Transitioning PWD to a More Effective Road Network Manager

Concept Note
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Roads for Development Program (R4D)
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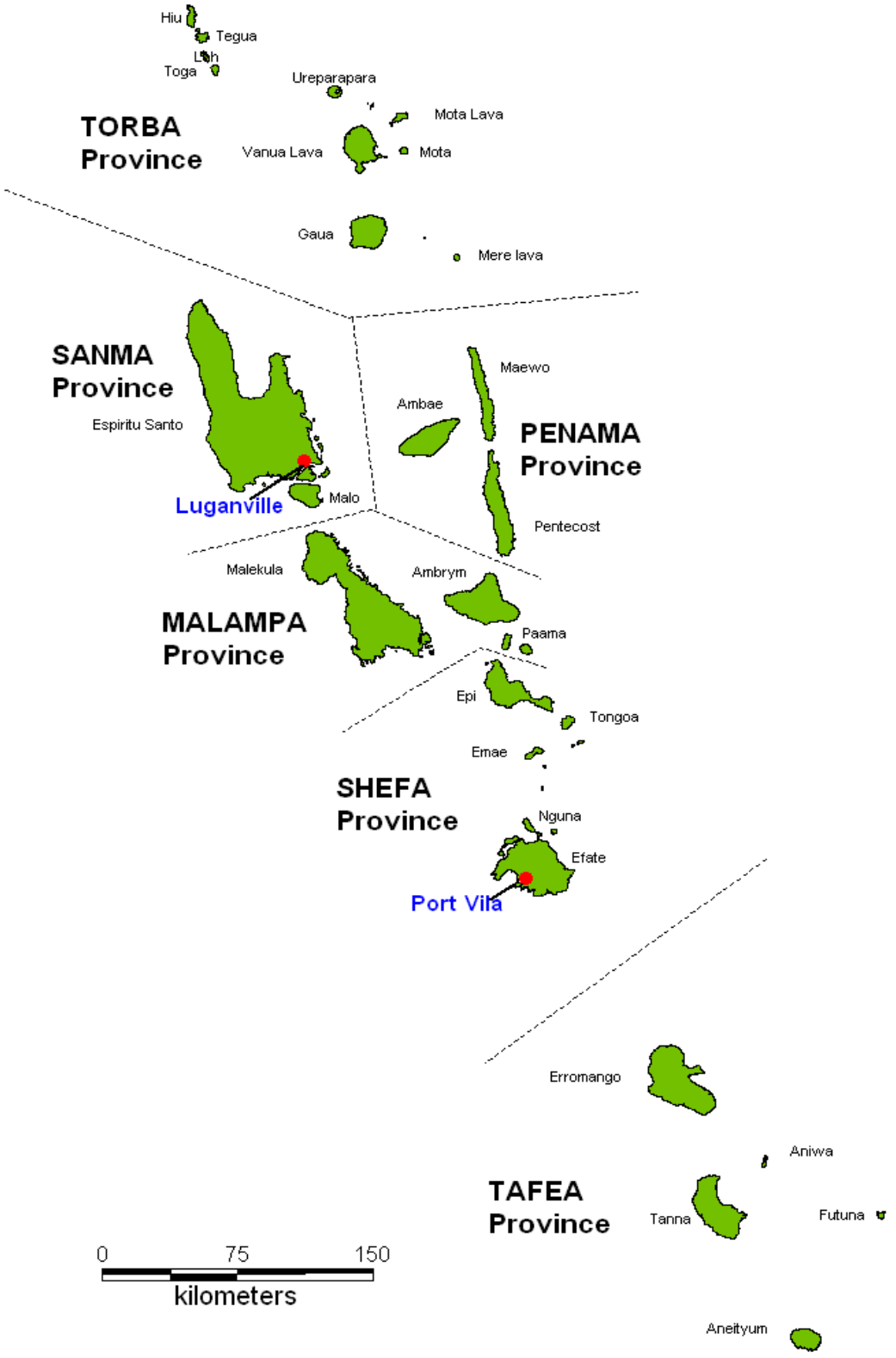
CONTENTS

ACRONYMS AND ABBREVIATIONS

AADT	Annual Average Daily Traffic
ADB	Asian Development Bank
BAS	Budget Allocation System
CBC	Community-Based Contract
COTS	Customised Off-the-Shelf (software)
CPO	Community Partnership Officer
DFAT	Department of Foreign Affairs and Trade
EHC	Equipment Hire Contractor
FA	Force Account
GIS	Geographical Information System
GoA	Government of Australia
GoV	Government of Vanuatu
IBC	Island-Based Contractor
JICA	Japan International Cooperation Agency
kms	kilometres
KPI	Key Performance Indicator
MFEM	Ministry of Finance and Economic Management
MIPU	Ministry of Infrastructure and Public Utilities
MYC	multi-year contract
NC	National Contractor
PBM	Performance-Based Maintenance
PBMC	Performance-Based Maintenance Contract
PFMS	Public Financial Management Specialist
PNG	Papua New Guinea
PWD	Public Works Department
R4D	Roads for Development (previously Vanuatu Transport Sector Support Program)
RAI	Rural Access Index
RAMS	Road Asset Management System
RFQ	Request for Quotation
RFT	Request for Tender
RIMS	Road Inventory Management System
RRAP	Rural Roads Access Policy
TBE	Tractor-Based Equipment
TBPET	Tractor-Based Plant and Equipment Trial
WB	World Bank

MAP OF VANUATU



KEY MESSAGES

- PWD has made considerable progress towards an outsourced model of road maintenance delivery: force account (FA) teams are expected to deliver only 14.6% by value of the maintenance works planned for 2017, down from 63% in 2013. The shift to outsourcing is supported by the cost comparisons in this Concept Note. These show that periodic maintenance of gravel roads by FA (which represents 84% of FA activity), for example, is 28% more expensive than by Island-Based Contractor (IBC) and 45% more expensive than by National Contractor (NC), once all attributable costs are included. Indirect overheads – additional costs that are incurred by PWD in supporting FA – make up 44% of total attributable FA costs, but only 5% of costs by NC.
- PWD's intended transition to a network manager will require a further shift towards outsourcing: from delivering projects to delivering a network that meets broader priorities like those in the Rural Roads Access Policy (RRAP). 2017's rural roads work plan envisages PWD's divisions administering as many as 344 individual contracts or work assignments: 239 community-based contracts (CBCs), 63 agreements with IBCs, 27 with NCs and 15 FA team assignments. This will test their capacity to ensure quality and contract compliance. The number could be reduced to only 8-10 per year if network delivery risk could be transferred to a smaller number of contractors held accountable for network performance (access, condition).
- Many communities depend on work assigned under these arrangements, however, and the sense of obligation to maintain local roads is a positive feature that should continue to be encouraged. This Note proposes trialling hybrid agreements under which participation by local communities remains guaranteed.
- During the coming design of the next phase of DFAT's infrastructure support[1], PWD has the opportunity to suggest long-term support for implementing several key reforms that would better equip it as network manager, each complemented by technical assistance (TA) and training:
    - a rationalisation and redeployment of FA resources, to concentrate on areas where private-sector capability does not yet exist or where competition is limited, and associated reforms to PWD's plant and equipment pool, including the tractor-based equipment (TBE) procured under R4D, to end its reliance on PWD's budget and transform it into a commercially-focused equipment-hire operation;
    - the trial introduction of a new form of contract for IBCs and NCs that mandates the use of community agreements for labour-intensive work and incorporates performance-based payment incentives and penalties;
    - the development and implementation of a pilot, multi-year, performance-based maintenance contract (PBMC), probably on Efate or Santo, to demonstrate how performance incentives and penalties work and test the model's suitability for PWD as network manager; and
    - the development and operation of a customised off-the-shelf road network asset management system (RAMS), including associated survey procedures for verifying contract performance and maintaining up-to-date information on traffic and road conditions. The coming design process of DFAT's next phase of infrastructure

[1] DFAT = Australia's Department of Foreign Affairs and Trade.

support could consider whether the follow-up facility might guarantee the data and functionality of the system until PWD is able to manage this itself.

- The resources available for drafting this Concept Note have been limited. Its proposals should be workshopped by PWD and DFAT before implementation details are finalised.

Roads for Development (R4D)

TRANSITIONING PWD TO A MORE EFFECTIVE ROAD NETWORK MANAGER

CONCEPT NOTE

1. Introduction

This Concept Note

This Concept Note suggests a staged strategy for transitioning Vanuatu's Public Works Department (PWD) from a public agency that delivers road maintenance projects – using a mix of its own labour and equipment ("force account", or FA), community agreements and maintenance contracts – to a more performance-focused organisation (a network manager) that relies mainly on outsourcing to meet targets for the serviceability of the whole network.

In addition to helping develop private-sector capacity, the justification for this lies in the closer links it establishes between the function of the network and the Government's wider economic and social development goals[2], and the way competition and formal contracts (if properly designed, tendered and supervised) incentivise productivity and quality. Yet the switch to a network manager's business model involves risks, not least in moving away from a system of works allocation and delivery that has served PWD reasonably well and on which many employees, communities and contractors rely. This Note suggests how these risks can be mitigated through better management of existing delivery methods during the transition, and closer attention to selecting the most appropriate method for each maintenance task.

Limitations

The Note's coverage is limited by its inputs: only two weeks in-country by a Transport Economist, with support from R4D's Public Financial Management Specialist (PFMS). Initially concerned with a comparison of the costs of road maintenance delivery by FA and outsourcing, its scope has grown to include an outline of how a continuing shift towards outsourcing fits within the tasks of a network manager. Its proposals will be developed further following PWD review and wider consultations.

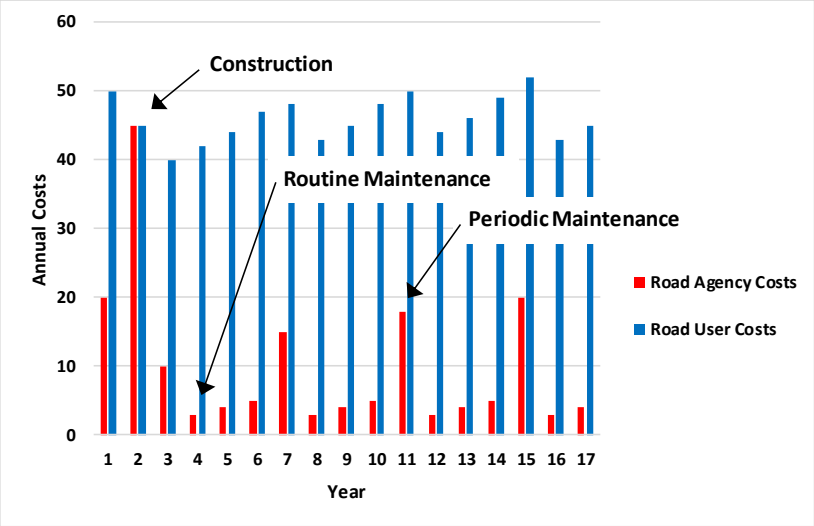
[2] The need for these links is evident in PWD's recently-issued Rural Roads Access Policy (RRAP), the goals of which include maintaining accessibility in all but the worst weather conditions and involving communities in road maintenance.

2. Background: Trends in Road Network Management

The Importance of Maintenance

In many countries like Vanuatu, a bias towards capital projects and neglect of maintenance have allowed roads to deteriorate, requiring expensive rehabilitation and reconstruction. This build-neglect-rebuild cycle wastes scarce public resources and imposes higher-than-necessary costs on users and the economy[3]. For all but very lowly-trafficked roads, road user costs usually far exceed agency costs, as Figure 1 shows. There is a growing awareness of the need to adopt better asset management practices that measure performance in terms of the functioning of the road network while minimising agency and user costs over the life-cycle between construction and eventual replacement.

Figure 1: Agency and User Costs over the Road's Life-Cycle



The Shift to Outsourced Delivery

Road agencies have also found that outsourcing construction and maintenance to competitive private-sector providers, including through performance-based maintenance contracts (PBMCs)[4], offers advantages over conventional delivery methods like FA. Later chapters show how significant these cost savings can be. Competition between suppliers, both directly in procurement and over a longer term, raises quality and efficiency. The arm's-length relationship established by contract between the road agency (as network manager) and contractor (as service supplier) incentivises and pressures the latter to deliver services on time and within budget. These incentives and pressures are weaker in the FA model or one that involves allocating work without competition. This Note assesses whether Vanuatu would gain by a shift to more competitive outsourcing, and suggests ways of making existing delivery methods more competitive and productive during the transition.

Community Involvement

Tendered contracts are an expensive way of mobilising resources for simple routine maintenance tasks like clearing drains and vegetation. An alternative already adopted by PWD is to use

[3] For a good overview, see *Infrastructure Maintenance in the Pacific: Challenging the Build-Neglect-Rebuild Paradigm*, Pacific Infrastructure Advisory Centre, Canberra, 2013.

[4] Under a PBMC, the contractor is committed to meeting specified road quality or performance standards for the duration of the contract (usually at least three years, preferably more), and receives deductions from regular payments and other penalties if those standards fail to be met.

community-based contracts (CBCs), with tools and materials supplied if necessary. These are valued by communities in Vanuatu because they engender a sense of local "ownership" and enable cash payments to circulate within the local economy[5]. They are, however, much more difficult for PWD to administer than contracts with island-based contractors (IBCs) or national contractors (NCs), disputes over performance and payments are not uncommon, and there are questions about the effectiveness of the work that is done. These too are considered later in the report.

Managing Delivery by Force Account

PWD's reliance on FA has been declining. Inadequate funding has allowed PWD plant to deteriorate and undermined productivity. This need not necessarily be so: with proper equipment maintenance and better training and supervision, FA could be cost-effective, but not without strengthened incentives to improve productivity and performance. This Note makes suggestions for how FA can be made more productive by adopting some of the incentives of formal contracts.

The current Tractor Based Plant and Equipment Trial (TBPET) in Ambae and Tanna aims to raise the productivity of both FA and CBC approaches with simple, low-cost equipment: tractor-drawn trailers to carry earth, gravel, water and materials, tractor-drawn rollers and grader blades, and a dedicated mini-grader. Its performance to date is also summarised in this Note, and recommendations are made about its role in network maintenance.

