# CHAPTER 10

# CAPACITY DEVELOPMENT PLAN

## 10.1 ASSESSMENT OF PRESENT CAPACITY

An assessment of the existing institutional capacity in DPWH-ARMM for road development and management is essential as the starting point for a responsive capability development program. This assessment will center on the core processes or aspects involved in road development and management, namely:

- Planning
- Design
- Construction
- Maintenance

The assessment will also deal with the capacity in the support processes of financial management, procurement, human resource management, and equipment management.

The existing capacity in each of these core and support processes will be discussed in terms of the systems and methods used, the database, and the skills and competency of the staff involved. Key institutional weaknesses and constraints will be identified in each process.

### 10.1.1 Present Road Planning Capacity

An evaluation of the existing capacity in road planning at DPWH-ARMM revealed the following characteristics, including institutional limitations and weak aspects.

- **Lack of focus on core programs**. Planning and programming do not appear to be focused on the core programs of ARMM, particularly on the strategic infrastructure projects of regional significance and impact. This may be noted in the medium-term infrastructure programs (see, e.g., **Annex 6-6)** which essentially consist of a compilation of projects that are not clearly related to each other and to an overall development strategy and plan for ARMM. The lack of regional focus is even more apparent in the annual infrastructure programs under the Public Works Acts funded from the GAA. As discussed above, these annual programs are diffused thinly to numerous small projects of localized impact – viz., farm-to-market roads, school buildings, multi-purpose buildings, etc. - in response to initiatives of local leaders. Although useful in meeting community needs, these projects do not seem to be interconnected to form a coherent framework that will have a significant regionwide effect, say, in providing a good main road network to allow the efficient flow of goods from key production areas to markets. Besides, these local projects can more appropriately be handled by the LGUs in accordance with the Local

Government Code, so that ARMM can concentrate on the strategic regional projects.

- **Low priority on asset preservation**. While there are no complete, accurate and up-to-date records on the condition of the national roads in ARMM, the general impression is that they are far from being in good motorable condition, especially the unpaved roads. This is due partly to the limited technical capacity of DPWH-ARMM to program and execute proper repair and maintenance works, and partly to the inadequate financial capacity of DPWH-ARMM to maintain the national roads. Underlying these weaknesses in capacity, however, is the fact that road maintenance or asset preservation is not given the top priority it deserves especially in allocating limited resources and in planning road works, and is overshadowed by the tendency to focus funding on the more visible and politically-attractive construction works, as noted in the ARMM budget structure for 2006-2009 discussed in Section 3.3. This situation is not unique to ARMM, but is also prevalent in many LGUs throughout the country.

- **Preoccupation with project programs of work**. From discussions with DPWH-ARMM officials and a review of planning documents and as noted above, most of the planning done by DPWH-ARMM, through the Planning/Programming and Infotech Division, is devoted to the preparation of individual programs of work for projects funded in the Public Works Acts (PWAs) and approved by the Regional Economic Development Planning Board (REDPB). It is recognized that the PWA requires that programs of work be prepared and approved before implementing the projects, as the basis for fund expenditures. The preparation of programs of work, however, consumes much of the planning efforts and resources of DPWH-ARMM, to the extent that the more essential function of road planning at the network or system level appears to be given little attention.

- **Lack of systematic road network planning**. Thus, with its planning activities concentrated on project programs of work, the Planning/Programming and Infotech Division has limited exposure and capability in undertaking systematic road planning at the network level. There appears to be no effective planning system in place at DPWH-ARMM that would enable it to produce long/medium-term and annual plans and programs for the national/regional road network efficiently addressing the needs of both asset preservation/maintenance and network development/ construction within resource constraints. This system would entail the development of future network scenarios, estimation of future traffic demand, identification of road sections that need construction/improvement and preservation, preparation of feasible projects to meet the needs, and prioritization and programming of these projects under the budget ceilings. As noted above, the projects included in the medium-term plan and annual budget do not appear to have been systematically generated and prioritized from an overall network planning process suggested above. Rather, they seem to be a collection of

unconnected construction projects identified by various interest groups with no clear strategic fit into the overarching road development framework for the region, and with no defined criteria showing their technical and economic feasibility and relative priority. In addition, maintenance projects works have been programmed yearly under the same historically low budget allocation which is not clearly related to actual maintenance needs.

- **Inadequate road project preparation and prioritization**. At the project level, there also appears to be no defined system in DPWH-ARMM to select, prepare – through adequate pre-feasibility/feasibility studies - and prioritize road projects for inclusion in the medium-term and annual programs, based on objective and consistent technical and economic criteria. Thus, conformance of the projects to regional development plans, economic viability, social and environmental impact, and technical readiness of the projects are not systematically evaluated. The insufficient competence and capacity of DPWH-ARMM personnel in project preparation or feasibility studies is disclosed by the results of the survey of training needs under the on-going JICA project on ARMM Human Capacity Development Project (AHCDP). The survey revealed the following information, among others:

  - 85 percent of the Project Preparation (Feasibility Study or FS) participants have not attended any training on feasibility study preparation even if most of them have inherent functions in the conduct of such activities as part of their responsibilities in the organization.
  - The FS training attended by the remaining 15 percent of the Project Preparation participants was conducted for only three days, and the short duration could not possibly impart a good knowledge on proposal preparation to the participants.
  - More than 60 percent (Levels 1 and 2) of the Project Proposal Preparation (FS) participants feel that they need basic training in feasibility study preparation, while the rest needs enhancement.
  - 100% of all of the participants have limited knowledge on environmental and social safeguard management.

  Note:
  Level 1 – Poor/zero knowledge/competence (requires basic training) in FS.
  Level 2 – Fair knowledge/competence (requires basic training) in FS.

- **Disconnect between plans and budgets**. The ARMM medium-term infrastructure plans and programs are not related to any medium-term expenditure framework based on realistic budget ceilings. Moreover, the projects in the medium-term plans are not significantly translated into the annual budgets based on the Public Works Acts. For example, national roads and regional/inter-provincial road construction projects in the medium-term program are practically absent in the ARMM budget. Instead, as pointed out, the annual budgets are dominated by local projects.

National road projects, especially foreign-assisted ones, are generally planned, funded and implemented by DPWH-National in its budget, and ARMM is not closely involved in the planning and implementation of these projects.

- **Weak database**. A major constraint is the inadequate database for the planning of roads, particularly on road inventory and conditions and traffic counts, as discussed in detail in Section 3.6.1. Regular road and traffic surveys are not carried out in accordance with the standards of DPWH-National to generate complete and precise data needed for effective road planning and programming. The database relies mainly on the Road Diagrams and Bridge List. In many cases, the information given is in many cases incomplete, old, inaccurate, and/or unverified – e.g., road conditions, if at all reported, are based on subjective ratings, traffic volumes are still circa 1990s, and bridge condition data are spotty.

### 10.1.2 Present Design Capacity

The existing capacity in design at DPWH-ARMM is marked by the following traits.

- **Limited staff and equipment**. The engineering survey and design capacity of DPWH-ARMM is very limited, compared to the large number and magnitude of infrastructure projects being undertaken every year. Aside from having just ten personnel, the Survey and Design Division of DPWH-ARMM has only one total station surveying instrument; District Engineering Offices have none. Soil investigations for road and bridge projects are seldom done. Private firms are practically not used to do engineering surveys and technical investigations.

- **Uncertain quality of survey data and designs.** The Survey and Design Division uses computer-aided design (CAD) software to prepare engineering designs and plans for roads, bridges, and buildings. The quality of these designs, however, is not always assured because the survey data used as inputs appear largely inadequate. Hence, the integrity and performance of the structures could be compromised.

### 10.1.3 Present Construction Capacity

The existing capacity at DPWEH-ARMM in the area of construction shows the following institutional constraints.

- **Lack of technical basis for selection of implementation mode**. A review of the list of numerous construction projects of DPWH-ARMM undertaken in the last three years shows that the projects were implemented by a combination of the following modes:

  a. Work by administration by the Construction Division and DEOs.
  b. Implementation by contract.

c. Implementation by LGUs – through contract or administration – via MOAs with DPWH-ARMM.

There appear to be no clear and consistent criteria for choosing the implementation mode and implementing agency. As explained earlier, the choice is usually based on the recommendation of the project proponent, who is usually a political leader. In this regard, the capability of the selected implementing entity does not appear to be systematically evaluated and considered.

- **Insufficient staff and equipment for construction by administration**. For projects implemented by administration, the DPWH-ARMM Construction Division and DEOs do not seem to have enough in-house staff and construction equipment to handle the workload. This is indicated by the fact that most of the works reported as implemented by administration were actually partly contracted out to contractors and suppliers.

- **Strained capacity for construction supervision**. For projects implemented by contract, actual inspection and supervision by DPWH-ARMM Construction Division and DEOs is reportedly spotty, given their limited skilled staff in relation to the large number of projects. For projects assigned to LGUs through MOAs, the works are implemented by these LGUs via a combination of administration and contract works. While DPWH-ARMM, through its Construction Division and DEOs, is still accountable for these projects which are funded under its budget and, therefore, expected to exercise technical supervision on project implementation, actually the Division and DEOs perform very little or no supervision, again because of their meager staff vis-à-vis the large number of projects. If all of these local projects - which are done by administration, by contract, and though MOAs with LGUs - were devolved to LGUs as envisioned in the Local Government Code and the ARMM Organic Act, DPWH-ARMM would greatly relieve itself of the burden of supervising hundreds of small projects, and can refocus its attention on the bigger but fewer and, thus, more manageable projects of regional significance.

In this regard, in the JICA-ARMM Human Capacity Development Project (AHCDP) mentioned above, the training needs survey revealed the following information on the level of competency of the participants in Infrastructure Management, which includes road project management and construction supervision.

- 60 percent and 73 percent of the Infrastructure Management participants have not attended training on roads and bridges, respectively.
- The training attended by the remaining 40 percent and 27 percent of the Infrastructure Management participants for roads and bridges, respectively, could not possibly impart the necessary knowledge and skills of the broad areas needed to be covered for each type of infrastructure facility.

- More than 60 percent (Levels 1 and 2) of the Infrastructure Management participants feel that they need knowledge enhancement on basic infrastructure planning and management.
- While 67 percent (Levels 3 and 4) of the Infrastructure Management participants feel that they have general knowledge in construction methods, their level of knowledge on each type of infrastructure (roads bridges, water supply and buildings) needs to be reviewed to firm up the identified modules.

Note:
Level 1 – Poor/zero knowledge/competence (requires basic training)
Level 2 – Fair knowledge/competence (requires basic training)
Level 3 – Good knowledge/competence (requires enhancement training)
Level 4 – Very Good knowledge/competence (needs no further training)

It is also noted that, like DPWH-National, DPWH-ARMM has no comprehensive manual on construction management and supervision which would include specific regulations, procedures, forms, tests, and field instructions, reports, and likely effects if neglected. Because of this, it is likely that, as widely observed in a 2005-2006 JICA study at DPWH-National, project engineers and supervisors in ARMM would tend to perform construction management and supervision according their own interpretation of the disparate regulations.

