



International  
Labour  
Organization

## TEAM-BASED MAINTENANCE OF RURAL ROADS



## IMPLEMENTATION MANUAL

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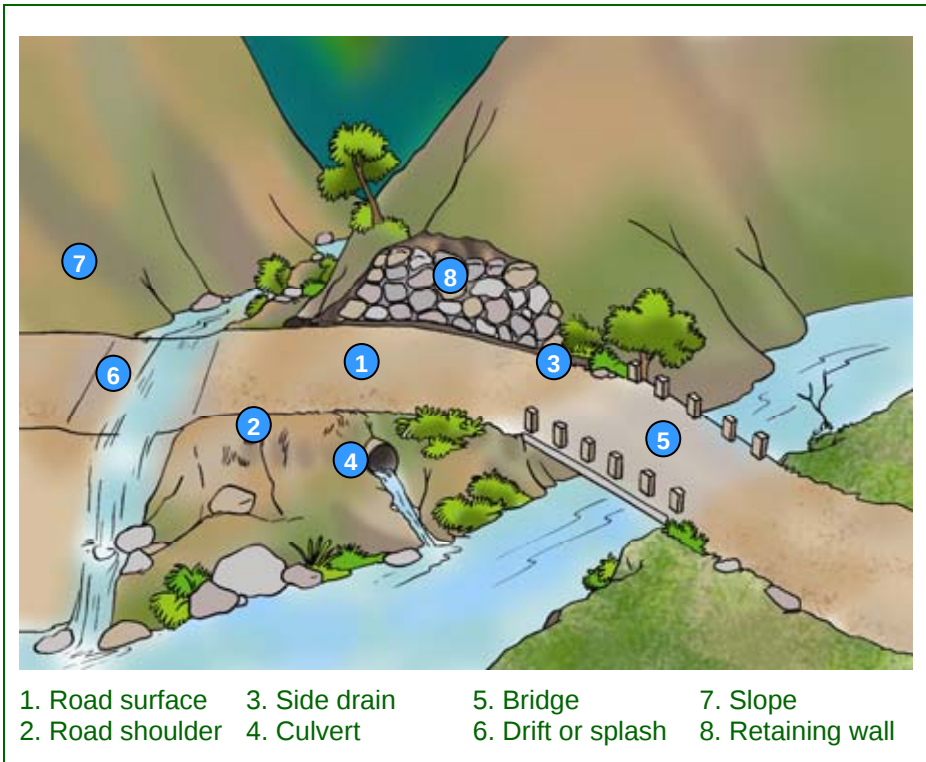
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## ROAD ELEMENTS

A road is built up of different road elements. The picture below gives an overview of the most common road elements in rural roads.



Each of these road elements has a specific function. The road surface serves to support the traffic driving over it. The road shoulder gives additional support to the road. The drainage system (side drains, drifts, splashes, culverts and bridges) serves to guide water safely away from the road without causing damage. The retaining walls serve to avoid the road from collapsing or material from the slopes from falling onto the road.

## ROAD DETERIORATION

As a result of traffic and water, these road elements are weakened or damaged. Potholes and ruts are formed by the tyres of vehicles. Where water remains on the road and weakens the road surface (muddy), this process is accelerated.



**Pothole**



**Ruts**

The lack of a proper drainage system or its blockage can cause water to flow over the road, causing rills and gullies in the road surface, cuts in the road shoulders and undermining or damage to the other road elements. This is worse where shoulder banks have been formed, preventing the water from leaving the road.



**Gully in road surface**



**Cut in road shoulder**

Water flowing over the slopes causes landslides, especially where there is loose material. Vegetation grows and blocks the road or decreases visibility.



**Landslides**



**Vegetation**

As a result of this deterioration of the road, vehicles are damaged, travel times are higher, and travel costs increase. After some years, the damage may be so severe that vehicles are no longer able to use the road.

## **TEAM-BASED ROAD MAINTENANCE**

Team-based road maintenance is aimed at preventing or slowing down the deterioration and damage to the road. It consists of three types of activities, which are carried out by maintenance teams throughout the year.

The first type of maintenance activities is aimed at cleaning and clearing the different road elements to avoid blockages and ensure they work properly, thus avoiding damage to the road from occurring.

### **Preventative maintenance activities**

1. Clearing of obstacles and landslides
2. Clearing drainage ditches
3. Clearing drifts
4. Clearing culverts
5. Clearing bridges
6. Clearing and cutting vegetation
7. Clearing banks on shoulders
8. Clearing loose material on slopes

The second set of maintenance activities consists of minor repairs to damaged road elements aimed at avoiding more serious damage from occurring to the road.

### Minor repairs

9. Repairing drainage structures
10. Repairing ruts and potholes
11. Repairing rills and gullies
12. Repairing cuts in the road shoulder
13. Repairing retaining walls
14. Repairing the backfill over culverts

The third set of maintenance activities consists of the creation of simple road protection measures where these do not yet exist, aimed at safely guiding water away from the road and avoiding the collapse of road shoulders and slopes.

### Creation of simple road protection measures

15. Creation of earthen side drains
16. Creation of small stone-paved water crossings
17. Creation of diagonal diversion ditches
18. Creation of dry stone retaining walls
19. Protection of slopes by planting vegetation

All these maintenance activities will be carried out by the maintenance teams. They are explained in more detail in the second part of this manual. Where more serious damage to the road has occurred, this should be communicated to the DDC and they will be responsible for fixing it.

Wherever the maintenance activities involve removing material away from the road surface, shoulder or drainage system, this should be placed in a suitable location where it does not affect the drainage system, traffic, cultivated land, canals or streams.

## TOOLS AND SAFETY EQUIPMENT

The maintenance teams will receive the following tools and safety equipment to be used in carrying out the maintenance activities. These will be provided by the DDC and should be returned in good condition at the end of the contract.



**Wheelbarrow**



**Hoe**



**Pickaxe**



**Shovel**



**Long-handled  
shovel**



**Rake**



**Bush knife**



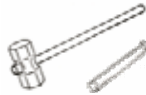
**Machete**



**Earth rammer**



**Crowbar**



**Hammer &  
chisel**



**Watering can**

The tools will be provided in different numbers depending on how much they are used and the size of the maintenance team. Different tools should be used depending on the activity being carried out (see also the second part of this manual).



**Warning flags**



**Safety vest**



**Hat**



**Mask**



**Boots**



**Raincoat**



**First aid kit**

The safety equipment serves to ensure the safety and health of the maintenance workers. These should be used at all times. The first aid kit should always be present at the work site. Warning flags should be placed at the road side at some distance on each side of the work site to warn traffic.

### **WORK PLANNING AND PERFORMANCE**

The maintenance contracts are based on performance, not on time. This means that the monthly payments depend on the amount of work carried out and on how well this work has been done.

The amount of work to be carried out is determined at the beginning of the month and indicated in the workplan. The workplan shows which activities should be done and in which part of the road they should be carried out. The maintenance team must complete the work as indicated in the workplan. An example workplan is given on the next page.

The required result of the work is defined by the performance indicators. These describe what the condition of the different road elements should be like after completion of the work. The performance indicators are given for each maintenance activity in the second part of this manual.

### **WORK ORGANISATION**

In implementing the workplan, the different team members and tools should be organised in such a way that the work can be completed as quickly and easily as possible. For certain activities, different team members may carry out complementary tasks (e.g. creation of side drains: one person loosening soil, one person excavating the loose soil and throwing it on the road, one person spreading the soil on the road surface). For other activities the different team members may carry out the same task (e.g. cutting vegetation), or even carry out different activities altogether (e.g. one person cutting vegetation, two people filling potholes). The important thing is that the different team members work together in order to get the work done quickly and easily.

