New Zealand Business Roundtable

Submission to the Ministry of Transport on the Land Transport Pricing Study's Discussion Documents

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September 1996

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Summary

1. This submission is made by the New Zealand Business Roundtable (NZBR), an organisation of chief executives of major New Zealand business firms. The purpose of the NZBR is to contribute to the development of sound public policies that reflect New Zealand's overall interests. The NZBR's longstanding interest in transport issues stems from the central role the transport system plays in commerce and in the wider community.

2. The comments in this submission are based on the view that the key reform objective should be to increase economic efficiency. This is not to ignore other considerations. Rather it reflects a view that these can often be pursued more effectively by other means.

General Comments

3. The Land Transport Pricing Study (LTPS) reports aim to provide a basis for developing a safe, sustainable transport system at reasonable cost which necessitates the establishment of an appropriate pricing and regulatory framework for ensuring that users face the full economic costs of their decisions to use land transport.

4. In section 2 we comment on the difficulties with this objective, identifying in particular its failure to distinguish between marginal cost pricing and average cost recovery and the risks this could pose to efficient pricing and to inter-modal neutrality.

5. We hoped that the LTPS would throw useful light on the following two key questions:

- are road users being charged the right overall amount?; and
- what are the optimal rates of charge across classes of users and charging instruments?

6. In the event, the LTPS appears to seek the answer to the first question as an exercise in cost recovery, rather than in efficient pricing principles. Current charges are derived by applying administratively-determined cost allocations to a total cost based on a principle of recovery of past costs. This is a very different procedure to one based on efficient pricing principles.

7. The one report in the series which might have helped answer the second question explicitly stated that it was beyond its scope. Nor did the reports as a group appear to provide a clear and satisfactory framework for answering either question.

8. While the reports might be viewed as work in progress towards these goals, they do not inspire confidence that clear answers to these questions will emerge under current arrangements.

9. Our major concern is that the LTPS fails to acknowledge, let alone analyse, the fundamental conflict between efficient pricing principles and the capital charge approach to pricing. In our view this deficiency is potentially a serious threat to the achievement of efficient prices and improved inter-modal neutrality. The LTPS could have negative value if it directs discussions about optimal charges for road users from efficient pricing principles to cost recovery and cost allocation issues.

10. In our view the minimal progress made towards determining efficient charges or prices for road use reflects the relatively weak incentives provided under current arrangements for producing price-relevant information, planning for the optimal introduction of new billing technologies or for making best use of current information. In this respect the reports do help motivate a case for further institutional reform. They fall short, however, of providing a sound framework for such reforms.

11. In our view what is now required is:

a) an in-depth discussion of efficient charging levels under existing billing arrangements. It should specifically addresses the issues of returns to scale, excess capacity, and optimal network average pricing;

b) a detailed analysis of the current impediments to the timely introduction of direct billing systems, with recommendations for legal and institutional changes designed to reduce those impediments; and

c) to make a specific group responsible for recommending a timetable and process for moving New Zealand's network providers to direct billing arrangements, perhaps using shadow tolling for an interim period.

12. The remainder of this section summarises our key observations on each report in the series.

The Cost of the Roading Infrastructure

13. The following are our major observations on the report entitled *The Cost of the Roading Infrastructure* (the CRI report). Section 3 of this submission and the appendix provide detailed comments.

14. The report provides useful information on the costs of the infrastructure and useful estimates of its depreciated replacement cost. The report fails to note, however, the critical distinction between efficient prices and prices which are designed to recover current and past costs.

15. As a general rule, efficient prices should be based on forward-looking costs. They aim to cover future, not past, capital costs.

16. As a general rule, a capital charge based on an administratively determined asset value should be regarded as a useful management information tool, but it should not affect price. A capital charge should

ideally be calculated by applying a required market return on capital to the opportunity cost of the capital employed; it is not formally correct to apply a market return on capital to an administratively-determined value of capital.

17. If roads are priced to ensure that the required return on past capital is achieved, come what may, the resulting profit stream is likely to be valued at something approaching the risk-free rate, regardless of the book value of the infrastructure or the assumed cost of capital.

18. A capital-charge-inclusive, average cost, approach to pricing roads could be optimal if: constant returns to scale applied so that average cost was also marginal cost; marginal cost was so unobservable that average cost could be assumed to provide the best available estimate of marginal cost; and/or road users and the government had an implicit long-term agreement that road users would pay for the roads on an average cost basis.

19. Depreciated replacement cost could depart markedly from optimised depreciated replacement cost since many roads may not be built optimally for current and future traffic flows. Changes in road price levels or charging mechanisms could affect optimised depreciated replacement cost by altering traffic flows.

20. Economic depreciation is the change in the market value of a steadily maintained asset through time due to such factors as obsolescence which reduce consumer demand. Describing the sum of current and deferred maintenance as economic depreciation could create confusion – it would be better to use a term like accrued maintenance.

21. The rationale for calculating a capital charge for state highways but not for local roads is spurious, whether looked at from a management information perspective or from a pricing perspective.

22. We do not have a particular view about the $25 billion estimated depreciated replacement cost of the road network or the 6.4 percent p.a. required return on capital. These estimates can be refined by experts at a later date, following resolution of the issues summarised above.

Roading as an Economic Good

23. This report (the REG report) finds that "the state highway network and rural and urban arterial routes appear to be close to pure public goods". It then asks for comments on the question: "What good is roading?".

24. It does not appear to be useful or accurate to categorise the state highway network and rural and urban arterial routes as a pure public good. While academics may debate the issue of rivalry, revenues of $1.4 billion per annum from road users establish the practicality of charging users.

25. Instead, the unusual issue arising in respect of road pricing is that direct billing systems, such as manual or electronic tolling, appear to be less efficient for cars than petrol excise tax and annual registration

fees. Further, monopoly and other incentive problems would arise if the road network were in the hands of a road operator which had similar powers to impose excise taxes and levies on road users as the government.

26. The second question posed for discussion in this report is: "What is the most efficient means of charging for roads?". The report itself appears to take the view that some combination of current arrangements is optimal.

27. In our view the report's discussion of options for moving more quickly to direct billing options was disappointingly brief and dismissive apart from its acknowledgment that electronic billing was conceivably practical on the Auckland Harbour Bridge and the Hutt Motorway and that the Wellington City Council already had a system of supplementary vehicle licensing for residential parking.

28. New technologies are lowering the cost of electronic tolling but current arrangements do not provide commercial incentives to bring these arrangements into place in a timely manner. The report stops short of recommending a strategy for following up on its own suggestions. Nor does it explicitly consider the case for electronic tolling of heavy vehicles.

29. We note that current arrangements also appear to impede active consideration of direct charging for congestion through supplementary vehicle licensing, but the report does not identify these constraints or discuss how they can be eased.

30. In our view considerably more attention needs to be given to the issue of how best to reduce the barriers to the more timely introduction of direct billing systems since the potential efficiency advantages of these systems are obvious and will become more compelling as traffic volume growth increases congestion problems in Auckland and some other regions. We suggest therefore that more work be done on both the above issues. Further institutional reforms appear to be necessary if New Zealand is to progress in a timely manner to the implementation of direct billing systems which, when economic, will provide much better signals to road users and much better incentives to road operators.

31. The REG report's answer to the third question it poses: "What is the appropriate role of the private sector?" is that there may be scope for greater involvement in management, design and operation of publicly-owned networks. Private operation could be based on shadow-tolling or franchise arrangements. Undoubtedly there is such scope.

32. On the other hand, the REG report sees little early scope for greater private involvement in funding or ownership. But this is surely a matter of timing. Greater private involvement can be delayed by a failure to invest in commercial information systems and to take a more commercial approach. The ability of the government to implement optimal charging arrangements may be limited while the system remains under Crown control.

33. In our view the REG report's premise that public ownership is better than private ownership is unwarranted. What is required is a comparative institutional analysis which contrasts the problems under government ownership with those under private ownership.

34. Similarly, we do not share the REG report's reservations about the scope for private funding of future road capital expenditures.

35. Detailed comments on this report are in section 4. The appendix contains some supplementary material.

Environmental Externalities

36. This report does not discuss the link between externalities and efficient pricing principles. The report implicitly assumes that non-road users have property rights in the environment. Yet an assumption that road users have such rights is arguably equally valid. Road user charges could be sensitive to the choice between subsidising would-be road users who decide not to use the road and taxing those who do choose to use the road.

37. The report does not provide a detailed discussion of how externalities could be priced to improve outcomes, or what alternative actions could be taken.

38. While negative environmental externalities might rightly motivate consideration of taxing road use, positive externalities could have the opposite funding implication. Since road networks arguably provide positive externalities this may be an important balancing factor.

39. The very imprecise nature of the estimates of the costs of these externalities raises serious doubts about their usefulness as a basis for adjusting road prices.

Safety Externalities

40. We agree with the dissenting view in the appendix of this document that there is a safety externality which is not corrected for simply because the costs of road accidents might be spread across all users. The facts are that a road user who decides to break the road code does not necessarily pay a higher insurance premium to reflect the greater risk which that behaviour imposes on others, nor does that road user get confronted with the full amount of all additional *(ex post)* costs which arise from that decision.

41. The perspective, taken in the main body of this report, that externalities have been internalised if the costs all fall on road users is mistaken. Just as efficient pricing should not be confused with recovery of past costs, correction of externalities should not be confused with the income distribution question of who should pay.

42. We agree with both the main and dissenting views that it is plausible that there are more efficient means of addressing road safety issues than raising petrol tax or road user charges.

43. We continue to favour the view expressed in our 1993 study that the road network provider should be responsible for all aspects of road safety, except the regulation of other providers. ACC insurance and tort law reform issues should also be addressed, independently of the LTPS.

44. The distinction drawn in this report between private costs and resource costs is puzzling.

National Traffic Database

45. The *National Traffic Database* report provides useful information for the industry on traffic densities in each part of the road network, by type of vehicle. We have no particular comments to offer on this document.

1.0 Introduction

1.1 The New Zealand Business Roundtable (NZBR) is pleased to present this submission on the Ministry of Transport's five reports which have been released for discussion as part of its Land Transport Pricing Study (LTPS). The five reports comprise:

- *The Cost of the Roading Infrastructure*, July 1995;
- *Roading as an Economic Good*, December 1995;
- *Environmental Externalities*, March 1996;
- *Safety Externalities*, May 1996; and
- *National Traffic Database*, April 1996.

