International Labour Organization

Local Resource-Based Road Maintenance in the Philippines

A GUIDE

Published by the **International Labour Organization**
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INTRODUCTION

When President Benigno S. Aquino III assumed office in 2010, he directed the government's infrastructure agencies to adopt labour-intensive methods to create jobs, especially for the poor. In his 22-Point Agenda on Labour and Employment, he stressed the need to "create jobs immediately so people can have income to spend for their basic needs" (DOLE, 2012).

The President said that in communities where infrastructure projects are located, employment opportunities should be made available to the socially and financially disadvantaged.

Since the 1970s, the International Labour Organization (ILO) had refined what it calls the labour-based method for infrastructure works. This method maximizes employment opportunities, particularly among the poor, without compromising engineering standards and at competitive rates. The labour, both skilled and unskilled, uses equipment, tools and materials available in the communities where the infrastructure activities are located (ILO, 2002).

Under its Decent Work Country Programme framework, the ILO and its Employment Intensive Investment Programme (EIIP) developed labour-based and community-led tools not only to generate jobs and provide income but improve living conditions as well. These tools include participatory planning, appropriate technology, small contract management, and operation and maintenance of infrastructure (ILO, 2012).

In the Philippines, as in most developing countries, an area where jobs can be created is in rural road maintenance.

For local governments, well maintained rural roads not only support and facilitate development but enhance governance through significant savings that could be invested in other beneficial activities. In the ILO Road Maintenance Study in the Philippines (ILO, 2006), it was established that routine road maintenance for five years will cost only about 17 percent of total costs of rehabilitating, or repairing, a damaged road. This means, for example, that it will cost only PhP57,000.00 a year to maintain a kilometre of road for 5 years as against PhP1.62 million needed to rehabilitate or repair this same road portion.

By involving residents of the communities in road maintenance work – from planning and implementation to monitoring the road conditions, local government units (LGUs) are able to provide decent and sustained employment. Moreover, these LGUs are able to provide their constituents with improved access to institutions that provide basic services: public markets, hospitals or rural health centres, schools, churches, and government offices, among others.

From this development and governance perspective, LGUs are encouraged to consider road maintenance in their localities as a regular program to create jobs and, in the longer term, foster mobility and accessibility and guide growth.

This Guide has thus been prepared for LGU administrators and decision-makers in mind, from the provincial government level to the barangay (village). Other stakeholders, including both public and nongovernment organizations involved in rural development and community leaders, may also find this material helpful in their advocacies.

THE PHILIPPINES' ROAD SYSTEM

How large is the country's road system?

The road network of the whole country is 199,685 kilometres (km) long. Of this, 27,897 km (14%) are national roads and 171,788 km (86%) local roads. The local roads are further distributed into: 28,503 km provincial roads; 15,816 km municipal roads; and 121,701 km barangay (village) roads (InfRES, 2006).

Republic Act (RA) No. 917 or the Philippine Highway Act, classifies roads into National, Provincial, City, Municipal and Barangay Roads.

What is the state of the road system?

Table 1 indicates that only 14 percent of the country's roads is paved (concrete and/or asphalt), while 86 percent is unpaved, either as earth or gravel roads (InfRES, *ibid*).

Table 1. Road Inventory, Philippines (in km)

Classification	Paved	%	Unpaved	%	Total
National	16,029	57	11,868	43	27,897
Local	23,287	14	148,501	86	171,788
Total	**39,316**	**20**	**160,369**	**80**	**199,685**
Local Roads					
Provincial	5,825	20	22,678	80	28,503
City	4,048	70	1,719	30	5,767
Municipal	5,394	34	10,422	66	15,816
Barangay	8,020	7	113,682	93	121,702
Total	**23,287**	**14**	**148,501**	**86**	**171,788**

Most unpaved roads are barangay farm-to-market roads.

Majority of national roads are paved with asphalt or concrete.

What are the main uses of unpaved roads?

Most of the country's unpaved roads are located in the rural areas. These are mostly farm-to-market roads. These roads are vital to the economic life of rural communities since these constitute the main arteries that not only connect the communities with the markets but to mainstream development as well.

These roads are usually the sole structures that facilitate access of the rural residents to health centres, schools, public markets, and government offices. Since these roads are often far from the main roads and entrusted to the local government level with the least in resources and technical capacity, these are often neglected and therefore susceptible to deterioration and damage from natural elements like rains and floods.

Unpaved roads, where animal-pulled sleds and motorcycles are the main vehicles of transport, are the rural communities' links to the outside world.

ROAD MAINTENANCE:
DEFINITION AND IMPORTANCE

There are also unpaved national roads used by regular transport vehicles.

What is road maintenance?

The Department of Public Works and Highways (DPWH) defines road maintenance as the "preservation of roads and bridges as nearly as possible to its original condition when first constructed or subsequently improved" (DPWH, 2003).

All roads need maintenance as they are exposed to traffic and the forces of nature. Maintenance is all about keeping the road in good condition and effectively slowing down its deterioration. It is realizing the usefulness of the amount spent on the road's construction and postponing the need for expensive rehabilitation.

In tropical countries, rural road deterioration is caused by surface water, like rains and floods, and by the vehicles that use the road. Even with good design and materials, water weakens the road so the objective of maintenance is to get water away from the road as quickly and efficiently as possible (ILO, 2007).

Maintenance of rural roads is categorized under two groups – those done on the road surface, or carriageway, and those done outside the road surface. Work outside the road surface aims to ensure that the drainage system functions well to drain water away from the road. Work on the road surface seeks to keep the carriageway smooth, without obstructions and with the centre kept higher than the shoulders to make sure that surface water does not remain on the road surface (ILO, *ibid*).

