

Session 4.1: The Role of Rural Transport Infrastructure

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- 4 Appropriate Solutions, & Standards
- 5 Low Volume Sealed Roads & Basic Access
- 6 Road Maintenance
- 7 Finance & Resources

What is rural transport infrastructure?

- Classified roads, bridges
- Unclassified roads and tracks, water crossings
- Trails and footpaths, footbridges
- Jetties, waterways and canals
- Bus terminals, lorry parks

What is the Problem with Rural Transport Infrastructure?

- Rural infrastructure performance is invariably poor
- There is no market to supply and maintain infrastructure, (governments become involved)
- There is confusion over responsibilities
- Different authorities are involved and planning is inconsistent
- Financial and management resources are scarce and inadequate
- Too often infrequent, over designed, investment is accompanied by totally inadequate maintenance

Who Looks After Rural Transport Infrastructure?

A diversity of organizations:

- Central government authorities
- State, regional, and local government
- Local communities and ad hoc groups
- Contract executing agencies. In Francophone Africa non-profit agencies for undertaking public works have been formed (AGETIP) - working on 5% fee basis.
- Individuals and companies
- Transport operators

AFCAP Community Roads & Footbridges



Infrastructure Performance and Traffic

- Appropriate solutions depend upon traffic volumes and vehicle types: pedestrians, donkeys, carts, boats, bicycles, motorbikes, cars, minibuses, trucks
- Quality and nature of infrastructure determines what type of traffic can pass
- In general the greater the investment then the larger the vehicle types that can be accommodated and the lower variable unit operating costs – expressed per ton/km
- Performance can be improved through new investment or more intensive maintenance

PASSABILITY, TRAFFICABILITY AND ROUGHNESS

The performance of rural roads is dependent on a range of characteristics from the users perspective: passability, trafficability, roughness are key.

Passability: This determines the extent to which vehicle of a given type can/ or cannot pass along the road throughout the year

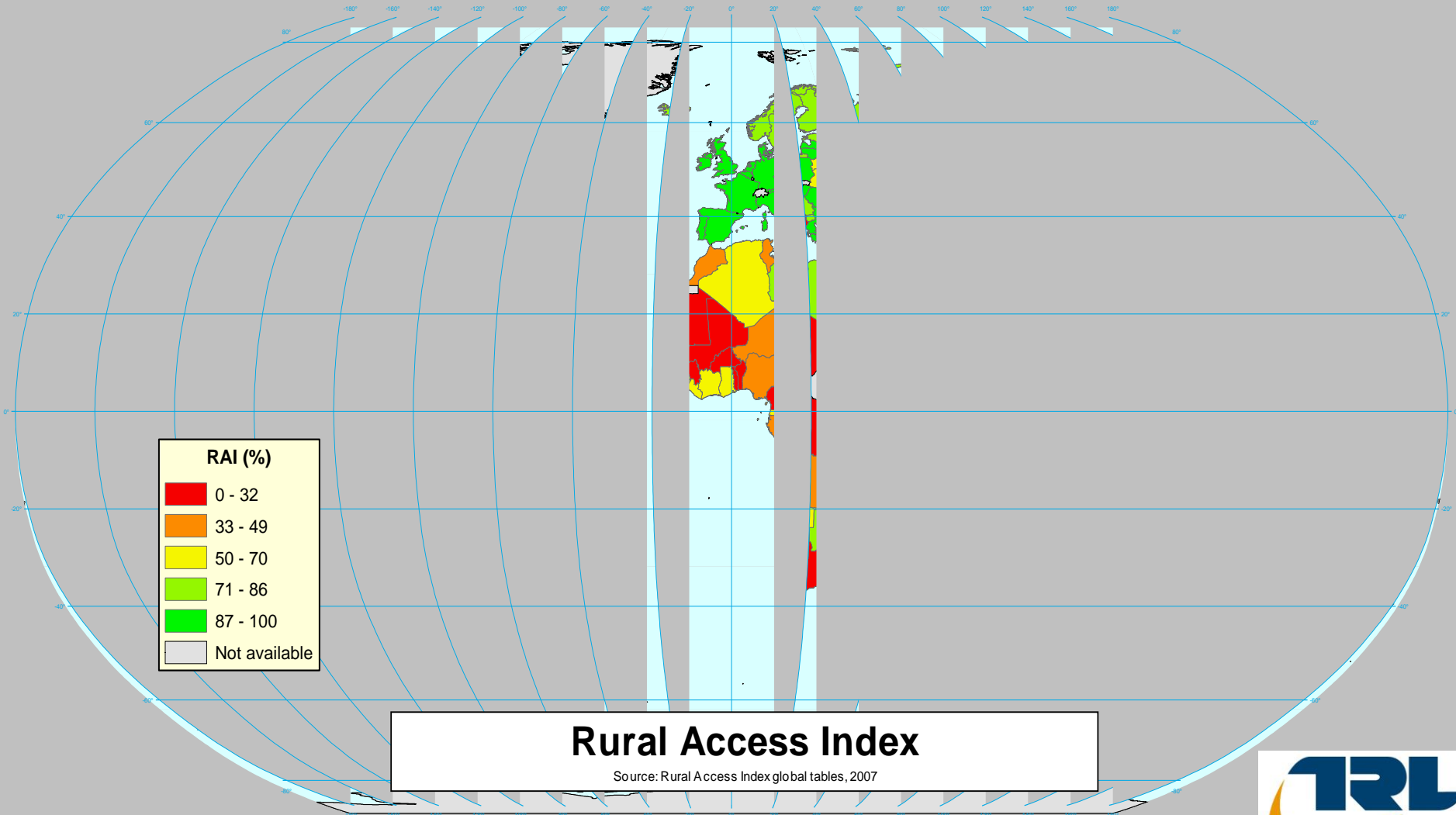
Trafficability: This characteristic indicates the ease with which a vehicle can pass. It has been found that vehicles will tend to avoid routes (even though they can physically pass) when the going is difficult. Soft mud, sand, roughness, standing water, or high vegetation can reduce trafficability

