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**ROAD ASSET MANAGEMENT SYSTEM (RAMS) AND ROAD SECTOR REFORM IN
PACIFIC REGION (PAPUA NEW GUINEA)**

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ABSTRACT

The Government of Papua New Guinea, through its executing department, the Department of Works is doing a Road Sector Reform using Technical assistance and guidance provided by the Asian development Bank. In the starting of the Road Sector Reform, the development of a Road Asset Management System (RAMS) has been implemented. The RAMS is a planning tool that has a database, which stores and presents road data information, planning short and long-term road maintenance. The system is also used to create budgets and maximises economic returns of the investments made for the road network.

The Government of Papua New Guinea has also established requirements for institutional reform and strengthening under its public sector reform program. The Government has wasted no time to respond to the community and other stakeholder pressure in legislating Road Sector Policy. As a result, the Government has committed itself to establish a National Road Authority.

Naturally for the past 20 years the Government, through Department of Works has funded and managed the road networks. The Government has found it difficult to maintain road

funding. As a result, some of the core road asset networks have received minimum maintenance or no maintenance at all.

There is no doubt that poorly maintained roads will have a significant adverse effect on National Economic Growth, with adverse effect on GDP. In a developing country such as Papua New Guinea there is always a need to provide a basic level of access to all areas of the country in order to be able to provide basic services for all the population (f.e access to markets, administrative, health, education). A poorly maintained road network limits access, depriving rural populations of basic services.

1. BACKGROUND

The road network of Papua New Guinea comprises an approximate of 8,258 km classified as national roads, which serves as the core road network of the country. Another 19,937 km of road network classified as provincial roads with lower traffic volume but equally important roads that serve the bulk rural population. The total value of the national road network is estimated to be over 5 billion Kina (US\$ 1 billion). Planning, Funding and Maintaining this significant asset places a great responsibility on the Government and DOW.

The Government has received pressure from the community and the other stakeholders on maintaining the roads. Because, there is always a great risk for the poorly maintained roads to have a significant adverse effect on National Economic Growth, with adverse effect on GDP. The Government, through DOW, using funds and guidance provided by the Asian Development Bank (ADB), has with the assistance of Finnroad consultant developed a Road Asset Management System (RAMS) as an initial stage to its road sector reform. RAMS is a tool for planning road maintenance and maximising economic returns of investments made for the road network. Senior government departmental heads, politicians, stakeholders and donors have endorsed the success of RAMS in introducing a totally new transparent approach to allocation funds for the road sector and given the government lots of confidence in legislating Road Sector Policy on establishing a National Road Authority.

The RAMS project started in 1998 and currently the extension of RAMS project has been established to year 2005. That is to ensure the sustainability of RAMS and complete the Governments initiative on Road sector Reform.

The Government of Papua New has established requirements for institutional reform and strengthening under its public sector reform program emphasising on performance base salary schedules. In the 2002 budget the Government has committed to establish a Road Authority and a cost recovery system that will be based on user charges. This committee to establish the new funding mechanism, similar to the Road Fund, is part of the Public sector Reform Project.

The main components of the Road Asset Management System are:

- Road Information Data Bank (RIDB)
- Geographical Information System (GIS)
- Strip Map
- Highway Development and Management System (HDM-4)
- User Friendly Version of Rams

The main function of the Road Information Data Bank (RIDB) is to store and to produce information on road condition and other characteristics related to the roads.

Geographic Information System (GIS) of RAMS is based on ArcView GIS software, which is used for storing; updating, analysing and displaying geographically referenced information. RAMS-GIS is used to visualise road information data and to provide practical means for presenting information to decision-makers.

The Highway Development and Management System (HDM-4) is a computer program used for economical analyses. HDM-4 calculates the total transport costs of alternative road improvement and maintenance strategies through the life cycle of the road network. The program provides detailed modelling for pavement deterioration and maintenance effects, and calculates annual costs of road maintenance, vehicle operation, and travel time. HDM-4 program can also be used for preparing maintenance plans and budget for all levels of the road network.

Strip map is a graphical representation of the key condition information along the longitudinal profile of a road section.