- **Insufficient monitoring**. The monitoring and reporting system for the numerous construction projects implemented through the different modes likewise appears inadequate. The reports are not independently validated.

### 10.1.4 Present Road Maintenance Capacity

The assessment of the existing capacity in road maintenance at DPWH-ARMM showed the following institutional weaknesses.

- **Limited maintenance funding**. With the low priority given to maintenance, DPWH-ARMM has allocated Php 110.6 million a year from its GAA funds for the maintenance of its national roads measuring 974 km, while DPWH-National has provided an additional Php 109.7 million from MVUC funds. This gives a total available maintenance fund of only Php 220.3 million for 974 km or Php 226,000 per km. This is merely 35 percent of the Php 655,000 per km that is needed to adequately maintain the entire national road network according to World Bank-DPWH National estimates (i.e., Php 19 billion for the 29,000-km national roads system). Using this estimate as a rough order-of-magnitude basis, the maintenance needs of ARMM national roads would be over Php 600 million a year, or more than five times the current funding level.

- **Sub-optimal allocation and use of funds**. Compounding the inadequacy of the available funds (Php 220.3 million) is the uncertain quality of the allocation and use of these funds. DEOs prepare maintenance work

programs but these do not appear to be based on a systematic assessment of real needs for road maintenance. As explained above, the DPWH-ARMM Maintenance Division provides lump-sum allocations to DEOs based on the same old EMK data used way back in 1991/1992. DEOs are allowed to allocate the lump-sum funds to sections that they judge to be in most need of repair and maintenance. DPWH-ARMM admits that overlaps between the two sources (DPWH-ARMM GAA and DPWH-National ARMM) are likely. The actual use of the maintenance funds and their impact on road quality are not properly monitored and evaluated.

- **Insufficient database**. The problem stems partly from the weak database on road conditions and insufficient planning based on maintenance needs. As noted earlier, data on road/bridge attributes and conditions supplied by DEOs are often incomplete, old, and/or inaccurate. Condition data are based on subjective adjectival ratings, which are no longer used by DPWH-National, and the data are not routinely verified by the DPWH-ARMM Maintenance Division. Good technical data on bridge conditions are scanty.

- **Inadequate inspection and work programs**. As also pointed out, DPWH-ARMM lacks an effective and regular system for inspecting roads and bridges, evaluating their conditions, identifying deficiencies and damages, and programming and costing effective repair, maintenance, or rehabilitation works. There is no comprehensive manual to guide road and bridge inspectors in their work. Thus, DPWH-ARMM also lacks the skills needed to undertake the systematic maintenance inspection and evaluation of roads and bridges, and the planning of appropriate intervention works.

- **Preponderance of maintenance by administration**. Repair and maintenance works are almost 100 percent done by administration. With the limited number of DEO personnel and of ARMM equipment units totaling 71 units, of which 35 are non-operational, DPWH-ARMM clearly cannot effectively handle the maintenance by administration (MBA) workload. In any case, based on experience at DPWH-National and in other countries, maintenance by contract (MBA) is generally found to be more cost-efficient than MBA. DPWH-ARMM, however, does not yet possess the experience or capacity to plan, bid out, and supervise an extensive program for road MBC. In addition, the capability and interest of local contractors to undertake road MBC has to be developed.

- **No truck overloading controls**. There are no weighbridges or portable weighing machines in ARMM which could check overloading by trucks. Overloading has been found rampant in many parts of the country, and inflict considerable damage on the roads. DPWH-ARMM has no survey data on vehicle axle loads.

### 10.1.5 Present Support Systems Capacity

The evaluation of the support processes showed the following salient institutional features.

- **Financial management**. The budget and accounting systems of DPWH-ARMM follow the conventional systems of government agencies. The new electronic Government Accounting System (eNGAS) developed by COA has not been implemented yet. The Internal Audit units in DPWH-ARMM need the capability to undertake effective systems and risk-based audits.

- **Procurement**. DPWH-ARMM staff appear to be familiar with and possess the basic capacity to undertake the procurement process prescribed by RA 9184 (Government Procurement Reform Act) and its Implementing Rules and Regulations. The Regional Office proper and the DEOs have their own Bids and Awards Committees (BACs), supported by Technical Working Groups (TWG) and Secretariats, which have been conducting the bidding of many infrastructure contracts. Their operations are generally done manually.

- **Human resource management**. DPWH-ARMM has a total staff of 605. About 60 percent of this staff is doing work related to national roads totaling 974 km. This translates to a productivity of about 2.7 km per worker. While this productivity is almost double the 1.4 km per worker at DPWH-National, it pales in comparison with the 9.6 km per worker in Indonesia. DPWH-ARMM thus appears overstaffed. DPWH-ARMM also appear to be too centralized with 21 percent of its personnel in the Regional Office proper, compared to the ususal norm of not more than 10 percent (See Section 3.2.2). Furthermore, of the 605 personnel, 24 percent or 147 are engineers/architects. If the survey under the on-going JICA-ARMM Human Capacity Development Project mentioned in Section 9.1.1 is to be a gauge, the majority of the DPWH-ARMM engineers lack basic training to develop their capability in project feasibility studies and infrastructure project management. The organizational structure and functions of DPWH-ARMM may have to be realigned and rationalized if the different proposals for its improvement discussed in this Report are to be favorably considered.

- **Equipment management**. As mentioned, DPWH-ARMM has only 71 pieces of heavy equipment, of which 36 are operational and 35 are non-operational. These are spread over the five Area Equipment Services (AESs), and service the road maintenance requirements of the eight DEOs. Obviously, this equipment fleet is not sufficient to maintain the 974 km of national roads in ARMM under the present system where road maintenance work is mainly done by administration. The AESs are also poorly equipped with equipment repair facilities, and with its average of 40 personnel each, are clearly overstaffed and underused.

## 10.2 OPTIMUM LEVEL OF CAPACITY TO BE ATTAINED AND ASSESSMENT OF CAPACITY GAP

Given the foregoing discussions of the present capacity of DPWH-ARMM in the key areas of road development and management, a preliminary analysis is

made here of the optimum level of institutional capacity that the Department can and should aim for in the foreseeable future. Defining the appropriate optimum level of capacity for DPWH-ARMM ARMM should consider the following factors:

- The desired optimum capacity must enable DPWH-ARMM to efficiently deliver quality road facilities and services in the region according to the performance standards and targets defined by the regional road development plans and programs.

- The optimum capacity must entail a reasonable use of resources - in terms of manpower, technology and funds – which should be within the capability of ARMM to provide, considering the other demands on its limited resources.

- The optimum capacity to be set must be realistic and doable within a reasonable timeframe, given the current capacity level, the resource constraints, and the socio-economic and political environment in the region.

- The optimum capacity level must be sustainable in the long-run.

This preliminary analysis of the optimum capacity level will cover the core institutional processes of road planning, design, construction, and maintenance, as well as the support systems of financial management, procurement, human resource management, and equipment management. The capacity measures would range from improving or strengthening existing weak processes to introducing or adapting relatively new tested systems and technologies that are deemed suitable to ARMM.

### 10.2.1 Roads Planning

DPWH-ARMM must ultimately possess the optimum level of institutional capacity in road planning that is marked by the following features:

a. **Focus on core programs and major final outputs**. DPWH-ARMM could be most effective if it focuses its operations and resources – and, consequently, its planning capacity - on the core programs under its mandate with strategic regional significance and impact in relation to its development objectives. This focus could be defined in terms of Major Final Outputs (MFOs) of DPWH-ARMM through the logical framework process adopted by the Department of Budget and Management-National. For example, DPWH-ARMM could consider adopting the following MFOs:

   MFO 1 - Maintenance services for national/regional roads.
   MFO 2 - Construction services for national/regional roads.
   MFO 3 – Maintenance/construction of other infrastructure of regional significance.

There is a need for DPWH-ARMM to adopt a clear-cut policy that would give first priority in resource allocation to the core program of asset preservation or maintenance of existing national/regional roads (MFO 1). This is warranted by the fact that maintenance has been proven to be a cost-effective strategy, involving relatively low but sustained expenditures which yield very high and immediate economic returns, to preserve the existing roads in good working condition throughout their economic life; this would consequently avoid premature road deterioration and costly rehabilitation, and reduce the transport costs of the road users as well as the road construction and maintenance costs of the asset manager (DPWH-ARMM).

After maintenance, the construction of national/regional roads (MFO 2) would be considered for resource allocation according to the following general order of priority: (i) rehabilitation of damaged sections, (ii) improvement and upgrading of heavily traveled roads, and (iii) construction of new roads and missing links ion the road network.

National roads, along with other regional (including inter-provincial) roads, under MFOs 1 and 2 should especially receive attention over other roads. This is because national/regional roads account for the main traffic flows in the region, while their condition in terms of extent and quality road is way below those at the national and Mindanao levels, as pointed out in the Inception Report.

DPWH-ARMM could also consider devolving or transferring its other activities that are outside the suggested core programs – e.g., construction of local roads and school buildings - to LGUs and other appropriate entities. This will enable DPWH-ARMM to concentrate its resources on strategic national/regional projects.

b. **Rational road planning system**. DPWH-ARMM must institute and be capable of using a rational system for the planning of national/regional roads in the region which would have the features mentioned below.

- The system would provide for the planning of national/regional roads in ARMM which is linked to the overarching national transport policy and national roads framework for the entire country as defined by DOTC-National and DPWH-National.

- The roads planning system for ARMM would be process-based and needs-oriented at all stages – strategic analysis, long-term scenario building, medium-term planning, multi-year and annual programming and budgeting. It would focus on resolving current issues and problems in the national/regional roads sector in the region through immediate and medium term measures, but within the context of strategic schemes for the long run performance of the national/regional roads network in ARMM.

- The planning applications would employ an integrated approach at all levels – i.e., joint planning for the dual needs of road network development (construction) and asset preservation (maintenance). The systems and techniques would be applicable to the entire national/regional road network and sub-network/orridors at both network and project levels at ARMM.

- The planning process would provide for the active involvement in road planning at different stages of the key players and stakeholders, both external to DPWH-ARMM - e.g., road users, REDB, DPWH-National, and private sector - and internal to DPWH-ARMM – i.e., concerned Regional Office units and DEOs.

- Where feasible, the planning process would adapt available and tested modern planning and programming system and tools rooted in objective technical and economic criteria to guide decisions leading to the efficient and effective allocation of resources for road investments and maintenance works.

In this regard, the methodology used in this JICA study on the road development plan for ARMM could be transferred to and internalized by DPWH-ARMM.

