

ASIAN DEVELOPMENT BANK

TAR:PNG 30493

**TECHNICAL ASSISTANCE
(Financed from the Japan Special Fund)**

TO

PAPUA NEW GUINEA

FOR THE

ROAD ASSET MANAGEMENT SYSTEM IN THE PROVINCES

December 1999

CURRENCY EQUIVALENTS

(as of 1 October 1999)

Currency Unit	–	Kina (K)
K1	=	US\$0.37
\$1.00	=	K2.7

ABBREVIATIONS

DOF	–	Department of Finance
DOTW	–	Department of Transport and Works
OoW	–	Office of Works
PNG	–	Papua New Guinea
RAMS	–	Road Asset Management System
SAP	–	structural adjustment program
PA	–	Provincial Administration
TA	–	technical assistance

NOTES

- (i) The fiscal year (FY) of the Government corresponds to the calendar year.
- (ii) In this report, "\$" refers to US dollars.

I. INTRODUCTION

1. During the Asian Development Bank's (ADB) Loan Appraisal Mission (June 1999) for the Road Maintenance and Upgrading (Sector) Project, the Government of the Independent State of Papua New Guinea (PNG) requested technical assistance (TA) to expand the road asset management system (RAMS) prepared under TA 3004-PNG: Road Asset Management System¹ to cover the entire provincial road network in PNG's 19 provinces. ADB's PNG 1999 TA program includes the TA.²

2. The Mission reached an understanding with the Government on the objectives, scope, cost estimates and financing plan, implementation arrangements, and terms of reference for consultants. This report was prepared on the basis of the Mission's discussions with the Government and observations in the field.

II. BACKGROUND AND RATIONALE

3. The Government has reconfirmed, in its 1999 National Charter on Reconstruction and Development 2000-2002, the relevance of the 1997-2002 Midterm Development Strategy and its commitment to the four development priorities of primary health, basic education, and rural transport and infrastructure maintenance. The programs in the transport sector include (i) restoring and maintaining existing infrastructure; (ii) planning and constructing new infrastructure, where appropriate; (iii) rationalizing the existing departmental structures; and (iv) clarifying responsibilities among the various governmental levels.

4. The total road network in PNG is 26,962 kilometers (km). The Government is responsible, through its Department of Works and Implementation (DOWI), for the national roads. These comprise 2,125 km of paved and 7,134 km of unpaved roads. The 19 provincial administrations (PAs) maintain a provincial road network of about 17,700 km with about 5 percent of these sealed. A planned reclassification of the roads by function would put a large number of the national roads under the responsibility of the PAs.

5. Central to improving road sector management is the length and quality of the current road network. At present, however, the provincial governments do not have reliable data on the length of total network or its condition. An absence of this basic management information has increased the difficulty of formulating policies and infrastructure improvement plans to support national economic development and expansion.

6. RAMS, an integrated pavement and maintenance management system, is being prepared under ADB's TA for all national roads and provincial roads in four provinces: Central, Madang, Western Highlands, and West New Britain. The TA has produced the national road maintenance requirements for 2000. RAMS consists of an information data bank containing a road inventory with detailed condition data, and tools for analysis, planning, and reporting. These include digitized maps on which road conditions can be shown and weekly routine maintenance schedules, based on which works can be organized. RAMS provides reliable and objective information for road maintenance and development, provides technical justification for road maintenance budget allocation, and demonstrates road deterioration and the related economic losses where maintenance is neglected. RAMS also optimizes resource allocation within the road budget by prioritizing road asset management actions based on economic

¹ TA 3004-PNG: *Road Asset Management System*, for \$1.0 million, approved on 3 April 1998.

² The TA first appeared in *ADB Business Opportunities* in June 1999.

criteria. This improves economic returns on road maintenance and rehabilitation. In the longterm, such prioritization should lead to preventive maintenance action instead of reactive repair of the road failures. The on-the-job training and workshops under the TA have strengthened the capacity within DOWI for conducting road inventories and updating the RAMS databases. This training will be continued under the current TA to ensure sustainable management and operation of the system. This TA has contributed to improved transparency in financing and planning of road asset management, resource allocation, and the overall efficiency of the road sector.

