PROVINCIAL AND KABUPATEN ROAD MAINTENANCE MANAGEMENT PLANNING

PHASE 1 REPORT

REVIEW OF CURRENT PRACTICE AND OPPORTUNITIES

INDONESIA
INFRASTRUCTURE
INITIATIVE

PROVINCIAL AND KABUPATEN ROAD MAINTENANCE MANAGEMENT PLANNING

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INDONESIA

INFRASTRUCTURE

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ACKNOWLEDGEMENTS

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ACRONYMS

BAPPEDA	Provincial Planning Organisation
BIPROG	Bina Marga Directorate of Planning
DAK	Specific Grants Fund
DGH	Directorate General for Highways, within the Indonesian Ministry of Public Works
EIRTP-1	Eastern Indonesia Road Transportation Program of the World Bank
IndII	Indonesia Infrastructure Initiative
IRE	Institute of Road Engineering, Bandung
IRMS	Indonesian Road Management System
KRMS	Kabupaten Road Monitoring System
LVRMS	Low Volume Road Management System
PKRMMP	Technical Assistance Support for Provincial and Kabupaten Road Maintenance Management Planning
PPB	Planning, Programming and Budgeting for road maintenance
PPBP-1	Adapting Planning, Programming and Budgeting Procedures to Eastern Indonesia project, a project within the EIRTP-1 program
RPF	Road Preservation Fund
RRFU	Sub-National Road Facilitation Sub-directorate of BIPROG
SK-77	Procedures for Planning and Budgeting Road Maintenance used in Kabupatens

EXECUTIVE SUMMARY

Rural roads provide vital links to services and employment for communities; access to markets and the transport of goods. Their quality, in terms of providing reliable and efficient access, can also significantly affect socio-economic outcomes.

In many parts of Indonesia, poor conditions exist on many regional and local road networks. Consequently, the Directorate General of Highways (DGH) has been given national responsibility for the provision of leadership and support to local road agencies for helping improve the management of regional roads; this being defined as the third important mission of DGH in RENSTRA 2010-2014.

This activity's primary aim is to review current road maintenance practices and funding at the sub-national level to assist DGH in its mission, through developing and demonstrating a systematic and sustainable approach to planning, programming and budgeting (PPB) road maintenance activities in selected provinces and kabupatens, which will provide a model that can be adopted throughout Indonesia.

This Phase 1 report presents the consolidated findings from a review of current capabilities for the planning and delivery of sub-national road maintenance in provinces and kabupatens, and presents proposals for the scope of future work to strengthen institutional capabilities and practice in this sector. The findings draw on extensive consultation with representatives from five provincial road agencies and eight kabupaten road agencies, which were selected as being representative of both eastern and western Indonesia. Consultations were also held with senior personnel from DGH, AusAID and IndII, and national and international consultants.

The report incorporates:

- background information on the justification, goals and objectives of the technical assistance (TA) support for the Provincial and Kabupaten Road Maintenance Management Planning (PKRMMP) project;
- basis for selection and a summary of the characteristics of the review provinces and agencies, funding needs and expenditure;
- a summary of the main findings and recommendations of the Phase 1 reviews;
- a specific list of topic areas, key issues and proposed actions;
- a set of scope options for future institutional strengthening and implementation activities, including consideration of support for each of the main building blocks of successful asset management, covering:
  - o maintenance policy and PPB procedures and tools, and associated stakeholder engagement, awareness raising and training,
  - o maintenance delivery and performance based contracting (PBC), and
  - o technology development for low volume rural transport infrastructure;
- specific proposals for Phase 2 activities covering:
  - o maintenance policy and guideline development,

- o awareness raising,
- o two pilot studies of the trial application of the draft policy and PPB procedures,
- o development of standard operating procedures (SOPs),
- o recommendations on wider application in the preparation of a full implementation trial, including use of appropriate funding instruments, delivery arrangements and obligations by Government of Indonesia (GoI) and participating agencies, and
- o a scoping study of national guidelines and specifications applicable to low volume rural transport infrastructure;

- • suggestions for possible Phase 3 activities and beyond covering:
  - o maintenance delivery and PBC,
  - o technology guidelines and specifications, and
  - o implementation of a series of trial output based road renewal and maintenance programs at a provincial/kabupaten level.

Summary of characteristics of review networks

The characteristics of the review jurisdictions displayed significant variety, providing a sound basis for both, this study and further study, as follows:

- • Different surface types were well represented, with the sealed road proportion varying between 100 and 25 percent, and 90 and 25 percent for the provincial and kabupaten agencies respectively.   Unpaved earth roads were also well represented.

- • Stable road conditions varied between 95 and 25 percent, and 80 and 25 percent for the provincial and kabupaten agencies respectively.

- • The ratio of road asset value to Gross Regional Domestic Product (GRDP) for the five review provinces suggests that capacity to support a sustainable and sufficient network varies considerably, with two cases of insufficient economic base, one instance of borderline insufficiency/adequacy and two cases of sufficient capacity/undersupply.

- • Better-than-average performance was shown by two provinces based on being significantly above a trend based relationship between GRDP and the proportion of stable network conditions.

Key findings and recommendations

Findings and recommendations are detailed in the report under four main components, namely: i)Needs, practices and capabilities; ii)Delivery of routine maintenance; iii)Procedures and tools; and iv)Legal and regulatory framework, procurement and support.

The most significant findings and recommendations are:

1. Whilst budget constraints exist across most agencies, the estimated funding needed for essential routine maintenance and periodic maintenance to help preserve existing assets is approximately 75 percent of the total road sector budget. Consequently, the latter activities should be given highest priority and additional funds sought to help fund renewal of the networks.

2. Overall funding needs for essential maintenance and removal of the backlog of major renewal works are between three to five times the current total funding. Needs vary by agency type and location, with those of kabupaten agencies being highest, and the relative needs in eastern Indonesia being greatest.

3. There is a need to socialise the benefits of asset preservation amongst decision makers and technical cadres, and encourage a more appropriate use of available and new funds. Too often, decisions are taken without a rigorous technical basis, leading to a cycle of building/renewal and failure. Achieving a change in behaviour will require a different approach to funding and contracting services. A 'carrot and stick' approach is proposed in which roads are selected for grant funding (hibah) under multi-year extended warranty type contracts, on the proviso that the regional road managing agency fulfills obligations to maintain other parts of the network to a sustainable level. Achieving the desired results will require strong leadership underpinned by appropriate regulations, policy, consistent guidelines and procedures, and appropriate funding instruments and delivery arrangements.

4. Proposals for taking forward practical demonstrations of a future system are described, including a full implementation trial. This is preceded by the preparation of a draft policy, guidelines, trial works programs and funding support.

Key Issues and Actions

The key issues and actions arising from the review findings are:

Topic area	Key issues and actions
Needs, practices and capabilities	Develop an agreed maintenance policy for: • appropriate access and maintenance standards, and performance indicators; • focus on safety and asset preservation; • a 'core' network, covering priority regional roads from national, provincial and Kabupaten; • funding mechanisms which aim to address the backlog and provide for sustainable maintenance at least on a core network; • clarification of regulatory and management responsibilities for road related assets and vehicle access; • complementary PPB procedures and gap analysis guidelines for road maintenance, renewal and improvement. Increase awareness of basis for proposed policy focus (see above) amongst stakeholders. Improved management and technical capacity in key areas to support policy objectives.

Topic area	Key issues and actions
Delivery of routine maintenance	Introduction of measurable maintenance standards.
	Study of the transition of government owned and operated road maintenance units to commercial businesses.
Procedures and tools	Adapt existing planning tools to better address planning priorities for low volume roads, including alternative socio-economic criteria.
	Extend design procedures and technology guidelines for low-volume rural transport infrastructure.
Performance based maintenance	Application of output based grant funding to reduce backlog on agreed core network, and a sample of community supported projects.
	Development of appropriate guidance and contract forms for outcome based maintenance contracts.
	Extend contract forms and procurement guidance to Rural Transport Infrastructure (RTI) including scope for community participation.
	Improved private industry capacity in the planning, supervision and delivery of maintenance.
	Pilot implementation of the use of 'hybrid'-type contracts for performance based maintenance at a provincial and kabupaten level.

The issues and actions emphasise:

- the need for a strong policy-driven environment;
- a commitment to clearly defined maintenance standards and their successful delivery;
- supportive planning procedures, tools and cost effective solutions; and
- building capacity in outcome based delivery.

Drawing from the detailed review data (documented in the project Interim Reports 1B, 2 and 3), a comparison of a comprehensive selection of characteristics, strengths and weaknesses of the provincial and kabupaten review agencies has been prepared, particularly to facilitate selection of agencies for participation in Phase 2 pilot studies.

In general terms, these comparative results have shown that the selection of agencies for the Phase 1 review of maintenance management practices has been very effective in presenting agencies and their road networks that cover a wide range of conditions, capabilities and experiences. The range of physical, financial, workforce capability and management environments across these agencies provides a rich range of choices from which plans for future TA can be prepared.

Many review findings relate directly to possible options for future work in Phase 2 of the PKRMMP project. However, in the course of the review, a number of issues have been identified as critical for the sustainability of maintenance management practices in sub-national agencies beyond the life of the PKRMMP project, involving:

- funding demand and supply;
- funding certainty – multi-year;
- strengths in current practice;
- challenges in current practice;
- cultural changes;
- cross-agency issues;
- gender issues; and
- environmental issues.

Future scope of work – Phase 2 and beyond

The key issues and actions listed above have been developed into a list of key requirements influencing the planning of future TA and implementation work programs, classified under three categories with the following scope:

Scope A – Policy and PPB	Developing maintenance policy, piloting of PPB procedures and tools, confirming funding mechanisms, undertaking awareness raising and training, and preparing a project for output-based grant funding; the rationale being that all contributions made under this project should be manifested in measurable outcomes on the network and within the communities.
Scope B – Delivery and PBC	Developing and piloting maintenance delivery and performance based maintenance initiatives, piloting contract forms and developing industry capability.
Scope C - Technology	Developing, adapting and piloting design guidelines, tools and specifications for low volume rural transport infrastructure.

The proposed plan assigns key requirements to a Phase 2 and a Phase 3 program, and a possible future implementation project.

- The Phase 2 program comprises the balance of activities to be completed within the current PKRMMP project, with minor modifications, and any necessary sub-projects.
- The Phase 3 program would comprise activities to be completed in a future TA project.
- The proposed implementation project comprises the full-scale application of output based grant funding to reduce backlog and establish sustainable maintenance on an agreed core network in a few selected provinces, and a sample of community supported local road projects.

The assignment of the key requirements into scope aspects and into project phases is discussed in Section 5 of the report.

Design of Phase 2

A design has been proposed to define objectives and scope of pilot trials of the use of PPB procedures for Phase 2 building on the preliminary scope identified earlier, and for subsequent pilot trials. The design can also be used to guide the selection of pilot agencies for participation in the pilot trials.

The common objectives of the proposed Phase 2 pilot study are to:

• Develop, socialise and apply a draft maintenance policy, and supporting PPB procedures and tools.

• Identify effective one and four-year road maintenance programs and budgets that will deliver measurable network performance outcomes, consistent with trial minimum level of service standards for access and asset preservation.

• Consider the relative benefits of programs developed for separate provincial and kabupaten road networks, and for an agreed "core" network of regionally significant roads serving a province and its kabupaten jurisdictions.

• Prepare comprehensive proposals for a trial implementation project to apply the results of the planning studies, including identifying appropriate funding instruments, delivery arrangements and obligations by the GoI and participating agencies.

A phase 2 pilot design has been prepared based on having up to three pilot studies, as follows:

• **Pilot Study A** provides for maintenance of a mixed sealed and unsealed road network in Eastern Indonesia serving a **moderately productive** region (province and selected kabupatens), but which displays below average performance based on a trend relationship between GRDP and the proportion of stable network condition.

• **Pilot Study B** provides for maintenance of a sealed and unsealed road network in Eastern Indonesia serving a **less productive** region (province and selected kabupatens), but which displays above average performance based on a trend relationship between GRDP and the proportion of stable network condition.

• **Pilot Study C** provides for maintenance of a sealed and unsealed road network in Western Indonesia serving a **moderately productive** region (province and selected kabupatens), but which displays below average performance based on a trend relationship between GRDP and the proportion of stable network condition.

By providing a wide coverage of network conditions, covering sealed and unsealed roads, and contrasting GRDP and above and below average performance, the pilots should provide an opportunity to fully test most aspects of any maintenance policy and procedures under a wide range of operational conditions, including likely access constraints.

SECTION 1: INTRODUCTION

1.1   BACKGROUND TO THIS PROJECT

Road maintenance in Indonesia is reportedly significantly under-resourced at the provincial and kabupaten levels. Moreover, the ability of the relevant agencies to objectively identify road maintenance needs, plan and then program works is limited. The work carried out on the Planning, Programming and Budgeting Procedures (PPBP) TA within the Eastern Indonesia Road Transport Project (EIRTP 1) funded by a World Bank loan, had as its core focus the need to determine how much should be spent on roads and how to efficiently allocate the scarce resources.

The PPBP reported that the current data collection process for both provincial and kabupaten roads mainly comprises surveys for road inventory and condition, while maintenance works carried out were more likely to be based on political decisions rather than on the limited collected data. Discussions with local authorities during the preparation of this activity also identified that routine maintenance had very little support, even within the limited funding levels, because of lack of "political visibility". This is of great concern, noting that even a modest level of regular investment in routine maintenance is essential to ensure the benefits resulting from investment in major capital and periodic maintenance works are realised.

The PPBP TA determined that the local road authorities wanted a tool and planning process that could more easily accommodate local factors as well as bridge the gap between their technical requirement and the needs and wants of the local parliament. Consequently, a tool - Low Volume Road Management System (LVRMS) based on simplified Highway Development and Management (HDM-4) models, specifically adapted for use by provincial and local governments and incorporated in a user friendly tool, was developed to assist in this process.

In response to a shift in emphasis from the Secretary General, Ministry of Public Works (MPW) and in view of the continuing generally poor condition of the regional and local road networks, the national responsibility of DGH to provide leadership and support to local road agencies for the management of regional roads is defined as the third important mission of DGH in RENSTRA 2010-2014. This has since been reinforced in discussions involving the Vice Minister of Public Works, and the Director of Planning at DGH, and a number of major Presidential and Ministerial initiatives are under preparation.

It is envisaged that the guidance from DGH could extend beyond technical standards to include institutional and governance aspects relating to cross ministry and jurisdictional synchronisation of planning priorities, resource allocation, road management and performance management. Although DGH is not directly responsible for implementing the management of regional roads, the outcome and effectiveness of their guidance should be measured by the standard and conditions of the regional road

network that results. The delivery of effective road networks is paramount, with appropriate standards and priorities being key to achieving outcomes.

Furthermore, greater funding security is also essential to address likely backlogs of major road rehabilitation works and to support a sustainable asset preservation and routine maintenance regime.

1.2   PROPOSED SUPPORT

AusAID wishes to facilitate improved sub-national road infrastructure in Indonesia by working in partnership with DGH and other GoI agencies in the development and trial application of appropriate policies, procedures, funding instruments and delivery arrangements to rural road maintenance and renewal, and is currently trying to define an appropriate assistance program in the medium- to long-term.

There are some 500 local road agencies, all of which could greatly benefit from support for capacity building; a single model is likely to cover a high proportion of their needs. Significant benefits could be generated by a program of TA which increases the ability of local government road agencies (LGRAs) to improve the effectiveness of existing funding. AusAID's task is to identify the most effective way to provide TA support to the sector, using a modality which would maximise benefits.

It is essential that detailed information on current road maintenance practices and budgeting be carried out in a number of selected provinces and kabupatens, in particular in Eastern Indonesia, to provide a clearer understanding of road maintenance needs.

It is proposed, therefore, that a two-phase process be adopted for this:

• Phase 1 (this Project) will concentrate on defining the problems and issues in the funding and delivery of road maintenance in sub-national governments and
• Phase 2 will demonstrate and reinforce the processes and procedures in selected provinces and kabupatens.

1.3   ACTIVITY GOAL AND OBJECTIVES

1.3.1 Goal

The goal of this activity is to review current road maintenance practices and funding at the sub-national level and to develop and demonstrate a systematic and sustainable approach to PPB road maintenance activities in selected provinces and kabupatens, which will provide a model that can be adopted throughout Indonesia.

1.3.2 Objectives

The specific objectives of Phase 1 (**TA for support of provincial and kabupaten road maintenance management planning** [the PKRMMP project]) are to:

• collect detailed information on the current road maintenance situation in representative sub-national road agencies, in particular in Eastern Indonesia;

• carry out a detailed investigation of the maintenance needs, funding and management practices in the selected local government areas as a basis for the design of an ongoing program of sector support;

• identify the role of DGH and other potential agencies in supporting road maintenance management for provincial and kabupaten roads; and

• confirm the jurisdictions which will be included in the piloting of the road maintenance planning process.

The proposed objectives of Phase 2 of the activity, which were reviewed under this project, are to:

• develop a road maintenance policy for the piloted jurisdictions;

• identify the existing condition of identified roads and bridges;

• identify the capability of available government personnel and equipment to carry out routine road maintenance tasks;

• identify current available budget for road maintenance and potential areas for additional sources of revenue for road maintenance;

• identify road maintenance needs and costs based on agreed scenarios of level of service;

• develop project-level road maintenance proposals for the immediate following year's program;

• develop planning-level road maintenance proposals for the following four-year program;

• prepare a set of road maintenance procedures for adoption by government; and

• prepare a training program for implementation of the road maintenance procedures.

1.4   PHASE 1

As a first step in identifying the most appropriate support strategies for the sector, Phase 1 of the PKRMMP project has undertaken a detailed review of the current situation in a sample of local government regions (selected provinces and kabupaten and municipalities), including examination of a range of aspects, including those components identified under Phase 1 of the Activity and a proposed Phase 2 as shown later in Table 6.1.