Road surface softened by surface water and traffic

Silted canal littered with debris that block flow of water

What are the types of deterioration or damage that require road maintenance?

Deterioration of unpaved rural roads is usually caused by heavy rainfall and flooding that softens the carriageway thereby making it prone to damage. This process is hastened by traffic involving heavy vehicles or animal-pulled sleds. Poor quality design and construction also contribute to early deterioration.

The more common types of deterioration or damage are:

a) ruts, potholes and corrugations on the carriageway;
b) deformation of road shoulders due to erosion, thereby weakening the road structure; and
c) silting and erosion of the drainage system, including the canals and culverts.

What are the different types of road maintenance?

From the engineering viewpoint, there are at least three different types of maintenance activities:

1. **Routine maintenance** – Considered the most important, routine maintenance is carried out two to three times a year to ensure that the road stays in good condition, and that small problems are dealt with before they become larger problems;
2. **Periodic maintenance** – This is carried out every few years (four or five years) and involves more work and higher costs and includes activities like re-gravelling, surface overlay, major repairs of bridges and culverts, and improving longer stretches of bad roads; and
3. **Emergency maintenance** – This includes activities to repair road surfaces, bridges or culverts that have been affected by natural disasters like heavy rains or rockslides.

Another type of road maintenance that is usually considered an element or activity of the three types listed above is preventive maintenance. This consists mainly of evaluating and monitoring the conditions of the roadways for possible defects and remedies and applying these, like before the rains begin.

Preventive maintenance done on sides of the road

Example of a rural road after maintenance work is conducted

Why is road maintenance important?

Well-maintained roads bring about tremendous benefits to communities:

1. Economically, good roads have the following effects:
    - lowers vehicle operating costs;
    - improves vehicle fuel consumption;
    - reduces transport prices and increases use of the roads, resulting in more efficient movement of people and commodities;
    - increases income because of lower costs of transport for farm inputs and produce;
    - encourages investments in agricultural production activities; and
    - creates jobs and livelihood opportunities, directly and indirectly, through investments in commerce, tourism and transport services
2. Allows faster and efficient access to basic social services, like schools, hospitals, government offices, and markets;
3. Supports the good governance agenda of LGUs. Aside from the economic and social benefits derived from good roads, local governments can also generate substantial savings from road maintenance which could be invested in other services and facilities that serve the communities; and
4. Supports development of the communities through improved links to provincial and national roads.

What are the costs and benefits of road maintenance?

It costs a lot of money to build roads. If these roads are not properly maintained, the money used to build them will have been wasted. If the roads are well-maintained, they remain open for use all-year round and for many years.

By keeping roads open, rural communities move around and gain access to basic goods and services such as health, water, and education. Roads also provide links to economic services like employment, production areas, markets and consumers. Roads empower communities to innovate with the information and technology that reach them.

Local manpower will be tapped to use gravel materials to repair damaged portions of unpaved roads.

With expenditures on routine maintenance of the rural road within the capacity of the local government units (LGUs), the gains are enormous. This was established by the ILO in the study Road Maintenance in the Philippines where it was determined that expenses to maintain one kilometre of road for five years amount to only 17 percent of what it would cost to reconstruct the same road when it has deteriorated (InfRES, *op.cit*).

Maintenance of rural roads, undeniably, contributes to alleviation of rural poverty.

What are characteristics of a defective and poorly-maintained road?

1. **Carriageway**. This is the main part of the road where vehicles pass through. The common defects that require maintenance work are:
   - *Loss of shape, or camber.* Camber refers to the shape of the road wherein the middle is higher than the sides to allow surface water to flow towards the side ditches. The loss of shape is usually caused by erosion, loose and poorly-compacted surface, and frequent traffic especially by vehicles with heavy loads;
   - *Ruts.* Ruts are depressions along the length of the road surface caused by wheels of vehicles or by animal-drawn sleds that repeatedly pass through the same depression;
   - *Potholes.* These are depressions on the road surface caused by poorly compacted materials aggravated by surface water that remain; and
   - *Corrugations.* These are wave-like patterns perpendicular to vehicle direction caused by volume and speed of traffic, variations on surfacing material as well as actions of surface water. These can also be attributed to poor compaction or intentional removal of materials by people.
2. **Shoulders and Side Slopes**. These refer to the areas at the sides of the roadway other than the canals and culverts. The common defects are:
   - *Deformation by as much as 20 to 50 percent due to loss or accumulation of materials.* Materials loosened from the carriageway are often pushed to the side by vehicular traffic. This is due to either poor material selection or lack of compaction. Erosion also plays a part, or sometimes by simply leaving excess materials from previous repair or reconstruction work.

- *Slides.* Side slopes, left exposed and unstable when segments of the road were cut during construction, are liable to move during heavy rains, sliding to cover side drains and shoulders and leaving rocks and soil on the carriageway;
- *Scouring.* The volume and speed of flowing water eat away and carry soil particles from along its path. Continuous action of flowing water can scour unprotected components of the road structure.
- *Thick and overgrown vegetation.* Shrubs, small trees and grasses on roadsides block drainage lines and obstruct the drivers' line of sight while on the road.

3. **Side and cross drains.** The primary purpose of these road components is to efficiently and effectively drain surface water away from the road to protect it from possible damage. The common defects are:
   - *Blocks that prevent free flow of water.* When unmaintained, side and cross drains accumulate silt, soil and debris carried by surface runoff and hinder normal water flow, thereby resulting in floods that accelerate road deterioration.
   - *Structural damage.* Canals and culverts can be damaged by strong rains and storms. Faulty construction also contribute to damage to these road components.