DPWH-ARMM could also adapt, with appropriate modifications, elements of the advanced DPWH-National planning system for national roads, as embodied in its Highway Planning Manual. The DPWH-National system involves the following process in road planning:

(1) **Perform strategic analysis**. Alternative highway network scenarios are established which integrate present and future network needs for both asset preservation and network development, identifying network deficiencies, based on traffic growth, service levels, transport and road costs, budget levels, and master plans. The alternatives are evaluated and ranked using Highway Development and Management Version 4 (HDM-4) tool and key performance indicators, and the preferred network scenario is selected.

(2) **Develop long-term plans**. Asset preservation and network development alternatives are identified based on the preferred network scenario, transport policy, maintenance standards, and master plans, considering on-going projects and using Pavement Management System (PMS) and Bridge Management System (BMS) planning tools explained below. The alternatives are evaluated and ranked using HDM-4, considering pre-feasibility guidelines, road and traffic data, user costs and asset value. The integrated the long-term highway network plan is then produced considering budget scenarios. Performance indicators for this plan are established.

(3) **Prepare multi-year (medium-term) program**. This is done using the Multi-Year Programming and Scheduling (MYPS) system. The steps

are: (1) identify from the long-term plan the planning road sections (PRSs) for the first six-year block, based on NPV/C; (2) prepare FS and designs for the priority PRSs; (3) rank the PRSs using multi-criteria analysis (MCA) - i.e., based on project preparedness, road network importance, and economic and social desirability - with HDM-4 inputs; (4) create three alternative lists of projects corresponding to the smallest tenable, most likely, and greatest realizable budgets - considering the DBM budget guidelines and the NEDA medium-term program; and (5) finalize the medium-term (six-year) program.

(4) **Prepare annual programs**. From the medium-term program, the detailed programs for the coming budget year are prepared. These consist of the annual work program (AWP) for maintenance and the annual infrastructure program (AIP) for construction/ improvement/ rehabilitation. These programs are split between two fund sources – General Appropriations Act (GAA) and the Special Road Support Fund (MVUC). The projects in the medium-term program scheduled for implementation in the budget year are reviewed, updated and refined, using HDM-4 to select and prioritize asset preservation and rehabilitation projects for the AIP/AWP, and using the Routine Maintenance Management System (RMMS) to program routine maintenance works for the AWP.

DPWH-ARMM could also adapt, with proper adjustments to suit the institutional environment in the region, the modern IT-based planning systems and tools developed and tested by DPWH-National and incorporated in its Highway Planning Manual. These systems and tools are briefly described below:

(1) **Road and Bridge Information Application (RBIA)** – This is the main database on road network inventory and conditions used for the planning and programming process. It serves as repository of information for the different road planning systems and tools mentioned - e.g., Highway Development and Management Version 4 (HDM-4), Pavement Management System (PMS), and Bridge Management System (BMS).

(2) **Road Traffic Information Application (RTIA)** – This is the repository of traffic and axle load data used for traffic demand projections, project analyses, planning and programming of road development/construction and asset preservation/maintenance works. Inputs will come from regular traffic surveys conducted in the field.

(3) **Pavement Management System (PMS)** – This is a set of tools, which include HDM-4, to assist the decision maker in finding optimum strategies for providing and maintaining pavements in a serviceable condition over a period of time. PMS can be applied to both road network and project levels.

(4) **Highway Development and Management Version 4 (HDM-4)** – This is a tool to generate optimum short, medium and long-term programs under given budget constraints, including objective prioritization of asset preservation and network development works, based on net present value/cost (NPV/C) indices. HDM-4 models the relationships among the environment, construction standards and costs, maintenance standards and costs, geometric standards, and road user costs.

(5) **Bridge Management System (BMS)** – This is a system to monitor and record the condition of bridges and to program and rank bridge asset preservation and development works. JICA has provided technical assistance which enhanced BMS.

(6) **Multi-Year Programming and Scheduling (MYPS) System** – This tool, together with MCA, generates priority lists of major national roads projects in the multi-year (medium-term) and annual programs within given budget ceilings.

(7) **Multi-Criteria Analysis (MCA)** - This tool, used in tandem with MYPS, employs the following criteria which are given weights and scores: (a) project preparedness - current project status, detailed design, economic feasibility, environmental assessment, and social impact; (b) road network importance - road category and road strategic network; and (economic and social development policy - access to basic services, development of undeveloped areas, support to law and order, support to agricultural modernization, support to traffic decongestion, and support to industrial and tourism development. The MCA scores are used to prioritize projects within the budget constraints

(8) **Routine Maintenance Management System (RMMS)** – This is a tool for estimating, programming and managing routine maintenance resources for national roads to meet specified results. DPWH-National plans to enhance and pilot the RMMS, as part of a coming JICA loan, before rolling it out nationwide.

(9) **Traffic Accident Recording and Analysis System (TARAS)** – This system stores and processes information on traffic accidents on national roads to identify accident blackspots and prioritize road sections requiring safety measures.

Instead of developing its own stand-alone planning system, DPWH-ARMM might find it more feasible to link up with DPWH-National to take advantage of the established planning systems and services of the latter. This could be achieved through a Memorandum of Agreement (MOA) between DPWH-ARMM and DPWH-National which would provide the following, among others:

- DPWH-ARMM would be connected to the DPWH-National planning system and database for national roads, and its authorized users would be given access to the system/database - just like any regular administrative region of DPWH-National.

- DPWH-ARMM would fund, acquire and install the necessary hardware and other facilities needed to link up with the DPWH-National system – viz., workstations, printers, computers, scanners, servers, and wide area network connections, etc. – using compatible specifications set by DPWH-National.

- DPWH-ARMM would provide it own staff to use the facilities and planning systems.

- DPWH-ARMM would collect, or collaborate with the central office of DPWH-National in collecting and encoding, the basic input data needed for the planning systems, such as road attributes, road conditions using International Roughness Indices (IRI) / Visual Road Condition (ROCOND) indices, traffic counts, and axle loads.

- Upon request of DPWH-ARMM, DPWH-National would undertake data processing and computer runs to generate feasible plans, programs, and projects of DPWH-ARMM for the construction/improvement/reconstruction and asset preservation/rehabilitation/maintenance of national/regional roads, and related information such as road and bridge conditions, annual average daily traffic (AADT), and make the results electronically accessible to DPWH-ARMM through the wide area network of DPWH-National.

- DPWH-ARMM would pay DPWH-National appropriate amounts to cover the operating cost of the latter in processing the data and producing the outputs requested by the former.

- DPWH-National could provide technical assistance to orient and train DPWH-ARMM personnel on the use of the IT-based planning systems and tools, such as those enumerated above.

The optimum capacity to undertake the rational road planning system suggested above should be built up in in both Regional Office proper and the DEOs.

c. **Adequate project preparation**. At the project level, DPWH-ARMM must attain the capability to carry out feasibility studies for new candidate national/regional road projects. These projects will be identified through the planning systems mentioned above. Pre-feasibility evaluation of these projects should have been carried out beforehand at the network planning stage. Subsequent full feasibility assessments are to be done for agreed projects with an expectation that they would be economically viable, and thus provide a sound basis to proceed forward to detailed design and thence construction. A full feasibility study will, in general, be required

only if the project type cannot be handled in normal road network analysis, particularly for the following project types:

(1) New roads, including "missing links" and diversion roads.
(2) Major road alignments and/or widening (noting that simple widening can normally be handled at the road network planning level).
(3) New bridges or replacement bridges.
(4) All cases where Land Acquisition Plans and Resettlement Action Plans are required to fit a least disturbance plan.

Feasibility analysis will involve benefit-cost comparison, which in turn requires traffic surveys, quantification of traffic generating sources, traffic forecasts, determination of vehicle operating costs, and estimates of improvement costs and the effects on maintenance costs. As exogenous factors, the impacts on the environment and the social implications of the proposed projects need to be carefully weighed against the results of the economic evaluation.

d. **Harmonized plans/programs and budgets**. DPWH-ARMM should have the ability to prepare medium-term (normally 4-6 years) infrastructure plans and programs for road construction and maintenance that fully match, and are translated into, the medium-term expenditure framework and annual budgets, in terms of investment/spending levels, component projects, and time frames. The programs and budgets must incorporate "forward estimates" – i.e., the committed costs of pursuing existing and approved programs in the coming years up to their completion. These forward estimates should include the following:

- As the highest priority, the maintenance and rehabilitation of existing roads (asset preservation) throughout the life cycle of the assets, to prevent their early deterioration or loss and to maximize benefits to the road users.

- The continuation or completion of on-going or unfinished road projects, including bridges, that meet the priorities in the medium-term national and regional development plans.

- Projects needed to make existing facilities/projects fully functional or usable – e.g., good access roads to bridges, ports, or airports.

On top of the forward estimates, and within the overall budget ceiling, DPWH-ARMM may provide new funding for projects that are identified, found feasible, and prioritized through the road planning and project preparation processes discussed above.

e. **Adequate computerized database, including survey inputs**. DPWH-ARMM should ultimately have the capacity to set up, operate and sustain a computerized modern database for road planning and management. This database should collect, process, and generate accurate and up-to-date information useful for network and project planning as well as

maintenance of national/regional roads. The database will include information on the attributes and conditions of roads and bridges, traffic volumes and loads, road user costs, construction and maintenance costs, deterioration rates, and related technical data, as well as basic socio-economic information. The DPWH-ARMM database should preferably be linked to the DPWH-National database to make use of the storage and processing services of the latter, particularly the Road and Bridge Information Application (RBIA), the Road Traffic Information Application (RTIA), and the Bridge Management System (BMS) as described above.

An essential element of the road planning system is the conduct of field surveys to collect the basic information needed to populate the database and be used for road planning and maintenance. Among others, DPWH-ARMM must have sufficient capability and proficiency to undertake the following vital surveys on a regular basis - whether the survey data are to be used in a stand-alone ARMM database or in a database linked to DPWH-National:

- Road inventory – to include road and bridge attributes survey, to be updated as intervention works are introduced.

- Road condition survey – at least once a year, possibly using or adapting the Visual Road Condition (ROCOND) system.

- Bridge inspection and condition survey – at least once as year, possibly using or adapting the Bridge Management System (BMS) methodology.

- Traffic surveys - including traffic counts on long-duration (monthly), medium-duration (quarterly, once or twice a year), and short-duration (once in three years) basis, plus axle load surveys.

The data collected in the road inventory, road condition, and bridge inspection and condition surveys will be fed into and processed by the RBIA database, while the data obtained from the traffic surveys will serve as input to and be processed by the RTIA database.

f. **Strong staff competency**. Hand-in-hand with the establishment of the improved road planning system in DPWH-ARMM, there is a need to undertake an intensive training of its planning staff to make them adept in the carrying out the improved system. This should enable the DPWH-ARMM staff to build up and strengthen their capacity on the following aspects:

- Planning and programming of the national/regional road network in the region – including strategic analysis, development of highway scenarios, development of long-term plan, preparation of medium-term programs, identification of priority projects, and prioritization of projects, and preparation of annual programs within budget constraints.

