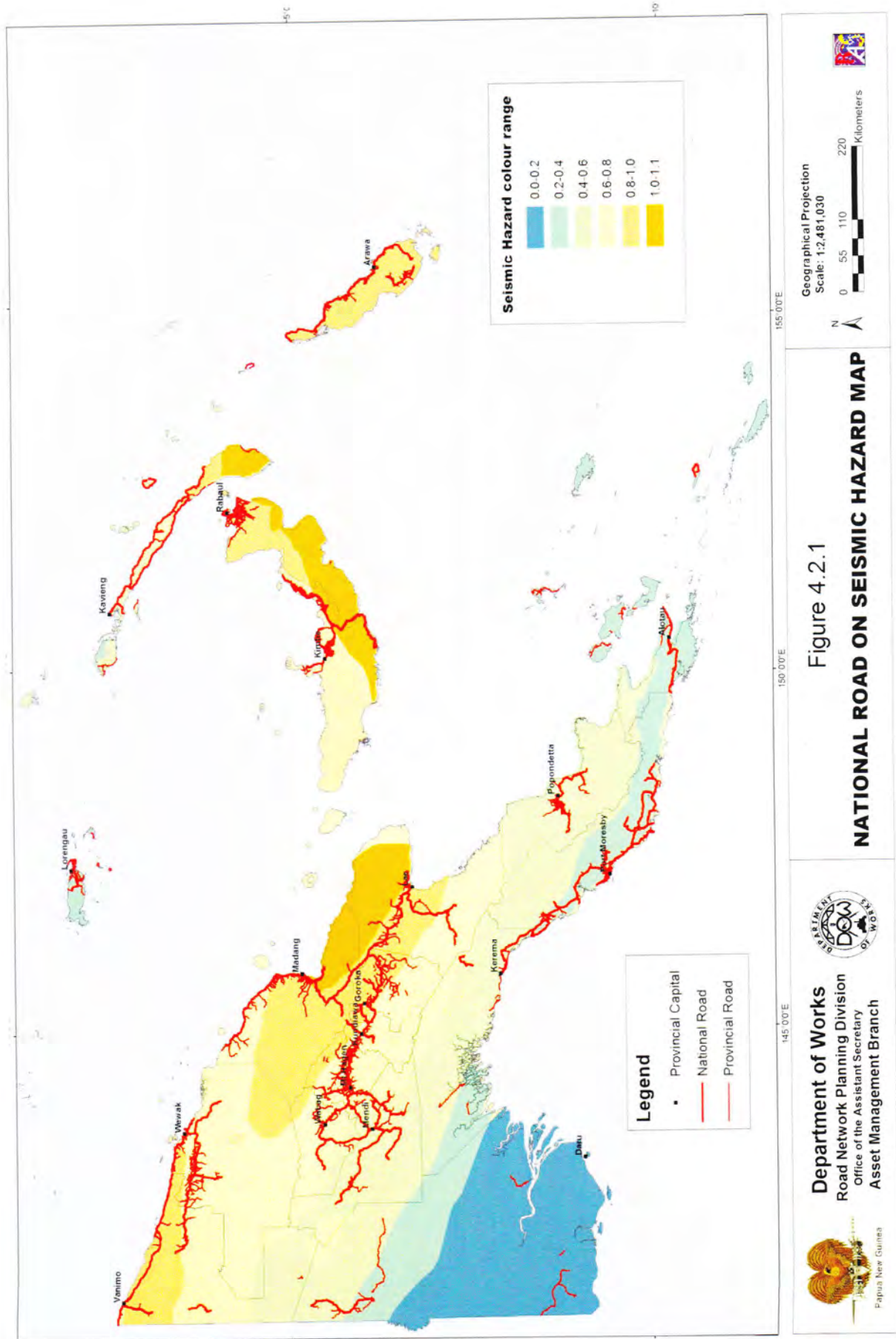
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<sup>18</sup> National Disaster Center.2005. *PNG Risk Reduction and Disaster Management – National Framework for Action 2005-2015*. Port Moresby, NCD.















## V. THE NATIONAL ROAD NETWORK STRATEGY (NRNS)

### 2.1 Context

Overall, it matters not only how much road infrastructure PNG has, but the condition these are in. Roads wear out with time and use, so proper and timely maintenance must be routinely and periodically conducted. Road maintenance expenditures are those that are required to sustain the services provided and required and are necessary for safe operation. Neglecting proper road maintenance inevitably leads to a decline in road condition: potholes, vegetation growth, unsafe road conditions, clogged drainages and so on. Roads in bad condition impose high costs on users. In the long run, failure to maintain roads leads to high reconstruction/rehabilitation costs. It had been estimated that for every Kina not spent on maintenance eventually results in 3 to 4 Kina in additional premature road reconstruction/rehabilitation. A well-maintained sealed road should last 7 to 10 years before resurfacing is required, but the absence of maintenance causes severe deterioration requiring road resealing in as little as three to five years.

The TIPS<sup>19</sup> identified national and provincial roads that warrant priority attention for restoration, rehabilitation and maintenance. Sixteen national roads or a total 4,256 km were considered “priority roads” where 1,206 km or 28.3% were in poor condition. While some improvements may have been implemented since, deficiency in road maintenance funding may have only delayed deterioration of the NRN.

The DSP recognized that PNG’s road infrastructure was inadequate in terms of proper maintenance and nationwide connectivity. The rise in trade and prosperity requires growth in the coverage and quality of the NRN. The DSP advocated a comprehensive program of road rehabilitation and construction to expand the NRN to 25,000 km by 2030 and improve its condition at the same time. The 2030 target was for 100% of the 25,000 km of PNG roads would be in “good” condition. The cost requirement of such an optimistic target is high and beyond the absorptive capacity of the government. Given these expected costs, expenditure on reconstruction should be focused on the priority or a reduced number of core roads depending on available funding.

Aligned with the DSP, the NTS and MTDP2 further recognized that maintenance of the NRN was priority. The rehabilitation/reconstruction of roads in “bad” condition was to be undertaken simultaneously, so that the proportion of roads in bad condition would decrease over a planned period. This assumes that sufficient funding for: (a) Maintenance (routine and periodic maintenance) of national road sections in “good” and “fair” condition and (b) Rehabilitation/reconstruction of sections in “bad” condition, would be provided in a reliable and consistent manner. This had not materialized.

The GoPNG’s ambitious target for roads involved expansion from 8,738 km to 25,000 km by 2030<sup>20</sup>. This includes completion of “missing links” and new road projects, and to enhance provincial government capacity to manage and maintain provincial and district roads. This target is considered “aspirational”. A moderated target supported by a doable strategy is needed.

### 2.2 NRNS Assumptions

The assumptions in the formulation of the NRN strategy are:

- GoPNG’s financial situation remains constrained or worsen in the next 5- 10 years. The DoW budget envelope will be restricted;
- The condition of the NRN (roads/bridges) continues to deteriorate; and

<sup>19</sup> Colin Gannon, Joe Kapa and Paul Unas.2006. Papua New Guinea Transport Infrastructure Priorities Study (TIPS). Canberra, Australia

<sup>20</sup> Department of National Planning and Monitoring, 2010, PNG Development Strategic Plan 2010 – 2030, Port Moresby



- Allocating DoW's maintenance budget to the NRN on a piecemeal basis is not tenable, and results in the further deterioration of the NRN.

## 2.3 NRNS Objectives

The objectives of the NRN strategy are:

### Role of the Roads Subsector

#### *(c) Support sustainable and inclusive economic growth*

The NRN has a key role in linking domestic producers to local and international markets. The NRN enables the mobility of the labour force to access employment opportunities and for entrepreneurs to develop business prospects in various parts of the country.

#### *(d) Provide access to as many people as possible within the maintained sections of the NRN*

The NRN is the main arterial connecting provincial, district and other rural roads. Keeping the NRN in "fair to good" condition is essential to link local communities to government, health, education and police services. The rural economy depends on a reliable and trafficable link to the NRN to minimize the cost of farm inputs and increase the profits from agricultural production.

### Delivery of a Sustainable, Reliable and Efficient NRN

#### *(d) Improved management of NRN assets*

DoW improves the management of NRN assets by rationalizing the delivery of services and ensures that a base NRN to sustain reliable access for economic activities and social services is assured and maintained in good condition. The "maintenance first" policy ensures the consistent quality of the NRN or its sub-network.

#### *(e) Improved road safety along the NRN*

The number of road accidents and the resulting deaths and injuries demand that road safety is enhanced.

### Strengthening of the Provincial and District Capacity on Road Management and Investment

#### *(e) Improved capacity of the Local Governments on Road Management and Investment*

The capacity of DoW to manage PNG's road network including local roads is limited and needs to be devolved to the local governments. DoW would assist the local government staff responsible for road management and investment until such time that they are capable of undertaking the required tasks.

### 2.3.1 Key Strategies for the NRN

To achieve the strategy objectives, the NRN strategy are summarized in **Figure 5.1-1** and discussed below.

- (1) "Maintenance First". GoPNG continues to make significant investments on the NRN, but have neglected to provide the required road maintenance on the existing NRN. The primary focus should therefore be on undertaking the required NRN maintenance to preserve the existing national road assets so that these attain their economic life and provide the required level of service.

Ensuring focus on NRN maintenance avoids the high costs to restore roads in "poor" to "fair or good" condition. It is of general knowledge that K1.00 spent on road maintenance per year saves K3.00 in future road rehabilitation/reconstruction expenditures.



The priority on road maintenance ensures that the NRN or a sub-network is in “good to fair” condition. However, 8,738 km of the NRN in various condition is challenging to maintain in the face of GoPNG’s funding shortfall.

**Figure 5.1-1 The NRN Strategy**

STRATEGIES	
5.	<p>Maintain the NRN or a sub-network to support sector objectives, economic corridor development, access to employment and job opportunities, and to connect effectively with the provincial and district roads. The NRN is maintained on a least cost basis within the funding capacity of the government and other sources, reduces whole of life costs:</p> <p>5.1 Pursue the “Maintenance First” policy to ensure that maintainable road sections are in “fair to good” condition;</p> <p>5.2 Match the available DoW funding envelope with the road network to be maintained. DoW to identify the core network or roads that will have priority over the DoW maintenance budget;</p> <p>5.3 NRN road sections in “fair to good” condition without the core roads would be provided with minimum standard maintenance levels to be preserved in their current condition.</p>
6.	<p>Rehabilitate/reconstruct Core Road sections in “poor” condition. Within Phase 1 [five (5) years] of the NRN Strategy period, all Core Roads will be in “fair to good” condition:</p> <p>6.1 Prioritize the rehabilitation/reconstruction of Core Roads in “poor” condition economic viability measures. HDM 4 to generate the annual and rolling 5-year maintenance plans to achieve the stated target.</p>
7.	<p>Develop the NRN or a sub-network that is safe for users through regular road safety audits, installation of traffic signs and safety barriers, and correction of accident black spot locations:</p> <p>7.1 Provide the Core Roads with the appropriate signage, traffic calming measures and lane markings for safe operations;</p> <p>7.2 As funds are available, the NRN should have all traffic safety measures as in 3.1 above; and</p> <p>7.3 Maintain the database of road accident locations or blackspots.</p>
8.	<p>Provide technical assistance and capacity-building to provincial and district government staff on all areas of road construction, operation and management:</p> <p>8.1 Assist the provinces in the formulation, implementation and monitoring of their road network maintenance and investment plans through the conduct of capacity-building programs and on-site coaching of the local engineering and planning staff; and</p> <p>8.2 Assist the provinces in the design, tender, contracting and monitoring of road/bridge projects local or PNG government funding assistance.</p>

To restore the NRN to “fair or good” condition, maintenance funds should be provided in a consistent and required amount.

