TOWARDS AN OVERVIEW OF THE AUSTRALIAN TRANSPORT SECTOR

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ABSTRACT: *The paper reviews aspects of the methodology adopted by the authors in their study of Resource Use in Transport 1972-73 prepared for the Bureau of Transport Economics. Until the Bureau releases the report, it is not practicable to present in a paper of this nature the results of the study as was contemplated when the paper abstract was submitted to the Forum. The material in this paper has been drawn partly from the preliminary reports of the study, with the approval of the Bureau of Transport Economics.*

THE AUSTRALIAN TRANSPORT SECTOR

INTRODUCTION

In 1975 the Bureau of Transport Economics (BTE) commissioned Nicholas Clark and Associates to undertake a study of resources used in the transport sector. The purpose of this study was to assist the BTE in its continuing examination of the processes of resource allocation in the transport sector of the Australian economy.

The analysis was carried out as if the transport sector was a single integrated enterprise, ignoring distinctions of mode and ownership in themselves. Major features of the methodology adopted by the consultants is discussed in this paper.

It should be noted that the Bureau of Transport Economics does not necessarily endorse this methodology. For this reason, this paper can be addressed only to a discussion of the methodology used in the study. Consideration and debate of the results of the study must await another opportunity. The reader, however, might reflect on the possible truth of a proposition that the authors have selected for discussion in this paper those issues of methodology which may prove to be of more than passing interest when the full results of the study are available.

OBJECTIVES OF THE STUDY

The full report of the study presents the results of an analysis of resources used in transport in Australia during 1972-73. It is the first comprehensive review of the transport sector for some years. The main objective of the study was to examine the transport sector as a whole, rather than concentrate on those features of the sector for which

information in detail was readily available. For this reason, the report presents a general picture only of the broad structure of the transport sector and its use of resources.

The challenges of the study were to identify just how large was the transport sector; what percentage of national production in each year was absorbed by the transport sector; and what conclusions could be drawn from the pattern of capital formation and resource flows in each of the principal subsectors of the transport sector.

Major difficulties were encountered in establishing a suitable methodology to enable all subsectors to be examined on a consistent basis. The sector comprises all possible economic entities; government authorities, public trading enterprises, private trading corporations, a wide range of unincorporated businesses as well as individuals providing transport services for themselves, mainly through the ownership and operation of private motor vehicles. The sector consists of businesses mainly engaged in transport operations and many more businesses engaged in transport operations ancillary to their other activities. Each of these economic entities must be examined on a similar basis if meaningful comparisons are to be made. In most previous studies of the transport sector, and indeed in the Australian National Accounts, components of the transport sector have not been treated on a consistent basis.

The results of the study should have implications in the management of the economy and in the formation of national economic policy. Firstly, the absolute size of the transport sector and the substantial call that it makes on the total of available goods and services in the economy, indicates clearly the need for examination of possibilities for improving the efficiency of existing transport operations. In fact, it is

clear that obtaining more efficient use of resources now committed to the performance of the national transport task is of greater importance than the development of optimum investment programs which has been the predominant concern of transport researchers in the past.

Secondly, gross capital formation for transport is an important component of total capital formation in the economy. It is one of the largest single items in the national capital budget. Furthermore, as this capital formation is undertaken collaboratively by both public and private sectors, it is of vital importance that the public sector capital formation should be fully supportive of private sector capital formation and the private sector capital formation should be undertaken with a clear knowledge of the future plans of the public sector. Private sector capital formation exceeds greatly public sector capital formation which indicates the urgent need for techniques of public sector investment analysis which recognise its supportive nature to private sector investment.

Finally, perhaps the most important conclusion of the study is the identification that much of the capital formation occurring in the transport sector is necessary to maintain the capabilities of existing transport systems. This means that it is necessary to undertake, each year, substantial programs of capital formation to ensure that the existing transport assets are replaced as they wear out. If this is not done, the efficiency of transport operations in the future will be adversely affected. It also means that governments and private enterprise must relate their capital formation programs more to the needs for replacement of existing assets than to the needs for expanding or augmenting the existing assets.

This last conclusion represents a significant de-

parture from previous concepts of the objectives of transport development in Australia. For nearly two centuries the objective has been perceived as a need to establish a national transport network; to provide transport facilities where none had existed before. The study indicated that while the expansion of the transport system remains an important secondary objective of transport developments, it can no longer be seen as the primary objective.

