IMPROVING PATHS AND TRACKS PART 1

Most transport tasks undertaken by rural people in developing countries take place on paths and tracks. These link small communities to sources of water and firewood, farmland, and village centres. They also provide access to the nearest part of the road network which can, in some regions, be up to several days' walk away.

Simple improvements to paths and tracks can often bring about substantial benefits to rural communities by making the paths safer and easier to use. Spot improvements on short sections of the path or track are usually the most effective. These are targeted at improving specific problems, of which the most common are:

- slipperiness and erosion caused by poor drainage;
- slipperiness and erosion caused by steep gradients;
- wet and marshy ground;
- dangerous, steep and rocky sections; and
- difficult stream or river crossings.

In many cases these problems can be remedied by using simple techniques, some of which are described here.

This Technical Brief describes the:

- identification of problems on paths and tracks;
- items to consider in the planning of path and track improvements;
- recommended standards to adopt;
- methods of constructing a path or track including the surfacing materials; and organization of the work.

Identification of problems

The identification of problems on paths and tracks starts with consultations with the users. This is most important, not least because problems may not be evident at all times of the year. Other problems, such as load carrying on the path, may not be obvious. Village-level meetings are effective and may be sufficient by themselves to identify the problems on paths which are used mainly by local people.

Technical inventory surveys are carried out to gather information on the physical condition of a path or track. Information is usually only recorded for sections where there are existing or potential problems. The type of observations and measurements required are:

- reference number and location of the section (relative to obvious landmarks);
- length of section (can be paced out, but preferably measured with a tape measure);
- soil type;
- gradient of path or track;
- crossfall (sideways slope) of surrounding land;
- type of problem (e.g. slippery section, gully erosion, etc.); and
- details of the situation with possible solutions (sketches and notes).

The survey is usually carried out by an engineer or technician but it is preferable if the technician is accompanied by the users of the path or track who can point out or confirm the problem areas. For long-distance footpaths and in cases where priorities for improvement need to be set, consultations and technical inventory surveys can be supplemented by traffic surveys.

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Traffic surveys are most appropriate where the use of the path or trail is heavy. The survey point must be chosen carefully to avoid sections of path where there are several alternative routes. For this reason bridge crossings make good survey points. They should also be located far enough away from large villages, so that very short local trips do not overwhelm the longer distance trips. Two enumerators are normally sufficient to carry out the survey. Typically the following information should be collected:

- origin and destination of the traveller;
- location of intermediate overnight stops on the journey, if appropriate;
- whether the traveller is male or female;
- whether a load is carried and, if so, the 'weight, owner, and type of load; and
- type or means of transport (pack-animal or bicycle, for example),

It should be borne in mind that the number of users of a path or track can vary significantly both from day to day and from season to season. Repeat surveys on successive days and at different times of the year are therefore recommended.

Planning of improvements

Having identified the problem or problems, the following decisions must be made:

- What measures are required to rectify the problem?
- What resources are required (labour and materials, for example)?
- How will the improvements be carried out, including by whom and when?

Notes:
Desirable widths are shown; minimum recommended widths in parentheses.
All dimensions in metres