- Surveys and data collection systems for national/regional road planning – including road conditions and attributes data, traffic surveys, socio-economic information, geographic information systems, and related surveys.

- Feasibility studies of national/regional road projects – including technical, economic, financial, social, environmental, and operational aspects.

The present JICA study on the road network development plan for ARMM provides an excellent opportunity to demonstrate and provide skills training to DPWH-ARMM personnel on the use of appropriate planning technology and processes, particularly the preparation of master plan, the conduct of road and traffic surveys to generate data needed for planning, the development and use of an effective planning and maintenance database, and the conduct of feasibility studies. This is being done through the technology transfer component of this study, including on-the-job training of DPWH-ARMM planning staff.

The on-going JICA ARMM Human Capacity Development Project is also useful as it will provide training of DPWH-ARMM personnel on project proposal preparation (FS). This involves nine modules – project development cycle, market analysis, technical analysis, financial analysis, economic analysis, social and environmental analysis, project monitoring and evaluation, and technical writing –to be conducted at two levels – basic and advance courses. The training should be sustained and enhanced to cover not only the Regional Office proper, but eventually also DEO staff for the smaller regional projects.

### 10.2.2 Road Design

To achieve an optimum level of capacity to effectively undertake and manage the engineering design of national/regional road projects in the region, DPWH-ARMM could consider the following:

a. **Adequate design preparation and appraisal**. The DPWH-ARMM Survey and Design Division and DEO design staff should have the capability to directly undertake engineering surveys and designs of national/regional road projects, and/or supervise, appraise and conduct quality checks on the surveys and designs contracted out to private firms.

b. **Outsourcing of surveys and designs**. DPWH-ARMM could outsource some of the engineering surveys and designs to private consultants, especially for the bigger and more complex projects and those requiring specialized investigations and analyses. This would lighten the in-house workload.

c. **Access to DPWH-National design software**. DPWH-National, through its Bureau of Design, will soon acquire modern design software to upgrade

its capability in engineering designs of roads, bridges and buildings. This software consists of network versions which will be uploaded in the DPWH-National website and can be accessed by authorized users. The software includes: (a) Civil3D – a package of programs that include AutoCad and highway design; and (b) STAAD – for structural engineering analysis and design. DPWH-ARMM may request DPWH-National to allow it access to this software.

d. **Strong staff competency**. To attain the capacity to perform the design processes described above, DPWH-ARMM should undertake a continuing training program for its Survey and Design Division and DEO design staff to develop or reinforce their skills on design principles and techniques, including engineering investigations, design analyses, quantity estimating, and value engineering, as well as quality assurance on designs and estimates. The training should also include supervision of outsourced activities. DPWH-National can also provide technical assistance in the training of DPWH-ARMM engineers on design principles and techniques mentioned above.

### 10.2.3 Road Construction

DPWH-ARMM should build up an optimum level of institutional capacity to effectively undertake and supervise the construction of national/regional roads in the region. This could consider the following:

a. **Construction by contract as general mode**. In line with the national policy as provided in RA 9184 (Government Procurement Reform Act), DPWH-ARMM should, as a general rule, undertake construction projects for national/regional roads and other infrastructure by contract after public bidding. Work by administration should be done only where there is failure of bidding. Even Memoranda of Agreement (MOAs) with LGUs should require that works be done by contract under the supervision of LGU engineers. This will relieve DPWH-ARMM of the onus of mobilizing staff and equipment to undertake projects by administration.

b. **Adequate construction supervision**. DPWH-ARMM, through its Construction Division and DEOs, should build up its capacity to supervise construction works, including quality assurance, on all its projects – whether implemented by contract or by administration or by LGUs. The objective is to ensure that the works comply with the approved plans, specifications, budgets, and timetables, thereby achieving quality work with minimum or zero defects, delays, and overruns. The supervision capacity should be developed in-house in the Construction Division and DEOs. But, DPWH-ARMM should also consider outsourcing of construction supervision to private consultants, especially for the larger projects, to ease the workload of its in-house staff. In this regard, DPWH-ARMM should gear its construction supervision capacity to meet the requirements of a proposed two-way devolution:

- The first is the proposed devolution of local projects from DPWH-ARMM to LGUs in accordance with the Local Government Code and the ARMM Organic Act (RA 9054). This would greatly reduce the construction and technical supervision responsibilities of DPWH-ARMM.

- The second is the proposed devolution of national road projects – both locally-funded and foreign-assisted – from DPWH-National to DPWH-ARMM, in conformance to EO 125 and the spirit of the ARMM Organic Act.

Manuals on construction management should also be developed for project engineers, project inspectors, and materials engineers. These manuals would indicate (i) checklists of supervision activities to be performed by the staff, (ii) cross-reference to the "Blue Book" (DPWH-National Standard Specifications for road projects), (iii) step-by-step procedure in construction supervision, (iv) requirements for work requests for major items, (v) requirements for site instructions to correct improper work, (vi) quality assurance requirements including tests, (vii) standard forms, and (viii) likely adverse effects if the work items are not properly supervised. Where applicable, the manuals could adapt those developed and used by DPWH-National, e.g., under its completed and on-going JICA projects.

c. **Effective monitoring**. DPWH-ARMM should strengthen its monitoring and evaluation system for the numerous projects implemented in the region. This system should periodically track the actual progress of work against planned accomplishments, identify and assess delays, substandard works, overruns, and other problem areas, and initiate timely countermeasures. To assist it in this activity, DPWH-ARMM might consider the involvement of an external entity which could be a Civil Society Organization (CSO)/Non-Government Organization (NGO) - similar to Bantay Lansangan (Road Watch) for DPWH-National - to provide an independent monitoring and evaluation of the projects as well as of the overall DPWH-ARMM performance in the delivery of road services.

d. **Adequate staff competency**. To achieve optimum capacity in the above processes, DPWH-ARMM should undertake continuing training of its staff in the Construction Division and DEO construction personnel in order to improve and strengthen their skills in construction supervision and quality control. The JICA-assisted ARMM Human Capacity Development Project mentioned above could provide basic training on infrastructure management, including procurement, construction management and supervision and quality control. The training should also include a working knowledge and placation of the manuals on construction management and supervision mentioned in item b above. It is also necessary to set up a system of accrediting qualified project managers, project engineers, and materials engineers, and of a system of incentives for good performers and sanctions for poor performers.

### 10.2.4 Road Maintenance

DPWH-ARMM should achieve an optimum level of institutional capacity to sufficiently maintain and preserve the national/regional roads in the region. This should consider the following:

a. **Sufficient and sustained funding level to cover maintenance needs**. DPWH-ARMM should eventually acquire and sustain the capacity to provide adequate funding for asset preservation or maintenance of existing infrastructure, especially national/ regional roads, as the first priority in apportioning the available ARMM budget. The funding requirements should be based on the life-cycle analysis of network maintenance needs through the rational road planning systems cited above. DPWH-ARMM should be capable of funding at least 70 percent of the estimated maintenance needs for national/regional roads by 2012, and 100 percent by 2015. Thereafter, the Department should sustain the full funding of the yearly maintenance needs of the road network.

b. **Efficient allocation of maintenance funds**. DPWH-ARMM should establish a system for the planning and allocation of funds for maintenance works in the different districts and sections of the national/regional road network - based on needs. This can be provided through sound maintenance planning within the context of the overall road network plan, using tested planning systems such as Routine Maintenance Management System (RMMS) and Highway Development and Management 4 (HDM-4) supported by an accurate database. In addition, for the maintenance of national roads funded by DPWH-National from MVUC funds and the GAA, DPWH-National should release the funds to DPWH-ARMM which in turn should sub-allot the funds to its DEOs. This will replace the present practice where DPWH-National releases the funds directly to DPWH-ARMM DEOs. It will enable DPWH-ARMM to exercise more effective planning and management of maintenance works financed from both DPWH-National and DPWH-ARMM funds.

c. **Reliable database**. The data needed for effective road maintenance of national regional roads should already be incorporated in the computerized database for road planning and management discussed in Section 9.2.1, which DPWH-ARMM should establish and operate. These include accurate and up-to-date data on the attributes and conditions of national/regional roads and bridges. DPWH-ARMM DEOs, under the supervision of the Maintenance Division, should be able to conduct the surveys needed to generate information for the database, using, say, the road attributes inventory, Visual Road Condition (ROCOND) indices, and Bridge Management System (BMS). As mentioned, the database could be a stand-alone system of ARMM or be connected to the DPWH-National (through RBIA and RTIA) which could electronically process the data into feasible maintenance work programs for DPWH-ARMM. DPWH-ARMM should also institute a system to require, store, and update as-built drawings upon the completion of each construction or rehabilitation

project. This will serve as ready reference for future planning and maintenance works.

d. **Effective inspection and work programs**. There is a need to improve the road maintenance inspection and programming system at DPWH-ARMM to enable the DEOs and Maintenance Division to properly identify, measure and record defects and damages on the national/regional roads and bridges. From this, the staff should be able to plan cost-effective repair and maintenance works. For this purpose, DPWH-ARMM could develop manuals for inspection of pavements and bridges which include (i) checklists of required inspection activities, (ii) step-by-step procedure, (iii) critical portions of pavements/bridges to be inspected, (iv) types of defects to be inspected, and methods of assessing and monitoring their attributes, (v) methods to evaluate cost-effective repair or intervention works according to type of defects, (vi) standard forms and records keeping system, and (vi) likely effects of roads/bridges if the inspection activities are not properly done. The manuals could adapt those already/being developed at DPWH-National under a JICA project. The maintenance work programs would consist of routine maintenance (pothole patching, crack sealing, drain cleaning, etc) and preventive maintenance (asphalt overlays, selective concrete re-blocking). The DPWH-National systems could be good models - RMMS for routine maintenance, HDM-4 for preventive maintenance of roads, and BMS for bridge inspection and maintenance. DPWH-ARMM could use these systems through the proposed link-up with DPWH-National systems mentioned above.

e. **Maintenance by contract (MBC) as dominant mode**. As a medium-term objective, following the direction of national policies and best practices in many countries, DPWH-ARMM should consider gradually shifting from the present mode of almost total MBA to MBC of national/regional roads, say, to achieve 60 percent MBC by 2012 and 80 percent by 2015. In the long-run, DPWH-ARMM could consider up to 90 percent of the program done by MBC, with the remaining 10 percent as MBA for emergencies and isolated areas not attractive to private contractors. DPWH-ARMM could also consider undertaking long-term performance based maintenance contracts (LTPBMC) which have been demonstrated to be cost-effective by DPWH-National and in other countries. DPWH-ARMM, therefore, needs to build up its capacity, at the Regional Office proper and DEOs, for the planning, tendering, and supervision of MBCs, including LTPBMCs.

f. **Vehicle load controls**. DPWH-ARMM should install and operate a sufficient number of weighbridges and portable axle-weighing machines at strategic locations on the road network. This will be coupled with strict enforcement of the 13.5-ton limit per axle, in order to prevent overloaded trucks from damaging the roads. DPWH-ARMM will also regularly collect axle load data.

g. **Good quality of roads**. With the above reforms, DPWH-ARMM should be able to achieve a significant improvement in the condition of roads

through better maintenance together with upgrading works on the national/regional roads. DPWH-ARMM could target, say, achieving 70 percent of the roads in good condition by 2012 and 100 percent by 2015.

h. **Adequate staff competency**. To attain the necessary capacity in the foregoing areas of maintenance, intensive training of maintenance personnel of DEOs and the Maintenance Division of DPWH-ARMM in these areas is essential. This will include competency in the collection and encoding of data, setting up of database, road and bridge inspection methods, work programming, and orientation on RBIA, RTIA, RMMS, HDM-4, and BMS, among others. The training should also include a working knowledge and placation of the manuals on maintenance inspection suggested in item d above. Skills development of DPWH-ARMM staff is also necessary in programming and supervising MBCs including LTPBMC, as well as parallel capacity development of local contractors on MBC. Training on weighbridge operation and enforcement of load limits is also needed.

