

Taking Non-Motorised Transport Seriously: measurement and evaluation

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Abstract:

The renewed focus on the performance of transport enterprises (generally referred to as micro-economic reform) has largely passed non-motorised transport by. The influence on non-motorised transport of this greater emphasis on transport enterprise performance is considered, and appropriate adjustment proposed. Both performance measures and a wider range of evaluation measures are required. Non-motorised transport movements are fundamentally different to motorised transport modes in a number of ways, and the lack of appropriate pricing signals makes it all the more important to recognise this. The near universal accessibility to non-motorised movement means that a more systematic assessment of the value of actual and potential access and travel time is required, and that the full externalities of motorised transport are brought out when assessments are made that include NMT modes. The information flows on NMT trends are sparse and only crash data is available in most States. The need to assess all aspects of transport accessibility and usage under environmental and social pressures requires a systematic reassessment of NMT movements. This is now beginning to occur in Australia.

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Non motorised transport (NMT) fits uneasily into conventional transport planning. The bicycle and pedestrian modes are not usually charged for registration, insurance or movement (although sometimes for parking), and have access to a wider network of routes than the highway system, including paths and pedestrian routes away from roads. Walking has restricted access to the highway system, and is catered for by footways adjacent to the highway. However cycling is permitted on almost all roads, and on the shoulders of many freeways. NMT is treated differently when its transport contributions are assessed, and some aspects of its valuation are quite different to those for motorised transport. It is often overlooked that many pedestrians and cyclists are also own and use motor vehicles, for which they have paid taxes and insurance, but are not using these vehicles while walking or cycling.

No single organisation is responsible for NMT planning, evaluation and management, and there is no bureaucracy specifically to administer revenue raising measures from NMT movements and vehicles. Ownership, in the administrative sense, is diffused across a number of areas from sport to public health and the emergence of a national strategy is a very recent development. As a result of this lack of focus there are few continuing information flows providing monitoring intelligence about NMT performance, and even fewer widely agreed measures of performance for expenditures associated with NMT provisions.

These shortfalls are brought into clear focus by the spreading implementation of micro economic reform in transport. As each transport operator in the public sector is reviewed, given performance goals, better accounting and a contestable area of responsibility, areas such as NMT (owned by no one body in particular) become more difficult to address in a systematic manner.

Microeconomic reform places pressure on creating the correct pricing signals and market information, as well as organisational changes. NMT sits uneasily between many different interest groups and public sector organisations, and requires a clear position and objectives. Recent developments have produced a National Bicycle Strategy for Australia, which declared broad agreement across a wide area of bicycle issues and given rise to a number of projects. There is as yet no equivalent for pedestrian movements.

The only long standing and continuing flow of broadly based and detailed information on bicycles and pedestrian activities is about collisions and injuries where bicycles and pedestrians are involved. The lack of any other body producing continuing monitoring information has helped to give the impression that NMT is essentially about the safety of 'vulnerable road users', rather than a set of transport modes with costs and benefits different from most of the motorised modes of transport.

The valuation of NMT has been strongly influenced by this, and the development of a broadly based and widely accepted evaluation framework for NMT has not yet emerged. This has by default encouraged the treatment of NMT as a marginal mode, considered in

transport planning largely only at the interfaces with motorised transport (typically pedestrian crossings, collisions).

The treatment of NMT benefits needs to be extended beyond that applied to motorised modes to account for the additional benefits that NMT movements generate. It is equally necessary to ensure that the full costs and externalities of the motorised modes are accounted for in any comparisons, as the impacts of NMT and motorised modes are so different. The Industry Commission specifically advocates this approach to cycling in a recent report (Industry Commission, 1994).

2. WHY IS NMT DIFFERENT?

- NMT modes are essentially unpriced.

This was recognised by the Industry Commission as substantiality complicating the valuation of cycling and walking proposals. In practice there are some costs, and the costs of maintaining and replacing a bicycle have been estimated at around \$60-80 pa. (Travers Morgan, 1982), but few riders regard their travel as costing any more than the effort they expend. It would be possible to regard walking as having a cost, on the basis of the purchase and replacement of shoes, but once again these costs are not normally considered to be costs attributable to travel or movement.