- (a) *Match available funding to the road length to be maintained.* Insufficient maintenance funds resulted in the NRN’s continued deterioration. Available funding determines the network length to be maintained, that is, the lower the funding, the shorter the network length. This requires disaggregating the NRN into smaller networks of various lengths and varying conditions.

### **Defining the Core Roads**

#### **Step 1. Priority Roads**

Priority Roads (PR) were identified in the TIPS and is about 4,526 km, connecting provincial capitals to other capitals and major urban centres. PR includes bridges, culverts and other



river/spring crossings. The TIPS assessment criteria included quantified key factors<sup>21</sup> and a qualitative priority scale. The priority roads comprise the priority sub-network of the NRN.

#### Step 2. Core Roads

Priority roads require significant maintenance funding and available funds may not be sufficient. A shorter sub-network of the priority roads should be determined to implement the phased improvement of the NRN. This sub-network or Core Roads have the following characteristics:

- i. The Core Roads maintain the existing links between provincial capitals, district centers, and the priority economic corridors;
- ii. The Core Roads are important links to intermodal transfer nodes, such as ports, wharves, airports and airstrips. Ports, wharves, airports and airstrips can serve as alternatives to the Core Roads in the event of road closure due to natural disasters;

The Core Roads have priority over the rest of the NRN roads in the allocation of maintenance funds (routine, periodic and reconstruction/ rehabilitation).

The selection of the Core Roads was based on the assessment of whether the specific road connects two or more provincial capitals, intermodal stations or the major link road in the island. The list of Priority and Core Roads are given in **Table 5.1-2**. The preliminary length of the Core Roads is about 2,309 km. It is a significant reduction in road length to be provided full maintenance treatment including rehabilitation/ reconstruction on which DoW can focus its budget. **The list of Core Roads is preliminary and subject to revision.** The sections of the Core Roads, which will undergo periodic maintenance and reconstruction/rehabilitation, will be generated using HDM 4 and prioritized from highest to lowest economic internal rate of return (EIRR). **Figure 5.1-2** shows the location of the initial set of Core Roads identified.

**Table 5.1-2 Priority and Core Roads in the NRN**

No.	Name of National Road	Core Roads	Non-core Roads	Priority Roads
		Length (km)	Length (km)	Length (km)
1	Highlands Highway	611	-	611
2	Boluminsky Highway	122	216	338
3	Koroba to Mendi Road	195	-	195
4	Pogera Road	-	70	70
5	Enga Highway	90	-	90
6	Wabag-Mendi Highway	144	-	144
7	New Britain Highway <sup>22</sup>	271	41	312
8	Sepik Highway	99	159	258
9	Coastal Highway	73	678	751
10	Baiyer Road	-	60	60
11	Hiritano Highway	296	-	296
12	Kokoda and Northern Highways	58	105	163
13	Wau Road	102	26	128
14	Buka Road	-	183	183
15	Magi Highway	67	316	383
16	Ramu Highway	181	-	181
17	West Coast Road	-	198	198
<b>TOTAL</b>		<b>2,309</b>	<b>2,052</b>	<b>4,361</b>

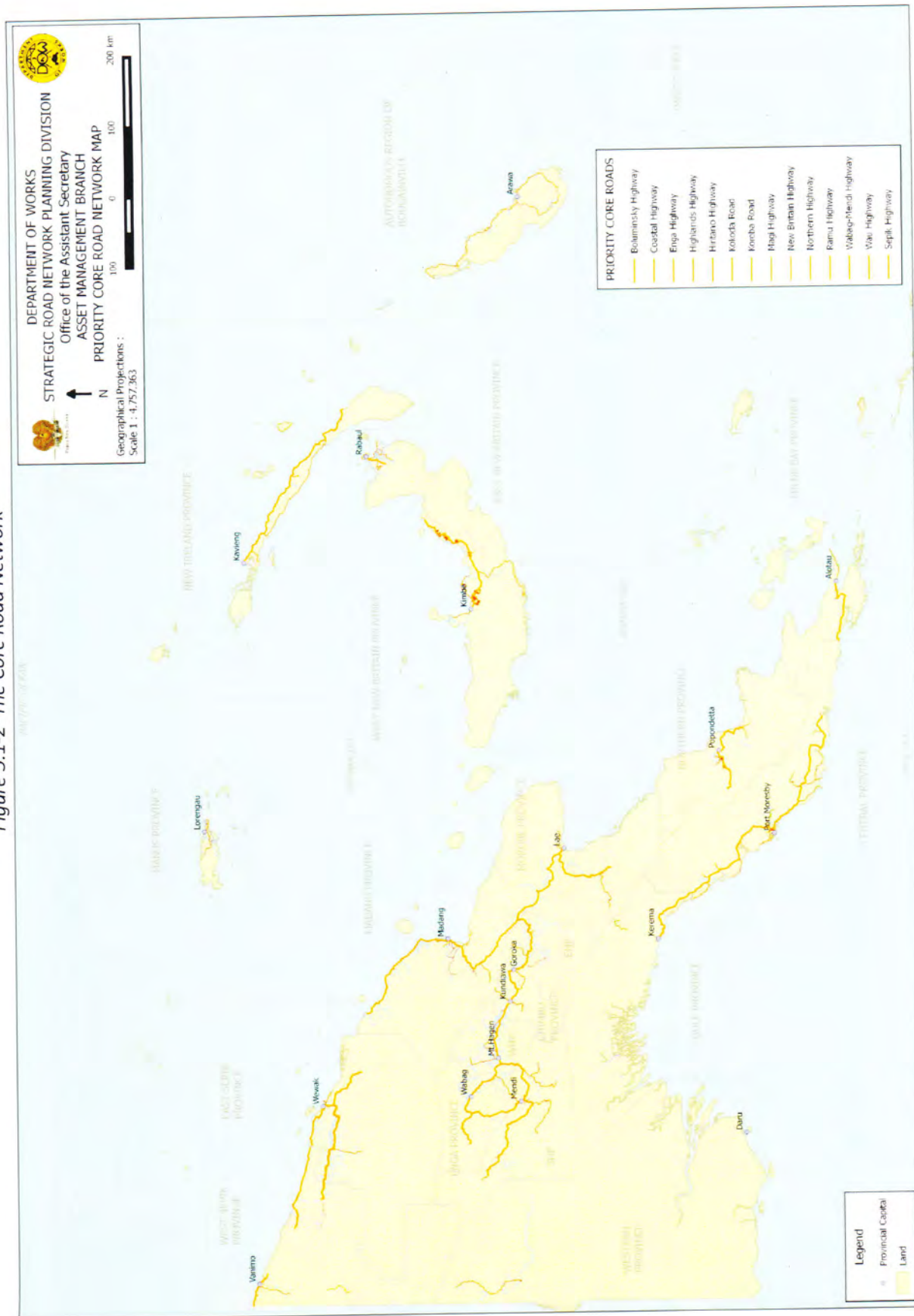
Source: DOW-AMB, 2017

<sup>21</sup> The quantified key criteria are comprised of the following: (i) Value of export flows supported by the infrastructure asset; (ii) Traffic level; (iii) Strategic role; (iv) Population and income potential indices; (v) road condition; and (vi) works in progress. Colin Gannon, Joe Kapa & Paul Unas. Nov. 2006. PNG Transport Infrastructure Priorities Study (TIPS). Canberra, Australia

<sup>22</sup> Includes strategically important 'intermodal' sections of non-priority roads - Talasea and Hoskins roads, totalling 39km



Figure 5.1-2 The Core Road Network





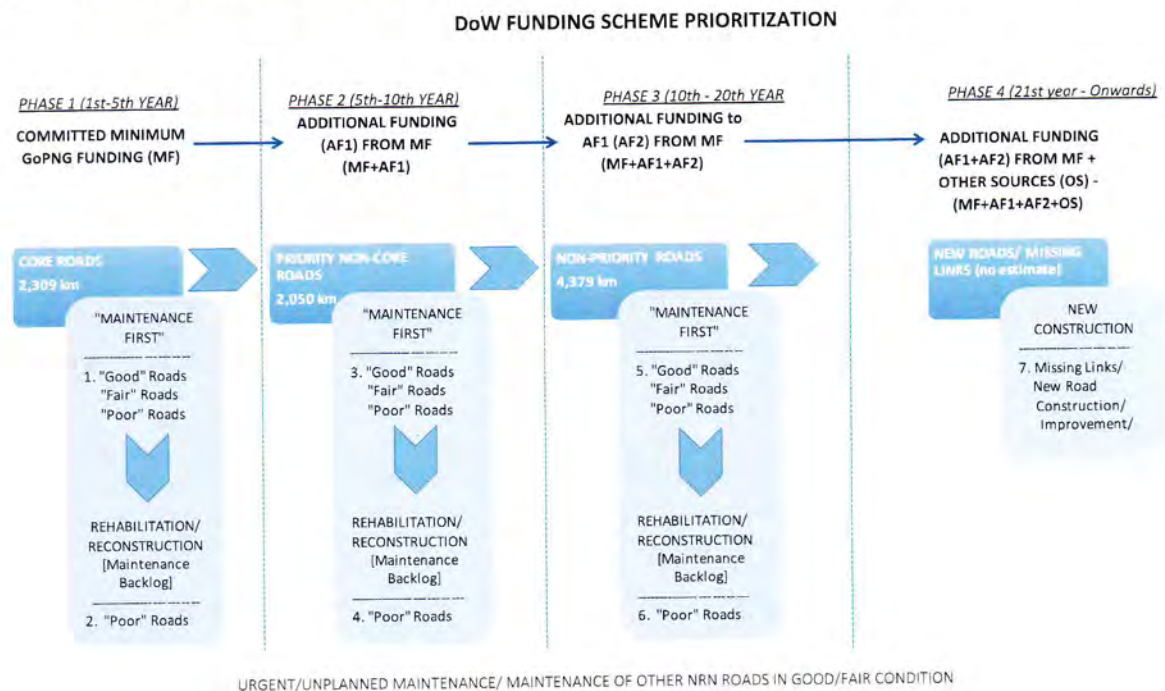




### 2.3.2 Prioritizing NRN Maintenance Funding

With the expected maintenance funding shortfall, DoW will focus on Phase 1 - the Core Roads - under the NRN strategy. Under Phase 1 and subsequent phases, GoPNG funding for the estimated amount required for road maintenance must be committed. However, the NRN strategy has flexibility for utilizing available monies as shown in **Figure 5.1-3**, but this would mean extending the Phase 1 period to complete Phase 1 targets. Any surplus funds (if any) can be utilized along the priorities laid down under the scheme. The strategy for the phased improvement of the NRN should result in a NRN in “fair to good” condition, although the time frame for achieving the target is not necessarily fixed.

**Figure 5.1-3 Prioritization Scheme for NRN Maintenance, Reconstruction and Improvement**



NOTE: As discussed, the lengths of the phases depend on when the specific targets for each phase are achieved.

An important assumption of the prioritization scheme is that progressing from one implementation phase to the next requires first achieving the target outputs for the current phase before moving to the subsequent phase. Furthermore, estimated funding requirement increases cumulatively, as more roads need to be maintained in subsequent phases.

- 1) NRN Road Sections in “fair and good” condition net of the Core Roads [Non-Core Roads] are provided with minimum maintenance to sustain their existing condition at best.

A question is on what to do with the Non-Core Roads”. Non-Core Roads in “fair to good” condition are provided with minimum maintenance to sustain their condition and maintain trafficability. The funding requirement for the Non-Core Roads has been included in the funding estimates.

Core Roads are provided full maintenance funding inclusive of rehabilitation/ reconstruction of Core Roads in poor condition. Non-Core Roads” in “fair to good” condition are provided maintenance to sustain their current condition.



2) Rehabilitate/reconstruct Core Road sections in “poor” condition.

