COMPOSITION OF TRAFFIC AND DISTRIBUTION OF PROJECT BENEFITS ON RURAL-SUB-TERTIARY ROADS

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Abstract

MRD Seila Working Group undertook a study of laterite road projects supported by Commune Councils in 2003. These are small local access projects identified through a participatory planning process. MRD staff interviewed the Commune Council and made physical measurements before project implementation and 3 times post-implementation over a 12 month period. At each stage, a traffic count was undertaken. An economic cost-benefit analysis was carried out.

It was found that about 90% of wheeled traffic on the study roads consisted of bicycles and motorcycles. Most vehicles were locally owned and most journeys were short. Journeys from home to fields were ranked most important, followed by journeys from home to market. Fifty-six percent of all trips were within the home village area and a further 30% within the home commune.

About 75% of economic benefits were for non-motorised traffic and motorcycles. Trucks of all kinds represented less than 1% of traffic volume and about 4% of project benefits.

For roads of this type, exclusion of heavy trucks will have minimal impact on project benefits. Excluding heavy trucks will allow lighter and less costly structures, reduce maintenance costs, minimise dust nuisance and reduce accidents. Weight restrictions are not a practical at this level and the most suitable means of restricting vehicle size is by physical obstacles to wide or high vehicles.

Successful implementation of vehicle size restrictions on rural roads requires a detailed inventory of roads to be compiled. Using the IRAP system, Provincial Departments of Rural Development should cooperate with Commune Councils to clarify management responsibilities for each line of road and to determine appropriate vehicle size restrictions.

Introduction

The lowest level of the rural transportation network in Cambodia consists of sub-tertiary roads and paths, which are under management responsibility of the Commune Councils. There are believed to be around 20,000 kilometres of these roads in total, implying that each Commune is responsible for a network of 10 – 15km. In most cases these roads are quite short – typically less than 5km, and are used mainly for local journeys by light traffic. Nevertheless, the majority of travel by rural Cambodians, as well as local transport and trading activities, the first stages of transport of crops to market and the final stage of

distribution of agricultural inputs, are on these roads. Appropriate management of these roads, including choice of surface treatment and regulation of vehicle loads, is as important as for the higher levels of the road network.

Commune Councils spend over 60% of their development funds on road construction and improvement projects, which are identified through a participatory planning process. In 2003, MRD selected a sample of these projects for study. Ten projects were selected at random. However, in the event one of the projects selected was not implemented, and for a second project, in a remote area, it proved impossible to collect sufficient data for cost-benefit analysis.

This paper describes the MRD study and presents some key findings that are relevant to the workshop themes of planning and of vehicle axle load regulation.

Table 1: Details of Sample

Province	District	Commune	Length (km)
Battambang	Banan	Snoeng	6.382
	Bavel	Kdol Tahen	3.619
	Sangkae	Kampong Preah	2.021
	Kamrieng	Boeng Reang	2.145
	Koas Krala	Thipakdei	2.732
Kampong Cham	Prey Chhor	Thma Pun	0.62
	Tbong Khmom	Thma Pechr	2.238
Takeo	Bati	Krang Leav	6.245
	Kirivong	Phnom Denh	1.7
	Samroang	Khvav	4.365

Study Methodology

The MRD study team visited each selected project four times: once during the project preparation phase, in May 2003, and after implementation in August 2003, December 2003 and April 2004.

At each visit the team interviewed the Commune Council and made physical inspections and measurements of the road. As a simple and appropriate index of road condition, the speed at which it was possible to travel in comfort on a motorcycle (while carrying a basket of eggs and not breaking the eggs) was measured. Actual traffic speeds were measured by timing over a selected 100m section. A traffic survey comprising volume traffic counts between 6.00 a.m. and 6.00 p.m. over one week, and recording number of passengers, origin and destination for a sample of vehicles, was carried out by the Commune Council at each stage of the study.

Contractors implementing the projects were interviewed to investigate the level and structure of their costs.

A cost-benefit analysis of each project was carried out. In addition to calculation of conventional econimic indicators (ENPV / EIRR); the cost-benefit analyses were also used to identify the benefits gained by users of each transport mode.

Findings.

Composition of traffic

Table 1 shows the volume of traffic of different types, totalled for the 8 projects for which both pre-survey and post-survey data were collected.

Table 2: Volume and Composition of Traffic

Traffic type	Pre-survey		Final post-survey		
	Volume	Proportion	Volume	Proportion	Change
Bicycle	1967	49.1%	2348	46.2%	19%
Moto	1725	43.1%	2315	45.5%	34%
Remorque	35	0.9%	78	1.5%	119%
Ox Cart	154	3.8%	167	3.3%	9%
HorseCart	23	0.6%	88	1.7%	286%
Koh-Yon	33	0.8%	16	0.3%	-52%
Car	14	0.3%	33	0.6%	136%
Pickup	13	0.3%	36	0.7%	170%
Trucks	24	0.6%	7	0.1%	-73%
Other	19	0.5%	0	0.0%	-100%

Data from 8 projects with traffic counts conducted in April 2004

Over 90% of all wheeled traffic on rural feeder roads consists of motorcycles and bicycles. Rehabilitation of the roads led to increased use of horse carts, moto-remorques, cars and pickups, but from a very small base.