Roughness : This characteristic measures the unevenness of the road surface. A good paved road may have an IRI of 2, a very rough road will have an IRI above 20. Roughness is a key determinant of vehicle operating costs.

Poor Quality Roads



Adequate Access to Rural Transport ...



- The Rural Access Index measures the proportion of the rural population who live within 2 km (typically equivalent to a walk of 20 minutes) of an all season Road.
- An “all-season road” is a road that is motorable all year round by the prevailing means of rural transport (often a pick-up or a truck which does not have four-wheel-drive). Predictable interruptions of short duration during inclement weather (e.g. heavy rainfall) are accepted.
- The Rural Access Index is the only Transport Indicator required in the IDA /World Bank reporting process.
- Unfortunately reporting is not consistent. It can be via LSMS household interview or via mapping and engineering surveys. Also ‘all-season’ is sometimes taken to be a paved road, while other surveys will accept good quality gravel roads.

The Benefits of Improved Infrastructure Performance

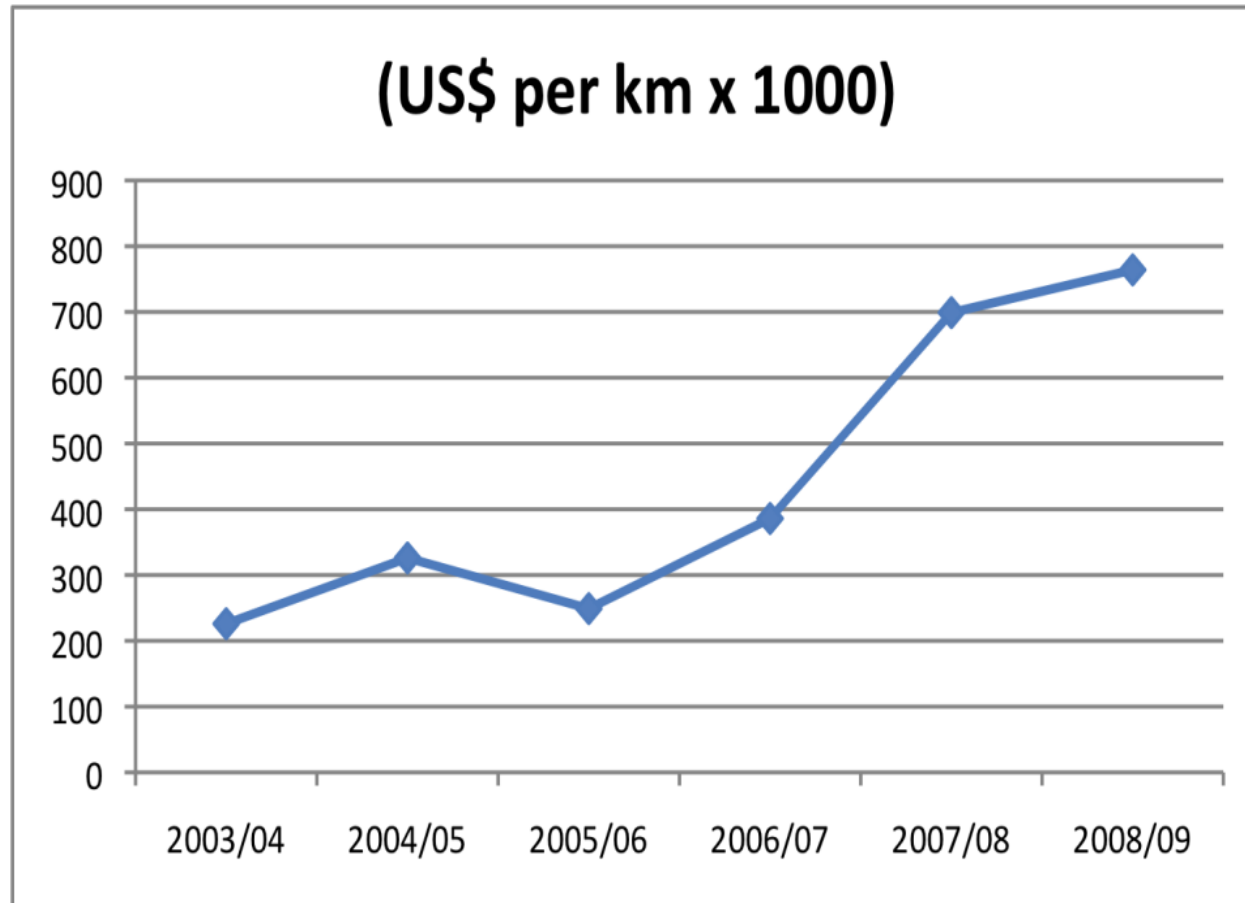
- Faster travel speeds
- Lower operating costs, fares and tariffs
- Improved service reliability
- An increased range of vehicle types
- An expansion of economic activity
- Better performance and increased utilization of clinics, hospitals, schools, extension services etc.
- Health is most at risk during the wet season from diseases such as malaria and diarrhoea when rural accessibility is poor and food stocks are at their lowest.