- NMT modes are not subject to insurance fees

This is correct only if the mode of transport is separated from the individual. In practise, the majority of adult (as distinct from child) cyclists in Australia own motor vehicles, and have the choice of which mode they use. Certainly at the margin, evaluations of mode shifts from car to cycling or walking generally assume that the car is not then used for an additional trip by somebody else. This will occur in some cases, but the insurance and road usage coverage aspects of registration are effectively an individual concern. The use of a car or a bicycle, if both are available, will then be a choice between an insured and an uninsured vehicle. This is the effect of insuring vehicles rather than people, and this distortion of the price signals needs to be corrected to ensure that motorised choice is not biased by this effect. This is a purely administrative issue, and is rooted in equity concerns that excluded bicycle (and indeed pedestrian) movements. Bicycle organisations in several States have arranged bicycle-specific insurance.

- NMT modes use a wider network than the designated road system

Bicycles are usually defined as vehicles in law, but can use a wide range of off-road routes, and often use footpaths and pedestrian road crossings. Pedestrians use both the roadside footways and also access via malls, arcades, through buildings and on off road pathways. Pedestrian usage of the highway is limited mainly to road crossings, where a balance is sought between pedestrian safety and vehicle flows and delays. For safety, bicycles often share pedestrian crossings at traffic lights and elsewhere. The road authorities are responsible for the public rights of way and adjacent footways, but other

departments are responsible for off road foot and bicycle ways, and within malls, transport interchanges and buildings.

- NMT is accessible to all

Walking is available to all but people with mobility limitations, and cycling is also available to all, subject to physical ability (and access to a bicycle in the case of cycling). Practical constraints limit access to bicycles to children of an age to ride them, but walking is the basic mode for even fairly small children. Pedestrians are their own 'vehicle', and so cannot easily be distinguished from the person. Bicycles can be distinguished, and so may be treated differently. This universal potential access is valued, even if not ever used, but needs to be accounted for in any valuations of cycling and walking provisions (Weisbrod, 1964).

- NMT does not involve registration

The lack of a registration system means that records are not kept of the vehicle (ie the person as a pedestrian or cyclist, and the bicycle itself), and there is no continuing flow of information on the availability of the vehicle for movement, as there is for motorised vehicles. Registration schemes have been proposed for bicycles in Australia, largely for theft recovery purposes, but the experience overseas has been mixed. IVHS¹ initiatives may eventually require an automatic identification tag on all vehicles, but this is not yet imminent. However, to ensure detection at vehicle loops this is becoming a useful option. This may yet yield a measure of automatic monitoring and information about bicycles and their use, but not yet.

- NMT is not administered centrally

There is at present no equivalent to vehicle registration departments, vehicle licensing bodies, or third party vehicle accident cover companies for cyclists or pedestrians. This has a positive aspect, in that there is no organisation to reform. However, when comparing NMT to motorised vehicles this emphasises that some resource overheads for these organisations should be added to the costs for motorised vehicles (or alternatively equivalent credits should be applied to NMT usage)

- NMT can be, and is, used by people without legal access to a motor vehicle

This is important to young people, as bicycles offer them their only personal transport alternative. This age group is not normally in the workforce, and the valuation of bicycle and pedestrian travel by this age group requires special consideration. Cycling and walking also continue to be available to those who have had their licences to drive a car withdrawn.

- NMT generates no revenue streams

¹ Intelligent Vehicle-Highway Systems: covers the application of a range of advanced communication and control technologies to road and transport systems

Many NMT users generate revenue streams for their general transport accessibility (as they are often owners and users of other means of transport), but this is not accounted for in assessments of their NMT movements as there are currently no revenue streams directly identified with NMT usage, other than bicycle parking, public transport carriage and locker fees.