7. With the establishment of the provincial government system in 1976, the provincial works units of the PAs were made responsible for the provincial roads. A technical adviser coordinates the activities of each unit with a staff of a civil engineer, a few supervisors, and a small number of support staff. The PAs receive an annual infrastructure grant from the fiscal budget based on their area and population. This is budgeted together with the internal provincial revenues in accordance with the provincial development plans. Road sector development receives the highest development priority under these plans, with the objective to efficiently link populations to their district centers. DOWI operates in the provinces in through its 19 provincial offices of works, each managed by a provincial works manager, who is accountable to a regional manager.

8. Adoption of the Organic Law on Provincial Governments in 1995 endorsed the crucial role of the PAs and led to the establishment of geographic divisions under DOWI. It also provided for the decentralization of the Government's operations. Provincial and local level governments, and their interfaces with the national Government and the private sector, are essential to improvement in road sector management. To this end, the Government seeks to strengthen the 19 PAs. Under this process, provincial and local authorities have produced development plans.

9. Provincial road maintenance has been inadequate, resulting in road deterioration, high vehicle repair costs, and short vehicle lives. Conditions on the provincial roads (many of which are completely unusable), demonstrate that maintenance is carried out only to tackle emergency situations. Inadequate road maintenance in the provinces has been caused primarily by (i) extremely low funding that has prevented effective maintenance, (ii) very limited capability of the field maintenance organizations, and (iii) the vast extent of the road network.

10. The PAs' capacity to plan road maintenance and allocate adequate funding to maintenance activities is weak. While RAMS is being prepared in the four provinces under the ongoing TA, all PAs need an inventory of their basic road assets, and an investment analysis process that links systematic performance and economic analyses of the road assets to resource allocation over their life cycle. This would also establish a systematic scheduling of (i) maintenance activities, (ii) planning and programming resource allocation, and (iii) reporting on implemented road maintenance activities on a multiyear basis. RAMS in the provinces will generate prioritized expenditure programs corresponding to road maintenance needs. It will assign target indicators for the desired condition of the road network, generate rolling one-year maintenance works programs, and a long-term (five-year) maintenance expenditure program. RAMS will support the coordination between the national and provincial road networks that serve the same beneficiaries. This will improve the economic return to the PNG road network. It will also strengthen provincial implementation of road maintenance and rehabilitation programs, disbursement, and monitoring of the national infrastructure grants, and decentralize

road maintenance operation enhancing the linkage between road maintenance expenditure and road conditions.

11. RAMS for the national road network has been well appreciated by the Government and the funding agencies active in the road sector. Its outputs are being used both in national planning for resource allocation and in identifying maintenance needs and schedules. Other aid agencies have recognized the importance of RAMS and are coordinating their road investment and maintenance programs in accordance with the outputs of RAMS. ADB's Road Maintenance and Upgrading (Sector) Project³ incorporates further institutionalization and use of RAMS for the national and the provincial roads, when made available as a result of this TA. Similarly, the World Bank's Road Maintenance and Rehabilitation Project,⁴ prepared for six provinces (Central, East and West New Britain, Manus, Morobe, and Oro), will support institutionalization of RAMS and use RAMS for scheduling the maintenance and rehabilitation activities. Also, the combined road and bridge rehabilitation program of the Australian Agency for International Development (AusAID) is similarly using RAMS for the provincial road network. Thus, the use of RAMS on all roads in PNG will enhance effective use of the Government's and the donors' resources.

III. THE TECHNICAL ASSISTANCE

A. Objective

12. The objective of the TA is to develop and implement an integrated RAMS covering 15 provincial road networks of PNG. This will improve the provincial road sector resource allocation and returns to road investments. RAMS provides (i) information on the physical condition of roads and bridges over time, (ii) priorities for maintenance action, (iii) budget requirements and allocations for addressing priority needs, (iv) information on specific and periodic maintenance projects, (v) annual and long-term expenditure programs for routine and emergency maintenance, (vi) routine maintenance work schedules, and (vii) information on the service delivery performance of the road network.⁵ A logical framework for the TA is in Appendix 1.

B. Scope

13. The TA includes (i) implementation of an integrated pavement and maintenance management system for provincial roads in the 15 provinces not yet covered by the current RAMS program, and development of a planning framework for maintaining these provincial roads; and (ii) sustainable institutionalization of RAMS through on-the-job and formal training at the provincial level.