The number of trucks counted in the post-implementation survey was less than in the pre-implementation survey; this is influenced by regulations or physical obstructions introduced by the Commune Councils to protect the rehabilitated road from use by heavy trucks.

Pedestrian traffic is also important on these local roads. Pedestrians were not counted directly in traffic counts but Commune Councils stated that pedestrians outnumbered cyclists on 7 of the 10 roads investigated, and that improving road conditions for pedestrians was an important project benefit.

These data were combined with vehicle occupancy data to estimate the proportion of personal travel represented by each type. These proportions are shown in Table 3.

Table 3: Transport means as % of personal journeys

Traffic type	% of wheeled traffic	Occupancy	% of personal journeys	Adjusted to include pedestrians
Pedestrians				22%
Bicycle	46.2%	1.2	32%	26%
Moto	45.5%	1.9	51%	40%
Remorque	1.5%	5.5	5%	4%
Ox Cart	3.3%	1.9	4%	3%
HorseCart	1.7%	2.5	3%	2%
Koh-Yon	0.3%	2.5	0%	0%
Car	0.6%	3.7	1%	1%
Pickup	0.7%	5.4	2%	2%
Trucks	0.1%	7.3	1%	0%

Further, vehicles using the road are mainly slow vehicles. Of the classes investigated, only cars, pickups and trucks will travel at speeds much greater than 40kph even on a high quality road surface.

For this profile of traffic, and relatively low traffic volumes, a road of 3m width (for very low traffic volume) or 4m (for moderate traffic volumes) with light structures will provide as much benefit as a 5m or 6m width road, but at greatly reduced cost. This is reflected in actual planning decisions made by Commune Councils, with the reservation that at present, the road standard adopted is as likely to be determined by budgetary considerations as by rational planning criteria.

Breakdown of journey types

The traffic count included an investigation of journey origins and destinations, with each journey classed as either “in village;” i.e. journeys beginning and ending within the home village; “in commune,” i.e. beginning and ending within the home commune, and journeys either beginning or ending outside the commune.

The results showed that more than half of journeys are local journeys within the village and a further 30% are within the home commune. Only 14% (by traffic volume) are journeys to or from outside the commune.

Vehicle ownership was found to be concentrated amongst commune residents. Around 70% of vehicles overall (though less than 50% of cars and pickups) were found to belong to residents of the commune.

Table 4: Vehicle Ownership and Origin and Destination Data

Traffic type	% owned by commune residents	Journey type		
		Within village	Within commune	To or from outside commune
Bicycle	69%	60%	28%	12%
Moto	65%	53%	33%	14%
Remorque	96%	43%	42%	15%
Ox Cart	75%	75%	13%	12%
HorseCart	75%	88%	9%	3%
Koh-Yon	27%	52%	38%	10%
Car	42%	32%	22%	46%
Pickup	39%	54%	25%	21%
Trucks	71%	44%	36%	19%
Weighted average	**68%**	**56%**	**30%**	**14%**

Priority reasons for implementation.

Table 5: Reasons For Prioritising Projects

Rank	Reason
1	People travel from their houses to the fields
2	People from the commune travel to the market to sell
3	Children go to school
4	People from outside the commune come to buy
5	People travel to work
6	Transport Crops

The importance of different journey types by purpose was ranked based on answers from the Commune Councils. The results of this ranking are shown in the table. The most important journey type is stated to be that from home to fields, followed by journeys to local markets and schools. This finding is consistent with the origin and destination data reported above.

Breakdown of economic benefits

The economic present value of benefits; in reduced journey times and operating costs, gained by users of each traffic type, was estimated. Table 6 shows this distribution totalled for 8 projects.

Table 6: Distribution of benefits

Type of journey	Present Value	%
Foot	$ 44,737.47	25%
Bicycle	$ 21,848.59	12%
Moto	$ 66,089.12	37%
Moto-trailer	$ 4,774.31	3%
Ox Cart	$ -	0%
Horse cart	$ 1,799.27	1%
Koh-Yon	$ 18,851.29	11%
Car	$ 3,349.23	2%
Pickup	$ 6,897.59	4%
Truck	$ 7,658.90	4%
Other	$ 2,904.19	2%
Total	**$178,909.94**	**100%**

The proportion of benefits accruing to pedestrians and two-wheeled vehicle users is somewhat less than the importance of these transport types as a proportion of personal journeys (74% vs 88%). However, this finding is of great importance to investment decisions as the type of road and road structure required for these traffic types is different and less expensive than that needed for four-wheeled vehicles or for trucks.