Care must also be taken to use the proper tools for the job. No single tool is suitable for every job. For loosening hard or stony soil a pick-axe is very suitable, whilst for soft soil a hoe may be more productive. For throwing loose material onto the road or into a wheelbarrow, a shovel is generally more appropriate than a hoe. It is therefore important to use the proper tool, and to make sure to bring along all the tools required for the maintenance activities to be carried out, and in sufficient numbers.

| WORKPLAN                                      |  |                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|--|--|--|--|--|--|--|
| Month: July                                   |  | Machhi Jhirkaiya VDC                                                                                                                                                                                   |  |  |  |  |  |  |  |  |  |  |  |  |
| District: Dhanusha                            |  | Kamala Main Canal                                                                                                                                                                                      |  |  |  |  |  |  |  |  |  |  |  |  |
| Road Name: Hulaki road                        |  | Ekrahi                                                                                                                                                                                                 |  |  |  |  |  |  |  |  |  |  |  |  |
| Section: Aurahi VDC - Giddha VDC - Ekrahi VDC |  | Tinkauriya Chok                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |
|                                               |  | Dumariya Nadi                                                                                                                                                                                          |  |  |  |  |  |  |  |  |  |  |  |  |
|                                               |  | Giddha VDC                                                                                                                                                                                             |  |  |  |  |  |  |  |  |  |  |  |  |
|                                               |  | Harusaha                                                                                                                                                                                               |  |  |  |  |  |  |  |  |  |  |  |  |
|                                               |  | Aurahi                                                                                                                                                                                                 |  |  |  |  |  |  |  |  |  |  |  |  |
|                                               |  | Kaplauli                                                                                                                                                                                               |  |  |  |  |  |  |  |  |  |  |  |  |
|                                               |  | Dauri Parwaha VDC                                                                                                                                                                                      |  |  |  |  |  |  |  |  |  |  |  |  |
|                                               |  | Aurahi VDC                                                                                                                                                                                             |  |  |  |  |  |  |  |  |  |  |  |  |
| ACTIVITY                                      |  |                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Clearing of obstacles and landslides       |  | Easily recognizable places along the road are indicated here to facilitate the location along the road. The chainage may also be painted on rocks or electricity poles to further facilitate location. |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Clearing drainage ditches                  |  |                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Clearing drifts                            |  |                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |
| 4. Clearing culverts                          |  |                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |
| 5. Clearing bridges                           |  |                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |
| 6. Clearing and cutting vegetation            |  |                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |
| 7. Clearing banks on shoulders                |  |                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |
| 8. Clearing loose material from slopes        |  |                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |
| 9. Repairing drainage structures              |  |                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |
| 10. Repairing ruts and potholes               |  |                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |
| 11. Repairing rills and gullies               |  |                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |
| 12. Repairing cuts in shoulders               |  | For each activity that has to be carried out, the approximate location is indicated here                                                                                                               |  |  |  |  |  |  |  |  |  |  |  |  |
| 13. Repairing retaining walls                 |  |                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |
| 14. Repairing backfill over culverts          |  |                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |
| 15. Creating side drains                      |  |                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |
| 16. Creating stone-paved water crossings      |  |                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |
| 17. Creating diagonal diversion ditches       |  |                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |
| 18. Creating dry-stone retaining walls        |  |                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |
| 19. Planting vegetation on slopes             |  |                                                                                                                                                                                                        |  |  |  |  |  |  |  |  |  |  |  |  |

Prepared by:

Maintenance Engineer

Agreed by:

Maintenance Team Leader

Date:

Date:

In implementing the work, care must be taken that sufficient is done every day in order that all the work indicated in the workplan can be finished by the end of the month. The determination of the amount of work to be finished each week or even each day can be useful to control progress. The quality of the work should also be monitored regularly, to ensure it is in concordance with the performance indicators for the activity concerned, so that it will be approved at the end of the month.

### REMUNERATION

In return for carrying out the maintenance activities, the maintenance teams will receive regular payments. The payments consist of one advance payment at the beginning of the work and subsequent monthly payments at the end of each month.

The advance payment is to cover the costs of tool maintenance, the costs of transport and the costs of any work related injuries. This payment will be made upon signing the contract and will be for the whole contract period. The monthly payments are made at the end of each month on the basis of the work carried out, and serve to pay the salaries of the maintenance workers.

### INSPECTIONS

At the end of each month, the work carried out by the maintenance teams is inspected. During the inspection, the amount of work completed is compared to what was agreed in the workplan, and the quality of the work (how well it was done) is compared to the performance indicators.

If all is in order, the work is approved and the full monthly payment is made. If the work has not been done properly (not enough work done or not done well), a deduction may be applied and the maintenance team will not receive the full amount. If the maintenance team continuously fails to carry out the work properly, the contract may even be terminated.

The result of the inspection is indicated in the inspection report. This describes the condition of the different road elements for the relevant maintenance activities, indicating any problems encountered. It also indicates the standard monthly payment amount and the level of any deduction that may be applied, as well as the resulting final monthly payment approved for the maintenance team. An example inspection report is given on the next page.

## **PAYMENT PROCEDURES**

In order to receive the advance and monthly payments, the maintenance team needs to open a bank account. This bank account should require at least two signatures for any transactions.

The advance payment is a lump sum to cover any expenses for tool maintenance, transport or work-related injuries. Any remaining funds at the end of the contract period may be kept by the maintenance team (on condition that these funds are used whenever needed). Careful and proper use of the tools and safety equipment, thoughtful use of the transport allowance and avoidance of accidents will leave more funds at the end of the contract.

In order to ensure the timely monthly payments of the maintenance team, quarterly instalments are transferred to the bank account of the maintenance team at the beginning of every three-month period. This money may only be withdrawn from the account, however, after receipt of the inspection report, and then only to the amount indicated in the inspection report (taking into account any deductions made).

At the end of the three-month period, the maintenance team must submit copies of the previous three inspection reports and a bank statement to the DDC to show that the funds have been used properly. If all is in order, the next quarterly instalment is transferred. Any deductions applied in the previous period will be deducted from the next instalment, thus ensuring three full monthly payments at the beginning of any three-month period.