[5] The extent to which they do, however, varies. Village chiefs have been known to withhold a portion of payments due to workers, others to pay the revenue into funds to be used for other community infrastructure.

3. The Government's Commitments in Relation to Road Network Management

National Sustainable Development Plan (NSDP), 2016-2030

The NSDP has several objectives central to PWD's transition strategy: strong governance arrangements; cost-effective use of resources for sustainable asset management, achieved through partnerships; universal access to affordable, safe and secure transport; development of the private sector and rural communities as transport and infrastructure service suppliers; and better access to information, including on-line government services.

PWD Rural Roads Access Policy (RRAP)

These same aims are also shared with PWD's RRAP, which lays stress on keeping roads – including Basic Access Roads[6] – open in all but the worst weather conditions and involving local communities as much as possible in maintaining them. It gives priority to maintenance (preservation) over upgrading (improvement) and network development (expansion).

The Commitment to Network Management

Both NSDP and RRAP signal a shift from managing individual projects towards a more holistic view – that of a network manager – of infrastructure's broader role in addressing national development priorities: improved access under the RRAP, for example. PWD wants to be able to meet community expectations about the functioning of the road network, not just about spending budgets and delivering projects.

[6] These are roads of Classes 3. 4 and 5 (see Table 2 on page 4).

4. PWD's Current Approach to Delivering Maintenance

The Road Maintenance Task

Table 1 shows the length of PWD's road network, by province and type of pavement, amounting to just over 2,000 kms. Sealed and gravel (i.e. engineered) roads make up less than half (47%) of the total length. Over 80% of the network in Sanma (the largest provincial network) and Torba are engineered, but less than a quarter in Penama and Tafea. Up-to-date information on traffic and the condition of the network is still being assembled (some is available from 2014)[7], but most lower-order roads are in poor condition and many links require some rehabilitation to bring them back to a maintainable state.

Table 1: Vanuatu Road Network, 2017
(kms)

Province	Sealed (S)	Gravel (G)	Earth (E)	Total	% Total	S+G Kms	S+G %
Malampa	0.0	150.1	256.8	406.9	20.0%	150.1	36.9%
Penama	0.0	74.3	280.9	355.2	17.4%	74.3	20.9%
Sanma	68.0	353.9	101.5	523.4	25.7%	421.9	80.6%
Shefa	130.1	61.5	164.5	356.0	17.5%	191.6	53.8%
Tafea	0.3	81.7	261.5	343.5	16.9%	82.0	23.9%
Torba	0.0	42.2	9.4	51.6	2.5%	42.2	81.8%
Total	198.4	763.7	1,074.6	2,036.7	100.0%	962.1	47.2%

Source: R4D and PWD

Not shown in the table is the breakdown of the network into road classes. There are five, varying according to function and traffic range. PWD's engineering standards (Table 2) are linked to these road classes.

Table 2: PWD Engineering Standards

	Class 1	Class 2	Class 3	Class 4	Class 5
AADT range (vehs/day)	>500	200-500	50-200	20-50	<20
Surface	Sealed (Unsealed)	Sealed (Unsealed)	Unsealed	Unsealed	Unsealed
No. of Lanes	2	2	1	1	1
Min. traffic lane width (m)	3.0 (2.5)	2.5 (2.0)	3	3	2.5
Min. shoulder width (m)	1.0 (0.5)	1.0 (0.5)	0.5	0 (passing bays required)	0 (passing bays required)
Min. carriageway width (m)	8.0 (6.0)	7.0 (5.0)	4.0	3.0	2.5
Operating speed (km/h)	>60 (>50)	>60 (35-50)	20-35	<20	<20

Figures in brackets are for hilly terrain
Classes 3, 4 and 5 are Basic Access Roads as defined in the RRAP

Planning and Budgeting

Maintenance is planned and budgeted annually (there are no multi-year contracts, an important consideration for PBMCs), based on an initial allocation between provinces by the Ministry of Finance and Economic Management (MFEM)[8]. PWD uses a Budget Allocation System (BAS),

[7] Comprehensive traffic data for major islands was started to be collected for the first time in 2016. No trends are available yet for forecasting.
[8] PWD can propose changes to the provincial allocations based on relative need, but rarely does so.

developed by R4D, to allocate these provincial totals over the network, based on average work quantities and frequencies for maintenance tasks and representative unit costs, with provision for some network development (upgrading or extension). In addition to routine and periodic maintenance, provision is made for limited corrective maintenance on earth roads (to keep them open) and the supply and stockpiling of materials. Table 3 shows the resulting budget for 2017. Apart from the small amount for corrective works, the maintenance budget is evenly split between routine and periodic maintenance, with both at around VUV 174 million for 2017.

Note that planned maintenance treatments are not based on surveyed road conditions and predicted rates of deterioration, nor is there any analysis of optimum maintenance strategies to minimise PWD and user costs over time. This will be possible in future, using a road inventory management system (RIMS) and a road asset management system (RAMS) that is currently being developed.

The current approach to planning and budgeting would change if PWD's role were to become that of a network manager. Instead of allocating budgets between provinces and programs, and having performance measured by completed projects, a network manager would set targets for the standard, availability and condition of the network, reflecting its role in serving broader economic and social development priorities (like all-year-round access), and would be accountable for meeting these. This would require up-to-date information on road conditions and an ability to demonstrate that optimum maintenance strategies have been applied[9].

Choice of Delivery Models

Maintenance is currently delivered through three main models:

- force account (FA), using mainly PWD labour (local casual labour is often recruited too), with payments based on work inputs;
- community-based contracts (CBC), using local community labour under divisional PWD supervision, with payments based on outputs (i.e. tasks completed); and
- island-based contractors (IBC) – or national contractors (NC) for more complex work – with payments also based on outputs.

FA, CBC and, to a lesser extent, IBC options sometimes involve PWD equipment – and could involve tractor-based equipment (TBE) in future – or, when PWD equipment or TBE is not available, plant supplied by equipment hire contractors (EHCs)[10]. IBC and NC contractors generally provide their own equipment.

[9] An implication of this is that provinces would eventually vie for comparable road conditions, rather than a fair share of maintenance funds.

[10] PWD currently has only one operational heavy grader, with one more coming from Japan International Cooperation Agency (JICA) in 2017. A light grader supplied by R4D has been assigned to Tanna. Tractor-based plant supplied by R4D are being trialled on Tanna and Ambae under the TBPET.

Table 3: Maintenance Budgets for 2017

Province	Maintenance and Improvement Works										Materials				Total	
	Corrective		Routine		Periodic		Improvements		All Works		Stockpiling		Materials Supply		Budget	
	V mln	%	V mln	%	V mln	%	V mln	%	V mln	%	V mln	%	V mln	%	V mln	%
Malampa	3.21	2.9%	27.11	24.8%	34.87	32.0%	23.75	21.8%	88.94	81.5%	13.96	12.8%	6.18	5.7%	109.09	16.9%
Penama	3.51	4.0%	13.41	15.1%	30.44	34.3%	22.83	25.7%	70.20	79.0%	12.69	14.3%	5.94	6.7%	88.83	13.8%
Sanma	1.27	0.8%	76.18	48.3%	44.85	28.5%	16.44	10.4%	138.74	88.0%	14.60	9.3%	4.28	2.7%	157.62	24.4%
Shefa	2.06	1.8%	34.58	30.7%	30.51	27.0%	25.64	22.7%	92.79	82.2%	13.37	11.9%	6.67	5.9%	112.84	17.5%
Tafea	3.27	3.6%	14.80	16.1%	29.43	32.0%	24.93	27.1%	72.43	78.8%	12.95	14.1%	6.49	7.1%	91.87	14.2%
Torba	0.12	0.1%	7.62	9.0%	4.42	5.2%	47.74	56.3%	59.90	70.7%	12.42	14.7%	12.43	14.7%	84.75	13.1%
Total	13.43	2.1%	173.70	26.9%	174.52	27.1%	161.35	25.0%	523.00	81.1%	80.00	12.4%	42.00	6.5%	645.00	100.0%
% of all works		2.6%		33.2%		33.4%		30.9%		100.0%						
% of maint'ce wks		3.7%		48.0%		48.3%										

Source: R4D, PWD

Work under CBC and IBC is not competitively tendered: once the provincial budget allocation has been determined and a decision made on its breakdown by type of maintenance, works are allocated among community groups (for CBCs) or local companies (for IBCs), depending largely on the availability and suitability of the latter. This provides continuity of work and maintains relationships between PWD and local service suppliers. For larger tasks, and tasks on the main islands, contracts with national contractors (NCs) are more commonly used, depending on availability and suitability. These are tendered (RFT) if the project value exceeds VUV 5 million; below that, they are awarded following a request for quotation (RFQ).

Table 4 shows a breakdown of PWD's 2017 maintenance budget by type of work and delivery option. As one might expect, CBCs are the most common for routine maintenance (mainly vegetation control), IBCs for more complex maintenance tasks, and a mix of FA and NC outsourcing for periodic maintenance. The proportions differ from province to province (and island to island), however, depending on the availability of contractors and equipment and, in future, the roll-out of new-model CBC contracts[11]. On Penama, most periodic maintenance is done by FA; in Sanma, it is mostly done by NC; in Torba, where there are no CBCs yet, almost all maintenance is done by IBCs; and in Shefa, NCs do some of the routine maintenance work. Table 5 shows the composition of contracts for 2017.

Table 4: Total Value of Rural Works by Delivery Option, 2017

Delivery	Routine		Periodic		Improvement		Materials		Total	
	V mln	%	V mln	%	V mln	%	V mln	%	V mln	%
CBC	85.97	55.8%	0.00	0.0%	2.10	1.0%	0.00	0.0%	88.63	14.4%
IBC	9.44	6.1%	12.20	7.0%	197.62	94.4%	11.50	14.8%	231.84	37.5%
RFQ	15.04	9.8%	22.56	13.0%	0.00	0.0%	24.34	31.3%	62.17	10.1%
RFT	41.38	26.9%	63.84	36.8%	8.70	4.2%	30.31	39.0%	144.91	23.5%
FA	2.15	1.4%	74.82	43.1%	1.01	0.5%	11.55	14.9%	89.97	14.6%
Total	153.98	100.0%	173.42	100.0%	209.43	100.0%	77.70	100.0%	617.52	100.0%
%	24.9%		28.1%		33.9%		12.6%		100.0%	

Note: CBC = Community-Based Contract, IBC = Island-Based Contract, FA = Force Account
RFQ = Request for Quotation, RFT = Request for Tender (for projects over VUV 5 million)

Table 5: Rural Works Contracts and Registered Contractors, 2017

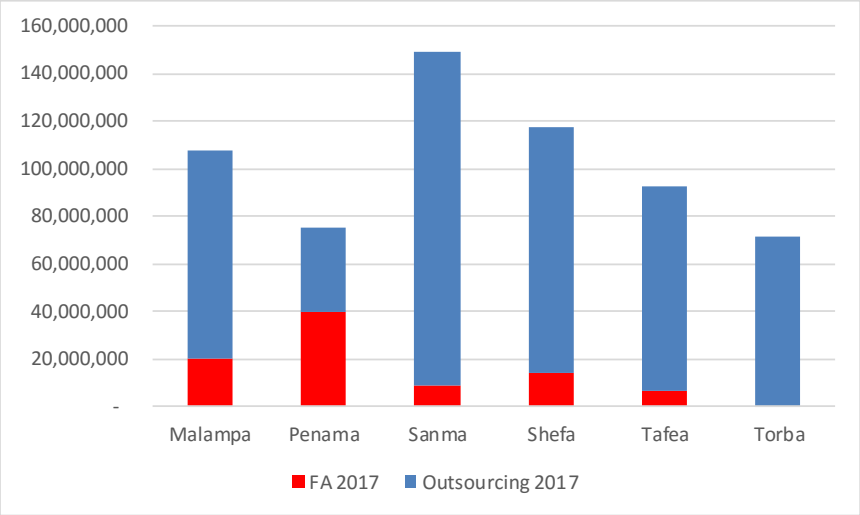
Province	PWD FA		CBC	IBC		NC	
	Jobs	Workers	Contracts	Contractors	Contracts	Contractors	Contracts
Malampa	3	13	82	5	12	0	3
Penama	5	17	63	7	8	0	0
Shefa	1	19	41	2	5	20	12
Sanma	2	25	28	2	7	9	9
Tafea	4	13	25	5	10	1	3
Torba	0	0	0	7	21	0	0
Total	15	87	239	28	63	30	27

Notes: 7 international contractors are included in NC
Tafea includes one improvement works contract in CBC list
Contract numbers based on 2017 plans
FA staffing based on 2017 payroll budget

In terms of value, FA's contribution is small: only 14.6% overall, with only Penama relying on FA to any significant extent (52.2% of works by value) (Figure 2).

[11] There is a plan to introduce a 5-km lower limit on CBC contracts, largely because of difficulties in administering smaller agreements. An earlier attempt to include drainage maintenance was unsuccessful, so CBCs are confined to vegetation control.

Figure 2: FA versus Outsourcing, 2017, by Value of Works



Factors Affecting Choice of Delivery Model

There are several factors that influence the present mix of delivery models and need to be considered in any move towards greater outsourcing:

- an expectation that work in one province or island would be carried out by people from that province or island, unless it requires equipment or skills they don't have;
- for FA, a flexibility in being able to respond at short notice, but also –
    - lack of access to equipment (see Table 6), and poor equipment productivity due to its condition and lack of maintenance,
    - inconsistent productivity and work quality compared with IBC/NC, largely due to the lack of performance incentive but also to equipment availability,
    - a greater risk of being assigned to unauthorised tasks, including work in other sectors or even private work;
- PWD's preference to use CBCs as a way of meeting the RRAP objective of involving communities in road maintenance, but with –
    - difficulties in administration and control, requiring many village-level agreements, extensive community consultations, dispute resolution, output verification and payment (239 separate community contracts are expected in 2017, see Table 5 above),
    - low efficiency/productivity, compared with contracted works,
    - an apparent inability to accommodate much more than low-skilled vegetation-control tasks without close supervision;
- for IBC, a familiarity with local needs, but with –
    - expectations of entitlement, as the sole provider/s of local capacity, and a reliance (with only one or two exceptions) on PWD-allocated works,
    - low efficiency/productivity and quality relative to NC-contracted works, through lack of equipment and performance incentive,
    - occasionally, disputes with local communities over payments for casual labour;
- for NC, a more professional contract-based response to needs, but –
    - a preference for working on the main islands, and on major projects, and a corresponding lack of interest in smaller-scale, infrequent works elsewhere.