- NMT funding base limitations

Unlike all other modes of transport, NMT movements have no dedicated major body with revenue streams and information flows to consider investments and regulatory measures. Coordination between specialist bicycle units now provides the framework for bicycle-specific funding on both a State and Federal basis, but only recently has there been an initial coordinated national program.

There are many other areas where NMT differs from motorised transport, but the last is perhaps the most significant :

- NMT movements generate a positive outcome (fitness) through the exertion required to use either of the major NMT modes.

NMT movements also generate negative impacts due to collisions and injuries, but they create no pollution, no noise, no Greenhouse gas emissions, and no petroleum product consumption. Appropriate assessments of NMT options in conjunction with motorised vehicles must therefore specifically include these costs for motor vehicles, or add a credit to the non motorised modes to ensure equitable and efficient assessments. In addition to these factors, the exercise levels involved in NMT movement are a quantifiable additional benefit which should be included in such appraisals.

3. REVENUE, OWNERSHIP AND ADMINISTRATION

The thrusts of micro economic reform are to improve the performance of administrative and other structures involved in transport, and to make them more responsive to their clients through contestability or competition. The restructuring possible for major public transport and road construction organisations has no direct equivalent for cycling and walking. Both of the major NMT modes have been influenced by such reorganisations. This has generally resulted in an increased role for cycling community interest groups and improved the coordination of different interests. The management and application of funds directed towards cycling and walking is still spread across a number of different organisations and sections of organisations. The shift towards a customer focus that has accompanied micro economic reform has made a wider group aware of the needs of NMT users, but evaluation and monitoring information and methods are still in short supply.

State Bicycle Committees exist in most States, and BikeWest in Western Australia is part of the Ministry of Transport. However, Departments of Sport and Recreation, Public Health, Planning, Water Resources, Local Government, Roads and Transport all have a

real interest, and coordination across multiple portfolios is required. Regulation, safety and transport issues for cycling and walking, and efficiency with which cycling and pedestrian projects are implemented are of concern to all these groups.

The information flows from crash records provide a basic staple for bicycle and pedestrian planning, and policies for improved safety. State bicycle units and committees are concerned with policy, and some information is drawn from ABS and other sources as available. In Australia, only the ABS Journey to Work collections (supplemented by special ABS surveys in individual states), and widely spaced transport surveys are generally available on a regular basis for monitoring bicycle and pedestrian transport trends.

This diffused information flow is insufficient for bicycle and pedestrian planning, and ad hoc surveys have been done at various times in several States to fill this gap. It is difficult to see how the performance of NMT transport could be monitored without a wider range of appropriate additional information being collected on a regular basis.

One of the first steps in the Australia-wide National Bicycle Strategy was to initiate work to assemble what information is currently available, and consider appropriate performance indicators for cycling projects. This is the Australian National Bicycle Information Base project, currently being undertaken at ITS in the University of Sydney for the Federal Government on behalf of the National Group of Bicycle Officials.

No equivalent National strategy and program for pedestrians is yet in place. The recently completed US National study of cycling and walking (Zeeger, Stutts, Hunter, Pein, Feske, Cheeney, et al., 1994) also concluded that a better information base was direly needed, and Congress has already accepted that recommendation.

The funds for bicycle and pedestrian projects come from a range of sources, at all levels of Government. No specific and identifiable revenue stream comes directly from cyclists or pedestrians themselves. This reflects the vehicle and infrastructure orientation of transport planning, organisation and investment. A person-oriented approach would provide rather different streams of revenues, benefits and costing structures. This approach - particularly important to cycling and walking - would be a more appropriate accounting and assessment framework. It also has benefits for motor vehicles, as insurance premiums could then follow risk more accurately and flexibly, as well as ensuring that the inconsistent incidence of insurance premiums were better recognised, and current gaps left in third party coverage filled.

Improved planning for NMT therefore requires a genuine integration within the planning and project systems operating for transport as a whole. This places considerable importance on appropriate information (already discussed), and balanced evaluation methods to ensure balanced transport outcomes. The NMT evaluation area needs closer attention, as the lack of pricing signals and identifiable revenue streams makes market based responses harder to obtain.