Implementation of the system has been progressing well. Naturally, the most important goal of the projects is to ensure that local experts are fully capable of using the system. Without effective training programs these goals will not be achieved. With these projects training was an important part in every step and training strategies were designed with ambition.

Also the Government of Papua New Guinea has established requirements for institutional reform and strengthening under its public sector reform program. Furthermore responding to community and other stakeholder pressure, the Government has committed itself to launching a road sector reform program as part of its strategy to restore the integrity of state institutions and to improve overall government sector performance. There is a widespread support to the road sector reform within DOW and Department of National Planning and Monitoring (DNPM). In its 2003 program the Government has committed to establish a Road Authority and a cost recovery system that is based on user charges. This commitment to a new funding mechanism, similar to the Road Fund, is part of the Public Sector Reform Project. The estimates of the needed revenues are based on the needs of Road Network of PNG and RAMS prepare this information and it is presented in short- and long-term plans and budgets.

2. RAMS SYSTEM COMPONENTS

The main components of the Road Asset Management System are:

- Road Information Data Bank (RIDB)
- Geographical Information System (GIS)
- Strip Map Component
- Highway Development and Management System (HDM-4)

- User Friendly Version of RAMS

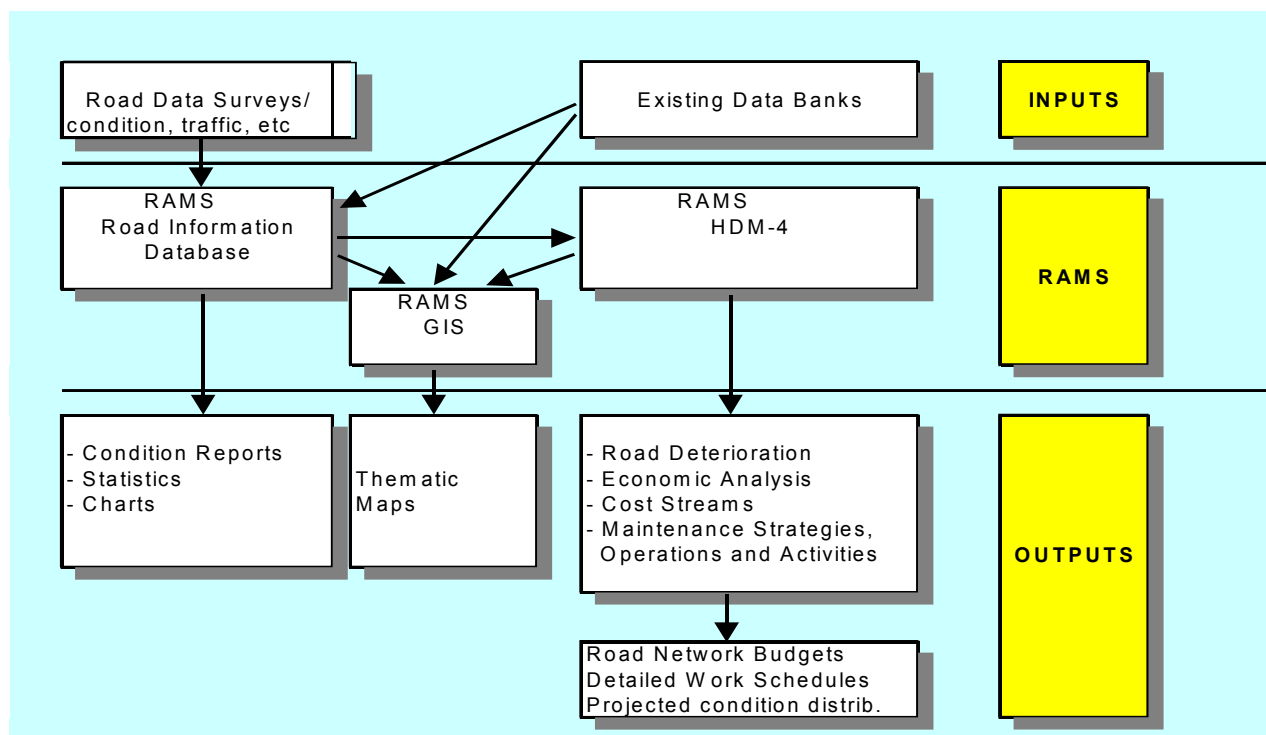


Figure 1 - The structure of RAMS

2.1 RAMS ROAD INFORMATION DATA BANK

The Road Information Data Bank (RIDB) is the main core of the system, wherein all the information on road data is to store like road conditions, road characteristics, traffic information, environmental factors, and other factors (f.e socio-economic factors) related to the roads.