The shortage of equipment often limits the ability of FA, CBCs and IBCs to deliver much more than manual vegetation-clearing, despite R4D training efforts. The TBPET is R4D's attempt to trial a new, more flexible, lower-cost solution that avoids reliance on PWD's limited equipment pool or specialist equipment hire. As we will see later, it shows some promise in complementing the work of FA, CBC and IBC routine maintenance teams, and in increasing the productivity of periodic maintenance, although its performance varies according to road material and whether commercial incentives (such as those experienced by EHCs) are able to ensure effective equipment maintenance over the long term.

Table 6: PWD Equipment, 2017

Equipment	Condition	Shefa	Sanma	Malampa	Tafea	Penama	Torba	Total	% Optl
Bulldozer	Operational			1		1		2	33.3%
	Non-operational				2		2	4	
Grader	Operational					1		1	12.5%
	Non-operational	2	2	1	1	1		7	
Loader	Operational					1		1	14.3%
	Non-operational	1	2	1		1	1	6	
Excavator	Operational					1		1	50.0%
	Non-operational					1		1	
Backhoe	Operational		1					1	14.3%
	Non-operational	2	1	1	1	1		6	
Roller	Operational	1	1	2	3	2		9	90.0%
	Non-operational				1			1	
Tractor	Operational				4	3	1	8	72.7%
	Non-operational		1	1		1		3	
Tipper truck	Operational	2	2			3		7	33.3%
	Non-operational	3	2	3	2	2	2	14	
Water truck	Operational					1		1	25.0%
	Non-operational	1	1	1				3	
Crane truck	Operational							0	0.0%
	Non-operational	1						1	
Cargo truck	Operational							0	0.0%
	Non-operational	1	1					2	
Seal truck	Operational							0	0.0%
	Non-operational	1						1	
Prime mover	Operational							0	0.0%
	Non-operational	1						1	
All	Operational	3	4	3	7	13	1	31	38.3%
	Non-operational	13	10	8	7	7	5	50	

Note: Operational = good working condition
Non-operational = requiring frequent repairs or warranting disposal
Excludes pick-ups, quad bikes and motorcycles

The work-assignment model used by PWD (only NC contracts are bid-priced) is an important feature of the current maintenance regime. It has evolved as a practical response to the issues listed above. Prices are accepted by contractors and are based on unit rates that are updated annually with the help of R4D. The approach guarantees continuity of work to CBCs and IBCs, and gives PWD assurance that capacity is available locally. Most IBCs depend on PWD's works allocation; few chase other work elsewhere, despite having been encouraged by PWD (and by a reduction in advance payments) to do so. But because prices are fixed by PWD and payments are made on a BoQ basis, there is little incentive – other than the risk of losing future contract opportunities – to offer improvements in quality or productivity, and pressure on PWD supervising staff to verify compliance with IBC contracts, which are quite basic, is weak.

The Tractor-Based Plant and Equipment Trial (TBPET)

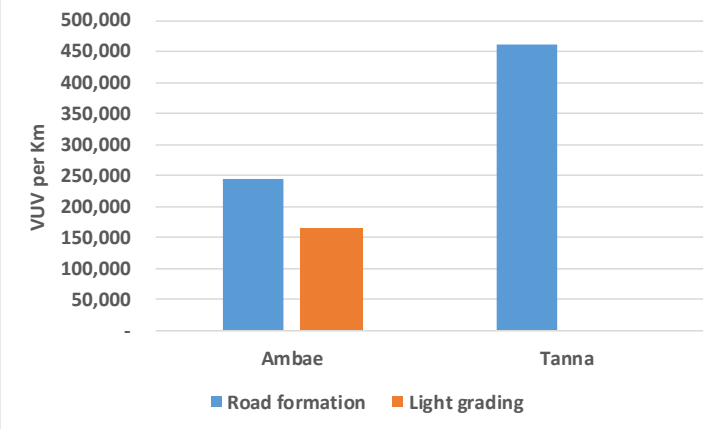
Tractor-based equipment (TBE) was introduced as a R4D-supported trial in Tanna and Ambae in March 2016. It was intended to complement labour-intensive methods for light grading and re-sheeting of gravel roads.

The trial is not particularly useful as a basis for comparison with the costs of conventional delivery methods, however. Its cost structure is unrepresentative of normal conditions: it carries significant overheads that would not be incurred in normal operations, and its arrangements for operations, repairs and maintenance are not typical of those that would apply to operations by FA or IBC. The trial is more one of a technical solution, testing the suitability of the equipment for the road conditions found on Ambae and Tanna. Table 7 summarises TBPET operations and costs over the 12 months from March 2016 to February 2017.

TBE is cheaper to run than equivalent heavy plant, but the repair and maintenance costs incurred in the trial are high, yet they could be reduced once teething troubles have been ironed out. Working on compacted coronous surfaces damages the grader blades. And the Holland tractor suffers frequent breakdowns when a higher-quality tractor might have done better. In both cases, spare parts take a long time coming. The finished work by TBE is also less satisfactory than for heavy equipment, not just because unscreened coronous material has been laid; using screened material would probably still result in a less uniform profile due to the smaller size of the grader blade.

Figure 3 summarises the TBPET costs of gravel formation and grading work. In Chapter 5, to provide a more realistic comparison between delivery models, the direct components of cost from the TBPET experience are incorporated in estimates for IBC using tractor-based equipment for routine and periodic maintenance tasks on gravel roads.

Figure 3: Unit Costs of Maintenance by TBE, Ambae and Tanna, 2016-2017



Indications so far suggest that the TBE concept is good, but the costs per km for shaping and grading works are high, largely due to the unrepresentative arrangements put in place for management and monitoring. TBE would appear to have an advantage on narrow, lower-class roads (e.g. Basic Access Roads) where maintaining access is important, with the quality of work depending on whether material is screened. It is probably less suitable for full-width roads of Class 2 and above. There are also concerns about the reliability of the model of tractor chosen. These concerns would likely be overcome if the plant were to be operated under a commercial plant-hire model.

Table 7: TBPET Costs, Ambae and Tanna, 12 Months, March 2016 to February 2017

AMBAE			**Costs per Km (VUV)**					**Total Costs (VUV)**				
	kms	Machine Utilisation (hrs)	Direct - Labour	Direct - Other	Indirect	Other (O'head)	Total	Direct - Labour	Direct - Other	Indirect	Other (O'head)	Total
Works Completed												
Road Formation	56.42		86,624	35,844	95,760	27,293	**245,521**	4,887,170	2,022,223	5,402,592	1,539,821	13,851,807
Light Grading	14.30		57,749	23,888	63,839	18,195	**163,672**	825,811	341,602	912,904	260,192	2,340,509
Total	70.72	1,652						5,712,981	2,363,825	6,315,496	1,800,013	16,192,317

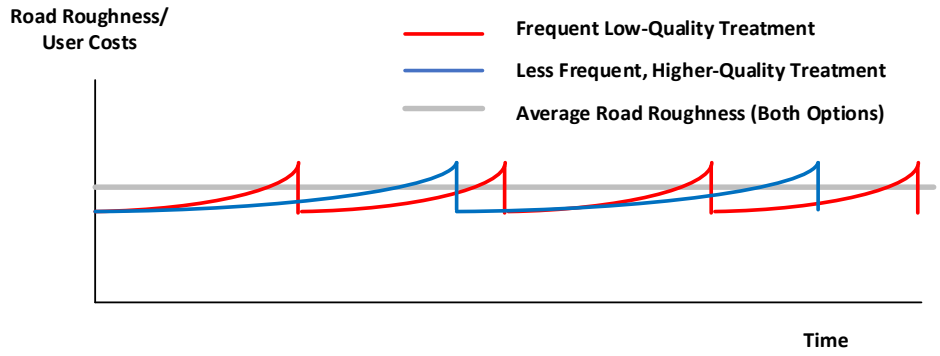
TANNA			**Costs per Km (VUV)**					**Total Costs (VUV)**				
	kms	Machine Utilisation (hrs)	Direct - Labour	Direct - Other	Indirect	Other (O'head)	Total	Direct - Labour	Direct - Other	Indirect	Other (O'head)	Total
Works Completed												
Road Formation	41.97		91,109	132,428	196,331	41,939	**461,805**	3,823,462	5,557,454	8,239,213	1,760,000	19,380,129
Light Grading			-	-	-	-	-	-	-	-	-	-
Total	41.97	1,849						3,823,462	5,557,454	8,239,213	1,760,000	19,380,129

5. The Case for Outsourcing

Maintenance Cost and Performance Comparison

In concept at least, for most maintenance tasks – routine, periodic and rehabilitation – PWD's three delivery models are all potentially available: FA, CBC and IBC/NC, with the first two complemented by PWD, TBE or hired equipment where available. They differ, however, in cost and quality. The quality of maintenance carried out under CBC or IBC, for example, usually falls short of what can be achieved by more experienced national contractors for a comparable task. These differences in work quality are reflected in different rates of subsequent road/pavement deterioration and user costs (Figure 4).

Figure 4: Treatment Frequencies to Achieve Comparable Road Conditions



In practice, there are only a few instances where the cost and quality of alternative delivery methods can be compared for similar types of work. CBCs don't do periodic maintenance work. NCs are not attracted to routine maintenance. There is sufficient data in PWD's reported expenditures and work plans, however, to allow a like-for-like comparison for routine and period maintenance of sealed roads by FA and NC in Shefa and Sanma, and routine and periodic maintenance of gravel roads by FA, IBC and NC in all provinces.

Periodic Maintenance of Sealed Roads

Data on periodic pavement and drainage works for sealed roads are limited to the networks of Shefa and Sanma, where only FA and NCs have the capability to carry out the work. Figure 5 summarises the results for 2017, weighted by kms of work to be carried out, when all indirect costs incurred by PWD – explained below – are fully allocated. Mobilisation costs are assumed to be the same for both options. On average, for comparable works, FA (at VUV 18.0 million per km) is 7.8% more expensive than NC (VUV 16.7 million per km). Although the direct costs of FA are lower (see Figure 6), the attributable indirect costs – of divisional support staff, office costs, repairs, and depreciation of plant and equipment, all shown in blue in the figure (red signifies direct costs) – swing the balance against FA.

Figure 5: Fully-Allocated Costs of Periodic Maintenance of Sealed Roads by FA and NC (VUV per km, 2017)

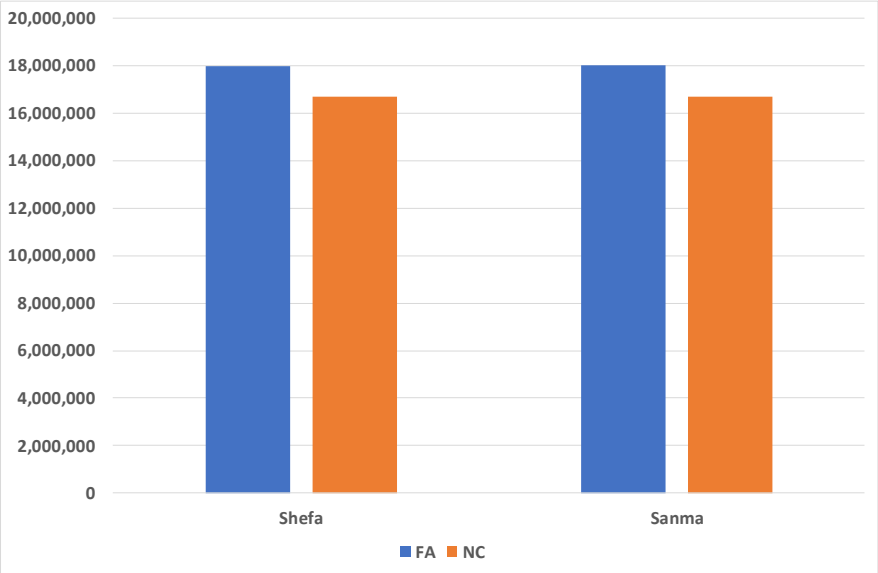
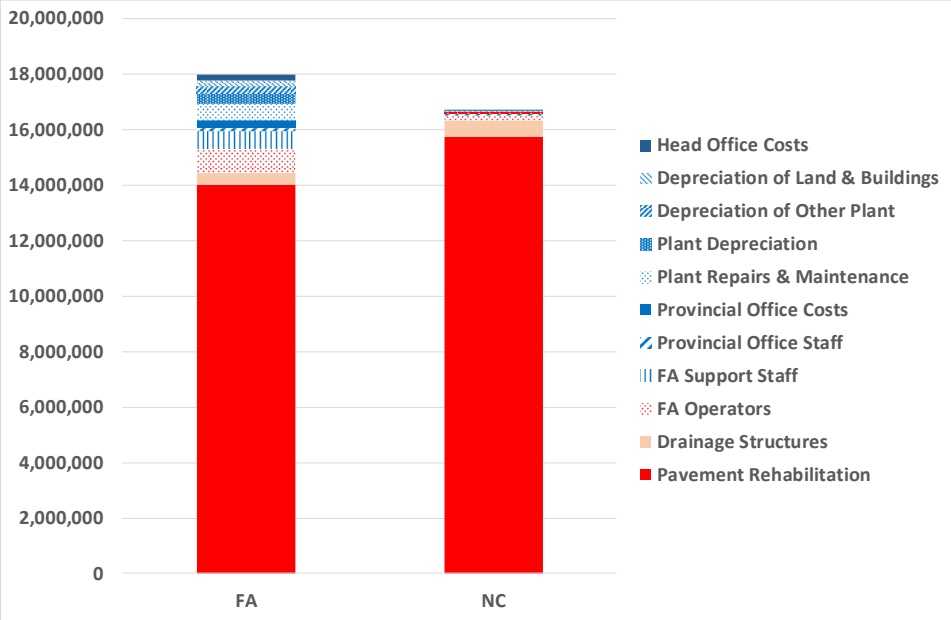