Valuing time

Nonmotorised trips provide beneficial alternatives to a number of trip categories, and are already a significant part of personal transport for some age groups. The gender and age differences in the use of nonmotorised and motorised modes of transport help to distort the evaluation of transport proposals which affect nonmotorised travel. Personal business and non "work" travel is rising more quickly than travel to and in the course of work, the relative importance of non work travel (and also that by the non paid) is rising. Nonmotorised travel is used by women and young people, especially those not in the paid workforce. The inconsistent application of values to different segments of walking (based on revealed preferences) also confuses the issue as to what the appropriate valuation of walking and cycling time should be for resource allocation decisions.

Current practice varies. New Zealand has adopted a consistent formal valuation framework for cycling, but not for walking (Walters, 1992). Walters quotes Bone as recommending that the value of time for cycle and motorcycle trips be the same as the value of time used for car drivers. Bone also recommends that the value of time for walking trips be valued at a different rate depending on the mode of transport the walk trip is linking up to. Bone proposes weighting the value of time in walking to or from a bus at a value 60% above that used for valuing bus passenger time. Similarly time spent in waiting for a bus should be weighted at twice the value used for valuing bus passenger time, and time spent walking to or from a car should be valued at a 50% more than the value used to value a car drivers time.

New Zealand practice still varies from these recommendations. Walters cites the NZ 1991 Project Evaluation manual, which recommends that the same value of time be used for working travel by car drivers, cyclists and pedestrians. The values of time recommended for non-work travel varied substantially between motorised and non-motorised modes of transport. Non working time for car drivers was recommended to be set to 32% of the value used for car driver working time, but for cyclists and pedestrians the value to be set on their non-working time was to be 48% of their working time rates.

Other countries use different bases for valuing NMT travel time. The UK formally requires (UK Department of Transport, 1989) cycling and pedestrian travel time values - whether working or not - to be set to twice that for non-working time for users of motorised travel. The author joins with other analysts (Sharples, 1993) in questioning this rationale!

The valuations of time by foot and by bicycle have a major impact on the cost benefit evaluations of walking and cycling travel, as the 'vehicle operating costs' are effectively zero, and travel time valuations provide virtually the only economic factor attributed to NMT movements in the evaluation process.

Clearly the evaluation of walking and cycling travel needs to be at least in the first instance be considered in terms of unlinked trips, so that the linking stages in multimodal

journeys are considered. The use of linked trip information as a standard output from transport surveys may be adequate for a number of vehicle-oriented planning purposes, but can do little justice to NMT movements.

The differences between working and non working time matter for NMT movements, and the assumption that paid work is the only type of work purpose introduces a gender distortion in these assessments. For cycling it is a comparatively small effect, as cycling is far less used by females: for walking it is a significant effect. Recent work on paid and unpaid work has shown that there is a fairly close correspondence between the total time spent in the combination of paid and unpaid work by each gender over the range from 15 to over 75 years. This method of accounting for 'work' purposes on the basis of the nature of the activity rather than the payment made for it allows a natural equity in assessment to applied with an equal weight for each sex (Australian Bureau of Statistics, 1993). This is shown in Fig. 1. The structure of the new composite 'work' purpose can be used to assess the appropriate time valuation to be applied. This approach is also applicable to all transport modes, and is an example of a systematic person-oriented approach to transport: an approach needed if NMT is to be valued appropriately.