Other signs of poor maintenance that cause road accidents are debris and obstructions that are not immediately removed, such as tree trunks, large stones, or other man-made structures like houses that protrude on the road and stalled or abandoned transport vehicles.

Examples of road defects and their corresponding maintenance approaches are listed in Annex C.

What is the potential of road maintenance as a source of jobs?

Road maintenance is a continuous process. Through labour-based work methods, jobs that do not require high-skill levels are created. Whether temporary or on a continuous basis, road maintenance work inject significant cash amounts to rural communities, especially those that rely on farming as their main economic activity.

Who is responsible for doing road maintenance?

Executive Order (EO) No. 113 identifies the entities responsible for design, construction and maintenance of the different roads. See table below.

The Local Government Code of 1991, through Rule V, Article 25 reiterates that the local government units (LGUs) shall be responsible for the roads, bridges and water supply system within their administrative boundaries.

Table 2. Responsibilities for Maintaining Roads

Type of Roads	Responsible Agency/Entity	Administrative Responsibility
National roads, including arterial and secondary roads	National Government, through the Department of Public Works and Highways	Design, construction and maintenance
Provincial roads	Local Government – Provincial Government, through the Provincial Engineering Office	Design, construction and maintenance
City roads	Local Government – City Government, through the City Engineering Office	Planning, design, construction and maintenance
Municipal roads	Local Government – Municipal Government, through the Municipal Engineering Office	Planning, design, construction and maintenance
Barangay roads	Local Government – Barangay Council, through the Barangay Road Maintenance Committee, also referred to as Committee on Public Works/Infrastructure	Routine maintenance

LOCAL RESOURCE-BASED ROAD MAINTENANCE

Community-based workers repairing a road damaged by a typhoon-induced landslide

What is local resource-based road maintenance?

Local resource-based road maintenance, as the name suggests, is the use of materials, manpower and technology that are available in the community. The local labour for maintaining roads – both skilled and unskilled, is supported by light equipment and uses materials and tools that are generally available in the locality.

The experience of the ILO with its Employment Intensive Investment Programme (EIIP) under the Decent Work Country Programme demonstrated that local resource-based job creation tools not only generate jobs and provide incomes but improves living conditions as well.

What are the advantages of local resource-based road maintenance?

Between equipment-based road maintenance done by large contractors and one done by local resource-based groups, the latter is more advantageous in terms of costs and helping the local economy.

Equipment-based contractors usually come from outside the poor rural communities and the bulk of income generated does not benefit the local economy.

In the early 1970s, the ILO refined the labour-based approach for sustainable employment. Labour-based technology maximizes employment opportunities without compromising engineering standards. Labour – both skilled and unskilled – is supported by light equipment and uses materials and tools generally available in the localities where the road infrastructure projects are located (ILO, 2002).

Why is local resource-based road maintenance needed?

Local governments, by law – particularly through the Local Government Code, are expected to address the deterioration of public assets, like roads, within their respective jurisdictions. Due to the nature of the country's budgeting system as well as the dynamics of local decision-making processes, needed action to stall deterioration of infrastructure usually comes late or not at all. As a result, this often leads to the more expensive rehabilitation or reconstruction.

Moreover, under current government procurement laws and practices, construction of infrastructure projects entails bidding that most often are participated in by contractors from outside the community. In reality, routine maintenance does not require big contractors. Local residents from the affected communities can do the needed road maintenance work.

Are local resource-based road maintenance effective?

Yes. The ILO demonstrated that communities can be relied upon for the upkeep of small community infrastructures, including road maintenance activities. The demonstration projects established that the communities' involvement at the start of the development gives them the sense of ownership that leads to the proper use and maintenance of the infrastructure. See Annex A on the demonstration activities as documented.

What are the benefits from local resource-based road maintenance?

The ILO demonstration projects showed that the following benefits resulted from the approach:

- Short-term emergency employment was provided to the residents of the area, especially the poor and unemployed. Through the Special Local Road Fund (SLRF) and other LGU financing mechanisms, employment can be sustained over the long term;
- The roads were rehabilitated, thus improving mobility in the area;
- Access to basic services – schools, health centres, the business centres and the market, was improved;

Community residents evaluate road conditions and material requirements for maintenance work.

- The local residents were equipped with basic knowledge and skills through hands-on and on-site skills transfer; and
- The local economy was stimulated through cash inflow to workers and local suppliers.

What are the steps needed to implement local resource-based road maintenance?

1. Identify and secure the sources of funding for the road maintenance project;
2. Undertake preparatory activities to ensure the availability of local resources for the project: local labour, materials (including sand and gravel), basic tools, and administrative support from the municipal and barangay LGUs;
3. Identify and organize the workers from the community for the road maintenance work; and
4. Do capacity-building activities for involved participants: municipal engineering officers/staff, barangay administrators and staff, and the workers.

These activities should be accompanied by a concern for working conditions and compliance with international labour standards – or decent work – which is an essential component of labour-based practice.

These standards include provision of protective work gear for the workers such as boots, gloves and hats/hard hats that provide protection against falling objects and harsh sunlight. These workers must also be covered by health insurance such as Philhealth (Philippine Health Insurance Corporation), in the case of the Philippines.

What other benefits can local resource-based road maintenance bring about to local residents?

Aside from the income from jobs generated for the local economy as well as improved mobility and accessibility, local resource-based road maintenance can provide skills and related knowledge needed by the community to conduct other infrastructure-led work. The residents also learn other matters like safety standards, technical aspects of road-building and basic management.

What are the common local resource-based activities for routine road maintenance?