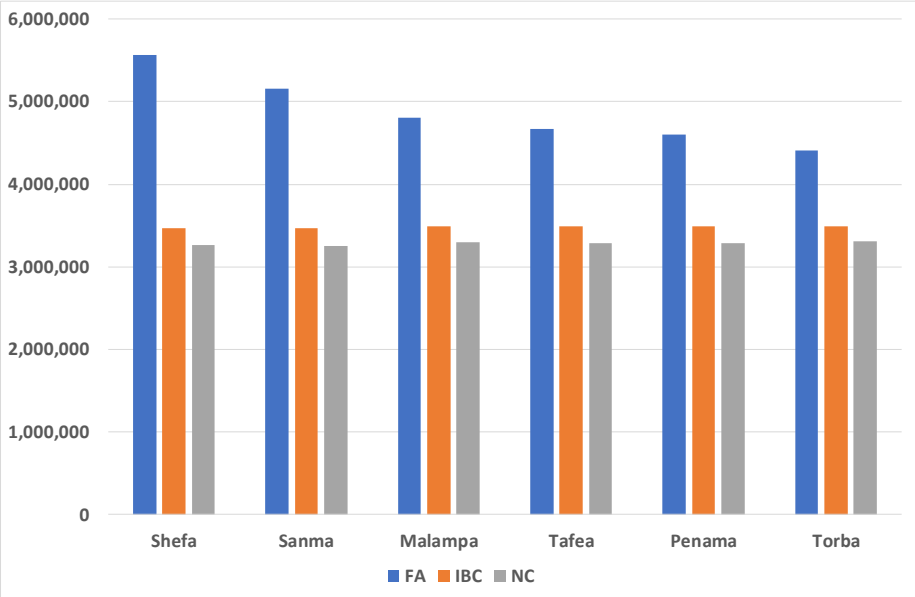
Figure 6: Breakdown of Costs of Periodic Maintenance of Sealed Roads by FA and NC (VUV per km, 2017)



Periodic Maintenance of Gravel Roads

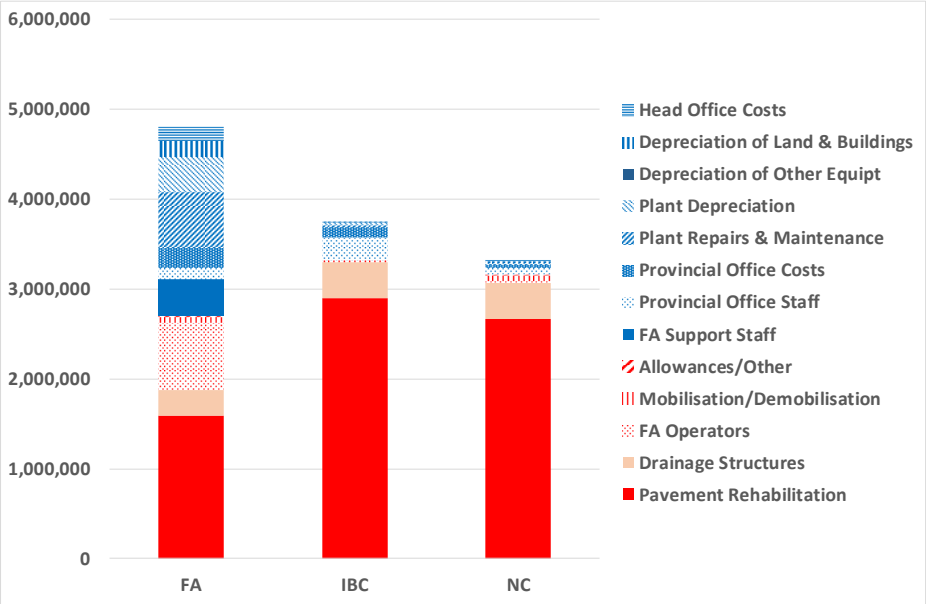
A more comprehensive comparison of fully-allocated costs between FA, IBC and NC is possible for periodic maintenance works on gravel roads, a more common maintenance task (84% of FA work is on periodic maintenance of gravel roads). The conclusion is similar, though: that FA is more expensive – in this case, significantly so – than either of the outsourcing options when all indirect costs are included (Figure 7).

Figure 7: Fully-Allocated Costs of Periodic Maintenance of Gravel Roads by FA, IBC and NC (VUV per km, 2017)



On average, for the comparable works costed in all provinces, FA (at VUV 4.81 million per km) is 28.1% more expensive than IBC (VUV 3.75 million per km) and 44.5% more expensive than NC (VUV 3.33 million per km). Why? Again, because of FA's high equipment maintenance, repair and depreciation costs and the avoidable costs of administration – see Figure 8, which reflects average costs for all provinces combined. Whereas indirect costs, shown in blue (direct costs are in red), comprise 44% of all costs for FA, they make up only 12% of costs for IBC and 5% for NC.

Figure 8: Breakdown of Costs of Periodic Maintenance of Gravel Roads by FA, IBC and NC (VUV per km, 2017)



Routine Maintenance of Sealed Roads

Comparing routine maintenance costs has similar conclusions. For sealed roads, FA is 38% more expensive than delivery by NC (Figure 9) when indirect costs are included. The indirect costs incurred by PWD (shown in blue in Figure 10) are enough to overcome any advantage in direct costs.

Figure 9: Fully-Allocated Costs of Routine Maintenance of Sealed Roads by FA and NC (VUV per km, 2017)

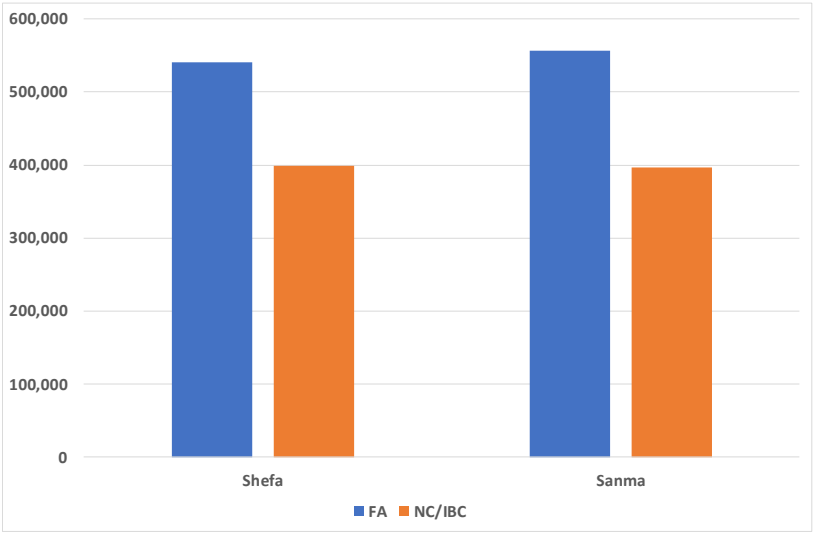
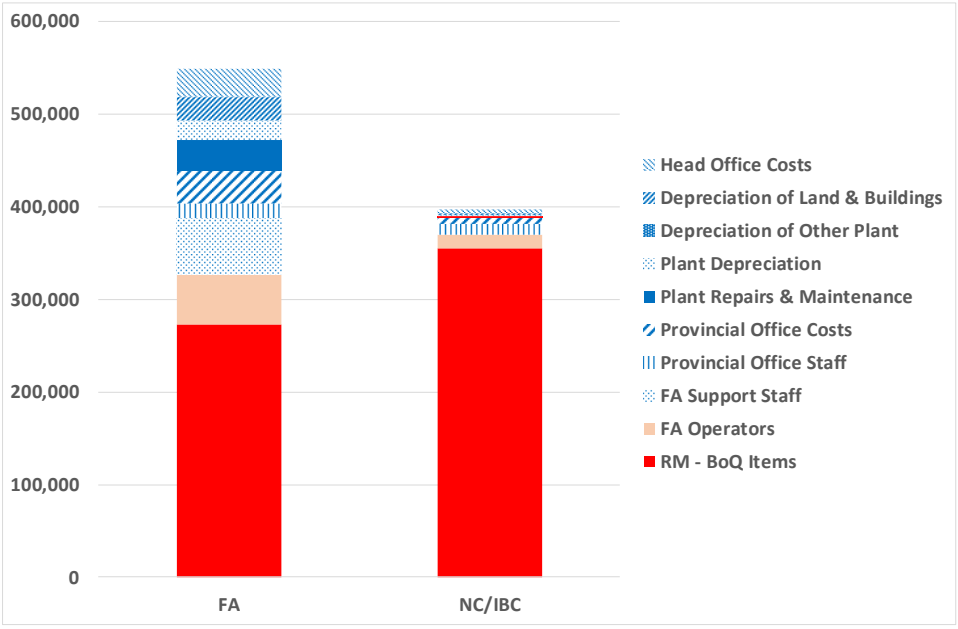


Figure 10: Breakdown of Costs of Routine Maintenance of Sealed Roads by FA and IBC/NC (VUV per km, 2017)



Routine Maintenance of Gravel Roads

For routine maintenance of gravel roads, however, the picture is more complex. As Figure 11 shows, FA (at an average of VUV 617,539 per km for comparable tasks) is 15.6% more expensive than delivery by CBC using EHC for reshaping (VUV 534,296 per km) and NC (VUV 488,870 per km). But it is 16.9% cheaper than by IBC: despite the higher overheads associated with the FA option, this appears to be because IBC direct costs for pavement and drainage works are significantly higher (Figure 12).

Figure 11: Fully-Allocated Costs of Routine Maintenance of Gravel Roads by FA, IBC and NC (VUV per km, 2017)

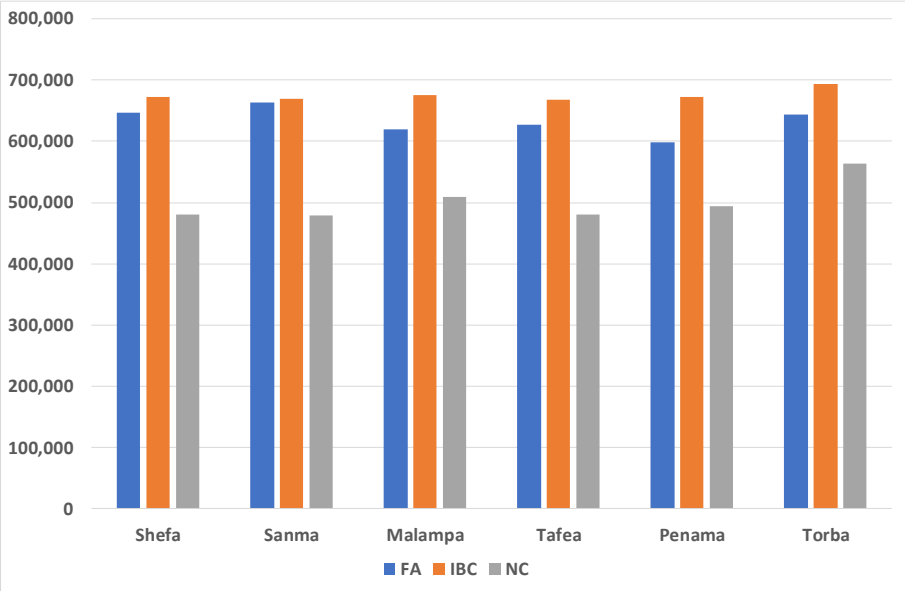
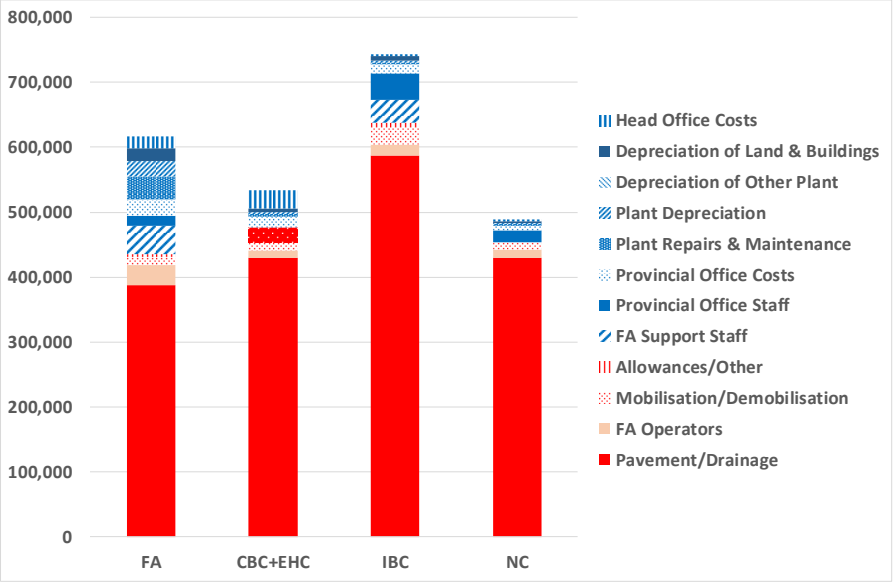


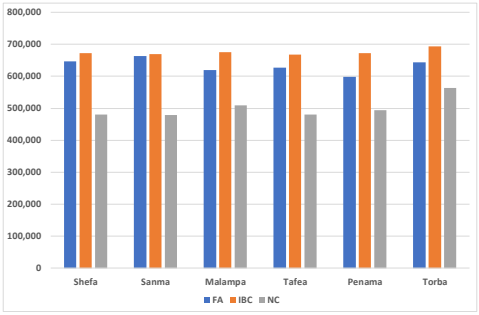
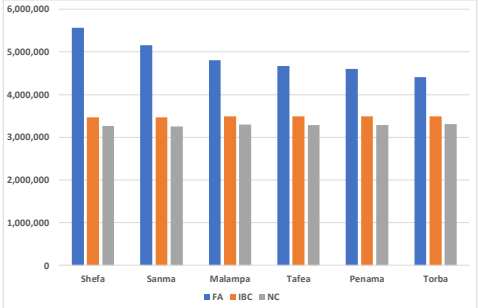
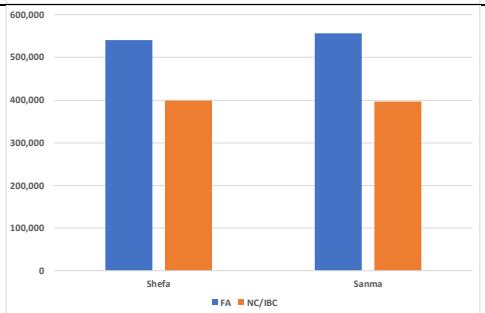
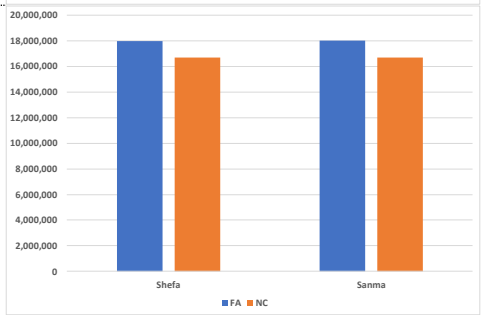
Figure 12: Breakdown of Costs of Routine Maintenance of Gravel Roads by FA and IBC/NC (VUV per km, 2017)



Conclusions from the Cost Comparison

Based on these cost comparisons, and with differences in quality also given consideration, Table 8 suggests some decision rules about the respective roles of the current range of maintenance delivery models.