Phase 1 has:

1. reviewed the current capabilities for planning sub-national road maintenance in provinces and kabupatens, and potential opportunities for strengthening institutional capabilities for road maintenance planning in sub-national agencies.

2. clarified the detailed scope for a PKRMMP Phase 2 project to undertake pilot implementation of capability-raising initiatives in selected Indonesian provinces and kabupatens.

The activity has largely involved extensive consultation at both central and local locations, involving senior personnel in the DGH Directorate of Planning, and two consultation workshops with representation from selected provincial and kabupaten planning and maintenance implementation functions, and a review of relevant local and international practices.

The consultations have considered the current status and future opportunities across a range of road maintenance management and technical topics, which fall into the following topic areas:

• Funding needs and mechanisms, practices and capabilities.

• Procedures and tools.

• Legal and regulatory framework, and procurement and support.

1.5 PURPOSE OF REPORT

This Phase 1 Report presents the consolidated findings from the review of sub-national road maintenance management practices, and presents proposals for the scope of future work to strengthen capabilities and practice in this sector.

The scope of services required that a comprehensive report of the review be prepared which describes the rationale behind the selection of the pilot locations and Terms of Reference for Phase 2.This report addresses the above, in support of which it incorporates:

• the basis for the selection of agencies for review, and the characteristics of the selected provinces and kabupatens;

• a summary of the main findings of the Phase 1 reviews, including opportunities and possible solutions aimed at developing maintenance management practices and processes in a further phase or phases of this project;

• a specific list of topic areas, key issues and proposed actions;

• a summary of the basis for the proposals, including pertinent information on review activities detailed in the supporting interim reports;

• a set of alternative scope options covering the defined goals and objectives of this activity, including consideration of support for each of the main building blocks of successful road asset planning and management, appropriate technology solutions and delivery. These are intended to establish a sound basis for the preparation of eventual grant and TA support leading to substantially improved road performance and maintenance.

Furthermore, this Phase 1 Report draws on an extensive, integrated review as required under the scope of services, in addition to the outcomes of the consultation workshops. This is because the nature of the issues and needs of the review agencies first needed to be better understood to help provide context for possible solutions, and to justify the proposed activities and approaches for Phase 2. Also, advice is provided on other activities which in our view will be necessary to help achieve the intended outcomes.

This report is one of the five reports for PKRMMP Phase 1, listed below.

Report	Contents
Interim Report 1A[1]	The status of early project consultation and selection of review agencies, and consultation workshop and questionnaire methodologies that have been used in Phase 1.
Interim Report 1B[2]	Characteristics of selected road networks, road maintenance funding needs and expenditures, and the detailed findings for Topic Area 2A – Needs, Practices and Capabilities.
Interim Report 2[3]	The detailed findings for Topic Area 2B – Procedures and Tools.
Interim Report 3[4]	The detailed findings for Topic Area 2C – Procurement and Support.
Phase 1 Report[5]	Consolidated findings from the review of sub-national road maintenance management practices, and presents proposals for the scope of future work to strengthen capabilities and practice in this sector (this report).

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[1] IndII (2010a)   PKRMMP Interim Report 1A – Status of Review of Sub-National Organisations, May 2010

[2] IndII (2010b)   PKRMMP Interim Report 1B – Findings of Topic Area 2A – Needs, Practices and Capabilities, August 2010

[3] IndII (2010c)   PKRMMP Interim Report 2 – Findings of Topic Area 2B – Procedures and Tools, August 2010

[4] IndII (2010d)   PKRMMP Interim Report 3 – Findings of Topic Area 2C – Procurement and Support, August 2010

[5] IndII (2010e)   PKRMMP Phase 1 Report – Review of Current Practice and Opportunities, September 2010

SECTION 2: SELECTION AND CHARACTERISTICS OF PHASE 1 REVIEW AGENCIES, PROVINCES AND KABUPATENS

2.1 SELECTION OF REVIEW AGENCIES

In selecting the provinces and kabupatens to be examined during Phase 1 of the project, consideration was given to the following:

1. provinces that had requested support from IndII – West Nusa Tenggara (known as NTB) and West Sulawesi;

2. kabupatens that expressed an interest in participating in the Phase 1 workshops;

3. provincial and kabupaten networks exhibiting both, below and above average condition characteristics;

4. representation from eastern and western Indonesia;

5. a combination of networks representing a) sealed pavements; b) unsealed pavements;

6. time and budget constraints of the project; and

7. advice provided by the DGH's Sub-National Road Facilitation Sub-directorate of Planning(RRFU).

A review was carried out of the summary data provided by the RRFU to review current condition characteristics, and these clearly identified that the kabupaten and provincial roads in NTB and West Sulawesi represent some of the worst conditions in Indonesia. The review also identified that these provinces also have a higher than average proportion of unsealed roads. Bali, which is located adjacent to NTB in contrast has roads in a relatively good condition with a much higher proportion of sealed roads, and was therefore considered a good contrast to NTB and West Sulawesi.

Because much of the work was to be carried out in Jakarta, it was considered that jurisdictions to be included from western Indonesia should be located as close as possible for ease of access and with advice from RRFU. The kabupatens selected from each of these provinces were those that showed interest to participate in the workshops which were organised in Jakarta and Mataram, NTB.

The resulting list of provinces and kabupatens reviewed are shown in Table 2.1. They include agencies from two provinces that showed interest at an early stage in project development, namely NTB and West Sulawesi, and agencies from three other provinces considered at the time to possess characteristics which would ensure a wide coverage of conditions at a local level. The condition summary which helped justify their inclusion is presented in the annex to this report.

Table 2.1: Provinces and Kabupatens included in Phase 1 consultation

Province	Kabupaten
West Sulawesi	Mamuju Utara, Mamasa
West Nusa Tenggara	Lombok Barat, Sumbawa, Dompu
Bali	Tabanan
Central Java	Cilacap
West Java	Bandung

2.2   COLLECTION OF NETWORK CHARACTERISTIC DATA

Characteristic data were sourced for the road networks managed by each agency for the review provinces and for **all non-urban kabupatens** within those review kabupatens[6], covering:

- Total road network lengths;
- road length by surface type; and
- road length by surface condition indicators.

The surface condition data comprises proportions of each provincial or kabupaten network classified as **Good**, **Fair**, **Poor** and **Very Poor**, according to consistent definitions of these classes applied to all networks. Also included are the classes **Stable** (the sum of the Good and Fair proportions) and **Unstable** (the sum of the Poor and Very Poor proportions). These terms are widely understood and used across National, Provincial and Kabupaten road management jurisdictions.

Population and GRDP per capita were also captured for each agency jurisdiction (province or kabupaten)[7].

The following discussion on network characteristics reports network condition in terms of the above condition descriptive classes, and uses the **Stable** condition proportion as a representative performance indicator for ranking relative condition performance across the review networks.

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[6] Data was compiled and supplied to the Phase 1 project team by DGH Sub-National Road Facilitation Unit, current to December 2009.

[7] Data was compiled by the project team from statistics researched at the GOI National Statistics Office.

2.3 NETWORK CHARACTERISTICS OF REVIEW AGENCIES

The total length of road network represented by all sub-national agencies participating in this review (the **review network**) is approximately 14,794 kilometres. The lengths of individual province and kabupaten networks, including the review agencies, are provided in Table 2.1, with the eight kabupatens representing approximately 6,636 kilometers, while the five provinces representing approximately 8,158 kilometers of network maintained.

2.3.1 Surface types

On an overall basis, close to three-quarters of the total length of network subject to review has sealed surfacing, with most of the remainder being various paved but unsealed, or unpaved formed roads. Only 4 percent of the review networks have been reported as unformed or similar tracks. **Asphalt** (or asphaltic concrete) constitutes around half of the review networks' surfacing.

However, as illustrated in Figure 2.1, at a review agency level, a considerable variation in the proportion of different surface types exists, with this also differing between provincial and kabupaten agencies.

Table 2.2: Length of road network by review agency

Province	Kabupaten	Review Agency	Approximate Length (km)
West Java	-	West Java	2,453
Central Java	-	Central Java	2,539
Bali	-	Bali	441
NTB	-	NTB	1,842
West Sulawesi	-	West Sulawesi	883
West Java	Bandung	West Java/Bandung	1,134
Central Java	Cilacap	Central Java/Cilacap	1,181
Bali	Tabanan	Bali/Tabanan	379
NTB	Dompu	NTB/Dompu	1,188
NTB	Lombok Barat	NTB/Lombok Barat	446
NTB	Sumbawa	NTB/Sumbawa	906
West Sulawesi	Mamasa	West Sulawesi /Mamasa	541
West Sulawesi	Mamuju Utara	West Sulawesi /Mamuju Utara	861

Figure 2.1: Proportions of surface type for review provinces
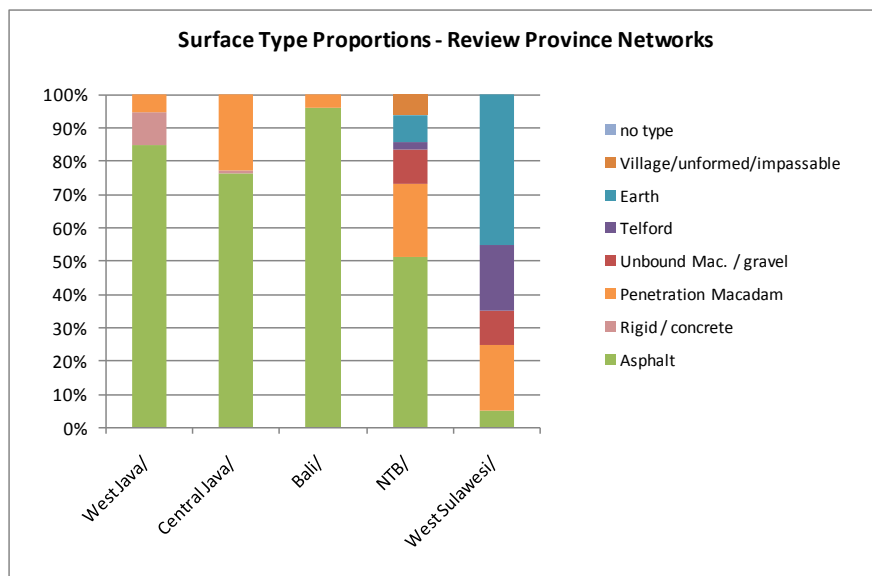
The provincial networks predominantly comprise the following sealed surface types:

- **Asphalt**
- **Rigid/concrete**
- **Penetration macadam**

The exception is West Sulawesi Province, which is approximately 25 percent sealed, and therefore presents as the most undeveloped of the review networks. West Java, Central Java and Bali Provinces are essentially fully sealed networks, and would require different maintenance treatments and priorities from those needed in West Sulawesi and West Nusa Tenggara.

Figure 2.2 shows that the kabupaten networks predominantly comprise the following unsealed surface types:

- **Unbound macadam/gravel**
- **Telford**
- **Earth**
- **Village/unformed/impassable**

The exceptions are Bandung Kabupaten (West Java), Lombok Barat Kabupaten (NTB) and Tabanan Kabupaten (Bali), which have 3 to 23 percent unsealed networks. Overall, the kabupaten networks present a wide range of mixes of surfacing types.

Mamasa and Mamuju Utara Kabupatens (West Sulawesi) present the most undeveloped networks, in terms of surfacing types, while Bandung Kabupaten (West Java) and Tabanan Kabupaten (Bali) present almost fully developed sealed networks.

Figure 2.2: Proportions of surface type for review kabupatens

Surface Type Proportions - Review Kabupaten Networks
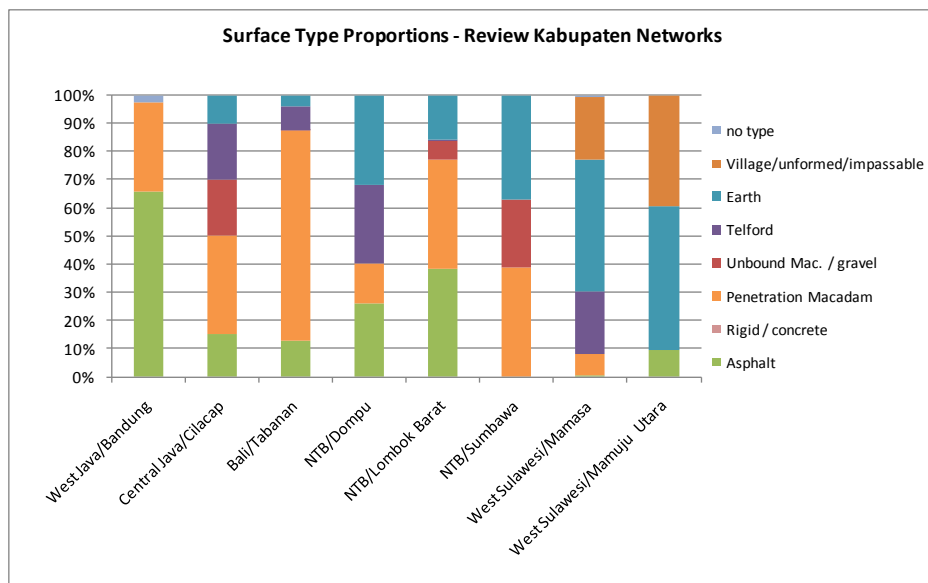
2.3.2 Road Network Conditions

Network conditions, in terms of the descriptive condition classes, are compared for review provinces in Figure 2.3 and for review kabupatens in Figure 2.4.

Figure 2.3: Comparison of road network conditions for review provinces

Network Condition Rating 2010
Review Province Networks

	West Java	Central Java	Bali	NTB	West Sulawesi
■ Very Poor	2.4	0.0	0.0	33.2	46.3
■ Poor	9.4	4.4	9.6	20.7	29.1
■ Fair	53.2	14.5	37.4	16.1	14.4
■ Good	34.9	81.0	53.0	29.9	10.2

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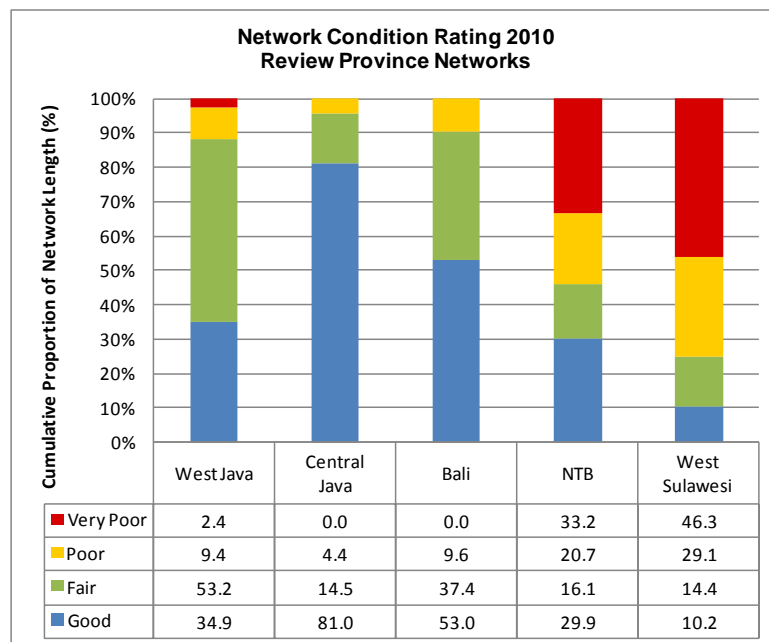
Figure 2.4: Comparison of road network conditions for review kabupatens[8]

Network Condition Rating 2010
Review Kabupaten Networks

	West Java/Bandung	Central Java/Cilacap	Bali/Tabanan	NTB/Dompu	NTB/Lombok Barat	NTB/Sumbawa	West Sulawesi /Mamasa
Very Poor	0.0	24.0	2.3	42.4	27.8	31.7	49.5
Poor	20.1	17.9	14.0	20.1	21.7	25.5	24.1
Fair	4.1	12.0	50.7	13.6	20.2	24.7	9.3
Good	75.8	46.1	33.0	23.8	30.3	18.1	17.1
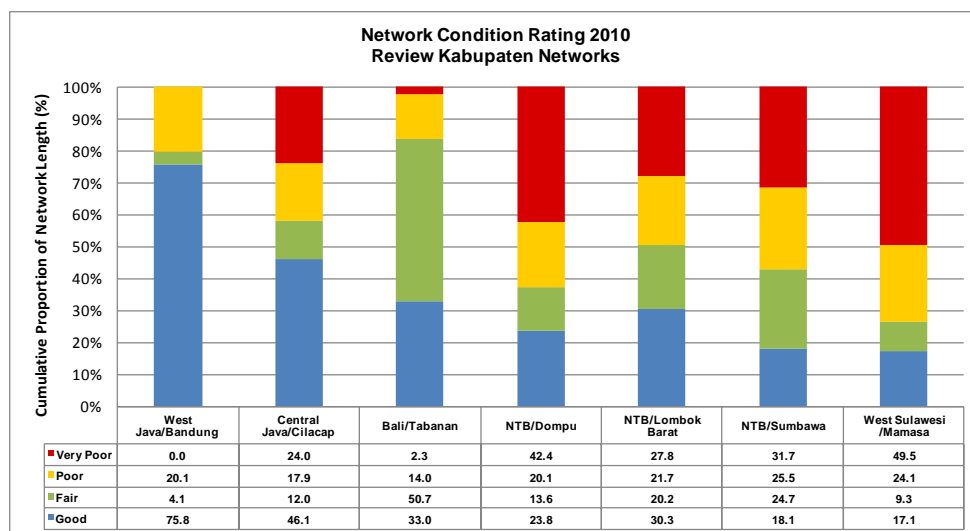
Taken together, the review agency networks exhibit a wide range of network conditions, offering good potential for selecting networks and agencies to participate in pilot implementations of improved approaches to systematic management of maintenance.