The broad aggregate data of the study suggests four principal guidelines for transport development in Australia. In order of importance the four guidelines are:

1. Increased efficiency of operations

   The large commitment of national resources for transport operations preclude their use for other purposes: increased efficiency of utilisation of existing resources used for transport must be the dominant objective of national and local transport policies.

2. Replacement of assets

   The structure of the transport sector indicates that a greater proportion of all expenditures on new transport assets is required for the replacement of existing assets which have worn out in use. Investment guidelines for transport projects must reflect this.

3. Increased capacity

   Transport investments, other than those replacing obsolete assets, should be undertaken where there is expected to be a rapid growth of transport demands.

4. Extension of transport facilities

As mentioned above, this guideline for transport development, which has dominated transport policy in the past, must now be seen only as a secondary objective.

SUMMARY OF THE STUDY METHODOLOGY

In the study, the transport sector was treated as a single integrated enterprise without regard for the reality of ownership or operational control being bested in either the public or private sectors. Each subsector was treated as a division of this integrated enterprise, with its own asset stock, its own capital formation requirements and its own current trading account to identify the gross operating surplus of its activities.

Thus for each subsector, irrespective of ownership, a current trading account of annual operating costs, depreciation and interest has been established. On the other side of the trading account, estimates have been developed of the revenue of the subsector. This revenue includes direct charges for transport services provided by the subsector and tax revenues which may properly be considered as charges for services. A deficit in these trading accounts was regarded as a subsidy from the owners of the assets to the users of the assets. Implicit subsidies were common in subsectors owned by governments, but also existed in some subsectors owned by private enterprise.

Similarly, for each subsector the source and application of funds for gross capital formation have been identified. One of the main sources of funds for capital formation

are actual or notional charges for depreciation of existing assets. Depreciation charges do not involve cash flows, even in private sector enterprises, but nonetheless they represent an actual cost of operation of the subsector and must be recovered from the existing users of these assets.

The basic structure of the accounts for each subsector is illustrated in Table 1 for resource flows in the government rail subsector.

In Table 2 the account for the source and application of funds for government railways is presented.

The concept of gross operating surplus of a sector needs to be discussed. Technically, it is the sum of depreciation and notional rent from the current trading account of the sector. The notional rent is similar to interest on capital. Its true meaning is discussed below.

The illustrative account of sources and application of funds discloses that much of gross capital formation of the government rail sector was provided through depreciation charges of $228m, the balance being funded by notional government advances of $65m. The notional rent which is included in the gross operating surplus on the left hand side of the account is also shown as a payment on the right hand side. This reflects the payment by railway users to the community at large for their use of the capital funds tied up in the railway system.

The methodology adopted for the study analyses all operations in transport as if they were trading enterprises, including individuals who provide themselves with transport services through the ownership and operation of private motor vehicles. Government authorities providing transport services

TABLE 1: ILLUSTRATION OF SECTOR TRADING ACCOUNTS - RESOURCE FLOWS - GOVERNMENT RAIL 1971-72

Item		$M
Capital Formation		
recorded gross capital formation (a)	153	
capital formation maintenance (b)	150	
Total Capital Formation		303
Current Resource Flows		
depreciation (c)	238	
notional rent (d)	226	
operating costs (e)	524	
Total Current Resource Flows		988
Revenue (f)		
freight operations	461	
passenger operations	141	
land tax (notional) (g)	36	
miscellaneous earnings	36	
implicit subsidy (h)	314	
Total Revenue		988

(a) gross capital formation for government railways published in the Australian National Accounts.

(b) refer to later discussion - the item refers to expenditures charged to operating costs which properly should be regarded as capital formation. The amount shown is approximate.

(c) depreciation is assessed on value in use of assets valued in current money terms.

(d) rent payable by users to owners.

(e) reported operating costs less amount assessed as capital formation maintenance.

(f) reported revenues - see notes (g) and (h) below.

(g) notional apportionment of state land tax collections on portions of land values deemed to be created by the existence of railway systems. This item was not assessed in detail but it is suspected that these land values occur mainly in central areas of cities.

(h) the implicit subsidy represents a balancing item only between current resource flows and direct or attributable revenues. It can represent the contribution for beneficiaries other than users, or it can indicate that it is more efficient to charge users through the general tax system than by direct user charges.