RIDB is used for the following tasks

- store road condition surveyed and traffic data
- store data from existing databases (e.g. drainage, environment)
- link data from existing databases (e.g. bridges)
- produce road characteristic and condition data and reports for HDM-4 and RAMS –GIS system
- produce annual statistics from the road network
- produce basic information for road maintenance programming and budgeting

RIDB has following four elements: 1) database for importing data, 2) database for updating data, 3) database for reporting, and 4) database for StripMap application.

2.2 RAMS GIS

Geographic Information System (GIS) of RAMS is based on ArcView GIS software, which is used for storing; updating, analysing and displaying geographically referenced information. Because this geographic data is in digital form, it facilitates fast data retrieval and updating. GIS allows much more efficient management and analysis of geographic data than traditional ready-made maps.

RAMS-GIS is used to create visualise road information data and provide practical means in presenting information to decision-makers. It produces thematic maps based on the coordinates and location data collected by GPS devices during the road inventories. The longitude and latitude from GPS survey serves as the x and y coordinates in thematic mapping. The road information data is dynamically linked to the GIS system, this feature can automatically create new road theme on the GIS. Other relevant existing data on roads, bridges, traffic, and road condition have coordinates and are also linked to the GIS themes (digital database).

2.3 RAMS STRIP MAP

Important part of the RAMS system is the strip map, application that is based on Access software with direct links to the National and Provincial Road Information Data Banks (RAMS RIDB and PRIDB). The charts used are created by using MS Graph '97 and linked to Access