| INSPECTION FORM                           |          |           |                |                                                                                                                                                                                                                |
|-------------------------------------------|----------|-----------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| General Information                       |          |           |                |                                                                                                                                                                                                                |
| Inspection period (month)                 |          |           |                |                                                                                                                                                                                                                |
| Name of inspector                         |          |           |                |                                                                                                                                                                                                                |
| Date of inspection                        |          |           |                |                                                                                                                                                                                                                |
| Road name and length                      |          |           |                |                                                                                                                                                                                                                |
| Road section start and end                |          |           |                |                                                                                                                                                                                                                |
| Team leader's name                        |          |           |                |                                                                                                                                                                                                                |
| Team leader's telephone number            |          |           |                |                                                                                                                                                                                                                |
| Inspection Results                        |          |           |                |                                                                                                                                                                                                                |
| Maintenance activity                      | In order | Deficient | Not applicable | Problems to be corrected                                                                                                                                                                                       |
| 1. Clearing obstacles and landslides      |          |           |                | Here the inspector indicates for each activity whether it was in order (with workplan and performance indicators) or deficient. Activities not included in the workplan are indicated as not applicable.       |
| 2. Clearing drainage ditches              |          |           |                |                                                                                                                                                                                                                |
| 3. Clearing drains                        |          |           |                |                                                                                                                                                                                                                |
| 4. Clearing culverts                      |          |           |                | The different maintenance activities are listed here.                                                                                                                                                          |
| 5. Clearing bridges                       |          |           |                |                                                                                                                                                                                                                |
| 6. Clearing and cutting vegetation        |          |           |                |                                                                                                                                                                                                                |
| 7. Clearing banks on shoulders            |          |           |                | If work is marked as deficient, the problem encountered is described here                                                                                                                                      |
| 8. Clearing loose material on slopes      |          |           |                |                                                                                                                                                                                                                |
| 9. Repairing drainage structures          |          |           |                |                                                                                                                                                                                                                |
| 10. Repairing ruts and potholes           |          |           |                | In this part the standard monthly payment and any applicable deduction are indicated, as well as the final approved payment to the maintenance team. Both the inspector and team leader have to sign the form. |
| 11. Repairing rills and gullies           |          |           |                |                                                                                                                                                                                                                |
| 12. Repairing cuts in the road shoulder   |          |           |                |                                                                                                                                                                                                                |
| 13. Repairing retaining walls             |          |           |                |                                                                                                                                                                                                                |
| 14. Repairing the backfill over culverts  |          |           |                |                                                                                                                                                                                                                |
| 15. Creating side drains                  |          |           |                |                                                                                                                                                                                                                |
| 16. Creating stone-paved water crossings  |          |           |                |                                                                                                                                                                                                                |
| 17. Creating diagonal diversion ditches   |          |           |                |                                                                                                                                                                                                                |
| 18. Creation of dry-stone retaining walls |          |           |                |                                                                                                                                                                                                                |
| 19. Planting vegetation on slopes         |          |           |                |                                                                                                                                                                                                                |
| Conclusion                                |          |           |                |                                                                                                                                                                                                                |
| Standard monthly payment (NPR)            |          |           |                |                                                                                                                                                                                                                |
| Deduction (NPR)                           |          | None      |                | NPR                                                                                                                                                                                                            |
| Approved monthly payment (NPR)            |          |           |                |                                                                                                                                                                                                                |
| Signature inspector                       |          |           |                |                                                                                                                                                                                                                |
| Signature team leader                     |          |           |                |                                                                                                                                                                                                                |

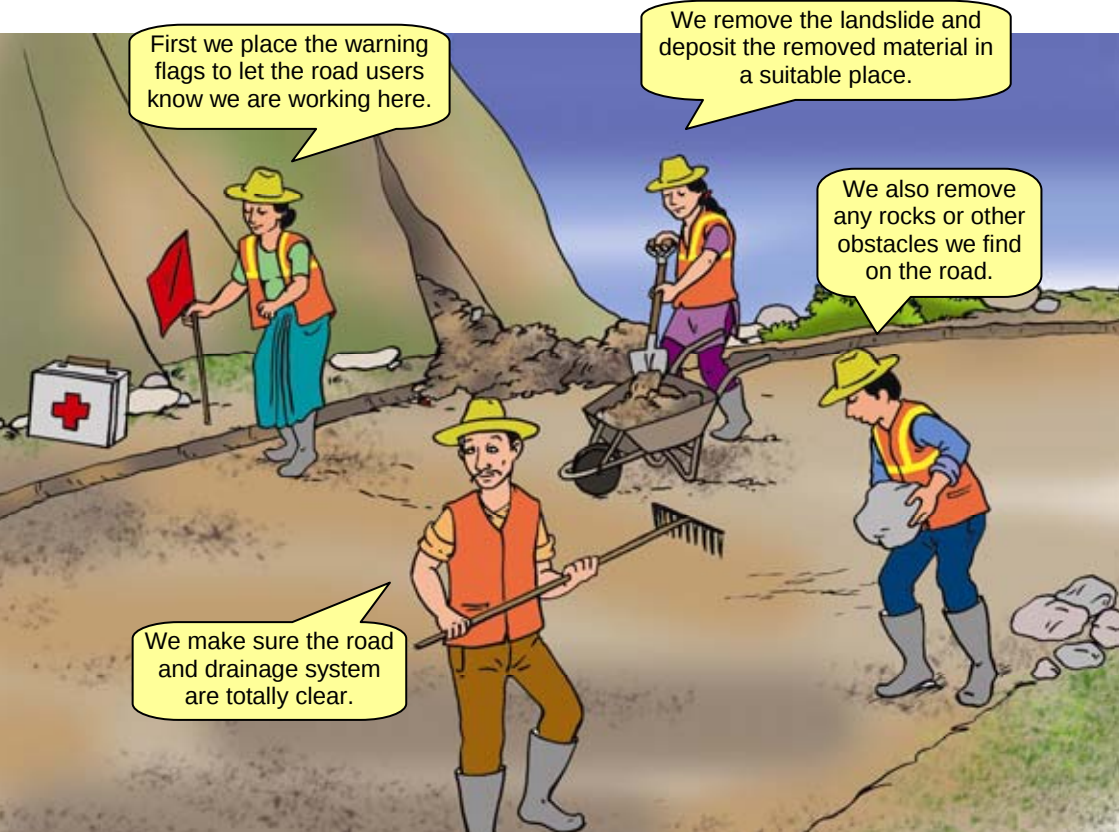
# **MAINTENANCE ACTIVITIES**

## 1. CLEARING OBSTACLES AND LANDSLIDES

**WHAT:** Remove any landslides or other obstacles (rocks, branches, etc.) that block the road surface, road shoulder or drainage system.

**WHY:** So vehicles can pass easily and water does not flow over the road where it may cause damage.

### HOW:



**WHEN:** Whenever landslides or other obstacles are encountered, especially during the rainy season.

**TOOLS:**



**PERFORMANCE INDICATOR:** The road surface, shoulder and drainage system are free of landslides and other obstacles.



## 2. CLEARING SIDE DRAINS

**WHAT:** Remove any earth, stones, vegetation, garbage or other material from the side drains and other drainage ditches.

**WHY:** So water can flow freely through the side drains and does not flow over the road where it may cause damage.

**HOW:**

First we place the warning flags to let the road users know we are working here.

We remove all the material from the side drain.

And deposit the removed material and garbage in a suitable place.



**WHEN:** Before the rainy season starts and again during the rainy season if necessary.

**TOOLS:**



**PERFORMANCE INDICATOR:** The drainage ditches are clear and there is no stemming of water.



### 3. CLEARING DRIFTS

**WHAT:** Remove any earth, stones, vegetation, garbage or other material from the drift and make sure the inlet and outlet are clear.

**WHY:** So water can cross freely over the drift and does not flow over the road where it may cause damage or remain stagnant on the drift where it may weaken the drift.

**HOW:**



**WHEN:** Before the rainy season starts and again during the rainy season if necessary.

**TOOLS:**



**PERFORMANCE INDICATOR:** The drift is clear and there is no stemming of water.



## 4. CLEARING CULVERTS

**WHAT:** Remove any earth, stones, vegetation, garbage or other material from inside the culvert.

**WHY:** So water can flow freely through the culvert and does not flow over the road where it may cause damage.

**HOW:**



**WHEN:** Before the rainy season starts and again during the rainy season if necessary.

**TOOLS:**



**PERFORMANCE INDICATOR:** The culverts are clear and water can flow freely.



## 5. CLEARING BRIDGES

**WHAT:** Remove any earth, rocks, branches, vegetation, garbage or other material from under the bridge.

**WHY:** So water can flow freely under the bridge and does not cause damage to the bridge or the road.

**HOW:**



**WHEN:** Before the rainy season starts and again during the rainy season if necessary.

**TOOLS:**



**PERFORMANCE INDICATOR:** The area under the bridges is clear and water can flow freely.



## 6. CLEARING AND CUTTING VEGETATION

**WHAT:** Cut and remove any vegetation growing on the road surface, shoulder or next to the road that impedes visibility, traffic or the flow of water away from the road, or which is damaging the road, drainage system or other road structures. The roots should not be removed because these protect against erosion.