Table 8: Conclusions from the Cost Comparisons

For **routine** maintenance of **gravel** roads, the preferred choice on cost alone would be to use NCs. But NCs are not attracted to outer islands or small contracts of short duration. Where NCs are unavailable, or find routine maintenance unattractive, the choice lies between FA and IBC. But with FA already limited in coverage and capacity by equipment constraints, IBC is generally to be preferred. FA should generally be reserved for places where IBC/NC capability is unavailable.	
For **periodic** maintenance of **gravel** roads, outsourcing is clearly the preferred option, whether by IBC where NC capability does not exist, or NC where it does.	
For **routine** maintenance of **sealed** roads, outsourcing is preferred, usually (on Sanma and Shefa) through NCs. FA does not have the equipment to sustain a maintenance program for sealed roads, nor is it likely to be cost-competitive.	
For **periodic** maintenance of **sealed** roads, which only exist at present on Sanma and Shefa, outsourcing to NCs is the only realistic option. It makes little sense to scale up a capacity within PWD for what is only an intermittent task.	

Benefits to Local Communities

Alternative delivery methods also differ in the level of cash injected into the roadside community's economy. These payments made to unskilled workers help raise welfare and consumption levels[12], and are greater for CBC operations than for contracted operations that are more equipment-intensive and employ fewer local workers. Arguably, they can be treated as project benefit. The

[12] Increased cash incomes enable improvements in diet, health and children's education, the purchase of tools and utensils, and/or investments in other social infrastructure. These do not follow from payments to contractors for equipment and materials. As of 31 March 2017, 124,904 workdays have been created under CBC agreements since the start of R4D Phase II, with total community payments amounting to VUV 149.9 million.

justification for doing so receives support from the NSDP and RRAP, both of which have the specific objective of involving local communities in providing road-related services.

The inclusion of direct unskilled labour payments as benefits would result in CBC being a more competitive (but not necessarily least-cost) option for routine maintenance of gravel roads, at least in the outer islands where FA and more formal contractors would have difficulty mobilising; on the main islands, IBC is preferred where IBC contractor are available. Routine maintenance of sealed roads, and all periodic maintenance, remains best done by contract (IBC or NC).

Possible Resistance to Change

It is important to bear in mind – since it has an impact on the possible pace of change if PWD decides to outsource network maintenance – that there is a strong vested interest in the current contracting arrangements. In 2017 (see Table 5 earlier):

- 87 people are employed by PWD under its FA workforce; many others are recruited as casuals;
- there are 239 separate CBCs being supervised by PWD's divisions and assisted by CPOs, each of which might employ 10-15 local people; CBCs have not yet been introduced in Torba, though, nor does PWD maintain FA resources there;
- PWD plans 63 separate contracts with 28 IBC contractors; and
- PWD plans 27 separate contracts from a pool of 30 NCs, but all but one contractor are in Shefa and Sanma (the one in Tafea is expected to have three contracts).

The state of PWD's equipment also constrains options for the role of FA. As Table 6 earlier shows, only a little over a third of its items of heavy equipment are operational; the rest require frequent repairs or warrant disposal. Only one grader, one loader and one excavator are operational (all in Penama), and there are only 28 various other items operational elsewhere in the country. Largely because of the absence of any commercial imperative to maintain equipment, PWD's capacity to mobilise an effective FA capability is already severely limited.

Blockage Points

Climate change is a serious threat to road infrastructure. Already, most road damage is caused by flooding and landslides brought about by heavy rain, which often make roads impassable. Among the tasks generally assigned to NCs and IBCs are the following:

- replacement or installation of culverts, gabion retaining walls and mattresses, concrete slabs, grouted stone work, lined drains and river training works at washed-out river crossings;
- installation of new or replacement of pre-cast or *in-situ* culverts;
- full-width or wheel-path concrete sealing of steep approaches; and
- raising the pavement above flood-prone and water-soaked ground.

The RRAP commitment to keeping roads open in all but the worst weather conditions puts a sharper focus on this type of work. Currently treated as emergency maintenance requiring special work assignment, it lends itself to being included in performance-based maintenance (PBM) arrangements (see below), with the PBM contractor held accountable for ensuring a minimum required level of accessibility[13].

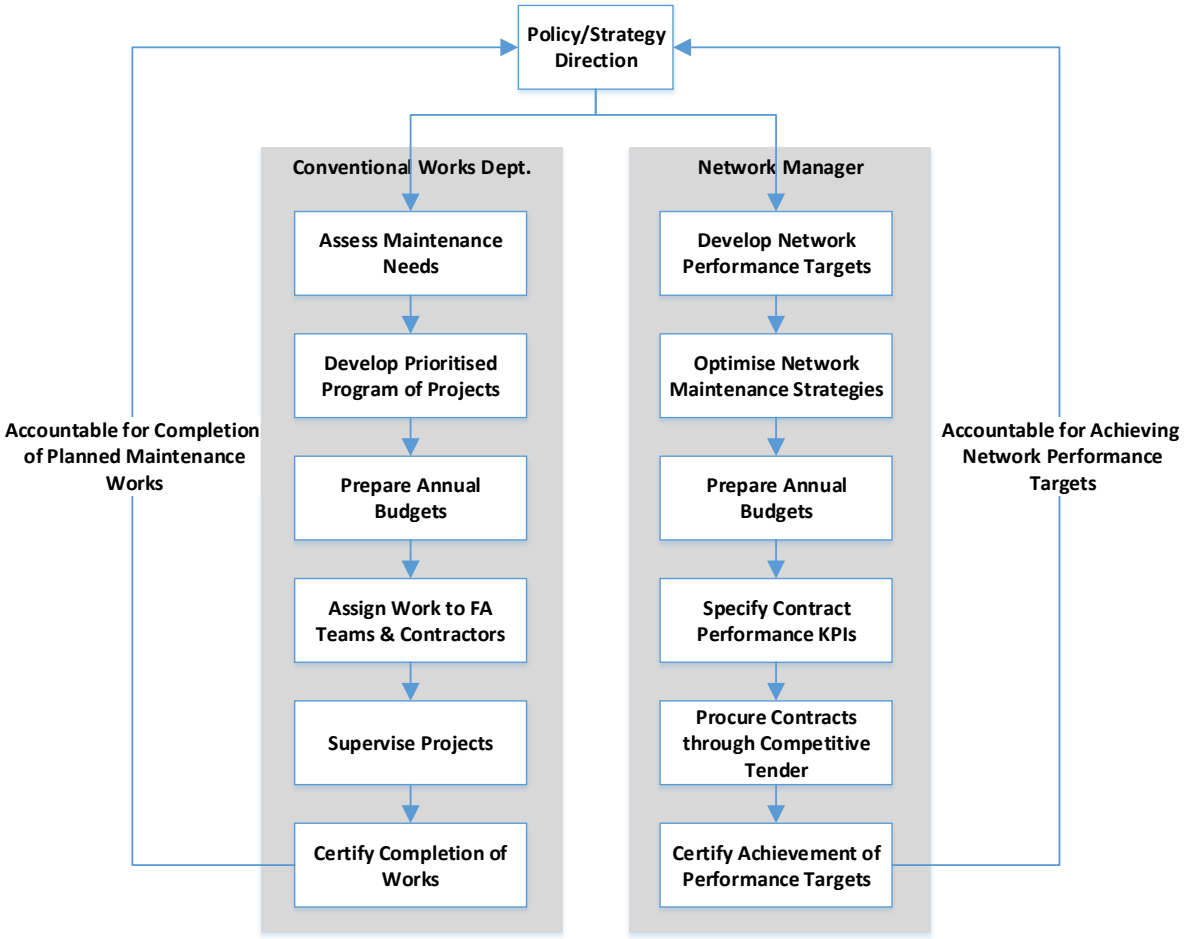
[13] Penalties would apply if the road was closed for more than a specified number of days per year. This would incentivise the contractor to carry out preventive works.

6. Business Case and Transition Strategy

The Network-Manager Business Model

Changing PWD's role from a conventional public works model to that of a network manager relying largely on outsourcing would require changes in authority, organisational structure, capacity and skills. Figure 13 illustrates the differences in approach. Under the old model, PWD's focus has been on executing contracts within assigned budgets. As network manager, it would focus on meeting targets for the standard, availability and quality of the whole network. Its reporting would emphasise the improvements in network functionality achieved by its maintenance strategies, rather than the number of contracts successfully completed and the amount of money spent on them.

Figure 13: Differences between a Conventional Works Department and a Network Manager



A key change would be in the way PWD accounts for its performance. As network manager, it would set target performance measures (in terms of network standard, availability and quality) and demonstrate how its expenditures help achieve those targets in a way that minimises both PWD's and users' costs. This would require:

- up-to-date information on the condition of all links and structures in the network; and
- an ability to determine the optimum mix of maintenance treatments (routine, periodic and rehabilitation) required to achieve the target performance measures over time at least cost, i.e. with greatest value for money.

Maintenance delivery would eventually be by contractors (whether CBC, IBC, NC or PBMC) who are incentivised by agreements that hold them accountable for network performance rather than units

of input. This is a radical change from present arrangements, of course, and one that cannot happen overnight.

Performance-Based Maintenance

Performance-based maintenance (PBM) has not yet been tried in Vanuatu, but is commonly used elsewhere. A performance-based maintenance contract (PBMC) commits the contractor to meeting specified road condition standards throughout the contract period (usually a minimum of 3-5 years for unsealed roads, longer for sealed roads[14]). For this, he receives regular payments. His performance is monitored periodically, often by an independent assessor. Penalties are imposed or deductions made from the payments if those standards fail to be met.

PBMCs have advantages for a network manager:

- the focus is on outcomes (road conditions) and not inputs;
- the network manager deals with one contractor, not numerous individual IBCs and/or CBCs;
- rather than being told (in contract specifications) what inputs to provide, the contractor has autonomy over how best to manage his resources to meet the required performance conditions – thus, risks (such as poor workmanship or poorly-specified materials) are managed by the party best able to control them[15];
- the contractor's incentives are aligned with the objectives of the network manager – he is rewarded for good-quality work that minimises road deterioration and is penalised for bad;
- provided the network managed by the contractor is of sufficient scale, they encourage him to invest in equipment, materials and staff training to improve quality, productivity and profitability.

PBM is closely aligned with the network-manager concept: one party is held accountable for ensuring that target road network condition standards are met.

There are disadvantages too, however:

- until the model is well-established, or unless they receive advice from foreign experts, it will be difficult for local contractors to anticipate risks and price bids to guarantee outcomes over a 3-5-year period or longer[16], and higher costs could result;
- the key performance indicators (KPIs) against which performance is measured need to be objective, simple and easily measured;
- for roads in poor condition, some rehabilitation may need to be done to bring them to a maintainable state; this is often included in hybrid contracts and paid for at agreed BoQ rates;
- performance verification should be done objectively by a third party (or by adjacent communities) that is trusted by both network manager and contractor;

[14] The reason for 3-5 years (and a decent length of network, too) is to encourage the contractor to invest in plant, material and training to improve his chances of meeting contract performance standards.

[15] Road agencies have a habit of specifying inputs in detail; that's what they always do for conventional contracts. In doing so, they take on these risks, and reduce the performance incentive (how can the contractor guarantee performance if key inputs are proscribed?) Road agencies should learn how to specify outcomes, not inputs, and to allow the contractor leeway in deciding how best to meet them.

[16] Where this is the case, PWD (with technical assistance, if necessary) could hold pre-bid briefings to explain the risks and how to price and manage them, and could hand-hold the successful bidder through the implementation process, with training also provided to other contractors.

- competition in procurement usually achieves best value for money; there must be enough competitive bidders, and they should be given enough time to assess resource requirements in detail and price risk;
- introducing PBMCs in Vanuatu could disrupt established arrangements involving the allocation of work among CBCs and IBCs, unless a continuation of community involvement were proscribed as a condition of the PBM contract.

For these latter reasons, PBMCs should be considered in the first instance only where the contract duration and the extent of network are large enough to warrant the required commitment of resources to achieve the efficiency and quality gains. This Concept Note recommends that the approach should be carefully introduced and managed as a pilot, to demonstrate to the industry how PBMCs work. More about this below.

Principles to Guide the Transition

Managing Change

As noted earlier, for 2017, PWD's divisions are expected to administer 344 individual contracts or work assignments on the rural network: 239 CBC agreements, 63 IBC agreements, 27 NC contracts and 15 FA team assignments (Table 5 on page 8). That's an awful lot, and must severely stretch the resources of divisional staff and, for CBCs, Community Partnership Officers (CPOs). It must also make it difficult to guarantee quality of outcome. Moreover, all but NC RFQs and RFTs, of which there are only a few, are assigned without competitive tender, which must risk complacency among contractors. Yet changing this arrangement can only be done slowly: there are many parties that depend on work assigned under these arrangements. Moreover, the positive qualities need to be preserved: most notably, a degree of community "ownership" and sense of obligation to maintain local roads. If changes are to be made, a way must be found to retain these positive features while also raising the quality of work and the ability to meet future network performance standards.