TABLE 2: ILLUSTRATION OF SECTOR SOURCE AND APPLICATION OF FUNDS ACCOUNT - GOVERNMENT RAIL 1971-72

Source		Use	
Item	$M	Item	$M
Gross operating surplus	464	Capital formation	303
Notional government advances for net capital formation	65	Notional rent	226
	529		529

are treated as if they had raised loans, specifically loans indexed to the value of the assets, to pay for the construction of the existing assets. In the trading account of the sub-sector, the users are regarded as paying charges for their use of these assets to allow interest to be paid on these loans, to reimburse the government authority for the wear and tear (depreciation), to meet operating and general maintenance costs and when appropriate, to reimburse non-users of the sector for certain social costs caused by transport service.

Such a trading account is in no way different from a similar account prepared for enterprises in the private sector. Only by establishing these accounts for each subsector is it possible to compare the operations of all sectors on a consistent basis. Where revenues for the use of the subsector do not equal costs of operation of the subsector, an implicit subsidy for operational costs is disclosed.

THE CONCEPT OF RESOURCE FLOWS

This methodology described above has been adopted to enable comparisons of financial outcomes between private

and public sectors. It has also been adopted to reflect the fundamental meaning of economic resources. The concept of resource flows will now be discussed briefly.

When capital assets are created, whether by enterprises, governments or persons, the existence of these assets represents a resource which is available for use in later years. These capital resources are no different in kind from available labour resources, and in the transport sector, capital resources are often more significant in the performance of transport services than labour resources. In addition, capital resources are frequently used in substitution for labour resources.

In studying resource flows in the transport sector, therefore, it is necessary to measure the contribution from capital assets in such a way that this contribution can be added directly to the contribution from labour.

One approach, which was not adopted in the study, is to regard all capital assets as consisting of the labour originally used in their construction. The resources necessary to perform a transport service could thus be regarded as the labour required in any one year, plus an apportionment of labour represented by capital assets worn out or used up in that year.

Another approach, which also was not adopted in this study, is to regard the resources used to provide transport services as the labour required in any one year plus the labour used to build new transport assets in that year. This approach is actually used in calculating the gross domestic product in the Australian National Accounts for significant portions of the transport sector. It is, nonetheless, inappropriate. It is recognised to be inappropriate in the Australian National Accounts, but justified because of data

limitations.

The concept of resource flows for transport which has been adopted for this study is developed from the proposition that users of transport systems must be seen as different from the owners of those systems. This is so, even in the case of the road system, where the users as a whole are identical (or almost so) with the owners. In other words, both the users and the owners of roads are the community as a whole. This distinction between users and owners is of vital importance in the analysis of all government operations. It is only irrelevant if all owners made equal use of the system - a situation that could be considered to exist in relation to defence systems, but is definitely not the case with transport systems.

In the case of transport systems, where the infrastructure is commonly provided by government authorities, individual users make quite different demands on the systems. It is therefore necessary that the users pay a rent, reflecting the use they make of the system, to the owners of the system. This rent, which is similar to an interest payment in financial terms, is quite different from interest in economic terms. It represents the resource flow from the capital assets which is greater than the value of labour and other resources originally used to create the asset.

The notional rent included in the calculation of resource flows is a measure of the value of the availability of the asset, while depreciation is a measure of the value of the asset worn out. Notional rent is properly payable by users and accrues generally to the owners of the asset.

It can also be thought of as a compensation to the owners of the asset, since the original resources to construct

the asset could have been used then to construct other types of assets.

When an asset is used to provide a transport service, a portion of the asset is worn out, and users are properly charged for this wear. The revenue raised from charges to users of this nature accrues also to the owners of the asset. It may be allocated for the construction of assets to replace those worn out, but this is not the case with the notional rent. The revenue from notional rent of government owned assets is available for any use that the community wishes to apply it to. Conversely, if notional rent is not paid by the users of transport assets, it represents a subsidy from the community to the actual users of transport.

The resources used to provide a transport service thus consist of an amount indicating the contribution of non-capital inputs, principally labour, and an amount indicating the contribution from capital assets. The sum of these two amounts is described as current resource flows. It is these flows of resources which enable a particular transport service to be provided in any one year.

The flow of resources necessary to create new capital assets in any one year is also of some importance as these resources must be drawn from the available resources in the economy. The resources necessary for the construction of new assets in a year, obviously have only an indirect connection with the transport task performed in that year. These new assets are related to future tasks, not present tasks. Their costs of construction are a charge on future users not the present users.

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TRANSPORT IN THE NATIONAL ECONOMY

There is no more abused economic statistic than the proportion of the national economy represented by the transport sector. Some of the abuses result from selective inclusion and exclusion of components of the sector; many others from incorrect economic reasoning.