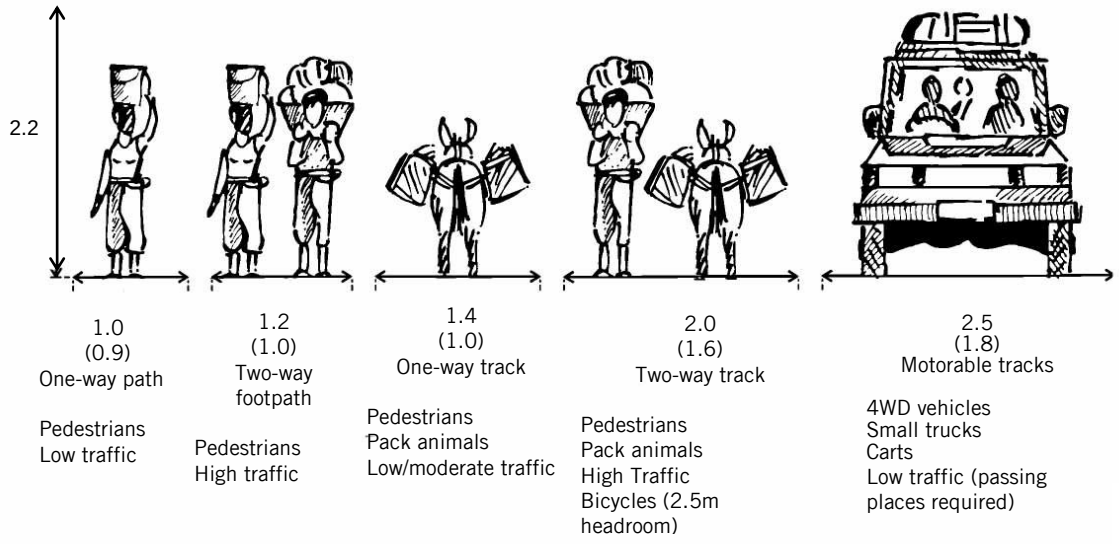
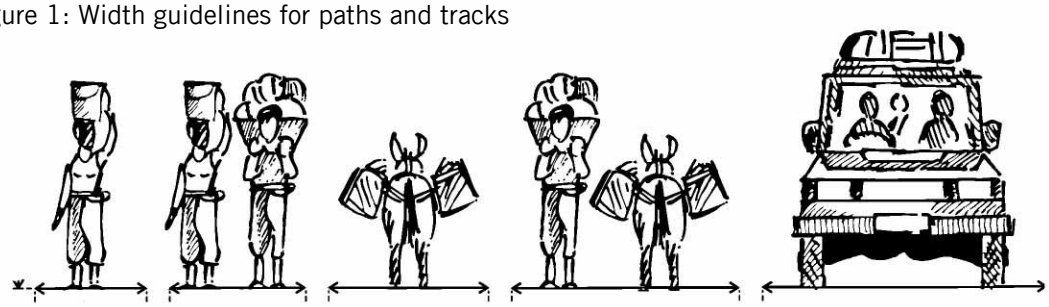


Figure 1: Width guidelines for paths and tracks



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Most improvements to paths or tracks can be carried out by local people, with some technical direction, as the techniques are simple and make use of locally available materials. If the improvements will benefit mainly the local people themselves, then they may be willing to provide their labour on a voluntary self-help basis. This will be the case particularly if they feel that they have also been fully involved in the process of identifying and prioritising the problems. Where the benefits are more widely spread, such as on important long-distance paths or tracks, paid labour may be necessary.

Technical direction is necessary both to specify the measures and resources required and to supervise the work. Technical supervision is important as, inevitably, situations will arise where on-the-spot technical decisions are required.

Design standards

The main standards to apply to a path or track are the width and the maximum longitudinal (along the path) gradient. It is important first to establish the type of traffic which uses, or will use, the path. The significant factors are:

- the number of users per day or hour;
- whether the users are load-carriers (headloading? dimensions of load?);
- whether pack animals use the path or track; and
- whether any wheeled vehicles (bicycles or wheelbarrows, for example) use the path or track?

Figure 1 gives guidelines on the cleared width of path or track to adopt in different situations.

The optimum gradient for a stable path is one that drains quickly without causing erosion. Figure 2 gives guidelines on maximum longitudinal gradients.

The major damaging factor affecting footpaths is rainwater. The preferred cross-section of a path or track is one that sheds rainwater rapidly from its surface and leads the water safely away without causing erosion. The most appropriate cross-section depends on the slope of the surrounding ground, the permeability of the soil, and the volume of surface run-off. Figure 3 gives typical cross-sections which can be adopted where a section of path or track is to be fully reconstructed.

The camber or arched cross-section can be made by using the material from the ditches dug on either side.

For spot improvements the standards will be applied to the improved section of the path or track only. In the special case where a path or track is to be made accessible to new types of traffic, for example pack animals or wheeled vehicles, the new standards will need to be applied throughout its length.

Gradient		Remarks
1 in 20	5%	Max. gradient for bicycles with trailers
1 in 14	7%	Max. gradient for bicycles
1 in 10	10%	Max gradient for animal drawn carts
1 in 9	11%	Desirable max. gradient for forest roads
1 in 8	12%	Desirable max. gradient for forest roads
1 in 5.2	20%	Absolute max. gradient for forest roads
1 in 4	26%	Shallow steps required
1 in 3	36%	Moderate steps required
1 in 2	46%	Steep steps required
1 in 1.4	70%	Hands needed to aid assent
Note: Paths to be used by wheeled vehicles or pack animals obviously cannot have steps		