**WHY:** So traffic can move easily and safely, water can easily flow away from the road and the road elements are not damaged by plant roots.

**HOW:**



**WHEN:** Before the rainy season starts and again after the end of the rainy season.

**TOOLS:**



**PERFORMANCE INDICATOR:** The vegetation does not impede visibility or normal vehicle transit, nor does it restrict the flow of water away from the road or damage the road in any way.



## 7. CLEARING BANKS ON SHOULDERS

**WHAT:** Cut raised road shoulders where these impede runoff water from flowing away from the road.

**WHY:** So water does not flow along the road surface where it may cause damage, but flows away from the road.

**HOW:**



**WHEN:** In the dry season and also during the rainy season if necessary.

**TOOLS:**



**PERFORMANCE INDICATOR:** The raised banks in the road shoulder do not restrict the flow of water away from the road.

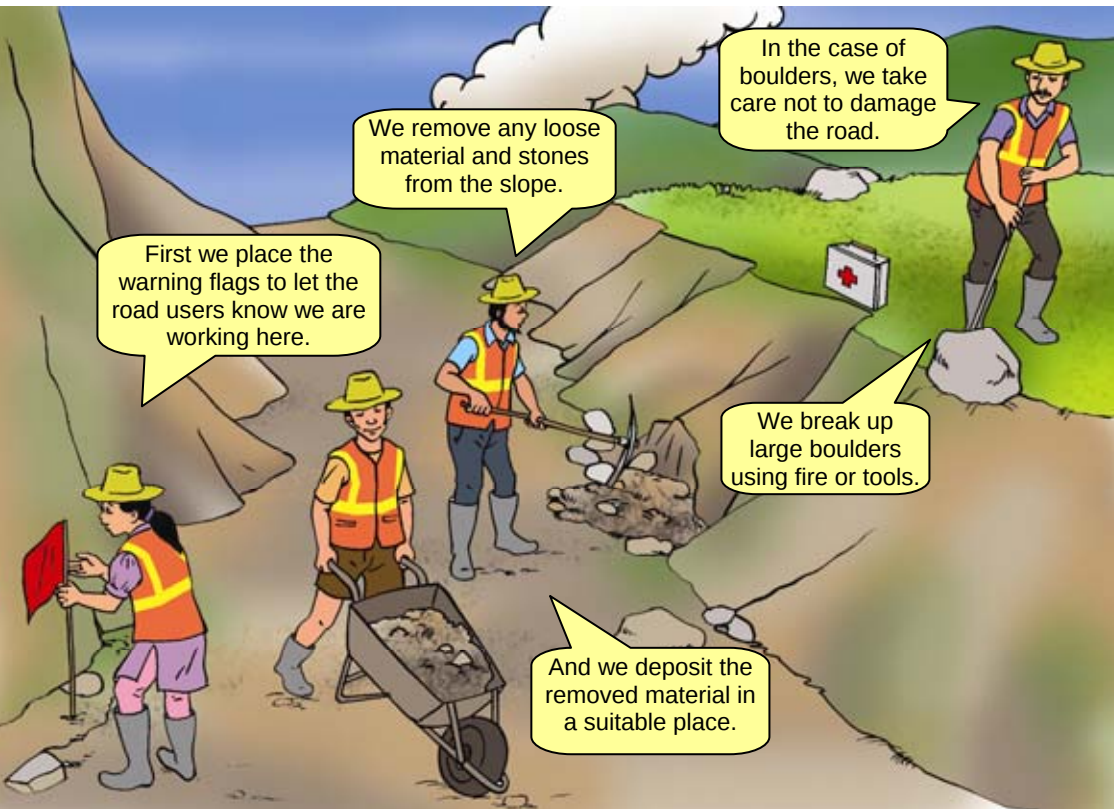


## 8. CLEARING LOOSE MATERIAL ON SLOPES

**WHAT:** Remove any loose earth, stones and rocks from slopes above the road.

**WHY:** So they do not fall during rains and create landslides which may cause damage to vehicles or block the road.

**HOW:**



**WHEN:** Before the rainy season starts and again during the rainy season if necessary.

**TOOLS:**



**PERFORMANCE INDICATOR:** The slopes are free of loose rocks, stones and other loose material that may provide a hazard to road users.

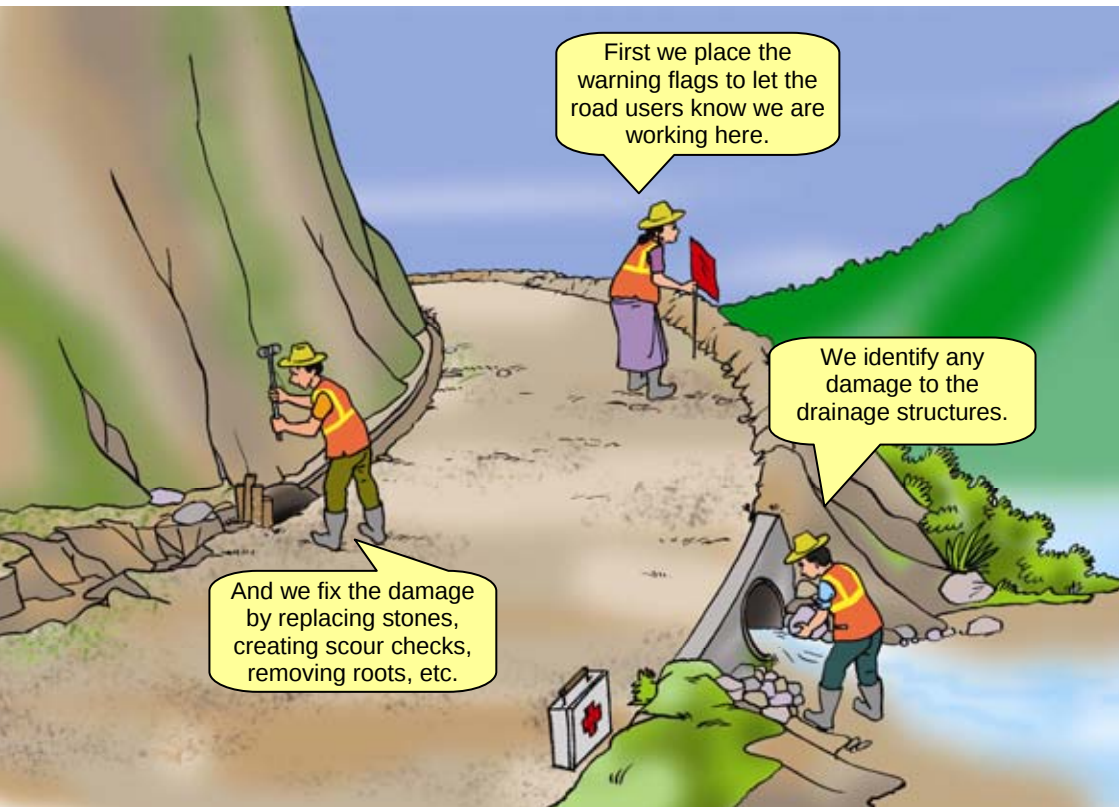


## 9. REPAIRING DRAINAGE STRUCTURES

**WHAT:** Make repairs to drainage structures, especially where these are being undermined by erosion.

**WHY:** So the drainage structures continue to work properly and safely guide the water away from the road.

**HOW:**



**WHEN:** In the dry season before the rains start.

**TOOLS:**



**PERFORMANCE INDICATOR:** The drainage structures are able to perform their work properly and are not damaged or undermined.