³ Loan 1709-PNG: *Road Maintenance and Upgrading (Sector) Project*, for \$63 million, approved on 20 October 1999.

⁴ Loan negotiations and board approval are scheduled for 2000.

⁵ Service delivery performance indicators, i.e., road roughness, travel time, maintenance expenditure per kilometer, evaluate the performance of the road network as a result of maintenance activities against the determined average condition at which the network should serve the community, and the quality of service delivered by the executing agency.

C. Cost Estimates and Financing Plan

14. The total cost of the TA is estimated at \$845,000 equivalent, comprising a foreign exchange cost of \$494,000 and a local currency cost of \$351,000 equivalent. ADB's financing of \$581,000 covers the entire foreign exchange cost of consultant remuneration, per diems, international travel, and equipment; and \$87,000 equivalent of the local costs, including the local travel of the consultants, field inventory and survey data collection, communications, preparation of reports, and cost of a Government observer to the consultant's contract negotiations at ADB headquarters. The TA will be financed by ADB on a grant basis from the Japan Special Fund, funded by the Government of Japan. The balance of the local currency cost, to be financed by the Government, covers the use of Government and PA resources for road inventory and condition survey of all national roads and provincial roads in the provinces, counterpart staffing at the national and provincial levels, and local transport. Details of the cost estimates are in Appendix 2.

D. Implementation Arrangements

15. DOWI will be the Executing Agency of the TA. The 15 PAs will be implementing agencies for the TA, responsible for daily activities under supervision of the provincial administrators in each PA. In consultation with a steering committee, DOWI will coordinate TA requirements between the consultant, PAs, and the Government. The progress of the TA will be reviewed in three meetings involving the PAs, the Government, ADB, and the consultants. These will be held (i) one month after TA inception, (ii) after RAMS for the provincial roads has been established, and (iii) when a draft final report has been submitted. In connection with these meetings, consultation meetings with the funding agencies in the sector will be arranged by the consultants. The consultants will consider comments from these meetings, as appropriate. The progress of the TA will be evaluated against the performance indicators listed in the logical framework.

16. DOWI and the PAs will appoint appropriate and adequate counterpart staff to support the proposed TA activities. DOWI will assist the PAs in organizing field teams to collect road inventory and condition survey data and to perform location reference work as identified in the consultant's terms of reference. Teams under the TA will be guided and assisted by the consultants. DOWI and PAs have traffic data collection and management capability, on which the TA will rely. These will be improved by the PAs as required by the TA. The Government will provide two vehicles for full-time use by the consultants and hire additional vehicles, as required to allow field-testing and monitoring of the field activities.

17. The TA will be implemented over a 10-month period commencing in March 2000 and ending in December 2000. RAMS will be institutionalized in the 15 provinces concurrently with system development and implementation. The implementation schedule is in Appendix 3.

18. An international consultant firm will be engaged for about 15 person-months to complete the TA. Outline terms of reference are in Appendix 4. Expertise required by the TA includes transport economics, transport planning, road and maintenance engineering, pavement management systems, road management information, and capacity building for implementing asset management systems. The consultants will be engaged in accordance with ADB's *Guidelines on the Use of Consultants* and other arrangements satisfactory to ADB for the engagement of domestic consultants. As the detailed terms of reference provide a

structured methodology for achieving the TA objectives, the Simplified Technical Proposal will be used for engaging the consultants.

19. Implementing RAMS in the provinces requires procurement of equipment and computer software. A detailed list and technical specifications of the equipment will be prepared under the TA. In general, the equipment will include road survey equipment; computer hardware; hardware for a local area network, file, and print server; and application software enabling effective use of the RAMS. The TA will be closely coordinated with the activities of RAMS being established for the national roads and its specifications and functions of software system architecture. The consultants will procure the software and other equipment in accordance with ADB's *Guidelines for Procurement*.

IV. THE PRESIDENT'S DECISION

20. The President, acting under the authority delegated by the Board, has approved the provision of technical assistance, on a grant basis, to the Government of the Independent State of Papua New Guinea in an amount not exceeding the equivalent of \$581,000 for the Road Asset Management System in the Provinces, and hereby reports such action to the Board.