Planning Infrastructure

- In the World about 1 bn people do not have all season road access. Perhaps 300 m may have no motorized access at all.
- The evidence of impact is strong but often conflicting.
 - Do roads promote development or does development promote roads?
- The very poor maybe the least likely to benefit.
- In the last few years roads have increased massively in price. \$1 m per km for two lane paved main road is not uncommon. The practices of international contractors may be the cause.

Costs of Paving 2 Lane Road Tanzania



**What are your
experiences of donor
driven transport
infrastructure
interventions?**

- High Traffic Roads : Cost-Benefit Analysis (CBA) based on transport cost savings from road roughness reduction (HDM4) and increased speeds.
- Low Traffic Roads (under 50 vpd) : Some CBA (RED), and prioritisation procedures (based mostly on traffic, and population) + participatory planning.
- Village Infrastructure: Integrated Rural Accessibility Planning (IRAP) based on cost effectiveness of giving time savings + participatory planning.

The Social Impact of Rural Transport

- Rural transport development has the potential for improving the livelihoods of the rural poor with improvements to the following:
 - Education
 - Health
 - Access to basic facilities
 - Empowerment
 - Access to markets and towns

- An econometric study by Stefan Dercon of Oxford University, and others, carried out a repeat panel survey, from 1994 to 2004, of 15 village areas (kebeles), with 1477 households, in Ethiopia found that the presence or absence of a road was a major factor in reducing poverty.
- Access to an all weather road reduced poverty by 6.9% and increased consumption growth by 16.3%.

- New Macro Studies give more promising results: Shenggen Fan and others (at the International Food Policy Research Institute), have found through an analysis of regional data the following:
 - China: 6.37 Yuan return for 1 Yuan invested in rural roads (for major roads ratio 1.45Y :1Y)
 - Vietnam: 3.01 Dong agric production for 1 Dong invested in rural roads; \$63,000 invested would bring 132 people out of poverty
 - India: Per Rupee spent impact of reducing poverty was higher for rural roads than for R&D, irrigation, education, rural development
- In each case the analysis is based on extending the road network, not improving existing access.

POTENTIAL IMPROVEMENT IN FARM GATE PRICES (Research from Ghana)

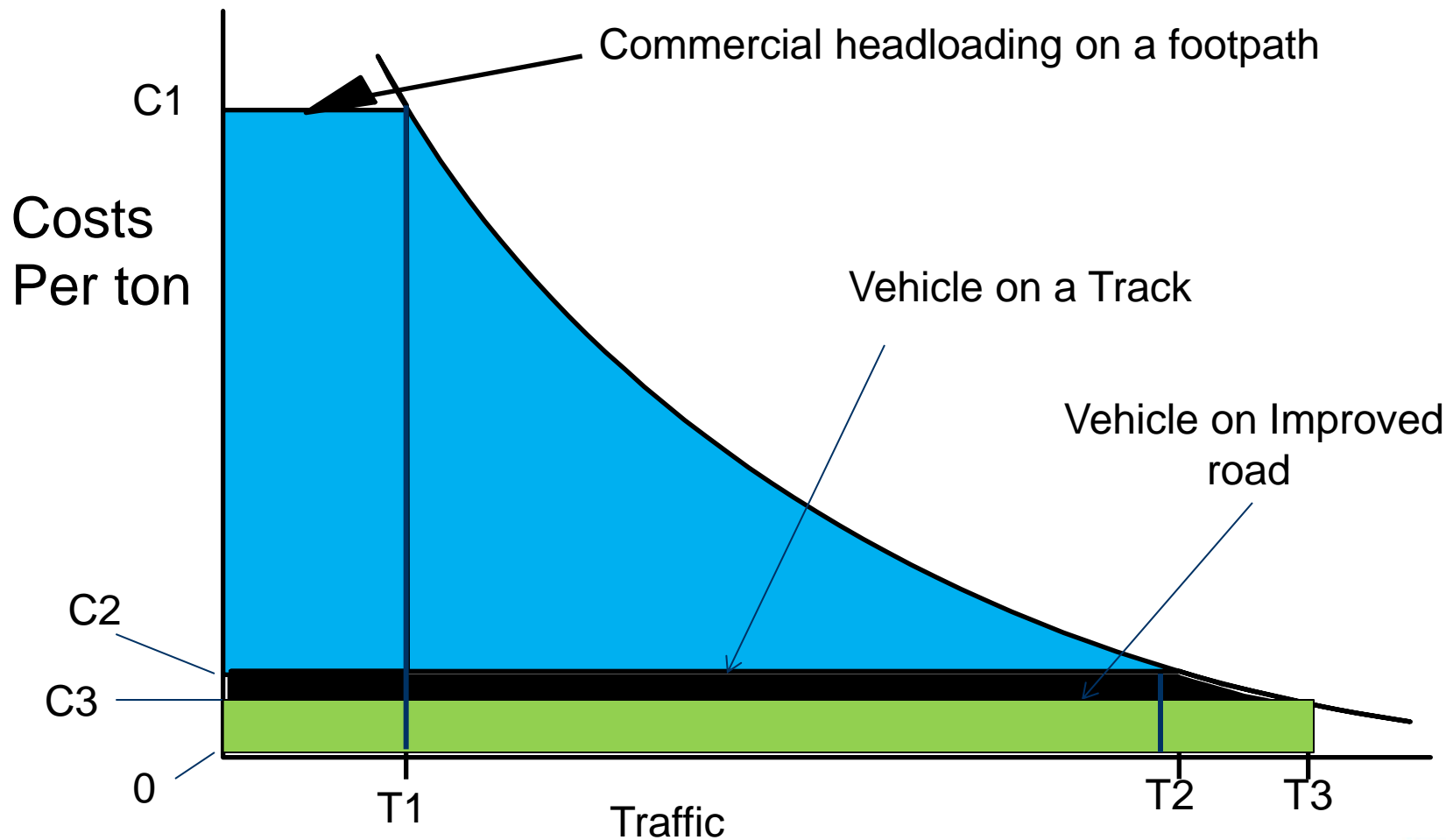
Percentage increase in farm-gate price of maize with improved access