The commonest mistake is to regard the transport sector as consisting only of those transport activities which constitute the final uses of goods and services. In this approach capital formation for transport is added to the value of passenger fares and similar items and the costs of private motoring (using, for the latter, the figure incorrectly computed in the national accounts). These, strictly speaking, are the identifiable output of the transport sector.

The reason for the difficulties in the past has been precisely this. The transport sector cannot be examined from its final output. The principal purpose of transport services is to provide an input to other economic activities and not an output in itself. Even the costs of passenger transport, fares and private motoring are conceptually inputs to economic and social activity. Capital formation for transport purposes is also an output of the construction and manufacturing sectors.

The place of the transport sector in the national economy must be examined from the input or production side of the national accounts and not from the output or expenditure side. It is useful to list the categories of inputs measured in the national accounts. The principal inputs are:

1. wages, salaries and supplements
2. gross operating surpluses of trading enterprises

3. indirect taxes less subsidies
   which together equal the gross domestic product
4. imports of goods and services
   which together with GDP comprise the total value of goods and services used in the economy.

The relevant question therefore is what proportion of these available resources is used to provide transport services. Having recognised the right question, however, it is not sufficient to go to the national accounts to obtain the necessary data. This arises because for significant components of the transport sector, no calculation is made of the gross operating surplus of these components. Among these are:

(1) government railway operations
(2) ownership and operation of private motor vehicles
(3) ownership and operation of roads.

The nature of adjustments to the calculation of national income statistics cannot, unfortunately, be discussed in detail here. The discussion is confined to methodology. It will be clear, however, to those familiar with national accounting that the calculation and inclusion of estimates of these gross operating surpluses will cause significant changes to the values of the main economic aggregates.

When looking at the economic performance of the transport sector from the input side, the question of what should be included as transport and what should be excluded as non transport becomes simply one of deciding which activities are to be labelled as transport activities. Thus, obviously, the carriage of water and waste products by pipelines would normally be excluded, it could for some analyses be properly included.

The economic scope of the transport sector, once defined, simply becomes the sum of wages and gross operating surpluses of the subsectors plus any other inputs purchased from non transport sectors. The calculation fundamentally requires the construction of an input-output table of some complexity as one illustration will demonstrate. Fuel purchased for the operation of motor vehicles already contains outputs of other transport subsectors.

Nonetheless, assuming that these adjustments may be made, the call on national resources by the transport sector can be identified - at least for domestic transport. The conceptual treatment of resource use for international transport still requires the resolution of complex conceptual questions including the resolution of the argument whether the importing or exporting country is allocating resources to enable the movement to occur.

Modification to the National Accounts

The Australian National Accounts differentiates between public enterprises and public authorities, the latter are assumed to yield no gross operating surplus. This and certain other conventions were not appropriate for this analysis.

Some discussion of the modifications required is provided below:

(i) Identify a gross operating surplus for the public authority operations - By convention general government output. that is the service provided by government authorities such as mobility, education, law and order, etc., are valued at the cost of these services. But cost is measured by outlays on current and capital items. This measure of cost ignores the resource flows that occur

as assets wear out as well as their rental value. A measure of the costs of the non-labour primary inputs of capital, land and entrepreneural skill is needed. Depreciation is a measure of the value of capital 'used up' in the production process during the period in question and is clearly a resource flow to be entered in the accounts of government authorities. The other major item in the gross operating surplus is the payment to creditors in the form of rent, interest, dividends, etc. This should also appear in the production account of government bodies providing transport. It was clearly necessary for this study, where certain services are provided jointly by the private and public sphere, to use a consistent resource flow concept, otherwise misallocation in favour of the public sector is encouraged. All activities compete for the one pool of resources and clearly these resources must contribute to costs in a consistent manner in whatever the activity or sector they are used.

(ii) Adjust gross operating surplus for any abnormality in the year in question to an expected normal private rate of gross operating surplus - In theory the gross operating surplus of the private sector should be determined on the basis of a long run normal private rate of gross operating surplus. In the public sector this will be achieved automatically by the use of a constant notional rate of return on capital which is applied to all activities. A 10 percent return does not seem unreasonable. The depreciation rate will vary for each asset and is uniquely determined by the life of the asset.

(iii) Redefine gross national turnover from fob. to cif. - The gross national turnover on goods and services as

defined in the Australian National Accounts excludes freight on exports. In a discussion of resource flow through the transport sector this activity must be considered. Freight on exports is clearly related to Australia's transport task.