1.2 The NZBR is an organisation of chief executives of major New Zealand business firms. Its purpose is to contribute to the development of sound public policies that reflect New Zealand's overall interests. It takes the view that the interests of consumers not producers should be paramount, and that all businesses large and small should serve consumers' needs. The more open and competitive economy favours consumer interests, and is also encouraging the growth of more efficient and well-run businesses.

1.3 The transport sector contributes about 5 percent of New Zealand's gross domestic product and directly or indirectly affects the whole community. Failure to get the right price signals in this sector could impose significant costs on the community. Further, the importance of making the right investment decisions will increase as strong economic growth and changes in the transport mix put pressure on the current infrastructure. This concern is heightened by the degree of rationing of investment funds which is indicated by the current very high benefit to cost ratio hurdle for new roading projects.

1.4 Because of the significance of this sector for the business sector and the wider community, the NZBR has had a longstanding interest in transport policy options. As reflected in our 1993 publication, *Options for the Reform of Roading in New Zealand*, our fundamental approach is to seek reforms which will increase economic efficiency in this sector, as in others.

1.5 Section 2 of this submission provides some general comments on the progress made by the five papers towards developing new approaches which would contribute to the goal of greater efficiency in land transport.

1.6 The subsequent five sections comment on each of the papers. An appendix elaborates on some of the economic principles discussed in the body of this submission. Our overall conclusions are contained in the Summary section.

2.0 General Comments

2.1 The LTPS reports state that:

> The fundamental purpose of the Land Transport Pricing Study is to provide the basis to develop a safe, sustainable transport system at reasonable cost that will meet the needs of New Zealand in the twenty-first century. This will necessitate establishing the appropriate pricing and regulatory framework to ensure that users face the full economic costs of their decisions to use land transport.

2.2 The first sentence in this statement suggests that the purpose of the LTPS encompasses all questions relating to institutional structure and regulatory arrangements. On the other hand, none of the reports released to date under the LTPS addresses issues of institutional reform in a structured manner or discusses in any detail the regulatory and institutional impediments which are, or may be, retarding moves to more efficient pricing arrangements. In this section and in section 4 we register our concern about such impediments.

2.3 The second sentence in the statement cited in paragraph 2.1 is consistent with the underlying rationale for marginal cost pricing, namely that users should be confronted with the costs which their use of the network imposes, at the margin, on society. When this occurs, there is a *prima facie* case that the private benefits they derive from the use of the network at the margin are at least equal to the social cost. Unfortunately, and disturbingly from an efficiency viewpoint, the sentence fails to specify that it is the marginal rather than the average cost that counts for efficiency. This looseness lends itself to the confusion, noted in sections 3 and 4 below, between cost recovery (e.g. average cost pricing) and efficient (e.g. marginal cost) pricing. Average cost pricing could be very inefficient if there are increasing returns to scale in the provision of roads and/or if excess capacity exists most of the time throughout the network.

2.4 A second concern in respect of the same sentence in paragraph 2.1 relates to the potential for confusion over the issue of who should pay whom when an external damage/benefit is conferred. The statement could be read as presuming that the road user should pay where the externality is negative. But, in abstract, there should be no such presumption. If a road user's decision to use the road at the margin imposes a cost on someone else then his or her decision not to use the road at the margin confers a benefit on the other person. Should the road user pay for imposing a cost on someone else or should that other person pay the would-be road user for forgoing the use of the road? This is a question of optimal property rights.

2.5 From an efficiency perspective, the optimal assignment or property rights in a 'greenfield' situation would depend (in a non-trivial manner) on the nature of transaction costs as Coase (1960) explained. Road networks have been in place for a long time and property rights have long been assigned implicitly or explicitly. The case for altering these property rights from an efficiency perspective needs to be made in an explicit way. Possibly it is more efficient to allocate property rights to those who suffer from noise or air pollution, but this

should be a matter for analysis rather than something which should be taken as a given. This potential error is discussed further in section 5 below.

2.6 Given these ambiguities, it is perhaps unsurprising that the reports commented on in this submission do not cast much light on the issue of determining the optimal charging structure for individual road users from an efficiency perspective – either under current technologies or under an expanded set of technologies. It was a surprise, nonetheless, to read on page 30 of the second LTPS report (see section 4 below) that consideration of the efficient distribution of charges "across users and across pricing instruments" was "beyond the scope of this paper". Nor did this question come within the scope of any of the other reports. Nor do any of the reports provide a clearly stated "pricing and regulatory framework" addressing this question.

2.7 In addition, the reports do not shed much light on the optimality, from an efficiency perspective, of total amounts currently being levied on road users. It is here that the scope for error between average cost recovery and efficient (marginal cost) pricing is most evident.

2.8 What is optimal will depend markedly on what constraints are assumed to apply. Constraints arise from many sources. Particularly relevant ones include the many factors which might drive a wedge between average and marginal cost and which may constrain billing system options. The discussion in the appendix briefly illustrates some aspects of these issues.

2.9 Regardless of the constraints, it is highly desirable for inter-modal neutrality that road users are confronted by charges based on efficiency rather than cost recovery considerations, where the two are in conflict. On the other hand, marginal costs are not objectively determinable. They depend, for example, on a judgment as to the degree to which an observed increase in demand is sufficiently permanent to bring forward a future capital expenditure programme. Institutional reform, such as a move to a SOE framework, franchising, or privatisation would alter the constraints and therefore price outcomes.

2.10 Relative to a commercial situation, current arrangements provide weak incentives to discover information relevant to forming more accurate judgments about marginal cost or to utilise existing information to the full. Nor do current technologies allow much fine-tuning of user charges to cater for variations in marginal cost by time of day, location, type of vehicle or driver behaviour. For these reasons, a degree of averaging is inevitable in determining optimal charges.

2.11 Given these very real difficulties, the temptation is to charge road users on an average (depreciated replacement) cost basis. Average cost-based charges may be a good proxy for marginal cost-based charges if there are constant returns to scale and no serious problems associated with surplus capacity and/or peak-period congestion.

2.12 However, neither of these preconditions may apply to our road network. First, consider the issue of returns to scale. The NZIER's 1993 study (updated for NZ Rail in 1995) formally presents a model which finds that in the presence of strong returns to scale (per weight-equivalent travel kilometre) pricing at *ex post* average

operating cost (in respect of road reshapings) would be efficient (i.e. be equivalent to marginal cost pricing) as long as the ages of the various road lengths making up the network were uniformly distributed. In the formal model, the market value of such a network would be zero, or close to zero, implying a zero or near-zero capital charge based on the market value. Such a price would not allow recovery of the average (depreciated replacement) cost of constructing the network because of the assumed increasing returns to scale.

2.13 The existence of a network based on pricing at average *ex post* operating cost would require arrangements for funding the construction of the network from the outset. Property developers currently construct new roads for urban sub-divisions, leaving local authorities to pick up the ongoing road-related costs which result from this addition to their network. This is one (particularly targeted) solution to the funding gap implied by the increasing returns to scale assumption. Other options include levies on taxpayers, ratepayers and/or road users generally.

2.14 Whatever arrangements are made, they might also be expected to contain features which guarded against subsequent hold-up by a network operator each time some part of the network required resurfacing. Otherwise, in the NZIER's model it would be in the commercial interest of the road operator to let the network deteriorate. This is because if the network had a zero market value if maintained in perpetuity (as is implied by pricing at average operating cost), a positive value could be derived by allowing it to run down. From a road user perspective this would be *ex post* hold-up. It is surprising that the LTPS reports to date do not comment on the relevance of the NZIER's study.

2.15 The second point to be made in terms of average cost pricing (refer to paragraph 2.11) is that the degree of utilisation of network capacity varies enormously by location and by time of day in the relatively small parts of the network which experience congestion.

2.16 If the above considerations are valid, the efficient price must be below average (optimised) depreciated replacement cost.

2.17 At present use-related charges are based on petrol excise for most cars and road user charges. Such differentiation, within a cost recovery framework, requires an allocation of common costs. This is the basis of the road user charge system. The inescapable arbitrariness of cost allocations creates risks that potential resource misallocations will result from incorrect allocations, but these risks must be balanced against the probability that significant efficiency gains are being achieved relative to even cruder pricing arrangements.

2.18 Even so, current pricing arrangements clearly fall well short of what might be achievable under improved arrangements for price and cost discovery and newer billing technologies. It is the scope for achieving some of these potential efficiency gains which motivates the NZBR's interest in this study and its concern that public policy in this area should be driven by efficiency considerations.

2.19 It is unfortunate that the LTPS reports leave so much to be done and risk moving the public policy focus so far from efficiency considerations. In the NZBR's view, the LTPS process demonstrates the lack of

information which officials and analysts currently have about consumer willingness to pay, marginal road network costs and the economics of better-targeted alternative or supplementary billing systems. We are concerned that under current incentive structures this situation is unlikely to improve materially for the foreseeable future. No government agency is likely to get its budget cut if New Zealand moves too slowly to improve on this situation.

2.20 The potential efficiency advantages of direct billing systems are obvious. The only uncertainty is when it will be cost efficient to introduce them and on which parts of the system they should be introduced first. Clarifying these issues is a significant task. Much needs to be done in assessing the situation and in demonstrating to the general public the potential advantages of direct billing in terms of efficiency, equity and flexibility in handling environmental concerns.

2.21 An obvious step would be to seek to introduce such systems in sections of the network where congestion and/or the need for network enhancements create the scope for efficiency gains and a clear constituency for action. An alternative and complementary approach would be to investigate the advantages of direct billing systems amongst commercial users (such as freight transporters) who will be sophisticated enough to realise the potential efficiency gains from such systems.

2.22 We are concerned at reports from local government that such options are not being pursued actively because of perceived legal and other constraints (refer to section 4.2 for details). This concern is aggravated by the diffidence with which the LTPS reports have addressed direct billing options and the issues associated with impediments to change. Realism about timeliness is in order; policy drift is not. Without a greater sense of focus and direction, policy effort could easily continue to be misdirected into less productive issues such as the recovery of past sunk costs and network valuations which do not relate to user-willingness to pay. Timeliness for the introduction of improved billing technologies will be lost.

2.23 In our view what is now required is:

a) an in-depth discussion of efficient charging levels under existing billing arrangements. It should specifically addresses the issues of returns to scale, excess capacity, and optimal network average pricing;

b) a detailed analysis of the current impediments to the timely introduction of direct billing systems, with recommendations for legal and institutional changes designed to reduce those impediments; and

c) to make a specific group responsible for recommending a timetable and process for moving New Zealand's network providers to direct billing arrangements, perhaps using shadow tolling for an interim period.