All Core Road sections in “poor” condition are rehabilitated/reconstructed to bring them to “fair or good” condition. At the end of Phase 1, all Core Roads would be in “fair or good” condition, and applicable to subsequent phases thereafter. DoW would have cleared its maintenance backlog for the Core Roads and progress to Phase 2 and so on.

Prioritisation of new roads should depend on the results of the business cases for each, which will be conducted in advance of their target implementation schedule to determine viability and expedite land acquisition. There is some overlap between the “missing links” and the new road connections through the economic corridors.

The NRNS “Maintenance First” principle requires that in the current and ongoing constraint funding environment, the restoration and maintenance of the National Road Network (NRN) must take priority over other network expansion projects. However, if future GoPNG funding streams become sufficient to pay for both NRN restoration/maintenance and network expansionary works, both activities can be implemented concurrently.

3) A safe NRN for all users.

In PNG’s national roads, the number and severity of road accidents have increased. Prevention or minimizing road accidents require cross-sectoral interventions.

(a) Ensure that Core Roads have appropriate traffic signage, traffic calming measures and lane markings.

The Core Roads are subject to safety audits to identify required safety measures, especially in locations identified as “accident black spots”. The road markings, signage and calming measures are installed either as part of routine or periodic maintenance or as a special DoW road safety initiative.

(b) Ensure that Non-Core Roads have traffic signage, traffic calming measures and lane markings

On safety measures for Non-Core Roads, these are installed contingent on availability of funding. Road safety audits on the Non-Core Roads are undertaken to update road characteristic information in the Road Asset Management System (RAMS).

4) Provide technical assistance and capacity-building to local governments on road construction, operation and management.

Provincial and district roads are, presumably, in worse condition than national roads, although this needs verification. Local governments lack the technical capacity to undertake proper maintenance and rehabilitation/reconstruction works for local roads. DoW’s Provincial Works offices will provide capacity-building to local government staff and assist in the implementation of projects on a case to case basis.

### 2.3.3 Road Network Expansion

The government has committed in the ‘Alotau Accord II, to continue to develop and maintain key productive infrastructure assets. Regarding roads, the government is undertaking to rehabilitate the entire Highlands Highway; expedite on-going road projects, including the reconstruction of the Lae – Nadzab Phase II project; and to complete 11 ‘Missing Road Link Roads’ (MLRs). The total length of the MLRs is 4,557 km, of which 1,279 km are committed in the Alotau Accord II for construction in the 2018-2022 term of government. The MLRs are listed in **Table 5.1-3** and their locations are shown on **Figure 5.1-4**.



**Table 5.1-3 Missing Links and Alternative Routes**

No.	Alotau Accord II	Missing Link Road	Est. Length (km)
1		Kiunga-Aiambak-Obo-Morehead-Malam-Daru	476
2		Kiunga-Mendi	400
3	<b>a. Gulf/Southern Highlands</b>	<b>Kerema-Ihu-Kopi</b>	<b>295</b>
4		Kagua-Erave-Samberigi-Kopi Road	170
5		Malalaua-Wau	300
6		Kupiano-Gadaisu	184
7		Bubuletta-Motau-Lavora-Raba Raba-Agaun	159
8		Bariji-Safia-Moreguina	96
9		Wau-Garaina-Morobe Patrol Post	136
10		Lae-Finschhafen Road	98
11	<b>c./d. Madang/Baiyer (Middle Ramu) Road</b>	<b>Baiyer River-Aiome-Amele</b>	<b>160</b>
12	<b>e. Kiunga/Teleformin</b>	<b>Kopiago-Oksapmin-Telefomin-Tabubil</b>	<b>153</b>
13		Saidor-Wasu-Sialum	97
14	<b>j. Madang/East Sepik Highway</b>	<b>Bogia-Angoram</b>	<b>76</b>
15		Pagwi-Ambunti-Kuvenmas-Laiagam	193
16	<b>i. East/West Sepik Highway</b>	<b>Aitape-Vanim</b>	<b>82</b>
17		Bewani-Imonda-Amanab-Green River-Telefomin	305
18	<b>b. East/West New Britain</b>	<b>Bialla-Kerevat</b>	<b>242</b>
19		Kimbe-Gloucester	200
20		Rabaul-Tol-Pomio-Gasmata-Kandrian-Gloucester	425
21		Siara Junction-Soraken-Kunua-Koripobi-Torokina-Boku	39
22	<b>f. Ungai/Chuave Road</b>		<b>56</b>
23	<b>g. Ramu/Bena Road</b>		<b>50</b>
24	<b>h. Mendi/Tambul Road</b>		<b>74</b>
25	<b>k. Dona/Kerowagi Road</b>		<b>91</b>
		<b>Total:</b>	<b>4,557</b>
		<b>Alotau Accord II Total:</b>	<b>1,279</b>

Source: DoW - Missing-Links Projects

The NRNS proposes to expand the national road network, through: (a) reclassification of important provincial and district roads to national road category; and (b) through the construction of new roads, prioritising the identified 'Missing-Link' roads considered to be of significant strategic importance to the nation.

There are clear overlaps between the missing links and the new roads to link the economic corridors. The prioritization of these roads shall depend on the business cases for each. The initial 5-years of NRNS implementation will progress/complete current network expansion works and include the preparation of feasibility studies, pre-construction technical investigations, and land acquisition. Missing-links currently in progress include:

- (a) Karamui – Gumine Missing-link
- (b) Kopiam – Baiyer Missing-link
- (c) Pomio – Kokopo Missing-link
- (d) Teleformin – Tabubil Missing-link
- (e) Gulf-Southern Highlands Missing-link (Samberigi to Erave)
- (f) East-West New Britain Highway Missing-link
- (g) Baiyer – Madang Missing-link



### 2.3.4 Subnational (Provincial and District) Roads

PNG's subnational road network is 21,000km in length. These roads are classified by the DoW as provincial and district roads.

Development and maintenance of provincial and district roads including other rural infrastructure, such as health centres/clinics, schools, water supplies, electricity supplies, office buildings, etc., are the shared responsibility of Provincial and Local Level Governments (LLGs) and the National Government, through the Department of Works. Funding for rural infrastructure is provided by the national government through the Provincial Support Investment Program (PSIP) and the District Support Investment Program (DSIP). These funds are managed by the Provincial and Local Level Governments.

The Provincial Governments and LLGs have limited technical capacity to manage and maintain their infrastructure and as a result much of the key services in the districts are neglected and in poor condition. DoW estimates that 64% of the provincial and district road networks are in poor or failed condition.

The need for good provincial and district infrastructure is great, given that about 80% of the population live in rural communities, district centres and provincial towns. DoW will continue to provide support to Provincial Governments and LLGs for the maintenance and development of their roads and other rural infrastructure. However, the need for a long-term strategy to recover and maintain the subnational road networks is obvious.

The Department of Works, supported by Australian Government, is currently conducting a review of institutional arrangements for the management of the road networks (IAMRN) in response to instruction from the CACC in September 2016, to determine core functional responsibilities of institutions in the road sector and where necessary reform and eliminate duplication and wastage. The review also considered the institutional arrangements for the management of the subnational road networks.

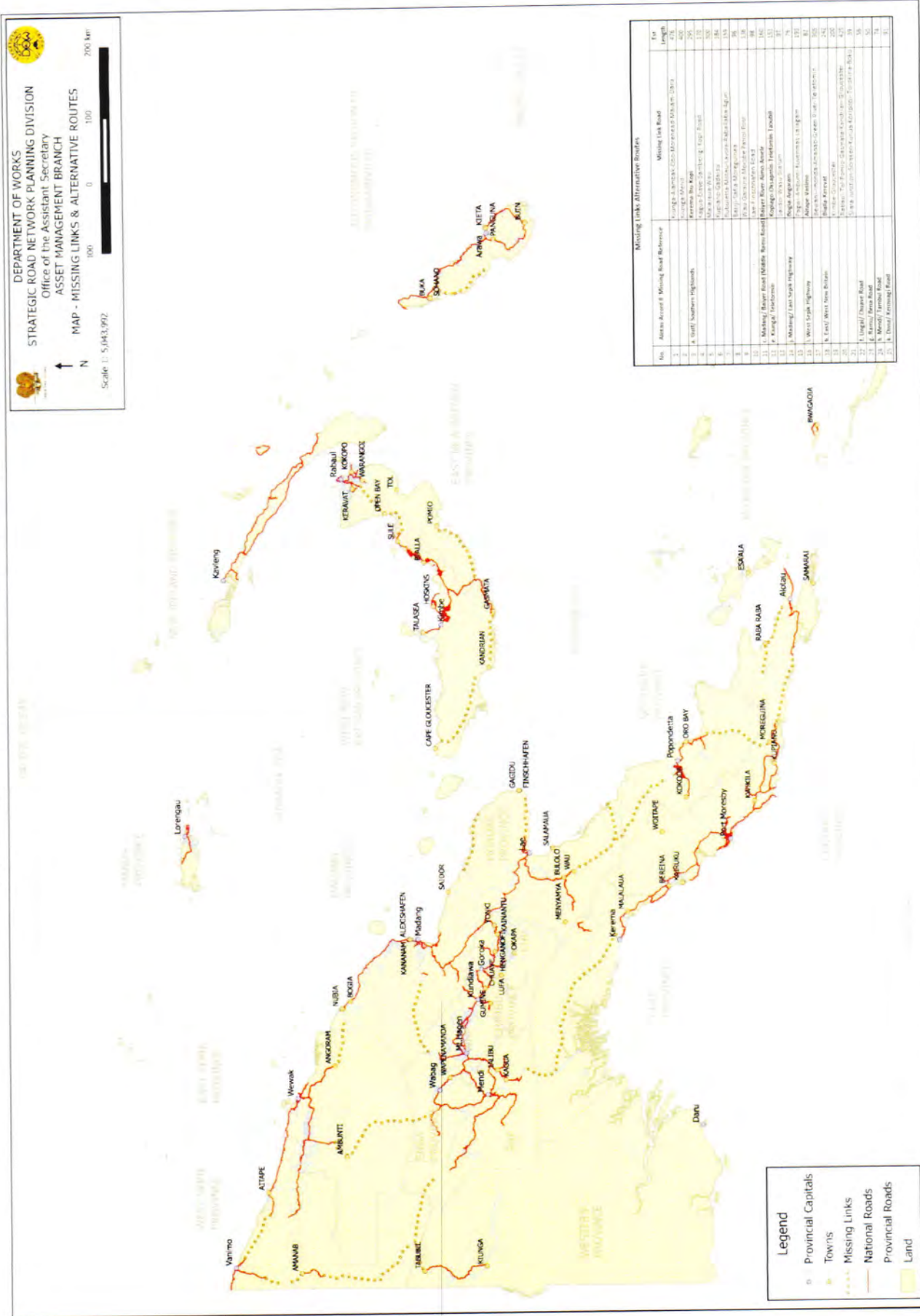
Building on the findings of the IAMRN review, the Department of Works will develop a separate strategy proposal, in consultation with DPLLGA, the Provincial Governments and LLGs for the recovery and maintenance of subnational roads and long-term management and operational arrangements, including the role and function of the DoW Plant and Transport Division (PTD).

### 2.3.5 DoW 5-Years Road Recovery and Maintenance Workplan, 2018 to 2022

**Appendix E** shows DoW's **5-Years Road Recovery and Maintenance Workplan from 2018 to 2022**. This workplan is a live document, depicting a snapshot of DoW's implementation plan for the period of the NRNS Phase 1. The plan is aligned with the National Road Network Strategy, incorporating current on-going projects, whilst emphasising the use of road rehabilitation and long-term (performance based) maintenance contracting model, as the main methodology to achieve 50% 'Good' and 50% 'Fair' conditions in the Core Road Network (2,309 km) by 2022.