TECHNICAL ASSISTANCE LOGICAL FRAMEWORK

Design Summary	Targets	Project Monitoring Mechanism	Risks/Assumptions
Goal <ul style="list-style-type: none"> Effective road sector resource allocation to improve economic returns to provincial road investments 	<ul style="list-style-type: none"> Integrated Road Asset Management System (RAMS) Internalized operation and management of RAMS 	<ul style="list-style-type: none"> Delivery of RAMS Delivery of training in management of RAMS in 15 provinces A planning framework for prioritized maintenance of provincial network Strengthened capacity in provinces to prepare economic evaluation and project feasibility analyses 	<ul style="list-style-type: none"> Timely road inventory and condition data collection Availability of Department and Works and Implementation (DOWI), provincial administration (PA) budget and personnel for purposes of the technical assistance (TA)
Purpose <ul style="list-style-type: none"> Delivery, implementation, and institutionalization of RAMS for provincial roads in 15 provinces Development of a planning framework for prioritization of maintenance on the provincial roads 	<ul style="list-style-type: none"> Establishment of RAMS equipment and databases in the PAs One- and five-year investment programs of maintenance works for the provincial roads Periodic prioritized maintenance works schedules under constrained budgets for provincial roads Preparation of sample feasibility studies for provincial road investments 	<ul style="list-style-type: none"> Periodic TA reports TA review missions Tripartite meetings 	<ul style="list-style-type: none"> Timely road inventory and condition data collection Availability of DOWI and PA budget and personnel to develop and approve treatment rules in a timely manner
TA Outputs/Activities <ul style="list-style-type: none"> Delivery of RAMS software Collection and input of road inventory and condition data for about 20,000 km of provincial roads in 15 provinces Development of prioritization treatment rules Preparation of first annual prioritized maintenance works programs under constrained budgets for provincial roads in 15 provinces 	<ul style="list-style-type: none"> Determination of software architecture Establishing hard- and software in the PAs for RAMS Preparation and delivery of training programs Establishing location reference system 	<ul style="list-style-type: none"> Completed road location referencing, road condition surveys, and traffic surveys on all roads, totaling about 20,000 km of provincial roads RAMS software in PAs and/or provincial offices of works, as appropriate, and the necessary system support arrangements 	<ul style="list-style-type: none"> Availability of counterpart budget and staff for effectively and timely carrying out the inventorying task

Design Summary	Targets	Project Monitoring Mechanism	Risks/Assumptions
<ul style="list-style-type: none"> • Preparation of one- and five-year prioritized road maintenance investment programs • Sample feasibility studies for road maintenance projects • Delivery of training in conjunction with development and delivery of RAMS 	<ul style="list-style-type: none"> • Collection and calibration of data, and determining prioritization rules • Preparation of one- and five-year road maintenance programs 	<ul style="list-style-type: none"> • Road network maintenance performance indicators • Steering committee meetings • Tripartite meetings • Review missions • Periodic TA reports 	

COST ESTIMATES AND FINANCING PLANS
(\\$)

Item	Foreign Exchange	Local Currency	Total Cost
A. Financed by the Asian Development Bank (Japan Special Fund)			
1. Consultants			
a. Remuneration	270,000	-	270,000
b. Per Diem	72,000	-	72,000
c. International Travel	24,000	-	24,000
d. Local Travel	-	15,000	15,000
e. Field Surveys/Local Consultants	-	50,000	50,000
2. Equipment			
a. Computer Hardware/Software	60,000	-	60,000
b. Professional Equipment	10,000	-	10,000
3. Miscellaneous			
a. Communications	-	5,000	5,000
b. Report Preparation	-	6,000	6,000
c. Office Supplies	-	2,000	2,000
4. Government Observer to Contract Negotiations	5,000	-	5,000
5. Contingencies	53,000	9,000	62,000
Subtotal	494,000	87,000	581,000
B. Financed by the Government			
1. Office Space and Logistical Support	-	30,000	30,000
2. Office Support	-	10,000	10,000
3. Field Inventory and Survey Data Collection	-	200,000	200,000
4. Contingencies	-	24,000	24,000
Subtotal	-	264,000	264,000
Total	494,000	351,000	845,000

Source: Staff estimates.