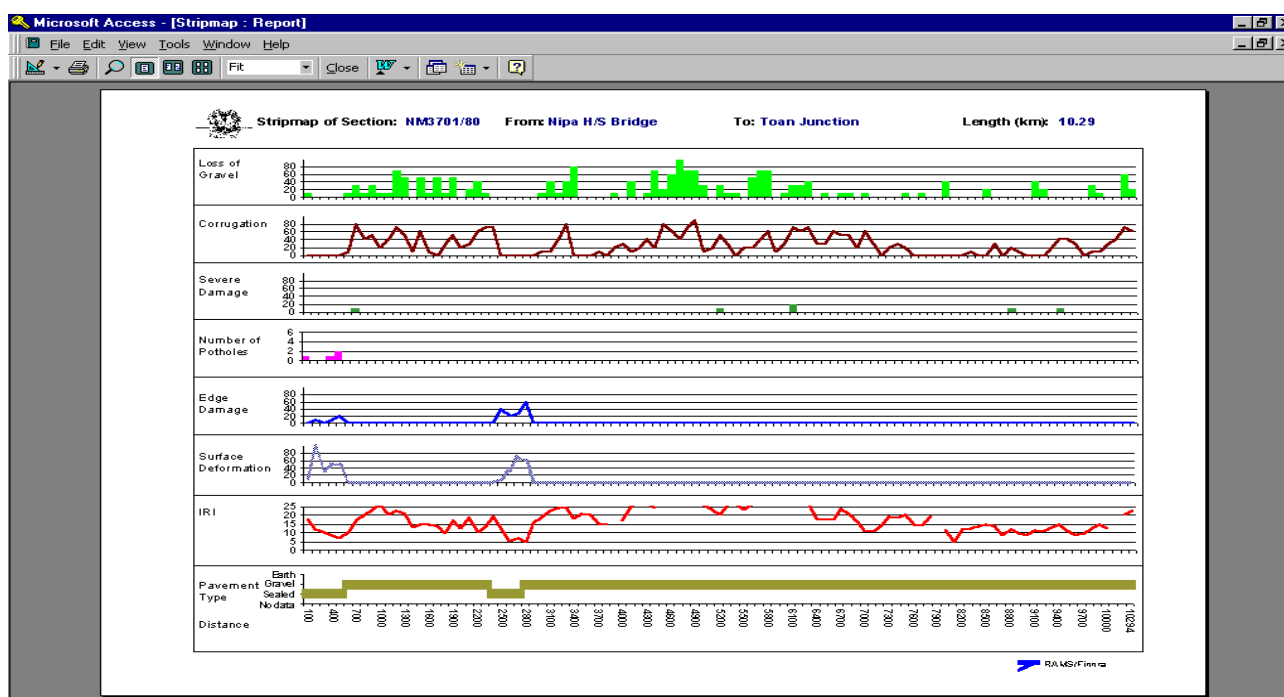


Figure 2 - RAMS Strip Map

Strip map is a graphical representation of the key condition information along the longitudinal profile of a road section. Condition indicators are described as histograms and bar charts together with the distance information, which runs on the longitudinal axle of the chart.

2.4 RAMS HDM-4

The Highway Development and Management System (HDM-4) is a program used for economical analyses and creating maintenance plans. HDM-4 calculates the total transport costs of alternative road improvement and maintenance strategies through the life cycle of the road network. The program provides detailed modelling for pavement deterioration and maintenance effects, and calculates annual costs of road maintenance, vehicle operation, and travel time.

provincial survey team using separate condition survey form and GPS device carries out the manual road condition data collection.

2.6.3 Traffic Counts

The number and type of vehicles using the road network is an important element in determining maintenance priorities. There has been traffic counts for all the national road sections and currently the traffic counts are on-going for provincial road sections. In the count the traffic is divided to seven different vehicle categories as in RAMS HDM-4. Therefore the information of traffic is very accurate in RAMS and it is possible to conduct very accurate calculations of road user costs. The traffic is one of the key elements in economic analyses.

2.7 CALIBRATION OF HDM-4 MODEL TO PNG ENVIRONMENT

Internationally accepted default models for climate, road deterioration, maintenance effects as well as road user effects are included in HDM-4 package. These models have to be calibrated to local circumstances. In the first phase of the project the lowest level (1 of 3) calibration was done, but during the second phase of the project when data collection in field was annual the calibration level has reached of some points the highest level (3 of 3). Still what is needed to ensure the correctness of the results is:

1. Improve gravel road deterioration model to be more accurate for those mountainous provinces of PNG, also having high annual rainfall.
2. Add the environmental and social factors to RAMS and also include those when conducting economical analysis
3. Improve the interface between HDM-4 reporting component and the RAMS reporting component
4. Improve the interface between HDM-4 and RAMS GIS

During the calibration the vehicle fleet was divided to seven different categories and a full study of the all information in the HDM-4 vehicle fleet was collected (in year 1998). Naturally, the information must be updated regularly and the last update of the vehicle fleet was done in April 2002.