In terms of the **Stable Condition** rating as a network performance indicator, review province networks and kabupaten networks are compared in Figure 2.5 and Figure 2.6 respectively.

Figure 2.5: Stable Condition ratings for review provinces

Stable Condition Rating
Review Province Networks

	West Java	Central Java	Bali	NTB	West Sulawesi
Stable Condition	88.2	95.6	90.4	46.0	24.6

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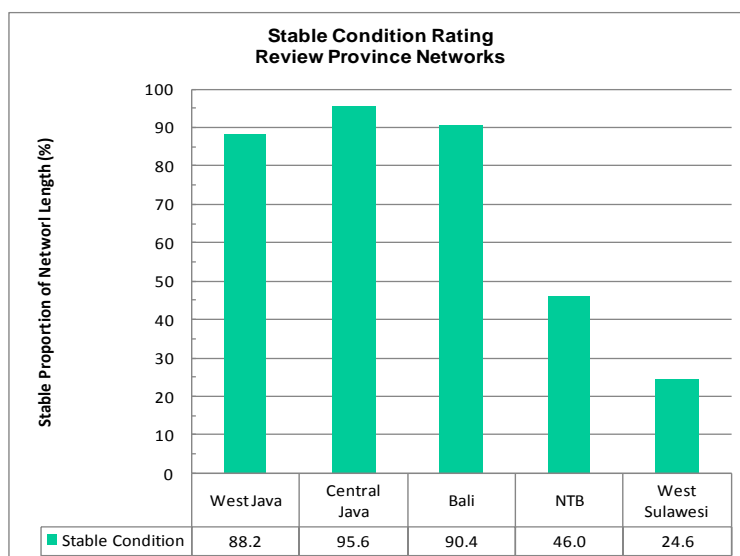
[8] Mamuju Kabupaten is excluded from most condition summaries because of the short length of road (36 km) for which condition data was available.

Figure 2.6: Stable Condition ratings for review kabupatens
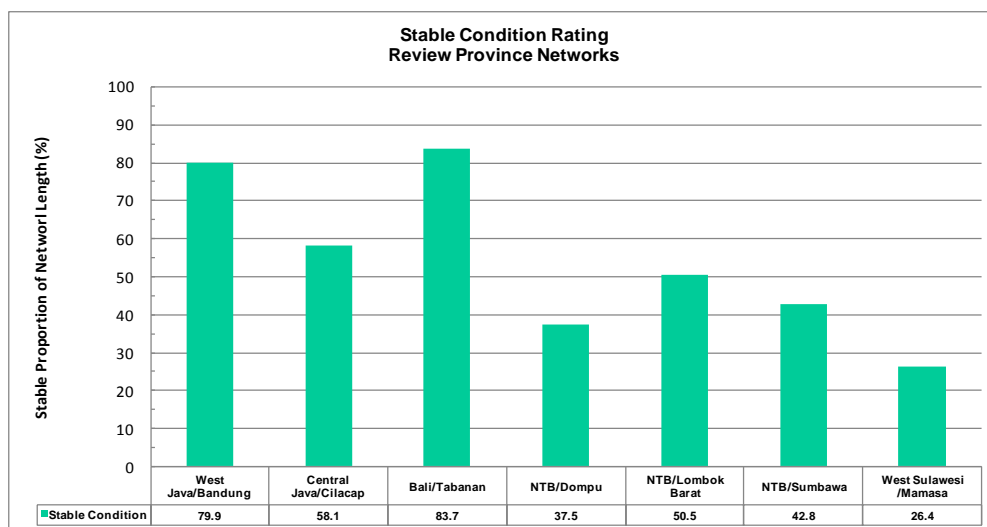
The provinces with the highest condition performance (West Java, Central Java and Bali) are also the provinces that have predominantly sealed networks. West Sulawesi, with the lowest condition performance, also has the lowest proportion of sealed network.

As evidenced with the review provinces, the condition performance of kabupaten networks tends to reflect the proportion of sealed surfaces in these networks.

2.3.3 Network condition, replacement value and productivity

Analysis of relationships between network condition, replacement value and productivity of the region served by the road network can provide a means to assess the comparative "health" of road networks, in relation to the productivity demands that the region places on its road transport infrastructure, and to the ability of a region to preserve and develop its economic infrastructure.

A general analysis of the ratio of asset replacement value (ARV) and productivity was carried out in 2006 by an earlier project, and produced the results shown in Figure 2.7.

The concept, which draws on work undertaken for the Asian Development Bank9, is based on ensuring a road network is in reasonable balance with the economy, considering all public road networks, i.e., national, provincial and kabupaten. This is typically achieved where the Ratio of Assets to GDP is between 0.2 and 0.4, and is consistent with findings from many developed countries. Where the ratio is greater than 0.4, maintenance of the asset base is likely to eat into other funding needs,

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9 Wood, W G and Metschies, G (2006) Road Asset Management Technical Assistance Consultant's Report for the Asian Development Bank, March 2006.

including basic social services, and trying to maintain such a network may be doomed to failure unless a sufficient economic base can be established. For regions where the ratio is less than 0.2, an undersupply may exist, whilst economic capacity is likely to be sufficient to support a significantly greater asset base. Such undersupply is also likely to act as a brake on economic development. The concept is also founded on the need to invest regularly in road assets, at a rate of the order of 2.5 percent of its replacement value per year. Consideration of the sufficiency of current funding based on this norm is addressed later in this report.

Figure 2.7: Ratio of GDP to road asset value for Indonesian provinces (DGH 2006 study findings[10])
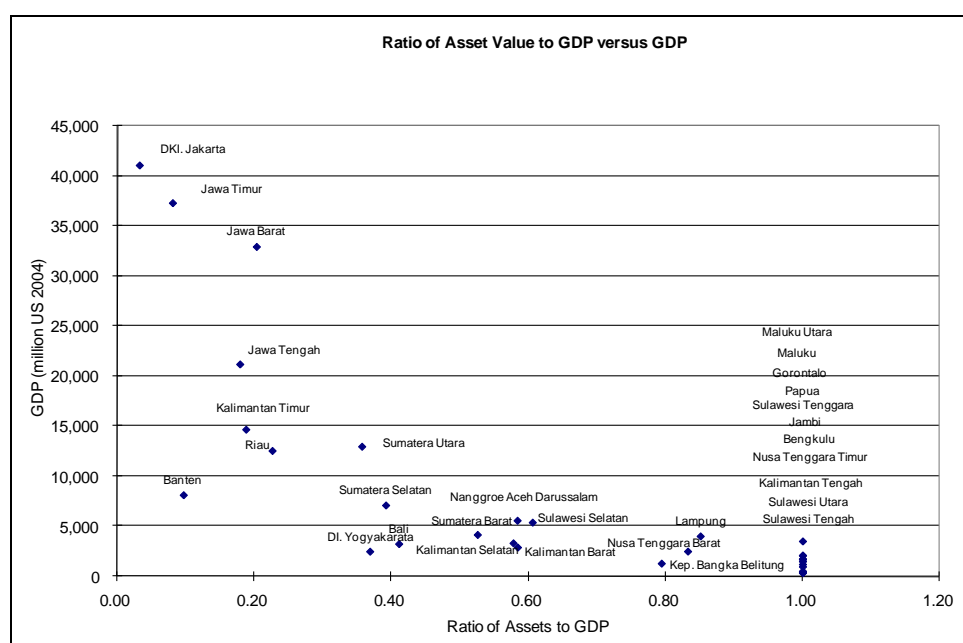
The above figure provides a relative basis for a broad assessment of economic sustainability at a provincial level. A classification of the respective review provinces is shown in Table 2.2 in accordance with the above discussion, together with specific provincial and kabupaten GDP data.

Figure 2.8 and Figure 2.9 illustrate the relationship between the stable condition rating and Gross Regional Domestic Product (GRDP) per capita for the review province and review kabupaten networks respectively.

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[10] W G Wood, Personal Communication (2010)

Table 2.3: Classification of GDP and GDP to asset value by review location

Province	Review jurisdiction	GDP per head of population (Rp) (H, M, L)	Ratio of GDP to road asset value
West Java	Whole of Province	14,309,520 (H)	Borderline under supply
West Java	Bandung	12,674,125 (H)	
Central Java	Whole of Province	8,541,304 (M)	Borderline under supply
Central Java	Cilacap	18,583,064 (H)	
Bali	Whole of Province	14,198,733 (H)	Borderline insufficient economic base
Bali	Tabanan	9,531,998 (M)	
NTB	Whole of Province	4,985,784 (L)	Insufficient economic base
NTB	Dompu	6,660,785 (M)	
NTB	Lombok Barat	4,693,651 (L)	
NTB	Sumbawa	6,500,168 (M)	
West Sulawesi	West Sulawesi	7,534,953 (M)	Insufficient economic base
West Sulawesi	Mamasa	8,170,320 (M)	
West Sulawesi	Mamuju Utara	9,369,734 (M)	

Figure 2.8: Relationship between Stable network condition and GRDP for review provinces
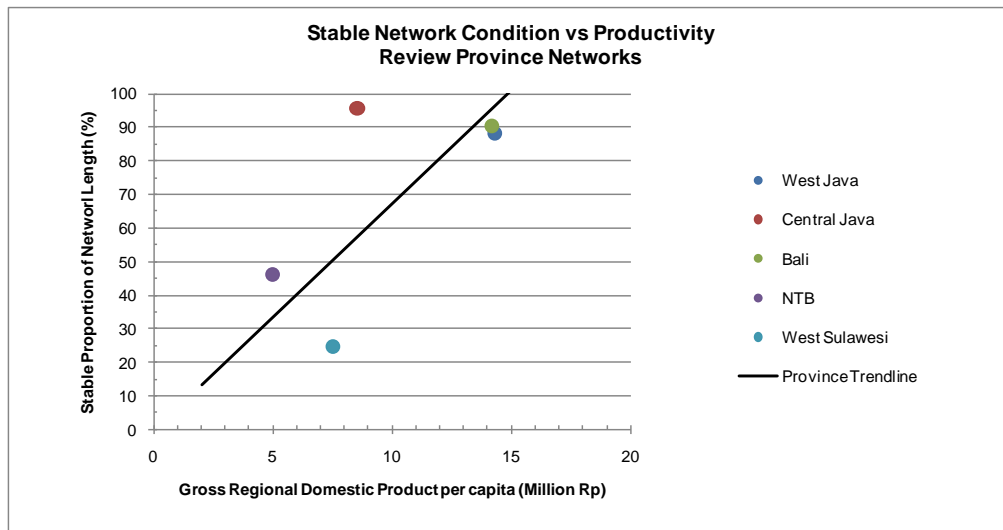
Figure 2.9: Relationship between stable network condition and GRDP for review kabupatens
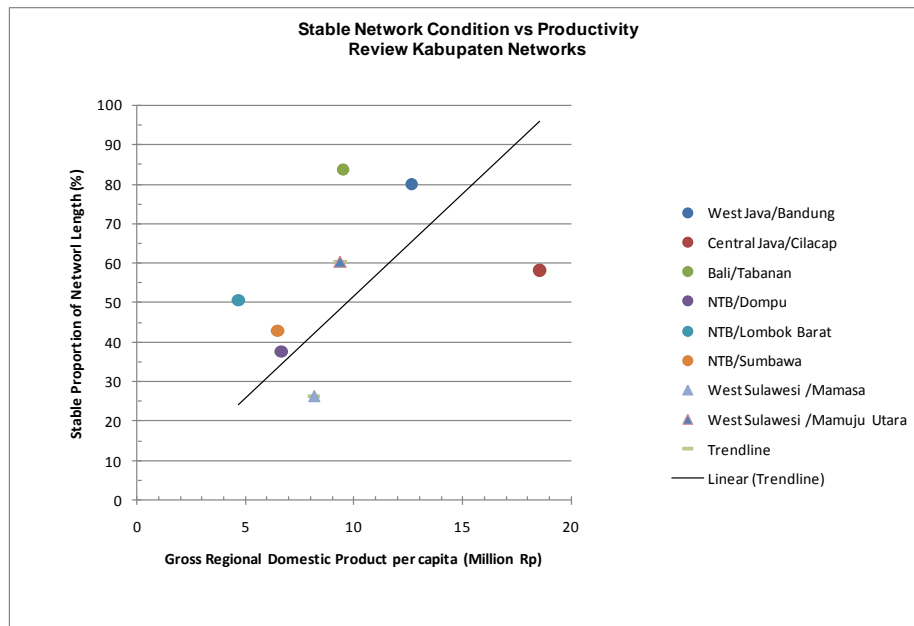
The individual review data points are supplemented with a least squares trend line for the data population. Data points above the trend line may indicate 'better than average' agencies, in terms of their ability to maintain and preserve their road network within the region's productive capacity, and/or networks which have received greater historical investment.

Overall, considering both provincial and kabupaten roads, Bali and NTB agencies are placed the highest above the trend, whereas West Sulawesi is consistently below the trend. The remaining agencies straddle the trend.

It is important to recognise that any inference of ranking of agencies using this information relates to the overall management environment that has resulted in the current network performance. Thus, better performance may be a result of greater attention to road infrastructure in the past (for example through greater development and preservation investment, or through better quality of past designs and construction/maintenance works). Similarly, better performance may be a result of better current maintenance management practices and funding achievements.

However, the data illustrates a general relationship with GRDP, but also the possibility of "better than average" maintenance management performance by the agency where data points lie above the general trend. Further consideration of this data and reported investment trends is discussed later in this report.

2.3.4 Summary characteristics

On the basis of the above statistics, the characteristics of the review jurisdictions display significant variety and confirm the findings of the review at the time of selection, providing a sound basis for further study, as follows:

- Different surface types are well represented, with the sealed road proportion varying between 100 and 25 percent, and 90 and 25 percent for the provincial and kabupaten agencies respectively. Unpaved earth roads represent a significant proportion of a number of networks.

- Stable road conditions vary between 95 and 25 percent, and 80 and 25 percent for the provincial and kabupaten agencies respectively.

- The ratio of road asset value to GDP for the review provinces suggests that capacity to support a sustainable and sufficient network varies considerably, with cases of insufficient economic base (two out of five), borderline insufficiency/adequacy (one) and sufficient capacity/undersupply (two).

- Better-than-average performance was shown by two provinces based on being significantly above a trend based relationship between GRDP and the proportion of stable network conditions.

PROVINCIAL AND KABUPATEN ROAD MAINTENANCE MANAGEMENT PLANNING

SECTION 3: CHARACTERISTICS OF ROAD MAINTENANCE FUNDING NEEDS AND EXPENDITURES

3.1 COLLECTION OF ROAD MAINTENANCE FINANCIAL DATA

Financial data, characterising maintenance funding needs and current expenditure has been collected in two ways. Initially, data on funding needs and current expenditure were obtained for each of the maintenance types:

- routine maintenance;
- periodic maintenance/resurfacing; and
- reconstruction/overlay/widening

through questionnaire responses and the consultation workshops. This data was obtained for the 2008 and 2009 financial years.

Subsequently, a more consistent and controlled collection of financial data was made, in collaboration with staff of the review agencies, to source the following financial data from national, provincial and kabupaten allocations and financial records for each of the 2008 and 2009 financial years.

- Maintenance funding needs
  - o routine maintenance;
  - o periodic maintenance/resurfacing; and
  - o reconstruction/overlay/widening.
- Current maintenance expenditure
  - o routine maintenance;
  - o periodic maintenance/resurfacing; and
  - o reconstruction/overlay/widening.
- Road sector funding allocation/budget plan

This data was sourced by the review agencies. Funding needs data were also sourced from the maintenance planning tool or method used by the agency (for example SK77, Indonesian Road Management System [IRMS] or manual methods)[11]. Expenditure data were sourced from various allocation sources – National Budget (APBN), National Budget Specific Block Grant (DAK), National Budget General Allocation Block Grant (DAU), National Budget Adjustment Fund, Provincial Budget (APBP1), Kabupaten Budget (APBD2), Grant, and P2TPD (Initiatives for Local Government Reform) Program.

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[11] Note the reported needs analysis utilises project estimates by the study team as described in 3.2.5 below. The information reported by the review agencies is compared with study results in 3.5.

These latter data sets have been provided by all review agencies except for West Sulawesi Province, the two West Sulawesi kabupatens, and Cilacap Kabupaten (Central Java Province), for which responses have not been received. Where possible in these cases, the financial data obtained through the questionnaire process has been used in the analysis of financial characteristics discussed below. No financial data has been received from West Sulawesi Province from any source.

3.2 DERIVED FINANCIAL MEASURES

The financial and network data obtained has been used to calculate the following derived financial performance measures, which have been used to compare the financial performance aspects of maintenance management in the review agencies.

3.2.1 Funding Demand/Supply Ratio

This ratio is calculated as

$$FDS\,Ratio = \frac{Maintenance\ Funding\ Need\,(Demand)}{Maintenance\ Expenditure\,(Supply)}$$

High ratio values (greater than 1) indicate that funding demand exceeds supply, implying that maintenance needs are not being fully met each year, and that a maintenance backlog exists. Ratio values less than 1 indicate that the expenditure level is higher than known maintenance needs. This can occur if unpredictable emergent expenditure is required or if expenditure budget is being inefficiently allocated.

3.2.2 Maintenance Need/Roads Funding Ratio

This ratio is calculated as

$$Needs\,Ratio = \frac{Maintenance\ Funding\ Need}{Total\ Road\ Funding}$$

The Needs Ratio represents the proportion (as a percentage) of total road sector funding that is needed to meet all maintenance requirements in any year. A Needs Ratio of 100 percent means that all road sector funding is needed for maintenance. Values greater than 100 percent indicate the extent of unmet road maintenance needs.