3.0 The Cost of the Roading Infrastructure

3.1 Introduction

3.1.1 This section comments on the Ministry of Transport's July 1995 discussion paper: *National Roading Account: The Cost of Roading Infrastructure* (the CRI report). This is the first report in the LTPS series.

3.1.2 Section 3.2 summarises the analysis underlying the main conclusions of the CRI report. Section 3.3 comments in detail on this analysis. Section 3.4 summarises our conclusions. Unless the text clearly refers to this submission, all the references to page or paragraph numbers in sections 3.2 to 3.4 below refer to pages and paragraph numbers in the CRI report.

3.2 The Ministry of Transport's Analysis

3.2.1 The CRI report's main aim "is to develop the accounts of the public roading network". The following summary of the Ministry's analysis concentrates on the methodology used to derive the mid-points of the estimated ranges provided in the CRI report.

(i) Users of other transport modes are charged prices which incorporate the cost of capital.

(ii) If road users do not also pay cost-of-capital-inclusive charges, inter-modal resource use will be distorted at a cost to economic efficiency – the playing field will not be level.

(iii) A capital charge regime for public enterprises helps ensure that the cost of capital is reflected in resource use and pricing decisions.

(iv) The magnitude of any capital charge should be calculated as the product of the unit opportunity cost of capital and the quantum of capital employed.

(v) The capital asset pricing model is appropriate for calculating the unit cost of capital in roading, although some argue for using the social rate of time preference and the Ministry considers a case for a non-uniform charge through time (see page 46).

(vi) Based on a real risk-free rate of 3.85 percent (5.35 percent nominal less 1.50 percent for inflation), a road industry asset beta of 0.35, a debt risk premium of 1.00 percent, an equity risk premium of 6.50 percent, a tax rate of 20 percent and a debt: equity ratio of 50 percent, MoT calculate a weighted average cost of capital for road infrastructure of 6.44 percent (see Table 10, page 44).

(vii) The quantum of capital employed is estimated as the depreciated replacement cost of the existing infrastructure. It is not practical to use a cash-flow-based valuation given the absence of a conventional billing system for the provision of road infrastructure services (see page 22).

(viii) The CRI report notes the conceptual superiority of optimised depreciated replacement cost to value assets for book purposes, but argues that the refinement of optimisation would not alter any estimate materially given the longevity of road infrastructure and the sharply declining unit costs associated with construction of excess road thickness or traffic capacity (see page 24).

(ix) The (land-inclusive) depreciated replacement cost of the road network is estimated to be $25.8 billion (see Table 7, page 32). Crown state highways contribute $7.1 billion to this total.

(x) The $7.1 billion depreciated replacement cost of state highways is derived from: land values based on current assessed values of adjacent land (13.37 percent of the total value); undepreciated values for road formation costs (41.39 percent) and tunnels (2.30 percent); and depreciated replacement costs for pavements (16.34 percent), bridges (20.08 percent), drainage (4.45 percent) and smaller items comprising traffic facilities, culverts, underpasses and river protection works (see Table 5, page 28).

(xi) An $18.4 billion estimate of the depreciated replacement cost for local roads (excluding state highways not owned by the Crown) was derived simply by combining book values for the roading assets of 24 representative road-controlling authorities (divided into four categories with a sample of six in each category), calculating an average per kilometre value for each of the four categories and applying those unit values to the nationwide length of road in each category. The 24 authorities in the sample accounted for about 24 percent of the entire local road network in terms of length. The quality of the book value data for local roads is in doubt so much less confidence can be felt concerning the $18.4 billion estimate than for the estimate for State Highways (see pages 29-31).

(xii) Applying the 6.4 percent estimate of the cost of capital to the $25.8 million estimated value of the network would produce a capital charge of $1,650 million for the public roading network as a whole. The capital charge on the state highway network would contribute $470 million to this total.

(xiii) Annual expenditures required to maintain the technical condition of the road network are estimated to be $750 million. This is defined as the sum of current and deferred maintenance. The sum is referred to as economic depreciation. However the CRI report notes that this approach is such that if these expenditures were actually incurred there is an argument that net economic depreciation would then be zero (see pages viii and 52).

(xiv) Total economic costs of the road network are estimated to be $1,220 million as the sum of 'economic depreciation' of $750 million plus a capital charge for state highways alone of $470 million. This is slightly less than the $1,470 million collected from road users in 1992-93 (see page viii and Tables 13 and 14 on page 56). The economic cost thus calculated excludes any consideration of a capital charge in respect of local roads, or charges for externalities such as safety and environmental damage.

(xv) The case for excluding a capital charge in respect of local roads is that such a charge "would simply comprise cancelling entries in the income and expenditure statements of territorial local authorities" if,

as "is probable", ratepayers and road users (including pedestrians, cyclists and others) are similar people (see page 55).

3.3 Commentary

3.3.1 Our major criticism of this chain of logic is that it confuses efficient pricing and cost recovery. Efficient prices would aim to allow the network operator to recover from road users the future costs which their decision at the margin to increase their road use imposes on the network operator. The following are some specific comments on the points summarised in section 3.2 above.

3.3.2 Point (i) is not valid as a justification for a capital charge approach to pricing. We would expect prices in rail, air and sea transport to recover the cost of capital in relation to future rather than past costs. We do not expect prices to be based on the recovery of depreciated replacement cost, unless they are determined by prior contracts.

3.3.3 Point (ii) is similarly not valid as a justification of a capital charge approach to pricing. Marginal cost and other manifestations of efficient, forward-looking pricing for roads would be consistent with a level-playing field approach.

3.3.4 Point (iii) does identify a use for a capital charge as a public sector management tool. Capital charge calculations may raise interesting questions about resource use, pricing and the relationship between average cost and marginal cost. For example, the discussion on pages 111-112 of the NZBR's 1993 report on *Options for the Reform of Roading in New Zealand* was motivated by consideration of how the long-run marginal cost of a new road might compare with a capital charge based on a $60 billion network value.

3.3.5 Point (iv) is valid if the 'quantum of capital employed' is also measured on an opportunity cost (market value) basis. But this immediately highlights the circularity in the relationship between price charged, the value of the asset and the required rate of return. The capital charge cannot be determined until the value of the asset is assessed, but this cannot be determined unless the price at which the product is to be sold is known. Therefore the capital charge cannot be properly used to determine price.

3.3.6 The second issue to note in relation to point (iv) is that it is not correct to charge a price each year which is designed to generate an *ex post* return which is close to a positive beta *ex ante* required return regardless of market swings. This would be a contradiction because a positive beta implies that the *ex post* return will vary with variations in the market-wide return. The required return on a monopoly which can price so as to achieve a pre-determined *ex post* profit each year, regardless of market volatility, is a bond-like return. It is not an equity-related return.

3.3.7 In respect of point (v), it is hard to envisage a case for using market-determined discount rates for some transport networks and a social rate of time preference for others. The capital asset pricing model is the best available for determining a market-related *ex ante* cost of capital. However, as noted above, in principle it should

be applied to an opportunity cost-based value for assets rather than an administratively-determined cost of capital. It should not be used to produce a predetermined *ex post* return, for the reasons set out in the previous paragraph.

3.3.8 In respect of point (vi), the particular parameters to be used in applying the capital asset pricing model will vary through time with changes in required market returns and in the factors influencing the risk characteristics of the cash flows from operation of the road network. These are matters which can be addressed in greater detail at a later date.

3.3.9 The approach set out in point (vii) is a cost-effective way of determining a book value, but it is not a market value concept. It is definitely not practical or meaningful to talk of a market value for the network independently of market-determined prices for services. Under particular assumptions about prices it would be possible to talk about a market value for the net cash flows resulting from those assumptions.

3.3.10 The argument in point (viii) that depreciated replacement cost is a good approximation of optimised depreciated replacement cost is unconvincing. If the road should never have been upgraded (or built) in the first place its depreciated replacement cost is largely irrelevant for pricing purposes. Further, what is optimal depends on traffic volumes which depend on pricing policies. Because the CRI report does not consider optimal pricing, its ability to consider optimised depreciated replacement cost is limited.

3.3.11 It is useful to have an official estimate of the depreciated replacement cost of the state highways system (ix and x above).

3.3.12 The same comment applies to the more problematic $18.4 billion estimate for the depreciated replacement cost of local roads (point xi above).

3.3.13 The capital charge calculation in (xii) unwisely presumes that estimated depreciated replacement cost is the correct opportunity cost value. The validity of this presumption was questioned in paragraph 3.3.10 above. A further point is that the argument that increasing returns to scale apply in road construction suggests that there could be a wedge between optimised depreciation replacement cost and market value. A sounder approach would be to determine optimal pricing policies based on future costs, estimate net cash flows based on these prices and discount them at the estimated user cost of capital in order to derive a market value. In unregulated competitive markets, market values are determined as the present value of future net cash flows. Even under constant returns to scale, the ratio of market value to depreciated replacement cost or book value can depart markedly from unity for prolonged periods. The degree of departure depends on the industry.

3.3.14 The sum referred to in point (xiii) is a maintenance figure, comparable to the cost of painting a house. It is confusing to call it economic depreciation. It would be less confusing to call it annual maintenance (accrual basis) and to state that the MoT sees a case for assuming that economic depreciation is zero. In reality, economic depreciation for the network is unlikely to be zero in a dynamic economy. Changing traffic flows will have value implications for the network.

3.3.15 This capital charge calculation in point (xiv) is a book entry concept rather than an economic cost. When paid it is a transfer of funds. Economic cost would include depreciation if non-zero. See the next paragraph for a comment on the cost of local roads.

3.3.16 This case in (xv) for excluding local roads from the calculated capital charge is spurious. First, it is inconsistent with the stated book-keeping goal of the CRI report to "develop the accounts of the public roading network". Second, as a statement about optimal funding, it ignores incentive considerations. By the same logic, councils would not charge directly for water or electricity because all ratepayers use them. This is an extraordinary and major error in the report.

3.4 The Discrepancy Between the Implied Charge and Current Charges

3.4.1 The first report values the road network at $25 billion on which the capital charge would be $1,650 million per annum at a 6.44 percent required return on capital. Adding the $750 million for maintenance and assuming zero economic depreciation would give a total economic-cost-based, mid-point estimate of the revenues required from road network users of $2,400 million.