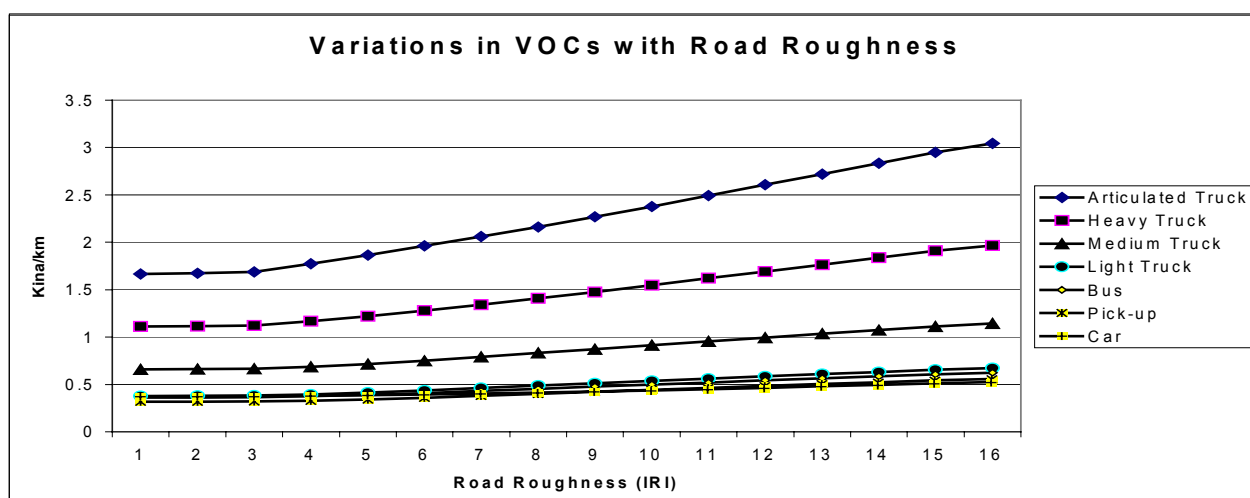


Figure 5 - Variations in VOCs with different Road Roughness (1 Kina ~ 0,2 USD)

Currently four different vehicle fleets is in use in the project (regional vehicle fleets), but during the year 2003 the vehicle fleet will be established for all the provinces. The chart 5 presents the average variations in VOCs with road roughness in Papua New Guinea.

The calibration of the work descriptions and unit costs has been done annually. This information is different for each of the provinces and therefore 19 different unit cost and work descriptions tables are currently in use in PNG Rams.

For the passenger time it was assigned considerably higher values compared with former studies in PNG, where passenger time was not valued at all, or it was not given great significance. The passenger time values were added to PNG RAMS in November 2002.

3. USING RAMS

Currently RAMS is fully in use in Papua New Guinea Department of Works for budgeting, road project appraisals and planning purposes. It is also everyday tool presenting road condition information; traffic information and all that information needed carrying out maintenance and planning new construction projects for the road network purposes.

3.1 BUDGETING

With Rams HDM-4 component the maintenance budget for Papua New Guinea is prepared. In RAMS budgeting the main principle is that at least minimum routine maintenance is provided for all roads. Therefore the routine maintenance plan is prepared without economical analysis. The amount of the routine maintenance of the total maintenance budget is ~20 %. The rest of the works are ranked based on the Net Present Value divided by Costs of the operation (NPV/C).

The budget is divided to three different level activities and plans. Those are:

1. Routine maintenance plans
2. Periodic, rehabilitation and upgrading
3. Emergency

In the first phase of preparing the budget, the unconstrained budget run is done. After that the presentable amount of the total budget for each province is established. Because there haven't been enough funds in previous years and the deterioration level of the road network is high it is not possible to get funds for the road maintenance as needed based in the un-constrained budget run. Therefore the need is divided to five-year period and based on that the first year budget is created. After the Government has established the final budget the final plans are created.