### Figure 5.1-4 Missing Links and Alternative Routes









## VI. NRN MAINTENANCE FUNDING REQUIREMENTS

### 3.1 Estimate of NRN Maintenance Funding Requirements

#### 3.1.1 Maintenance Activities

The scope of DoW's road maintenance program consists of the following:

- Routine maintenance activities - all road sections - works required to be undertaken to prevent the rapid or premature deterioration of the road surface and pavement.
- Periodic maintenance activities - selected road sections - maintenance activities that are carried out on a programmed basis; and
- Urgent/unplanned maintenance on affected road sections as required.

##### (a) Routine Maintenance

The routine maintenance program is implemented throughout the year on a cyclical basis and includes the following activities: (i) Vegetation clearing; (ii) Crack sealing; (iii) Pothole repairs in sealed roadways; (iv) Edge Repair; (v) Filling of potholes - unsealed roadways; (vi) Drain cleaning; (vii) Culvert cleaning; (viii) Bridge cleaning; (ix) Culvert and headwall maintenance; and (x) Maintenance of road furniture.

##### (b) Periodic Maintenance

Periodic maintenance includes the following activities: (i) Shoulder grading; (ii) Patrol grading; (iii) Team grading; (iv) Pavement repairs - sealed roadways; (v) Pavement repairs - unsealed roadways; (vi) Resealing of road surface; (vii) Line markings; (viii) Regraveling - unsealed roads; (ix) Culvert headwall replacement; (x) Culvert repairs; (xi) Bridge repairs; and (xii) Drainage repairs.

##### (c) Urgent/Unplanned Maintenance

Urgent/unplanned maintenance includes temporary repair works due to flash flooding, spillage, land slips, willful damage and occurrences that close the road to vehicular traffic. In addition, this include responses to unforeseen events requiring road closure and cover a wider area than the roadway. Budget allocation for urgent/unplanned maintenance works has been estimated at 10% of routine maintenance cost.

#### 3.1.2 Unit Costs

To estimate the maintenance cost of the NRN or a sub-network, the DoW establishes the average unit costs for various maintenance activities. These unit costs are recalculated on a periodic basis to consider increases in materials, labour and supervision costs. A shorter method would be to use the consumer price indices (CPI) as adjustment factors applied to the current unit costs.

Estimates of unit costs using actual costs of selected TSSP, World Bank and ADB projects in PNG were estimated. For the NRN strategy, this updated estimate was utilized to determine budget requirements for each year of the strategy implementation period.

#### 3.1.3 Maintenance Backlog [Road Rehabilitation/Reconstruction]

The maintenance backlog is the level of maintenance required to return the road to a condition profile that is acceptable, sustainable and manageable. Expressed in monetary terms, it is the total costs which must be spent to bring the road assets in "backlog" condition to predefined standards (total monetary backlog) or the absolute value irrespective of the available budget. The maintenance backlog is treated as the estimated cost for rehabilitation/reconstruction of portions of the NRN in "poor condition" starting with the Core Roads to "fair or good" condition. A phased strategy is proposed wherein, annually, 20% of the Core Roads in "poor condition" are rehabilitated/



reconstructed to “fair or good condition”. After five (5) years, all Core Roads should be in “fair or good condition”.

### 3.1.4 Road Condition

The existing condition of the NRN determines the required annual maintenance and rehabilitation/reconstruction costs for the NRN Strategy implementation. The worse condition the NRN is in – higher proportion of roads in “poor” condition – the higher would be the funding requirement for improving all roads to “fair and good” condition. DoW data on NRN condition should be current and updated periodically to monitor improvement in NRN condition.

**Table 6.1-2** gives the road condition data from various sources. For the NRN Strategy, the forecast NRN condition using 2014 Visual Condition Road Survey data on the NRN is used. This is considered the “worst case” scenario and gives the high cost estimate for implementing the NRN Strategy annually. A lower cost is estimated when the AMB 2017 Road Condition Report of the provincial works engineers is used.

### 3.1.5 Estimated Costs for Implementing the “Maintenance First” Policy

The activities covered under each NRN Strategy implementation phase is shown in **Figure 6.1-1**. The assumptions on the strategy implementation are as follows:

**Table 6.1-2 National Road Condition Data, 2008, 2012, 2014, 2017 & 2018e**  
by source

No	DATA SOURCE/YEAR	Total Length (in km)	Sealed				Unsealed				Not Surveyed (% of Total)
			Good (%)	Fair (%)	Poor (%)	% of Total	Good (%)	Fair (%)	Poor (%)	% of Total	
1	National Road Network Condition, 2008	8,460	51%	34%	15%	32%	38%	35%	27%	68%	
	- Priority Roads	4,127	60%	34%	6%	47%	46%	36%	18%	53%	
2	PNG Road Statistics, 2012										
	- National Road Network	8,738	73%	23%	3%	39%	4%	62%	33%	59%	2%
	- Priority Non-Core Roads	4,256	78%	20%	2%	57%	2%	85%	13%	43%	
	- Non-Priority Roads	4,483	61%	31%	8%	21%	5%	50%	44%	75%	4%
3.1	VRCS/ARRB, 2014										
	- National Road Network	8,695	27%	15%	58%	43%	2%	1%	97%	57%	
	- Core Roads	2,246	21%	14%	66%	82%	0%	1%	99%	18%	
	- Priority Non-Core Roads	2,050	29%	12%	59%	40%	3%	4%	93%	60%	
	- Non-Priority Roads	4,379	37%	18%	46%	24%	1%	1%	98%	76%	
3.2	VRCS/ARRB, 2018 projected										
	- National Road Network	8,738	24%	16%	60%	38%	0%	2%	98%	62%	
	- Core Roads	2,309	18%	15%	67%	77%	0%	0%	100%	23%	
	- Priority Non-Core Roads	2,051	26%	14%	60%	31%	0%	5%	95%	69%	
	- Non-Priority Roads	4,379	34%	19%	47%	21%	0%	1%	99%	79%	
4	DOW-AMB, 2018										
	- National Road Network	8,738	47%	32%	21%	38%	33%	30%	37%	62%	
	- Core Roads	2,309	43%	38%	19%	77%	56%	28%	16%	23%	
	- Priority Non-Core Roads	2,051	57%	28%	15%	31%	55%	19%	27%	69%	
	- Non-Priority Roads	4,379	47%	23%	30%	21%	21%	34%	45%	79%	

Sources: AMB-DoW; e: TSSP Advisers' estimates

#### Phase 1 (1<sup>st</sup> – 5<sup>th</sup> Year)

- All Core Roads (sealed and unsealed) in “fair to good” condition provided routine and periodic maintenance (without resealing/regraveling). Twenty percent (20%) of sealed and unsealed roads in “fair and good” condition are resealed/regraveled annually;
- All sealed Core Roads in “poor” condition are rehabilitated/reconstructed to “fair (50%) or good (50%)” condition by the 5<sup>th</sup>-year of Phase 1;



- All unsealed CORE Roads in “poor” condition are rehabilitated/reconstructed to “fair (50%) and good (50%)” condition by the 5<sup>th</sup>-year of Phase 1, and All Non-Core roads (sealed and unsealed) in fair and good condition are provided routine maintenance.

#### Phase 2 (6<sup>th</sup> – 10<sup>th</sup> Year)

- All sealed/unsealed Priority Non-Core and Core Roads in “fair to good” condition are provided routine and periodic maintenance (without resealing/regraveling). Twenty percent (20%) of sealed and unsealed roads in “fair and good” condition are resealed/regraveled annually;
- All sealed Priority Non-Core roads in “poor” condition are in “fair (50%) or good (50%) condition by the 10<sup>th</sup>-year;
- All unsealed Priority Non-Core roads in “poor” condition are in “fair (50%) or good (50%) condition by the 10<sup>th</sup>-year; and
- All Core and Priority Non-Core sealed roads will be in fair (50%) or good (50%) condition by the 10<sup>th</sup>-year;
- All Core and Priority Non-Core unsealed roads will be in fair (50%) or good (50%) condition by the 10<sup>th</sup>-year; and
- All routine maintenance costs for Non-Priority roads are included in Phase 2 budget requirements.

#### Phase 3 (11<sup>th</sup> – 20<sup>th</sup> year)

- All sealed Non-Priority Roads in “poor” condition are brought to “fair (50%) or good (50%) condition by the 20<sup>th</sup>-year;
- All unsealed Non-Priority Roads in “poor” condition are brought to “fair (50%) or good (50%) condition by the 20<sup>th</sup>-year;
- All routine and periodic maintenance costs for the Core and Priority Non-Core Roads are included in the Phase 3 budget requirement;
- All NRN sealed roads will be in “fair (50%) or good (50%)” condition by the 20<sup>th</sup>-year; and
- All NRN unsealed roads will be in “fair (50%) or good (50%)” condition by the 20<sup>th</sup>-year

#### AFTER PHASE 3 (21<sup>st</sup> year - onwards)

The roads that were rehabilitated/reconstructed in Phase 1 (1<sup>st</sup> – 5<sup>th</sup> year) will be approaching the end of their design life and they will be requiring renewal of failing sections. Continued funding of road maintenance and renewal, is essential to maintain the economic benefits that the strategy, would bring to Papua New Guinea. The cycle of road maintenance does not end after Phase 3 and a new National Road Network Strategy, will have been developed in the prior years.

**Table 6.1-3** gives the estimated maintenance and rehabilitation/reconstruction costs for the Core, Priority Non-Core and Non-Priority roads. The average annual funding estimates for Phases 1 to 3 are: (i) K901.8 million or K4,509.1 million over 5 years for Phase 1; (ii) K960.6 million or K4,803.0 million over 5 years for Phase 2; and (iii) K1,181.6 million or K11,816.4 million over 10 years for Phase 3.



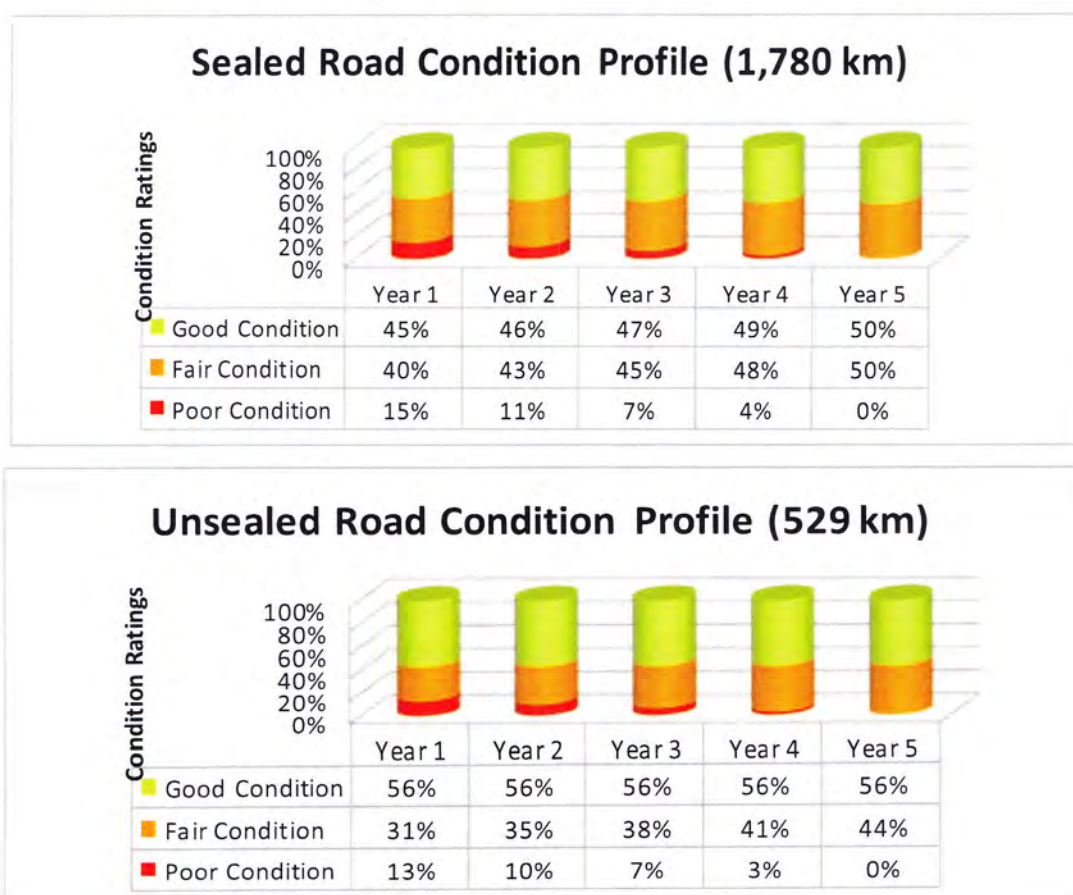
Table 6.1-3 Estimated NRR Maintenance and Reconstruction Costs, Phases 1-3, in million Kina