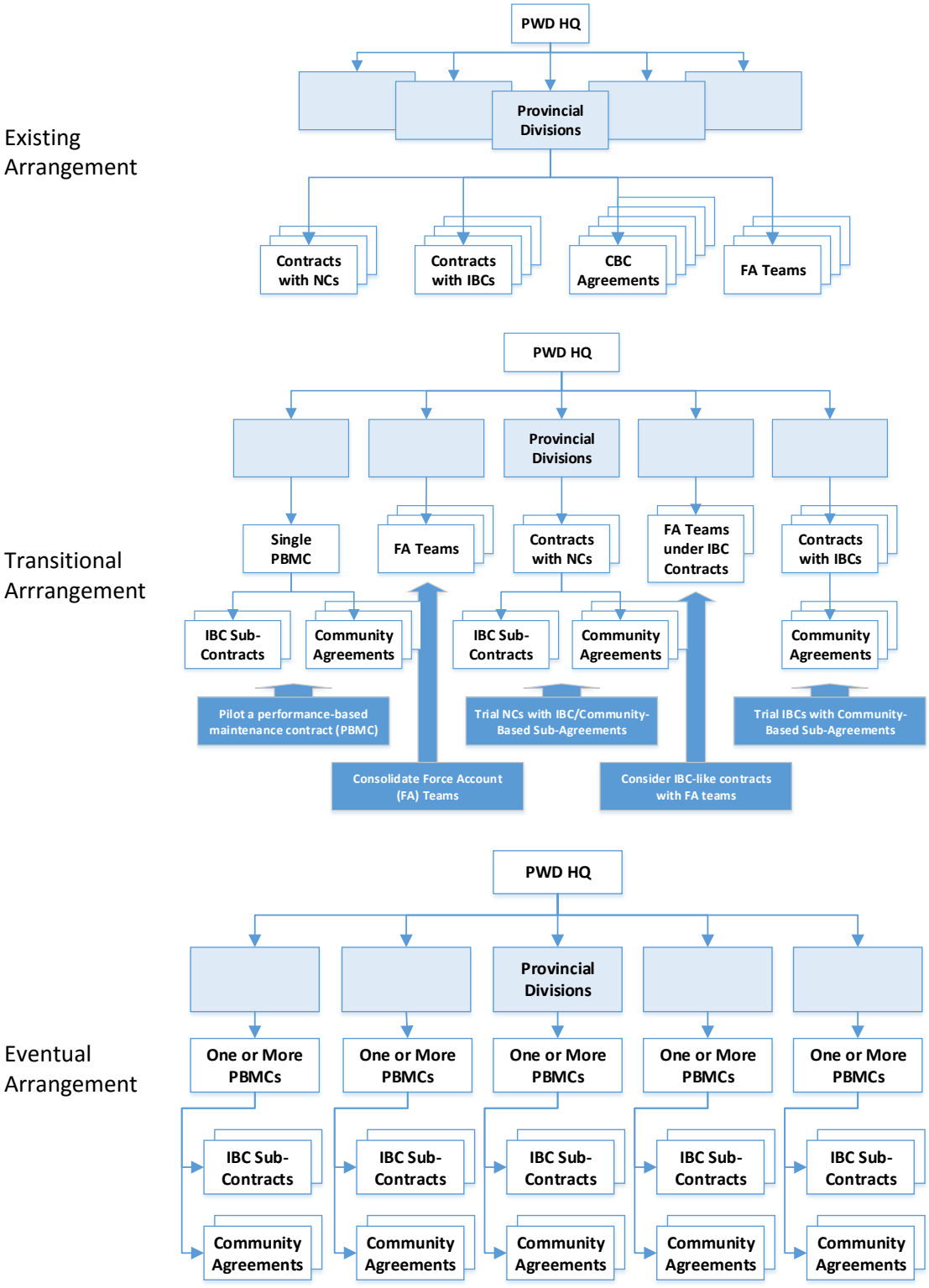
Allocating and Managing Risk

Figure 14 illustrates how this might be done in stages. Its underlying principle is to manage risk more effectively. Eventually, PWD, as network manager, would outsource responsibility for delivering effective network maintenance to PBM contractors held accountable for the quality, condition and availability of the network (consistent with the right-hand workflow in Figure 13 on page 20). The risk of time/cost overruns, and of poor materials and workmanship, would be borne by the PBM contractors, as the party best able to manage those risks. PWD's role, exercised through its divisions, would only be to verify that the contracted performance standards continue to be met. This is a much easier task than managing 344 individual contracts; it doesn't even involve checking that the right amount of material has been laid, or that drains are clean, or that vegetation has been cleared: that would be the responsibility of the PBM contractors who, if they failed to ensure that these were done effectively, would suffer payment penalties.

But getting from here to there is complicated. In addition to building the needed skills and capabilities in PWD and among PBM contractors, it requires careful handling of existing parties (FA, CBCs, IBCs and NCs) to shepherd them through the transition in a way that encourages their involvement and maintains the benefits of community participation. As the middle diagram in Figure 14 illustrates, this could involve:

- maintaining a role for FA only where better alternatives are unavailable, and creating opportunities elsewhere for excess FA teams to take on work assignments under IBC-like contracts;

Figure 14: Staged Changes in PWD's Relationship with Contractors



- introducing new IBC or NC contracts that mandate the use of community agreements for vegetation control, drainage clearing and other simple, labour-intensive components of routine maintenance; and

- as a trial intended to demonstrate the effectiveness of the performance-based approach and to develop an understanding of what's involved for PWD and contractors, introducing a pilot multi-year PBMC, with preparation, management, technical assistance and possibly funding from R4D and its successor.

Each is discussed in more detail below.

Incentive and Competition

The introduction of new contracting models (FA teams working under IBC-like contracts, IBC and NC contracts with community-based sub-agreements, and the pilot PBMC) provides an opportunity to inject a degree of competition into the procurement process. In any outsourcing model, competition is the key to improving quality and securing value for money, but it is not what IBCs and CBCs are used to. Until the benefits become more widely apparent, each pilot should be prepared and publicised as a limited demonstration of a new approach, rather than a threat to existing work-assignment arrangements; the potential benefits to IBCs and community sub-contractors should be highlighted and carefully monitored. Except for emergency works, however, or works needed to bring the road to a maintainable state, the contracts themselves should be based as much as possible on payments for verified outputs, rather than BoQ inputs.

Output Performance

Ultimately, with PBM contractors held accountable for maintaining their networks to defined standards of availability and quality, PWD's task will be comparatively simple: to verify that the performance standards are being maintained. Its divisions will likely have to manage no more than 8-10 multi-year PBM contracts at any time, rather than the 344 they manage in 2017. The standards (KPIs) adopted will depend on PWD's objectives in managing the network (like its access objective under the RRAP) and the techniques available to verify that KPIs are being met. If this Note's recommendations for network asset management are adopted (see below), PWD should be able to measure and report on the following:

- the proportion of the network that is trafficable all year round, under all weather conditions, and hence the Rural Access Index (RAI) required by the RRAP; and
- the proportion of the network that has a road surface roughness of a given level or below.

Both are an appropriate basis for KPIs for performance-based contracts, whether fully-fledged PBMCs or the interim arrangements proposed above. They lend themselves to objective measurement using simple, cheap hand-held devices or to reporting by local communities – see *Network Asset Management* below.

Managing Information

A successful road network manager uses information to strengthen accountability for performance. Currently, PWD cannot show how effective it is in ensuring the functioning of its network: it simply doesn't have the data to do so. As a network manager, it would routinely survey road conditions and traffic, and would be able to demonstrate graphically[17]:

- the justification for the level and allocation of its spending on road maintenance;
- the impact of its maintenance program on the condition and availability of the network; and

[17] Under this Note's proposals, anyone, from the Minister to an interested community member, would be able to view online the condition of any part of the network, the plans for maintaining it, and the degree to which PWD's KPIs are being achieved, all presented graphically using GIS (Geographic Information System) software.

- its success in meeting the network performance targets for which it is accountable.

Just as importantly, it would be able to use this information – coupled with the incentives of output-based payments and deductions for under-performance – to pressure PBM contractors to meet the same performance targets.

Recommendations for the Short Term

As R4D draws to a close in 2018 and its replacement under DFAT's assistance program is designed, PWD has the opportunity to seek long-term support to start implementing the initial reforms suggested above. The key components would include:

- a rationalisation and redeployment of FA resources, to concentrate on areas where private-sector capability does not exist or where competition is limited, linked with reforms to PWD's plant and equipment pool, including the TBE procured under R4D, to end its reliance on PWD's budget and transform it into a commercially-focused equipment-hire operation;
- the trial introduction of new forms of IBC and NC contract that mandate the use of CBC-like community agreements for labour-intensive inputs and incorporates performance-based payment incentives and penalties;
- the development and implementation of a pilot, multi-year PBMC to demonstrate how network performance-based incentives and penalties work and test the model's suitability for PWD as a network manager; and
- the development and operation of a customised off-the-shelf (COTS) road network asset management system with greater prospects for sustainability than present R4D plans, including associated survey procedures for verifying contract performance and maintaining up-to-date information on traffic and road conditions.

Each would include associated TA and training, designed to establish the necessary institutional capacity within PWD and among contractors.

FA and Equipment Deployment

Under the network manager model, FA would have a limited role. As this Note has shown, it is not cost-competitive with outsourced delivery, and it lacks the commercial incentives to maintain the necessary standards of efficiency and quality, not least because of the low availability and productivity of PWD plant and equipment. Its role should be limited to providing maintenance services where there exists no competitive private-sector market. This means:

- consolidating resources (i.e. staff and equipment) to establish a reliable capability in provinces where IBC/NC competition is limited or does not exist; and
- introducing incentives to raise output quality and achieve higher rates of productivity for both staff and equipment.

According to Table 5, NCs and IBCs are active in Shefa and Sanma, with 17 contracts under PWD's 2017 program in Shefa, and 16 contracts in Sanma. Although NCs might find work in outer islands unattractive, there are eight IBC contracts in Penama, 21 in Torba, 12 (and 3 NC) in Malampa and 10 (and 3 NC) in Tafea. Yet, except in Torba, FA teams also work in all these provinces, where they fail to provide maintenance services that are competitive with IBCs and NCs. It is questionable whether they should do so. According to Table 6, Penama has the largest fleet of operational PWD equipment (13), including the sole grader, and is one of two provinces where R4D's TBPET is operating (the other is Tafea, which has little else). Five of the six provinces have operational rollers, but most other equipment is non-operational or does not make up a full complement for periodic maintenance.

Since there is currently no commercial incentive to carry out effective plant maintenance or to maximise productivity, the sensible strategy for FA equipment would be to dispose of non-operational items and to sell working equipment to plant-hire companies who have the incentive to maximise utilisation and minimise down-time. Hire rates should be lower than PWC's current costs of operation, maintenance, repairs and depreciation at replacement values[18]. If there are barriers to disposing of equipment this way, then full complements of working equipment should be assembled in provinces and islands where no private-sector capability exists. The details of this redeployment should be workshopped with PWD divisional staff. Until it is finalised, PWD should resist efforts from donors and equipment suppliers to sell it additional equipment, and should instead seek assistance in strengthening the role and capacity of EHCs through, for example, trade credits, soft loans and partnerships with suppliers. FA staff should be reassigned with the equipment. Those that cannot might be offered IBC-like contracts paid on output performance, treating the teams effectively as IBC contractors and paying them equivalent rates.

Tractor-Based Equipment

The TBPET is not a realistic test of typical tractor-based operations. But it does show that, properly maintained, TBE can play a role in keeping roads open and maintaining the surface of lower-grade gravel roads, say of Class 3 and below. For wider roads carrying more traffic, the better-quality finish provided by conventional plant would generally be preferred. The problem however, is incentivising effective fleet maintenance. Only a commercial fleet operator, or a maintenance contractor, would be motivated to keep adequate spares and workshop capability, and to minimise non-operational time. This Note advises that the future role of TBE should be in the hands of plant-hire companies or contractors, rather than PWD. Hire rates for TBE should be relatively low, since such companies should also be able to offer the equipment for non-road purposes and so maintain higher productivity. And contractors are best able to make the commercial decision about what plant is optimal for any given task and whether it is more economical to buy or hire.

Piloting IBC and CBC Reforms

Notwithstanding the popularity of CBC agreements, they are difficult for PWD to manage effectively: there are simply too many of them. Rather than manage 239 individual agreements, PWD should move towards bundling formal community agreements under IBC and NC contracts, initially in a trial. This would require the contract to be amended to mandate the use of such agreements for specific tasks, initially limited to labour-intensive vegetation and drainage clearing, but with the contractor held accountable for the quality of work done by them. Supervision of the community-supplied work would be done by the contractor, not by PWD's divisional staff. In addition to its own performance against KPIs, the contractor would be required to report details of the agreements in force, the numbers of people employed by gender, the payments made to them, and their compliance with social and environmental safeguards. CPOs would no longer verify work completed, but would focus instead on ensuring that the contractor's use of community labour is in accordance with its contract obligations and that safeguards to protect community labourers are enforced.

Changes to the IBC and NC forms of contract would also be necessary to start the move from paying for inputs to paying on an output/performance basis. While some BoQ items may be needed for initial rehabilitation and emergency works, new KPIs could be introduced with associated payments and penalties to incentivise the contractor's efforts (i) to keep roads open under all weather conditions by giving greater attention to maintaining effective drainage and flood protection, and (ii)

[18] Existing equipment is often diverted to unauthorised tasks. This would be discouraged if PWD's equipment needs were satisfied at plant-hire rates.

to maintain a consistent level of surface quality, both of which can be verified easily using the techniques recommended in *Network Asset Management* below.

It is recommended that R4D should assist PWD by drafting the required revisions to IBC and CBC agreements, and should help PWD to select a suitable portion of the network for the trial/s.