Figure 2: Maximum longitudinal gradients for paths and tracks

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Surfacing

Most paths and tracks have not been 'constructed' but have developed naturally from the passage of traffic. The compaction of the soil by pedestrians, animals, or light vehicles is usually sufficient to give a satisfactory surface. The addition or replacement of surfacing material is relatively expensive and can only be justified in special circumstances. Examples of such circumstances are marshy areas, very rough terrain, very sandy soils, or easily erodible soils on steep slopes. For these sections selected material is brought to the site and is used to construct the path in one or more layers. Ideally suitable material should be obtained from pits excavated close to the section under construction. Where the major problem is an erodible surface, a single layer of well-compacted gravelly soil may be adequate. If the naturally occurring soil is very weak, such as loose sand, construction using several layers will be necessary. This spreads the load of the traffic through the layers and reduces the pressure on the underlying soil. A certain amount of clay mixed in with the gravel helps to bind the material together and produce a dense impermeable surface layer. Figure 4 illustrates some surfacing methods for paths and tracks. (In very marshy areas special techniques, which will be described in a later technical brief, are required.)

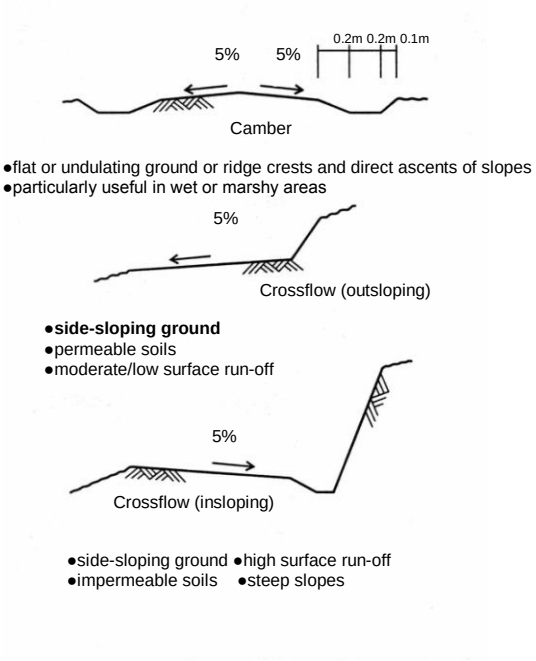

Figure 3: Typical cross-sections for improved paths and tracks

Construction sequence

Where a section of path or track is to be reconstructed or improved, the construction sequence shown in Figure 5 should be followed.

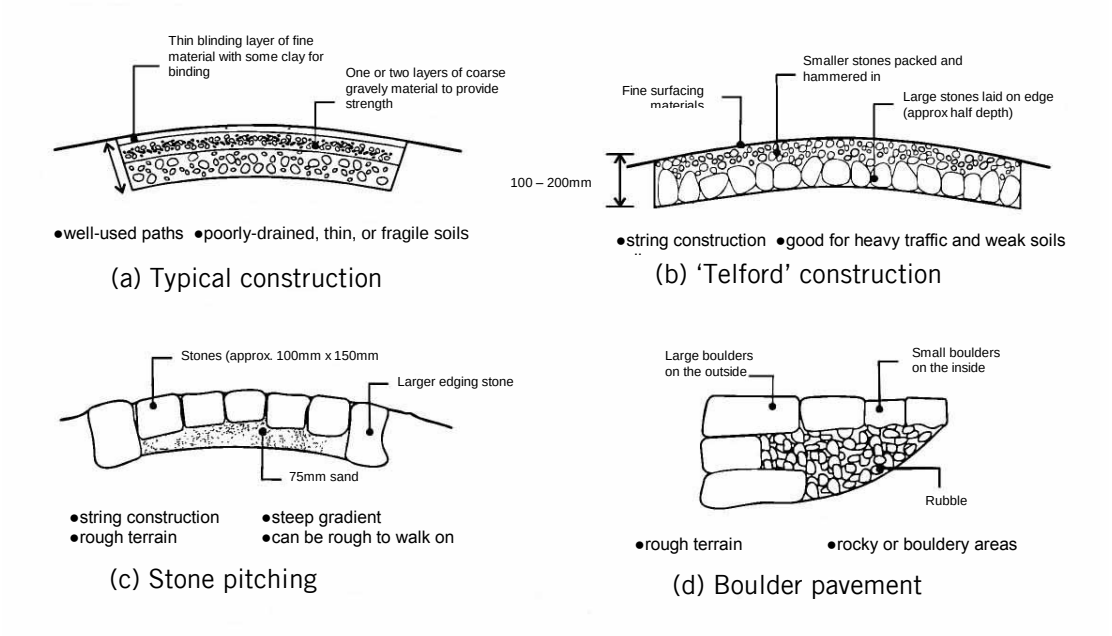

Figure 4: Surfacing methods for paths and tracks

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For paths in side-sloping ground the construction sequence is similar - only the ditch details are different. Material for forming the crossfall is won from the ditch excavation or from trimming back the uphill side-cut face.