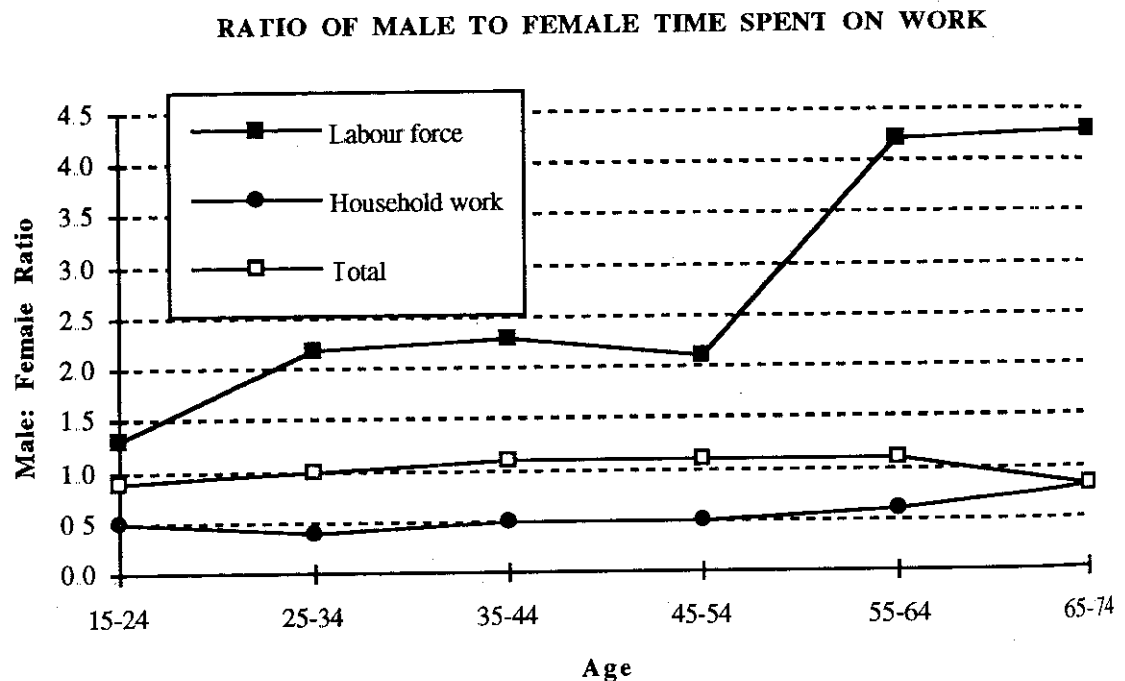


Figure 1. Equity of gender treatment by combining paid and unpaid work

The large volume of pedestrian and cycling trips led (Whitelegg, 1993) to state that, for Europe:

".....putting a high value of time on pedestrians or cyclists would reshape transport, as they make many short trips, and are generally disregarded unless on travel to work..."
(p95)

For Australia, this is probably an overstatement. However a more systematic and complete treatment of pedestrian and cycle movements could well raise the level of importance of NMT modes in many transport evaluations.

Option valuation

The problem of evaluating public goods without price signals has been approached by recreational and environmental planners. The techniques used include contingent valuation and hedonic pricing, both of which have been widely applied for transport analysis and demand forecasting. The valuation of environmental assets such as forests and recreational parks and wilderness areas has consistently identified two different forms of benefit for which people are prepared to pay.

- Option benefit
- Existence benefit

These are variants of the same concept. They identify how much people are prepared to pay to have the option (even if never exercised) of access to the resource or facility, and the price they will pay in order that a given resource remains in existence for others, even if they have no intention of using it themselves.

The significance of these 'prices' are that they are 'paid' by the very large group of people who do not use the resource themselves. NMT attracts several such factors. The option benefit is relevant as rather less than half of all Australian households have adult bicycles available (Wigan, 1984) - and recent surveys suggest that this number is probably increasing - yet considerably fewer people actually use them (Adena & Montesin, 1988), and many who do use bicycle use them only intermittently. This suggests that an Option benefit is appropriate for this sizeable fraction of the population.

The Existence benefit is also relevant to many more people, as cycling and walking facilities are contribute to the safety of young and old, and towards a more pleasant living environment: both of these are areas where such altruistic payments are realistically available.

Neither of these types of benefit are available to motorised transport, whose usage generally produces a reduction in the levels of both safety and general environmental quality.

Greenhouse gases

Sustainable development requires not only that transport does not consume more than necessary, it also places a significant and escalating premium on environmental qualities that are not replaceable. Air quality is one such resource, and cycling and walking are already contributing to reductions on Greenhouse gas production. Many of the trips currently made by foot or bicycle would have to be made by car. These trips are already providing benefits that are currently unpriced.