| | Length of access to be upgraded | |
|-----------------------------------|---------------------------------|-------|
| | 5 km | 20 km |
| Upgrade from earth to gravel road | 0.08 | 0.29 |
| Upgrade from path to earth road | 11.4 | 70.6 |

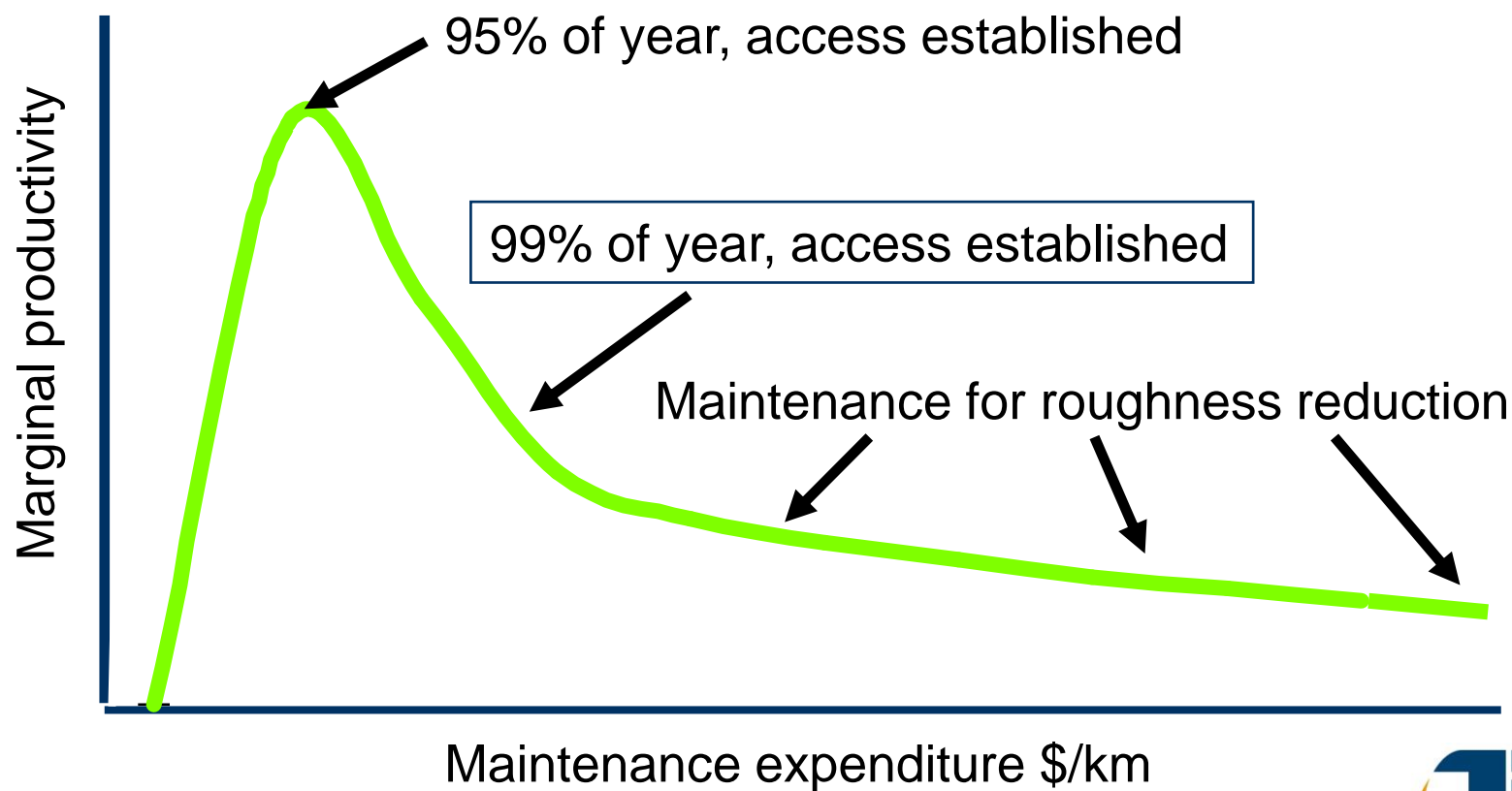
What are the Lessons of the Research?

- Substantial benefits arise by providing new vehicle access.
- Basic vehicle access appears to be the most cost-effective key to Rural Development when traffic volumes are low.

