Module 2:

Planning, Design, Appraisal and Implementation

Economic Analysis of a Rural Basic Access Road Project. Case Study: Andhra Pradesh, India

Session 2.3

Part 2

Presentation 2.3b

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1. Introduction

Learning Objectives

This session enables participants to:

- Describe key indicators that may be used to assess the potential impact of road improvements
- Explain how the CBA and CEA methods were used in the case study
- Explore the components of the spreadsheet CBA programme
- Reflect on lessons learnt from the case study and consider how these may apply to their own project work

Session Overview

- The rationale for using CEA and CBA in Andhra Pradesh
- Project background and overview of economic analysis
- Village and household transport survey results
- The spreadsheet CBA programme
- Key lessons learnt

2. The Rationale for using CEA and CBA in Andhra Pradesh

- Rural road projects aimed at improving basic road accessibility from villages to markets & social services are expected to provide:
  - savings in vehicle operating cost (VOC) and road-user travel time cost (TTC)
  - socio-economic opportunities for the rural population
- Most rural access roads have low-traffic volumes
  - social benefits are often more important than the direct road-user cost savings
  - But! cost-benefit analysis that quantifies road-user benefits as VOC and TTC savings is unsuitable for evaluating rural basic access road projects for financing

more of the rationale ……

- Alternative methodologies should be adopted, such as
  - cost-effectiveness analysis (CEA) to supplement cost-benefit analysis (CBA)
- This case study examines the application of such methodologies in Andhra Pradesh, India

3. Project background and overview of the Economic Analysis

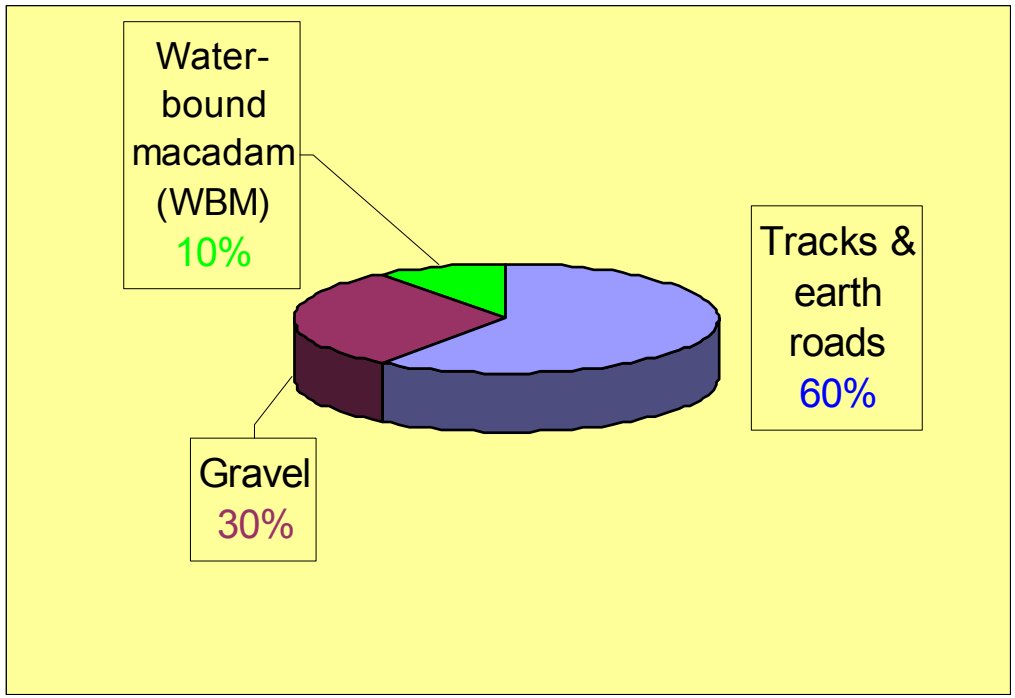
- The project area = 3 poor rural districts:
  - Adilabad, Karimnagar, and Warangal
  - total population of 6.8 million
- The project proposes to:
  - improve the rural road network to at least basic, all-weather passable standard

The role of economic analysis is to assist the design, prioritisation, and selection of road works for financing under the project.

The project area road network

The rural road network
= 15,000 km

- mostly in poor condition
- neither tracks nor earth roads are all-weather passable



Both gravel and WBM roads can be all-weather passable, but many do not meet the all-weather standard due to broken or missing cross-drainage facilities.