3.4.2 This implied cost recovery charge is over 60 percent higher than the amount actually raised from road users. As we illustrate in the next paragraph, current payments from road users are more consistent with a network value of $7.5 billion and a capital charge of only $482 million. These are vastly different figures. How are they to be interpreted? The remainder of this concluding comment considers this question.

3.4.3 A total of $1,470 million was raised from road users in 1992-93. Deducting the MoT's estimate of $750 million of actual and deferred maintenance costs from that total would give a cash surplus of $720 million. Taking economic depreciation as zero and ignoring the costs to society of accidents and environmental damage over and above those borne by road users, this would also be the pre-tax operating surplus attributable to the network. Applying a 33 percent corporate tax rate would produce a post-tax surplus of $482.4 million. The present value of this operating balance at the MoT's 6.44 percent cost of capital would be $7.5 billion. (This very crude calculation implicitly assumes that all future capital expenditures return the cost of capital and that the 1992-93 operating surplus can be maintained in real terms in perpetuity. The calculation should be treated as illustrative; it is not meant to be indicative.) Note that, given this value for the network, the MoT's methodology would, of course, produce a capital charge of $482.4 million.

3.4.4 The following are some possible interpretations of the difference between a valuation based on current charges and a valuation based on depreciated replacement cost:

- the first report's calculated depreciated replacement cost is far too high;
- the calculated depreciated replacement cost is the best available estimate, but optimised depreciated replacement cost is much lower because the road network is dramatically over-built in relation to existing traffic flows;

- the market value of the net cash flows which can be derived from the network is much lower than can be inferred even from optimised depreciated replacement cost; and

- road users are currently being grossly undercharged and traffic volumes are well above optimal levels.

3.4.5 The first of these interpretations does not seem plausible. To the contrary, at the time the NZBR report was written, informed opinion was suggesting that the replacement cost of the network could be of the order of $60 billion. The second interpretation seems more plausible, but may not be able to account for the full discrepancy.

3.4.6 In respect of the third interpretation, increasing returns to scale could put a wedge between optimised depreciated replacement cost and the market value of net cash flows. If network user charges were set at post-construction marginal cost and if this were less than the average cost of constructing the network, optimised depreciated replacement cost would exceed the market value of the cash flows which might be generated by the network. (Refer to the discussion in section 2 of this case.)

3.4.7 The CRI report has not made a case that there are implicit or explicit understandings with road users which would warrant pricing network services so as to recover any discrepancy between recovery of forward-looking costs and past costs. In the absence of such a case, it would be folly to increase user charges so substantially that usage charges markedly exceed marginal costs and the existing network becomes heavily underutilised for many years. Even if such understandings existed, it might be desirable to review the wisdom of pursuing them in the light of current circumstances. While two-part tariffs could be used in this situation, this raises optimal taxation issues.

3.4.8 If road users are being as substantially undercharged for road services as the comparative figures in paragraph 3.4.3 above suggest, the implication would be that network capacity is markedly excessive in relation to that which would be required under full user-pays pricing. However, an over-expanded road network is largely a sunk cost and the marketplace would write-down the value of such an asset accordingly. Whereas the CRI report in section 4.6.2 (second paragraph) notes an argument that the theoretical market value of the network is likely to exceed depreciated replacement cost, the above consideration raises the possibility that it would be totally uneconomic to attempt to raise anything like the calculated capital charge in *usage fees.*

3.5 Concluding Comment

3.5.1 Economic theory favours basing prices on forward-looking costs (which would not include the costs of replacing the network if this was not contemplated). The critical question in relation to the last alternative in paragraph 3.4.4 above is to what extent current charges to road users should go beyond covering forward-looking costs. This is a question which the CRI report motivates, but does not begin to address.

3.5.2 Section 4.2 below comments further on the potential for confusion between efficient prices and prices determined by cost recovery/cost allocation principles.

4.0 Roading as an Economic Good

4.1 Introduction

4.1.1 This section comments on the Ministry of Transport's December 1995 discussion report: *Roading as an Economic Good* (the REG report) and its companion *Summary Report*. The REG report is the second in the government's LTPS. Again references to section, page and paragraph numbers are references to the REG report unless the text states otherwise.

4.1.2 The REG report aims to provide the analytical economic framework to apply to the analysis of the accounts of the public roading network which were presented in the first report and to the forthcoming reports on safety and externalities.[1] More specifically, the Summary Report describes the role of the REG report as to extend:

> ... our understanding of the roading network by defining its economic characteristics and researching ways in which road services might be priced more efficiently. It looks at alternative ways of charging for roads to better reflect their true costs and send more accurate price signals to users.[2]

4.1.3 Particular questions on which the REG report invites discussion are:

- what sort of good is roading;
- what is the most efficient means of charging for roads; and
- what is the appropriate role for the private sector?

4.1.4 Section 4.2 comments on the analysis underlying the main sections in the REG report. Section 4.3 comments on the above questions for discussion. Section 4.4 summarises our main conclusions.

4.2 General Comments on the Analysis

4.2.1 The REG report comments separately on: the economic characteristics of roads; pricing and economic efficiency; charging for road services; and competition and institutional issues. This section discusses its main findings in each of these three areas.

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1 The REG report, page 1, fifth paragraph.

2 *Summary Report*, page 1.

Economic Characteristics of Roads

4.2.2 The main conclusion in this section of the REG report is that:

> The state highway network and rural and urban arterial routes appear to be close to pure public goods. Consumption is non-rivalrous for the majority of the time and exclusion is impractical with present technology. (Section 6.4.2.1, page 47.)

4.2.3 A public good is defined in a leading basic economic textbook as:

> A commodity whose benefits may be provided to all people (in a nation or town) at no more cost than that required to provide it for one person. The benefits of the good are indivisible, and people cannot be excluded from using it. For example, a public-health measure that eradicates smallpox protects all, not just those paying for the vaccinations. To be contrasted with **private goods**, such as bread, which if consumed by one person, cannot be consumed by another person. (Samuelson and Nordhaus, 13th edition, page 980.)

4.2.4 Pure public goods are very rare. As the REG report itself notes, national defence is thought to fall into this category. Armchair-theorising economists once speculated that lighthouses were also a public good, but subsequent empirical work has discredited this hypothesis.[3]

4.2.5 As presented in the REG report, the 'pure public good' characterisation is not particularly convincing. More to the point, it does not appear to be particularly pertinent. The statement that consumption is non-rivalrous is arguable where excess capacity exists. Excess capacity, most of the time, is normal in network, and many other, industries. Any connected user can use more water or electricity most of the time. Movie-goers and air travellers do not crowd anyone else out when the theatre and the aeroplane are not filled to capacity. But each movie-goer and traveller must use a different seat just as each road vehicle must occupy a different space at any given moment of time. The exact unit of water or electricity taken by one user is not available to another. Whether use of road space is regarded as rivalrous or non-rivalrous is something which academics can debate.

4.2.6 Of greater moment is the puzzling claim that exclusion is impractical with present technology. The claim is true for pedestrians but is surely not true for vehicles. Vehicles without current registration plates are not permitted on the roads, and are seldom seen. Most vehicles pay for current warrants of fitness and most users pay petrol tax or road user charges. If roads were a pure public good, people who did not pay could not be excluded.

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[3] See Coase, Ronald., C. *The Lighthouse in Economic*s, chapter 13 pages 255-278 (reprinted from the *Journal of Law and Economics* (October 1974)), in *The Theory of Market Failure: A Critical Examination* edited by Tyler Cowen, George Mason University Press, Virginia, 1988, pages 1-384. A similar rebuttal of bees as an externality for orchardists is provided by Cheung, Stephen, *The Fable of the Bees: An Economic Investigation,* chapter 14 in Cowen (op. cit.) pages 279-304 (reprinted from the *Journal of Law and Economics* (April 1973)).

4.2.7 Possibly the authors are thinking that an individual road or section of roads within a road network is a public good – in the sense that it might be too costly to monitor which subset of the entire network a road user might have paid for. If so, this would appear to be simply one of a number of considerations which would point in favour of integrated ownership of the network.

4.2.8 Another possibility is that the authors are taking the view that because it is currently more efficient to charge road users through taxes and levies rather than by manual tolls or other means, it is most economical for the government to be the funder, owner and provider. However, this would then be a debate about how best to extract payment rather than about how to exclude non-payers.

4.2.9 In any case, the relevance of the public good categorisation to the road pricing problem is not clear. As the REG report notes, many goods have mixed public/private good characteristics but can be profitably provided by the private sector. The REG report correctly notes that the pricing of roading is extremely complex.[4] But this is partly because of the issues associated with externalities, common costs, joint costs and possibly increasing returns to scale. Such pricing problems are evident in other network industries, such as electricity and telecommunications.

4.2.10 The REG report correctly notes that public goods *may* have to be supplied by the government because the private sector may be unable to recover the costs of supply. But this may be true in increasing returns to scale situations also – if the operator tried to price at marginal cost. Nevertheless, an unfettered monopoly operator of the network could surely find the funds to cover the costs of the network. Other things being equal, an annual network access charge, paid as a licence fee, of $480 p.a. per registered vehicle in 1992 would have raised, by itself, the estimated $840 million spent on the road network in that year from the 1.75 million registered motor vehicles, vans and trucks.[5] The question here concerns the efficiency of the billing systems available to a private operator rather than user-affordability in the face of the monopoly provider.

4.2.11 Indeed, as the REG report acknowledges in section 5.4.1, it is arguable that, far from suffering from under-recovery of costs, the fear would be that unfettered private provision could produce supernormal returns from monopoly pricing. This fear could lead to heavy regulation, price control, severe under-funding problems, operator bankruptcy and state takeover.[6]

4.2.12 Economic efficiency considerations also provide an alternative perspective to the REG report's public good approach to the public/private ownership issue. Governments can impose petrol taxes, road user charges and other fines or levies. While a private road operator could be assigned the property rights to impose similar taxes and levies, monopolistic concerns could see the rates of tax and levy being government-controlled, reducing the benefits from private operation. In addition, a fuel tax actually gives a commercial road provider an incentive to find ways of increasing users' fuel consumption.

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4 *Summary Report*, page 1.

5 The data are from pages 108 and 110 of the New Zealand Business Roundtable (NZBR) report: *Options for the Reform of Roading in New Zealand*, June 1993.

6 See the NZBR report, *op. cit.*, page 80 on the collapse of private road operators in France.

4.2.13 In general, the optimal fee structures for a private network operator depend on the assignment of property rights and the transaction costs of monitoring road usage, billing for usage and enforcing payment. These costs change with new technologies. Incentives to develop more efficient billing technologies are likely to be stronger under private ownership.