### 10.2.5 Support Services

DPWH-ARMM should achieve an optimum level of institutional capacity to effectively provide the supporting services to the core programs for the efficient provision of national road services in the region. This should consider the following:

a. **Financial management**. To streamline its financial management, DPWH-ARMM should install the electronic New Government Accounting System (eNGAS) developed by the Commission on Audit (COA). The eNGAS consists of accounting and budget modules similar to those recently set up at DPWH-National and rolled out to its regions and selected districts with good results. The system would enable DPWH-ARMM to track the status of infrastructure funds – including appropriations, programs, releases, obligations, and disbursements/payments – by project and by transaction. Eventually, DPWH-ARMM should be able to correlate the financial status of the projects with the corresponding physical accomplishments, and to post this information at its website to provide transparency. DPWH-ARMM should also enhance the capability of its Internal Audit units at the Regional Office proper and DEOs to perform risk-based and systems compliance audit of infrastructure operations.

b. **Procurement**. As a general rule, all projects under DPWH-ARMM should be implemented by contract through competitive bidding in accordance with RA 9184 and its Implementing Rules and Regulations. Continuous training on procurement procedures and rules of the members of the Bids and Awards Committees (BACs), Technical Working Groups, and Secretariats at the Regional Office proper and the DEOs should be undertaken. DPWH-ARMM could consider adapting the computerized system for the registry and eligibility screening of contractors used by DPWH-National, by connecting to the wide area network of the latter as mentioned above. Bidding documents should be posted at and

downloadable from the DPWH-ARMM website. A computerized cost database and estimation system could also be established as reference in making realistic estimates for the Approved Budget for the Contract (ABC). These automated systems will greatly facilitate procurement, make it transparent, and reduce the opportunities for undue discretion and corruption.

c. **Human resources management**. There is a need to streamline the organization, including staffing, of DPWH-ARMM. This must be aligned to the recommended focus of the Department on its core programs, particularly on national/regional roads, with local projects devolved to LGUs. The DPWH-ARMM planning group definitely needs to be strengthened as stated above. The design, construction, and maintenance of roads could be substantially outsourced to private firms. This would enable DPWH-ARMM to right-size its staff and to develop their capability to perform the contract management/supervision of the outsourced activities. In the meantime, the in-house staff must be further trained to directly undertake the portions of the design, construction, and maintenance works that are not yet attractive to or feasible for the private sector to handle. In realigning and refocusing the functions of DPWH-ARMM along the lines suggested in this Report, the proposed rationalization plan of DPWH-National could serve as a good reference.

d. **Equipment management**. The heavy equipment and repair facilities under the existing area equipment services should be carefully assessed as to their operational status and cost-effectiveness. The facilities could be refurbished but only to the extent needed by the decreasing maintenance program to be done by MBA, noting that the bulk of the MBA equipment requirements could be provided through lease from private companies. If the recommendation for DPWH-ARMM to move towards MBC as the main mode to implement maintenance works on national/regional roads is adopted, the Department could consider liquidating or phasing out its equipment assets, except perhaps for a minimum 10 percent fleet for contingency MBA works. Planning for the phase-out of the equipment fleet and repair shops should include provisions for adequate separation benefits of the employees affected.

### 10.2.6 Summary of Present vs. Optimum Capacity and Capacity Gap

To recapitulate the foregoing discussions based on an evaluation of available materials and initial consultations with DPWH-ARMM and other ARMM officials, as well as DPWH-National officials, **Table 10.2.7-1** has been prepared. This summarizes the preliminary analysis of (a) the present institutional capacity, including observed weaknesses and constraints, of DPWH-ARMM in undertaking the different core and support processes involved in the development and management of national/regional roads in the region, (b) the suggested optimum level of institutional capacity that DPWH-ARMM needs to attain to perform those processes efficiently in the context of regional development objectives and plans, and (c) the resulting gap in capacity which should be bridged.

## TABLE 10.2.7-1. PRELIMINARY ANALYSIS OF PRESENT VS. OPTIMUM CAPACITY AND CAPACITY GAP IN ROAD PLANNING AND MANAGEMENT AT DPWH-ARMM

| Present Capacity | Optimum Capacity to be Attained | Capacity Gap |
|---|---|---|
| 1. Planning<br>• Lack of focus on core programs – medium-term projects not clearly related to each other and to regional dev. strategy; annual programs diffused to numerous local projects<br>• Low priority on asset preservation – overshadowed by construction projects<br>• Preoccupation with project pro-grams of work – little attention to broader road network planning<br>• Lack of systematic road network planning - to produce long/ medium-term and annual plans to meet development and preservation needs within budget constraints<br>• Inadequate road project prepara-tion (FS) and prioritization – objective technical and economic criteria wanting; most personnel lacking FS skills<br>• Disconnect between plans/ programs and budgets – medium -term plans/programs not related to medium-term expenditure framework; projects in medium-term programs not reflected in annual budgets which have very few national/regional projects<br>• Weak database – especially road inventory and conditions and traffic counts; database relies on Road Diagram and Bridge List (RDBL) which gives incomplete/ old/inaccurate/unverified data; road condition data based on subjective ratings | • Focus on core programs and major final outputs – with strategic regional impact; first priority to asset preser-vation, then rehabilitation, improve-ment, and new construction; atten-tion to natl/ regl roads; local projects devolved to LGUs<br>• Rational road planning system – process-based and needs-oriented at all stages (strategic analysis to annual programs); integrated plan-ning of network devt and asset pre-servation; participation of key stake-holders; adapting or linked with tested modern IT planning systems - e.g., DPWH-National HPM process, with RBIA, RTIA, PMS, HDM-4, BMS, MYPS, RMMS, TARAS; operational at Regional Office (RO) proper and DEOs<br>• Adequate project preparation (FS) – for candidate road projects identified thru the proposed planning system; operational at RO proper and DEOs<br>• Harmonized plans/programs and budgets – with forward estimates for existing/approved programs, plus new projects from the planning process, within budget ceilings<br>• Adequate computerized database - incl road/bridge attributes and conditions, traffic, costs, etc; prefe- rably linked to DPWH-National database (RBIA, RTIA, BMS); DPWH-ARMM able to do road and traffic surveys to generate info; database operational at RO proper and DEOs<br>• Strong staff competency on above - at RO proper and DEOs | • Focus on core programs and major final outputs – with strategic regional impact<br>• Rational road planning systems - national/regional roads process-based and needs-oriented at all stages; integrated planning of network devt and asset preservation; participation of key stake-holders; adapting or linking up with tested modern planning systems - e.g., DPWH-National HPM process and tools;<br>• Enhanced project preparation (FS) – for candidate projects<br>• Harmonized plans/programs and budgets – with forward estimates and new projects from the planning system, within ceilings<br>• Adequate computerized database – incl. surveys; preferably linked to DPWH-National database<br>• Strong staff competency on above |

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| 2. Design<br>• Limited staff and equipment – 10 personnel and 1 total station in Survey and Design Division vs hundreds of projects; limited soil investigations<br>• Uncertain quality of survey data and design – inadequate survey data affects the quality of design; thus, the integrity and perform-ance of the structures is compromised | • Adequate design preparation and appraisal – in-house surveys and designs and supervision of contracted surveys/designs; at Survey and Design Division and DEOs<br>• Outsourcing of surveys and designs – esp. for larger/complex projects<br>• Access to DPWH-National design software – e.g., Civil3D and STAAD<br>• Strong staff competency on above - at RO proper and DEOs | • Enhanced design preparation and appraisal<br>• Outsourcing of surveys and designs<br>• Access to DPWH-National software<br>• Strong staff competency on above |
| 3. Construction<br>• Unclear basis for selection of implementation mode – mainly based on proponent's preference<br>• Inadequate staff and equipment for const. by administration – most works actually contracted<br>• Strained capacity for const. supervision – meager staff vs numerous projects; most staff lacking training; no operations manual<br>• Insufficient monitoring – no independent validation | • Construction by contract as general mode – works by admn only when bidding fails.<br>• Adequate construction supervision on all projects – with min. defects, delays, overruns; use of operating manuals; capacity at RO proper and DEOs. Local projects devolved to LGUs, and national roads devolved from DPWH-National<br>• Effective monitoring – with CSO partner; at RO proper and DEOs<br>• Adequate staff competency on above - at RO proper and DEOs | • Construction by contract as general mode<br>• Adequate construction supervision on all projects - with min. defects, delays, overruns<br>• Effective monitoring –with CSO<br>• Enhanced staff competency on above |
| 4. Maintenance<br>• Limited maintenance funding – programmed Php 220 million is 35% of needs.<br>• Sub-optimal allocation and use of funds – not based on needs assessment; use of old EMK and judgment on allocating lump sums to road sections<br>• Insufficient database – old/ incomplete/inaccurate data; subjective condition ratings; unverified data<br>• Inadequate inspection and work programs – no system and manual; most staff lack skills<br>• Preponderance of maintenance by administration – meager | • Sufficient and sustained funding level to cover maintenance needs - as top budget priority, based on life-cycle network analysis using rational planning systems<br>• Efficient allocation and use of maintenance funds – based on needs, using RMMS, HDM-4, BMS<br>• Reliable database for maintenance - incorporated in the overall database (item 1); DPWH-ARMM DEOs, under supervision of Maint. Division, able to do road/bridge attributes and conditions surveys to provide info for the database<br>• Effective inspection and work programs – using modern systems and manuals; operational at RO proper and DEOs<br>• Maintenance by contract (MBC) | • Sufficient and sustained funding level to cover maintenance needs - as top budget priority<br>• Efficient allocation and use of maintenance funds – based on needs, using RMMS, HDM-4, BMS<br>• Reliable computerized database – incorporated in the overall database; DPWH-ARMM capable of road/ bridge attributes and conditions surveys to provide info for the database<br>• Enhanced inspection and work programs – using modern systems and manuals<br>• MBC as dominant mode – incl LTPMC; capacity for planning and supervising MBCs incl LTPBMCs |