The journey to work is only a small part of total travel in Australia (~20%), but provides a useful example of the type of contribution currently being made. Fig. 2 shows the State-wide fractions of the journey to work carried out wholly by bicycle.

JOURNEY TO WORK SURVEY : AUSTRALIA 1991: BICYCLE % BY STATE

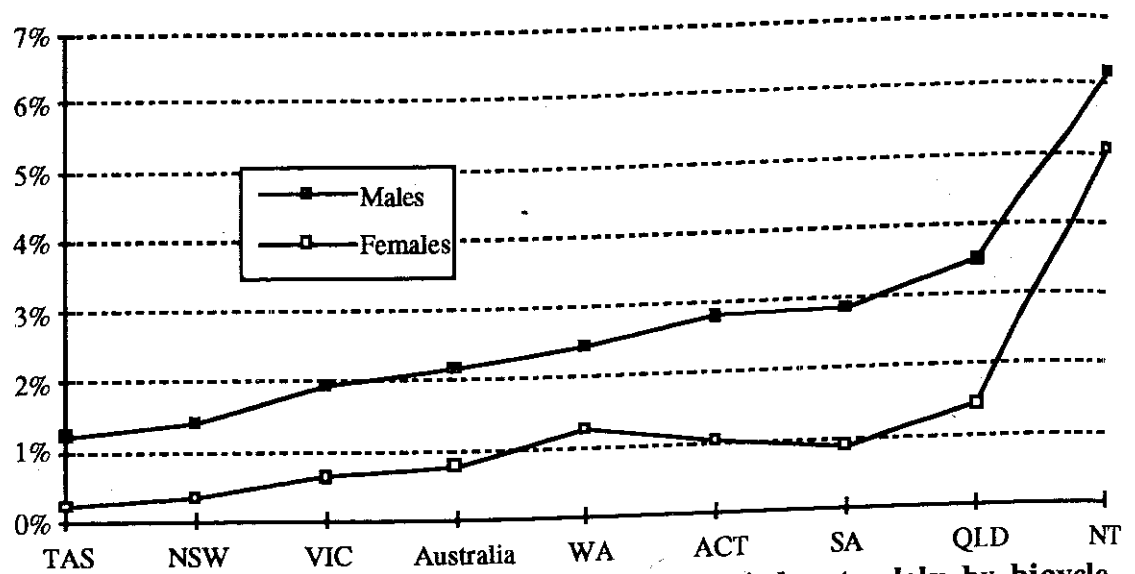


Figure 2. % of State-wide journeys to work carried out solely by bicycle

If all of these trips had to be made by some other mode and the bicycle trips were distributed over the other available modes in proportion to the 1991 model split, then a fraction (it turns out to be about two thirds) would appear as car driver journeys (Australian Bureau of Statistics, 1994a; Australian Bureau of Statistics, 1994b).

Australia-wide this represents 0.8% of all the car driver trips, and the gas production, noise and pollution that goes with them.

Once again, greater use of an NMT mode of movement produces few if any externalities, so that the evaluation of transport proposals without full environmental evaluation of the motorised modes will underestimate the value of using NMT.

Similar calculations can be made for educational, shopping and other travel purposes by foot and bicycle².

It is also necessary to account for another counter-intuitive NMT valuation factor. NMT movements require physical effort, and this effort is a contribution to health and fitness. A substantial fraction of cycling is undertaken with this objective in mind as at least a secondary goal, and walking is frequently advocated for mobility reasons for the elderly, who do indeed walk considerably more than they cycle.

² This is currently being done at ITS as an extension of this work

In both cases, the average distance covered by cyclists in a week is estimated to be sufficient to meet with the exercise requirements needed to halve coronary heart disease (Hillman, 1990; Shayler, Fergusson, & Rowell, 1993).

At least part of the savings to the health system in dealing with such cases should be attributed to variations on the level of cycling (and indeed walking) by people in the age groups at greatest risk (44-54 in particular).