3.2.3 Average Cost Rate

This measure is calculated as

$$Average\ \ Cost\,Rate = \frac{Annual\ \ Maintenance\ Expenditure\,(per\ maintenance\ type)}{Road\ Network\ Length}$$

The Average Cost Rate can be used as an indicator of maintenance efficiency that can be compared against international norms, and is expressed in this report in units of USD per kilometre. For example, in South East Asian economies, routine maintenance of roads would be delivered efficiently at an Average Cost Rate in the range USD 2,000 per km to USD 3,000 per km, and periodic maintenance in the range USD 4,000 per km to USD 6,000 per km.

In applying these figures to actual real situations, consideration should be given to the issue of whether a backlog exists, whether there is a lack of adequate quality roads and the mix of sealed versus unsealed roads with the above figures being typical of network with predominantly sealed roads. The norms also assume the roads in question are in a reasonably stable state, and are fit for purpose in terms of access standards.

3.2.4 Other measures

In addition, two further measures have been introduced, as follows:

- ARV, where this is the full value of reconstruction of the pavement, surfacing and ancillary asset features. For the networks concerned it varies from USD 300,000 per km for an asphalt surface provincial road, to USD 10,000 per km for a formed earth track.
- Estimated backlog, representing the value of the renewal works required to bring poor and very poor roads into an as-new condition. For this, an assumption has been made that roads in a poor condition require a treatment equal to one third of their ARV, whereas a road in a very poor condition requires the full ARV to be invested.

3.2.5 Unit cost rate based on a percentage of asset value

An alternative estimate of budget need can be provided by relating the annual maintenance investment to a proportion of the ARV. The European Union recommends that a target of between 2 and 2.5 percent of the value of current assets should be allocated annually to routine and periodic maintenance[12]. This target – 2 to 2.5 percent of ARV per annum – has been suggested for use as a norm for a sustainable maintenance budget (Wood & Metschies 2006)[12].

On the basis of ARV for the provincial networks reported here, an acceptable average annual cost rate would range between approximately USD 1,200 per km and USD 7,400 per km, with the value varying depending on the characteristics of the network. The lower value represents a network where 75 percent of all roads are unsealed, whereas the higher value represents a network with 100 percent of all roads sealed. The latter,

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[12] Wood, W G and Metschies, G (2006) Road Asset Management Technical Assistance Consultant's Report for the Asian Development Bank, March 2006.

therefore, closely represents the norm quoted in Section 3.2.3. The weighted average value was approximately USD 5,700 per km per year, this being affected by the mix of road types on each network[13].

Whilst the above figures may be suited for general comparisons, the nature of kabupaten networks warrants consideration of their specific needs and the transport demands that they serve. This is because for circumstances of low demand where lower access standards may be appropriate, including provision of basic access, meaning the ability for a standard vehicle to pass on most days of the year. Such concepts have been widely applied in other countries and are the subject of international guidance[14]. The maintenance cost implications therefore differ.

On the basis of maintaining the status quo in terms of surface type and utilising 2.5 percent ARV as a typical annual maintenance cost, the norm for kabupaten roads is approximately USD 1,600 per km per year. This is approximately 30 percent of the figure quoted above, based on an analysis of provincial roads data, with a wide spread of values from approximately USD 600 per km to USD 4,100 per km, reflecting the actual characteristics of the network.

The majority of comparisons made between current funding and needs are therefore reported based on weighted average cost rates per agency for the specific network composition, i.e., as an **independent** estimate of needs. This was deemed to be a more consistent basis for estimating needs for the purposes of this study, although broad comparisons with agency supplied needs are also provided in 3.5.

3.3   OVERVIEW OF FINANCIAL CHARACTERISTICS OF ALL REVIEW AGENCIES

3.3.1 Provincial Financial Characteristics

Average Cost Rate indicator results for routine and periodic maintenance combined are compared for the review provinces in Figure 3.1[15]. The orange data represents the independently estimated cost rate, on a needs basis.

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[13] These figures are based on a number of broad assumptions. Given the closeness to published norms a figure of USD 7,500 per year for routine and periodic maintenance would seem reasonable for an established network.

[14] See Lebo and Schelling (2001), Design and appraisal of rural infrastructure: ensuring basic access for rural communities, World Bank Technical paper 496, the World bank, Washington D.C., and Toole, Morosiuk, Petts and Done (2001), Management guidelines for unsealed roads, TRL Report PR/INT/230/01 for UK Department of International Development, TRL, Crowthorne, UK

[15] In a number of cases, data for particular maintenance types is absent, e.g. for West Sulawesi, whereas the 2008 data for Bali appears low. In the latter case the actual roads budget for both 2008 and 2009 are reasonably similar, but the balance of treatments differ with more reconstruction in 2008.

Figure 3.1: Comparison of routine maintenance and periodic maintenance needs and expenditure cost rates for review provinces
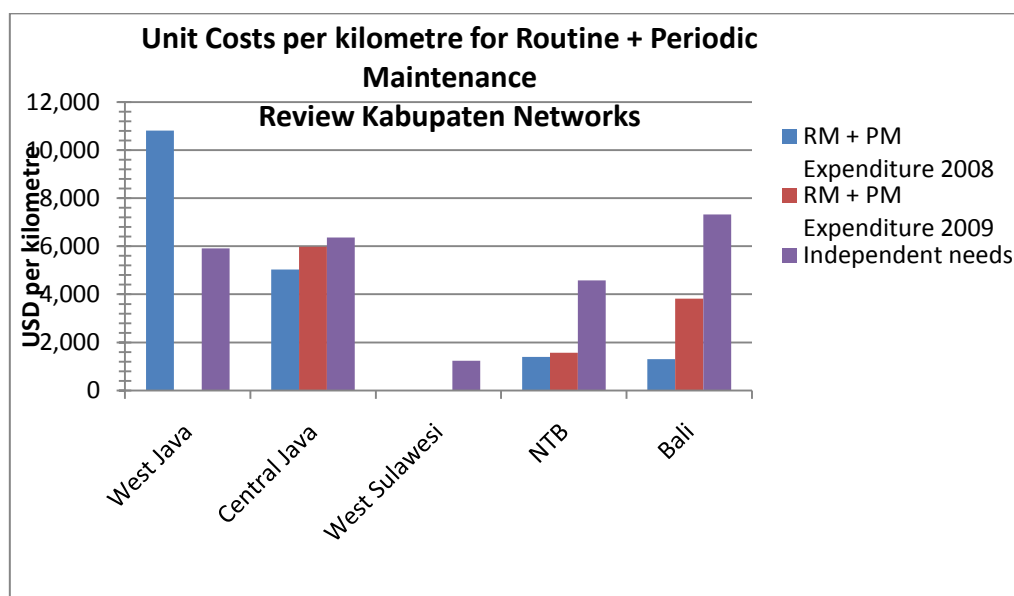
For West Java and Central Java, the average expenditure based cost rates for identified routine maintenance and periodic maintenance needs are reasonably close to international norms (USD 6000 to USD 9000 per km) for the costs of efficient delivery of combined routine and periodic maintenance[16], with Central Java being closest to the value derived from the independent analysis performed under this study. The average expenditure cost rates for routine maintenance and periodic maintenance needs for Bali and NTB are low compared with the norms. For Bali this may be a result of use of the assignment of too high a replacement value, or due to other factors, such as the province has been more successful in managing its road maintenance needs; and/or the network has received greater or more recent historical investment; or traffic usage is less or climate less aggressive. For NTB, this is most likely a result of underfunding, noting that the extent of unstable road condition is significant.

The relationship between funding demand (maintenance needs) and funding supply (maintenance expenditure) for the review provinces is illustrated in Figure 3.2 for routine and periodic maintenance based on actual routine and periodic maintenance expenditure, and total road expenditure.

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[16] See the definition of Average Cost Rate in Section 3.2.3

Figure 3.2: Funding Demand/Supply Ratio – routine and periodic maintenance for review provinces
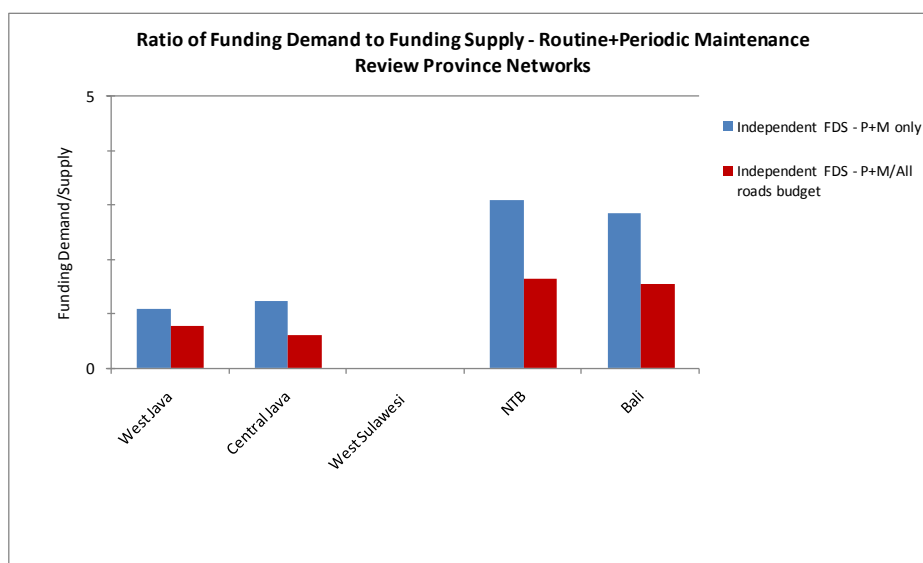
West Java has a need close to its expenditure for solely routine and periodic maintenance. Central Java's need is 20 percent higher, whereas NTB and Bali require approximately 200 percent more to meet their needs. The overall average need is some 50 percent higher than current routine and periodic maintenance expenditure.

Where the denominator is changed to the Total Roads Expenditure, routine and periodic maintenance needs range between 60 and 140 percent of the Total Road Expenditure, with an average of 120 percent. This is an important finding as it implies that if spending was prioritised to address routine and periodic maintenance first, available funds would meet the majority of needs.

The ratio of the estimated backlog, i.e., the investment amount to restore roads in a poor and very poor condition, and asset replacement value is shown in Figure 3.3. West Sulawesi and NTB face the greatest challenge; with backlogs equal to between roughly 40 and 50 percent of the asset value, whereas the remaining provinces have backlogs of the order of 1 to 6 percent of asset value. Whereas in the former cases needs are many times the average annual cost rate for routine and periodic maintenance, in the latter cases they are at most only two to three times the annual costs rate. Whilst there is the risk that this may be an over-estimate, again resulting from simplifications in the analysis, the results clearly indicate a very significant difference in the extent of backlog across the various locations, both low and very high.

Figure 3.3: Ratio of Estimated Backlog to Asset Value for review provinces
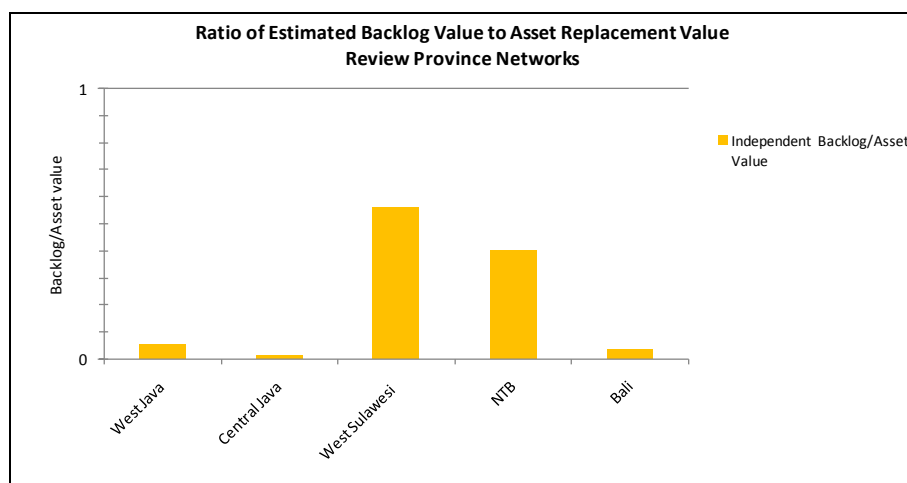

3.4 KABUPATEN FINANCIAL CHARACTERISTICS

Average Cost Rate indicator results for routine and periodic maintenance combined are compared for the review provinces in Figure 3.4. The orange data represents the independently estimated cost rate, on a needs basis.

Figure 3.4: Comparison of routine and periodic maintenance needs and expenditure cost rates for review kabupatens
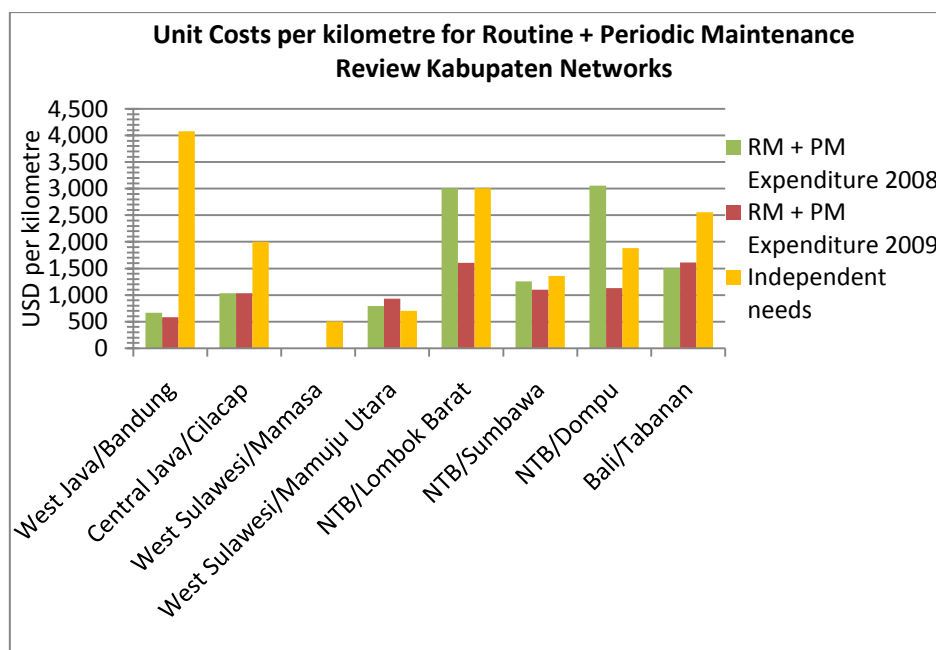
In terms of average cost rates, with the exception of West Java, most kabupatens show that their needs for routine and periodic maintenance are close to the budgeted expenditure.

The relationship between funding demand (maintenance needs) and funding supply (maintenance expenditure) for the review kabupatens is illustrated in Figure 3.5 for routine and periodic maintenance based on actual routine and periodic maintenance expenditure, and total road expenditure. For most agencies, total routine and periodic maintenance needs are between 10 percent below and 90 percent above current expenditure.

Where the denominator is changed to the Total Roads Expenditure, routine and periodic maintenance needs range between 45 and 130 percent of the Total Road Expenditure, with an average of 60 percent. This suggests that kabupatens could potentially fund all their routine and periodic maintenance needs from their existing roads budget. This, however, would be dependent on the application of appropriate access standards, particularly not over investing, and that the assumptions made here prove to be valid. The biggest risk is that the current surface types cannot reasonably meet demand. Confirming this requires an independent field data driven quantification of needs.

Figure 3.5: Funding Demand/Supply Ratio – routine and periodic maintenance for review kabupatens
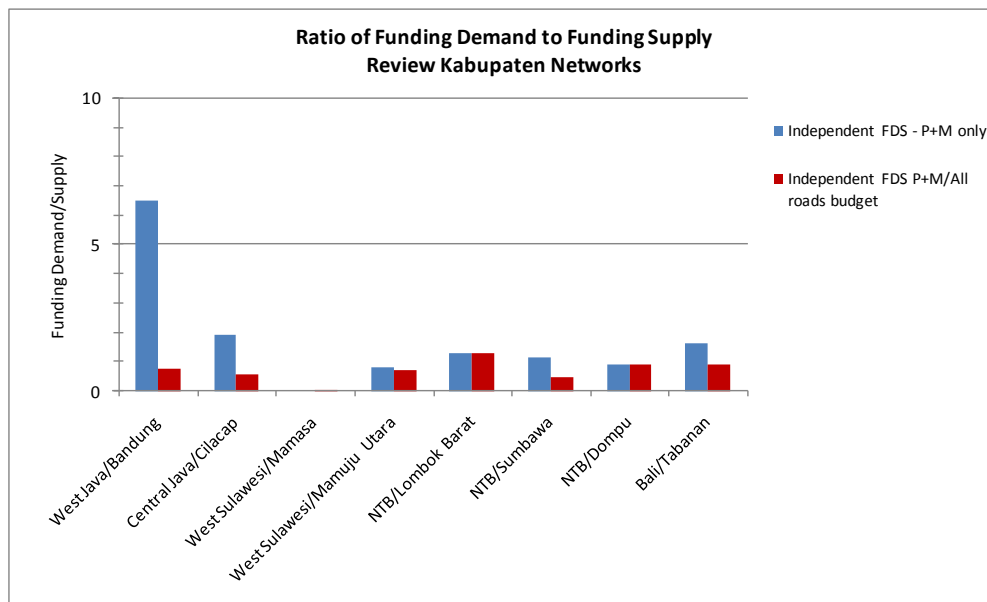
The ratio of the estimated backlog and ARV for kabupatens is shown in Figure 3.6. Significant differences exist, with both relatively low values and very high values.

3.5   ESTIMATE OF TOTAL NEEDS

An estimate of total needs, representing the sum of the routine and periodic maintenance needs and the estimated backlog, has been determined for both provincial networks and for kabupaten networks.