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|---|---|---|
| • No truck overloading controls – no weighbridges and load data | • Effective vehicle load controls – sufficient weighbridges and strict enforcement of load limits<br>• Good quality of roads – on the entire network of national/regional roads<br>• Adequate staff competency on above - at RO proper and DEOs | • Effective vehicle load controls – sufficient weighbridges and strict enforcement of load limits.<br>• Good quality of roads – on the entire network of national/regional roads<br>• Enhanced staff competency on above |
| 5. Support Systems<br>• Financial management: conven-tional budgeting and accounting systems; internal audit unit needs strengthening<br>• Procurement - Basic capacity per RA 9184; manually operated<br>• Human resource management (HRM): low productivity at 2.7 km/worker; too centralized at 21%-79% distribution of RO proper-field personnel<br>• Equipment management: only 71 units (36 operational) for 974 km | • Financial management: use of eNGAS at RO proper and DEOs; internal audit units at RO proper and DEOs able to do systems and risk-based audits<br>• Procurement: continuous training at RO proper and DEOs; computerized contractors' registry, eligibility check and cost estimation; posting bid docs at website; use of procure-ment manual<br>• HRM: Rationalization based on above core programs and realigned functions; 40% increase in km/ worker productivity; RO-field personnel distribution at 10%-90%<br>• Equipment management: liquidation or phase-out of equipment (with separation pay) since work is mostly to be done by MBC | • Financial management: use of eNGAS; internal audit units able to do systems and risk-based audits.<br>• Procurement: continuous training; computerized contractors' registry, eligibility check, and cost estimation; posting bid docs at website; use of procurement manual<br>• HRM: Rationalization based on above core programs and realigned functions; increase in km/ worker productivity; reduction of RO-field personnel distribution<br>• Equipment management: liquidation or phase-out of equipment (with separation pay) since work is mostly to be done by MBC |

## 10.3 CAPACITY DEVELOPMENT SCENARIOS

To bridge the gap between the present institutional capacity and the suggested optimum level of capacity of DPWH-ARMM in road development and management, the JICA Study proposed a phased program reflected in terms of scenarios of the institutional capacity that must be in place and operational at DPWH-ARMM by the end of two target years - 2012 and 2015. These capacity scenarios should be harmonized with the road development scenarios for the region. The capacity development scenarios were also presented in the Progress Report of February 2009 and are summarized in **Table 10.3-1.**

## TABLE 10.3-1 PRELIMINARY SCENARIOS FOR CAPACITY DEVELOPMENT AT DPWH-ARMM

| Scenario by End-2012 | Scenario by End-2015 |
|---|---|
| 1. Planning<br>• Focused mainly on core programs and major final outputs – with strategic regional impact; first priority to asset preservation, followed by rehabilitation, improvement and new construction; programs contain not more than 30% allocation for local projects<br>• Rational road planning systems – operational at ARMM RO proper with links to DEOs: process-based, needs-oriented at all stages, integrating network development and asset preservation needs; with full participation of key stakeholders; adapting or linked with modern IT planning systems and tools - e.g., DPWH-National HPM process, incl. RBIA, RTIA, PMS, HDM-4, BMS, MYPS, RMMS, TARAS.<br>• Adequate project preparation (FS) – for candidate projects identified from the proposed planning system; proficiency at RO proper for major projects.<br>• Harmonized plans/programs and budgets - with 80% match, including forward estimates and new projects from the planning system.<br>• Adequate computerized database – operational at RO proper, linked to DPWH-National database. RO proper and DEOs capable of conducting road and traffic surveys for the database.<br>• Strong staff competency on above | 1. Planning<br>• Focused fully on core programs and major final outputs - with strategic regional impact; first priority to asset preservation, followed by rehabilitation, improvement and new construct-ion; programs contain not more than 10% allocation for local project.<br>• Rational road planning systems – operational at RO proper and DEOs.<br>• Adequate project preparation (FS) – proficiency at RO proper for major projects, and DEOs for smaller projects.<br>• Harmonized plans/programs and budgets – with 100% match.<br>• Adequate computerized database - operational at RO proper and DEOs, linked to DPWH- National. RO proper and DEOs capable of conducting road and traffic surveys for database.<br>• Strong staff competency on above |
| 2. Design<br>• Adequate design preparation and appraisal – in-house and contract supervision capability at Survey and Design Division<br>• Outsourcing of surveys and designs –for 60% of the projects<br>• Access to DPWH-National design software – by RO proper<br>• Strong staff competency on above | 2. Design<br>• Enhanced design preparation and appraisal – in-house and contract supervision capability at Survey and Design Division and DEOs<br>• Outsourcing of surveys and designs – for 90% of the projects<br>• Access to DPWH-National design software –by RO proper and DEOs<br>• Strong staff competency on above |
| 3. Construction<br>• Construction by contract as general mode – for 70% of projects<br>• Adequate construction supervision – with minimum defects, delays, overruns, for 70% of the projects<br>• Effective monitoring – with CSO partner – at RO proper, covering major projects<br>• Adequate staff competency on above | 3. Construction<br>• Construction by contract as general mode –for 90% of projects<br>• Adequate construction supervision - with minimum defects, delays, overruns – for 90% of the projects<br>• Effective monitoring – with CSO partner – at RO proper and DEOs, covering all projects<br>• Adequate staff competency on above |
| 4. Maintenance<br>• Funding level for road maintenance - covering 70% of the needs.<br>• Efficient allocation and use of maintenance funds - based on needs, using RMMS, HDM-4, BMS – with 75% match between program | 4. Maintenance<br>• Funding level for road maintenance - covering 100% of the needs<br>• Efficient allocation and use of maintenance funds - based on needs, using RMMS, HDM-4, BMS – with 95% |

| | |
|---|---|
| and actual allocation.<br>• Reliable computerized database (incorporated in overall database) - operational at RO proper, with DEOs, under supervision of Maint. Division, able to conduct road/bridge attributes/condition surveys for the database.<br>• Effective inspection and work programs – at RO proper and DEOs, covering 75% of the roads.<br>• Maintenance by contract (MBC) as dominant mode – for 60% of the works including LTPBMCs.<br>• Effective vehicle load controls – 60% of required weighbridges operational with strict enforcement of load limits.<br>• Good quality of roads – on 70% of the network based on ROCOND/IRI.<br>• Adequate staff competency on above. | • Reliable computerized database (incorporated in overall database)- operational at RO proper and DEOs, with DEOs conducting road/bridge attribute/condition surveys for the database.<br>• Effective inspection and work programs – at RO proper and DEOs, covering 100% of roads.<br>• MBC by contract as dominant mode – for 90% of the works including LTPBMCs.<br>• Effective vehicle load controls – 90% of required weighbridges operational with strict enforcement of load limits.<br>• Good quality of roads – on 90% of the network baed on ROCOND/IRI<br>• Adequate staff competency on above |
| 5. Support Systems<br>• Financial management: eNGAS operational at RO proper; RO internal audit unit able to do systems and risk-based audits<br>• Procurement: 70% of BAC/TWG/Secretariat members trained; computerized contractors' registry, eligibility check, and cost estimation system operational at RO proper; bid docs posted at website; procurement manual used<br>• Human resource management (HRM): 60% implementation of rationalization plan based on core programs and realigned functions; 20% increase in km/ worker productivity; 15%-85% distribution of RO-field personnel<br>• Equipment management: liquidation or phase-out of 60% of equipment (with separation pay) since work is mostly by MBC | 5. Support Systems<br>• Financial management: eNGAS operational at RO proper and DEOs; RO and DEO internal audit units able to do systems and risk-based audits<br>• Procurement: 95% of BAC/TWG/ Secretariat members trained; computerized contractors' registry and eligibility check, and cost estimation system operational at RO proper and DEOs; bid docs posted at website; procurement manual fully used.<br>• HRM: 90% implementation of rationalization plan based on core programs and realigned functions; 40% increase in km/ worker productivity; 10%-90% distribution of RO-field personnel<br>• Equipment management: liquidation or phase-out of 90% of equipment (with separation pay) since work is mostly by MBC |

## 10.4 PRIORITY AREAS FOR INSTITUTIONAL CAPACITY DEVELOPMENT

The above analyses of the capacity gap and capacity development scenarios for road planning and management at DPWH-ARMM have been generally accepted by the DPWH-ARMM officials. In a workshop on Institutional Improvement and Reinforcement held on 25 May 2009 in Cotabato City as part of the JICA Study, the DPWH-ARMM participants reviewed the scenarios and, based on these, identified and ranked ten priority areas for institutional development. These are summarized in **Table 10.4-1**, in the order of importance.

**TABLE 10.4-1 TEN PRIORITY AREAS FOR INSTITUTIONAL CAPACITY DEVELOPMENT IDENTIFIED AND RANKED BY DPWH-ARMM OFFICIALS IN THE WORKSHOP ON 25 MAY 2009**

| Area | Ranking |
|---|---|
| a. Road Database (Road Bridge and Information Application or RBIA) ---- | 1 |
| b. Traffic Database (Road Traffic Information Application or RTIA) ------ | 2 |
| c. Bridge Management System (BMS) ---------- | 3 |
| d. Multi-Year Programming and Scheduling (MYPS) ---------- | 4 |
| e. Pavement Management System/Highway Development and Management Version 4 (PMS/HDM-4) ---------- | 5 |
| f. Maintenance Planning and Programming ---------- | 6 |
| g. Road Network Planning System (DPWH Highway Planning Manual) -- | 7 |
| h. Computerized Road Design Systems ---------- | 8 |
| i. Budgeting within Organizational Performance Indicator Framework (OPIF) and Medium-Term Expenditure Framework (MTEF) ---------- | 9 and 10 |
| j. Project Preparation: Feasibility Studies ---------- | 9 and 10 |

## 10.5 PROGRAMMING OF INSTITUTIONAL CAPACITY DEVELOPMENT

Based on these ten priority areas, the Institutional Capacity Development (ICD) Plan for DPWH-ARMM will be implemented in three stages:

- Stage I or Short-Term Program, 2010-2011: This will cover the development and installation of an operational database for roads and road traffic – i.e., priority areas a and b above. This is because an accurate and reliable database is fundamental to effective road planning and management.
- Stage II, 2012-2013: This will involve the adaptation and application of road planning systems under priority areas c to j, using the database installed in Stage I.
- Stage III, 2014-2015: This will involve the enhancement of the database and planning systems established in Stages I and II.

**Annex 10-1** shows the overall ICD plan.

This report focuses on Stage I (Short-Term Program).