Illustration of Economic Benefits



The marginal productivity of maintenance expenditure

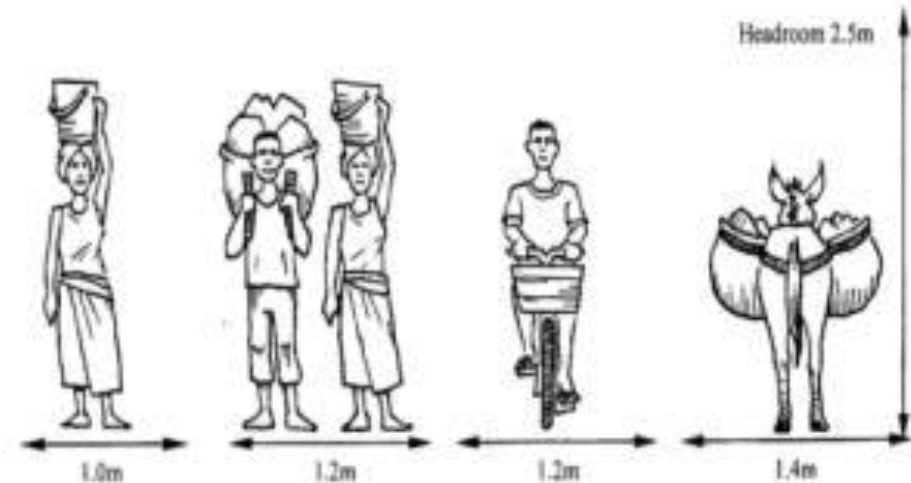


What is the Appropriate Solution for Different Traffic Levels?

- Footpath or seasonal access track - no maintenance?
- Track with simple structures – very limited maintenance.
- Earth road, structure, spot improvements, routine maintenance, grading?
- Gravel road, regular grading and routine and periodic maintenance
- Bitumen surfaced road, routine and periodic maintenance

PATH & ROAD WIDTHS FOR DIFFERENT TRAFFIC

- 1-2 m Suitable for footpaths and routes for bicycles
- 2.5 m Minimum width for a track with animal carts and occasional motor vehicles
- 3 m Minimum width for a single track road with passing places. Suitable for low volumes of traffic.
- 4.5m – 6m Narrow roads permitting two way traffic. Suitable for small rural roads with <100 vpd



- >6m Two way roads permitting large vehicles to pass comfortably, and with >100 vpd

ROAD STANDARDS AND TRAFFIC VOLUME

Road standards are determined via various processes dependent on engineering judgement, economic analysis, political direction and availability of funds. Typical traffic volumes might be as follows:

- Under 5 vehicles a day – simple track
- 5 to 50 vehicles a day – engineered earth road
- 50-200 vehicles per day – engineered gravel road
- Above 200 vehicles per day – bitumen paved road

Economic appraisal approaches will give varying traffic levels depending on construction costs, maintenance approaches, and the availability of suitable materials. Increasingly it is recognised that suitable gravel material (which needs to be renewed every 4 to 7 years or so) is getting scarce and so the traffic threshold for paving is being reduced.

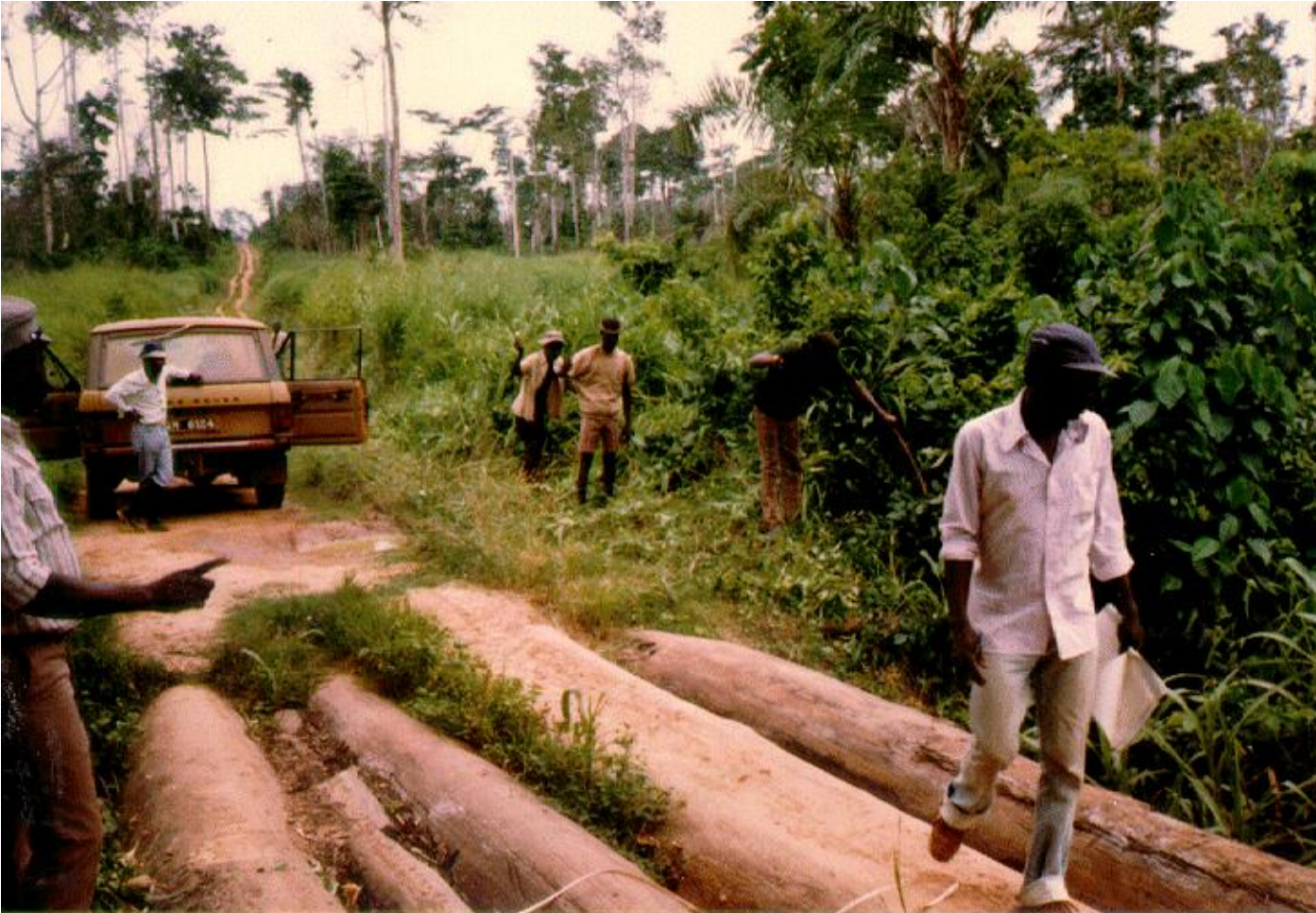
AFCAP Standards should be related to Traffic Volume