(iv) The purchase of private motor vehicles is a capital purchase not an item of consumption - The treatment of private motoring in the Australian National Accounts is inadequate. The net value of the stock of non-business cars is an additional item of asset stock on which depreciation and interest must be charged.

(v) Time represents a real cost of travel - The time spent travelling on public transport and during private motoring represents real costs to the individual which should be included in the cost of the relevant transport activity. Such costs are important when comparing performance of different modes and the one mode over time. While this adjustment is clearly necessary, no sound conceptual basis exists for imputing values to time.

CAPITAL FORMATION

There are two sources of capital formation. One is the readily recognisable recorded capital formation, where capital funds are set aside for the purchase of fixed assets. There is another activity which must be identified as capital formation. Part of the outlays on maintenance yield a service for many years, and are thus effectively capital formation. This component of maintenance expenditure which increases the value of the fixed assets is called capital formation maintenance. Capital formation maintenance may well be very important,

particularly where a sector has had limited access to capital funds. Thus for example, the life of the rail network is maintained by new capital purchases but also through periodic renewal maintenance expenditure.

Capital formation maintenance

When maintenance expenditures are used to replace or renew worn out assets then this is clearly an example of capital formation and not a current resource flow or operating cost.

Railway maintenance procedures provide for the periodic replacement of decayed or broken sleepers, the selective replacement of damaged rail and the repacking of track ballast. The effect of these procedures is that the track is constantly renewed. Clearly some part of these maintenance expenditures relates to basic maintenance but another part relates to capital formation.

In roads, the situation is similar but more complex. The replacement maintenance occurs partly through operations such as periodic resheeting and resealing but can also occur through minor works, for example, laying of bituminous concrete which has the effect of upgrading the road above its earlier standard.

Somewhat similar choices confront the owners of a motor vehicle who may purchase vehicles on a regular basis with minimum maintenance expenditure; alternatively he may meet these maintenance costs and prolong his use of an existing vehicle.

These illustrations demonstrate that renewal maintenance expenditures are incurred as an alternative to

capital expenditures.

The significance of this is that when renewal maintenance occurs the apparent resource flow is less than the actual resource flow. What happens is that the wearing out of the original asset is disguised by the renewal maintenance. Resource flows for depreciation and for capital formation are understated and for maintenance are overstated. The diagram of resource flows can be used to illustrate this:

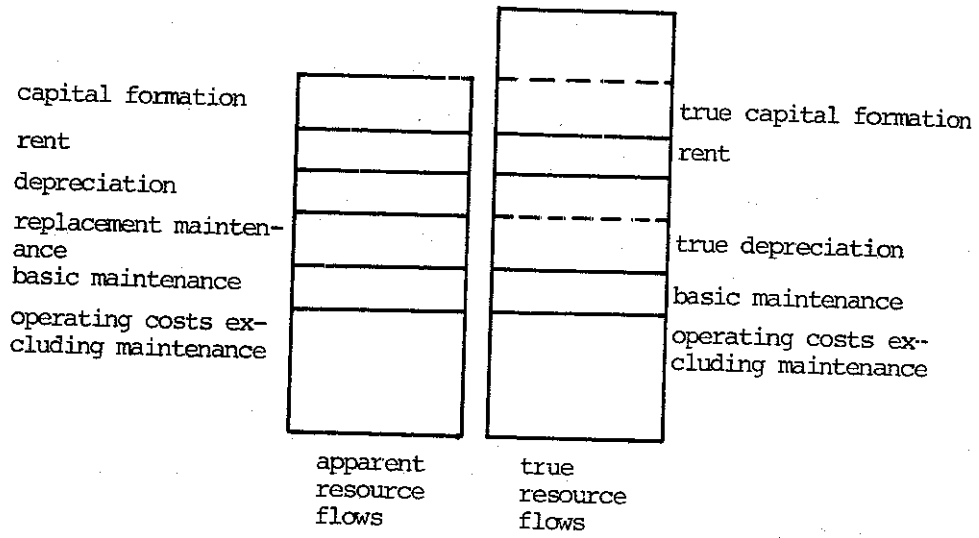

Figure 1: Diagram to illustrate true resource flows when renewal maintenance occurs.

Note: The value of renewal maintenance has to be subtracted from reported maintenance and added to both depreciation and capital formation.