Accident cost contributions

Pedestrians and cyclists are amongst the most vulnerable road users, and are involved in substantial numbers of collisions with motor vehicles. This vulnerability (and the high cost of treatment) has been frequently cited as a reason to limit access to cycling, and to support legislative programs requiring bicycle users to wear helmets. This view paints cyclists as vulnerable road users, and is cited to support arguments that their exposure on the road should perhaps be restricted in their own interest.

However, in the context of micro economic reform, and greater cost recovery of public transport, it has been noted that raising public transport fares can bring with it an increase in bicycle injuries as a result of displaced bus users. Time series analysis of London data showed that fare rises of this type were clearly associated with rises in bicycle and motorcycle accidents, although the results for pedestrian injuries were equivocal (Allsop & Robertson, 1994). This is a further example of the need to account more fully for all the externalities when evaluating transport proposals that include NMT and motorised modes of transport.

The argument can be carried one step further. Jansson (1994) has traced the externalities associated with road accidents. The results show that if increasing the number of bicycles on the road did not increase the number of bicycle accidents, then a notional payment to bicycles would be justified (ie. a positive encouragement factor to use bicycles would be warranted) for equitable evaluations.

There does appear to be a level of bicycle usage (somewhere between the typical Australia 2-6% and the Danish or Dutch 30-40%) where accident rates for bicycles no longer increase with the number of bicycles. Oxford in the UK has seen a doubling in bicycles over decade of motorised traffic restraint, with no change in bicycle accidents (or indeed pedestrian accidents). While this is at present not a serious omission from NMT evaluations, it is another example of where the externalities involved in motorised travel need to be closely assessed to give projects NMT equitable assessment.

This section on valuation has concentrated on the reasons why a full range of costs and benefits needs to be covered for a balanced assessment of the relative rates of social return from investments in NMT and motorised transport.

5. PERFORMANCE MEASUREMENT

The emphasis on NMT as external to the transport organisations places a heavy emphasis on central government determining and requiring performance indicators to be created and maintained that include both the efficiency aspects (which are needed for good management) and the effectiveness indicators (which are required for good policy).

The range of special features in the valuation of NMT make it clear that the range of measures of performance to cover them would be substantial, and difficult to define. The further test - who should be responsible for the outcomes measured by the efficiency and effectiveness measures? - can be addressed far more easily for efficiency factors than for effectiveness measures due to the range of outcome types.

Application of microeconomic reform principles demands that this effort be made, and indeed the very first stage in this process (exploring possible performance indicators) is part of a major bicycle project at ITS.

6. CONCLUSIONS

NMT is a major component of personal transport, and is accessible to virtually everyone of all ages. However, it has not been a revenue producing area of transport, requiring large scale administration. The information and monitoring flows have therefore been generated by default as a small part of the safety and crash records in road organisations. The combined effect of these two factors has been to encourage a perception of NMT as a factor external to core transport provision, and a cause of external costs to the motorised transport system and its users.

Social and local pressures for better environmental standards, and global requirements for reduced environmental impact by the transport task, have focussed attention on NMT once more. However the valuation, monitoring and pricing signals are all deficient when compared to the motorised modes of transport. The special features of NMT movements include near-universal access, a positive product from movement (exercise and fitness) and little or no pollution production. The lessons of microeconomic reform are that pricing signals need to be correct, both for NMT and the motorised modes, and it is clear that this has not yet been achieved. A more systematic treatment of the valuation of travel times by NMT modes is also necessary to ensure that the evaluation frameworks currently in use reflect appropriate valuations of time.

A number of proposals have been made to improve the basis for NMT valuation and assessment, and it is clear that close attention to the externalities of motorised transport and also the benefits peculiar to NMT transport both need to be brought into the evaluation framework to gain a balanced assessment of NMT's contribution to transport projects and initiatives. The complementary pressures of new national environmental goals and pressures for an improved local environment have been necessary to establish a broadly-based recognition of the need to reassess NMT modes as full transport participants.

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