Totals needs for provincial networks represented in this study are approximately 4.4 times the available road sector budget for the respective agencies. The corresponding figure for kabupaten networks is 5.7, with an overall weighted average figure of 4.8.

The review agency estimates for provincial and kabupaten networks are 1.7 and 7.9 times the respective road sector budgets, with an overall weighted average of 3.1, whereas the total required routine and periodic maintenance budget based on the reported independent analysis is approximately 75 percent of the current roads sector budget.

Figure 3.6: Ratio of Estimated Backlog to Asset Value for review provinces
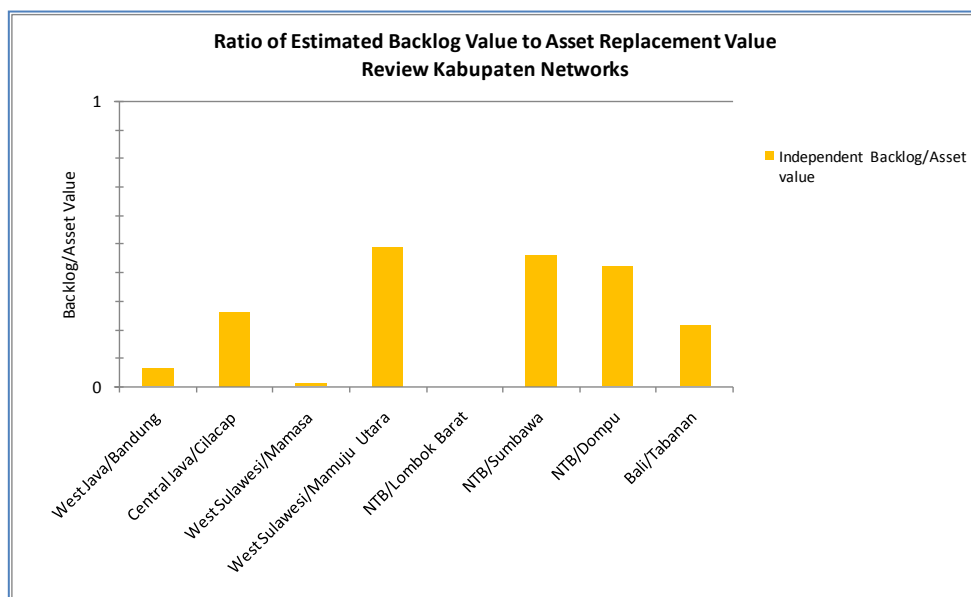
Significant variation in total needs also exists on a location by location basis. As noted earlier, the methods employed in this study and by the agencies themselves differ. However, the overall quantum is similar, i.e., the total initial (year 1) need is for an investment of between three and five times the current funding. Possible reasons for differences are likely to include:

- The assumptions used in this study, particularly those related to ARV and backlog estimates, may not reflect field conditions where road widths and pavement thickness needs, etc. could differ.
- This study assumed current surface types were appropriate, whereas this may not be the case.

- Individual views on whether more or less maintenance or renewal is required.

Finally, achieving clarity on needs requires a fully quantitative analysis supported by independent field condition and construction data, and traffic data. This should form part of the proposed Phase 2 activity, details of which are provided in section 5.

SECTION 4: SUMMARY OF FINDINGS AND RECOMMENDATIONS

4.1   REVIEW FINDINGS, OPPORTUNITIES AND SOLUTIONS

A detailed summary of the review findings, and identified opportunities and solutions are presented below against the specific outputs listed in the Phase 1 Scope of Services, activity components (Section 2: Review of selected sub-national agencies). Each required output is first summarised, and the findings summarised followed by recommendation(s).

4.2   NEEDS, PRACTICES AND CAPABILITIES

4.2.1 Funding needs, expenditure and sources

> **Output: Identify road maintenance funding needs, current expenditures and sources and availability of funds, in the context of overall local government expenditures and sources of funds.**

The financial characteristics of the review agencies have been examined in terms of comparisons of maintenance funding needs and actual expenditure, and of normalised average cost rates, which can be compared with international norms for efficient management of road maintenance.

The following general observations were drawn:

- Substantial backlogs of unmet maintenance needs exist for both provincial and kabupaten agencies.
- The overall ratio of Funding Demand/Supply (FDS) for all maintenance across all review agencies is around three to five, i.e., removing the backlog and providing sufficient funding for a sustainable maintenance regime would require an initial injection of a four-fold increase in current funding. If necessary, this could be spread over several years depending on funding availability.
- The imbalance between funding needs and actual expenditure is more challenging for kabupaten agencies than it is for provincial agencies, with the overall average FDS ratio for kabupaten agencies being 30 percent higher than the corresponding value for provincial agencies.
- For those provincial agencies with more developed networks, the average cost rate for maintenance funding needs compares well with international norms (based on an annual need of 2.5 percent of ARV). The corresponding values for less developed networks are significantly lower, reflecting the network composition and likely maintenance demand.

- The independently derived average cost rates for kabupaten networks are substantially lower than those for provincial networks, and international norms, because kabupaten networks can tolerate lower design standards and levels of service for lower traffic loading demands. Consequently, as indicated above, the affordability imbalance between funding demand and supply is not as great as that reported by the individual agencies for kabupaten networks. Nevertheless, the lack of maintenance funds and consequent maintenance backlogs remain as severe problems for kabupaten networks. Furthermore, application of appropriate holding treatments (sub optimal but adequate solutions) and staging investment over a number of years could reduce upfront costs for all networks.

- For ongoing routine and periodic maintenance considered together, the total funding need is some 75 percent of the current total road funding budget. Thus, if maintenance backlogs could be substantially reduced or eliminated through provision of additional funds, and available road funding gave priority to maintenance, the possibility of funding sufficiency exists. This assumes no network expansion or additional capacity, i.e., through upgrading.

- The ratio of road asset value to GDP for the review provinces suggests that capacity to support a sustainable and sufficient network varies considerably, with cases of sufficient capacity/undersupply (West Java and Central Java), borderline insufficiency/adequacy (Bali) and insufficient economic base (NTB and West Sulawesi).

- Better-than-average performance was shown by two provinces, namely Bali and NTB, based on being significantly above a trend based relationship between GRDP and the proportion of stable network conditions. This is despite NTB's position of having amongst the highest FDS ratios.

- Finally, as noted in section 3.5, differences exist in the reported needs by review agencies and the independent analysis by the study team, and the latter has been given more weight. However, on an overall basis, the results are reasonably similar with this study suggesting a five-fold shortfall in funding, whereas the collective responses from the review agencies suggest a possible three-fold difference. Possible reasons for differences have been noted, including the data used, key assumptions related to asset value and maintenance costs, and the relationship between road condition and backlog renewal costs.

> **Recommendation(s):**
>
> 1. Significant initial investment required to return roads to a maintainable and operational condition, with likelihood of a substantial reduction in road user costs, although needs vary by location.
>
> 2. Application of appropriate access standards/design guidelines and use of holding treatments would minimise investment cost whilst delivering appropriate service levels.
>
> 3. At current levels of maintenance demand relative to total road sector allocations, priority for routine and periodic maintenance should take precedence over rehabilitation and reconstruction.

4. Consistent encouragement of appropriate maintenance policies is required and should be accompanied by capable personnel and appropriate decision support tools for investment prioritisation, and by comprehensive and consistent attention to awareness-raising at technical, senior management and political levels.

5. Further analysis of funding sources over a longer historical basis is warranted.

6. A fully independent analysis of needs using actual field data should be undertaken as a key component of the proposed pilot studies, given the significant variability between reported needs and expenditure by type of works, this being particularly acute for kabupatens.

4.2.2 Maintenance management practices

Output: Review and detail current maintenance management practices, and examine the implications of different strategies by which these might be strengthened.

Findings were as follows:

- In general terms, maintenance management practices in both provinces and kabupatens follow methodical lines, in which there is reliance on the collection and use of network data to assess needs and to inform decision processes. However, provincial practices tend to be more systematic and consistent across agencies, than those practices used by kabupatens.

- The planning methodologies used (IRMS and SK77) mostly relate to prioritisation of major works, and therefore may be missing both essential routine maintenance and preventative works, and greater awareness of the latter is required.

- Basic access improvement has been judged as the most important driver of maintenance for all respondents across all review agencies. Generally, asset preservation has been judged the least important driver of the four choices. In the majority of responses, transport efficiency has been assessed as more important than safety.

- Respondents provided a long list of consequences of funding needs exceeding maintenance expenditure. The consequences have been classified against these four maintenance drivers and detailed in an accompanying report17.

- Discussion with central DGH confirmed a high priority and commitment to safety, including through the changes resulting from the 2009 Road Transport Law, and of asset preservation, the latter being the subject of a major new regulation which is under preparation to implement a Road Preservation Fund.

- Regulations exist related to desirable levels of service, e.g., for maximum roughness levels and journey speeds, with these differentiating between roads with different functions, demand, etc., and provide a basis for improving practices should they be applied widely. However, they are not globally accepted

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[17] See Interim report 1a.

particularly amongst key non-technical cadres, e.g., in the Ministry of Home Affairs (MoHA). This is slowing the development and therefore dissemination of consistent policy.

- The possibility of greater coordination between line ministries and jurisdictions to achieve greater synchronisation of planning for a 'core' strategic network is also the subject of a draft Presidential Instruction. DGH is currently engaged in preparing advice on the subject. If followed at a provincial level, and on the understanding that it includes rational selection criteria, it could provide a solid basis for prioritisation and maximising the benefits of road infrastructure investment. Such cross (political) constituency planning could also help achieve a better overall balance, and more robust justification, in investment choices.

> **Recommendation(s):**
>
> 7. Achieving greater consistency in addressing priority outcome areas, much of which is increasingly captured by national regulations and related guidance, is essential. To mainstream improvements, this could best be addressed by a comprehensive, agreed policy statement and accompanying guidelines which address the range of circumstances faced in practice and clearly articulate how road maintenance management should be planned and delivered for different circumstances.
>
> 8. The policy guidance should be established in cooperation with all affected parties, including other ministries, e.g., MoHA, and representatives of review agencies, and be accompanied by an awareness raising program. It should elaborate on the benefits of appropriate standards and asset preservation, and be accompanied by case study examples which illustrate how consistent application can deliver improved outcomes to communities.
>
> 9. That asset preservation was ranked lowest by review agencies suggests a lack of awareness or misunderstanding of what is required to establish sustainable maintenance. Whilst this is most likely exacerbated by current backlogs, it demonstrates a clear need for a concerted program of awareness raising and training to socialise and mainstream good practice.
>
> 10. The planning methodologies (IRMS and SK77) employed mostly relate to prioritisation of major works, and therefore may be missing both essential routine maintenance and preventative works, and greater awareness of these is required. Both of the latter works types are essential to effectively comply with current and future regulations, and need to be given significant emphasis in any future support.

4.2.3 Adequacy and strengthening of human resources

> **Output: Review the adequacy of human resources (HR) in the sector, and ways by which these might be strengthened**

PROVINCIAL AND KABUPATEN ROAD MAINTENANCE MANAGEMENT PLANNING

Findings were as follows:

- DGH's Rural Road Facilitation Unit has a recognised role in a nationally coordinated local road information–sharing forum which was established in 2009, involving all provinces. This is a technical rather than political forum and is aimed at facilitating the adoption of best practice within the sector, including an integrated cross-road hierarchy/jurisdiction approach to network planning and management.
- DGH is also in the process of socialising draft new regulations on asset preservation.
- Overall, responses from the review agencies indicated the need for greater priority on improving HR capabilities (knowledge and skills) than on improving HR capacity (HR numbers), with specific feedback as follows:
  o Highest priorities for capability improvement are planning/budgeting skills, works supervision, engineering skills, management skills and planning/ budgeting tools and data.
  o Favoured strategies included management training, technical training, improved supervision of works, improved technical procedures, externally funded TA and recognition of skills.
  o The favoured opportunities include technical information sharing, consistent standards of designs and works, collaborative prioritisation across networks, collaborative pooling of funds, sharing skilled work teams and collaboration between community maintenance initiatives.

Recommendation(s):

11. The existence of the RRFU and the national forum to which it contributes provides access to the target agencies, and its operation and development should be supported given its formal role and the access it has to experienced trainers and practitioners.

12. However, to address the wider need to socialise best practice with a strong link to community outcomes, consideration should be given to supplementing the RRFU resources by engaging practitioners who can articulate the socio-economic benefits of the maintenance and development of rural transport infrastructure. Such capacity exists within Indonesia.

13. Whilst the overall priorities determined by the review agencies are reasonable, the specific content needs to be agreed. Suggested areas which complement the recommendations in this report and national priorities include:

   – supporting appropriate standards and corresponding levels of investment through better planning and prioritisation procedures;

   – reducing funding constraints, including avoiding use of maintenance funds for asset restoration or improvement;

   – strengthening support for essential routine and preventive maintenance. Examples exist from best practice, including the 'must do' and 'stitch in time' policies of many international agencies, both of which are consistent with current policy directions.

4.2.4 Delivery of routine maintenance

<div style="border:1px solid teal; background:teal; color:white; padding:8px;">
Output: Review and provide recommendations on the delivery of routine maintenance
</div>

Findings were as follows:

- Across all agencies, the primary method of maintenance delivery varies by the type of maintenance. Routine maintenance is delivered primarily using internal workforces, often supplemented by temporary labour from surrounding communities. The same trend is reported by both review provincial agencies and Kabupaten agencies.

- Periodic maintenance and reconstruction/overlay/widening projects are almost universally delivered by contract.

- Standard, rather than project-specific contract forms are preferred in the review agencies. The most common documentation forms comprise standard Conditions of Contract and Bill of Quantities. Simpler contract forms, based on unit cost rates and standard work methods, also exist.

- For periodic maintenance and other major works, third-party consultant supervisors are used in the majority of circumstances, whereas internal works supervisors perform routine maintenance supervision. However, in the latter case concerns exist that the level of internal supervision has decreased over the last two decades, with a possible serious impact on performance.

- Whereas DGH is in the process of initiating a trial fully outsourced performance based maintenance contract, the possibility of outsourcing routine maintenance on a widespread basis is seen as being problematic from a workforce/social perspective.

- Where a road link is subject to a periodic maintenance or betterment contract, all maintenance within a contract period, including routine maintenance, is the responsibility of the contractor. Contracts may also be multi-year and funded from various sources, thus providing the potential for a possible gradual shift to outsourced maintenance.

- The findings of the independent review undertaken as part of this project emphasised the following:
  - Irrespective of the delivery model, routine maintenance needs to be conducted to achieve basic road performance objectives to minimise hazards, loss of access and preserve assets. This requires specific attention to defining hazards, asset risks, inspection regime, and response framework (termed 'maintenance standards'). Such a system forms the basis of the 2009 Road Traffic Law, and is consistent with international practice. However, early reports suggest it is not well understood or applied by many local agencies, but it is providing an incentive to improve overall performance.
  - For such to work effectively, a competent management/supervision structure is essential. This could initially be operated through a government agency although the pilot operation of an outsourced or independent management

unit should be considered, noting the absence of effective supervision capability amongst local agencies (iv) above).

o   In the medium to long term, delivery arrangements for routine (and emergency) maintenance should preferably be contracted to the private sector, with arrangements for engagement of sub-contractors and the community for delivery of specific tasks.

o   Whilst transition away from government agencies is desirable, as the overall task of establishing efficient business units is likely to detract from other imperatives including the establishment of properly functioning planning and management units, it needs to be considered in a pragmatic manner. Experience from Malaysia and South Africa provide two relevant examples where a transition has been relatively effective.

o   Where contracting is pursued, appropriate hybrid forms of contract should be established which combine elements of PBCs and schedule of rates contracts, with a payment system based on a combination of outputs and outcomes. Examples have been applied in a number of countries in the region, including Papua New Guinea18 under AusAID support which was shown to be very effective.

o   Potential advantages exist in combining the scope of maintenance contracts to include both routine and periodic maintenance, the aim being to provide an incentive to minimise life cycle costs. However, industry capacity to achieve this is uncertain, with the first PBC on National roads yet to be implemented. Furthermore, significant challenges remain in the governance of road contracts, as evidenced from the early findings of the EINRIP audit program19, and significant improvements are required in the sector to allow more confident risk transfer.

o   Consideration should be given to TA or training schemes which include support to delivery organisations, as opposed to the traditional TA provided only to government agencies. This is also understood to form a component of the EINRIP program, and has been key to successful sector development in other countries.

> **Recommendation(s):**
>
> 14. The effective enforcement of prescribed maintenance standards as defined in the 2009 Road Traffic Law should be given priority. This will require introduction of independent surveillance/oversight arrangements and would be a useful step towards transitioning to fully commercial delivery arrangements. It will require operational units to build their capacity and understanding in meeting obligations.

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[18] See Key Roads for Growth Maintenance Project (KRGMP), AusAID support to the maintenance of the Highlands Highway, PNG.

[19] Eastern Indonesia National Road Improvement Project, or EINRIP, is a joint GoI and Government of Australia infrastructure improvement program. A technical and financial audit of the program is underway and holds some interestingly lessons for future projects.

15. The current practice of allowing contractors to take full responsibility for the maintenance of road links subject to contract works provides an entry point for greater contractor involvement. The opportunity should be taken to trial this as a basis for establishing an alternative to current maintenance delivery arrangements in cooperation with provincial-based agencies.

16. A wider review of the potential for greater private sector involvement is required, but should be timed so that it benefits from the results of the proposed trials.