Pricing and Economic Efficiency

(i) Externalities

4.2.14 The REG report introduces the concept of externalities (on page 15) under the heading of property rights, but as a separate category from public goods. Externalities get considerable prominence in this section, with separate sections on road damage externalities, congestion externalities and the so-called network externality. A possible externality which does not get mentioned is the degree to which network enhancement raises the values of adjacent properties which are not owned by the investor in that enhancement.

4.2.15 Common though concerns about externalities are in public policy circles, it is not clear how important they are to a discussion of how a road, rail or telecommunications network should be priced in a commercial, level-playing-field situation. Regardless of whether or not central government can usefully take action in respect of external effects, a road operator in a competitive environment would face all the pricing difficulties raised in sections 3.4 and 3.5 of the REG report.

4.2.16 From a public policy perspective, external effects cause potential welfare losses because individuals may not be able to transact with each other to improve outcomes. But these potential losses may be relative to an unattainable ideal situation rather than to an achievable alternative - i.e. they may be academic. Individuals may not be able to transact because of imperfect information – they may not be able to locate each other or they may not be aware that the external effect is occurring or how damaging it is until it is too late. As such, externalities simply reflect imperfect information and both monopoly and public goods can be treated as subcategories of externalities.[7] The basis for the REG report's distinction between public goods and externalities is unclear.

4.2.17 Since imperfect information abounds, external effects can commonly be 'found' everywhere. But this does not mean that markets are failing to optimise. To remove an externality might require superior information to that which can be possessed by any entity. One of the references cited in the REG report questions, in particular, the significance of independent concerns about the network externality:

> While network externalities are common and important, network externalities as market failure, we will argue, are theoretically fragile and empirically undocumented.[8]
>
> The debate over network externalities is a reminder of more general methodological concerns. It demonstrates that rigour comes in small and incomplete packages. The models of network externality

[7] See page 211, footnote 4, in Dahlman, Carl, J., *The Problem of Externality*, in Cowen *(op. cit.)*.

[8] Liebowitz and Margolis, *Journal of Economic Perspectives*, Spring 1994, page 135.

proceed with great rigour from a simple and plausible assumption - that the benefits of an activity depend upon the number of participants - to a variety of conclusions. But these models can not tell whether such a problem is important. After we economists have had our fun, thinking about network effects and considering how social interactions have a similarity to networks, we need to acknowledge that the *a priori* case for network externalities is treacherous and the empirical case is yet to be presented. Most constructs in economics find their way only very slowly into either public policy or established theory. The construct of network externalities should be one of them.[9]

4.2.18 We discuss the issues raised by externalities further in sections 5 and 6.

(ii) Common Cost and Marginal Opportunity Cost

4.2.19 The REG report usefully introduces most of the concepts which are relevant to discussions of optimal pricing issues. These include: short-run and long-run marginal cost, joint supply, tied pricing arrangements, Ramsey prices including multi-part tariffs, cost allocation, and optimal taxes. One omission is the lack of a careful discussion of common cost issues.

4.2.20 Common costs occur when the unit of production is greater than the unit of sale and/or when multiple outputs result from the same operation.[10] The provision of a road for use by more than one user illustrates a common cost situation. The bulk of the costs of the road are not incurred user-by-user, but all together or not at all. The marginal cost for the service consumed by each user might be close to zero, but the cost of unit production (e.g. a unit of road length) is much greater than zero. In addition, the road provides different services for different customers (passenger services, freight services, day versus night services, scenic services, access to roadside facilities etc.). No road provides a single service at a single price, but the costs are common so optimally pricing individual services is analytically difficult.

4.2.21 Joint costs are a special form of common cost. Kahn[11] defines joint costs as those which occur in common when diverse products can be economically produced only in fixed proportions. In the pure joint cost case, there is no marginal cost for each individual product, only the marginal cost of producing the bundled output. However, required minimum prices for each product can be inferred from this marginal cost and observed demand for the other products being jointly produced, using the concept of marginal opportunity cost. This is the cost of supplying an additional unit to one customer as measured by what the next (unserved) customer would have been prepared to pay. Hence, at times of congestion, the cost of allowing one more vehicle to use the road is measured by what the use of that space at that time would have been worth to someone who

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9 Liebowitz and Margolis *(op. cit.)* page 149.

10 Alfred Kahn, *The Economics of Regulation: Principles and Institutions,* 1990, MIT Press, volume I, page 77, discusses the basic concepts.

11 Kahn *(op. cit.*) vol I, page 79.

missed out. In such situations the cost of supplying the service is demand-dependent rather than cost-dependent (as the REG report notes at the start of section 3.4.1).

4.2.22 The discussion in section 3.3.1 of the REG report, particularly the second paragraph, confuses the public good issue with the common cost problem identified in paragraph 4.2.5 above. None of the other sections in chapter 3 of the REG report requires any consideration of public good issues, nor is any provided. This demonstrates that the public good focus of chapter 2 is not relevant to most, if not all, road pricing and efficiency issues. Clearly common cost and joint cost issues are relevant.

(iii) Economies of Scale

4.2.23 The discussion in section 3.5.1 of the REG report is confusing because it does not always carefully define the dimension. For example, it states variously that:

> The net result is approximately constant returns to scale in road production[12]; and
>
> ... the evidence of New Zealand is supportive of the existence of economies of scale in the overall provision of roading services.[13]

It would be useful if the REG report defined what bundle of outputs (including the weights put on the various outputs) economies of scale apply to.

4.2.24 More significantly, the report notes only in passing at the end of the section that these results apply to new roads and there may be constant or even decreasing returns to scale in improvements to *existing* roads. Since New Zealand's road network is mature, most expenditures are currently on existing roads. If these expenditures are being priced efficiently, revenues should cover ongoing average and marginal costs. It would be useful to have some information on the gap between such a price and long-run marginal cost for new roads. Such a gap would presumably have implications for the optimal investment decision in respect of the timing of construction of new roads.

4.2.25 Nonetheless, the conclusions to section 3.6 appear to be unexceptional.

Charging for Roading Services

4.2.26 The material in the following paragraphs under this heading should be read in conjunction with our comments in section 3 above on the CRI report. In short, the material in the REG report only serves to heighten our concerns about the scope for policy confusion between efficient prices and cost recovery/cost allocation issues.

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12 Last sentence, top paragraph, page 23.

13 First sentence, last paragraph, page 23.

4.2.27 In section 4.2.4, page 29, the REG report states that:

> It is desirable on efficiency grounds to recover fixed costs through charges which have minimal impact on usage.

4.2.28 The assumptions behind this statement need to be spelt out since the more normal situation is to set price at marginal cost which is also average cost. This recoups fixed costs from the positive margin between price and average variable cost. There would be no use-invariant charge. User charges for seats in a cinema or on a plane illustrate the point – patrons do not pay a use-invariant fee. What is efficient depends on what constraints are being assumed to apply. Note that the REG report has found against economies of scale in respect of existing roads and that investments in new roads are subject to formal cost/benefit analysis including an explicit cost of capital.

4.2.29 In section 4.3.2 the REG report states that:

> There has been no explicit intention of recovering a return on capital from any of the charges considered above [i.e. fuel excise, RUCs, rates, vehicle registration, ACC, leaded petrol and network charges]. Instead expenditure on investments and improvements is funded out of current revenues and thus treated as an expense.
>
> It also states that:
>
> Any ... capital charge should ideally be levied in such a way that it impacts on long run decisions as to roading use but has minimal impact on short run decisions. If short run decisions as to individual journeys are affected by the price of fuel then, depending on the alternatives available, the fuel excise may not be an efficient way of recouping a capital charge.

4.2.30 This discussion raises far more questions than it answers. First, the issue for efficiency is the appropriateness of existing charges, not their explicit intentions. Second, nothing in the discussion about efficient pricing in section 2 of the REG report suggested that efficient prices would involve an explicit capital charge in respect of past network expenses. Third, it is common for capital expenditures to be funded in part out of retained profits (i.e. out of current revenue). It is correct, however, to note that it is uncommon for all investment to be funded from operating surpluses – except in a mature, non-growth, situation where capital expenditures are essentially replacement. But perhaps this is close to the case with respect to the road network? Fourth, interest expenses can be thought of as a capital charge – and are conventionally regarded as an expense and funded out of current revenue. Dividends can also be thought of as a component of a capital charge regime, and they are typically revenue-funded. Fifth, it is unclear what is being assumed here about increasing returns to scale – in the construction of the existing network (a sunk cost recovery issue raising questions of implicit contracts and optimal taxation), in the ongoing refurbishing of an existing network or in respect of network

enhancements. The NZIER report[14] provides an analysis in which economies of scale apply to initial road construction but in which marginal cost pricing for a seasoned road network would service all future costs at the current cost of capital. Sixth, if there is a concern about increasing returns to scale in new investment, what are the implications of what is being said for the appropriateness of the current cost/benefit calculus for new investments – which of course explicitly includes a required return on capital? Seventh, while we agree that reliance on fuel excise may be an inefficient way of recouping a capital charge, recouping a capital charge may be an optimal tax issue rather than a road pricing issue.

4.2.31 The lack of an explicit link between efficient pricing principles and the capital charge concept (thought of as a cost of capital applied to an administratively-assessed book value for the network) is a fundamental flaw in the REG report at this point. The absence of any discussion of this sort of capital charge concept in the discussion of efficient pricing in section 3 of the REG report was appropriate – and telling. While the REG report acknowledges in the last paragraph of page 30 the question as to whether a capital charge would be an efficient levy, it does not attempt to answer that question using any of the efficient pricing concepts it developed in section 3. There is a clear risk that a capital charge approach will introduce a control-oriented, backward-looking, rate-of-return-on-assessed-value approach to pricing rather than the forward-looking approach implicit in the efficient pricing discussion in section 3. The REG report neither recognises nor reconciles this fundamental difference in approach.

4.2.32 Owners or a chief executive might use a capital charge as an internal control device to improve the incentives of managers to use resources wisely. Market prices to end users would reflect the efficient pricing principles developed in section 3 of the REG report. Such prices would be determined in the marketplace independently of the firm's internal capital charge. The manager would report an accounting surplus or deficit to the chief executive – net of the capital charge (and of any other common costs allocated to the manager's operation). This internal report would improve the chief executive's information base and would provide a basis for discussing the adequacy of pricing policies, the validity of both the internal allocation of common costs and the capital charge (which raises valuation issues) and the opportunities for the manager to use fewer assets. This system might encourage a manager to relinquish resources which were not being used efficiently. However, management control and incentive systems should not be confused with efficient pricing principles.