Road Infrastructure funding by Programs for 2003

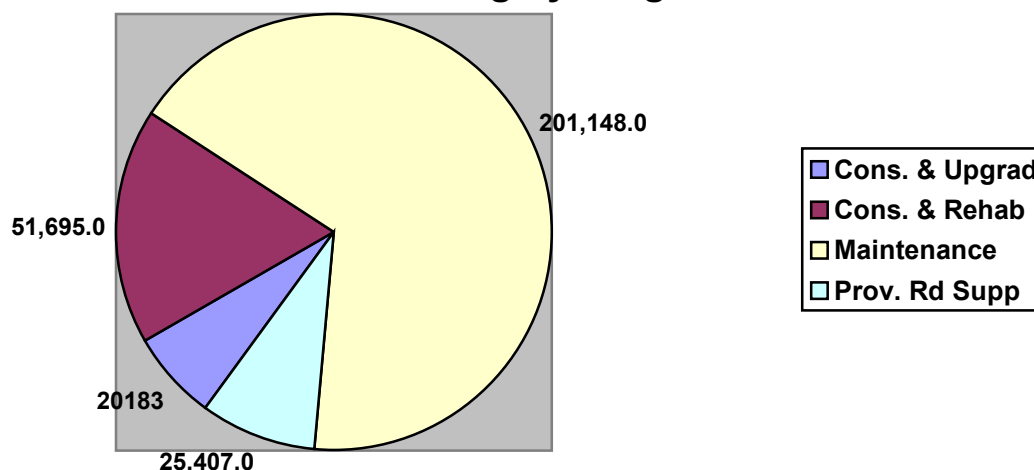


Figure 7 – Funding by Programm for Year 2003

3.3 ECONOMICAL ANALYSES

RAMS economical analysis is used estimating the economical viability of the activity. In RAMS the factor used is Net Present Value divided by Costs (NPV/C) or Internal Rate of Return (IRR). All the projects, which will be carried out by the ADB and WB funding, must meet the criteria of giving the needed “value of the money” and RAMS is a tool for calculating those.

3.4 PREPARING MAPS AND STATISTICS

The RAMS is producing maps for presenting information of road network, road condition, traffic information, population information etc. Presenting information on maps gives better idea than only presenting the information in tables and in word documents. RAMS is also providing annual road network statistics where is all the information related to road network of Papua New Guinea.

5. RAMS LINKAGE TO ROAD SECTOR REFORM IN PAPUA NEW GUINEA

The overall goal for the institutional reform and strengthening of the public sector is to achieve excellence in the performance and delivery of government services to the people of Papua New Guinea, within the resource (human and financial) capacity of our nation. To reach this goal, the Government has outlined nine objectives, which are relevant to the Government’s aspirations for DOW:

- To strengthen the policy, planning, and decision-making process, as well as the relationship between the political institutions and the state services.
- To streamline functions, organization structures, and resource management.
- To establish and align the cost of government operations with available funding and development priorities.
- To improve efficiency, performance and accountability.
- To establish a stable, professional, and performance oriented public service.

- To improve reporting systems and data base linkages at both an agency (e.g. DOWT) and government-wide level.
- To establish and rationalize office and accommodation infrastructure and facilities, better to support public sector organizations.
- To improve partnership and cooperation amongst public sector, churches NGOs and the private sector.
- To encourage a public sector that operates with probity, integrity and respect for the law.

In the DOW's structure, its key responsibilities are centred on the roads sector, because it is the most prominent sector in terms of expenditure and management of the road infrastructure, which is the Department's primary responsibility

Over the years, the Department's lack of funding for road maintenance has increased DOW's difficulties in achieving good results and best practice. Also some weaknesses in road maintenance management and delivery have arisen as a consequence of the major shortfalls in funding for road maintenance, and the unreliability of its provision. In particular, the funding shortfall and unreliability have:

(i) Undermined the road maintenance planning and programming process, by rendering the need for such planning to be somewhat purposeless. As a result, the discipline of planning has deteriorated in the Department.

(ii) Rendered inapplicable the full use of RAMS as a major planning tool in its first year of full operation, so that an early opportunity has been missed to gain experience while the RAMS project is ongoing in the country and the international consultants working on the project remain available to provide guidance when needed.

(iii) Prevented the engagement of contractors to undertake the maintenance works, and therefore delayed the implementation of government policies to outsource this work to the private sector. Potential increases in the productivity and efficiency of service delivery have not been availed as a result.

In PNG the institutional reform, in addition to the establishment of DOWT, is focused on setting up of an independent Road Authority. The focal point of the reform on road sector financing is the development of new funding mechanisms based on user charges and private sector participation. Planning functions are being reformed by strengthening the role of Road Asset Management System (RAMS) as the main planning and budgeting tool for road maintenance both at the national and provincial level. Capabilities in implementation (technical capacity) will be improved through three technical assistance project financed by ADB and WB.

6. CONCLUSIONS

Insufficient funding for road network has lead to a prematurely damaged road network in Papua New Guinea. Using RAMS it is possible to estimate the funding needs in future and it is possible to get a maximum value of money carrying out the most beneficial projects and using the most beneficial maintenance standards. The role of the Road Sector Reform is to ensure appropriate funding for road maintenance in the future.