4.3   PROCEDURES AND TOOLS

Output: Review the availability and current use of guidelines and procedures to support all aspects of road asset management, including:

- **tools and procedures for planning, programming and budgeting for annual works program including the use of LVRMS as the main planning tool for road maintenance planning in local governments,**

- **procedures used for the preparation of designs; the adequacy of current contract documents; procurement and contracting; construction supervision; etc.**

Findings were as follows:

- For planning, programming and budgeting:
  - Most agencies (with some exceptions, for example in West Sulawesi) show reasonably mature approaches to maintenance management procedures, in which both systematic (tool outputs, historical trends) and social/political/higher authority (community pressure, political expectation, higher government direction) functions play important roles.
  - IRMS dominates in provinces and SK77 in Kabupatens.
  - Provincial agencies tend to operate with the systematic functions playing the major role, while in Kabupaten agencies the social/political/higher authority functions tend to be more dominant, although not necessarily predominant.

- For design:
  - Design tool outputs are the primary influence, but significant differences between provincial design decision making and Kabupaten design decision making influences exist between both agency groups.
  - In provincial agencies, the systematic functions (design tool outputs and historical trends grouped together) have the greater influence.
  - In Kabupaten agencies, social/political/higher authority functions have the major effect on design decision making.

- Key observations (by study team):
  - Emphasis on social, political and higher authority influences in the decision making processes require targeted awareness raising activities covering technical, senior management and political / legislative audiences.
  - Awareness raising activities should build on the Community of Practice Forums that has been developed nation-wide by the DGH RRFU.
  - Kabupaten procedures appear to be more variable and have less availability and access to quality data on their networks than the provinces do. Easy access to relatively simple data should be an important component of strengthening of Kabupaten procedures and tools.
  - West Sulawesi Province and its Kabupatens consistently stand out as the least capable in terms of procedures and tools, and may not be fully aware of, or less motivated to apply procedures and tools in use elsewhere.
  - Whereas the most popular current tools support prioritisation for mainly asset restoration, they are weak in terms of essential routine maintenance and preventative maintenance. They are also mainly based on conventional economic prioritisation. This then leads to a possible conflict with community wishes.
  - The LVRMS has the potential to assist in that it contains a selection of alternative prioritisation procedures, including both 'Social points score' and 'Cost effectiveness' priority indicators. Taken alone, these latter indicators can help formalise community input, and also better capture the factors not captured within conventional cost benefit analysis.
  - Understanding where best to apply different indicators is key, as no single set of rules is appropriate for all circumstances.
  - Considerable design guidance exists at least for sealed roads, and is likely to be strengthened through a parallel IndII initiative on reviewing road design standards and preparing a guideline for application of design standards to each class of National roads.
  - A likely significant gap is in the design of appropriate low volume roads, although both national and international guidance is available which could be adopted, and which is consistent with recommendations on planning and prioritisation procedures.
  - The adequacy of contract documentation, procurement, contracting and supervision is understood to be the same irrespective of circumstances, including the standard of infrastructure and the capability of the target supervision and delivery teams.

Recommendation(s):

17. There is an urgent need to increase the awareness of the political community to rational decision making processes, and to ensure these include appropriate socially oriented safeguards through direct engagement and consultation, and extending the Community of Practice Forums by the DGH RRFU.

18. There is a need to ensure consistent application of appropriate procedures and tools amongst all agencies, particularly so at a kabupaten level where capacity and/or motivation to employ these is weak. This could benefit from a re-statement (suitably updated) of the previous regulations which in the past brought about more consistent usage, e.g. of SK-77.

19. Updated procedures and tools should include appropriate project selection and prioritisation criteria suited to the class of infrastructure under evaluation and which support desired policy outcomes. A number of solutions exist which are well founded on international practice, but these need to be articulated and applied in case study examples which clearly illustrate appropriate use.

20. Any planning procedures should consider adapting, rather than re-inventing, the MTEF framework which exists in Government and is currently subject to significant IndII support[20], and was previously reviewed under EIRTP-1 PPBP.

21. Whilst considerable design guidance exists in Indonesia particularly with respect to national roads, there is a need to review and consolidate this in an easily accessible set of resource materials for low volume, rural transport infrastructure. This could draw on national and international practice for which specific examples are available.

22. As a general rule, analysis of alternative maintenance policy options should be a regular feature of periodic and annual program reviews. This would also be a beneficial component of any case studies used to increase awareness of the benefits of effective road maintenance and investment programs.

23. Addressing minimum data needs for different levels of planning by developing appropriate guidance and encouraging well resourced and regular data gathering exercises.

4.4   LEGAL AND REGULATORY FRAMEWORK, PROCUREMENT AND SUPPORT

4.4.1 Legal and regulatory framework

Output: Review current laws and regulations that might affect or limit the use of PBCs or output-based grant funding of maintenance expenditures (by GOI or by other agencies such as AusAID)

Findings were as follows:

- Good prospects to allow wider use of PBCs or output based grant funding, and a new set of regulations are under preparation including the revitalisation of the Hibah Daerah capital grants system and on-lending by GoI to the regions. The support from IndII to the Hibah system in the water sector is a much quoted example; the intention of which is to provide a funding instrument which can accept and respond to proposals from the regions and which funds performance

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[20] William Paterson and Gandhi Harahap, Application of Medium-Term Expenditure Framework and Performance-Based Budgeting in Directorate General of Highways Indonesia, IndII Study Report, March 2010.

based output contracts, with funds paid when satisfactory output based standards are achieved.

- The Hibah system differs from the current DAK system, which although tied to agreed investment projects, no national supervision of the program implementation is allowed; this being the responsibility of the regional government. The DAK system has also been increasingly underfunded in recent years, and the proposed Hibah system offers greater certainty of funding including a mechanism for on-granting and on-lending with the possibility of drawing on contributions from international development agencies. A draft regulation is in preparation.

- Whereas output based grant funding has been applied in the water sector to deliver operating water supply infrastructure, no specific examples are available in the roads sector in Indonesia. However, similarities can be drawn between the objective of an output based investment and the normal periodic maintenance and betterment contracts applied by DGH, i.e., a product (renewed or refurbished asset) is delivered which is then available for continued use by the public. This could provide the potential for application within the roads sector, for example by restoring roads to a maintainable condition, a pre-requisite for the establishment of a sustainable road network.

- However, whilst seemingly possible, specific constraints exist which may limit their effective application and the delivery of intended outcomes, such as:
  o absence of well defined grant application/business case preparation guidelines, and the responsibilities of central and local agencies;
  o absence of defined specifications, contractual forms and tendering processes, and responsibilities of central and local agencies;
  o concerns over the likelihood of an effective post-completion maintenance regime;
  o lack of institutional experience and capacity within central and local agencies and industry;
  o issues associated with responsibilities lying with other agencies, e.g., Ministry of Communications, which impact effective road management, such as:
    ▪ control of vehicle access and overloading;
    ▪ management of road related assets including for lines and signs, traffic and road safety management.

- Opinions also differ on where funding should be targeted, delivered and managed, for example:
  o Should it only address initial renewal or provision?
  o How can it be used to reward the ongoing upkeep of roads, and network wide needs such as supporting an agreed core network?
  o What funding contribution should be sought from local governments?
  o Should it be used as an overall package covering renewal and maintenance, either as part of an extended warranty or PBC?
  o What management, supervision and audit arrangements should exist?

4.4.2 Performance based contracting

Output: Review the relative merits of different approaches to contracting.

Key findings of international review were as follows:

- Organisational change involving client-supplier separation, with formal agreements between the parties, is necessary regardless of who does the physical work.

- Successful delivery models exist which range from traditional day labour to fully outsourced performance-based lump sum contracts with terms up to 10 years.

- Setting and enforcing appropriate performance specifications which help allocate risk between parties appropriately, and set realistic measurable performance criteria for particular assets which take due account of the duration of the contract and any unrealised risk. This includes provisions which ensure minimum remaining service lives of assets, particularly where a long contract term is awarded.

  o Funding Mechanisms: Stable, usually multi-year, funding is essential.

  o Competition is more important than privatisation, with clearly specified and enforced maintenance standards.

  o Packaging of contracts will affect the extent of competition, and the trend is towards large contracts and large contractors leading to economies of scale.

  o Management of change: In-house units can transfer successfully to the private sector, providing the staff is fully consulted on the changes. Private

contractors and consultants can play a greater role in road maintenance with support and training.

- o Cost savings: The introduction of competition, particularly subjecting in-house units to competitive tendering, has resulted in significant cost savings up to 20 per cent.

- Experience in other countries has shown that the need for longer term strategic management of the network covering all facets of investment and performance is driving change, where the network owner retains substantial responsibility working in partnership with network managers and service providers. This has led to the introduction of integrated alliance-style models.

- Corporatisation of former internal works organisations has introduced a new level of professionalism and competition amongst maintenance contractors, with many authorities choosing to retain an internal workforce but within a new business oriented environment.

Recommendation(s):

28. The requirement is for comprehensive and consistent advice, consistent with much of the foregoing recommendations, which:

   – promotes stable, multi-year funding to ensure a market exists;

   – ensures asset maintenance is given priority and funds are not 'raided' to fund capital intensive works;

   – supports clearly specified and enforced maintenance standards and activities;

   – encourages change in delivery from internal workforces to contract;

   – ensures long term strategic management of a core economic network covering all facets of investment and performance is driving change;

   – fosters mature, cooperative behaviour between the client-supplier;

   – supports capacity building in the public and private sectors.

29. A gradual process of change should be encouraged by piloting alternative delivery arrangements supported by comprehensive planning.

4.4.3 Technical and HRD support

Output: Review possible roles of and opportunities for external agencies (DGH; Association of Local Government Engineers) to provide technical and HRD support, and most appropriate form of TA support for such "pembinaan".

Key findings were as follows:

- The most attractive support opportunities are:
   - o inter-government (National/Provincial/Kabupaten) communication;
   - o training and awareness;
   - o sustaining funding capability;

- o sustaining decision-making capability; and
- o sustaining technical capability.
- Support opportunities exist including the DGH Rural Road Facilitation Unit coordinated national forum, and capacity also exists in other organisations, e.g., university sector on socio-economic content.
- Though not discussed extensively, the following solutions have merit:
  - o Establishing formal accredited training courses in the range of subject matter relevant to road maintenance management and planning, perhaps initiated by a train-the-trainers led program to build delivery capacity.
  - o The possibility of introducing greater provincial leadership, similar to the Regional Road Group concepts in Australia, should be pursued.
- Technical and HRD TA support is most appropriate in developing a cadre of technical and management staff with a deeper understanding of solutions, and support to awareness raising and training activities covering all target groups including policy makers and political/community leaders.

Recommendation(s):

30. Build on the established RRFU and national forum by promoting a program of accredited training and a cadre of trainers, the core of which exist in DGH, amongst consultants and universities.

31. A comprehensive awareness raising and training program, and accompanying training resources materials, is required for all once clear policies and procedures and tools are available. This should be done irrespective of whether a particular agency is engaged in future pilot trials.

32. A cadre of accredited trainers should be established who are capable and motivated to undertake formal and on the job training. This could be initiated through a train the trainers program, and establishment of a trainer register.

4.4.4 Needs of different provincial and kabupaten agencies

Output: Throughout the review, identify the extent to which the findings are expected to vary by the circumstances of each local government.

Key findings were as follows:

- Whilst specific conditions and requirements differ, with significant obstacles evident in some agencies and fewer in others, the solutions are for the most part common to all.
- Detailed project information exists across the range of topics covered under this activity to help focus on follow on support.

Recommendation(s):

33. A coordinated and prioritised approach to meeting overall needs of different agencies is required, in which extremes should be considered, i.e., not just the best, or easiest.

34. For the most part the solutions are common, but the extent of support will need to differ between agencies, with some needing more basic introduction to road maintenance management practices than others.

    Finally, as noted earlier, the key to success will be an agreed comprehensive maintenance policy, complementary guidelines, and funding instruments and resources to help support change.

4.5 KEY ISSUES AND ACTIONS

The findings and recommendations fall into a number of distinct topic areas, which formed the core of the review activities, and key issues and actions against these are summarised in Table 3.1.

Table 4.1: Key issues and actions

Topic area	Key issues and actions
Needs, practices and capabilities	Develop an agreed maintenance policy to cover: • appropriate access and maintenance standards, and performance indicators, • focus on safety and asset preservation, • a 'core' network, covering priority regional roads from national, provincial and kabupaten networks, • funding mechanisms which aim to address the backlog and provide for sustainable maintenance at least on a core network, • clarification of regulatory and management responsibilities for road related assets and vehicle access, • complementary planning, programming and budgeting procedures and gap analysis guidelines for road maintenance, renewal and improvement. Increase awareness of basis for proposed policy focus (see above) amongst stakeholders. Improved management and technical capacity in key areas to support policy objectives.

Topic area	Key issues and actions
Delivery of routine maintenance	Introduction of measurable maintenance standards. Study of the transition of government owned and operated road maintenance units to commercial businesses.
Procedures and tools	Adapt existing planning tools to better address planning priorities for low volume roads, including alternative socio-economic criteria. Extend design procedures and technology guidelines for low-volume rural transport infrastructure.
Performance based maintenance	Application of output based grant funding to reduce backlog on agreed core network. Development of appropriate guidance and contract for the preparation and delivery forms for outcome based road renewal and maintenance contracts. Extend contract forms and procurement guidance to RTI, including scope for community participation. Improved private industry capacity in the planning, supervision and delivery of maintenance. Pilot implementation of the use of 'hybrid'-type contracts for performance based maintenance at a provincial and kabupaten level.

The above key issues and actions emphasise the following:

- **The need for a strong policy-driven environment**. Even though agencies and individual managers may take initiatives, sustainability is only likely to be achieved with strong policy support. This requires clear articulation of performance objectives in terms of measurable outcomes and a supporting framework of clearly defined responsibilities, funding and procedures supported by stakeholders, and the necessary understanding and capacity amongst managerial and technical teams. Policies need to reflect reality, and provide a clear basis for addressing funding constraints including focusing investment on a sustainable 'core' network.

- **A commitment to clearly defined maintenance standards and their successful delivery**. This reflects the concept of 'duty of care' owed to road users which requires agencies to exercise their maintenance powers to protect (the users) from foreseeable harm, much as intended by the 2009 Road Traffic Law. Failure to effectively manage the maintenance of roads (and road-related assets) to an appropriate and affordable standard places authorities in a position of liability. Fulfilling this requirement demands that road asset planners and managers have processes and defendable plans in place to demonstrate their intent to act responsibly. Ensuring successful delivery goes hand in hand with the existence of capable delivery organisations whose performance is measured against defined standards, and which is enhanced by the clear separation of client and supplier. Furthermore, to achieve long term improvements, a significant change in delivery capacity is needed, with the private sector being the most likely source.

- **Supportive planning procedures, tools and cost effective solutions**. It is important that procedures and tools support policy objectives, thus allowing planning and prioritisation to proceed in a manner which is consistent with intended outcomes. Thus, for example, those parts of the network and interventions for which conventional economic based evaluation and prioritisation are deemed relevant would be subject to such, whereas for other applications alternative procedures would be employed. Examples of the latter include the setting of minimum maintenance and access standards, noting that these should be specified and reviewed infrequently, and the selection of projects and project alternatives for low volume roads which, in many circumstances, do not lend themselves to conventional benefit cost analysis. It is also well known that particular technology solutions can significantly affect economic efficiency and minimise costs; and yet many of these may not be well known or may have been rejected by practitioners. Examples include spot improvement strategies for basic access, use of sprayed bituminous seals and local resource-intensive solutions which have, in many cases, fallen into dis-use.

- **Building capacity in outcome based delivery.** Having set policies, standards and procedures which help facilitate the better delivery of outcomes, the key need is to ensure that delivery happens as intended. This has not been a strong point in Indonesia, with poor performance affecting National roads as well as others. It is not simply a matter of expenditure, but of overall effectiveness. A significant cultural change is required. This area is also perhaps the most controversial, but it is well known that an evolutionary approach is most suited and can deliver successful outcomes. Simple examples include outsourcing basic routine maintenance activities to local contractors and communities, as opposed to the wholesale devolution of the long term management and performance of the full asset. Notably, Malaysia has been successful in contractor development, but has not extended to full performance specified network management, and road authorities in Australia are now aiming to achieve a better balance in the roles played by private industry and the agencies. Furthermore, sustainability is more likely to take place where funding is stable and a market is created, since this provides an opportunity for investment and lower risk to those entering. Therefore, delivery capacity needs to be supported by appropriate funding mechanisms, including a means to removing backlogs through, for example, output-based grants, thus creating conditions where local funds might stand a chance of being channeled to maintenance.

Finally, the above ideally needs to comprise a package of actions and support, as on an individual basis they would not address the full range of inputs necessary to make a significant impact. Further explanation of the need for each individual component, and sources of best practice, is given in the accompanying reports.

4.6 CRITICAL ISSUES FOR FUTURE SUSTAINABILITY

Many review findings relate directly to possible options for future work in Phase 2 of the PKRMMP Project. However, in the course of the review, a number of issues have been identified as critical for the sustainability of maintenance management practices in sub-national agencies beyond the life of the PKRMMP Project.

4.6.1 Funding demand and supply

Issues of funding demand and supply have been raised already in this report. The FDS Ratio results confirm with some certainty that very large maintenance backlogs exist in all review networks, but particularly in kabupaten networks. Unless and until a better balance is achieved between the need for maintenance and the affordability of maintenance (that is the funding ratios are reduced towards unity), then the backlogs will remain, and the probability of success of systematic, prioritised management of maintenance will be continually compromised.

Stronger maintenance policy implementation, in a context of national and sub-national planning frameworks will be required to achieve sustainable change in the relationship of maintenance funding and supply.

For example, recent asset management policy changes introduced in Australia across all governance levels for public infrastructure require the existence of 10 year Asset Management Plans linked to associated 10 year Financial Management Plans. These aim to demonstrate that future asset management activity can be afforded, and that the value of public infrastructure assets is being preserved.

