



The Green Roads for Water Initiative aims to transform the way roads are built and maintained all over the world by incorporating water management and greening in the design and construction of roads. The aim is to improve livelihoods and resilience of communities living around roads and doing away with negative impact such as erosion, flooding, sedimentation and dust, whereas at the same time improve the climate resilience of road infrastructure itself and reduce water related road damage.

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TECHNICAL PAPER 4



OPPORTUNITIES ON UNPAVED ROADS

Key Messages

- » Most damage to unpaved roads – as much as 80% - is caused by rain run-off
- » Unpaved roads surfaces are a major cause of sedimentation (up to 35%, excluding gullies) in mountain catchments
- » This can be minimized when water is systematically directed to the land rather than running along the road surface
- » This requires the consider design of unpaved road alignments – regular slope reversal, avoid sunken roads and include basic road drainage
- » Several additional measures preserve unpaved roads, enable water harvesting and reduce erosion: water bars, rolling dips and infiltrating bunds
- » Providing water harvesting measures combined with road drainage is essential to unpaved roads all over the world. Maintenance of unpaved feeder roads is in many countries heavily underfunded. Measures that have the double purpose of reducing damage and promoting beneficial water use will contribute to longevity of vital rural road connections

INTRODUCTION

Maintenance of unpaved roads is a challenge in many countries. The ballpark figure is that 80 percent of the damage to unpaved roads is water related. Unpaved roads are usually built to much lower standards than paved roads. For instance, they may not be equipped with a road drainage system. Moreover, funds for maintenance of lower-tier roads are chronically insufficient. Because the financing of maintenance is a challenge, repairs may take a long time, with a major impact on connectivity in remote areas.

Preventing damage to unpaved roads by combining adequate road drainage with water harvesting is essential. More than 75 percent of the roads in many countries are unpaved. They are the largest single intervention in the rural landscape.



PREVENTING EROSION AND HARVESTING WATER: RECOMENDED PRACTICES

In the construction of new unpaved rural roads there are several dos and don'ts to reduce sediment release and improve the capacity to harvest and recharge water. The measures taken are usually low cost and will help to preserve the integrity of the road. This paper discusses three sets of measures that help to preserve the road:

A) Planning the alignment of unpaved roads by avoiding long and steep slopes without drainage facilities

Water naturally exits the roadway at every grade reversal. The most important dos and don'ts are:

- » Try to reverse the slope of the road and avoid long uniform stretches.
- » Where possible, use crowned and/or outsloped/tilted road templates to drain the water immediately to the side of the road, although such templates are sensitive to wear and tear.
- » Use rolling drainage dips and water bars to remove water from road surface at designated places where the water can be used productively.
- » Locate drainage features at greater spacing on soils that are fine-grained and erosive
- » Ensure a well-vegetated buffer zone or row of stones (infiltration bund) at the edge of the road to disperse flow, reduce runoff velocity, and collect sediment from road runoff

- » Where there is considerable subsurface flow, provide side drains to collect this flow and reuse it.
- » Provide full road-drainage systems with side drains and cross culverts. Such welldeveloped drainage systems will not only protect the road but will also help to more systematically collect and harvest water from around the road.
- » Maintain a vegetative cover around the roads to increase roughness and reduce erosion. Where vegetation is removed (by road construction), sedimentation may increase sevenfold.



B) Using basic road-surface drainage

A series of rolling dips (small depressions with a small bump) or water bars (small slanted humps) can be built to divert water from the road surface to the land for productive use. Water bars and drainage dips are the main low-cost solutions to provide basic drainage for unpaved roads. They are inexpensive and should become standard elements of unpaved road development and maintenance. They will preserve these ubiquitous low-volume roads and help turn the runoff from the road into a productive asset.

Water bars are speed bumps. While their primary purpose is to divert water from the unpaved road

surface, not to reduce driving speed, they also serve this purpose.

Another drainage feature, closely related to water bars, are rolling dips or drainage dips. Different from a water bar, they consist of a small depression and a pushed-up hump, akin to a water board. The excavated material from the dip is used to create a higher area in the unpaved road, causing the road to slightly undulate, creating a double drainage feature of dip and ramp.

Rolling dips are the most reliable cross drains for low-standard roads. They collect surface runoff from the roadway and/or road ditch and direct the flow across and away from the roadway.



C) Using infiltration bunds to slow down the side erosion from the roads and promote recharge.

An alternative or complement to roadside vegetation is the use of infiltration bunds. These may be more appropriate in arid areas because of the difficulty for roadside vegetation to take root. Infiltration bunds can be placed on the downhill side of the road or at any other location in the catchment where they intercept sheet flow. The stone bunds disperse water and slow runoff. They ensure more infiltration of the runoff, contributing to improved soil moisture and recharge of groundwater. surface, not to reduce driving speed, they also serve this purpose.