Routine road maintenance activities are those that are labour-based, or uses manual labour, and do not require heavy equipment like road graders, road rollers, and the like. These include:

- vegetation control;
- patching of potholes and other depressions;
- erosion control;
- cleaning of canals/ditches and culverts;
- clearing the road of fallen trees and debris;
- repair of minor damages to road shoulders and slopes; and
- planting of trees and other shrubs to prevent erosion.

FINANCING ROAD MAINTENANCE

What are the sources of financing for road maintenance activities?

For all types of roads, the budget for operations and maintenance comes from three main sources:

- the General Fund (General Appropriations Act);
- 20 percent of the Internal Revenue Allotments to Local Governments, or the Development Fund; and
- the Special Local Roads Fund (SLRF), as provided for under Republic Act (RA) 8794 or the Motor Vehicles Users' Charge (MVUC) Law.

Additional sources of funds, albeit irregular or external in nature, include the Philippine Development Assistance Fund (PDAF) of Congressmen and Senators; the Social Fund of the Office of the President; and official development assistance (ODA) from bilateral and/or multilateral donors.

What is the SLRF?

The Special Local Road Fund is a source of sustainable funding for the maintenance of local roads that can be tapped by the local government units. The SLRF is generated mainly from the registration of motor vehicles and penalties for violations of traffic laws, such as overloading.

Part of the Fund is allocated to provincial and city governments in accordance with vehicle population and size of the road network under the LGU's jurisdiction. This is to be used solely for maintenance of local roads and traffic management.

How much does an LGU spend for road maintenance?

Sample computations to determine maintenance activity costs per kilometre are listed in Annex D-2.

The patching of potholes, for example, is estimated to cost PhP6,000.00 per km and covers costs of materials and labour. For vegetation control, which does not require any material, estimated labour costs is PhP4,000.00 per km. The most expensive routine maintenance work involves the reshaping of earth and gravel surfaces of the road including restoration of drainage. Costing PhP7,200.00 per km, this requires the use of a road grader.

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ANNEX A:
DEMONSTRATION PROJECTS:
Local Resource-Based Road Maintenance

PROJECT A: Maintenance of 10-Km Farm-to-Market Road	
Location:	La Libertad Municipality LGU, Zamboanga del Norte
Labour Sources:	Residents of La Libertad's Barangays
Project Cost:	PhP420,000.00
Funding Source:	ILO and La Libertad Municipal Government

La Libertad is one of the poorest municipalities of Zamboanga del Norte province, with 78 percent of its population living below the poverty threshold. The municipality is land-locked and located in the northeastern interior. Its economy is mainly agricultural, with copra as its major product.

The implementation of the ILO demonstration project on local resource-based road maintenance was facilitated in collaboration with the DOLE Region IX, the Provincial Government (PLGU) of Zamboanga del Norte, and the La Libertad Municipal Government (MLGU).

A Service Contract was signed between the ILO and the DOLE, wherein the former would release PhP420,000.00 to cover expenses for the activity, including cost of labour of the maintenance crews.

After a two-day training, the maintenance crews were gathered, organized and briefed by their respective group leaders. The workforce consisted of 262 residents from the barangays directly and indirectly affected by the target road segments. They were organized into 10 groups and assigned to corresponding one-kilometre segments of the 10-kilometre target road site.

Ground breaking rites open road maintenance project

Workers repairing road shoulder

For 10 days, the road maintenance workers undertook the following activities:

a) *Vegetation control*. Thick vegetation on roadsides were removed to expose the side ditches, side slopes and shoulders where other routine maintenance activities were applied.
b) *Clearing side drains, culverts and cross-drains of debris*. Work included the removal of silt as well as other obstructions like soil, rocks and litter that blocked the free flow of water from the drainage lines to the outfalls;
c) *Repair of potholes and ruts on the carriageway*. Work involved removing water from potholes, excavating prescribed volume of road surface material around the pothole, filling with enough quality sand and gravel, and compacting the materials with a hand-held earth rammer;
d) *Repair of road shoulders and eroded slopes*. Eroded shoulders and gullies were repaired with good material and compacted with an earth rammer;
e) *Clearing roadsides of vegetative overgrowth*. Bushes and grasses on and beside the road were removed or trimmed; and
f) *Repair of canals and side ditches*. Using a template of the canal cross-section made of plywood as guide, the workers repaired the damaged canals according to prescribed dimensions.

PROJECT B: Rehabilitation of Farm-to-Market Road	
Location:	Barangays Cadad-anan and Lenga, Tadian, Mountain Province
Labour Sources:	Residents of Barangays Cadad-anan and Lenga
Project Cost:	PhP753,742.00
Funding Source:	ILO and Municipal Government of Tadian

Tadian is a 4th class municipality in terms of income in the Mountain Province. Located 127 km northwest of Baguio City, it is composed of 19 barangays with a total population of 17,148 as of 2008.

The main livelihood of the people of Tadian is mixed crop agriculture, with rice and vegetables planted in its extensive mountain terraces.

Maintenance on road damaged by typhoon: women haul small rocks to be used as materials while men repair surface of damaged road.

About 70 percent of the roads in Tadian are rough and unpaved. It was one of the hardest hit areas by Typhoon Nesat (Pedring) in September 2011. Several barangays were isolated from the Tadian town centre due to landslides and washed-out portions of the roads. Two of these barangays are Lenga and Cadad-anan where the ILO intervened to assist its residents in rehabilitating the road.

The Rehabilitation of the Lenga-Cadad-anan farm-to-market road project was a joint activity of the ILO, the DOLE-Cordillera Administrative Region (CAR), and the Tadian Municipality.

The project consisted of three components: demolition of the eroded portions of the road; excavation and clearing of the slides blocking the road; and construction of rip-rap walls at the eroded portions of the road.