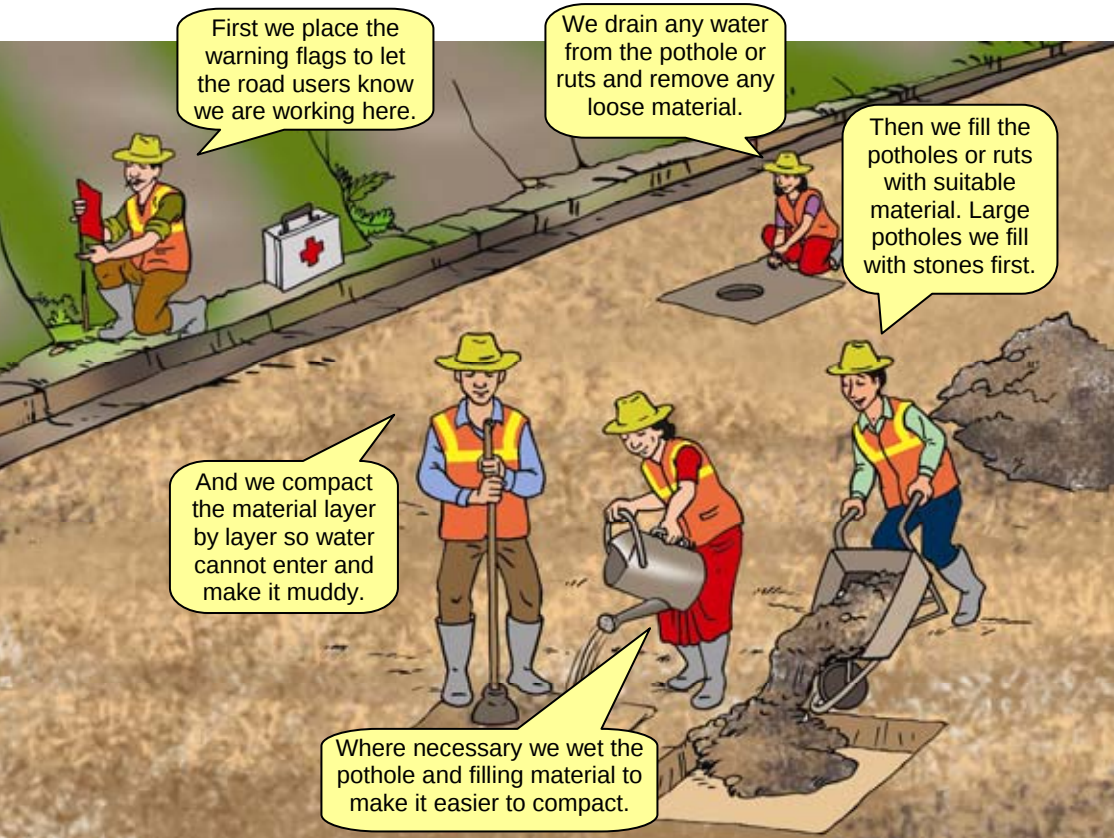


## 10. REPAIRING RUTS AND POTHOLES

**WHAT:** Remove water from potholes and ruts and fill these with stones and suitable material to restore a proper camber.

**WHY:** So water flows away from the road and does not damage the road base, and so traffic can pass easily.

**HOW:**



**WHEN:** Just after the rainy season and during the dry season, and also during the rainy season where potholes or ruts form a problem for traffic.

**TOOLS:**



**PERFORMANCE INDICATOR:** There are no potholes larger than 50 cm or ruts deeper than 10 cm, and water does not remain on the road surface.

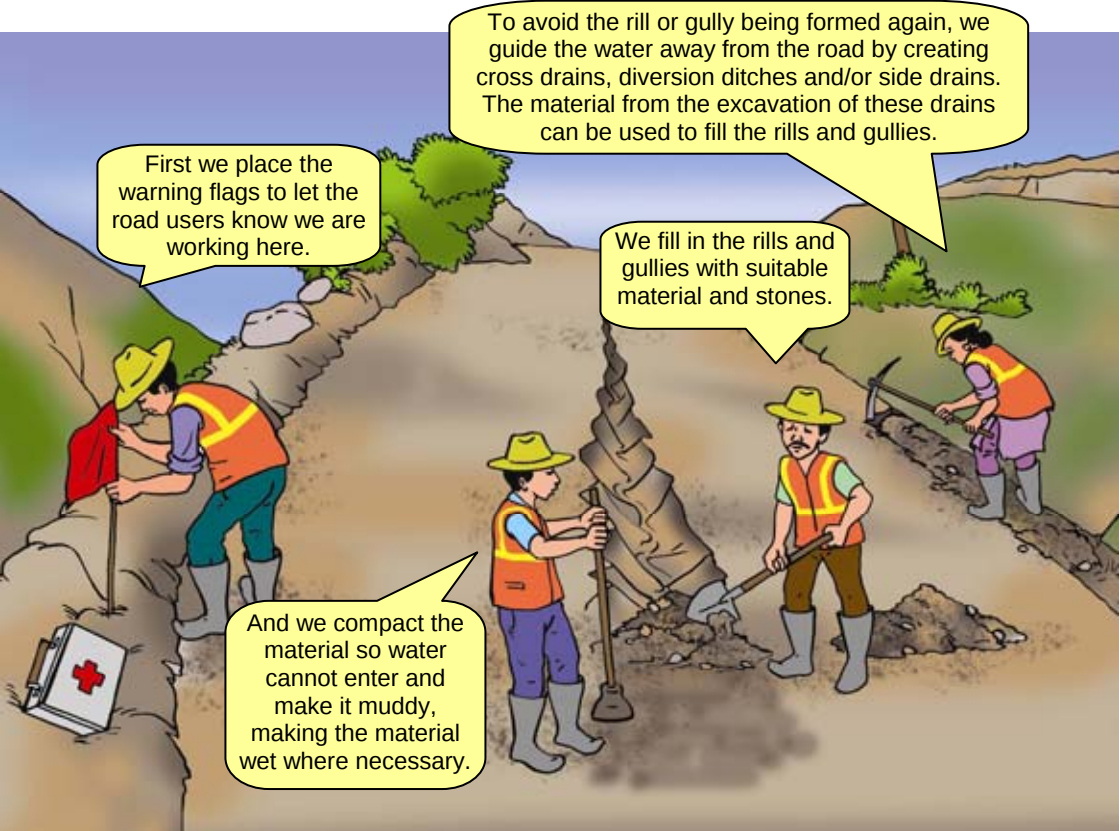


## 11. REPAIRING RILLS AND GULLIES

**WHAT:** Fill in any rills or gullies in the road surface or shoulder caused by water flowing over the road, at the same time removing the cause of the erosion.