IMPLEMENTATION SCHEDULE

Activity	1999		2000													
	N	D	J	F	M	A	M	J	J	A	S	O	N	D		
TA Agreement Signing		x														
Engagement of Consultants																
Mobilization/Field Works of Consultants																
Inception Report						x										
Midterm Report										x						
Draft Final Report														x		
Final Report															x	
Periodic Reports							x	x	x		x	x				
TA Inception Mission						x										
Tripartite Meetings/Review Missions										x			x			

OUTLINE TERMS OF REFERENCE FOR CONSULTANTS

A. Terms of Reference

1. The consultants, in consultation with the Government and the 15 provincial governments implementing the technical assistance (TA), will do the following:

- (i) during inception:
 - (a) Review the feasibility of using the data collection methodologies established under TA 3004-PNG: Road Asset Management System (RAMS) for the national roads and the provincial roads in the four pilot provinces. The review should confirm the appropriate relationships between the proposed methodologies and road functions.
 - (b) Review the feasibility of using software system architecture used under RAMS for the national roads. The review should address institutional and capacity aspects of operating, maintaining, and updating the system by the provincial road maintenance/planning units.
 - (c) Review the interactions between the system architecture proposal and the existing road location reference methodologies, if any, and, where such a system does not exist, review the feasibility of using the methodology prepared for the national roads. The review should also address coordination of the provincial location referencing system with the national system, establishment of a methodology where such does not exist, and preparation of plans for implementing the necessary changes.
 - (d) Review interactions between the system architecture and any existing road inventories, bridge inventories, and standard unit cost databases, and any other relevant data sets. Review the feasibility of coordinating these databases, if any, with those used at the national level. Plan and implement any required design modifications or enhancements to these databases, as required based on the review.
 - (e) Review interactions between the system architecture and any existing traffic data captures, processing, and storage arrangements. Review the feasibility of coordinating these with those used at the national level, and plan and implement the modifications or enhancements to these system accordingly.
 - (f) Review the prevailing institutional arrangements in the provinces, assess the best operational arrangements between the national and provincial road institutions, and propose modifications to the TA implementation plan as appropriate.
 - (g) Review the skill and knowledge level of staff in the provincial road organizations, appropriate education, and training opportunities. Prepare

training covering data collection, validation, input, and analysis, maintenance planning, and preparation of feasibility studies for road improvement activities including economic analysis. Prepare an institutional development program together with a related implementation plan for targeting sustainable implementation and management of RAMS by the provincial authorities establishing the necessary and appropriate coordination with Department of Works and Implementation (DOWI) and the national Government, as well as support systems for operation and use of RAMS. The training program will be implemented during the TA under these terms of reference as part of institutionalization and implementation of RAMS.

- (h) Review the mechanisms for implementing RAMS in the provincial administrations in light of the decentralization strategy of the Government, and the budgetary procedures and priorities of the provincial and the national governments.
 - (i) Review the existing resources of the provincial administrations and propose the necessary equipment for establishing RAMS in the provinces. Establish the needed equipment resources and system and data management arrangements that will ensure security and recoverability of any module or component of the software and database installation. Upon Asian Development Bank (ADB) approval of the inception report, procure the equipment in accordance with the Bank *Guidelines on Procurement*.
 - (j) Review the existing system support arrangements and resource requirements, and propose improvements as necessary.
 - (k) Plan provincial road condition surveys in the 15 provinces under the TA.
 - (l) Prepare and present an inception report, which will include the results from the preceding a through k, including findings and recommendation regarding the system architecture, organization and capacity review, and the training program. Organize a tripartite meeting involving representation of all implementing agencies (provincial administrations [PA]) and a consultation meeting with the road sector funding agencies, as appropriate. Present the inception report at the meeting, and incorporate the received suggestions as required.
- (ii) during development of pavement and maintenance management systems for the provincial roads:
- (a) Establish a location reference system for provincial roads that includes permanent reference points at appropriate intervals along each road. This location reference system will include, as a minimum, identification and geographic coordinate location of the reference points, and identification and definition of the length of the road between reference points.