It will be seen that the true capital formation is equal to the apparent capital formation plus the amount of maintenance expenditure which is attributable to the renewal of assets. Moreover, the total resource flow is equal to the

apparent resource flow plus the replacement maintenance expenditure. These adjustments do not affect the total of current resource flows, but they do affect the level of capital formation which is greater than otherwise reported. For the present discussion it is necessary to assess the effect of renewal maintenance on asset values. It is observed that it is the normal practice of authorities responsible for transport infrastructure to carry out renewal maintenance as required. It is suspected that these authorities charge renewal maintenance to their operating budgets if they are short of capital funds, and charge renewal maintenance to their capital budgets if they are short of operating funds. Thus, renewal maintenance carried out by railways and to a certain extent by aircraft operators appears to be charged to annual budgets. The equivalent of renewal maintenance in the road sector, for example periodic resheeting, appears to be charged to either capital or operating budgets, depending on circumstances relating to each project.

Without detailed enquiry no accurate analysis may be made. In this report asset values have been calculated on some occasions by reflating historic capital formation expenditures. When this method is used an accurate assessment of current asset values will be obtained, provided that annual capital formation expenditures do not include renewal maintenance expenditures, and a long term depreciation profile (discussed below) is also assumed. That is, the effect of renewal maintenance is ignored both in the aggregation of historical capital formation and in the assessment of rate of depreciation. This method provides a method of valuing assets only, it does not indicate the true resource flows. Similarly, the assessment of asset values is accurate when representative replacement costs are used. In this situation the representative replacement cost when applied to older assets, allows for the fact that renewal maintenance will have taken place, thus preserving the

value of the asset.

This discussion of renewal maintenance is unfortunately complex as the topic itself is highly difficult. It does not seem to have been recognised in previous studies of resource flows in the transport sector.

ANNUAL COSTS OF FIXED CAPITAL ASSETS

The resource flows associated with the existing stock of transport assets are the most significant in many subsectors. In performing transport tasks, part of the asset stock is used up or worn out. This use of resources is as important as the use of labour resources. It is therefore necessary to estimate how much of existing asset stock is consumed in this way each year. To do this it is necessary to value the asset stock. An estimate of the annual depreciation is based on the asset value and the expected life of the asset.

In addition to the use of resources through the wearing out of existing transport assets, there is a further resource flow associated with the existing asset stock. This is the disadvantage imposed on the rest of the community because, in the past, resources were used to create transport assets rather than non-transport assets. This resource flow, notional rent, is calculated from the current value of the assets used to provide transport services. A factor of 10% is assumed appropriate.

The comparable resource flow in the private sector is rent, interest and dividends, and represents the opportunity cost of resources tied up in a particular asset. Even though the road system cannot be sold, the concept of notional rent is appropriate. Unless the resources used to create assets

in the public sector are expected to earn a return similar to the private sector an excessive shift of resource to the public sector would result.

Notional rent is payable by the users of transport assets to the owners of the assets, which in many cases is the community as a whole. In other cases the rent is payable to the nominal owners of the assets who may be the investors in a trading enterprise or in some cases the users of the asset as with residential streets.

Valuation of the Capital Stock

The valuation of the transport asset stock is an essential and indeed, a critical part of the examination of resource flows in the transport sector. It is necessary to know the value of these assets to determine the rental payment that transport users owe the rest of the community.

Asset stock values used in the calculation of gross operating surpluses of transport subsectors have been based in some cases on past capital formation expenditures and in other cases on valuation of existing assets at current replacement cost. From an economic point of view the true value of an asset is measured only by the present value of the use or benefit that may be obtained from that asset in the future. An asset is valueless when it is useless and has value only when it is useful and its value reflects only that usefulness. Where assets are singularly exchanged in perfect markets, market prices indicate an approximate measure of value. An asset, whether in private or public ownership should be valued only at the discounted value of future surpluses or enjoyment that may be obtained from its use. The concept of asset value derives from the future and not from the past. This value of future use is indicated by market values.

For major items of transport infrastructure, no market exists. The current value of these assets is largely dependent on the likelihood that the asset will be replaced when it is worn out. If an asset will not be replaced its value is determined only from salvage value, or its value in some alternative use, together with any surplus that may be generated, including consumer surplus, by its use until it is scrapped. Thus a branch railway line for which a decision to scrap has been made has a value which can be precisely determined or at least for which a methodology of valuation can be precisely specified.

Secondly, the costs of redundant transport assets or ill-advised investments is a charge to the past and not to future transport operations. This rule raises serious problems for the practical management of investment programs on a year to year basis but the principle remains that the optimum use of transport assets and resources will be obtained only by valuing existing transport asset stock at its value for future use. The calculation of resource flows for transport will be inaccurate if the valuation of assets is carried out only by reference to historic costs of capital formation.