Similarly, the introduction of Regional Road Groups is a move to strengthen public accountability for affordable prioritisation of works, and also to strengthen local submissions to government for funding.

4.6.2 Funding certainty – multi-year

An important component of those maintenance policy initiatives will be to achieve greater certainty or predictability of maintenance funding supply into the medium term (say five to 10 year). This will require multi-year planning, programming and budgeting processes applied consistently at both national and sub-national levels. The trend towards multi-year road investment planning processes is now widespread internationally. Commonly, the multi-year period will consist of "committed" and "indicative" years (for example two years committed and three outer program years indicative).

4.6.3 Strengths in current practice

All review participants (having technical and lower to middle management roles) were well aware of the process, issues and challenges involved in road maintenance management, and showed willingness and enthusiasm to strengthen their practices. A lot of frustration was expressed around the flaws in present practice, particularly in relation to having well thought out budget submissions, yet these were not effective in influencing budget allocations. The presence of a positive attitude to do better is, without doubt, a strength in the current practice.

Indonesian road management practice, mainly at national level, now has a long history of taking an "evidence-based management" approach to asset management, which relies on periodic collection of data on asset inventory, condition, usage, and costs. The commitment to asset data collection has also existed at sub-national levels, but not with the same rigour. Availability of road asset data and of decision support tools is a strength that can be built on in the Phase 2 work.

4.6.4 Challenges in current practice

Challenges identified in the review include the following:

- The large differences between funding demand and supply tend to force a systematic planning and budgeting process to fail, because effective maintenance treatments become unaffordable and good practice is seen as being ignored in the decision making process.
- Lack of effective maintenance policy settings and supporting implementation strategies.
- Achieving a better balance in decision-making compromises between "systematic" decisions and "political/higher authority" decisions.
- Lack of consistency in practices
    o Existence and use of documented procedures.
    o Existence and use of functional and design standards that are sensitive to the context in which they are used.
    o Use of decision support tools.
    o PPB timeframes.

4.6.5 Cultural changes (procedural, organisational and gender issues)

- Developing a shared vision of future practice.
- Planning for the transition to the future state, and managing the intellectual and emotional impacts.
- Scope can be considered in Phase 2 for awareness raising activities – resource materials and forums.

4.6.6 Cross-agency issues

- Road maintenance planning should be more tightly integrated into national and provincial planning processes, allowing, for example, coverage of strategic planning responsibilities at national level; strategic and tactical planning responsibilities at provincial level; and operational planning and implementation at kabupaten level. Such a cascading hierarchy of planning responsibilities would imply significant responsibility changes for DGH and provincial administrations.

- Greater consistency is required for the definition and use of standard procedures, classification standards, maintenance intervention standards and design standards for provinces and kabupatens. These standards should not necessarily be uniform standards, but should be sensitive to similar contexts of type of road use and traffic demand.

4.7 CROSS-CUTTING THEMES

4.7.1 Gender issues

Encouraging representation of women has been achieved among the participants across the two workshops – four women in 43 of total participant numbers, or approximately one in 10. Three of the four women participants are engineers actively involved in maintenance management or implementation functions in their positional roles. The fourth female is a staff member of the DGH Sub-directorate for Rural Road Facilitation, which is the counterpart organisation for Phase 1 of this project.

A gender ratio of one female engineer/technician in 10 engineering/technical roles is not uncommon in many countries and cultures, and there is plenty of room for improvement. There will be opportunities in the future phases of this project, and subsequent to this project, to actively encourage participation by women in technical, change management and communication roles in the project team(s) and in counterpart teams. It is also important that participation of women is actively encouraged from the participating agencies in consultation workshops and in awareness and training activities.

4.7.2 Environmental issues

Evidence was observed by the project team of the adverse consequences of poor or non-existent routine maintenance, in terms of environmental impacts on both the road environment and adjacent rural land use, and also social impacts of dust and drainage issues on quality of life and safe access to villages.

The quality and timeliness of maintenance activity can have positive and negative consequences on the road and adjacent environments. The effects can also be directly as a result of the activity (for example air quality and access disruption during works) and indirectly (such as the impact of traffic-generated dust on adjacent village life,

scour of unprotected road-making materials into adjacent fields, and access disruption resulting from poorly maintained or repaired lateral and cross-drainage.

Effective maintenance standards (type and quality of work, and timeliness of maintenance intervention) should take into account good practice to minimise environmental impacts.

SECTION 5: FUTURE SCOPE OF WORK – PHASE 2 AND BEYOND AND SELECTION OF CANDIDATE AGENCIES

5.1 INTRODUCTION

This section sets out a proposed revised scope of Phase 2 of this project, which builds on the preliminary scope of Phase 2 work provided in the project Terms of Reference and the various findings and recommendations resulting from this review, outlined in Section 4.

It also identifies a number of additional areas of activity that would lead to sustainable strengthening of capabilities in sub-national road agencies, these being broader in scope and much larger than could be accommodated in the likely timescale of Phase 2.

A series of phased inputs are therefore proposed leading to a possible full scale application of an output based grant funded support for road renewal and maintenance at a local level.

5.2 KEY REQUIREMENTS FOR FUTURE PHASES

The key requirements have been classified under four aspects of scope:

Scope A – Policy and PPB — Developing maintenance policy; consulting with stakeholders;delivering awareness and training programs; developing, adapting and piloting of PPB procedures and tools; and developing and piloting of funding mechanisms; and preparing a project for output-based grant funding; the rational being that all contributions made under this project should be manifested in measurable outcomes on the network and within the communities.

Scope B – Delivery and PBC — Developing and piloting maintenance delivery and performance based maintenance initiatives, piloting contract forms, developing industry capability.

Scope C - Technology — Developing, adapting and piloting design guidelines, tools and specifications for rural transport infrastructure.

Scope A is for the most part consistent with the preliminary scope of the Phase 2, with the following qualification - a Phase 3 project preparation TA is suggested to prepare a future investment program. The proposed implementation project comprises the full-scale application of output based grant funding to reduce the backlog and establish sustainable maintenance on an agreed core network in a few selected provinces.

Furthermore, a stand-alone activity with a much broader remit covering the development of training capacity and the establishment of a series of accredited training courses and formal trainer development is warranted. However, this is not considered here, although suggestions are offered earlier in section 4.3.

Table 5.1 sets out the proposed approach for addressing each key requirement, in terms of assignment to future phases.

Table 5.1: Key scope requirements for future phases

#	Key Scope Requirements	Scope	Proposed Staging
1	Develop and trial agreed maintenance policy to cover:		
	> appropriate access and maintenance standards, and performance indicators;		Phase 2
	> focus on safety and asset preservation;		Phases 2 and 3
	> a 'core' network, covering priority regional roads from national, provincial and kabupaten;		Phase 2
	> funding mechanisms which aim to address the backlog and provide for sustainable maintenance at least on a core network;		Phase 2
	> clarification of regulatory and management responsibilities for road related assets and vehicle access;	A	Phases 2 and 3
	> complementary planning, programming and budgeting procedures and gap analysis guidelines for road maintenance, renewal and improvement.		Phase 2
2	Increase awareness of basis for proposed policy focus (see above) amongst stakeholders.		Phases 2 and 3
3	Increase awareness of good practice in Asia/Pacific Region.		Phase 2
4	Increase management and technical capacity in key areas to support policy objectives.		Phases 2 and 3
5	Develop measurable maintenance standards.	A	Phase 2
6	Introduce measurable maintenance standards in trials.	B	Phase 3

#	Key Scope Requirements	Scope	Proposed Staging
7	Study the transition of government owned and operated road maintenance units to commercial businesses.		Phase 3
8	Extend planning, programming and budgeting procedures and gap analysis guidelines for road maintenance, renewal and improvement to better address planning priorities for low volume roads, including alternative social-economic criteria.	A	Phase 2
9	Adapt existing planning tools to better address planning priorities for low volume roads, including alternative social-economic criteria.		Phase 2
10	Apply PPB procedures to case studies covering regional networks, including preparation of a multi year maintenance and renewal program.		Phases 2 and 3
11	Extend design procedures and technology guidelines for low-volume rural transport infrastructure.	C	Phase 3
12	Extend contract forms and procurement guidance to RTI, including scope for community participation.	B	Phase 3
13	Prepare an output based grant funding project to reduce backlog and establish sustainable maintenance on agreed core network, and a sample of community supported projects.	A	Phase 3
14	Application of output based grant funding to reduce backlog and establish sustainable maintenance on agreed core network, and a sample of community supported local road projects.	B	Future Project
15	Development of appropriate guidance and contract forms for outcome based maintenance contracts, and preparation of pilot study.		Phase 3
16	Improved private industry capacity in the planning, supervision and delivery of maintenance.		Phases 3
17	Pilot implementation of the use of 'hybrid'-type contracts for performance based maintenance at a provincial and kabupaten level.		Phase 3

5.3   PROPOSED REVISED SCOPE OF PHASE 2 ACTIVITIES

5.3.1 Scope

The proposed revised scope of Phase 2 activities are summarised in Table 5.2, this comprising a revision and clarification of the preliminary scope of Phase 2.

The primary Phase 2 activity encompasses the majority of Scope A, which provides continuity from the current activity, with the following exceptions:

- The extent to which safety can be adequately addressed from an asset management perspective, and clarification of regulatory and management responsibilities for road related assets and vehicle access is expected to be limited by the timescale of Phase 2 and progress in cross-jurisdictional cooperation.

- Progress in achieving improved awareness and contributions to capacity development will be limited by the timescale of Phase 2.

- Application of PPB procedures covering regional networks, including preparation of multi-year maintenance and renewal programs will be limited to a few case studies with the expectation that broader application will take place through the proposed Phase 3 preparatory activity.

The main focus, therefore, is to develop and pilot a comprehensive maintenance policy and PPB procedures and tools, including their initial application in two or three provinces, each of which would include both a provincial agency and at least one kabupaten agency, and provide and coordinate support in training and dissemination for all activities. During Phase 2, the province based activity would include a survey of road conditions and a 'first cut' determination of needs for all review agencies. This would provide a direct comparison with information supplied by the review agencies under Phase 1, and with estimates made by the study team. It would provide a demonstration of the application of the proposed maintenance policy and PPB procedures, including an example for a 'core' network. The training and dissemination activities would be designed to target a wider number of agencies, drawn from several provinces and DGH, with up to three locations selected for events.

5.3.2 Phase 2 - Policy and PPB Development

Additional information on the proposed content of Phase 2 is provided below.

Strategy options

- Consistently adopt multi-period budgeting.

- Investigate integrated maintenance planning across kabupatens, within at least two provinces.

- Investigate funding certainty/predictability (e.g. two years committed, three years indicative).

- Facilitate consistency of standards for classification, access, maintenance intervention and design.

Table 5.2: Proposed revised Phase 2 activity components

	DESCRIPTION/OUTPUT
1. Prepare road maintenance policy and accompanying technical guidelines	▪ When developing the draft policy, take into account the responsibilities identified in the June 2009 *Traffic and Road Transport Law* which places increased liability on the road authorities to provide safe road conditions, and provisions in the draft Road Preservation Fund regulation currently under preparation by MPW. ▪ Draft a complementary set of technical guidelines which detail appropriate access and maintenance standards, performance measures and indicators. ▪ Undertake an iterative process which will include the fiscal, technical and socio-economic implications of different scenarios to be tested in Phase 2, Component 4 (see below). ▪ Draft recommendations on potential sources of additional funding, including local revenue collection potential and review and document the latest legal and regulatory framework applicable to output-based grant funded project. ▪ Articulate the draft policy to local government (and subsequently seek their agreement) to achieve a better understanding on the cost implications of different levels of delivered service of road maintenance, and the gap between the current level of funding and the needs for road maintenance.
2. Prepare and undertake pilots	▪ Confirm pilot locations and detailed program in consultation with IndII, DGH and pilot agencies.
2.1 Confirm staff and available equipment	▪ Review the background and availability of staff and equipment (both office and field). ▪ Identify the time that available staff can commit to participating in the IndII Activity to enable the work program to be developed to maximise the transfer of knowledge.

	DESCRIPTION/OUTPUT

2.2. Field survey	▪ Design surveys and prepare survey forms based on the requirements for the identified decision support tools (e.g. IRMS and an updated LVRMS, or appropriate manual systems).
	
	▪ Supervise field work by experienced staff to describe:
	
	  o the current condition, road width, drainage and other characteristics of the road; and
	
	  o the current condition, characteristics and maintenance requirements of bridges;
	
	▪ Train local government staff in survey techniques.
	
	▪ Prepare strip maps and GIS outputs summarising the above characteristics and conditions.

2.3. Data Analysis and Reporting	▪ Utilise the IRMS, an updated LVRMS and appropriate manual procedures as appropriate to develop programs of road maintenance based on various investment alternatives, determined in close coordination with the local government and based on (or more likely shape) the road maintenance policy. ▪ Report on budget profiles and performance trends and tabulations of the comparisons between the alternative strategies for the various investment alternatives and road category. ▪ Conduct a workshop to demonstrate the impacts of different levels of funding and potential funding sources to the local government administration and representatives of the local parliament. ▪ Seek feedback from the above participants to develop agreed funding levels for 2011 and forward.
2.4. Identification of Immediate and Mid Term Maintenance Plans	▪ Based on the agreed level of funding, prepare the recommended program of road and bridge maintenance works for 2011, to include the locations and level of maintenance required. ▪ Ensure that the program for 2011 includes but is not limited to: routine maintenance, periodic maintenance, betterment, emergency, holding works. ▪ Develop an indicative program of works for 2012-2015, and identify locations requiring further engineering and design, e.g. where pavement reconstruction is required.

	DESCRIPTION/OUTPUT
2.5. Workshop and presentation of maintenance plans	▪ Prepare presentation materials. ▪ Conduct a workshop to introduce the 2011 program and maintenance plan(s) for 2012-2015.
3. Preparation of standard operating procedures	▪ Prepare a detailed standard operating procedures (SOP) manual which documents the processes, data, models, tools and criteria to be applied for all activities necessary to prepare future annual and projected future road and bridge maintenance plans.
4. Final technical report	▪ Prepare a final technical report at the conclusion of the services documenting all tasks carried out on the project, and recommendations for a Phase 3 project.
5. Activity Completion Report	▪ Prepare Activity Completion Report

Priority options

- Investigate collaboration options – provincial and kabupaten agencies working together.
- Focus on optimum intervention (under budget constraint) and holding treatments where resources are severely constrained rather than ''Worst First''. Intervention rules for use in a simple maintenance planning tool can be guided by optimum policy analysis of treatment options under budget constraints.
- Focus on minimum access standards and preventive maintenance interventions – routine and periodic maintenance.
- Develop measureable maintenance standards (intervention levels and work standards).
- Introduce a PPB tool (or tools) to kabupaten practice (the LVRMS).

Quick wins

- Consult with target agencies on Phase 2 scope options, particularly regional collaboration. Early consultation on the scope options will facilitate buy-in by the agencies participating in pilots.
- Arrange and facilitate a study tour and/or technical exchanges addressing provincial and local government asset management practice in the Asia-Pacific and Australasian regions. A number of examples of innovative practices in these regions are readily available (for example, the use of regional road groups, road management plans, linked asset management and financial management plans in Australia), and can inform and strengthen Phase 2 activities.

Pilots

- Focus on collaborative development of a three to five year forward maintenance budget in at least one provincial "region" (the province and a selection of its kabupatens), using consistent data and intervention standards.
- Design and conduct a pilot in at least two or three provinces.
- Simple integrated planning tool to allow consideration of combined provincial road and kabupaten road data.
- To the extent possible, the pilots would conform to draft maintenance policy and strategy, as developed within Phase 2.

Information sharing

- Build on the present technical forum arrangements through the DGH Sub-national Road Facilitation unit.
- Develop an Australian study tour proposal (see above - quick win).
- Compile a tool kit of resource materials, and deliver awareness raising forums for:
  o Senior management
  o Legislators
  o Asset managers

- Collaborate with Australian/Asian regional knowledge transfer and development initiatives concerning road management practices (for example, UK DFID, REAAA, Australian Local Government Assosiations, Austroads initiatives)

5.4   SELECTION OF PILOT AGENCIES FOR PHASE 2 PILOT

A phase 2 pilot design has been prepared based on having up to three pilot studies, as follows:

- **Pilot Study A** provides for maintenance of a mixed sealed and unsealed road network in Eastern Indonesia serving a **moderately productive** region (province and selected kabupatens), but which displays below average performance based on a trend relationship between GRDP and the proportion of stable network condition.
- **Pilot Study B** provides for maintenance of a sealed and unsealed road network in Eastern Indonesia serving a **less productive** region (province and selected kabupatens), but which displays above average performance based on a trend relationship between GRDP and the proportion of stable network condition.
- **Pilot Study C** provides for maintenance of a sealed and unsealed road network in Western Indonesia serving a **moderately productive** region (province and selected kabupatens), but which displays below average performance based on a trend relationship between GRDP and the proportion of stable network condition.

The experiment design provides for a selection of minimum requirements applying to all pilots, and options that are applied to individual pilot studies. Some of the requirements (both minimum requirements and options) make use of measures adopted in the review agency comparisons.

The proposed region groups for each pilot study are West Sulawesi (Pilot Study A) and NTB (Pilot Study B), whereas a suitable candidate in Western Indonesia is required, with the recommendation that this should be chosen from amongst the Java provinces with extensive rural networks, namely Banten, Central Java, East Java or West Java.

West Sulawesi has been included as it provides a challenging situation, including that of establishing the level of cooperation and motivation essential for the future, whereas NTB has been shown consistently to perform 'better than average', despite being seriously under-resourced. The choice of a Western Indonesia province would provide geographical balance close to the centre of government, and with easier logistics.