4.2.33 Normally, pricing would be independent of the capital charge. The firm should raise prices if doing so would make it better off – regardless of whether or not the chief executive had imposed a capital charge for reporting purposes. Only in a price-controlled monopoly situation could a firm take the view that average revenues should be increased to cover average cost (inclusive of an internally-determined capital charge). In other situations it would not have the power to so raise prices. But, in the monopoly situation, the value of the assets and therefore the size of the capital charge might be indeterminate. Raising revenues to recoup a capital charge would increase the market value of the firm's assets – 'justifying' a higher subsequent capital charge if

[14] *Are Road User Charges Competitive?*, NZIER, November 1995.

such a charge is based on market value. This is why, even in a monopoly situation, a capital charge should not be used to determine efficient prices.

4.2.34 On page 11 the Summary Report states that "The current PAYGO, or pay as you go, method of funding capital road works is a form of short-run marginal cost-pricing". The basis for this observation is not clear. In fact current charges appear to cover current operating costs plus replacement capital spending plus the element used as general government revenue. It is not obvious why this level of charges should be regarded as short-run marginal cost pricing.

4.2.35 Section 4.4 of the REG report contains some useful material on alternative charging mechanisms. It prudently draws attention to the cost implications of current electronic tolling technologies and the possibility that they will be not be used to implement efficient prices because of political factors. None of its examples is drawn from North America where electronic billing systems are being installed apace when new highways are being constructed.

4.2.36 However, the REG report's review of international developments is curiously negative. *The Economist* of 22 June 1996, for example, puts a less negative emphasis on developments in Europe:

> Proper road pricing is different from tolls, which have long served as a means of financing road-building in the United States, France, Italy and some of the small European countries.
>
> However, Europe is inching towards full-blown road-pricing. For instance, a road-charging system is already in use in Norway's three main cities: Oslo, Bergen and Trondheim. Although these are still intended mainly to pay for road-building, charges at peak times are well above those at other times of the day, and drop to nothing at night when there is little traffic. The Trondheim toll ring is regarded as the most sophisticated in Europe. Cars are identified and charged by electronic devices along the roads into town that read a chip inside the windscreen. Video cameras record the traffic and pick up the registration numbers of cars without chips. Since the system has been installed, traffic has fallen by 5-6%, but most of the drop has been outside peak periods. Norwegian experts estimate that peak charges in, say, Oslo, would have to be four times off-peak rates to discourage worthwhile numbers of people from travelling in the rush hour.
>
> The Netherlands is planning to introduce road-pricing before 2000 on key routes in the heavily populated central Randstad area (a rectangle bounded by Amsterdam, Rotterdam, the Hague and Utrecht). The scheme, which will operate between six and ten o'clock in the morning, is intended to encourage car-pooling and travel outside the peak period. The Dutch are confident that congestion in peak hours will ease by one third. Drivers will be able to book a trip by phone and have the charge deducted from their bank account, or pay at a ticket machine with a smart card. Cameras will photograph one car in six and check that the numbers tally with those listed as having paid.

4.2.37 The key point in terms of efficient pricing principles is surely that these technologies have the potential to provide a superior pricing system to all the other approaches. For this reason, the introduction of these technologies is arguably a question of "when and where?" rather than "if". The report notes that electronic road tolling may currently be efficient on key corridors such as the Auckland Harbour Bridge and the Hutt motorway, but it does not provide any of the details underlying this judgment or comment on what is impeding implementation.

4.2.38 The report also notes that supplementary vehicle licensing exists on a nationwide basis and that there may be scope for local schemes such as Wellington's coupon parking scheme. However, it fails to note the apparent lack of active consideration of such schemes in Auckland and Wellington or to comment on possible impediments to the development of such instruments. For example, the Auckland Regional Council states on page 13 of its September 1995 *Auckland Regional Land Transport Strategy* that:

> Serious congestion is now being experienced in the major travel corridors in peak periods, and delays are increasing at many locations throughout the region.

4.2.39 However, the same document (e.g. page 70) has nothing to propose in respect of direct congestion pricing except to review the idea when the results of the LTPS are available. More light is thrown on the lack of progress towards more efficient pricing systems on pages 7 and 22 of its September 1995 *Annual Report on the Auckland Regional Land Transport Strategy* where the ARC comments as follows on the use of congestion pricing and economic instruments:

> The likely effects of increased charges for fuel use and parking, and of electronic road pricing or tolls as a means of charging for use of road space in congested corridors, have been studied using the Auckland Regional Transport Model. As there is no provision within the existing legislation to implement these measures only limited work is being done in this area. (Page 7.)
>
> No action has been taken to investigate the feasibility and likely effects of introducing special rating provisions for areas which benefit directly from major transport initiatives. (Page 22.)

4.2.40 Instead of focusing on the implementation of efficient pricing principles and the optimal provision of network capacity to cater for peak demand, Auckland is, worryingly, flirting with expensive alternatives such as light rail.[15] Policy developments in Wellington are arguably even worse from an efficient pricing and inter-modal neutrality perspective.[16]

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15 See for example, *The Independent*, page 27, 30 August 1996.

16 Refer for example to the NZBR's 20 June 1996 submission to the Wellington Regional Council's Proposed Annual Plan for 1996/97 and to the keynote address on *The New Zealand Transport Industry* which was presented to the Australasian Transport Research Forum Conference by Roger Kerr on 29 August 1996.

4.2.41 Difficulties in moving towards more efficient arrangements are not restricted to the cities, as is illustrated by the friction between the Forest Owners Association and various local authorities over what it sees as discriminatory local government roading policies.

4.2.42 In our view, policy makers in central government should be reacting with considerable concern to the above developments. The indications are that the constraints embodied in current arrangements are not providing anything like the incentives to price peak capacity properly and/or to build timely capacity to cater for peak demand as is the routine response in other key network industries such as electricity and telecommunications.

4.2.43 There must be serious doubts about road network operators' incentives under current arrangements to build capacity at the right time and to implement efficient billing arrangements in a timely manner. Publicly-controlled and regulated monopolies typically lack any strong incentive to price efficiently, or even to produce the information necessary to be able to do so.[17] This may have been less of a concern when rates of economic growth were low, but hopefully those days are behind us. The need to improve incentives to move optimally to new billing systems in the future and to invest in more commercially-oriented information systems may be much more urgent than the expenditure of further resources on issues to do with cost recovery.

Competition and Institutional Issues

4.2.44 This section acknowledges the potential benefits from private sector involvement in roading (see page 42). It rightly sees monopoly issues and the absence of a viable economic billing system as precluding an immediate move to private ownership of the network.

4.2.45 However, the REG report does see scope for greater private sector involvement in the management, design and operation of publicly-owned networks, suggesting franchising and shadow pricing as possibilities (Summary Report, page 15). Section 5.6.1 of the REG report usefully lists a number of public policy issues which would need to be addressed in this respect.

4.2.46 Section 5.5.3 on international experience is regrettably brief and dismissive. It gives the impression that the international experience indicates that there are no benefits from private funding and provision of roads, only detriments. In particular it finds that:

> ... overseas experience does not appear to provide any sensible models for involving the private sector in the funding and ownership of roading services (page 44); and

[17] "Public sector monopolisation may have stifled the incentive to develop exclusion technologies" (B Bouckaret, see Cowen, *op. cit.*, page 6).

> ... in keeping with the review of alternative charging mechanisms overseas experience does not appear to provide any sensible models for involving the private sector in the funding and ownership of roading services.[18]

4.2.47 However, New Zealand has also found it difficult to find sound overseas models for many other domestic initiatives such as privatisation of telecommunications and electricity, value-added taxes, income tax (particularly border tax issues) and many regulatory policies. The more relevant question is what lessons can be gleaned from modern economic thinking about how to find the best ownership, governance and regulatory arrangements.

4.2.48 What is required is a comparative institutional analysis which contrasts the problems under public ownership with those under (regulated) private ownership. The premise in the REG report[19] that public ownership is better than private ownership because governments overseas have both assisted and constrained private ownership is unwarranted. Government funding of all or part of the cost of providing a service does not generally require government provision of that service.

4.2.49 Section 5.6, pages 44-45 lists six bullet points in support of the proposition that "the analysis suggests efficient provision of roading by the private sector through tolling is unlikely." In brief, the six points are:

i) direct tolling is not currently efficient;

ii) to obtain extra funds for roading it would be more efficient to raise existing charges than to use the private sector;

iii) artificial encouragement of private provision may be more costly than public sector provision;

iv) private operators could monopoly price;

v) private operators should be charged for links into the wider network; and

vi) pricing and interconnect arrangements should reflect inter-modal spill-overs and network effects.

4.2.50 Brief comments on these points follow:

i) Private providers would use the most efficient of the funding mechanisms available to them. They would also have an incentive to invest in improving the efficiency of funding mechanisms. If tolling is not the most efficient option, they would use an alternative mechanism. What that might be would depend, *inter alia*, on their property rights.

ii) It is not clear why existing charges are more efficient than private loans or equity.

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18 The Report, page vii, third last paragraph.

19 See, for example, the third paragraph on page 43.

iii) In general, New Zealand's experience with corporatisation and privatisation demonstrates that costs and real charges can be reduced markedly compared with non-commercial, non-competitive public provision. It is not clear why there should be any 'artificial' encouragement to private sector road operators.

iv) Monopoly pricing is a potential problem under any ownership structure. Under public ownership there is a risk that prices and unit costs will be much too high. New Zealand's experience with state-owned trading enterprises prior to the State-Owned Enterprises Act suggests that the probability that unit costs will be excessive and exceed average cost is quite high. The experience following the SOE reforms suggests that real prices to users can be much lower than prices under uncorporatised public provision, while profits are much higher.

v) The interconnection issue arises in telecommunications because the initiating user gets a single bill for the call, the revenue from which must be divided between contributing suppliers according to interconnection rules. If users were instead billed independently by the owner of each piece of the network which the user had required, there would be no need for such revenue sharing agreements. It is not clear why the authors do not simply have in mind a system in which private road operators toll users of those roads directly while public sector operators do the same on their roads. There is an issue of refunds for those who are levied for public roads but who mainly use private roads, but this would suggest that private road operators, or the users of private roads, should be reimbursed rather than levied.[20] The argument for an interconnection fee levied on the private operator is far from clear.

vi) Inter-modal spill-over effects would be a factor which an unfettered market would take into account in discovering the optimal aggregation of ownership. Public ownership 'solves' the problem by aggregating ownership but may well fail to provide the incentives necessary to realise the potential network synergies. Under private ownership the aggregation issue is essentially a (monopoly) regulation issue. Again a comparative institutional approach is required, rather than a presumption that public ownership is better.