Description	Phase 1	Phase 2	Phase 3	Total
	(5 yrs)	(5 yrs)	(10 yrs)	(20 yrs)
<b>Operational Works (Maintenance)</b>	<b>3,841</b>	<b>4,454</b>	<b>9,638</b>	<b>17,933</b>
National Roads (Routine & Periodic)	3,591	4,204	9,138	16,933
Emergency (unplanned) works	250	250	500	1,000
<b>Capital Works</b>	<b>649</b>	<b>356</b>	<b>2,181</b>	<b>3,186</b>
National Roads (Rehab/Reconst)	466	184	1,825	2,474
Bridges Major (Rehabilitation) Works	80	71	152	303
Minor CDS rehab/replacement	15	13	28	57
New Bridge (Const/Replacement)	88	88	176	353
<b>Grand Total:</b>	<b>4,489</b>	<b>4,810</b>	<b>11,819</b>	<b>21,119</b>
<b>Annual CASHFLOW (20 YRS Strategy)</b>				
Operational Works	768	891	964	
Capital Works	130	71	218	
<b>Total Cashflow</b>	<b>898</b>	<b>962</b>	<b>1,182</b>	

Note: Detailed computations are given in Appendix A.

The expected condition of the Core Roads at Phase 1 completion is shown in Figure 6.1-1.

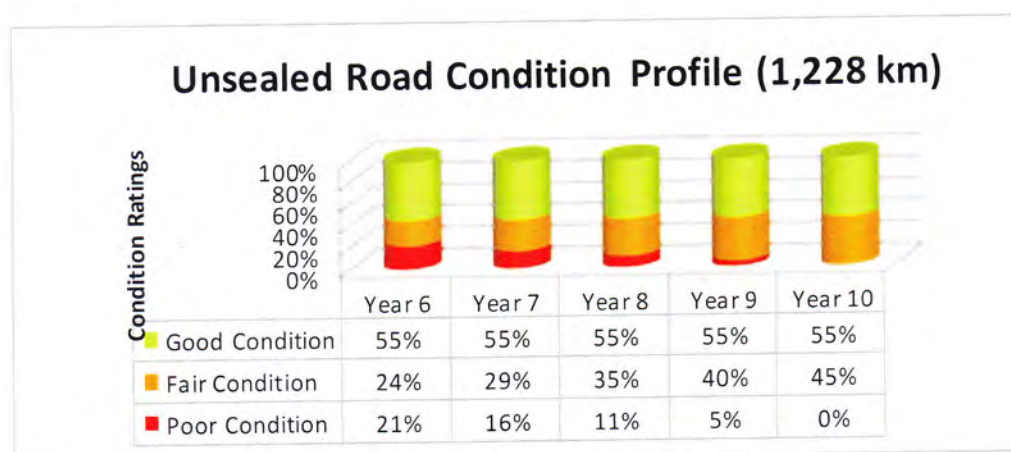
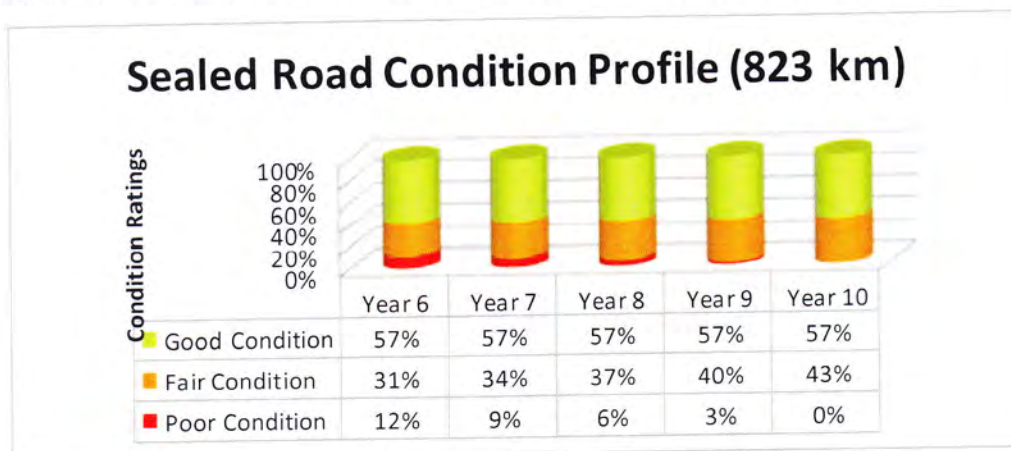
Figure 6.1-1 Expected Condition of the Core Roads – Phase 1 Completion





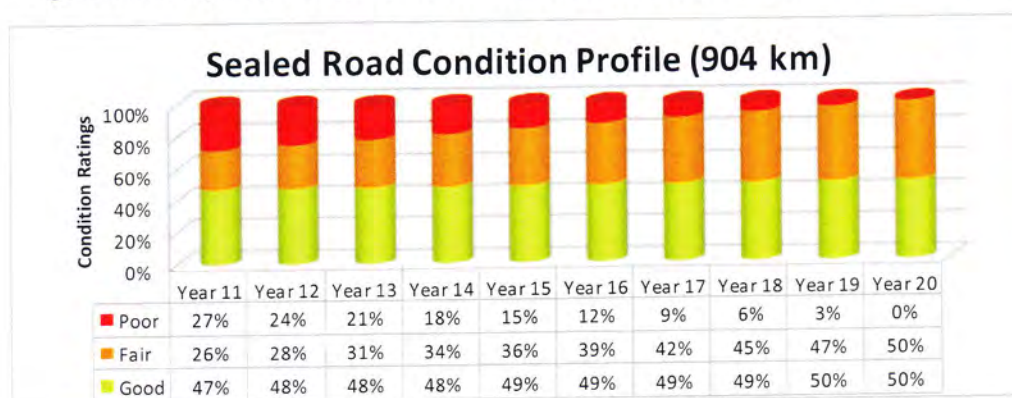
The expected condition of the Non-Core Priority Roads at Phase 2 completion is shown in **Figure 6.1-2**.

**Figure 6.1-2 Expected Condition of the Non-Core Priority Roads – Phase 2 Completion**

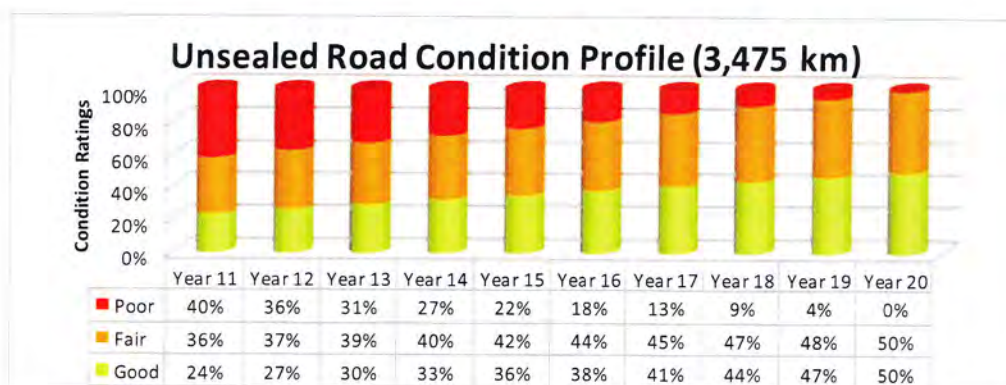


The expected condition of the Non- Priority Roads at Phase 3 completion is shown in **Figure 6.1-3**.

**Figure 6.1-3 Expected Condition of the Non- Priority Roads – Phase 3 Completion**







### 3.1.6 Estimated Costs for Road Network Expansion

Development of new ‘Missing-Link’ roads should be subject to results of the business case analysis to be undertaken for each road. These roads may be implemented subject to availability of funds, with Phases 1-3 road maintenance funding requirements to be given priority.

Based on the current list of roads, the length of identified ‘Missing-link roads amount to 4,557 km. The estimated total construction cost is K5,579 million. To complete all these roads within the 20-years strategy period will require expenditure of: K246 million per year, in the first 5-years phase; K253 million per year in the second 5-years phase; and K308 million per year in the third 10-years phase. Table ES-6, shows the expected cost of network expansion construction.

The projected cost of the planned “Missing-Link” Roads are shown in **Table 6.1-4**. The total cost of all identified Missing-Link roads (4,557 KM) over the 20 years period of the NRNS is shown in **Appendix D**. Given the current financial constraints, expenditure should be kept at affordable levels.

It is important that investment decisions for the Missing-Link roads is informed by comparative assessment, endorsed by DoW to ensure underlying estimates and assumptions are realistic. It is recommended that the government should continue to fund existing network expansion projects to protect past investment and continue to expand the network at an affordable budget of K50M per year for the duration (5 years) of Phase 1 of the NRN Strategy.

**Table 6.1-4: Estimated Cost of Missing-Link Roads**

Description	Phase: Period:	Phase 1 <sup>23</sup>	Phase 2	Phase 3	Total
		Years 1-5	Years 6-10	Years 11-20	
Unsealed <sup>24</sup> Length Constructed (km)		1,279	1,093	2,185	4,557
Construction Cost Kina (million)		1,162	993	1,986	4,141
Routine Maintenance Cost Kina (million)		66	223	871	1,160
Periodic Maintenance Cost Kina (million)		-	50	227	277
Routine & Periodic Maintenance Total Kina (million)		66	273	1,098	1,438
<b>Total Cost Kina (million)</b>		<b>1,229</b>	<b>1,266</b>	<b>3,084</b>	<b>5,579</b>
<b>Annual Cost Kina (million)</b>		<b>246</b>	<b>253</b>	<b>308</b>	

<sup>23</sup> Alotau Accord II Missing-Link Roads

<sup>24</sup> Completed to subbase-level standard



## VII. FINANCING THE NRN STRATEGY

### 7.1 GoPNG Revenue and Expenditure Situation

In 2016, GoPNG recorded a budget deficit of K3,086.9 million, compared to the 2015 deficit of K2,532.6 million. This represented 4.6% of nominal gross domestic product (GDP). Total revenue, including foreign grants, in 2016 was K10,485.5 million, 4.4% lower than 2015. This represented 89.5% of the revised budgeted revenue for 2016. Total expenditure in 2016 was K13,572.4 million, 0.6% higher than 2015 and represented 98.1% of the 2016 revised budget. Recurrent expenditure increased, while development expenditure declined in 2016 compared to 2015. GoPNG budget deficit was financed from external and domestic sources amounting to K1,448.9 million and K1,638.0 million, respectively.<sup>25</sup>

### 7.2 Historical and Recommended Road Maintenance Spending

Given the impact of NRN condition on the country's economy, GoPNG should provide the sufficient level of road maintenance funding to ensure the "fair or good condition" of the NRN. Road maintenance expenditures should range between 1.5% and 3.3% of GDP for developing countries<sup>26</sup>, depending on current network condition. GoPNG's cumulative underspending for road maintenance ranged from K3,745.1 million to K 11,413.5 million for the period 2008-2016. The amount is the cost of the NRN maintenance backlog. **Table 7.2-1** gives the annual road and bridge maintenance expenditure estimate for 2008-2016. **Figure 7.2-1** shows DoW's road maintenance expenditure (excluding bridge maintenance) by treatment type for 2008-2016. **Table 7.2-2** gives the recommended annual road maintenance expenditure as a percent of GDP.