- A range of research has been carried out (particularly in Southern Africa and Scandinavia) to adopt Low Cost Sealed Roads for lower traffic volumes. AFCAP is heavily involved on research in this area.
- The approach involves using low cost ‘marginal’ base materials such as screened gravel rather than more expensive crushed rock, and may involve using Otta seals that have a well graded aggregate.
- The Otta seals have been found to better able resist high solar radiation and so delay the aging of bitumen binder and hence improve the durability of the surface.
- A new simpler approach used to design pavements, based on the DCP, has been developed based on sub-grade strength, traffic volumes and strength of materials.

THE BASIC ACCESS APPROACH USING SPOT IMPROVEMENTS

- Where traffic volumes are low the best value for money is achieved by adopting a ‘Spot Improvement Approach’.
- So the track or road is not improved all the way along its length but particular problem spots are treated to ensure that vehicle access is achieved throughout the year.
- The object is to ensure passability and traffickability rather than reducing roughness.
- The approach may involve a wide range of activities, including cutting back vegetation, building culverts or drifts, gravelling low lying sections, paving steep slopes, cutting drains etc.





EXAMPLES OF LOW COST MEASURES



- A Culvert, a
- Vented Drift
- A Splash



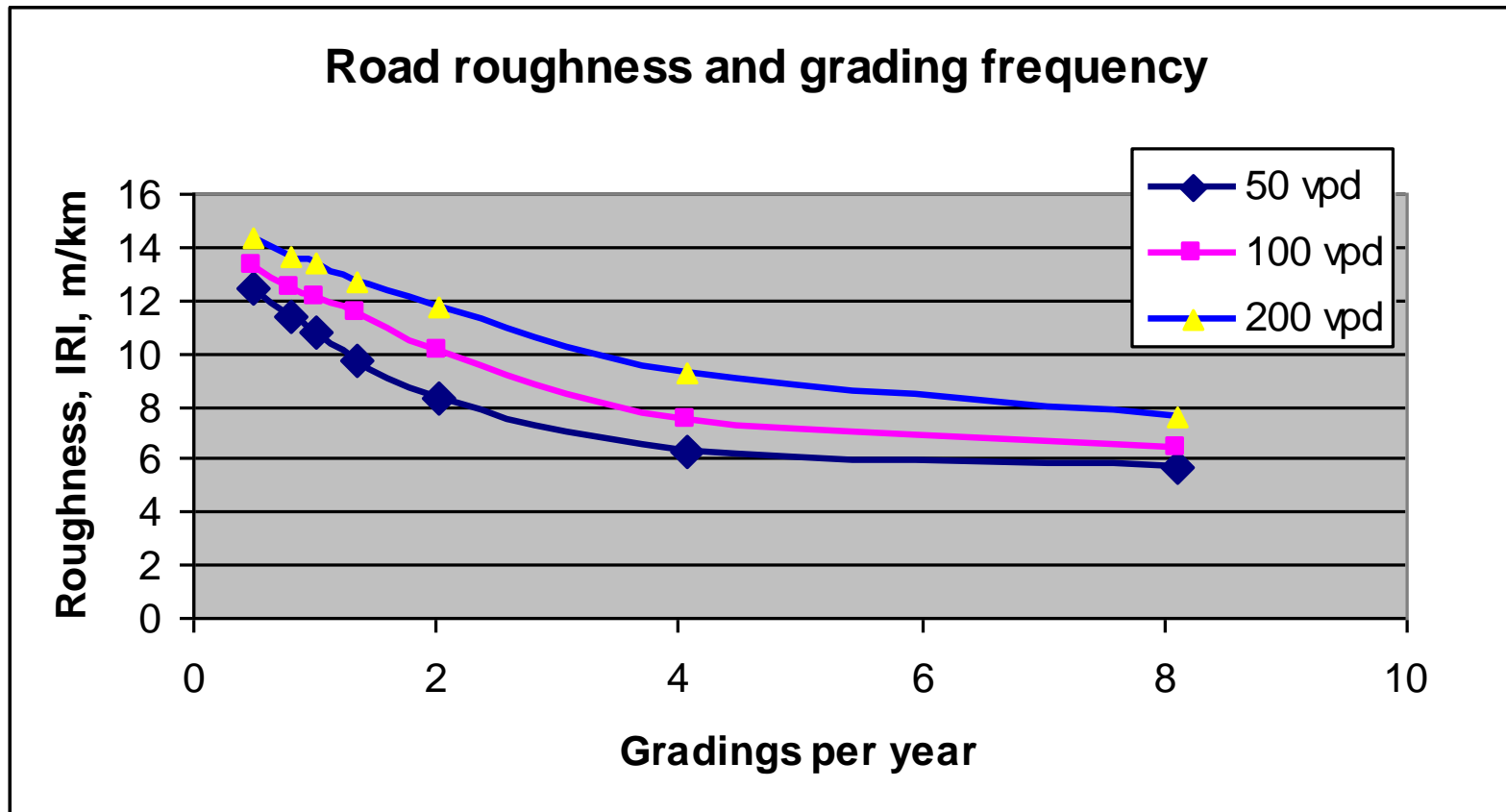
Stepping Stones

Cross channel across a footpath



- Quality of performance depends on maintenance: road roughness affects vehicle operating costs
- Maintenance is dependent on funding - but there is a particular problems with funding maintenance at the lowest levels
- Institutional development there is a trend separating ownership and planning from operations
- Trend towards commercialisation: contract maintenance, 'term contracts' and 'performance based contracts'
- Decentralisation: often major problems - Funds, functions and officials
- Contractor capacity constraints

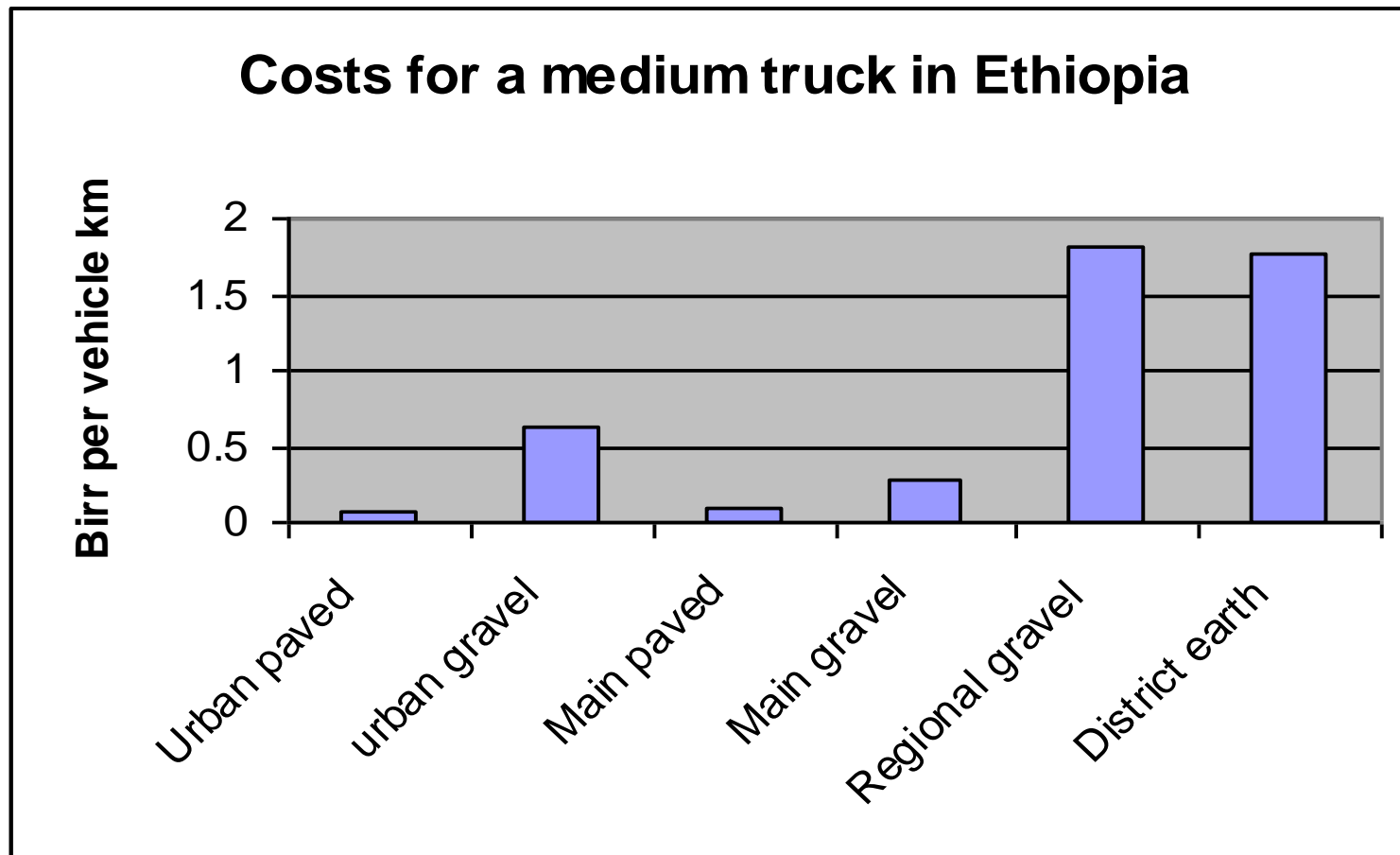
Road Roughness and Grading



Sources of Funding and Support

- Central government
- Road Funds
- Local taxation
- Road and bridge tolls, octroi payments
- Local labour, (compulsory or voluntary)
- Donor support
- Community Driven Development (CDD) initiatives, Non Governmental Organisations (NGOs)