- (b) Review and establish a condition survey methodology and traffic data updating methodology for provincial roads that provide an appropriate level of data detail and accuracy considering the traffic volumes and the institutional constraints of PAs.
- (c) Implement the road location referencing and road condition surveys and traffic surveys on the provincial roads in the 15 provinces under the TA, totaling approximately 20,000 km. The methodologies implemented should suit the prevailing organizational environment and capacity, as determined by the organizational implementation review. The implementation will train and utilize staff of the provincial administrations, and DOWI, as appropriate, and be coordinated among the provincial administrations through DOWI.
- (d) Establish and install the equipment and network resources, RAMS software, as required in provincial administrations and establish the necessary system support arrangements.
- (e) Carry out road condition surveys of all provincial roads in the 15 provinces. Use data collection processes appropriate for sustainable updating and management by the provincial administrations and for ensuring high quality of the data.
- (f) Verify all survey data and process it to standard input format required by the RAMS for provinces, as determined under the review completed under items (a) through (k) of (i) under these terms of reference.
- (g) Input road condition survey data into RAMS in each provincial RAMS.
- (h) Collect, and input into RAMS, data on supplementary physical characteristics and traffic volumes of provincial data.
- (i) Extend RAMS functional classification and road numbering to cover provincial roads in 15 provinces, as suggested under the review completed under items (a) through (k) of (i) under these terms of reference, and prepare a proposal for road reclassification, as appropriate.
- (j) Revise the RAMS systems as necessary, including data base structures, query-functions, and reporting procedures to ensure their appropriateness for the sustainable management and use by the provincial administrations. Revise as needed the RAMS segmentation procedures and program components. Update road themes and classifications to ensure they are appropriate for the sustainable management and use by the provincial administrations.
- (k) Deliver one-year and five-year programs of maintenance, rehabilitation, and upgrading works for the provincial road networks, establishing the necessary institutional cooperation and coordination between the

provincial administrations, DOWI, and the national government. These plans will include maintenance, rehabilitation, and upgrading works.

- (l) Establish a road network maintenance performance indicator capability to suit the provincial requirements and in coordination with the national RAMS.
- (m) Deliver and provide training in production of sample project feasibility analyses for projects identified in the first year of the program.
- (n) Provide the necessary training as proposed under the training program at each stage of development, installation, and implement of RAMS to ensure sustainable management, maintenance, and updating of RAMS by the provincial administrations.
- (o) Conduct workshops between the staffs of the provincial administrations and the DOWI provincial staff to establish coordination support systems for RAMS, and working cooperation between the two.
- (p) Establish and test future surveys to update the road condition and other relevant data to ensure sustainable maintenance of RAMS by the provincial administrations. Establish a rolling condition survey program for each province.
- (q) Review the achievement of deliverables against project objectives, and report on the achievements, assessing the effectiveness of operating RAMS and identifying issues including institutional and capacity aspects. The report should recommend any needed improvements to operation and maintenance of RAMS and provide solutions to any pending issues concerning TA implementation and achieving its objectives. The report will be presented at a tripartite meeting and at the funding agency consultation meeting as appropriate, and the suggestions received will be incorporated as appropriate.

B. Reports

2. The consultant will submit the reports in English to the Government (20 copies) and ADB (three copies). The consultant will organize three review meetings as follows: (i) one month after TA inception, (ii) after RAMS for the provincial roads has been established, and (ii) when the draft final report has been submitted. The consultant will also, in connection with the review meetings, arrange consultation meetings with the funding agencies in the sector. The consultants will prepare and circulate minutes of these meetings, and incorporate comments resulting from these meetings in the TA reports and activities, as appropriate.

- (i) A brief inception report will be submitted within four weeks of the start of the TA. It will outline, in accordance with the terms of reference, the consultants approach, methodology, and work plan, as well as cost implications for consulting services. The report will provide a bar chart of all activities under the TA.

- (ii) Brief monthly progress reports will inform the Government and ADB of achievements under the TA, and identify emerging difficulties in TA implementation, if any, outlining proposed solutions. The reports will provide, in clear graphical presentations, status of the TA and its performance personnel schedule, accomplishments under each item of the terms of reference, and plans for the next months' work. These reports will adopt a uniform format facilitating TA monitoring.
- (iii) The draft final report will be submitted on completion of the TA. It will summarize the TA activities and recommendations. It will outline a continuing training program, and programs for updating and management of RAMS, including the rolling condition survey programs in the provinces.
- (iv) The final report will be submitted by the consultants one month after receipt of the comments on the draft final report from ADB and the Government.