Hand-tools

The hand-tools required for the majority of path and track improvements are:-

Hoe
Axe
Pick axe
Machete
Shovel
Sledge-hammer
Slasher
Rake
Wheelbarrow (if appropriate)

The items in this list should be modified where appropriate to include tools that are both available locally and familiar to those who will carry out the work. The extra cost of buying the best available quality of hand tools is invariably recouped through higher productivity and longer tool life, and is therefore strongly recommended.

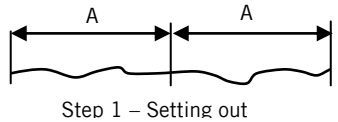
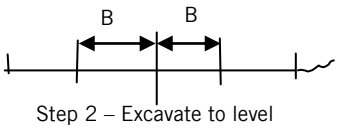
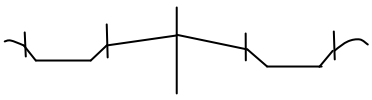
 Step 1 – Setting out	Place pegs on centreline of path (every 5 – 10 metres) Place two pegs at the back of the ditch (distance A depends on the required width of the path and ditch.
 Step 2 – Excavate to level	Excavate and fill between the two outer pegs to produce a level "bench" Place two new pegs at the edge of the path (distance B is half the required width of the path)
 Step 3 – Form camber	Excavate the ditches throwing the excavated material to the centre. Spread the excavated material to form the camber. Use wooden templates cut to the correct size to check and control the ditch shape and the path camber.

Figure 5: Construction sequence

Organization of the works

For the job to be carried out quickly and efficiently, path and track improvement works need careful planning and organization. The work gang needs to be large enough to be able to make significant progress each day, but not so large that individuals get in each other's way. The key steps are:

1. Decide on the work to be carried out.
2. Calculate the quantities of excavation, surfacing material, etc. required.
3. Ensure that the necessary materials and tools are on the site.
4. Calculate the size of work gang required for each activity.
5. Plan the sequence of activities.
6. Assign tasks to individuals or teams, preferably on a daily basis and clearly mark out the work to be done.

To assist in carrying out these steps, some useful measures are given in Figure 6, and some typical productivities are given in Figure 7.

A typical sequence of activities for carrying out the improvement of a path or track

2 shovels full	=	1 bucket (2 gallon)
Bucket (2 gallon)	=	0.01 cubic metres
Wheelbarrow	=	0.04 cubic metres level
	=	0.07 cubic metres piled up
1 cubic metre	=	25 wheelbarrows level
	=	14 wheelbarrows piled up

Figure 6: Some useful measures

Activity	Quantity per person per day*
Clear grass and small bushes	25 m^2
Excavate soil/Gravel	
• Soft	4-6 m^3
• Hard	2-4m^3
Excavate rock	0.5-2m^3
Haul and unload soil by wheelbarrows	
• 100 meters haul	5m^3
• 200 meters haul	3m^3
Spread fill material	7m^3
Dry stone masonry	1m^3
Lay stone pitching	1m^3
*Based on six hours work per day	

Figure 7: Typical productivities

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might be:
1. Hold local consultations on perceived problems with the existing path.
2. Obtain maps or make sketch maps of the existing path, and carry out technical inventory survey.
3. Carry out a traffic survey in heavy use situations.
4. Estimate quantities, resources, and costs for each section of improvement work required and decide on priorities.
5. Organize materials, tools, and labour.
6. Implement the improvement works following the construction sequence given above.
7. Establish, in consultation with the community, a maintenance system.

References and further reading

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The International Forum for Rural Transport and Development is a global network of individuals and representatives from government, academia, multilateral and bilateral donor agencies, consultancies and technical institutions, national and international NGOs and groups of community organisations in 83 countries in Africa, Asia, Europe and North and South America. There are over 1800 members in the network. The Forum's long-term vision is of a world in which rural communities, particularly those who are poor and disadvantaged, have improved accessibility and mobility.

Forum News is produced by the Secretariat, four times a year in English, French and Spanish. Members receive the newsletter free of charge. Each issue of the newsletter is based on a specific theme. Themes addressed in past newsletters have included sustainable rural livelihoods, gender and transport, engineering for transport, networking, maintenance, and community participation.

International Labour Office, Employment Intensive Investment Programme – useful publications and case studies on labour intensive road construction; not specific details on paths and tracks.

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