The project employed a total of 58 people, 35 of whom are women. These workers were recruited through the Tadian Public Employment Service Office (PESO). The major source of livelihood of these workers, mainly agriculture, had been temporarily disrupted because of the damages to the farm-to-market road.

The emergency maintenance project was completed in 16 working days. The rehabilitation activities were applied on two segments of the 8 km Lenga-Cadad-anan barangay road that were damaged by landslides and erosion.

A total of 228 households benefited from the project – 130 from Barangay Cadad-anan and 98 from Barangay Lenga. The ILO assistance amounted to PhP500,000.00 with the Tadian LGU counterpart at PhP253,742.

A very significant feature of the project was the use of traditional community knowhow, particularly on the construction of grouted rip-rap walls, on the eroded portions of the road. The workers belong to the indigenous Kankana-ey tribe who are also known for building and maintaining the centuries-old rice terraces in the province using traditional rip-rap (called kabite in the vernacular) technology.

PROJECT C: Rehabilitation of a Farm-to-Market Road	
Location:	Barangay Santa Maria, Alfonso Lista, Ifugao Province
Labour Sources:	Residents of Barangays Santa Maria and Poblacion
Project Cost:	PhP1,176,209.00
Funding Source:	ILO and Municipal Government of Alfonso Lista

Alfonso Lista is about 300 km from Manila and is the northernmost town in the province of Ifugao. It is a 3rd income class municipality and consists of 20 barangays. It is known as the site of the Magat Dam, the largest hydro-electric dam in the country. The municipality has a total land area of 43,474 hectares, or about 17 percent of the area of Ifugao province.


Portion of paved farm-to-market road completed through local resources based maintenance initiatives

Alfonso Lista has a total population of 25,470 as of 2008. The main economic activity is agriculture, with most agricultural lands planted to corn. The labour force participation rate is 58 percent.

The bulk of the municipality's road system consists of municipal farm-to-market roads. One farm-to-market road at barangay Santa Maria was the site of the application of the ILO local resource-based intervention.

The Santa Maria Farm-to-Market Road project in Alfonso Lista sought to convert what remained of a 400-meter long dirt road into an "all-weather, all-purpose" concrete road. Other aspects of the projects are:

a) A total of 58 individuals were employed by the project, all of them male, coming from the affected barangay (Santa Maria). Recruitment of the workers was facilitated by the Alfonso Lista PESO;
b) Total cost of the project was PhP1,176.209 of which PhP500,000 was provided by the ILO and the remaining PhP676,209 being the Alfonso-Lista counterpart; and
c) The project took 16 calendar days to complete, beginning on December 16 until December 31, including holidays and Sundays.

While the majority of the population of Alfonso Lista belong to a major ethnic group in the country (Ilocano), members of the town's indigenous tribes – namely the Ifugao and the Gaddang, were also employed in the project.

ANNEX B:
GUIDELINES ON COMMON ROUTINE ROAD MAINTENANCE ACTIVITIES

As part of their training, local residents are walked through a road to evaluate the maintenance work to be done.

Preparatory Activities

A. After having secured financing to conduct road maintenance, identify and organize the workers from communities along the road into teams to work on specific segments of the road.

B. With the teams designated for specific road segments, walk through with the team leaders and representatives from the LGU engineering office and the barangay to conduct a roads assessment and evaluation activity and identify the maintenance work to be done.

C. During the roads assessment and evaluation activity, the LGU engineering office representative must ensure that standards will be observed. These standards include:
   - *Width of the road*. This must be consistent with the approved road design. As an example, for a six (6) metres road right-of-way, the carriageway is four (4) metres with one (1) meter on each side allocated for shoulders and side ditches; and
   - *Right-of-Way*. The road must be on public land and should not pass through private property. There are instances when damaged roads are rerouted through private property without knowledge or consent of the owner.

D. The basic tools must be available either through the LGU or the DPWH. The workers must have the necessary protective equipment (gloves, rubber boots and headgear) in compliance with local, national and international agreements on occupational safety and health standards.

Activities for the Road Carriageway and Shoulders

A. Removing weak or soaked materials from a pothole/rut *B. Filling holes with gravel or soil* *C. Compacting the soil layer with earth rammer*

1. Filling potholes and ruts in the carriageway

Materials: As much as possible, use materials similar to what were used on the road surface. If not available, a mixture of cracked and angular stones with some clay is a good substitute. Top soil or black soil should not to be used.

Procedure: (a) Remove weak or soaked materials from the pothole or rut until firm or solid ground is reached; (b) fill the holes with gravel or stone and soil mixture with layers up to 10 cm; (c) compact each layer using an earth rammer; and (d) the last layer of filler should be slightly higher than the existing surface to allow for settling.

Required tools: pickaxe; shovel and hoe, and earth rammer

2. Repairing erosion of road shoulders and slopes

Road maintenance work includes planting of grass on slopes to prevent erosion and clearing roadsides of silt and soil from landslides.

Materials: Gravel or soil as fillers. Grass can be replanted on the shoulders to prevent erosion.

Procedure: (a) Fill the eroded portions of the shoulders and slopes with gravel and soil; (b) compact the filled area with an earth rammer; and (c) plant grass along the shoulders.

Required tools: hoe and shovel; rake; wheelbarrow; and earth rammer

NOTE: Where damage from erosion is massive, repair works may include construction of rip raps or retaining walls. For grouted riprap, large stones are placed on an initial layer of concrete laid over firm earth. Fill up the spaces between stones with a mixture of cement, sand and pebbles. On the fresh layer of concrete poured over the first set of stones, pile another layer of similar-sized stones with the voids in between stones filled the concrete mix. Repeat the process until the desired height is reached. Provide weep holes made of PVC pipes at least 1-1.5 meters apart along vertical and horizontal lines. This is usually considered a major road rehabilitation activity.