Conversely, trucks accounted for only 4% of the present value of benefits from the road investments, although the need to construct and maintain a road to allow truck traffic is likely to add a much higher percentage to the costs.

Implications and Proposals

Benefits of excluding heavy vehicles (but cost also: laterite transport)

The findings of the study demonstrate the potential benefits of excluding heavy truck traffic from rural feeder roads.

For this type of road the additional maintenance costs incurred due to damage from truck traffic may not be the most important consideration. If a decision to exclude heavy traffic can be taken at the planning stage, and can be effectively enforced, a lower design standard and in particular, much lighter structures, can be used, thus reducing investment costs. However, if this is done there is the danger of a single over-weight vehicle causing serious damage to road structures.

For small rural roads, exclusion of heavy traffic results in benefits to safety and to the environment. Slow moving, light traffic on a laterite road causes relatively little dust, however the passage of a single truck can result in serious nuisance for other road users and residents of roadside houses and businesses.

It is considered that exclusion of vehicles by use of physical obstructions such as width restriction or height restriction bars, is more practical than direct control of axle loads, at this level of the road network. Width restriction posts with a separation of 2.4m are commonly installed on rehabilitated rural roads in Cambodia. The main drawback is a tendency for these restrictions to be circumvented either by physical destruction or by the creation of diversions around the obstacle.

Importance of Planning

The decision to regulate traffic by excluding vehicles of a certain size or weight, is an economic decision. For some road types, the net value of the investment will be increased by excluding large or heavy vehicles; for other road types, the value will be reduced by inappropriate application of such measures.

Further, where there is a strong pressure to allow a road to be used by large vehicles, or where there is existing large vehicle traffic which has no alternative route, restrictions are unlikely to be successful.

It is proposed that vehicle restrictions based on size should become standard for all rural roads under the management of the Commune Councils. MRD policy is that roads providing access from District centres to rural communes should be under the direct management of the Provincial Department of Rural Development (PDRD); roads below this level; i.e. roads providing access from Commune to Village and roads providing lateral links between Communes, should be under the management of Commune Councils.

This guideline is appropriate in principle; however, for it to be applied in practice two further conditions are required:

1. there is a need for a actual inventory of roads in each district, so that Communes understand clearly which roads are under their responsibility, and which roads then can expect PDRD to manage;
2. there will be a proportion of roads which, although falling within the “Commune to Commune” or “Commune to Village” categories geographically, carry significant amounts of heavy vehicle traffic. Examples include roads providing access to natural resources such as laterite quarries. It is proposed that roads of this type should be identified as part of the planning process and should be placed under management of PDRD or, if appropriate, the Public Works Department, rather than the Commune.

In this regard, it is noted that traffic count results are often reported as a single ‘ADT” figure, which may reflect all vehicle types included in the count, either unweighted or by some weighting system. It is noted that this system does

not capture the essential information relating to small rural feeder roads; which is the composition, as well as the volume, of traffic. It is proposed that traffic counts on rural roads should as standard be reported in categories:

- the un-adjusted ADT of two-wheeled and non-motorised traffic.
- the un-adjusted ADT of light four-wheeled vehicles (cars, pickups, koh-yon, moto-remorques and trucks below a specified size limit;
- the un-adjusted ADT of trucks above the size limit.

Table 7 shows the pre-implementation traffic counts for the 10 project roads initially sampled by MRD, reported in the format proposed

Table 7: Traffic Counts Reported By Category

Project	Two-wheeled and NMT	Light 4-wheeled	Heavy goods
Snoeng	810	24	2
Kdol Tahen	261	10	0
Kampong Preah	**315**	**29**	**13**
Boeng Reang	**229**	**11**	**2**
Thipak -dei	60	0	0
Thma Pun	311	16	0
Thma Pechr	493	14	4
Krang Leav	986	11	5
Phnom Denh	**2863**	**614**	**48**
Khvav	633	10	0

Examination of the table shows immediately that the road at Phnom Den, Takeo, is not suitable, by volume and composition of traffic, for Commune management, and this project should have been rejected by PDRD at the planning stage. In the event, the project was not implemented by the Commune, but for reasons only indirectly related to this.

Of the other roads, truck traffic is insignificant (less than 1 vehicle per day) on all except the Kampong Preah road. These roads are appropriate for Commune management and for exclusion of truck traffic. The road at Kampong Preah has approximately 2 heavy goods vehicles per day; it is suggested that at this level, further investigation into the type, purpose and economic importance of the truck traffic should be carried out, before a decision to exclude truck traffic is made.

Expansion of the IRAP planning maps to all rural districts would appear to be an excellent opportunity to inventorise and assign management responsibility for the lower levels of the rural road network. For the majority of roads, the

relevant classification will be obvious. For a minority of roads, there will be a need for additional investigation, including traffic surveys where necessary, to determine the appropriate design standard and management responsibility.

Reference

Economic Evaluation of Laterite Roads supported by Commune – Sangkat Fund in 2003 MRD and Seila Task Force Secretariat, September 2004 (in draft).