Piloting Performance-Based Delivery

The longer-term scenario for PWD as a network manager involves the use of PBMCs (Figure 14). Because of the disruption they would cause to existing work-allocation arrangements, however, there is no big-bang option for introducing them. Their merits – for both PWD and existing NCs, IBCs and community groups – need to be tested in a pilot demonstration of the approach.

Two possible candidate networks for such a trial are Efate's Ring Road and Luganville – Port Olry on Santo, though this needs to be confirmed by PWD. Both have strong NC (and some international contracting) presence. Most of the links are in good condition or will soon be rehabilitated. And both have enough feeder roads to test accessibility performance indicators.

PBMC models, including hybrid models that involve initial rehabilitation works, are not new. Guidelines on best practice are available[19]. R4D could help identify an appropriate network for the pilot, and draft the necessary procurement and contract documentation. Key features to include are:

- a network that is sufficiently large (100 kms or more) and a contract term (4-5 years or more) to justify the contractor's building capacity (equipment, staffing, skills) to guarantee meeting KPI requirements;
- pre-bid briefings and workshops to explain the differences between PBMCs and conventional BoQ contracts, and to help ensure that bidders have the necessary skills (some of which may have to come through partnerships with foreign contractors or consultants) to assess, price and manage risks over the contract period;
- a competitive tender process, with sufficient time given to bidders to carry out due diligence and assess the performance risks they face, and with selection from pre-qualified contractors based on a single bid variable: the fixed monthly or quarterly payments (call this the "bid rate") needed to cover expected risk-adjusted costs and profit;
- limited opportunities to introduce contract variations;
- output specifications (KPIs) that are simple and easily verified as the basis for payment or imposition of penalties; for this initial pilot, it is suggested that payments be made at the bid rate by default for all but the following instances when penalties (payment deductions) would be imposed –
    - the number of days per year when a link is impassable by four-wheel drive vehicle,
    - the number of days per year when a link's surface roughness exceeds a specified minimum,
    - failure by the contractor to comply with the contract conditions and safeguards governing subsidiary community-based agreements; and
- a simple two-step process of independent verification involving –
    - formal notification by PWD divisional staff and/or adjacent community representatives of a suspected shortcoming in the contractor's KPI performance (such as a link that is impassable or badly deteriorated), and

[19] Examples: http://www.nigp.org/docs/default-source/New-Site/global-best-practices/performancebased.pdf?sfvrsn=2; https://obamawhitehouse.archives.gov/omb/procurement_guide_pbsc, http://www.performance-based-road-contracts.com/documents.htm; http://www-esd.worldbank.org/pbc_resource_guide/Update/IntExperience-PBMaintenanceContracts.pdf; http://www-esd.worldbank.org/pbc_resource_guide/Case-Australia.htm.

- field inspections, community consultations and, in the case of surface deficiencies, surveys of road roughness using hand-held devices as outlined in *Network Asset Management* below.

For the pilot, it is also suggested that R4D should assist PWD and the successful contractor in skilling up to meet their respective obligations under the PBMC; this could include assigning an advisor to work with the contractor, and would certainly include training workshops. The training workshops should also be extended to other contractors under a broader industry assistance program.

PBMCs require a multi-year budget commitment, however. Current regulations governing public-sector budgeting do not permit this. In parallel with the preparation of the PBMC pilot, therefore, it is recommended that amended regulations be drafted to allow multi-year contracts (MYCs) where it can be demonstrated that they offer cost savings over the conventional approach. And, in the meantime, consideration should be given to funding the bid-rate payments for the pilot directly from donor funds, to which multi-year restrictions do not apply.

Network Asset Management

Two basic asset management tools have been introduced by R4D: the inventory system (RIMS) and the budget allocation system (BAS). The intention is to develop a road asset management system (RAMS) that provides a more rigorous basis for allocating budgets based on road conditions, traffic, and optimum maintenance treatments. Many countries have done the same. And in most of them (PNG is a good example[20]), the system has eventually fallen into disuse, usually because of a failure to continue budget support for surveys and the system's maintenance, trained staff moving elsewhere, and a lack of continuity in donor support. A successful system needs the guarantee of continuing donor support over a long period (in PWD's case, spanning the end of R4D and a few years into the replacement facility), and the incentive of an output-based RAMS contract.

For PWD's RAMS, it is recommended that the tasks of data collection and developing and operating RAMS should be placed squarely under the responsibilities of the managing contractor and funded by DFAT, with a funding commitment made for the remainder of R4D and the first 2-3 years of its successor. The managing contractor would be accountable for:

- the quality and reliability of specified data, and for generating reports to PWD's specifications; surveys of road conditions would make use of low-cost hand-held devices and software like RoadRoid[21]; data would be available on-line for monitoring, reporting and analysis;
- running tests of alternative network, treatment and funding scenarios, and recommending works schedules and investment strategies, providing RAMS outputs to support PWD decision-making;
- carrying out independent technical and completion audits in support of PBM contracts; and
- developing and trialling new procedures for enlisting community leaders in signalling possible shortfalls in IBC/NC/PBMC contractor performance, including the use of mobile and smart phones[22].

[20] PNG's system, for example, is likely to fail without continuing DFAT support. This is a finding of a recent review carried out by DFAT's Operations Evaluation Division, soon to be published.
[21] For details, see http://www.roadroid.com/.
[22] A similar approach was recently developed under the DFAT-supported Indonesia Infrastructure Initiative (IndII) for use in monitoring small-scale roadworks by local communities in Lombok.

Training would also be provided to PWD staff to enable them to understand and make effective use of the data and decision tools. The R4D managing contractor would be incentivized to train its own local staff so that a pool of the necessary skills is maintained within the country to ensure it complies with its own performance-based contract conditions.

Given the Minister's recent commitment to maintaining all-weather access under RRAP, it is also recommended that RAMS, and its survey procedures, should pay specific attention to monitoring the condition of drainage and water crossings[23]. R4D and its successor should devise a survey program and maintenance strategy that better addresses this problem in the context of policies to strengthen resilience to climate change, allowing PWD and its contractors to increase their focus on drainage and protecting bridges and culverts through river training works and other treatments.

Institutional Implications

Transitioning PWD to a network manager will require external assistance and internal support for change. R4D and its successor are best placed to help the process through its initial stages, not only in supporting the pilot reforms outlined above but also in helping PWD establish the capacity to manage its new role. This capacity will require fewer lower-level technical supervision skills and more high-level policy, planning and contract management skills, albeit with a smaller technical workload. The transition should be planned carefully, ensuing that the contract pilots are used effectively to demonstrate the new skills required, and that reorganisation, recruitment and training draw on the experience. A transition implementation strategy for the next 5-6 years, with its institutional implications clearly spelled out, could be developed in the remaining 18 months of R4D.

Timetable

Figure 15 sets out a suggested timeline for the key tasks and decisions faced by PWD, DFAT and possibly other donors. It is probably realistic to aim for a trial of revised IBC and NC contracts to be initiated before the end of R4D, and for detailed plans for the pilot PBMC and the updated RAMS to be ready for immediate implementation under the new post-R4D facility.

Workshopping the Details

This is only a Concept Note. Its proposals need to be discussed, refined and if necessary amended in one or more PWD workshops, preferably with R4D and Australian High Commission (AHC) involvement.

Donor Support

The transition plan outlined in this Note envisages DFAT taking a lead in supporting the proposed reforms under R4D and its follow-up facility. Ideally, funding committed to Vanuatu under World Bank (WB) and Asian Development Bank (ADB) programs could also be directed at supporting the transition process and the institutional reforms needed. Both WB and ADB have considerable experience with supporting implementation of multi-year PBMCs.

Managing Risk

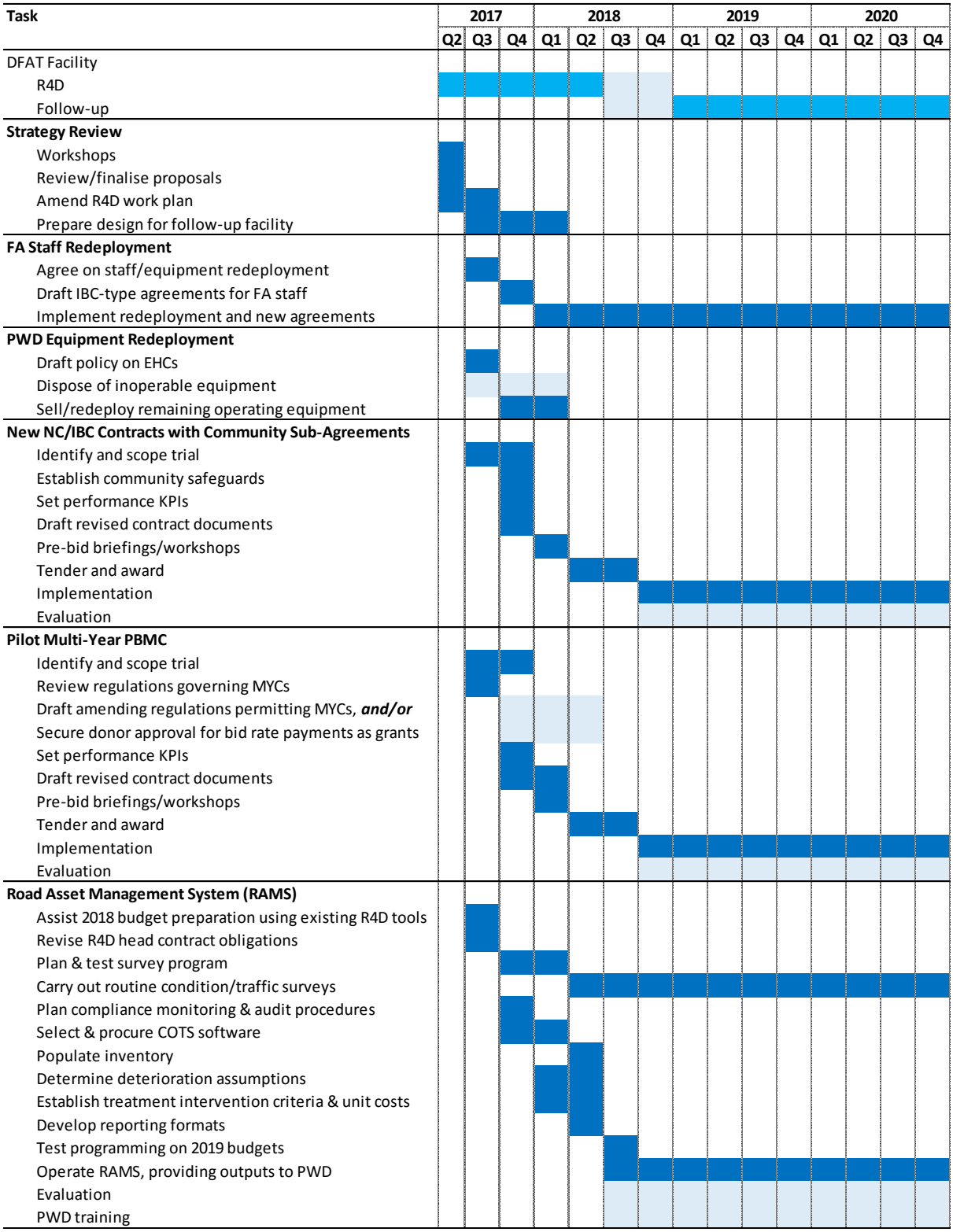
This Note's proposals are not without risk. Table 9 lists the key risks and suggests mitigation strategies.

[23] Road asset management systems usually model pavement deterioration over time and under the impact of traffic, but the most significant cause of road failure is often from water after heavy rains, a problem likely to get worse through the effects of climate change.

Table 9: Transition Risks and Mitigation Strategies

Risks	Mitigation Strategies
• Resistance to FA consolidation and redeployment	• Brief the Minister and PWD managers on the cost comparison; workshop with FA redeployment strategy with Divisional managers; highlight potential benefits to employees in moving to IBC-like contracts
• Resistance to equipment rationalisation	• Assess future maintenance equipment hire needs and opportunities for the plant-hire industry
• PWD cautious about the proposed pace of reform	• Emphasise the pilot nature of initial reforms; highlight benefits of lower technical workload; ensure R4D assistance with implementation planning
• DFAT concerned about financial commitment	• Discuss partnering/sharing arrangements with WB and ADB if necessary
• PWD concerns about institutional capacity to manage reforms	• Use pilot programs, largely managed by R4D and its follow-up facility, to identify the PWD management and technical skills needed and to carry out training workshops during pilot implementation
• NC/IBC resistance to proposed contract reforms (community sub-agreements, performance-based payments)	• Hold pre-bid workshops, treat initial pilots as demonstration projects, with R4D/facility assistance and training to all interested contractors
• Community resistance to working under IBC/NC contracts	• Workshop safeguards with communities in chosen pilot/s; ensure safeguard compliance is emphasised in contract KPIs
• MFED resistance to multi-year contracts	• R4D to provide analysis of potential cost savings and quality improvements; if necessary, fund the bid-rate payments directly from donor grant funds
• PWD resistance to outsourcing RAMS and associated surveys	• Specify schedule of functional capabilities; guarantee PWD ownership of survey data and RAMS functionality; offer DFAT guarantees of multi-year funding and head-contract guarantees of performance.