4.2.51 The lack of a comparative institutional analysis in this section of the REG report arguably biases it against private sector options in respect of funding and ownership. This may also have contributed to the lack of urgency in the REG report's muted consideration of the desirability of a much more commercial approach to public sector provision. None of the above is to argue against the REG report's more modest proposals in respect of private management, design and operation of roads, or its suggestions for an optimal regulatory regime.

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[20] Analogous issues are the taxes for public education levied on parents who send their children to private schools and the TV licence fees levied on those who mainly watch Sky TV. Here an argument that there should be a fee for 'interconnecting' to the competing state system would be novel.

4.3 Responses to the Questions for Discussion

4.3.1 As noted in paragraph 4.1.3, the REG report listed three questions for further discussion. This section attempts to summarise the REG report's answers to these questions and comments on these answers.

4.3.2 The REG report's answer to the first: "What good is roading?" is in essence that it is a public good. Section 4.1 above argues that this classification appears to be dubious and unhelpful. Many of the pricing issues which arise with a road network arise in other networks which are privately provided. A particular difficulty with the road network, from a commercial perspective, is the current reliance on coercive powers of taxation for funding – powers which would not normally be put in the hands of a private operator.

4.3.3 The REG report's answer to the second question: "What is the most efficient means of charging for roads?" appears to be some combination of current arrangements. The REG report is clear about why it rules out system-wide manual and electronic tolling at present, but is not clear on the impediments to its more limited use or the use of other approaches such as supplementary vehicle licensing, where congestion is a problem.

4.3.4 The REG report correctly notes, on page 50, a number of potential shortcomings in current charging arrangements, but does not set out a framework for determining if they are shortcomings in practice. Such a framework would, in principle, compare the welfare losses from alternative charging mechanisms taking incentives, elasticities, transaction costs and any externalities into account. In general, outsiders appear to have neither the incentive nor the information to accurately determine optimal charging arrangements. Transit New Zealand has better information than outsiders, but its information base is still limited. More fundamentally, Transit New Zealand does not have a strong incentive to invest in more commercial information systems, find the most efficient charging system, or energetically develop improved systems. Arguably, attention would be better focused on improving incentives than on trying to answer this question at a centralised level. This is not a criticism of the REG report.

4.3.5 The REG report's answer to the third question: "What is the appropriate role of the private sector?" is that there may be scope for greater involvement in management, design and operation of publicly-owned networks. Private operation could be based on shadow-tolling or franchise arrangements. Undoubtedly there is such scope.

4.3.6 On the other hand, the REG report sees little early scope for greater private involvement in funding and ownership. This is surely a matter of timing. Private involvement can be delayed by a failure to move sufficiently vigorously to improve incentives to invest in more commercial information systems and strategies. Conceivably, the ability of the government to obtain convincing answers to the pricing questions being asked is limited as long as the system remains under Crown control.

4.3.7 Arguably, as illustrated by the criticisms in section 4.2 above, the REG report has failed to provide an evenhanded analysis of the comparative advantages of public and private ownership. There are major issues to be addressed in the transition from a non-commercial, publicly-owned network to a commercial, optimally-

regulated privately-owned network, as discussed in the 1993 New Zealand Business Roundtable report. The costs of delay could be large.

4.4 Concluding Comments

4.4.1 Quite reasonably, the REG report's discussion in section 3 of efficient prices levied on users of the network made no mention of a capital charge approach based on applying a market-determined price of capital to an administratively-assessed value for the network. It was a surprise therefore that section 4.3.2 of the REG report introduced the concept of a capital charge without attempting to relate it in any way to efficient pricing principles. Indeed, as argued in paragraph 4.2.31 above, the lack of an explicit link between the capital charge concept and efficient pricing principles is a fundamental flaw in the REG report. This flaw is particularly concerning since the first report in the LTPS was based heavily on the presumption that the accounting-based capital charge approach was relevant to the pricing of network services.

4.4.2 Of course, efficient prices would be high enough to justify an expectation of the recovery of future capital costs, but this is very different from saying that they must be high enough to produce a return on past costs. However, the above discussion does not rule out any role whatsoever for capital charges. Capital charges may have a useful role to play as a management device but this is not an efficient pricing issue (see paragraph 4.2.6 above). It would be useful if the Ministry of Transport clarified its position – if economic efficiency is the objective in pricing road network services, as the introduction to section 3 in the REG report suggests, what is the relevance of the capital charge and how does it relate to Ramsey pricing?

4.4.3 In respect of the questions posed for respondents, the REG report does not provide the analysis or information necessary to attempt to answer the question about the most efficient means of charging for roads. The statement that consideration of the efficient distribution of charges across road users and instruments was beyond the scope of the report was a surprise.

4.4.4 The REG report's focus on the potential deficiencies of private ownership of the roads is not balanced by a comparable discussion of the deficiencies of public ownership, or of possibilities of improving incentives under public ownership.

5.0 Environmental Externalities

5.1 Introduction

5.1.1 The proposed treatment of environmental externalities was mentioned in the REG's report discussed in section 4 above.

5.1.2 The calculation of environmental externalities is examined at much greater length in the further LTPS report: *Environmental Externalities*. *Environmental Externalities* attempts to quantify the 'annual social costs' for four major areas in which the road transport network affects the environment: noise pollution; air quality; greenhouse gases and water quality. The estimates are based on a range of methodologies and are presented as a 'rough guide' only of the scale of environmental effects.

5.2 Commentary

5.2.1 As discussed in section 4 above, economic analysis recognises the possibility of undesirable third-party effects arising where the costs and benefits of transactions are not fully borne or captured by the parties to the exchange. Externalities are different from the mispricing which occurs when a buyer gets something from the seller at a price which does not accurately reflect the seller's costs. With such mispricing there is no third-party effect.

5.2.2 The discussion documents suggest that in relation to environmental externalities "users should be charged according to the costs they impose on the roading system and the benefits they derive". However, from an efficiency point of view, the key issue is not to ensure that users pay for the full costs and benefits they derive but rather that *at the margin* they face the full cost of their decisions (within the constraints of transaction costs). If there is a revenue target that would not otherwise be met through efficient pricing, prices will need to be set above marginal cost in a way that minimises distortions to decision making.

5.2.3 The reports promote the concept of 'internalising' externalities and provide estimates of the external costs of road use. The implication of the reports is that road providers or users should pay for the external environmental costs that they impose on others. However, this assumes that 'others' have a property right to a clean environment and road users must compensate them (or the government) when they infringe on this property right. However, an alternative allocation of rights is also possible. Road users could instead be assumed to have the right to emit pollution and make noise. Non-road users or the government could then pay road users to reduce pollution and noise. In the absence of transaction costs, if users and non-users could negotiate to pay to increase or reduce pollution, the same quality of air or level of noise would be achieved irrespective of the initial allocation of property rights. The outcome would be determined by the relative value of clean air and quietness to non-road users versus the value of the right to pollute to the road users.[21] Whatever the initial allocation of

[21] The initial allocation of rights would affect income distribution, and may therefore have second-order effects on resource allocation.

property rights, at the margin, road users and third parties would face the marginal costs of decisions to increase or reduce pollution (both parties would have incentives to trade off more versus less pollution). A zero level of pollution would generally not be the optimal outcome and there should be no presumption that it is efficient for road users to bear all the costs of pollution calculated in the report.

5.2.4 The discussion in the previous paragraph assumed transaction costs were zero. However, transaction costs may prevent negotiation of the optimal level of pollution. In this situation, welfare may be improved by assigning the property right to the party that values it most highly. Transaction cost considerations may therefore affect whether road users should be assigned a right to pollute or third parties should be granted a right to a clean environment.

5.2.5 Thus, from an efficiency point of view, the issue of who bears the costs of reducing noise, pollution etc., is at first blush irrelevant. What is relevant is the incentive to reduce levels at the margin, whether through tax or subsidy or some other means. The case for allocating all the burden to road users needs to be examined.

5.2.6 In considering whether intervention is justified on the basis of externalities it is important also to consider the following points:

- from a public policy perspective, external effects cause potential welfare losses only if there are alternative arrangements that reduce/overcome the transaction costs preventing value-adding transactions. Otherwise, the potential losses may be relative to an unattainable ideal situation rather than to an achievable alternative i.e. they may be academic;

- those who assert that externalities represent a deviation from achievable optimality are asserting they have superior information[22] and/or a superior ability to act. However, governments do not necessarily have a role in intervening in situations of imperfect information. They may face the same, if not more severe, information limitations and may also be subject to flawed incentives;

- since imperfect information abounds, external effects can commonly be 'found' everywhere. But this does not mean that markets are failing to optimise. To remove an externality might require superior information to that which can be possessed by any entity; and

- if there are grounds for concluding that third-party effects exist, the question then is whether there is some form of government intervention - taxes, subsidies, regulation or clarification of property rights - capable of achieving greater benefits, having regard to the costs of intervening.

5.2.7 The report notes that there are a number of possible mechanisms that could be used to 'internalise' externalities but it does not discuss the relative merits of different approaches in any detail.

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22 Dalham *op. cit.* Page 220.

5.2.8 It describes the New Zealand regulatory regime which controls environmental effects in New Zealand but offers little comment on whether or not the regime provides an efficient framework for dealing with environmental issues.

5.2.9 The report examines a variety of methods for estimating the social costs associated with the provision and use of roads. It acknowledges that the estimates of environmental externalities are extremely approximate at best. We do not attempt here to assess the methodologies adopted for calculating social cost. We do suggest that these methodologies should be assessed by competent academic referees. However, the following general comments may be helpful:

- the paper considers only negative environmental externalities. Any sound public policy analysis should consider all externalities. For example, enhancements to the roading network may raise the value of properties owned by unrelated parties. The magnitude of this effect may be substantial in some cases;

- petrol is already heavily taxed as a proxy for road use. Thus, the externalities associated with discharging pollutants to the atmosphere may already be reflected in the price of fuel;

- direct regulation of some harmful constituents in fuel may be more efficient than attempting to price or tax such components;

- the assumption that global warming would impose net costs on New Zealand is controversial;

- where an environmental problem is created by a number of parties including road users, it may not be efficient to target road users alone. The optimal level of pollution may be achieved at lower cost if all emitters are targeted and not just vehicle users; and

- many of the environmental effects discussed are very site specific. For example, the 'nuisance' impact of noise occurs only on particular parts of the system where houses and buildings are close to the road. An increase in charges to everyone would result in an insufficient reduction in road use in some areas and too much in others. Any regime for trading off the interests of road users and others needs to carefully consider the issue of effective targeting of the affected parties.