The dilemma …

- Demand for network investment greatly exceeds the project budget
- The key to maximising investment is to
  - focus on the improvement of a **core network**
    - to ensure minimum connectivity for *each* village to a nearby main road or market centre
- The **core network is identified** through a rural road master planning process
  - links that do not meet the basic all-weather standard are identified as candidate roads for improvement
    - economic analysis is only applied to these roads

Road works for candidate roads fall into two major categories:

(a) basic accessibility works

- upgrading tracks & earth roads to gravel or WBM roads
- all cross drainage works on existing gravel & WBM roads
- carried out as part of poverty reduction

(b) black-topping works

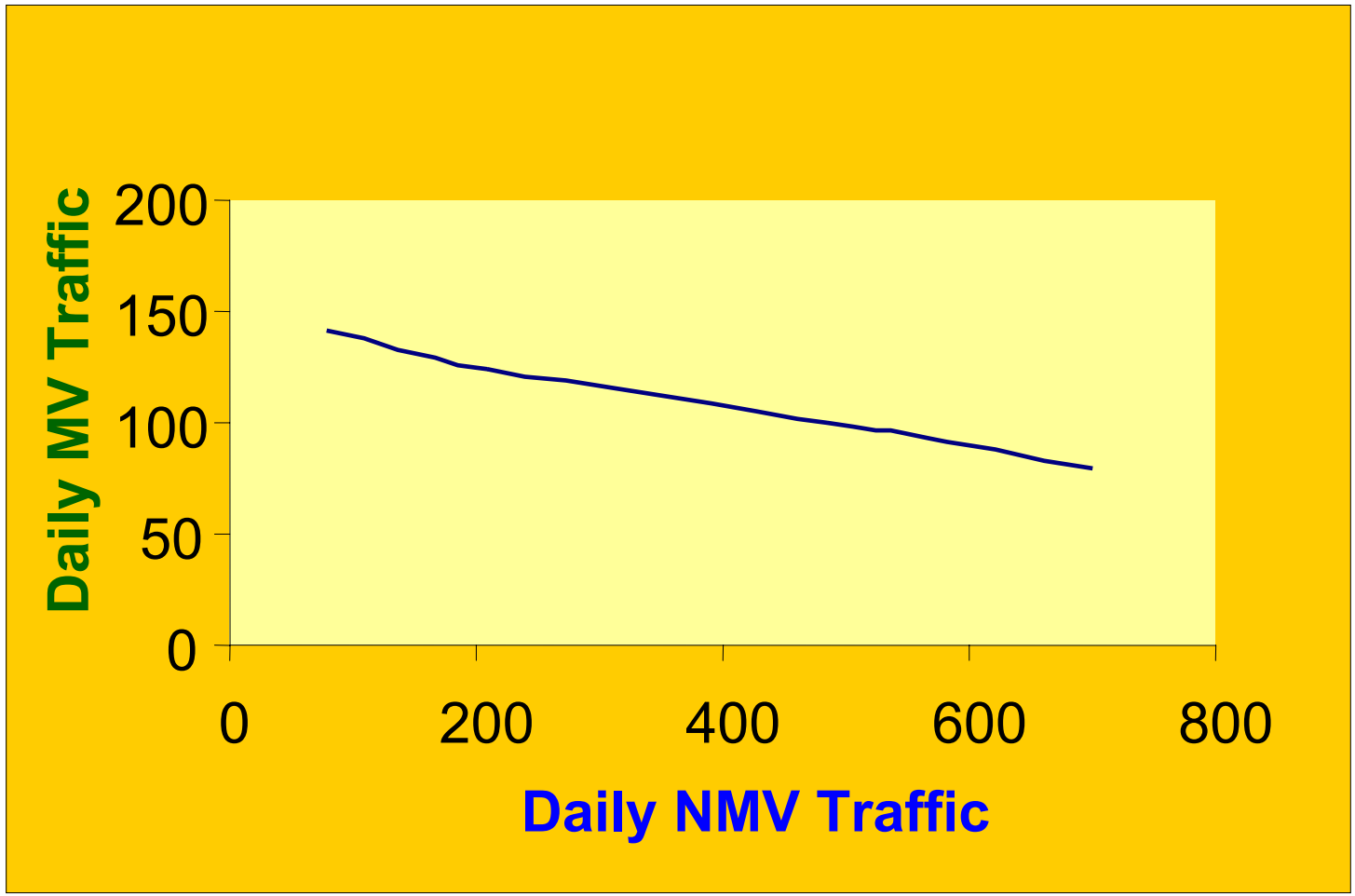
- existing earth, gravel, and WBM roads
- carried out primarily for economic reasons, and must be economically justified
- when traffic volume on an unpaved road reaches a certain level ...
  - it is **more economical to pave the road** rather than to keep restoring the unpaved road to all-weather condition

This project used CBA and CEA methodologies

CBA

- Used for black-topping works
- Minimum traffic thresholds determined using spreadsheet CBA programme
  - combination of motor vehicle (MV) & non-motorised vehicle (NMV) traffic levels at which black-topping would be justified
    - ➢ at the minimum economic rate of return (ERR) of 12 %
- Candidate roads with traffic levels below the thresholds are
  - dropped from the list of black-topping works
  - ... but considered for upgrading to basic access standard and evaluated in the category of basic accessibility works