### 10.5.1 ROAD DATABASE

#### 1) Description and Objective

This involves the establishment of an improved database or system at DPWH-ARMM to collect, upload, and access road inventory and condition data, and traffic volumes for national and regional roads in ARMM, which will be adequate for the planning and administration of the road network. This database will make use of appropriate information technology (IT).

The objective of the proposed DPWH-ARMM road database is to provide reliable, accurate and timely information needed for the effective planning and development of national and regional roads to address the transport needs of the region.

The following types of data are to be collected, processed, and stored in the road database:

- Road and bridge inventory data
- Road and bridge condition data
- Traffic volume

The information that will reside in the road database will be mot suitable for purposes of road network planning, and in the preparation of work programs and budgets.

**2) <u>Baseline Situation, 2009</u>**

a. The existing database at DPWH-ARMM – particularly the road inventory and conditions and traffic counts – is inadequate for effective road planning and management.

b. The database relies mainly on Road Diagram and Bridge Lists (RDBLs) which give incomplete/old/ inaccurate/unverified data.

c. There are some data given on road conditions, but these are mainly based on old subjective ratings formerly used by DPWH-National.

d. The Planning/Programming and Infotech Division of DPWH-ARMM, with its limited staff, has not been able to adequately check or validate data in the RDBLs.

**3) <u>Expected Results, 2010-2011</u>**

a. By the end of 2010, an improved IT-aided road database is expected to be operational at DPWH-ARMM, which can provide basic information on inventory and conditions of ARMM national and regional roads, traffic volumes and axle loads, road user costs, construction and maintenance costs, and socio-economic information, which are needed for road planning and management.

b. By the end of 2011, the DPWH-ARMM District Engineering Offices (DEOs) and DPWH-ARMM Central Office (CO) will be capable of conducting road inventory and condition surveys, and encoding and uploading the survey data to RBIA in order to populate the DPWH-ARMM road database.

c During Stage II, 2012-2013, with the development of road planning applications (under priority areas c to j above), DPWH-ARMM will be able to use its road database for effective planning and management of national and

regional roads, particularly in identifying needs for road network development (construction/ improvement) and asset preservation (preventive maintenance and rehabilitation), determining priority projects, preparing long/medium/annual plans, programs, and budgets for roads, and monitoring network performance.

**4) System Options**

After assessing different approaches to the development of the road database, these have been narrowed down to two practical options:

**Option A:**

This consists of a DPWH-ARMM road database, operationally linked to the DPWH-National Road and Bridge Information Application (RBIA). DPWH-ARMM will collect the required input data through field surveys, while DPWH-National will process and store the data in the existing DPWH-National RBIA database. DPWH-National will provide technical assistance to DPWH-ARMM in the development of the system, including training, field data collection, validation, and quality assurance; and accessing the processed data. DPWH-ARMM, however, will assume full responsibility over the integrity and quality of the data collection and validation. DPWH-National will process the ARMM data as a separate system for use by ARMM alone, and is not obliged to include the ARMM data in the preparation of the overall DPWH-National plans, programs and budgets.

**Option B:**

This consists of a stand-alone road database system at DPWH-ARMM.

DPWH-ARMM will establish its own database, independent of the DPWH-National RBIA. It will populate the database with data through its own field surveys, and process and store the data in the database. DPWH-National will provide technical advisory services to DPWH-ARMM in the development of the system, including field data collection and validation; and accessing the processed data. The stand-alone system may be developed with the aid of expert consultants. Or the system may be procured "off-the-shelf" and customized to suit ARMM needs.

A comparison of the advantages and disadvantages of these two options, from the viewpoint of DPWH-ARMM, is given in **Table 10.5.1-1**

**Table 10.5.1-1 Advantages and Disadvantages of Option A and B**

| | Advantages | Disadvantages |
|---|---|---|
| **Option A** | *Uses existing tested DPWH-Natl system.<br>*Faster to implement.<br>*Cheaper.<br>*Could facilitate total national roads planning<br>*Could rely on DPWH-Natl services. | *Constrained by DPWH-Natl system configuration and attributes.<br>*Affected by DPWH-Natl service priorities. |
| **Option B** | *Better customized to ARMM requirements and condtions.<br>*More readily accessible data.<br>*Independent of DPWH-Natl workload. | *Could take long to develop.<br>*More expensive.<br>*More difficult to interface with DPWH-National database. |

**5) Required Inputs**

**Option A**

a. The following survey data inputs must be provided into the RBIA:

- Locational Referencing System (LRS) Centerline Survey Data
- Road and Bridge Inventory Survey Data
- Road Condition Survey Data - Visual and Roughness
- Bridge Condition Survey Data
- Highway Imaging (Video)
- Traffic - Annual Average Daily Traffic (AADT) and Equivalent Standard Axle Load (ESAL)

b. DPWH-ARMM should acquire the required equipment, computer hardware and software for road inventory and condition surveys, as shown in **Annex 10-2**, and communication facilities, as shown in **Annex 10-3** conforming to the specifications set by DPWH-National to ensure compatibility with the RBIA.

c. DPWH-National should conduct the orientation and training of the staff of DPWH-ARMM DEOs and DPWH-ARMM CO on the RBIA, including surveys, data collection, encoding, and accessing, and interpretation of results.

d. DPWH-ARMM DEOs, supervised by DPWH-ARMM CO, should conduct annual road inventory surveys.

e. DPWH-ARMM DEOs, supervised by DPWH-ARMM CO, should conduct the annual road visual condition surveys.

f. DPWH-ARMM DEOs and DPWH-ARMM CO should conduct the periodic traffic surveys as part of the RTIA.

g. DPWH-ARMM DEOs, supervised by DPWH-ARMM CO, should conduct the centerline surveys of their respective road networks. The length obtained through the centerline survey should be the baseline length of their network and to be established in the system.

h. DPWH-ARMM DEOs, supervised by the DPWH-ARMM CO, should conduct the bridge inventory and conditions surveys.

i. DPWH-ARMM CO/DEOs should encode and upload the survey data to the RBIA.

j. DPWH-National should process and store the uploaded DPWH-ARMM data in the RBIA.

**Option B**

a. DPWH-ARMM should establish its own road database system – either through the development of a program or the acquisition of off-the-shelf program. DPWH-National may provide technical advisory services in preparing the Terms of Reference and specifications for the program and in evaluating proposals/bids from private proponents.

b. The following main types of survey data inputs are expected to be required by the database:

- Locational Referencing System (LRS) Centerline Survey Data
- Road and Bridge Inventory Survey Data
- Road Condition Survey Data - Visual and Roughness
- Bridge Condition Survey Data
- Highway Imaging (Video)
- Traffic - AADT and ESAL

c DPWH-ARMM should conduct the orientation and training of the staff of DPWH-ARMM DEOs and DPWH-ARMM CO on the resulting road database, including surveys, data collection, encoding, and accessing, and interpretation of results. DPWH-National will, as requested by DPWH-ARMM, provide technical advisory services in the training.

d. DPWH-ARMM DEOs, supervised by DPWH-ARMM CO, should conduct the different road, bridge and traffic surveys.

e. DPWH-ARMM CO/DEOs should encode and upload the survey data to the road database.

g. DPWH-ARMM should process and store the uploaded DPWH-ARMM data in the road database.

### 10.5.2 Road Traffic Database

#### 1) Description and Objective

This involves the establishment of an improved database or system at DPWH-ARMM to collect, upload, and access traffic counts for ARMM national and regional roads, which will be adequate for the planning and administration of the road network. This road traffic database will be either (a) linked to the DPWH-National Road Traffic Information Application (RTIA) for data processing and storage, or (b) a stand-alone system.

The objective of the proposed DPWH-ARMM traffic database is to provide reliable, precise and timely information necessary for effective road planning and management which responds to the transport needs of the country.

The following general types of data are to be collected, processed, and stored in the road traffic database:

- AADT for each vehicle type, by road section
- ESAL of large trucks, by road section

#### 2) Baseline Situation, 2009

Reliable traffic data needed for road planning are not collected and processed at DPWH-ARMM on a systematic basis. Regular traffic counts have not been made since DPWH-ARMM spun off from DPWH-National in the 1990s, except for JICA special surveys undertaken in 2003 and 2009.

#### 3) Expected Results, 2010-2011

a. By the end of 2010, an improved road traffic database is expected to be operational at DPWH-ARMM, providing basic information on traffic volumes and forecasts on national and regional roads in ARMM, which are necessary for road planning and management. The traffic data will be integrated into the road database (Section 3 above).

b. By the end of 2010, DPWH-ARMM DEOs and RO shall be capable of conducting long/medium/short-duration traffic counting surveys and uploading the data to the RTIA, thereby populating the DPWH-ARMM traffic database.

c. During Stage II, 2012-3013, with the development of planning applications (under priority areas c to j above), DPWH-ARMM will be able to use its traffic database, in conjunction with the roads database, for road planning and management, particularly in identifying needs for road network development (construction/ improvement) and asset preservation (preventive maintenance and rehabilitation), determining priority projects, preparing long/ medium/annual plans, programs, and budgets for roads, and monitoring network performance.

## 4) System Options

As in the case of the road database, the approaches to the development of the road traffic database have been narrowed down to two practical options:

**Option A:**

This consists of a DPWH-ARMM road traffic database, operationally linked to the DPWH-National Road Traffic Information Application (RTIA). DPWH-ARMM will collect the required input data through field surveys, while DPWH-National will process and store the data in the existing DPWH-National RTIA database. DPWH-National will provide technical assistance to DPWH-ARMM in the development of the system, including training, field data collection, validation, and quality assurance; and accessing the processed data. DPWH-ARMM, however, will assume full responsibility over the integrity and quality of the data collection and validation. DPWH-National will process the ARMM data as a separate system for use by ARMM alone, and is not obliged to include the ARMM data in the preparation of the overall DPWH-National plans, programs and budgets.

**Option B:**

This consists of a stand-alone road traffic database system at DPWH-ARMM.

DPWH-ARMM will establish its own database, independent of the DPWH-National RTIA. It will populate the database with data through its own field surveys, and process and store the data in the database. DPWH-National will provide technical advisory services to DPWH-ARMM in the development of the system, including field data collection and validation; and accessing the processed data. The stand-alone system may be developed with the aid of expert consultants. Or the system may be procured "off-the-shelf" and customized to suit ARMM needs.

The advantages and disadvantages of these two options, from the viewpoint of DPWH-ARMM, are similar to those for the road database given in Table 4.

## 5) Required Inputs

**Option A**

a. The following survey data inputs must be provided into the road traffic database:

- Manual traffic counts
- Automatic traffic counts
- Axle loads

The manual and automatic traffic counts have the following frequency:

- Long-duration

  - Permanent
  - 12 times a year
- Medium-duration

  - Four times a year
  - Twice a year
  - Once a year

- Short-duration

  - Once in every three year
  - Daylight only

b. DPWH-DPWH-ARMM should acquire the required traffic counting equipment, weighbridges/axle load machines, as specified in **Annex 10-4**.

c. DPWH-National should conduct the orientation and training of the staff of DPWH-ARMM DEOs and DPWH-ARMM DEOs CO staff on the RTIA, including surveys, data collection, encoding, and accessing, and evaluation of results.

d. DPWH-ARMM CO and DEOs should conduct long-duration (monthly), medium-duration (quarterly, once or twice a year), short-duration (once in 3 years) manual and automatic traffic counts.

e. DPWH-ARMM CO/DEOs should encode and upload the survey data to the RTIA.

f. DPWH-National should process and store the uploaded DPWH-ARMM data in the RTIA.