**WHY:** So traffic can pass easily and damage to the road surface and road base is avoided.

**HOW:**



**WHEN:** Whenever rills or gullies are encountered.

**TOOLS:**



**PERFORMANCE INDICATOR:** There are no rills or gullies deeper than 10 cm.



## 12. REPAIRING CUTS IN ROAD SHOULDER

**WHAT:** Fill in cuts in the road shoulder with compacted earth and stones, providing extra stability by creating small dry stone walls or planting vegetation.

**WHY:** So the cut does not form a problem for traffic and is not formed again by the next rains.

**HOW:**



**WHEN:** After the rainy season and also during the rainy season if necessary.

**TOOLS:**



**PERFORMANCE INDICATOR:** All cuts are filled, compacted and stabilised.

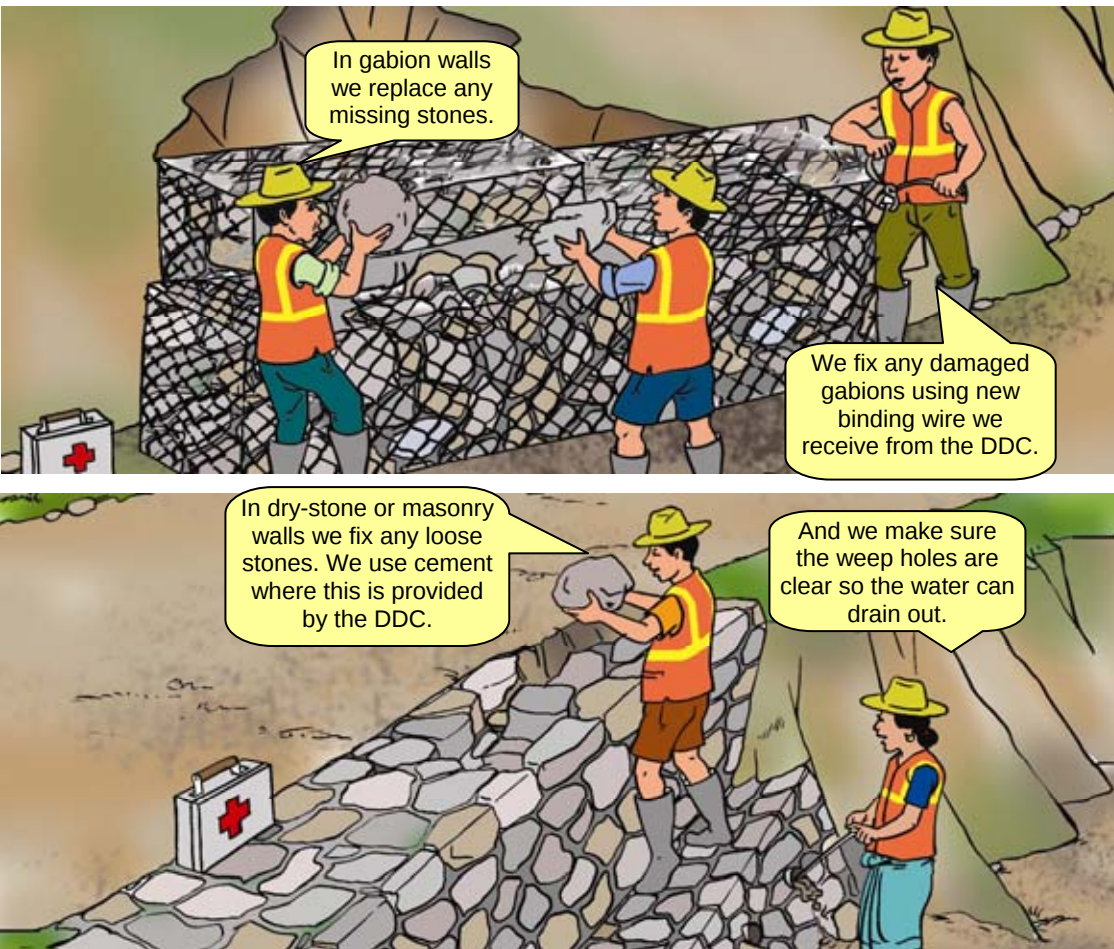


## 13. REPAIRING RETAINING WALLS

**WHAT:** Replace any loose or missing stones, repair gabions with new binding wire, clear weep holes, and fix any undermining of the retaining walls.

**WHY:** So the retaining walls do not collapse and continue to protect the road from damage.

**HOW:**



**WHEN:** During the dry season.

**TOOLS:**



**PERFORMANCE INDICATOR:** The retaining walls have no loose stones or broken gabion wire and the weep holes are clear.

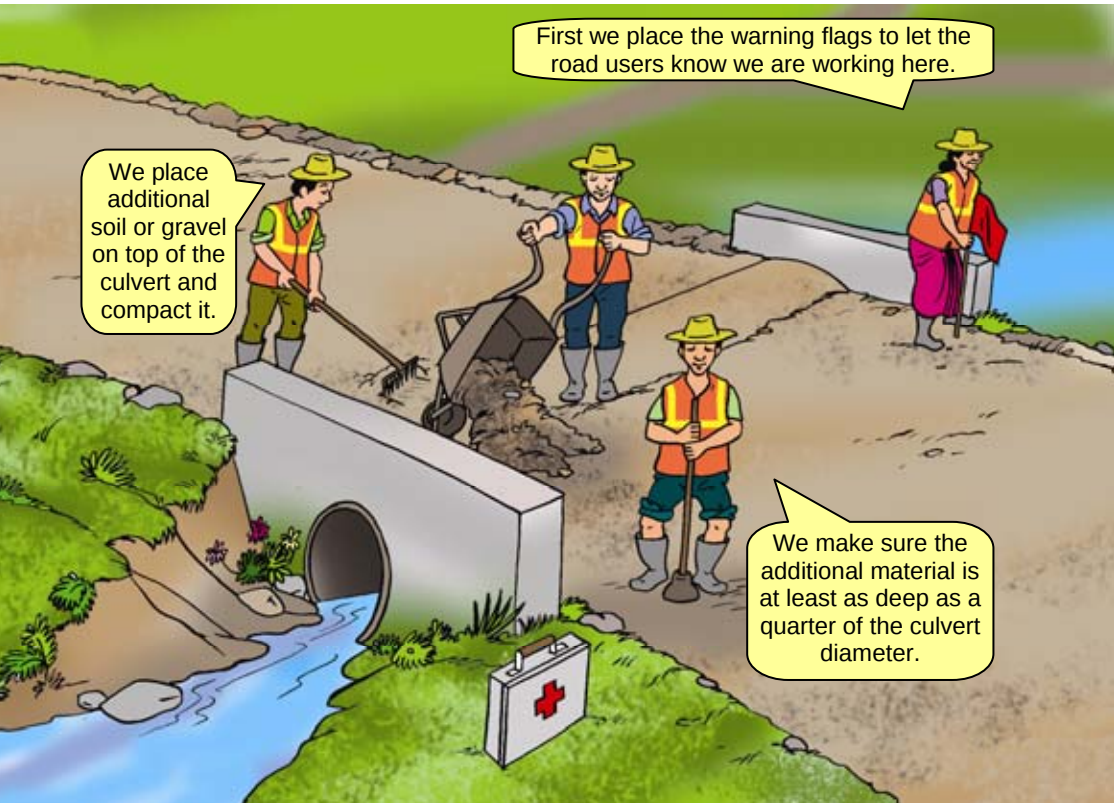


## 14. REPAIRING BACKFILL OVER CULVERTS

**WHAT:** Place and compact additional soil and/or gravel on the road surface over existing culverts where these stick out above the road surface.