The same considerations apply to the valuation of spare capacity of transport assets produced by the intrinsic lumpiness of transport assets. The value of assets of this type should be determined by allowing for the future surpluses and enjoyment that may be obtained from the assets. If the value of the assets is less than the cost, then redundant spare capacity has been provided and should be ignored in the valuation. A consequence of these rules of valuation is that any one asset will change its value in response to changes in supply and demand for the service provided by the asset.

It is useful to consider the possibility of vesting all or part of a major transport infrastructure system, for example the road system or parts of it, in a private enterprise corporation. The market price to be paid by the corporation to the community for this hypothetical transfer of assets would reflect the surplus that the private enterprise corporation expected to create from charges for the use of that infrastructure.

It is necessary to ask whether the community as a whole should adopt the same methods of valuation which is, in effect, an investment value. The community as a whole achieves different returns and benefits from the public ownership of assets than the returns and benefits that would be achieved by individual ownership of the assets. That, after all, is one reason why some assets are in public ownership and others are in private ownership.

To understand fully the issues that are involved in this matter it is useful to consider a very simple example. When an individual purchases an asset, for example a house, the price he will pay will be determined from the three possible methods of valuation, as follows:

(i) Scrap value - the amount that could be obtained by scrapping the asset and selling the constituent elements;

(ii) Replacement cost in present condition and technology - the cost of building an equivalent asset less an adjustment for wear and any obsolescence of technology;

(iii) Investment value - the discounted value of net surplus generated by ownership of the asset plus an amount representing the non-financial returns and satisfactions obtainable from ownership.

The estimate of asset value will normally be different for each of the three methods of valuations. There are three possible rankings of valuations as follows:

A. Investment value>Replacement value>Scrap value
B. Replacement value>Investment value>Scrap value
C. Replacement value>Scrap value>Investment value

Note that three other possible rankings have not been included, because for practical purposes, they are not relevant.

The following general comments may be made about each of the three rankings A, B and C above.

In Case A, the asset is of a highly profitable nature as the investment return exceeds the replacement cost. The investment value will determine the market value. In the private sector when investment value exceeds replacement value, further supply of these types of assets will occur, driving the market price down. This will not occur in the public sector, at least in most situations.

In Case B, the asset has ceased to be as valuable as the cost of its replacement but nonetheless it will continue in use rather than be scrapped because there are surpluses to be obtained by doing this. These types of assets will not be replaced as they wear out.

In Case C, the usefulness of the asset is such that a greater return is available by scrapping the asset, than by using the asset to create financial returns. The market value is the scrap value.

Even though conceptually correct methods for valuing assets can thus be defined, the translation of these methods into a practical estimate creates insurmountable problems when the asset is in the public sector, and not exchanged in the market. The accounting data that is available for public sector transport assets is of one of the following types:

> Historic Cost or Book value which records the value of the asset at the cost of construction.
>
> Depreciated Purchase Cost where assets are valued by depreciating the purchase or historic cost for wear and tear.

Neither of these is suitable and two alternative cost based methods of asset valuation have been applied.

Methods used in Valuing Transport Infrastructure

1. Replacement Cost Method

   A 'suggested' replacement cost, which ideally reflects the existing condition of the asset, is applied to the known inventory of fixed assets. This technique has been used in assessing the asset value of the road and rail infrastructure and allocating this value between the various subsectors. The accuracy is limited by difficulties in the choice of representative replacement costs which must necessarily be somewhat arbitrary. Furthermore, the knowledge of the existing

condition of the transport infrastructure is incomplete.

2. Indexing Past Capital Formation Expenditure

The sum of past capital formation expenditures approximately indexed and depreciated provides an alternative estimate of asset value. This approach is valid provided the bulk of the asset stock depreciates before becoming obsolete. It is also important that additional capital formation which may arise from renewal maintenance expenditures be reflected in such values.

This method of valuing asset stock requires the choice of an appropriate index of inflation and the selection of a procedure for defining the rate of depreciation.

Allowance for depreciation

The chosen profile of depreciation must reflect the loss of value that occurs with time and use and is not compensated by capital formation maintenance.

Two depreciation schedules have been used for infrastructure assets. One is based on the assumption that a long-term decline in value occurs at a uniform rate of 2% per annum over an assumed life of 50 years. The second is based on an assumption that there is no decline in value for a period of 10 years followed by a uniform decline in value over the remaining 40 years of the asset's life. Neither of these depreciation profiles are relevant for vehicles or rolling stock, for which diminishing balance depreciation profiles have been assumed.