Minimum Traffic Thresholds for Rural Road Paving



CEA

- Applied to the selected basic accessibility road works
- All roads proposed for basic accessibility work are ranked by
  - simple cost-effectiveness measure-total population provided with basic access per $2,500 equivalent of expenditure
- The top-ranking least-cost works are financed
  - with a maximum of $50 equivalent per person served used as a final restrictive measure to ensure cost-effectiveness

CBA and CEA has produced …

- A list of basic accessibility road works ranked by cost-effectiveness
  - 1,700 km of rural roads selected
    - cost-effectiveness ratio from $14 to $50 outlay/person served
- A list of black-topping works ranked by ERR
  - 1,300 km of roads are selected
    - with ERRs range from 12 to 90 % with an overall ERR of 24 %
- This project does **not** deal with the *optimal budget allocation* between the two categories of road works
  - allocation is decided through a stakeholder participatory process

2 million people are expected to benefit from the project.

4. Village and household transport survey

- The likely impact of basic road access on the welfare of rural households was also assessed (along with the CBA & CEA)
- Data was collected from 40 villages
  - 10 households/ village were randomly selected for the household level survey

Impact of road improvements

Group Activity

A. What are the problems faced by villages not connected by an all-weather access road to a major road or market centre?

B. What social and economic indicators can be used to assess the expected impact from the improvement of roads?

Andhra Pradesh survey results: constraints

- Major obstacles to village accessibility in unconnected villages
  - poor road conditions
  - seasonal road closures
  - lack of motorised access
  - high cost of freight delivery
- Road closure during the rainy season causes
  - produce spoilage
  - delay of freight delivery
  - labour unemployment
  - lower school attendance

Expected impacts from improved roads

- Households in connected and unconnected villages predicted:
  - more seasonal work taken outside villages
  - higher intensity of cultivation
  - expansion of cultivated land
- The survey results provided strong empirical evidence to support the social and economic justifications for the provision of basic all-weather access to these villages

Table E.1.1. A Summary of Rural Household Survey Results: Villages Connected with All-Weather Access Road vs. Villages Unconnected, 1997

Indicators	Connected	Unconnected
Household income ($/yr)	700	275
Literacy rate		
Male	51%	40%
Female	35%	22%
Total	43%	32%
Avg. distance travelled for: (km)		
Fertiliser	11	19
Seeds	11	19
Pesticides	9	16
Transport cost ($/ton-km)		
Fertiliser by bullock cart	0.13	0.33
Seeds by bullock cart	0.10	0.26
Fertiliser by lorry	0.16	0.25
Seeds by lorry	0.08	0.11
Avg. distance to school (km)		
Primary education	0.2	0.2
Secondary education	2.5	18.0

4. The spreadsheet CBA programme

Designed to evaluate rural road black-topping works

The programme consists of five panels

- Panel 1:
  - record the road data and economic input parameters
- Panel 2:
  - contains engineering unit cost data obtained from the field.
- Panel 3:
  - estimated unit vehicle operating costs (VOC) and travel speeds by both road type and vehicle type
- Panel 4:
  - calculates savings in VOC and value of travel time (VOT) for the users of each mode of transport
- Panel 5:
  - calculates the economic cost and benefit streams over the project life, the net present value (NPV), and the ERR

Non Motorised Vehicle (NMV) Basic Cost Data, 1997

Item	Unit	Bullock Cart	Bicycle
Vehicle price	US$	62.5	30.0
Price of a pair of ox	US$	312.5	n.a.
Annual cost of feeding the ox	US$/pair	150.0	n.a.
Annualized maintenance cost	US$	75.0	5.0
Vehicle depreciation	US$/yr.	12.5	5.0 (a)
Annual average usage	km	2,400	1,000
Average year of life	years	5	10
Average VOC per km	**US$**	**0.13**	**0.01**

Note: (a) annual depreciation for the first 3 years.

6. Key lessons learnt

- If the provision of basic road access is for social equity reasons, use cost-effectiveness analysis
  - to evaluate the impact of the project
  - implicitly, the least-cost design to achieve the project objectives
- The economic analysis described in this case study may not be transferable to other rural road projects
  - requires systematic data collection
  - but does show that low cost data collection is possible with the active participation of the client

more lessons ……

- A minimal level of data is required
  - where systematic data do not exist or is too costly to collect, then:
    - at least establish a transport/ poverty profile through a small-scale household survey
    - collect traffic data on the proposed rural roads.
- The methods used in this project have limits!
  - they help ensure the application of economic criteria
  - but! they **do not** deal with the optimal allocation of budget between the two categories of road works
    - this should be decided through a participatory process