TRANSPORT NOTES

TRANSPORT ECONOMICS, POLICY AND POVERTY THEMATIC GROUP

THE WORLD BANK, WASHINGTON, DC | Transport Note No. TRN-22 | January 2005

Notes on the Economic Evaluation of Transport Projects

In response to many requests for help in the application of both conventional cost benefit analysis in transport and addressing of the newer topics of interest, we have prepared a series of Economic Evaluation Notes that provide guidance on some of issues that have proven more difficult to deal with.

The **Economic Evaluation Notes** *are arranged in three groups. The first group (TRN-6 to TRN—10) provides* **criteria** *for selection a particular evaluation technique or approach; the second (TRN-11 to TRN-17) addresses the selection of values of various* **inputs** *to the evaluation, and the third (TRN-18 to TRN-26) deals with specific* **problematic issues** *in economic evaluation. The Notes are preceded by a* **Framework** *(TRN-5), that provides the context within which we use economic evaluation in the transport sector.*

The main text of most of the Notes was prepared for the Transport and Urban Development Department (TUDTR) of the World Bank by Peter Mackie, John Nellthorp and James Laird, at the Institute for Transport Studies (ITS) , University of Leeds, UK (The draft text of Note 21 was prepared for ITS by I.T. Transport Ltd). TUDTR staff have made a few changes to the draft Notes as prepared by ITS. Funding was provided from the Transport and Rural Infrastructure Services Partnership (TRISP) between the Department of International Development (DFID) of the Government of the United Kingdom and the World Bank.

The Notes will be revised periodically and we welcome comments on what changes become necessary. Suggestions for additional Notes or for changes or additions to existing Notes should be sent to *rcarruthers@worldbank.org*

TREATMENT OF PEDESTRIAN AND NON-MOTORISED TRAFFIC

Pedestrians[1[*]] and Non-Motorised Traffic vehicles (NMTs)[2[†]] are part of the complete transport scene and in some cases form a very important aspect of that scene. For example pedestrians and non-motorised vehicles may typically compose between 92% and 97% of the traffic volume on low volume rural roads [[i][1]], and non-motorised traffic forms a sizable percentage of traffic flow in cities within the developing world (e.g. bicycle usage in some Chinese cities). As with the motorised sector of the transport market, this sector will experience positive and negative impacts as a consequence of a transport investment and the sector therefore needs to be included within the appraisal of that investment.

Wheeled NMTs (e.g. bicycles and rickshaws) can experience benefits as smoother roads reduce operating costs and journey times, whether that be in an urban or rural environment. New roads and smoother roads can also lead to mode switching from pedestrian modes to either wheeled NMTs or motorised vehicles, giving both journey time and operating cost savings. An increase in the speed of traffic on an upgraded road may result in an increase in the seriousness of road accidents (i.e. an increase in the average number of fatalities per accident), with pedestrians and NMTs being the vulnerable road user groups. In some situations increases in capacity of urban intersections or urban arterials (e.g. construction of an urban motorway or freeway) may reduce the amount of road space available for NMTs thereby imposing costs (both travel time and operating costs) on that road user group.

As with motorised transport, pedestrians and NMTs may benefit from a transport investment in the following manners:

- Operating cost savings;
- Travel time savings; and
- Accident and Safety impacts.

[1[*]] Pedestrians are transport users who walk and include two groups: those who are paid to walk and carry a load (e.g. porters); and those who are walking to undertake an activity (e.g. to collect water or firewood, to paid employment, etc.).

[2[†]] Non-motorised vehicles would typically include: the bicycle, the rickshaw, mules/donkeys and the bullock cart. Though it should be noted that this is not an exclusive list.

The inclusion of benefits to pedestrians and NMTs can form a significant proportion of the total scheme benefits for investments such as low volume rural roads (*see TRN 21: Low Volume Rural Roads*).

Section 1 sets out the treatment of operating costs for pedestrian and NMTs, whilst Section 2 describes the treatment of travel time savings and Section 3 accidents. Section 4 presents a summary of the main points of this note.

OPERATING COSTS

Methods for calculating the non-motorised traffic user cost savings from road improvements have only recently been developed and become a part of project evaluation. Studies in Bangladesh and Indonesia have estimated user costs for a set of NMTs and the results of these studies have been integrated in the HDM4 model (Padeco, 1996 [ii[2]]; World Bank, 1996 [iii[3]]; and Odoki and Kerali, 1999 [iv[4]]).

Box 1 discusses the method used to calculate the Rickshaw costs in Bangladesh. Box 2 in *TRN 21: Low Volume Rural Roads* presents pedestrian load carrying operating costs and potential cost savings associated with modal switch from the portering of goods to the transfer of goods by truck.

Box 1. Rickshaw Operating Costs in Bangladesh

Studies in Bangladesh indicate how to realistically assess (changes in) the cost of transport services by rickshaws and rickshaw-vans that are used as a major form of rural transport The rickshaw-van is the most common NMT used for goods in rural Bangladesh, and it is driven (pedalled) by a van driver. It can carry about 400kg weight per trip. Since the main cost of its operation is the time and food-energy used by its driver, its operating cost is difficult to estimate. For project analysis, therefore, charges actually made by the rickshaw-van operators on different types of road conditions were collected through surveys. The vehicle operating cost savings used in the study are based on actual differentials in charges between existing poor roads and improved roads, as they substantially reflect the cost variations due to greater exertion, time and additional food for higher level of effort and energy needed for plying on rougher roads.