### 7.3 Funding Sources for Implementing the NRN Strategy

Current GoPNG spending for road and bridge maintenance are primarily sourced from GoPNG appropriations. This is complemented by other funding sources – tax credits, donor funding, fuel levy and GoPNG appropriations for roads to other sector/subsector agencies. The amount of GoPNG appropriations to DoW has been unpredictable and insufficient to fund all the maintenance activities for the NRN, where the actual amount released is substantially less than the approved budget. There are years where DoW was given a high allocation, but, on other times, the allocation has been minimal and insufficient to undertake maintenance activities on even a small section of the NRN. There is need to ensure that DoW gets a predictable, consistent and sufficient appropriation for roads and bridge maintenance annually.

Given the current financial situation of GoPNG, whatever budget is actually released to DoW will be insufficient to maintain the whole NRN.

#### DoW Budget

DoW depends on GoPNG to fund the major portion of its road maintenance expenditures including rehabilitation/reconstruction. To have better control over the funds earmarked for the NRN, GoPNG should aggregate all funds for road maintenance and rehabilitation/reconstruction including the fuel levy and tax credits, and focus maintenance expenditure on the Core Roads. The aggregated funds should be earmarked to fund Phases 1 to 3 of the NRN Strategy implementation. Using HDM 4, a rolling annual road maintenance program is prepared, where road sections are prioritized according to their economic internal rates of return (EIRR).

<sup>25</sup> Bank of Papua New Guinea. 2016. *December 2016 – Quarterly Economic Bulletin (QEB)*. Port Moresby

<sup>26</sup> Felix Rioja, *What Is the Value of Infrastructure Maintenance? A Survey*. Presented at the 7th Annual Land Policy Conference: Infrastructure and Land Policies, sponsored by Lincoln Institute of Land Policy, June 4–5, 2012.

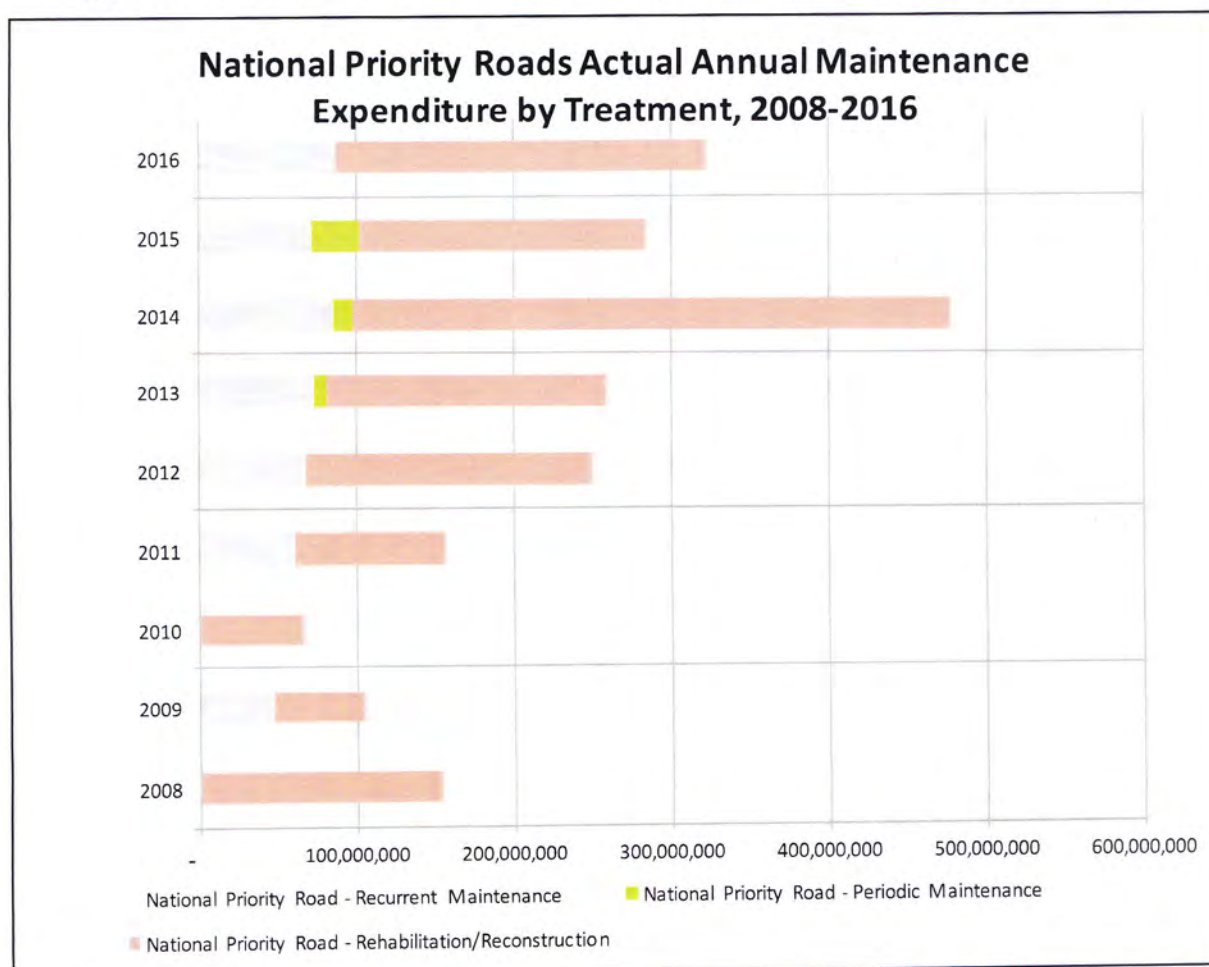


**Table 7.2-1 Actual Annual Road Maintenance Expenditures, 2008-2016**  
(in million Kina)

Year	Department of Works Budget				NRA	Total - All Sources
	Bridges	Priority Road Maintenance				
		Recurrent	Periodic	Rehabilitation/ Reconstruction		
2008	17.32			154.19		171.51
2009	11.79	46.93		56.99		115.71
2010	1.00	0.02		65.28	16.15	82.45
2011	43.72	59.97		96.00	14.17	213.86
2012	40.50	67.20		182.23	37.25	327.18
2013	53.36	77.13	7.37	178.00	49.97	365.83
2014	121.64	84.91	12.14	380.03	60.11	658.83
2015	23.87	71.52	30.12	182.73	28.39	336.63
2016	17.41	86.34		236.36	33.10	373.21
Ave. 2008 – 2016	36.73	54.89	5.51	170.20	34.16	687.82

Source: DoW, 2017

**Figure 7.2-1 Actual Annual Road Maintenance Expenditure by Treatment Type, 2008-2016**





**Table 7.2-2 Recommended Level of Road Maintenance Expenditures as a percentage of GDP, 2008-2016**  
(in million Kina)

Year	GDP (in billion Kina)	Recommended Maintenance Expenditure <sup>27</sup> (in million Kina)		Actual Road/Bridge Maintenance Expenditure (in million Kina)	Estimated Maintenance Underspending (in million Kina)	
		% of GDP			Low Estimate	High Estimate
		Low Estimate (1.5%)	High Estimate (3.3%)			
2008	31.5	472.5	1,039.5	171.5	(300.99)	(867.99)
2009	32.0	480.0	1,056.0	115.7	(364.29)	(940.29)
2010	38.8	582.0	1,280.4	82.5	(499.55)	(1,197.95)
2011	42.6	639.0	1,405.8	213.9	(425.14)	(1,191.94)
2012	44.4	666.0	1,465.2	327.2	(338.82)	(1,138.02)
2013	47.7	715.5	1,574.1	365.8	(349.67)	(1,208.27)
2014	56.6	849.0	1,867.8	658.8	(190.17)	(1,208.97)
2015	64.2	962.4	2,117.3	336.6	(625.78)	(1,780.66)
2016	68.3	1,023.9	2,252.6	373.2	(650.69)	(1,879.37)
Total		6,390.3	14,058.7	2,645.2	(3,745.1)	(11,413.5)

Note: Estimate only.

### Donor Funding

Donor funding, when available, should be utilized according to government priorities as defined under the NRN strategy. Given GoPNG's financial situation and continued deterioration of the NRN, the funding requirement for road maintenance including rehabilitation/reconstruction is now substantial due to the maintenance backlog, and donor support is required.

**Table 7.1-3** gives the list of current and new main donor-funded road projects. Donor funding will complement DoW's budget appropriations but is not sufficient to fund the requirements of the NRN. The major funding responsibility is still with GoPNG.

<sup>27</sup> Felix Rioja, *What Is the Value of Infrastructure Maintenance? A Survey*. Presented at the 7th Annual Land Policy Conference: Infrastructure and Land Policies, sponsored by Lincoln Institute of Land Policy, June 4–5, 2012.



**Table 7.1-3 Donor Funding for Roads and Bridges – DoW**

No.	Project Name	Main Donor	Type	Amount US\$ million)			
				Main Donor	Co-finance	GoPNG	Total
1	Highlands Region Road Improvement Investment Program	ADB	Loan	500.0	225.0	150.0	875.0
	Tranche 1 [2017 firm]			160.0	75.0	25.0	260.0
	Tranche 2 [2018 firm]			150.0	100.0	100.0	350.0
	Tranche 3 [2019 firm]			190.0	50.0	25.0	265.0
2	Bridge Replacement for Improved Rural Access Sector Project	ADB	Loan/TA	90.8			90.8
3	Sustainable Highlands Highway Investment Program	ADB	Loan				
	Tranche 1			302.0	11.5	44.0	357.5
4	Road Maintenance and Rehabilitation Project II	WB	Loan				
	Component 1 – Rehabilitation/Upgrade and/or Maintenance of Roads and Bridges			115.2		11.4	126.5
5	PNG Rural Bridges	EIB	Loan	62.7			62.7
6	Transport Sector Support Program2	DFAT	Grant	69.6			69.6
7	Reconstruction of New Britain Bridges	JICA	Grant	25.8		4.7	30.5
8	Capacity Development for Road Maintenance	JICA	Grant	0.7		0.3	1.0

Note: ADB - Asian Development Bank; WB - World Bank; EIB - European Investment Bank; JICA - Japan International Cooperation Agency; DFAT - Australia - Department of Foreign Affairs and Trade  
Estimates only based on loan documents, DoW and TSSP data.  
Exchange rate used: K1.00 : US\$0.30873; Yen100 : US\$0.91718; AU\$1.00 : US\$0.79307

**Table 7.1-4** shows the possible funding sources for Phase 1 of the NRN Strategy implementation. It is expected that GoPNG will be the major source of road maintenance and rehabilitation/reconstruction funding from annual budgetary allocation, tax credits and fuel levy. The ADB, WB, Australia's DFAT, JICA and EIB will provide supplementary donor funding for both roads and bridges' maintenance and rehabilitation/reconstruction. While donor funding may not be aligned to DoW priorities, overall, these would cover a considerable part of the NRN and impact the total funding requirement for NRN maintenance and rehabilitation/reconstruction.

### 7.3 Road Cost Recovery Policy

Roads need maintenance to repair the damage inflicted on it by the weather and traffic. A major component of road maintenance expenditure is the repair of damaged road pavements. Vehicles, especially heavy vehicles are a significant cause of road pavement damage. The fuel levy currently imposed on fuel is inadequate and is not representative of a direct fee for service charge for road usage<sup>28</sup>.

