global Transport Knowledge Partnership

Transport Power Points:
10-minute briefing series

Low Cost Grading of Earth and Gravel Roads

Rural Transport

The Rationale

Earth and gravel roads make up the majority of the networks in developing regions. They need to be 'reshaped' or graded at least once each year (traffic, material & weather related) to ensure they continue to shed rainwater and provide a safe running surface

In many developing regions grading maintenance is deficient leading to poor network conditions, unreliable access, & high transport costs. This is a major barrier to rural community social and economic development.

Unpaved Road Deterioration

Earth and Gravel roads deteriorate rapidly if not regularly reshaped

Typically routine grading is required 1 to 4 times per year to preserve the road camber and drainage

Common Faults - 1

Inappropriate Equipment – Motor graders are often used in developing countries for grading maintenance. They are:

- **Extremely expensive to buy, costly and problematic to maintain in a limited resource environment**
- **Rarely achieving the utilisation necessary to justify ownership in a high-finance-charge environment**
- **Dedicated task – can only grade**

They are an avoidable luxury - 'Like using a Rolls Royce to go shopping'!

Tractors v Motorgraders

- Motor graders cost 2 – 4 times as much as a tractor and towed grader, yet the hourly work output is similar (for the larger tractor towed grader units)
- Tractors can be used for other activities when not grading, thus raising utilisation & lowering unit costs
- Tractor servicing and repairs are simpler and cheaper than motor graders
- With typical finance costs of 20-25% p.a. or more, the risks of motor grader investment are much higher
- Hence the tractor technology is a better investment and risk for the private sector, and lower works costs for the client

Common Faults - 2

Dry weather grading – Without watering and compaction merely creates a layer of loose material on the road surface that is quickly dispersed by traffic and leads to 'sunken' road profiles that cannot be drained. These road sections often become impassable in the rains.

A waste of scarce resources!

Towed Grading Basics - 1

For Routine Maintenance grading a 70hp tractor and 2-3 tonne towed grader is usually required. This is a 'little and often' approach for roads *still retaining some camber.* Effectively moving a few cms of material back to the 'crown of the road'

Best done in the rainy season when the moisture present allows the loose graded material to 'bed down' under traffic without the need for (expensive) watering and compaction.

Possible output of 10 route-km/day

(with 4 passes)

Towed Grading Basics - 2

For Heavy or Rehabilitation grading to *restore camber*, a 100hp 4WD tractor and 5 tonne towed grader is required. It should be supported by watering and compaction equipment to ensure a more durable running surface. Can be done at any time of the year.

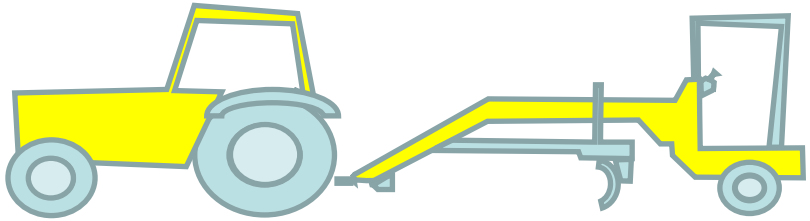
Possible output of 3 route-km/day. Watering and compaction work can also be tractor powered, allowing spares rationalization of power units

Towed Grading Requirements

Routine (light) towed grading ('little and often')

70hp 2WD tractor

1-2 tonnes on grader axle



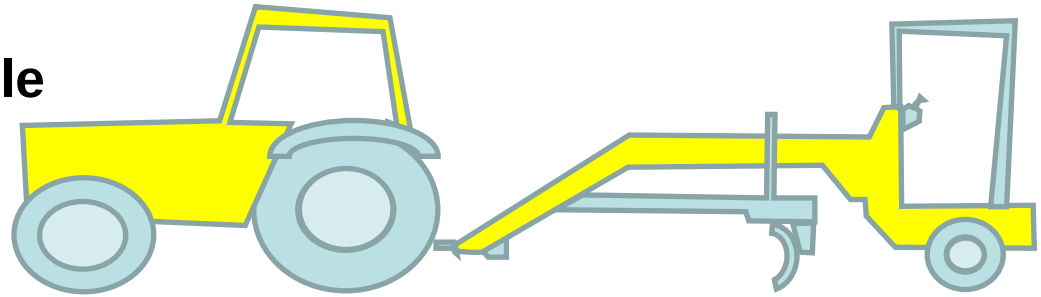
Heavy (rehabilitation) grading

100hp 4WD tractor

3-4 tonnes on grader axle

Plus

Water & compact



Therefore using 150hp motor graders is expensive 'overkill'!

Tractor Resources & Rural Enterprises

- **Agricultural Tractors are the simplest and cheapest mobile flexible power source**
- **There are many roadworks applications for tractors that can boost cross-sector utilization and profitability**

Multi-sector rural service enterprises should be promoted and supported

ROADS (paved and unpaved)	Gravel Haulage, Water Collection Haulage and Distribution, Personnel Transport, Bridge & Culvert Materials Haulage, Fuel Haulage, Plant Haulage (low loader trailer or semi-trailer), Towed Grading (heavy and light), Dragging, Towed Compaction (rubber tyred/steel roller), Earthworks Excavation & Haulage (towed scraper), Excavation (back hoe/ripper/scarifier/compressor & pneumatic tools), Loading (front shovel), Grass Cutting, Spreading Materials, Bitumen Sealing (towed bitumen/emulsion heater/sprayer), Stone crushing (towed crusher and screens), Chippings Transport, Recycling pavement (milling attachment), Brushing/Sweeping, Mixing (disc harrow), Slurry Sealing (mixer and spreader), Premix Patching Material Production, Temporary Accommodation (towed caravan/workshop)

Towed Grader Options

Some towed graders are twin axled with a simple drawbar to connect to the tractor

This allows for ease of changing attachments. However the load transfer onto the tractor back axle is limited. Traction can be improved by removing the front grader axle (increasing load transfer) or by adding tractor wheel weights. Single axle setup allows turnout drain cleaning

Further Information

The following important dissemination forums are supporting Low Traffic Volume Rural Roads (LVRR) knowledge:

global Transport Knowledge Partnership:

www.gtkp.com

SEACAP **Southeast Asia Community Access Programme**:

www.seacap-info.org

AFCAP **Africa Community Access Programme**

jeff.turner@afcap.org & rgeddes@africaonline.co.zw

Further information on LVRR may be obtained from the above websites and the gTKP Rural Transport Theme Champion: rob.petts@gtkp.com

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