3. Reshaping the carriageway

Materials: Gravel or soil fillers

Procedure: (a) Using a wheelbarrow and spade, fill uneven surfaces in the carriageway with the prescribed gravel and soil mix making sure more materials are laid on the middle of the road. With rakes, level the materials and the carriageway to the desired slope; (b) compact the materials with an earth rammer; and (c) from the edge of the carriageway, clear the shoulders and side ditches of excess vegetation.

Required tools: Hoe, shovel and rake.

Activities for the Drainage Canals

Culvert in unmaintained road is inspected and evaluated before obstructions are removed

1. Inspection and removal of debris and obstruction

Materials: none

Procedure: The activity begins with an inspection of the complete length of the road that will undergo maintenance work. The work does not require tools, except in cases where obstructions need to be removed with the help of equipment. The work includes: (a) Inspection of the road and side ditches and canals every working day, especially after every rainfall; and (b) removal of any obstruction or debris that block the drainage lines.

Required tools: machete to remove excess vegetation and shovels to remove silt, debris and litter.

NOTE: When culverts and drainage canals are damaged severely during heavy rains and flooding, rehabilitation and reconstruction work that require heavy equipment and durable materials are more appropriate interventions, other than the routine maintenance alone.

2. Cleaning culverts, including inlets and outlets

Materials: none

Procedure: (a) Remove all silt, soil, litter and debris from the culvert inlet and outlet as well as in the entire length of the culvert. Ensure that the outlet enables the free flow of water in the drains; (b) check the gradient of the culvert line. The outlet must be lower than the inlet. If the gradient cannot be improved, reconstruction of the culvert line is necessary.

Required tools: long-handled shovels; hoes; and measuring aids.

3. Cleaning side drains and canals and restoring these to original shapes

Materials: none

Process: The drains and canals at the sides of the roads should be kept free of obstructions such as debris, litter and silt to ensure the free flow of water. If the canals are of proper depth but are covered with grass and other vegetation, clearing the canals of these growths with bush knives or scythes is required.

This work flow is usually advised for preventive and routine maintenance work: (a) Excavate the silted and shallow drainage canals to achieve the correct canal depth; (b) remove all materials – silt and debris from the drains; and (c) ensure that the depth of the entire length of the canals is uniform to avoid the pooling of water during rains.

Required tools: shovels; pick-axes; bush knife; and measuring aids (to measure the depth of the drains).

Activities for Roadsides

Cutting grass, bushes and other vegetation

Materials: none

Process: Grass and vegetation on the sides of the road or on its shoulders should be kept short, at about 5 cm. The root system of cropped grass on the roadsides helps prevent erosion by holding on the soil in place.

For bushes and other vegetation, these should be cut and disposed off safely. Overhanging branches of trees by the roadsides should be cut to prevent obstruction of the motorists' line of sight. Dead trees near roads should be cut and removed to avoid accidents or disruptions of traffic flow if these fall on the road.

NOTE: It is not advisable to use chemicals such as herbicides to remove vegetation by the roadside. Herbicides, which are dangerous to health, can pollute waterways and affect crops, streams and even drinking water.

Avoid burning vegetation by the roadside for the following reasons: (a) fire could spread and destroy trees and crops near the maintenance site; (b) vegetation grow faster after burning; and (c) smoke and flames from fires can blow across the roads and pose a danger to motorists.

Required tools: Bush knives/machete, rakes, scythes or sickles, axes; and other cutting tools.

List of Hand Tools

Hoe (asarol)

Shovel (pala)

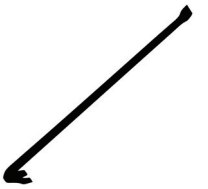
Mattock (piko)

Slasher (tapas)

Rake (kalaykay)

Pickaxe (piko)

Bush knife (itak)



Crowbar (bara de kabra)

Sledgehammer (maso)

Handrammer (pangbatok)

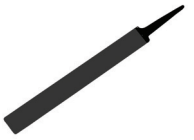
Broom (walis)

Bow saw (lagare)

Claw hammer (martilyo)

Axe (palakol)

Mallet (martilyong kahoy)



File (kikil)

Wheelbarrow (kartilya)

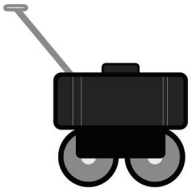
Carpenter's saw (lagare)

List of Hand Tools (continued)

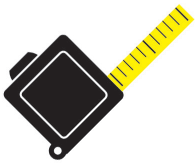
Bucket (balde)

Spirit level (lebel)

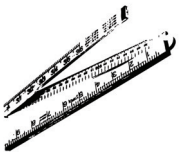
Ditch template with spirit level (gaya sa kanal na may lebel)



Roller compactor (pison)



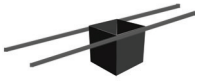
Measuring tape (pangsukat na metal)



Folding rule (pangsukat na natitiklop)

Hand trowel (paleta)

Hand brush (brutsa)



Aggregate measuring box (kahon)

ANNEX C:
COMMON RURAL ROAD DEFECTS, CAUSES AND REMEDIES

A. Defects of carriageway or main road area

Common Defects	Causes	Maintenance Work Needed
1. Flooded portions of road 	Floods or heavy rains, abetted by improper or non-existent drainage	Routine maintenance and emergency rehabilitation: a. Remove water from the road surface b. Reshape road with appropriate materials and restore roadway width and compact with a hand rammer c. Repair drainage at the sides of the roads d. Monitor the maintenance and rehabilitation of the road to ensure compliance with DPWH specifications
2. Presence of ruts, corrugations and potholes 	a. Heavy rains which create surface run-off b. Use of carabao sleds c. Lack of compaction d. Heavy traffic and axle load e. Removal of gravel/ aggregates by residents	Routine maintenance and rehabilitation: a. Restore the road's earth and gravel surfaces with appropriate filling materials and compacted accordingly b. Patch the potholes with prescribed materials and compact with an earth rammer c. Enforce local laws prohibiting the destruction of public property