A cost recovery policy that apply road user charges (RUC), representative of the cost of repair of roads damaged by vehicle traffic, should be adopted. The revenues collected from the RUC should be placed in an off-budget road maintenance fund and would be used to pay for road maintenance costs only.

<sup>28</sup> The fuel levy also applies to fuels purchased for non-road use purposes, such as fuel for power generators, etc.



Table 7.1-4 Indicative Funding for Phase 1 of the NRN Strategy Implementation

in million Kina												
Year	Department of Works Budget				Other Sources			Additional Funding Required for NRNS	Additional Funding required for Missing-Link Roads 5/	Total Additional Funding required for Phase 1		
	Bridges 2/	Priority Road Maintenance 2/		Tax Credits 4/	Dev. Partner 1/	Total - All Sources	Req. Maint Spend/year 3/					
		Recurrent	Periodic								Rehab/Recon	
Year 1	12.00	171.00	19.00	163.00	34.16	50.00	363.30	812.46	882.62	70.16	50.00	120.16
Year 2	12.00	171.00	19.00	163.00	34.16	50.00	291.40	740.56	887.24	146.68	50.00	196.68
Year 3	12.00	171.00	19.00	163.00	34.16	50.00	305.35	754.51	896.88	142.37	50.00	192.37
Year 4	12.00	171.00	19.00	163.00	34.16	50.00	305.35	754.51	906.51	152.00	50.00	202.00
Year 5	12.00	171.00	19.00	163.00	34.16	50.00	305.35	754.51	916.14	161.63	50.00	211.63

Note:

- 1/ Amount for TSSP and ADB-funded Sustainable Highlands Investment Program only. Assumes all funding is for Core Roads. TSSP funding only up to 2019.
- 2/ Assumes 2018 budget allocation for all years of Phase 1
- 3/ Based on estimate for Core Roads Maintenance Expenditure - Phase 1 of NRN Strategy
- 4/ Assumes K50.0 million in Tax Credits towards national road network expansion projects
- 5/ Constructed to sub-base standard. Estimate includes construction and maintenance costs
- 6/ From K0.04 per litre levy on diesel fuel sales.







## VIII. MONITORING AND EVALUATION FRAMEWORK

The monitoring and evaluation framework is given in **Table 8-1** below.

**Table 8-1 NRN Strategy Monitoring and Evaluation Framework**

<i>Narrative Summary (NS)</i>	<i>Objectively Verifiable Indicators (OVI)</i>	<i>Means of Verification (MOV)</i>	<i>Assumptions/ Risks</i>
<u>Impact</u>  Improved access to employment opportunities, trade, mineral and natural gas resources, social services, government services and tourism.	<u>By the year 2042</u>  Increase in GDP by 7% annually	PNG NSO	
<u>Outcomes</u>  Improved condition of the National Road Network   Improved condition of the provincial and district roads	<u>By the year 2042</u>  Increase in the employment rate/job opportunities.   Lower prices of basic commodities.   Increase in Annual Average Daily Traffic in all national, provincial and district roads. Decrease in overall vehicle operating costs  Decrease in travel time  Decrease in road accidents   Decrease in school dropout rate Increased number of population accessing hospitals/health facilities  Increase in number of km of provincial and district roads in good condition	Department of Labour statistics   Department of Trade and Industry price monitoring  AMB-DOW Traffic counts   AMB-DOW data  AMB-DOW data PNG Police/Traffic Authority Department of Education Department of Health  AMB-DOW	The phased strategy for the improvement of the national road network implemented and completed.   The provincial and district governments implement the maintenance and rehabilitation / reconstruction of their roads.



<i><b>Narrative Summary (NS)</b></i>	<i><b>Objectively Verifiable Indicators (OVI)</b></i>	<i><b>Means of Verification (MOV)</b></i>	<i><b>Assumptions/ Risks</b></i>
<u>Outputs</u>			
Phase 1. Condition of the Core Roads are improved and in good condition	All core roads maintained and rehabilitated/ reconstructed	PWM, AMB and contractors' monitoring reports	Required funding provided by the Government from various sources.
Phase 2. Condition of the Priority Roads are improved and in good condition	All priority roads maintained and rehabilitated/ reconstructed	PWM, AMB and contractors' monitoring reports	-
Phase 3. Condition of the NRN is improved and in good condition	All NRN maintenance and rehabilitation/reconstruction completed	PWM, AMB and contractors' monitoring reports	-
NRN Safety Standards improved	Safety standards of core and priority roads and NRN improved	PWM monitoring reports	Safety standards for NRN implemented based on the phased implementation strategy as identified. Funding requirements for safety standards provided by Government.
DoW provide technical assistance to provincial and district governments on improving the condition of their road network	No. of training on road asset management, road design, etc. conducted.	PWM monitoring reports	
	No. of participants in road asset training.	PWM monitoring reports	
	No. of training on procurement and contracting conducted	PWM monitoring reports	
	No. of participants on procurement and contracting training conducted	PWM monitoring reports	



# APPENDICES

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APPENDIX A: Estimate of Phase I Funding Requirement – CORE ROADS	57
APPENDIX B: Estimate of Phase II Funding Requirement – PRIORITY NON-CORE ROADS	59
APPENDIX C: Estimate of Phase III Funding Requirement – NON-PRIORITY ROADS	61
APPENDIX D: MISSING-LINK ROADS – Cost Estimate	63
APPENDIX E: Indicative DoW 5-Years Road Recovery and Maintenance Workplan, 2018 - 2022	65







## APPENDIX A: Phase I Funding Requirement – CORE ROADS

Description	Year 1	Year 2	Year 3	Year 4	Year 5
<b>Core Road Length (km) - 2,309 km</b>	<b>in million Kina (in 2017 prices)</b>				
<b>Financial Costs (Sealed) - 1,780 km</b>					
Periodic Maintenance - reseal	82	86	89	93	97
Routine Maintenance	100	105	109	114	118
Periodic Maintenance (excl. reseal)	19	15	16	16	17
Reconstruction	78	78	78	78	78
<b>Total Sealed</b>	<b>279</b>	<b>283</b>	<b>292</b>	<b>301</b>	<b>310</b>
<b>Financial Costs (Unsealed) - 529 km</b>					
Poor Roads - Upgrade to Good	-	-	-	-	-
Poor Roads - Upgrade to Fair	15	15	15	15	15
Routine Maintenance	-	-	-	-	-
Periodic Maintenance (excl. regravelling)	2	2	3	3	3
Periodic Regravelling	13	13	14	14	15
<b>Total Unsealed</b>	<b>30</b>	<b>31</b>	<b>31</b>	<b>32</b>	<b>33</b>
<b>Financial Costs (Bridges &amp; CDSs)</b>					
Bridges & CDSs (major maintenance)	16	16	16	16	16
Minor CDS Rehabilitation/Replacement	3	3	3	3	3
CRN Single Lane Bridges Replacement Program	18	18	18	18	18
<b>Total Bridges &amp; CDSs</b>	<b>37</b>	<b>37</b>	<b>37</b>	<b>37</b>	<b>37</b>
<b>TOTAL - Without Urgent/Unplanned Maintenance</b>	<b>346</b>	<b>351</b>	<b>360</b>	<b>370</b>	<b>379</b>
<b>Urgent/Unplanned Maintenance</b>	<b>50</b>	<b>50</b>	<b>50</b>	<b>50</b>	<b>50</b>
<b>Routine Maintenance of Other Roads (Good/Fair)</b>	<b>271</b>	<b>271</b>	<b>271</b>	<b>271</b>	<b>271</b>
<b>Periodic Maintenance of Other Roads (Good/Fair)</b>	<b>216</b>	<b>216</b>	<b>216</b>	<b>216</b>	<b>216</b>
<b>TOTAL - With Urgent/Unplanned Maintenance</b>	<b>883</b>	<b>887</b>	<b>897</b>	<b>907</b>	<b>916</b>
<b>Total, 2018-2022</b>					<b>4,489</b>
<b>Average Funding Required per Year</b>					<b>898</b>







## APPENDIX B: Phase II Funding Requirement – PRIORITY NON-CORE ROADS

Description	Year 6	Year 7	Year 8	Year 9	Year 10
<b>Priority less Core Roads Length - 2,052</b>	<b>in million Kina (in 2017 prices)</b>				
<b>Financial Costs (Sealed) - 823 km</b>					
Periodic Maintenance (Reseal)	31	32	33	34	35
Routine Maintenance	37	39	40	41	43
Periodic Maintenance (excl. reseal)	7	7	8	8	8
Reconstruction	20	20	20	20	20
<b>Total Sealed</b>	<b>96</b>	<b>98</b>	<b>101</b>	<b>104</b>	<b>106</b>
<b>Financial Costs (Unsealed) - 1,229 km</b>					
Upgrade to Good	-	-	-	-	-
Upgrade to Fair	16	16	16	16	16
Routine Maintenance	66	71	76	81	86
Periodic Maintenance (excl. regravelling)	5	6	6	7	7
Periodic Regravelling	30	32	34	36	39
<b>Total Unsealed</b>	<b>118</b>	<b>126</b>	<b>133</b>	<b>140</b>	<b>148</b>
<b>Financial Costs (Bridges &amp; CDSs)</b>					
Bridges & Cross Drainage Structures	14	14	14	14	14
Minor CDS Rehabilitation/Replacement	3	3	3	3	3
CRN Single Lane Bridges Replacement Program	18	18	18	18	18
<b>Total Bridges &amp; CDSs</b>	<b>35</b>	<b>35</b>	<b>35</b>	<b>35</b>	<b>35</b>
<b>TOTAL - Without Urgent/Unplanned Maintenance</b>	<b>248</b>	<b>258</b>	<b>268</b>	<b>279</b>	<b>289</b>
Urgent/Unplanned Maintenance	50	50	50	50	50
Routine Maintenance of Other Roads (Good/Fair)	324	324	324	324	324
Periodic Maintenance of Other Roads (Good/Fair)	320	320	320	320	320
<b>TOTAL - With Urgent/Unplanned Maintenance</b>	<b>942</b>	<b>952</b>	<b>962</b>	<b>972</b>	<b>982</b>
<b>Total, 2023-2027</b>					<b>4,810</b>
<b>Average Funding Required per Year</b>					<b>962</b>
<p><i>Note: 1/ Estimated periodic and routine maintenance expenditures for sealed and unsealed roads and bridges/cross drainage structures include those of the Core Roads</i></p> <p><i>2/ Maintenance of Other Roads are for the national road network roads less the Priority Roads inclusive of the Core Roads</i></p>					