Since NMT transporters operate in a highly competitive market where there are no significant externalities, these financial rate differences are taken to reflect economic cost differences. The surveys showed that the rate per ton-km on moving on a rough (earth) road was more than double the rate for a smooth asphalt road (about US$0.50 per ton-km for the rough road, compared to US$0.20 per ton-km on smooth roads). An interesting aspect of the case in Bangladesh was the realisation that human–pulled vehicles need smooth surfaces even more than motor vehicles, and that road investments in black-topping could be justified when heavy NMT traffic exists, even though the number of motor vehicles in use is less than 50 per day. It was also clear that the people generally had small parcel loads or a few bags at a time to transport over short distances, which was best suited for the efficient form of NMT in Bangladesh (the rickshaw-van). Indeed, with road improvements there was a fast increase in both motor vehicles and NMT traffic. The Bangladesh studies also established that after road development there is dynamic growth in traffic and a change in vehicle composition: buses starting to appear for the first time, and overall traffic growth exceeded 100% even in the first year after project completion. The study also found that cost differences between the with-and without-project situations are best estimated through likely changes in the composition of vehicles (decline of bullock carts and head porterage, and increase in both NMT and motor vehicles) and related unit costs.

Source: "Bangladesh, Rural Infrastructure Impact Study, with Special reference to RDP-7 and other projects", LGED; prepared by Socio-economic Monitoring and Environmental Research, Dhaka; September 1999" [v[5]]. (ii) Rural Infrastructure Strategy Study, 1996 [3]

DFID (2002) [vi[6]] contains a worked example regarding the calculation of operating costs for NMTs and Pedestrians, the main principles of which are set out below and are based on the principles utilised with HDM4. It should be noted that the purpose of the example is to illustrate the method of calculation; in application location-specific data must be obtained through field surveys and from secondary sources. Particular information is required regarding operating costs in relation to differing road surface conditions. The information requirements are demanding in terms of data input and subsequent analysis, and scope may therefore exist for simplification should the appraisal warrant it.

Non-Motorised Traffic Operating Costs

In deriving local operating costs for NMTs the following components should be considered:

- Capital costs (including depreciation costs and interest charges);
- Repair and Maintenance costs;
- Crew cost;
- Energy cost (also applicable to pedestrians (e.g. driver of a mule train)); and
- Overhead cost.

Pedestrian Operating Costs

In deriving operating costs for walking the basic principle should be the same as that followed in the case of non-motorised traffic. Thus operating costs for non-commercial or owner-carrier pedestrian traffic will be determined energy costs (which in turn will vary by terrain and load), whilst on a commercial basis the operating costs will be determined by the wage rate of porters.

Travel Time

Travel time impacts of the project on pedestrians and NMTs should be reflected in the appraisal. *TRN 15: Valuation of Time Savings* provides guidance regarding obtaining appropriate values for use in the economic assessment. In deriving estimates of travel time impacts it is important to consider the following two points:

- Care should be taken to avoid double counting of travel time costs with the operating costs of the NMT or pedestrian. For example, the wage rate of the porter (per hour) reflects both the time costs and the operating costs of the porter and therefore should not be used as an estimate of operating costs alone.
- Any predicted savings in travel time, particular those arising through the alleviation of congestion should be calculated in a robust manner – *see also TRN 12: Demand Forecasting Errors*.

Accident and Safety Impacts

The transport investment may alter both the number and the type of accidents in which pedestrians and NMTs are involved. Generally, speaking pedestrians and NMTs (e.g. cyclists) are vulnerable road users who tend to experience the worst injuries in an accident. As discussed in the *TRN 15: Valuation of Accident Reduction* it is important to ensure that road safety issues are fully reflected in the economic evaluation.

Summary

Pedestrians and Non Motorised Traffic (NMT) form an important part of the rural and urban transport scene within developing countries and as such will be impacted upon by transport investments. Whilst the incorporation of these slow modes into the appraisal is new and challenging, this is not justification for their exclusion. Policy decisions regarding investments should therefore be based on information that includes the anticipated impact upon pedestrians and NMTs.

This note has outlined three main areas where transport investments may impact on slow modes: operating costs, travel times and accidents and has described the key principles that are involved with the assessment of these impacts. These impacts may be both beneficial (e.g. operating cost and time cost savings) and detrimental (e.g. increased accident costs).

FURTHER READING

[1] Department for International Development (DFID) (2002) New Economists Guide Appraisal of Investments in Improved Rural Access Part 1: Core Guide Chapter 1. TRL, Crowthrone, Bershire, UK. [Also available online at http://www.transport-links.org/Economist Guide/English/Intro.htm]

[2] PADECO, Co., Ltd. (1996). Non-Motorized Transport (NMT) Modeling in HDM-4. (Draft Final Report). Report prepared for World Bank, Transportation, Water and Urban Development Department, Washington, DC : World Bank

[3] World Bank (1996), Bangladesh, Second Rural Roads and Markets Improvement and Maintenance Project, Project Implementation Document No. 15, Economic Appraisal of FRB Roads, South Asia Regional Office. Washington D.C : World Bank

[4] Odoki, J.B. and Kerali, H.R. (1999) Modelling Non-Motorised Transport Costs and Benefits in the Highway Development and Management System, Transportation Research Record 1695 (pp 5-13)

[5] World Bank (1999). Bangladesh Rural Infrastructure Strategy Study. Dhaka,: University Press

[6] Department for International Development (DFID) (2002) New Economists Guide Appraisal of Investments in Improved Rural Access Part 1: Mini-Guides, MG3 and MG6. TRL, Crowthrone, Bershire, UK. [Also available online at http://www.transport-links.org/Economist Guide/English/Intro.htm]