Common Defects	Causes	Maintenance Work Needed
3. Defects of Carriageway or main road area 	a. Heavy rains which create surface run-offs and erosions b. Lack of compaction c. Removal of gravel/ aggregates by residents	Routine maintenance and rehabilitation: a. Re-surface the eroded areas and compacted accordingly b. Enforce local laws prohibiting the destruction of public property

B. Defects of Road Shoulders/Slopes and Canals/Culverts

Common Defects	Causes	Maintenance Work Needed
1. Deformed sides of roads 	a. Erosion due to heavy rains/flooding b. Lack of compaction, including inadequate sloping materials c. Accumulation of surface materials or debris due to flooding	Routine maintenance and rehabilitation: a. Reshape the deformed shoulders using hand tools b. Strengthen the slopes through grassing, rip-rapping or other methods c. Restore original shape of slopes through compaction and removal of debris
2. Dense vegetation 	Uncontrolled growth of vegetation by the roadside which obstruct safe line of sight of motorists and commuters	Routine maintenance: Cut the vegetation, leaving the roots intact to strengthen the slope against erosion
3. Scoured road shoulders 	a. Erosion due to rains/ surface run-off; and b. Lack of compaction	Routine maintenance: Fill the scoured areas with earth and gravel aggregates and reshape

	Common Defects	Causes	Maintenance Work Needed
4.	Silted or blocked road canals and culverts 	Silt and debris brought about by either flooding or run-offs from the roads or sides of the roads	Routine maintenance: Clean the canals of the silt and debris before the next possible floods or rains
5.	Structural damage to the drainage system	Heavy flooding that could damage vulnerable parts of the drainage system	Routine maintenance and rehabilitation: a. Identify the damaged part of the drainage system and report this to the local engineering office for proper remediation b. Monitor reconstruction/ rehabilitation to ensure compliance with DPWH standards

ANNEX D-1:
PERFORMANCE MAINTENANCE STANDARD:

Earth and Gravel Roads and Bridges (Second Rural Roads Improvement Project, DILG)

Activity	Type	Manpower	Work Measurement Unit	Estimated Productivity
Patching unpaved roads	Routine	1 foreman, 4 maintenance workers, 1 equipment operator	Cubic meter aggregate placed	4.0 m^3 per crew day 0.80 m^3 per man-day
Blading unpaved roads	Routine	1-2 grader and/or roller operator	Kilometer (km) bladed	5 km per crew day
Regravelling	Periodic	1 foreman, 4 maintenance crew, 8 equipment operators	m^3 aggregate placed	250 m^3 per crew day 19.2 m^3 per man day
Reshaping earth/ gravel surfaces, restoring drainage	Periodic	1-2 equipment operators	Km reshaped	2 km per crew day
Blading unpaved shoulders	Routine	1 equipment operator	Km bladed	2 km per machine day
Vegetation control	Routine	Variable	Km cut (for planning), linear meters (for reporting) roadway length, both sides	50 linear meters per man-day
Erosion control	Routine	Variable	m^3 of materials per man-day	0.5 m^3 per man-day
Trimming roadside trees	According to need	Variable	Man-days	Varies according to conditions
Hand ditch cleaning	Routine	Variable	Km cleaned, meters cleaned roadway length, both sides	65 linear meters per man-day

Activity	Type	Manpower	Work Measurement Unit	Estimated Productivity
Cleaning and repair of culverts	Routine	Variable	No. of culvert lines cleared	According to conditions
Cleaning of roadside of flets	Routine	Foreman with up to 10 road workers	No. of flet channels cleared	66 channels/ per crew day; 6 channels/man-day
Bridge waterway clearing	Routine	Foreman, 6 maintenance workers	No. of bridge waterways cleared	0.5 bridge/ crew day; 0.071 bridge/man-day
Redecking wooden bridge decks	Periodic	1 bridge foreman, 4 carpenters, 6 maintenance workers	Linear meters re-decked or board feet re-decked	2.5 linear mts/ crew day; 0.25 linear mts/man-day; 320 bd ft/ crew day
Repainting steel bridges	Routine	1 bridge foreman, 2 painters, 4 maintenance workers	Gallons of paint	4 gallons/crew day; 0.57 gallon/ man-day
Minor repair of bridges	Routine	Variable	Man-days	According to conditions
Application of wooden preservatives to wooden bridges	Periodic	1 bridge foreman, 2-4 painters, 2-4 maintenance workers	Gallons of preservatives	5 gallons/crew day 0.60 gallon/ man-day
Repairs/ replacement of cut waters, headwalls, retaining walls, other bridge protection structures	Periodic	Capataz, 2-4 masons, 2-4 road workers	m^2 or m^3	According to conditions, 5 m^2or 3 m^3/crew day; 0.56 m^2 or 0.33 m^3 per man-day
Maintenance of water-proofing on reinforced concrete bridges	Periodic	Capataz, 2-4 painters, 2-4 road workers	m^2	45 m^2/crew day 5 m^2/man-day
Cleaning and clearing of bridges	Routine	Capataz, 4-6 workmen	m^2 (superficial area)	140 m^2/crew day 20 m^2/man-day