**WHY:** To avoid the culvert pipes becoming damaged by traffic.

**HOW:**



**WHEN:** During the dry season.

**TOOLS:**



**PERFORMANCE INDICATOR:** The culverts are covered by backfill with a depth at least equal to a quarter of the culvert diameter.

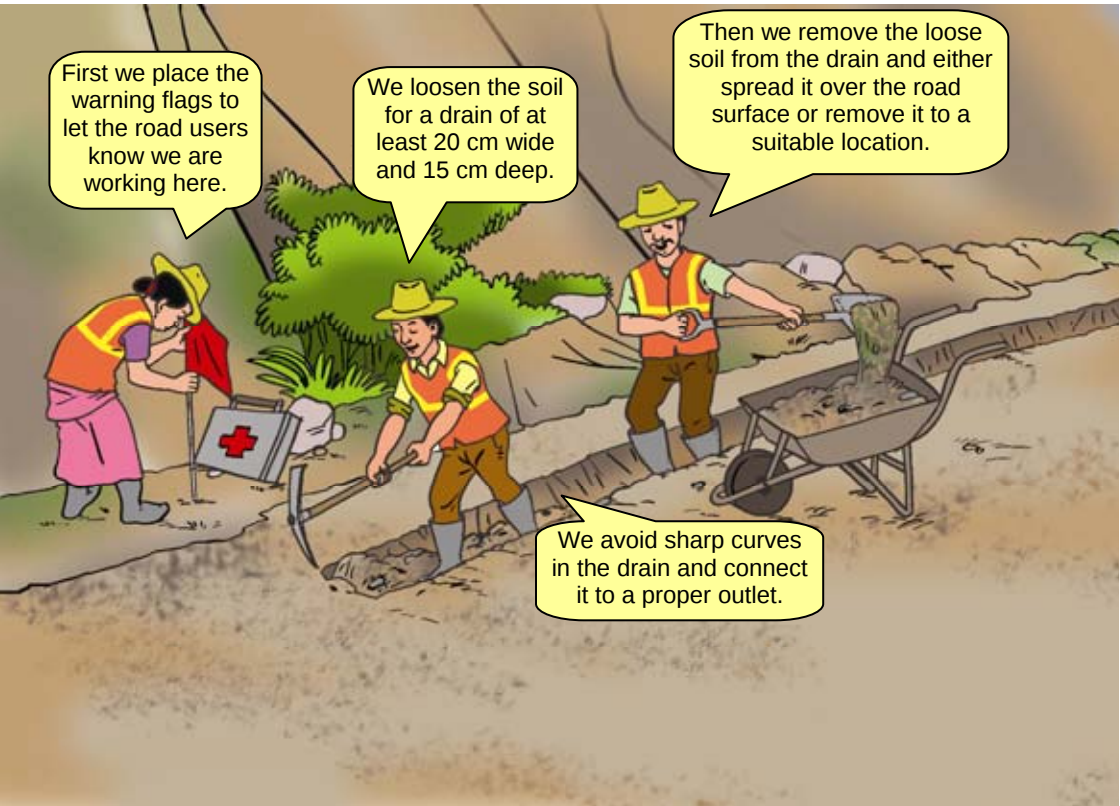


## 15. CREATING SIDE DRAINS

**WHAT:** Excavation of earthen drains along the road to guide water to a suitable outlet or crossing point.

**WHY:** So water does not flow over the road where it may cause damage.

**HOW:**



**WHEN:** Before the rainy season starts and also during the rainy season if necessary.

**TOOLS:**



**PERFORMANCE INDICATOR:** The created side drains are at least 20 cm wide and 15 cm deep, have no sharp curves and have a proper outlet.



## 16. CREATING PAVED WATER CROSSINGS

**WHAT:** Create permanent stone-paved cross drainage structures.

**WHY:** To guide water safely across the road without causing damage to the road surface, whilst withstanding damage by vehicles.

**HOW:**



**WHEN:** Before the rainy season starts and also during the rainy season if necessary.

**TOOLS:**



**PERFORMANCE INDICATOR:** Where water crosses the road stone-paved splashes have been created that ensure water does not flow onto the road.

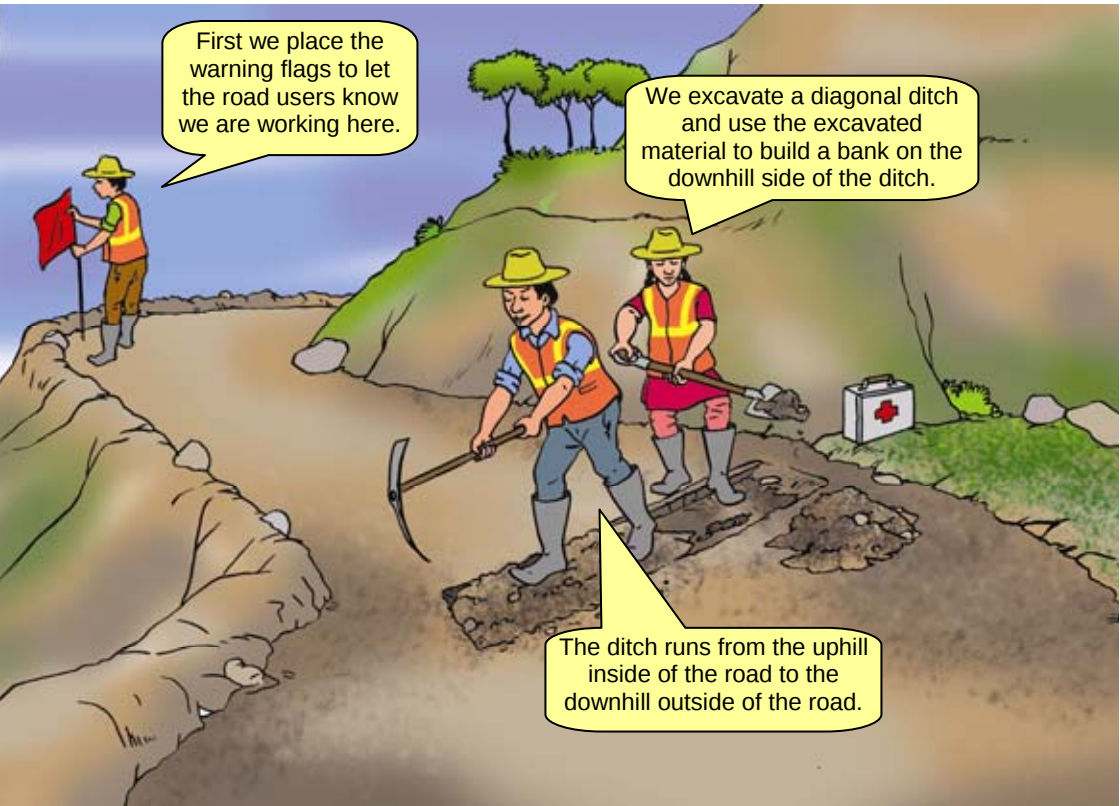


## 17. CREATING DIAGONAL DIVERSION DITCHES

**WHAT:** Create temporary earthen diversion ditches

**WHY:** So water flowing along the road surface is diverted away from the road where it cannot cause damage.

**HOW:**



**WHEN:** During the rainy season where necessary.

**TOOLS:**



**PERFORMANCE INDICATOR:** In areas subject to longitudinal erosion, diagonal diversion ditches have been created at regular intervals to guide the water away from the road.