Figure 15: Indicative Implementation Schedule



Annex A: Maintenance Cost Estimates

Periodic Maintenance of Sealed Roads

	All Provinces (Average)		Shefa		Sanma	
	FA	NC	FA	NC	FA	NC
Output (Km)						
Kms of Sealed Roads	40	40	20	20	20	20
Costs (per Kilometre)	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*
Direct Costs						
Pavement Rehabilitation	14,018,012	15,750,000	14,018,012	15,750,000	14,018,012	15,750,000
Drainage Structures	420,000	600,000	420,000	600,000	420,000	600,000
FA Operators	893,192	143,376	869,437	143,376	916,947	143,376
Total Direct Costs (per Km)	**15,331,204**	**16,493,376**	**15,307,449**	**16,493,376**	**15,354,959**	**16,493,376**
Indirect Costs						
FA Support Staff	607,462	-	472,370	-	742,554	-
Provincial Office Staff	125,304	86,350	140,829	88,265	109,778	84,434
Provincial Office Costs	261,526	54,485	264,792	55,165	258,261	53,804
Total Payroll (Indirect) & Office Costs	994,292	140,835	877,991	143,430	1,110,593	138,238
Plant Repairs & Maintenance	592,628	7,500	685,586	7,500	499,670	7,500
Plant Depreciation	411,903	9,375	404,005	9,375	419,801	9,375
Depreciation of Other Plant	250,000	-	250,000	-	250,000	-
Depreciation of Land & Buildings	188,438	20,100	234,375	25,000	142,500	15,200
Total Prov Plant & Building Costs	1,442,968	36,975	1,573,966	41,875	1,311,971	32,075
Head Office Costs	229,841	30,142	209,216	30,142	250,466	30,142
Total Indirect Costs (per Km)	**2,667,102**	**207,952**	**2,661,174**	**215,447**	**2,673,030**	**200,455**
Total Costs (per Km)	**17,998,306**	**16,701,328**	**17,968,623**	**16,708,823**	**18,027,990**	**16,693,831**
Total Costs for Works	**719,932,245**	**668,053,120**	**359,372,455**	**334,176,460**	**360,559,790**	**333,876,620**

Periodic Maintenance of Gravel Roads

	All Provinces (Average)			Shefa			Sanma			Malampa			Tafea			Penama			Torba		
	FA	IBC	NC	FA	IBC	NC	FA	IBC	NC	FA	IBC	NC	FA	IBC	NC	FA	IBC	NC	FA	IBC	NC
Output (Km)																					
Kms of Gravel Roads	56.9	56.9	56.9																		
Costs	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*
	Per Km	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*
Direct Costs																					
Pavement Rehabilitation	1,594,057	2,893,200	2,666,667	1,594,057	2,893,200	2,666,667	1,594,057	2,893,200	2,666,667	1,594,057	2,893,200	2,666,667	1,594,057	2,893,200	2,666,667	1,594,057	2,893,200	2,666,667	1,594,057	2,893,200	2,666,667
Drainage Structures	280,000	400,000	400,000	280,000	400,000	400,000	280,000	400,000	400,000	280,000	400,000	400,000	280,000	400,000	400,000	280,000	400,000	400,000	280,000	400,000	400,000
FA Operators	747,963	-	24,469	747,963	-	20,020	747,963	-	20,020	747,963	-	26,693	747,963	-	26,693	747,963	-	26,693	747,963	-	26,693
Mobilisation/Demobilisation	62,938	21,667	62,939	-	-	-	-	-	-	90,642	30,000	90,642	90,642	30,000	90,642	90,642	30,000	90,642	105,705	40,000	105,705
Allowances/Other	16,114	-	4,834	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	96,685	-	29,006
Total Direct Costs (per Km)	**2,701,073**	**3,314,867**	**3,158,908**	**2,622,020**	**3,293,200**	**3,086,687**	**2,622,020**	**3,293,200**	**3,086,687**	**2,712,662**	**3,323,200**	**3,184,002**	**2,712,662**	**3,323,200**	**3,184,002**	**2,712,662**	**3,323,200**	**3,184,002**	**2,824,410**	**3,333,200**	**3,228,071**
Indirect Costs																					
FA Support Staff	406,596	-	-	951,480	-	-	695,994	-	-	298,999	-	-	342,634	-	-	246,831	-	-	284,231	-	-
Provincial Office Staff	126,892	262,426	72,902	170,200	67,450	76,563	132,674	67,450	69,241	108,495	67,450	11,677	145,373	67,450	12,282	204,609	67,450	12,598	-	67,450	-
Provincial Office Costs	221,756	109,606	35,286	320,017	35,286	35,286	312,124	35,286	35,286	241,296	35,286	35,286	196,654	35,286	35,286	146,646	35,286	35,286	113,796	35,286	35,286
Total Payroll (Indirect) & Office Costs	755,244	372,032	108,188	1,441,697	102,736	111,849	1,140,792	102,736	104,527	648,790	102,736	46,963	684,661	102,736	47,568	598,086	102,736	47,884	398,027	102,736	35,286
Plant Repairs & Maintenance	621,690	22,500	6,923	621,690	22,500	6,923	621,690	22,500	6,923	621,690	22,500	6,923	621,690	22,500	6,923	621,690	22,500	6,923	621,690	22,500	6,923
Plant Depreciation	391,279	28,125	17,308	391,279	28,125	17,308	391,279	28,125	17,308	391,279	28,125	17,308	391,279	28,125	17,308	391,279	28,125	17,308	391,279	28,125	17,308
Depreciation of Other Equipt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Depreciation of Land & Buildings	178,641	2,426	14,338	283,256	3,846	23,077	172,220	2,338	14,031	314,981	4,277	25,662	142,761	1,938	11,631	142,761	1,938	11,631	15,862	215	-
Total Prov Plant & Building Costs	1,191,610	53,051	38,569	1,296,225	54,471	47,308	1,185,189	52,963	38,262	1,327,950	54,902	49,892	1,155,730	52,563	35,862	1,155,730	52,563	35,862	1,028,831	50,840	24,231
Head Office Costs	159,502	13,470	20,241	210,709	15,957	20,241	210,709	17,748	20,241	119,627	13,915	20,241	119,627	13,915	20,241	136,842	12,123	20,241	159,503	7,164	20,241
Total Indirect Costs (per Km)	**2,106,356**	**438,553**	**166,998**	**2,948,631**	**173,164**	**179,398**	**2,536,690**	**173,447**	**163,030**	**2,096,367**	**171,553**	**117,096**	**1,960,018**	**169,214**	**103,671**	**1,890,658**	**167,422**	**103,987**	**1,586,361**	**160,740**	**79,758**
Total Costs (per Km)	**4,807,429**	**3,753,419**	**3,325,907**	**5,570,651**	**3,466,364**	**3,266,085**	**5,158,710**	**3,466,647**	**3,249,716**	**4,809,029**	**3,494,753**	**3,301,098**	**4,672,680**	**3,492,414**	**3,287,673**	**4,603,320**	**3,490,622**	**3,287,989**	**4,410,771**	**3,493,940**	**3,307,828**

Routine Maintenance of Sealed Roads

	All Provinces (Average)		Shefa		Sanma	
	FA	NC/IBC	FA	NC/IBC	FA	NC/IBC
Output (Km)						
Kilometres of Sealed Roads	120	120	60	60	60	60
Costs (per Kilometre)	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*
Direct Costs						
RM - BoQ Items	273,341	355,343	273,341	355,343	273,341	355,343
FA Operators	53,333	14,459	53,333	14,459	53,333	14,459
Total Direct Costs (per Km)	**326,674**	**369,802**	**326,674**	**369,802**	**326,674**	**369,802**
Indirect Costs						
FA Support Staff	60,746	-	47,237	-	74,255	-
Provincial Office Staff	16,707	11,514	18,777	11,769	14,637	11,258
Provincial Office Costs	34,871	7,265	35,306	7,355	34,435	7,174
Total Payroll (Indirect) & Office Costs	112,324	18,779	101,320	19,124	123,327	18,432
Plant Repairs & Maintenance	33,333	1,000	33,333	1,000	33,333	1,000
Plant Depreciation	20,625	1,250	20,625	1,250	20,625	1,250
Depreciation of Other Plant	-	-	-	-	-	-
Depreciation of Land & Buildings	25,125	2,680	31,250	3,333	19,000	2,027
Total Prov Plant & Building Costs	79,083	4,930	85,208	5,583	72,958	4,277
Head Office Costs	30,646	4,019	27,896	4,019	33,396	4,019
Total Indirect Costs (per Km)	**222,053**	**27,728**	**214,424**	**28,726**	**229,681**	**26,728**
Total Costs (per Km)	**548,727**	**397,530**	**541,098**	**398,528**	**556,355**	**396,530**

Routine Maintenance of Gravel Roads

	All Provinces (Average)				Shefa				Sanma				Malampa			
	FA	CBC+EHC	IBC	NC	FA	CBC+EHC	IBC	NC	FA	CBC+EHC	IBC	NC	FA	CBC+EHC	IBC	NC
Output (Km)																
Kilometres of Gravel Roads	430	315	315	430	80	80	55	80	80	80	55	80	80	80	55	80
Costs	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*
	Per Km	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*
Direct Costs																
Pavement/Drainage	387,501	429,823	587,156	429,823	387,501	429,823	587,156	429,823	387,501	429,823	587,156	429,823	387,501	429,823	587,156	429,823
FA Operators	31,814	11,977	16,524	12,105	30,000	2,500	15,773	10,844	30,000	2,500	15,773	10,844	30,000	14,250	15,773	10,844
Mobilisation/Demobilisation	11,977	12,105	26,845	11,977	5,000	5,000	-	5,000	5,000	5,000	-	5,000	28,500	28,500	-	28,500
Allowances/Other	4,186	-	7,500	-	-	10,844	-	-	-	10,844	-	-	-	10,844	-	-
Total Direct Costs (per Km)	**435,478**	**453,905**	**638,025**	**453,905**	**422,501**	**448,167**	**602,929**	**445,667**	**422,501**	**448,167**	**602,929**	**445,667**	**446,001**	**483,417**	**602,929**	**469,167**
Indirect Costs																
FA Support Staff	44,325	-	34,484	-	59,046	-	-	-	92,819	-	-	-	30,925	-	-	-
Provincial Office Staff	14,650	21,779	40,788	18,624	17,604	17,587	31,102	18,040	13,722	16,799	32,236	17,561	11,222	22,819	37,792	18,356
Provincial Office Costs	25,603	17,320	14,562	6,826	33,099	20,135	20,060	6,896	32,283	19,639	19,565	6,726	24,957	20,382	15,125	10,399
Total Payroll (Indirect) & Office Costs	84,578	39,099	89,834	25,450	109,749	37,722	51,162	24,936	138,824	36,438	51,801	24,287	67,104	43,201	52,917	28,755
Plant Repairs & Maintenance	34,884	4,186	2,667	2,093	34,884	3,750	2,182	1,875	34,884	3,750	2,182	1,875	34,884	3,750	2,727	1,875
Plant Depreciation	23,559	2,834	3,333	1,526	23,559	2,344	2,727	1,172	23,559	2,344	2,727	1,172	23,559	2,813	3,409	1,641
Depreciation of Other Plant	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Depreciation of Land & Buildings	20,625	6,273	6,006	2,582	29,297	7,813	9,091	3,125	17,813	4,750	5,527	1,900	32,578	10,078	10,109	4,865
Total Prov Plant & Building Costs	79,068	13,293	12,006	6,201	87,740	13,907	14,000	6,172	76,256	10,844	10,436	4,947	91,021	16,641	16,245	8,381
Head Office Costs	18,415	27,999	3,421	3,314	26,152	23,340	3,868	3,768	26,152	27,423	4,303	3,768	14,847	26,298	3,373	3,393
Total Indirect Costs (per Km)	**182,061**	**80,391**	**105,261**	**34,965**	**223,641**	**74,969**	**69,030**	**34,876**	**241,232**	**74,705**	**66,540**	**33,002**	**172,972**	**86,140**	**72,535**	**40,529**
Total Costs (per Km)	**617,539**	**534,296**	**743,286**	**488,870**	**646,142**	**523,136**	**671,959**	**480,543**	**663,733**	**522,872**	**669,469**	**478,669**	**618,973**	**569,557**	**675,464**	**509,696**

	Tafea				Penama				Torba			
	FA	CBC+EHC	IBC	NC	FA	CBC+EHC	IBC	NC	FA	CBC+EHC	IBC	NC
Output (Km)												
Kilometres of Gravel Roads	70	70	55	70	80	80	55	80	40	40	40	40
Costs	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*	*VUV*
	Per Km	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*	*Per Km*
Direct Costs												
Pavement/Drainage	387,501	429,823	587,156	429,823	387,501	429,823	587,156	429,823	387,501	429,823	587,156	429,823
FA Operators	34,286	16,286	15,773	12,393	30,000	14,250	15,773	10,844	42,000	33,250	21,688	21,688
Mobilisation/Demobilisation	32,571	32,571	-	3,571	28,500	28,500	-	28,500	66,500	66,500	-	66,500
Allowances/Other	-	-	-	-	-	-	-	-	45,000	-	-	-
Total Direct Costs (per Km)	**454,358**	**478,680**	**602,929**	**445,787**	**446,001**	**472,573**	**602,929**	**469,167**	**541,001**	**529,573**	**608,844**	**518,011**
Indirect Costs												
FA Support Staff	40,501	-	-	-	25,529	-	-	-	17,129	-	-	-
Provincial Office Staff	17,184	27,019	39,222	20,761	21,163	18,108	46,627	13,990	-	18,000	64,113	27,980
Provincial Office Costs	23,245	15,110	12,327	5,811	15,167	9,859	9,192	3,792	23,540	9,000	9,808	7,584
Total Payroll (Indirect) & Office Costs	80,930	42,129	51,549	26,572	61,859	27,967	55,819	17,782	40,669	27,000	73,921	35,564
Plant Repairs & Maintenance	34,884	4,286	2,727	2,143	34,884	3,750	2,727	1,875	34,884	7,500	3,750	3,750
Plant Depreciation	23,559	2,946	3,409	1,607	23,559	2,578	3,409	1,406	23,559	5,156	4,688	2,813
Depreciation of Other Plant	-	-	-	-	-	-	-	-	-	-	-	-
Depreciation of Land & Buildings	16,875	4,860	4,582	2,160	14,766	4,253	4,582	1,890	3,281	5,145	700	420
Total Prov Plant & Building Costs	75,318	12,092	10,718	5,910	73,209	10,581	10,718	5,171	61,724	17,801	9,138	6,983
Head Office Costs	16,969	29,501	3,323	2,552	16,984	24,599	2,777	2,102	-	36,016	2,388	2,402
Total Indirect Costs (per Km)	**173,217**	**83,722**	**65,590**	**35,034**	**152,052**	**63,147**	**69,314**	**25,055**	**102,393**	**80,817**	**85,447**	**44,949**
Total Costs (per Km)	**627,575**	**562,402**	**668,519**	**480,821**	**598,053**	**535,720**	**672,243**	**494,222**	**643,394**	**610,390**	**694,291**	**562,960**