Activity	Type	Manpower	Work Measurement Unit	Estimated Productivity
Concrete bridge deck repair	Periodic	Capataz, 4-6 crewmen	m^2	0.71 m^2/man-day
Aggregate production	Routine	2-3 equipment operators	m^3 of aggregate	150 m^3/crew day 75 m^3/man-day
Hauling aggregates	As needed	4 equipment operators	m^3 aggregate x km	80 m^3 km/crew day 20 m^3 km/man-day

ANNEX D-2:
SAMPLE COMPUTATIONS TO DETERMINE MAINTENANCE ACTIVITY COSTS PER KILOMETRE[1]

1. Patching of potholes

Planning criteria:	10 m^3 aggregate per kilometre (km)
Productivity:	a) 0.8 m^3 per man-day (mday) b) 0.08 km per mday
Cost[2] of materials:	PhP350/m^3
Labour costs:	PhP200/mday
Computations:	

Labour:	1 km ÷ 0.08 km/mday = 12.5 mdays needed to cover 1 km (or 10 m^3/ km ÷ 0.8 m^3/mday = 12.5 mdays needed to consumer materials to cover potholes in 1 km of road)
Cost for 12.5 mdays is:	12.5 mdays x PhP200/mday = PhP2,500/ km
Materials:	10 m^3 x PhP350/m^3 = PhP3,500.00/ km
Equipment:	none
Total cost to do patching of potholes:	materials + labour = 2,500 + 3,500 or PhP6,000/ km

2. Reshaping earth and gravel surface/restoring drainage (blading unpaved roads)

Productivity:	2 km/machine-day
Cost of materials:	none
Labour costs:	none
Equipment:	1 grader
Computation:	

Equipment costs:	grader: 1 km ÷ 2 km/day x PhP1800/hr x 8 hrs/day = or PhP7,200/ km

[1] Productivity standard lifted from Road Maintenance Management Manual, SRRIP, DILG, 1993
[2] All costs are indicative and vary between LGUs, figures used are for demonstration only

3. Regravelling (to be applied every 5 years)

Planning criteria:	600 m^3 aggregate per kilometre
Productivity:	a) 19.2 m^3 per man-day or 0.032 km/man-day b) 250 m^3 per crew-day c) Grader – 2 km/machine day, PhP1,800/hour d) Roller – 2 km/machine day, PhP1,200/hour
Cost of materials:	PhP385/m^3
Labour costs:	PhP200/man-day
Crew:	1 foreman[3] 4 maintenance workers 3 equipment[4] operators (1 grader, 1 water truck, 1 roller)

Computations:

Labour:	1 km ÷ 0.032 km/mday = 31.25 mdays needed for 1 km (or 600 m^3÷ 19.2 m^3/mday = 31.25 mdays) 31.25 mdays x PhP200/mday = PhP6,250.00
Materials:	600 m^3 x PhP385/m^3 = PhP231,000/ km
Equipment:	grader: 1 km ÷ 2 km/day x PhP1800/hr x 8 hrs/day = or PhP7,200/ km roller: 1 km ÷ 2 km/day x PhP1200/hr x 8 hrs/day = or PhP4,800/ km
Total regravelling costs:	labour + materials + equipment = Php6250 + 231,000 + 7200 + 4800 = PhP249,250/ km

4. Vegetation control[5]

Productivity:	50 linear meters/man-day, roadway length both sides
Cost of materials:	none
Labour costs:	PhP200/man-day

Computation:

	1 km ÷ 0.05 km/mday = 20 mdays 20 mdays x PhP200/mday = PhP4,000/ km

5. Roadside slope repair/restoration

Productivity:	50 linear meters/man-day, roadway length both sides
Cost of materials:	PhP35/m2 of plant materials on earth side slope
Labour costs:	PhP200/man-day

[3] Foreman and heavy equipment operators are assumed to be permanent personnel of the LGU
[4] Materials delivered and dumped on roadside, dump trucks/operator costs included in materials costs
[5] Hand tools assumed provided by LGU

Computation:

Labour:	1 km ÷ 0.05 km/mday = 20 mdays 20 mdays x PhP200/mday = PhP4,000/ km
Materials:	depends on extent of area to be repaired/restored

Erosion control

Productivity: 0.50 m^3/mday, if additional materials are to be used, or 0.10 km/day, without additional materials

Cost of materials: PhP35/m2 of plant materials on roadside slope, prevailing costs of rock/cement for riprap

Labour costs: PhP200/man-day

Computation:

Labour:	1 km ÷ 0.05 km/mday = 20 mdays 20 mdays x PhP200/mday = PhP4,000/ km
Materials:	depends on extent of area to apply erosion control measures

6. Hand ditch cleaning

Productivity: 65 linear meters/mday, roadway length both sides

Cost of materials: none

Labour costs: PhP200/man-day

Computation:

Labour:	1 km ÷ 0.65 km/mday = 1.5 mdays 1.5 mdays x PhP200/mday = PhP100/ km
Materials:	depends on extent of area to apply erosion control measures

7. Culvert cleaning

Productivity: 2 culvert lines/mday

Cost of materials: none

Labour costs: PhP200/man-day

Computation:

Labour:	No. of culvert lines/ km ÷ 2lines/mday x labour costs/mday
Materials:	none

Instructions:

After computing for the unit costs, apply the figures to the corresponding maintenance activities in each road segment to get the budgetary requirement for the current year. To estimate maintenance expenditures within the planning period, increase current costs by 5% compounded annually over 10 years. Periodic maintenance on the 5th year would have 25% increase on current costs, and 50% increase on the 10th year.

NOTE: Present minimum wage in the province (ZDN) is P270.00 per day (as of Sept. 2011)

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