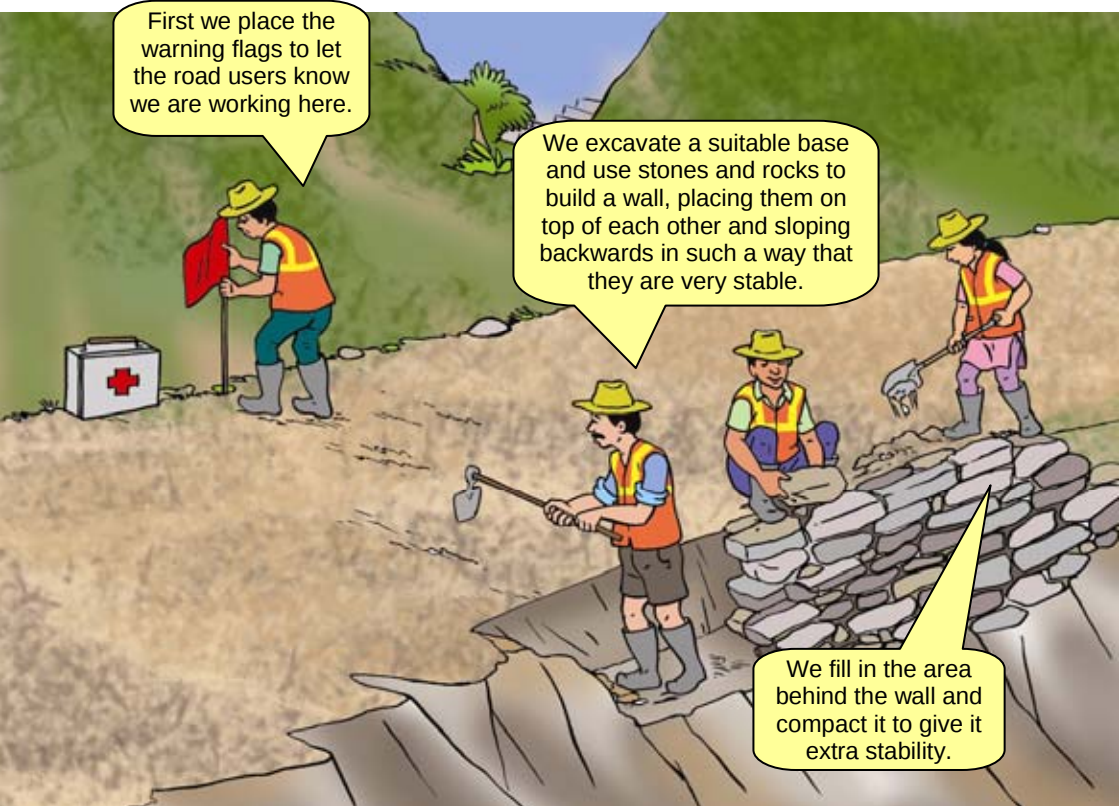


## 18. CREATING DRY-STONE RETAINING WALLS

**WHAT:** Creation of dry stone walls to provide support to slopes or the road shoulder.

**WHY:** To prevent landslides and the collapse of road shoulders.

**HOW:**



**WHEN:** Before the rainy season starts and also during the rainy season if necessary.

**TOOLS:**



**PERFORMANCE INDICATOR:** The created dry stone retaining wall is stable and the area behind it has been compacted.

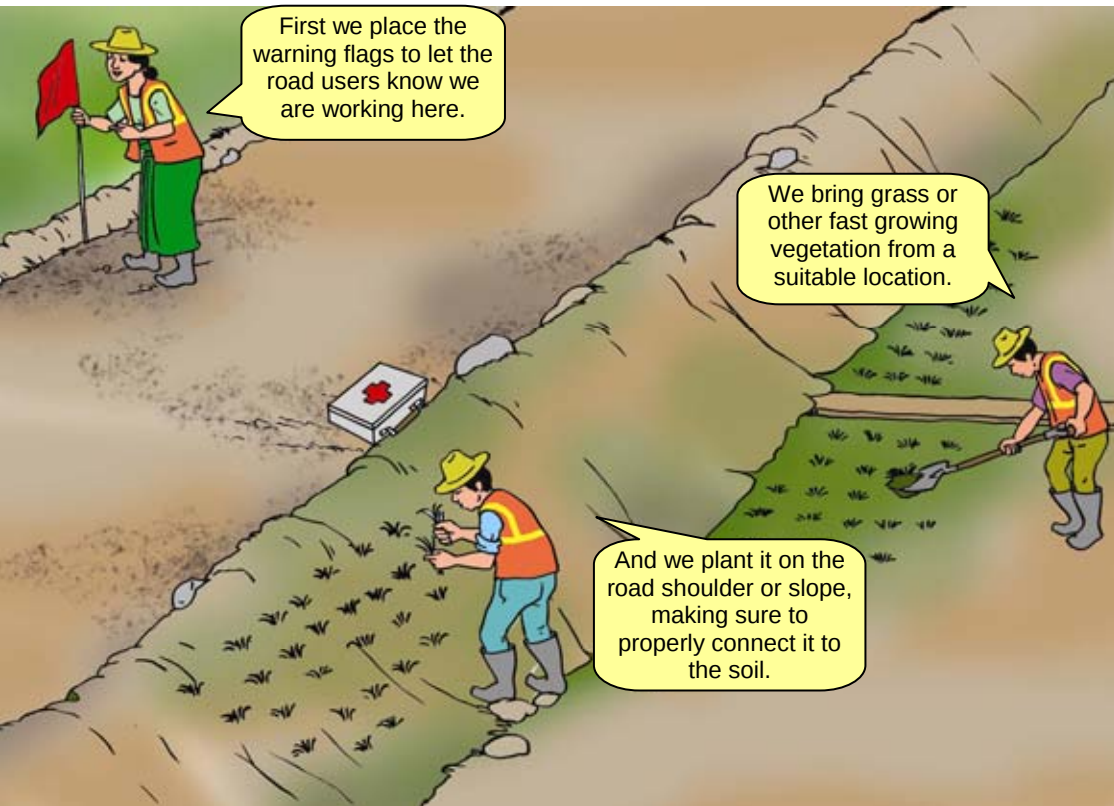


## 19. PLANTING VEGETATION ON SLOPES

**WHAT:** Plant vegetation on slopes and road shoulders prone to erosion.

**WHY:** To avoid the soil being washed away by runoff water, causing landslides or cuts in the road shoulder.

**HOW:**



**WHEN:** During the rainy season.

**TOOLS:**



**PERFORMANCE INDICATOR:** The slopes and road shoulders prone to erosion have been planted with vegetative material.





## Team-based maintenance of rural roads Implementation Manual

Team-based maintenance refers to every-day maintenance of rural roads by local maintenance teams, including the clearing and cleaning of the different road elements, the carrying out of minor repairs and the creation of basic road protection measures. The maintenance teams are formed by local people living along the road, who are contracted by the DDC and work together to maintain the road. Based on their performance, which is inspected on a regular basis, they receive a monthly remuneration that is complemented by allowances for tools & safety equipment, transport and insurance.



The present Implementation Manual complements the Conceptual Guide and is aimed specifically at the maintenance teams responsible for implementing the team-based maintenance activities. It is meant to be used as a training manual during the initial training of these teams and as a reference manual during the execution of the activities.



The first part of this manual describes the different aspects of team-based maintenance (activities, tools & safety equipment, payments, planning, inspection and team management), whilst the second part of this manual describes the different maintenance activities in more detail (objective, tasks, tools, and desired results).