**Option B**

a. DPWH-ARMM should establish its own road traffic database system – either through the development of a program or the acquisition of off-the-shelf program. DPWH-National may provide technical advisory services in preparing Terms of Reference and specifications for the program and in evaluating proposals/bids from private proponents.

b. The following main types of survey data inputs are expected to be required by the database:

- Manual traffic counts
- Automatic traffic counts
- Axle loads

The frequency of the traffic counts could be similar to those for Option A.

c. DPWH-ARMM should conduct the orientation and training of the staff of DPWH-ARMM DEOs and DPWH-ARMM CO on the resulting road traffic database, including surveys, data collection, encoding, and accessing, and interpretation of results. DPWH-National will, as requested by DPWH-ARMM, provide technical advisory services in the training.

d. DPWH-ARMM DEOs, supervised by DPWH-ARMM CO, should conduct the different road traffic surveys.

e. DPWH-ARMM CO/DEOs should encode and upload the survey data to the road traffic database.

## 10.6 ACTION PLAN FOR OPTION A

### 10.6.1 Definition of Scope and Requirements

**Months 1 and 2:** DPWH-National shall define the detailed scope of work to establish the proposed DPWH-ARMM roads database (RBIA) and traffic database (RTIA), with Technical Assistance from DPWH-National to DPWH-ARMM and advisory services from the JICA Study Team. This will include the following:

- Detailed description of the DPWH-ARMM roads database and traffic database to be established.

- Equipment and facilities to be provided by DPWH-ARMM (**Annexes 10-2, 10-3, and 10-4)**. These will include equipment needed to conduct the field surveys to obtain the road inventory, road condition, and traffic counts; computers and software needed to encode and upload the survey data to RBIA and RTIA, and to access information and reports from the databases; and communication facilities and services to link up DPWH-ARMM DEOs/CO with DPWH-National RBIA and RTIA.

- Syllabi for training of DPWH-ARMM staff – content of lectures and practicum/ pilot applications, schedule, qualification requirements of participants, and related information.

- DPWH-National inputs – trainors, training materials, access to RBIA and RTIA, and related items.

- DPWH-ARMM counterpart – equipment and communication facilities (item b above), training expenses, including travel expenses of DPWH-National trainors, cost of training materials and facilities, training venue, and expenses of participants.

- Schedule of activities.

- Draft Memorandum of Agreement (MOA) between DPWH-National and DPWH-ARMM.

### 10.6.2 Consultation and Signing of MOA

**Months 1 and 2**: DPWH-National and DPWH-ARMM shall consult with each other and work together to undertake the tasks under **Section 10.6.1.** This will include the conduct of a workshop among DPWH-ARMM and DPWH-National officials to discuss and finalize the Scope of Work and the draft Memorandum of Agreement (MOA) for the establishment of the road database and traffic database. DPWH-National and DPWH-ARMM will then sign the MOA and start implementing its provisions, including the Steering Committee and Technical Working Group meetings.

### 10.6.3 Provision of Equipment, Participants, and Counterpart

**Months 3 to 5:** DPWH-ARMM shall acquire the required equipment, select the participants for the training, and arrange counterpart funding and services for the training.

### 10.6.4 Training for Database

**Month 6 and 1st week of Month 7:** DPWH-National shall conduct the training of DPWH-ARMM staff on the establishment of the road database and traffic database, including the conduct of surveys.

Month 6, Week 1: Road database (RBIA)
Month 6, Week 2: Road condition (ROCOND) rating
Month 6, Week 3: Bridge Management System (BMS)
Month 6, Week 4: Traffic database (RTIA)
Month 7, Week 1: Overview of other planning applications – Pavement Management System (PMS) / Highway Management System Version 4 (HDM-4), Multi-Year Programming and Scheduling System (MYPS), Routine Maintenance Management System (RMMS), and Traffic Accident and Recording Analysis System (TARAS).

### 10.6.5 Field Surveys

**Starting 3rd week of Month 7:** DPWH-ARMM shall undertake field road inventory, road condition surveys, and traffic surveys.

## 10.7 ACTION PLAN FOR OPTION B

The action plan proposed below pertains to the development and application of a stand-alone road database at DPWH-ARMM. The action plan for the development and use of a road traffic database will essentially follow the same approach.

### 10.7.1 Development of Terms of Reference

**Month 1:** DPWH-ARMM shall define the detailed Terms of Reference (TOR), including scope of work, for consulting services to establish the proposed stand-alone DPWH-ARMM roads database (RBIA).

**Overview**

The TOR shall provide that the road database be designed to:

- Become the official source of road and bridge information for DPWH-ARMM.

- Contain the entire inventory of ARMM road and bridge assets to be used by all personnel involved with planning and other activities requiring data on inventory.

- Provide a readily accessible common source of inventory data where users can enjoy its benefits in the performance of day to day duties.

- Provide easy access to the database data. Application can be configured to run in the intranet or the internet. This means users can have access to reports even if they are not in the office.

- Provide storage and analysis of historical data allowing comparison of data from previous years.

- Provide a user-friendly interface allowing computer-literate users to use the application in a day or two of training.

- Require minimal technical know-how to support the operation of the application. For example, since the application is web-based, there is no need to install additional software in computers.

- Maximize use of free or open source software to minimize software licenses costs.

- Provide user security. For example, some users will only be allowed to view reports but not edit data. Auditing will also be in place so that there is tracking of who edited what data.

**Implementation Strategy**

The development of the application will divided into three phases. This is to allow DPWH-ARMM to use the application as soon as possible. In as short as four months, DPWH-ARMM will be able to start populating its road database. While the database is being populated by the DPWH-ARMM users, the programmer can continue developing the tasks in the remaining phases. The phased implementation will also make it easier for the users to use the application since they will not need to learn the whole application at one time.

**Phase 1**

Timeline: 4 months

After this phase, DPWH-ARMM will be able to populate its current road data and their elements such as nodes, Location Reference Points (LRPs), culverts, drainage, traffic signs, and carriageway, among others. Instant generation of basic tabular reports will also be possible.

**Phase 2**

Timeline: 3 months

After this phase, DPWH-ARMM will be able to populate its current bridge data and their elements such as abutments, piers, spans and beams among others. Instant generation of basic tabular reports will also be possible.

**Phase 3**

Timeline: 4 months

After this phase, DPWH-ARMM will be able to store historical road and bridge data. Generation of complex reports with graphs will also be possible. DPWH-ARMM will be able to use tools such as line diagram generator. This tool will generate line diagrams in seconds. If done manually, creation of line diagram takes days. Integration will be functional that will allow DPWH-ARMM to share its data with DPWH-National if it wants to.

DPWH-National may, as requested, provide DPWH-ARMM technical advisory services in preparing the detailed Terms of Reference (TOR) for the consulting services to develop and apply the stand-alone database for DPWH-ARMM.

For reference, an illustrative TOR used for the DPWH-National database is given in **Annex 10-5. This** may be modified to adapt to DPWH-ARMM requirements.

### 10.7.2 Procurement of Consulting Services

**Months 2 and 3:** DPWH-ARMM will procure the consulting services in accordance with the provisions of the Government Procurement Act (Republic Act 9184) and its Implementing Rules and Regulations (IRR). If requested, DPWH-National may also provide technical advice and assistance to DPWH-ARMM in conducting the procurement, including the evaluation of proposals from consultants. DPWH-ARMM will award the contract with the winning consultant, perfect the contract, and issue the notice to proceed to the consultant.

### 10.7.3 Implementation of Services

As mentioned, the services to develop the database will be implemented in phases as follows:

**Phase 1:**

**Months 4 to 7**: Phase 1 will be developed and installed at DPWH-ARMM.

**Month 8**: DPWH-ARMM will conduct the training of its central and district staff to conduct the field surveys to generate the data needed to populate Phase 1, particularly the road inventory and condition, including the attributes of the road elements, such as length, surface type, and related data. If requested, DPWH-National will provide technical assistance in the training, including the provision of trainors and training materials for the field surveys.

**Month 9:** DPWH-ARMM staff will start conducting the field surveys, validate the data and input the road data into the database. Where requested, DPWH-National may provide technical advice in this undertaking. The database consultant will also train the appropriate DPWH-ARMM staff in encoding and uploading the collected road data into the database, and in generating tabular and related reports.

**Phase 2**:

**Months 8 to 10**: Phase 2 will be developed and installed at DPWH-ARMM.

**Month 11**: DPWH-ARMM will conduct the training of its central and district staff to conduct the field surveys to generate the data needed to populate Phase 2, particularly the bridge inventory and condition, including the attributes of the bridge elements. If requested, DPWH-National will provide technical assistance in the training, including the provision of trainors and training materials for the field surveys.

**Month 12:** DPWH-ARMM staff will start conducting the field surveys, validate the data and input the bridge data into the database. Where requested, DPWH-National may provide technical advice in this undertaking. The database consultant will train the DPWH-ARMM staff in encoding and uploading the collected bridge data into the database, as well as in generating tabular and related reports.

**Phase 3**:

**Months 11 to 14**: Phase 3 will be developed and installed at DPWH-ARMM.

**Month 15**: DPWH-ARMM will conduct the training of its central and district staff to store historical road and bridge data and to generate complex reports with graphs, such as line diagrams. The consultant will assist in the training on these aspects. If requested, DPWH-National will provide technical

assistance in the training, including the provision of trainors and training materials for the field surveys. provide t

**Month 16:** DPWH-ARMM staff will start storing historical data and generating complex reports.

### 10.7.4 MOA between DPWH-ARMM and DPWH_National

**Month 1**: Based on the above undertakings, DPWH-ARMM and DPWH-National shall enter into a MOA to formalize the provision by the latter of technical assistance and advisory services to the former in the following:

- Formulation of the TOR for the consulting services to be procured by DPWH-ARMM for the development of the road database.
- Evaluation of proposals from consultants for the database development.
- Training of DPWH-ARMM staff in the conduct of field surveys to generate the required input data to populate the database.

**Provision of Funds, Equipment, and Staff**

DPWH-ARMM shall provide the necessary capital and operating budgets for the development and utilization of the database. These include the cost of the consulting services, the acquisition of the required hardware and software for the database, and the equipment needed for the field surveys. DPWH-ARMM shall also provide appropriate staff and funding to conduct the field surveys, encode and store the data, generate output reports, and maintain the database system in goop operating condition.