Indexing for inflation

The translation of past fixed capital expenditures from historic to current prices is strictly speaking not possible. The use of deflators can provide only very approximate measures of real value in current prices. The literature on the inadequacies of index number series is quite vast. However, the error of not using an index is considerably greater than that associated with its use. For this analysis two variables have been used as deflators, an index of consumer prices, and an index of minimum wages. The average minimum wage has been used as deflator of fixed capital expenditures consisting largely of labour inputs.

The estimated values of the road system, railway and air facilities based on the indexed series of capital formation expenditure must be considered tentative estimates only.

Changing supply and demand

The value of any asset, irrespective of historic cost or existing condition, depends only on the future use that may be obtained from it. It has proved difficult to make full allowance for this effect. The problem is illustrated by branch railway lines. For many lines the asset value is estimated from the scrap value. The value in use, however, will exceed scrap value by an unknown amount. In the long term the process of depreciation and capital formation provides some adjustment over time to the value of an asset as measured by replacement cost (or past capital formation expenditure for changing demand conditions).

Sunk Costs

For this analysis the concept that 'sunk costs are irrelevant' is not accepted. There is only one circumstance in which sunk costs may be ignored and that is when the owner of the asset makes a conscious decision that the asset will not be replaced when it wears out and that no attempt will be made to carry out renewal maintenance. In this circumstance, the historic cost of the asset ceases to be relevant and its value is indicated only by the future benefits or operational surpluses.

VALUATION OF LAND USED FOR TRANSPORT PURPOSES

There is no correct method for valuing land on which transport assets are constructed. The problem is a simple one to define. It is always the case that the value of a transport asset must include a component reflecting the alternative uses of its land. What is not clear is how this land component may be valued. Nor is it simple to assess resource flows associated with land once its value is known.

The use of land for transport pruposes presents special difficulties in the analysis of resource flows for transport. This arises, in part, because the existence of transport facilities directly affects the market value of land. In addition, the arrangements for financing transport operations can also affect land values, for example, whether all costs are charged to users and other beneficiaries. Frequently the beneficiaries will include land owners. A further difficulty arises because the market value of any parcel of land reflects the planning permits actually issued or expected to be issued in relation to that land. This component of value is transferable to other parcels of land by administrative decision.

One matter may be disposed of immediately. Land as a resource does not usually depreciate when used for transport purposes. Hence in calculating resource flows the depreciation of land assets is not relevant. It is necessary to value land assets therefore only to measure the notional rent payable by subsectors. The purchase and sale of land is not a real resource flow, even though it enters the accounts and must be budgeted for. Land purchase represents a transfer of resources only. The locational value of any parcel of land reflects the value of transport facilities and other infrastructure serving that land (which includes the intrinsic value of the land used for these transport facilities and infrastructure).

Clearly the market value of adjacent land cannot be used as the basis for the calculation of the notional rent on land absorbed by the various transport subsectors. If it were used an over-estimate would be indicated.

In the ultimate analysis the effect of allocating land for transport purposes is either to displace other land consuming activities or to encourage the substitution of other resources for land. The example of railway yards in the centre of a city can be usefully discussed. The existence of these yards produces a greater separation of the interacting social and economic activities of the city. Hence the resource cost of the land for these yards is indicated by the economic cost of this greater separation. Similar considerations apply in calculating the resource cost of land for urban roads. The rent for land used for transport purposes is approximately equal to the additional resource costs of transport as described above. Since these resource flows will appear in each subsector, the rent of land will also be automatically included and a further allowance for land rent would constitute double counting

in aggregate if not otherwise adjusted. The resource flows for each subsector would need some adjustment.

In the present analysis, the value of existing land assets is ignored in the calculation of asset values. Similarly outlays for the purchase of land are not regarded as reflecting resource flows except when payments are made in compensation for existing improvements to the land.

CONCLUSION

The preparation of this paper was a task similar to performing Hamlet without the Prince of Denmark. It would have been best if we had been able to illustrate the application of the methodology we discuss above using factual data. At this stage the preliminary conclusions of our study are being reviewed by the Bureau of Transport Economics which, obviously, must have the right to decide whether and in which form, these results will be published. It is hoped that what has been said above will assist in debate and discussion of the economic structure of the transport sector. Acknowledgement is made to the contribution of Dr. Neil Steeper of the Bureau of Transport Economics in the development of the concepts reported in this paper.