# APPENDIX C: Phase III Funding Requirement – NON-PRIORITY ROADS

Description	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
<b>Non-Priority Roads Length (in km) - 4,379</b>	<b>in million Kina (in 2017 prices)</b>									
Financial Costs (Sealed) - 904 km										
Periodic Reseal	36	37	39	40	42	43	45	47	48	50
Routine Maintenance	44	46	47	49	51	53	55	57	59	61
Periodic Maintenance (excl. reseal)	6	7	7	7	7	8	8	8	8	9
Reconstruction	30	30	30	30	30	30	30	30	30	30
<b>Total Sealed</b>	<b>116</b>	<b>119</b>	<b>123</b>	<b>127</b>	<b>130</b>	<b>134</b>	<b>138</b>	<b>141</b>	<b>145</b>	<b>149</b>
Financial Costs (Unsealed) - 3,475										
Upgrade to Good	105	105	105	105	105	105	105	105	105	105
Upgrade to Fair	48	48	48	48	48	48	48	48	48	48
Routine Maintenance	123	133	143	153	163	173	183	193	203	213
Periodic Maintenance (excl. regravelling)	6	6	7	7	7	8	8	8	9	9
Periodic Regravelling	34	36	37	39	41	42	44	45	47	49
<b>Total Unsealed</b>	<b>316</b>	<b>328</b>	<b>340</b>	<b>352</b>	<b>364</b>	<b>376</b>	<b>387</b>	<b>399</b>	<b>411</b>	<b>423</b>
Financial Costs (Bridges & CDSs)										
Bridges & Cross Drainage Structures	15	15	15	15	15	15	15	15	15	15
Minor CDS Rehabilitation/Replacement	3	3	3	3	3	3	3	3	3	3
CRN Single Lane Bridges	18	18	18	18	18	18	18	18	18	18
<b>Total Bridges &amp; CDSs</b>	<b>36</b>	<b>36</b>	<b>36</b>	<b>36</b>	<b>36</b>	<b>36</b>	<b>36</b>	<b>36</b>	<b>36</b>	<b>36</b>
<b>TOTAL - Without Urgent/Unplanned Maintenance</b>	<b>468</b>	<b>483</b>	<b>499</b>	<b>514</b>	<b>530</b>	<b>545</b>	<b>561</b>	<b>576</b>	<b>592</b>	<b>607</b>
Urgent/Unplanned Maintenance	50	50	50	50	50	50	50	50	50	50
Routine Maintenance of Other Roads (Good/Fair)	292	292	292	292	292	292	292	292	292	292
Periodic Maintenance of Other Roads (Good/Fair)	303	303	303	303	303	303	303	303	303	303
<b>TOTAL - With Urgent/Unplanned Maintenance</b>	<b>1,112</b>	<b>1,128</b>	<b>1,143</b>	<b>1,159</b>	<b>1,174</b>	<b>1,190</b>	<b>1,205</b>	<b>1,221</b>	<b>1,236</b>	<b>1,252</b>
<b>Total, 2028-2037</b>										<b>11,819</b>
<b>Average Funding Required per Year</b>										<b>1,181.93</b>

Note: Estimated periodic and routine maintenance expenditures for sealed and unsealed roads and bridge/cross drainage structures include those of the Core + Priority less Core Roads







# APPENDIX D: MISSING-LINK ROADS – Development Cost Estimate

Cost Description	Year:	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10	Yr 11	Yr 12	Yr 13	Yr 14	Yr 15	Yr 16	Yr 17	Yr 18	Yr 19	Yr 20
Length Unsealed Constructed (km)	(km)	256	256	256	256	256	219	219	219	219	219	219	219	219	219	219	219	219	219	219	219
Cummulative Length Constructed (km)	(km)	256	512	767	1,023	1,279	1,498	1,716	1,935	2,153	2,372	2,590	2,809	3,027	3,246	3,464	3,683	3,901	4,120	4,338	4,557
<b>Construction Cost</b>																					
Annual Construction Cost	Kina (million)	232.5	232.5	232.5	232.5	232.5	198.6	198.6	198.6	198.6	198.6	198.6	198.6	198.6	198.6	198.6	198.6	198.6	198.6	198.6	198.6
Cummulative Construction Cost	Kina (million)	232.5	464.9	697.4	929.8	1,162.3	1,360.9	1,559.5	1,758.1	1,956.7	2,155.3	2,353.9	2,552.5	2,751.0	2,949.6	3,148.2	3,346.8	3,545.4	3,744.0	3,942.6	4,141.2
<b>Routine Maintenance Cost</b>																					
Routine Maintenance Annual	Kina (million)		6.6	13.3	19.9	26.6	33.2	38.9	44.6	50.2	55.9	61.6	67.3	72.9	78.6	84.3	90.0	95.6	101.3	107.0	112.7
Routine Cummulative	Kina (million)		6.6	19.9	39.9	66.4	99.6	138.5	183.1	233.3	289.2	350.8	418.1	491.0	569.6	653.9	743.8	839.5	940.8	1,047.7	1,160.4
<b>Periodic Maintenance Cost</b>																					
Periodic Maintenance Annual	Kina (million)						10	10	10	10	10	18	18	18	18	18	27	27	27	27	27
Periodic Cummulative	Kina (million)						10	20	30	40	50	68	87	105	124	142	169	196	223	250	277
<b>Routine &amp; Periodic Maintenance Cost</b>																					
Annual Total	Kina (million)	0.0	6.6	13.3	19.9	26.6	43.2	48.8	54.5	60.2	65.9	80.1	85.7	91.4	97.1	102.8	116.9	122.6	128.3	134.0	139.6
Cummulative Total	Kina (million)		6.6	19.9	39.9	66.4	109.6	158.4	213.0	273.2	339.0	419.1	504.8	596.2	693.3	796.1	913.0	1,035.6	1,163.9	1,297.9	1,437.5
<b>Total Cost Implication</b>																					
Total Annual	Kina (million)	232.5	239.1	245.7	252.4	259.0	241.8	247.4	253.1	258.8	264.5	278.7	284.3	290.0	295.7	301.3	315.5	321.2	326.9	332.6	338.2
Total Cummulative Cost	Kina (million)	232.5	471.6	717.3	969.7	1,228.7	1,470.5	1,717.9	1,971.0	2,229.8	2,494.3	2,772.9	3,057.3	3,347.3	3,642.9	3,944.3	4,259.8	4,581.0	4,907.9	5,240.5	5,578.7







# APPENDIX E: Indicative DOW 5-Years Road Recovery & Maintenance Workplan, 2018-2022

DOW 5-YEARS ROAD RECOVERY AND MAINTENANCE WORKPLAN FROM 2018 - 2022

AS OF: 10-Aug-18

Item	Highway/Road	Province	Start	End	Section Length (km)	NRNS Phase 1 Budget (PGK M)	2018		2019			2020			FY 2021 (PGK M)	FY 2022 (PGK M)	PHASE 1 TOTAL
							FY19 Q3 (PGK M)	FY19 Q4 (PGK M)	H1	FY19 Q1 (PGK M)	FY19 Q2 (PGK M)	FY19 Q3 (PGK M)	FY19 Q4 (PGK M)	FY20 H1 (PGK M)			
DOW TOTAL 5-YEARS WORK PIPELINE																	
REHABILITATE & LONG-TERM MAINTENANCE (RLTM) PROGRAM ON 11 CORE HIGHWAYS (INCLUDES BRIDGE MAINTENANCE & WIDENING)																	
1	HIGHLANDS HIGHWAY	MORBE, EHP, CHIMBU, IJAWA, WHP	NADZAB JUNCTION	KAKAMUGA JUNCTION	430	845.47		64.73	89.25	336.88	336.88	673.76	673.76	1,347.51	1,347.51	4,950.00	
2	HIGHLANDS HIGHWAY	WHP, SHP, HELA	KAGAMUGA AIRPORT JTN	KORORA	337	662.62		49.73	74.25	311.88	311.88	623.76	623.76	1,247.51	1,247.51	4,540.00	
3	HIGHLANDS HIGHWAY	MORBE	NADZAB JUNCTION	LAKE WHARF	39	76.68			5.11	5.11	5.11	10.22	10.22	20.45	20.45	76.68	
4	BOLIMINSKI HIGHWAY	NEW IRELAND	KAVIENG	TBD	122	239.88				17.13	17.13	34.27	34.27	68.54	68.54	239.88	
5	ENGA HIGHWAY	ENGA, WHP	TOGORA JUNCTION	ENGA	90	176.96			11.80	11.80	11.80	23.59	23.59	47.19	47.19	176.96	
6	NEW BRITAIN HIGHWAY (INTERMITTENT)	ENBP, WMBP	TALASEA, WMBP	KOKOPO, ENBP	271	532.85				38.06	38.06	76.12	76.12	152.24	152.24	532.85	
7	SEPIK HIGHWAY	EAST SEPIK	PASSAM JUNCTION	TBD	107	210.39			210.39	15.03	15.03	30.06	30.06	60.11	60.11	210.39	
8	COASTAL HIGHWAY	ESP, WSP	PASSAM JUNCTION, ESP	WULUM, WSP	133	261.51				18.68	18.68	37.36	37.36	74.72	74.72	261.51	
9	HIRITANO HIGHWAY	CENTRAL & GULF	9-MILE JUNCTION, CENTRAL PROVINCE	KEREMA, GULF PROVINCE	296	582.00				41.57	41.57	83.14	83.14	166.29	166.29	582.00	
10	KOKODA & NORTHERN HIGHWAYS	NORTHERN PROVINCE	TBD	TBD	58	114.04			7.60	7.60	7.60	15.21	15.21	30.41	30.41	114.04	
11	WAIU HIGHWAY	MORBE	9-MILE JUNCTION	WAIU CREEK BRIDGE	128	251.68				17.98	17.98	35.95	35.95	71.91	71.91	251.68	
12	MAGI HIGHWAY (INTERMITTENT)	CENTRAL & MILNE BAY	MURRAY JUNCTION, CENTRAL PROVINCE	GOLANAI BRIDGE, MBB	117	230.05				16.43	16.43	32.86	32.86	65.73	65.73	230.05	
13	RAMU HIGHWAY	MORBE & MADANG	WATARAIS JUNCTION, MORBE	NR0008/NR0009 JTN	181	355.89				25.42	25.42	50.84	50.84	101.68	101.68	355.89	
MISSING-LINK ROADS PROGRAM (EXCLUDES MAJOR WATER CROSSINGS)																	
PETROLEUM RESOURCE AREA ECONOMIC CORRIDOR (PRAEC)																	
1	KEREMA-IHU-KOPI	GULF	KEREMA	KOPI	314	285.74								100.00	100.00	410.00	
2	KAGUA-ERAVE-SAMBERIGI-KOPI	GULF & SOUTHERN HIGHLANDS	KAGUA	KOPI	116	105.56			2.50	2.50	2.50	5.00	5.00	10.00	10.00	35.00	
CENTRAL CORRIDOR																	
3	MAGI HWY (KUPIANO-GADAIUS)	CENTRAL & MILNE BAY	KUPIANO	GADAIUS	184	167.44								10.00	10.00	45.00	
MADANG - BAIYER - KARAMUI ECONOMIC CORRIDOR																	
4	BAIYER RIVER-AIOME-AMELE	WESTERN HIGHLANDS, MADANG	BAIYER RIVER	AMELE	160	145.60			2.50	2.50	2.50	5.00	5.00	10.00	10.00	45.00	
5	KARAMUI-GUMINE	CHIMBU	GUMINE	KARAMUI	94	85.54			2.50	2.50	2.50	5.00	5.00	10.00	10.00	45.00	
6	KOMPIAM-BAIYER	WESTERN HIGHLANDS, ENGA	KOMPIAM	BAIYER	24	21.84			2.50	2.50	2.50	5.00	5.00	10.00	10.00	45.00	
MOMASE ECONOMIC CORRIDOR																	
7	BOGIA-ANGORAM	MADANG, EAST SEPIK	BOGIA	ANGORAM	116	105.56				2.50	2.50	5.00	5.00	10.00	10.00	35.00	
8	VANIMO-AITAPE	WEST SEPIK	VANIMO	AITAPE	82	74.62				2.50	2.50	5.00	5.00	10.00	10.00	35.00	
BORDER ECONOMIC CORRIDOR																	
9	TABUBIL-TELEFORMIN-OKSAPMIN-KOPIAGO	WESTERN, WEST SEPIK, ENGA	TABUBIL	KOPIAGO	153	139.23								10.00	10.00	45.00	
NEW BRITAIN SOUTH COAST ECONOMIC CORRIDOR																	
10	KOKOPO-POMIO-GASMATA-KANDRIAN-GLOUCESTER	EAST NEW BRITAIN & WEST NEW BRITAIN	KOKOPO	CLOUCESTER	425	386.75								10.00	10.00	45.00	