A Comparison of the Costs of Road Maintenance per Vehicle Km

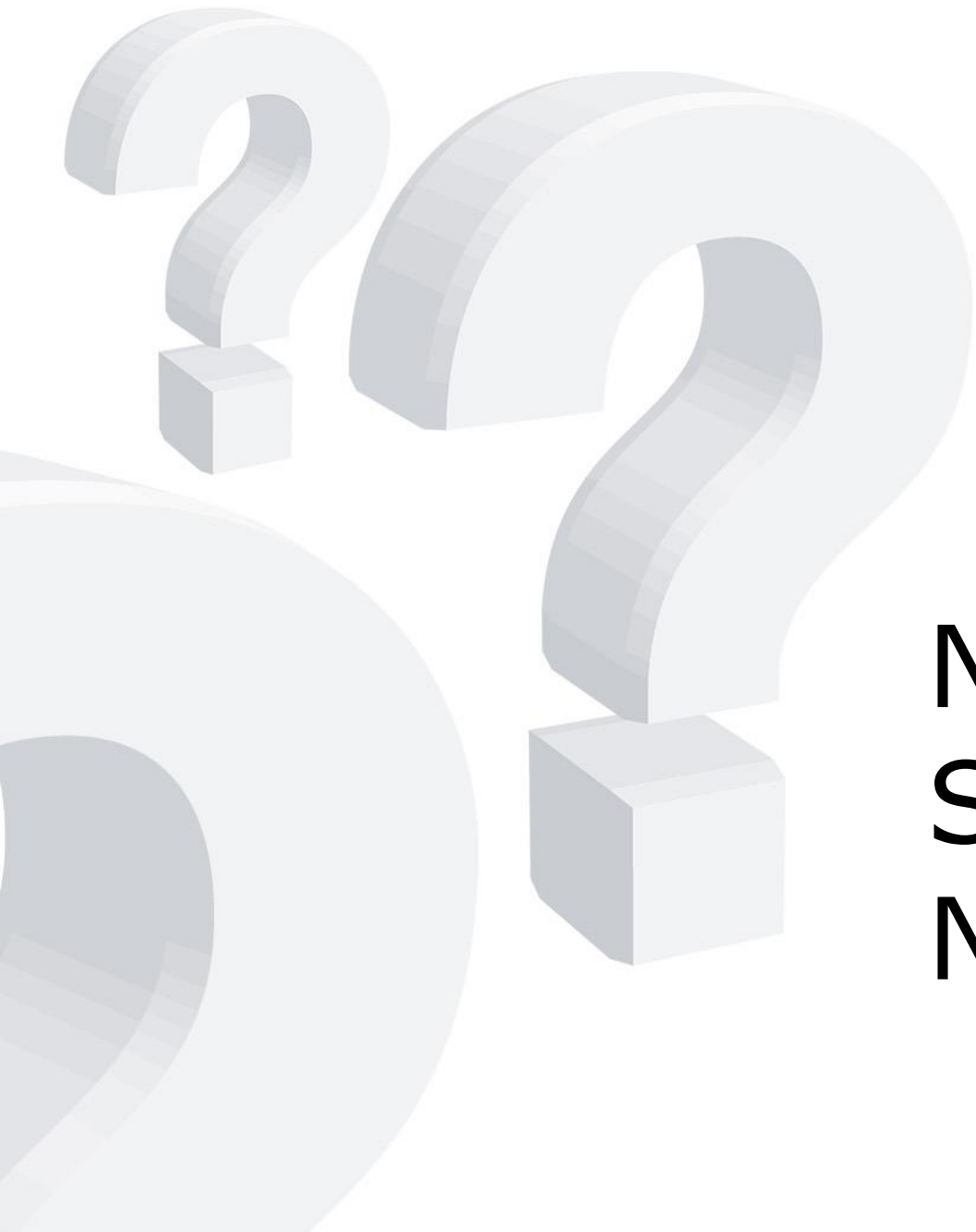


Particular Resource and Finance Problems for Rural Infrastructure

- Rural areas are poor and may have a very low tax base
- Traffic volumes are low hence maintenance costs per vehicle km are high
- If Road Funds are the key source of finance cross-subsidies from main and urban road traffic will inevitably be involved
- But if there is insufficient funds to maintain the main road network – should funds be switched to rural roads?
- Population densities may be low hence infrastructure costs per person will be high
- Low population densities will also be a major constraint in using community labour to maintain roads

Financial and Resource Solutions

- Long term reliable sources of finance are best
- Make a case to other agencies, road fund, donors, NGOs, CDD and social fund initiatives, for further support
- Find new sources of local funding, eg octroi payments, as in Asia?
- Provide incentives (e.g. matching funds) for community involvement, and voluntary labour



Now look at
Session 4.1
Notes!