By providing a wide coverage of network conditions, covering sealed and unsealed roads, and contrasting GRDP and above and below average performance, the pilots should provide an opportunity to fully test most aspects of any maintenance policy and procedures under a wide range of operational conditions, including likely access constraints. NTB is also amongst one of the most needy of the review provinces, and therefore any improvements brought about by the proposed pilot with its broad coverage provides the opportunity to benefit a wide section of the community.

SECTION 6:   ANNEXES

6.1   EXTRACT FROM PHASE 1 SCOPE OF SERVICES

Table 6.1: Phase 1 and Phase 2 Activity Components

#	Phase 1	DESCRIPTION/OUTPUT
1.	Select sub-national agencies to be reviewed	▪ Based on discussions with local government representatives and available information, identify the sub-national agencies which could be investigated in this phase (to include West Sulawesi and NTB provincial and (limited) kabupaten agencies); ▪ Conduct a review of overall characteristics of road condition and budgeting of provinces and kabupatens; ▪ If possible, identify a location or locations where road maintenance performance is substantially better than average, to determine which characteristics are different and why performance is better than average; ▪ Prepare an annotated list of "better-than-average" locations, with justification, for review by agreement with IndII.
2.	Review of selected sub-national agencies	▪ Identify road maintenance funding needs, current expenditures and sources and availability of funds, in the context of overall local government expenditures and sources of funds; ▪ Review and detail current maintenance management practices, and examine the implications of different strategies by which these might be strengthened; ▪ Review the adequacy of human resources in the sector, and ways by which these might be strengthened; ▪ Review and provide recommendations on the delivery of routine maintenance; ▪ Prepare interim report No. 1 detailing the findings of the above reviews; ▪ Review the availability and current use of guidelines and procedures to support all aspects of road asset management, including: o tools and procedures for planning, programming and budgeting for annual works program including the use of LVRMS as the main planning tool for road maintenance planning in local governments, o procedures used for the preparation of designs; the adequacy of current contract documents; procurement and contracting; construction supervision; etc. ▪ Prepare interim report No. 2 detailing the findings of the above; ▪ Review current laws and regulations that might affect or limit the use of PBCs or output-based grant funding of maintenance expenditures (by GoI or by other agencies such as AusAID);

#	Phase 1	DESCRIPTION/OUTPUT
		▪ Review the relative merits of different approaches to contracting; ▪ Review possible roles of and opportunities for external agencies (DGH; Association of Local Government Engineers) to provide technical and HRD support, and most appropriate form of TA support for such "pembinaan"; ▪ Throughout the review, identify the extent to which the findings are expected to vary by the circumstances of each local government; ▪ Prepare interim report No. 3 detailing the findings of the above.
3.	**Prepare Phase 2 Scope of Work**	▪ Select the local governments who will participate in the pilot demonstration of the process, taking into account the requests received by IndII and the work carried out in Phase 1 of the Activity; ▪ Review and modify the proposed Phase 2 tasks identified below; ▪ Finalise the scope of work for Phase 2 based on the above review.
4.	**Prepare Phase 1 Report**	▪ Prepare a comprehensive report of the review carried out in Phase 1 (to include as attachments the interim reports described above) specifying: ○ the rationale behind the selection of the pilot locations and ToRs for Phase 2; ○ staffing, budgeting and scheduling; ○ identification of milestones for monitoring and evaluation.

#	Phase 2	DESCRIPTION/OUTPUT
1.	**Prepare road maintenance policy**	▪ When developing the draft policy, take into account the responsibilities identified in the June 2009 *Traffic and Road Transport Law* which places increased liability on the road authorities to provide safe road conditions. ▪ Undertake an iterative process which will include the fiscal implications of different scenarios to be tested in Phase 2, Component 4 (see below). ▪ Draft recommendations on potential sources of additional funding, including local revenue collection potential. ▪ Articulate the draft policy to local government (and subsequently seek their agreement) to achieve a better understanding on the cost implications of different levels of delivered service of road maintenance, and the gap between the current level of funding and the needs for road maintenance.

#	Phase 2	DESCRIPTION/OUTPUT
2.	**Confirm staff and available equipment**	▪ Review the background and availability of staff and equipment (both office and field); ▪ Identify the time that available staff can commit to participating in the IndII Activity to enable the work program to be developed to maximise the transfer of knowledge.
3.	**Field survey**	▪ Design surveys and prepare survey forms based on the requirements for LVRMS; ▪ Supervise field work by experienced staff to describe: o the current condition, road width, drainage and other characteristics of the road o the current condition, characteristics and maintenance requirements of bridges; ▪ Train local government staff in survey techniques; ▪ Prepare strip maps summarising the above characteristics and conditions. [21]
4.	**Data Analysis and Reporting**	▪ Subject to confirmation in Phase 1, use the LVRMS to develop programs of road maintenance based on various investment alternatives, determined in close coordination with the local government and based on (or more likely shape) the road maintenance policy; ▪ Report on budget profiles and performance trends and tabulations of the comparisons between the alternative strategies for the various investment alternatives and road category; ▪ Conduct a workshop to demonstrate the impacts of different levels of funding and potential funding sources to the local government administration and representatives of the local parliament; ▪ Seek feedback from the above participants to develop agreed funding levels for 2011 and forward.
5.	**Identification of Immediate and Mid Term Maintenance Plans**	▪ Based on the agreed level of funding, prepare the recommended program of road and bridge maintenance works for 2011, to include the locations and level of maintenance required; ▪ Ensure that the program for 2011 includes but is not limited to: routine maintenance, periodic maintenance, betterment, emergency, holding works; ▪ Develop a program of works for 2012-2015; [22] ▪ Identify locations requiring reconstruction for further engineering and design. [23]

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[21] Note that these tasks will involve local government staff who will be trained on the job so that future survey work can be carried out or monitored by local government staff.

[22] The actual annual budgets and programs will need to be confirmed on an annual basis.

[23] As in Note 12 above

#	Phase 2	DESCRIPTION/OUTPUT
6.	**Workshop and presentation of maintenance plans**	▪ Prepare presentation materials; ▪ Conduct a workshop to introduce the 2011 program and maintenance plan(s) for 2012-2015.
7.	**Preparation of standard operating procedures**	▪ Prepare a detailed (SOP) manual which documents the processes to be followed for all activities necessary to prepare future annual and projected future road and bridge maintenance plans.
8.	**Final technical report**	▪ Prepare a final technical report at the conclusion of the services documenting all tasks carried out on the project.
9.	**Activity Completion Report**	▪ Prepare Activity Completion Report

6.2   SUMMARY OF KABUPATEN AND PROVINCIAL ROAD DATA

The following Table 1 is based on information provided by the Provinces and Kabupatens in NTB and West Sulawesi, the indicative condition information has not been verified.

Table 6.2: Summary of Construction Type and Condition

Province/Kabupaten	Construction Type (Km)			Condition %			
	Total Length	Sealed	Unsealed	Good	Fair	Poor	Very Poor
NTB							
Provincial Roads	1842.3	1361.8	480.5	34.8	18.8	23.3	23.0
Lombok Timor	733.0	400.5	332.5	47.2	12.1	29.4	11.3
Sumbawa	936.8	360.4	576.5	13.9	19.5	30.8	35.8
Sumbawa Barat	170.8	35.2	135.6	14.8	22.0	27.5	35.7
Mataram	288.0	279.8	8.1	66.8	15.1	18.1	0.0
Lombok Barat	395.7	308.7	87.0	40.0	19.0	18.0	23.0
Total	**4366.6**	**2746.4**	**1620.2**	**34.2**	**17.7**	**25.3**	**22.8**

Province/Kabupaten	Construction Type (Km)			Condition %			
	Total Length	Sealed	Unsealed	Good	Fair	Poor	Very Poor
West Sulawesi							
Provincial Roads	417.6	225.5	192.1	26.6	16.8	24.9	31.8
Polewali	900.0	461.0	439.0	n/a	n/a	n/a	n/a
Mamasa	386.6	30.4	356.2	4.8	7.2	15.6	72.4
Mamuju	1218.0	391.5	826.5	n/a	n/a	n/a	n/a
Total	**2922.2**	**1108.4**	**1813.8**	n/a	n/a	n/a	n/a
Grand Total	**7288.8**						

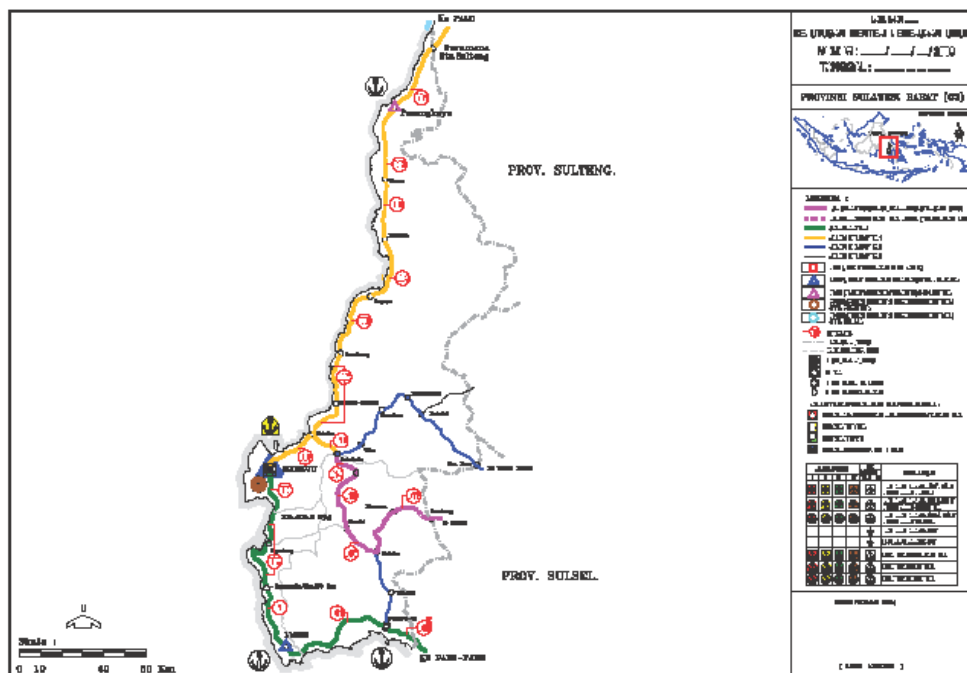**Figure 6.1: Map of West Sulawesi**
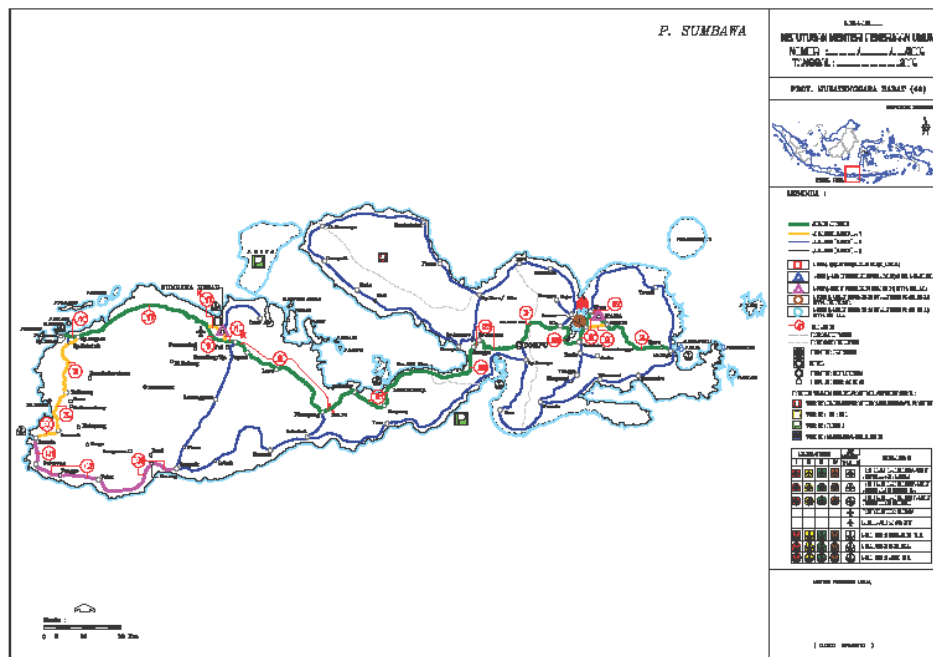
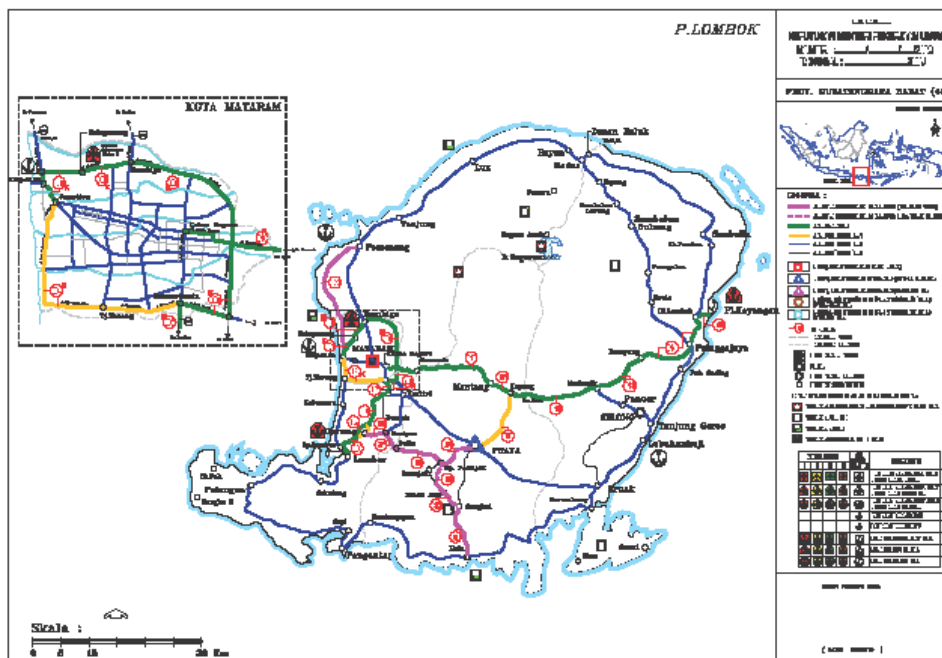**Figure 6.2: Map of NTB - Sumbawa**

Figure 6.3: Map of NTB - Lombok

6.3   SUMMARY OF THE LVRMS

The following description of Low Volume Road Management System (LVRMS) is taken from the Final Report for the Technical Assistance for Adapting Road Planning, Programming and Budgeting Procedures for the Eastern Indonesian Region (PPBP).

The immediate objective of the LVRMS development was to develop a fully working excel spreadsheet based model that enables the strategic level calculation of Agency pavement maintenance costs (annual average and whole of life) under a variety of different maintenance and reconstruction scenarios across any part of the sealed and unsealed National/Provincial/Kabupaten/Kota road network.

Further, the 'road management tool' was developed to ensure that the model fits the type of tasks that the regional officers are being asked to carry out on a day to day basis:

The tool employs the HDM-4 analysis framework to determine the change in road network condition in response to different traffic loading scenarios and under different pavement management regimes.

The modelling concept employs both an 'Aggregate Roughness Model' for sealed roads and the HDM-4 roughness and gravel loss models for unsealed roads, which is used together with time-based models to predict future road deterioration under different traffic loading scenarios and as a consequence of environmental effects. Intervention levels and works effects models are then applied to help determine future maintenance costs.

The tool considers three scenarios, namely a Base Case which predicts future performance of a selected set of existing sealed and unsealed road sections in terms of typical traffic growth and intervention levels, and two alternatives which evaluate performance based on a set of varying user defined intervention standards.

The tool can source data from the DGH's IRMS, as well as from field studies, as some key network characteristics are required to carry out a study

At the core of the tool is a simplified aggregate roughness progression model which allows the prediction of future deterioration in response to structural and environmental effects for sealed road sections, while the conventional HDM-4 roughness progression and material loss models are employed for unsealed roads.

The pavement deterioration model then uses the traffic composition details and the calculated traffic levels in order to calculate the traffic loading on the pavement from year to year. Coupled with the traffic loading, the deterioration models (described below) use the section characteristics and the model calibration factors to calculate the pavement roughness from year to year.

Together with this information, the system then evaluates on a year by year basis whether works should be triggered, either as a result of either of the following conditions being met:

• a specified roughness condition, or intervention level

• a maximum time interval between treatments

The LVRMS possesses a number of suitable prioritisation indices, these include:

1. NPV-based methods

2. Cost effectiveness indicator (CEI),

3. Simplified multi-criteria analysis (MCA) or Points Scoring Systems.

A number of reports have been incorporated into the software to aid the user in viewing the different outcomes of the analyses they have performed. Such reports draw not only on widely accepted programs such as IRMS and HDM-4, but also on the experience of the project team and key personnel involved in the project.

These reports essentially consist of the following forms:

• Line graphs – to depict budget profiles and performance trends

• Tables – to tabulate comparisons between alternative strategies and the various sub-divisions of investment alternative and road class

In a number of cases the User has a choice of selecting by various criteria, for example to compare one or more of the investment alternatives for a chosen strategy/programme.

The flexibility of the report designs are such that as users become more familiar with the tool and identify new tables or graphs that they would like to view, these could be easily added into the software and made available to other users.

The current set of reports available from the system include –

• Traffic profile by scenario (Line Graph)

• Average annual IRI by scenario (Line Graph)

• Average annual IRI by scenario and road class (Line Graph)

• Average annual IRI by road class and scenario (Line Graph)

• Works Programme by Scenario & Year (Table)

• Works Programme by Scenario & Section (Table)

• Before and After Works Condition (Table)

• Pavement Condition Summary (Table)

• Optimum Works Programme by Section (Table)

• Optimum Works Programme by Year (Table)

• Distress by Road Section and Scenario (Line Graph)