5.2.10 We remain concerned that although the paper recognises the case for inter-modal neutrality, the focus on estimating all conceivable costs associated with roads creates a risk that this need might be overlooked.

6.0 Safety Externalities

6.1 Introduction

6.1.1 This section comments on the Ministry of Transport's May 1996 report: *Safety Externalities* (the safety report). This is the last report in the LTPS series.

6.1.2 Direct road safety-related expenditures totalled $550 million in 1994/95. ACC payouts totalled $282 million and expenditures on policing roads totalled $131 million. The safety report suggests that the total social cost of road crashes in New Zealand was approximately $3.4 billion in 1994.

6.1.3 The report provides the following indicative statistics:

- a recent OECD study assumed that 30 percent of all crash costs are externalities. Applying this percentage to New Zealand would produce an annual externality cost of $1 billion per annum;
- very few road accidents in New Zealand are due to factors outside the control of road users – perhaps only 3 percent of accident costs ($100 million per annum) are due to such accidents;
- risky behaviour, the costs of which fall on the parties concerned, accounts for about 72 percent of all crash costs (about $2,430 million p.a.). If all drivers observed the road code, the risks of an accident would be low; and
- about 25 percent ($750 million p.a.) of the social costs of road accidents are suffered by road users not at fault. Property-related damages are recoverable from the driver who caused the accident. Insurance covers some of the costs of injury to persons.

6.2 Commentary

6.2.1 The report notes that reported fatalities and casualties have fallen absolutely from peak levels in the 1970s, despite increasing traffic volumes. A chart in the report indicates that the fatality rate has fallen 50 percent and the rate of reported injuries has fallen 60 percent since 1967. This suggests that factors other than road user charges have a significant effect on safety.

6.2.2 The safety report draws a distinction between resource costs and the costs of externalities, defining a third concept "external costs" to be the sum of the two. The costs of externalities are defined in a conventional manner. Resource costs are defined as the transaction costs associated with defining and enforcing property rights. The costs of enforcing the road code, providing standby emergency and medical services and insurance policy excesses are given as examples of resource costs. Social costs are defined as the sum of private costs and external costs. Private costs are not included in the glossary of terms and conditions but appear to be defined (on

pages 6 and 7 of the safety report) as direct private costs inclusive of amounts collected from drivers in the form of insurance premiums, petrol excise and vehicle registration fees.

6.2.3 The resource cost discussion is confusing. Social costs, as defined, include double counting if resource costs are funded from levies on users which are included in private costs. In any case, the costs of policing and of providing standby emergency and medical services are common costs from the perspective of the road system as a whole. If they are recouped from road users in the same way as other common network costs, it is not clear why they are treated as external costs rather than as private costs.

6.2.4 The body of the report argues that accident costs are largely internalised because existing arrangements such as the ACC and mechanisms for redress through the courts or private insurance essentially internalise them. On the other hand, it argues that some people drive more defensively because of the risks which arise from the actions of those who break the road code. Those who break the road code do not transact with those who feel obliged to drive defensively, so that there is an *ex ante* externality after all.

6.2.5 A dissenting view in an appendix to the report argues, in our view correctly, that there is an externality as long as drivers who break the road code do not bear the full (marginal) costs of their risky behaviour either before the event (e.g. by way of a higher insurance premium) or after the event (e.g. by being liable for all damages). Clearly unlawful and risky drivers do not bear the full (marginal) costs of their decisions. First, ACC premiums are not related to driver-specific risks. Second, New Zealand's no-fault system is not conducive to ensuring that risky drivers bear the full cost after the event. Third, they may simply be uninsured and lack the resources to pay.

6.2.6 We therefore concur with the dissenting view that a safety externality will exist, in part because of deficiencies in New Zealand insurance and tort law arrangements. It is a puzzle as to how the main body of the report could come to a different conclusion.

6.2.7 We do not have a particular opinion about the likely magnitude of the external effect but note that it is the external social cost at the margin which counts in designing the optimal policy response rather than the average social cost of the externality.

6.2.8 We also concur with the view that raising road use charges for all users is likely to be a very inefficient way of trying to shift the external costs on to those road users who break the road code and put other motorists at risk.

6.2.9 More efficient approaches are likely to be found in improved policing arrangements in regard to safety and in improving New Zealand's accident insurance and tort law arrangements.

6.2.10 In respect of improved policy arrangements, we still favour the approach suggested in the 1993 NZBR report of making the road infrastructure provider fully responsible for all aspects of road safety, except for

regulating providers. Transit New Zealand, for example, would be responsible for writing contracts with the police for the provision of safety services and with the monitoring and enforcement of those contracts.

6.2.11 In respect of tort arrangements, Professor Richard Epstein[23] has suggested that strict liability may be an efficient arrangement in stranger-with-stranger situations. Road accidents are of this type.

6.2.12 In respect of insurance arrangements, a key problem is that the ACC is a monopoly insurer which has little incentive to price policies accurately.

7.0 National Traffic Database

7.1 Commentary

7.1.1 This database provides information on average daily traffic volumes, by vehicle type, for almost every public road in New Zealand. It contains information on 120,000 road links, classified by road use category (eleven fields), type of road (two fields) and type of vehicle (15 classes). Traffic composition surveys of approximately 450 road links have also been used to generate a database on the distribution of vehicles across road links. Weight data have been used to infer a distribution by weight.

7.1.2 The database indicates that:

- in 1994, road users clocked up approximately 32 billion vehicle kilometres on New Zealand public roads;
- travel on state highways accounted for 44 percent of total travel, although state highways account for only 11 percent of the length of the road network;
- only 3 percent of total travel is on unsealed roads, although these roads represent 40 percent of the length of the road network;
- commercial vehicles (trucks, buses and light commercials) make up 15 percent of distance travelled along state highways and about 12 percent of distance travelled on local roads;
- about 51 percent of revenue is attributable to travel along state highways, but this is $23 million less than expenditure on state highways.

7.1.3 The database allows a detailed comparison of travel-related revenue and expenditure to be made by road link. The information in the survey data indicates that heavier vehicle traffic densities and average observed weights are too small to explain revenue from road user charges. These densities have therefore been somewhat arbitrarily scaled up to produce results which are consistent with observed revenues. An alternative

[23] Richard A. Epstein, *Cases and Materials on Torts*, Little, Brown and Company, New York, 1995.

approach would have been to assume that licences are bought on average to reflect the peak expected load of a vehicle during 1,000 km of travel rather than its average surveyed load.

7.1.4 The need for the scaling which occurred is a concern and is, we understand, a point of discussion amongst those with expertise in this area. Pending further developments, we merely note that there is a large and disturbing gap between surveyed densities for heavier vehicles and the densities which have been loaded into the National Traffic Database.

Appendix

The Cost of Capital, Efficient Prices and Asset Value

A.1 Marginal Cost Pricing and the Required Return on Capital

A.1.1 In private markets, efficient prices reflect forward-looking costs, including the opportunity cost of future investments. The starting point for discussions about efficient pricing is the proposition that prices should equal marginal cost so that the marginal buyer only consumes an additional unit if the value derived is at least equal to the cost to the community of the resources going into the production of that unit.

A.1.2 When economists talk about the efficiency of pricing according to marginal cost, they define marginal cost to include the cost of capital. Recovery of marginal cost would therefore allow the recovery of all marginal operating costs, including repairs and maintenance, plus economic depreciation (defined as the change in the value of the asset through time) plus a normal profit margin.

A.1.3 The basic concept that prices should, *ex ante*, be high enough to allow current and future revenue to cover avoidable future costs including a required return on capital is therefore entirely orthodox. The cost-benefit analyses of road expenditure proposals already accommodate the requirement to take the cost of capital into account in expenditure decisions. Signals to road users of rising future costs are conveyed through rising congestion until the cost-benefit analyses determine that the construction of additional capacity is justified.

A.1.4 Unless provided for in an earlier contract, average incurred (i.e. historic) cost is not a relevant benchmark for efficient pricing. Where current marginal cost is different from average incurred cost, competition will tend to force prices to track marginal cost rather than average incurred cost. Pricing at marginal cost is not the same as pricing at average cost. Only where demand for a network's services cuts the average cost curve exactly at its minimum would pricing at marginal cost be the same as pricing at average cost. If the minimum does not exist, because of increasing returns to scale in the relevant range for demand, marginal cost would always be less than average cost. Marginal cost pricing would then always be inconsistent with average cost pricing.

A.1.5 Where, as in network industries, economies of scale are such that there is room for only one network of an economic size, it would be a remarkable coincidence if marginal cost were equal to average cost. This could only occur if demand, (which depends on tastes, incomes, road user charges, prices for substitute commodities and other factors) happened to cut the average cost curve (which is determined largely by unrelated unit costs of producer inputs and available technologies) at minimum average cost.[24] Therefore, in such an industry it is likely

[24] In industries in which there are no economies of scale, competition will tend to force prices down to

that pricing at marginal cost would, in the absence of multi-tier pricing, lead to supernormal or subnormal returns on the original investment in the network.

A.1.6 For this reason, if a network's services are faithfully priced at marginal cost, the achieved operating rate of return calculated in relation to the net incurred (carrying) cost, or the depreciated replacement cost, of the network could depart markedly from the opportunity cost of capital – even if usage rates were exactly as planned.

A.1.7 Where price differs from average cost, the market value of the asset will differ from an average-cost-based book value. Such differences are readily observed in listed companies where substantial and volatile deviations between the book value of the firm and its market value are common.

A.1.8 The market value of the firm will tend to be the higher of the expected present discounted value of future cash flows accruing to investors in the firm and the value which could be derived from the asset in an alternative use. The value of a road network in an alternative use could be very low. The market's required 'capital charge' would be given by the product of the required market rate of return and the market value of the asset. This charge is the opportunity cost of continuing to hold an investment of that market value. Net cash flows plus capital gains or losses must be adequate in relation to this required return. Where the book value of the assets differs from the market value, the product of the book value and the required return will not indicate the correct amount for the opportunity cost of capital invested.

A.2 Departures from Marginal Cost Pricing

A.2.1 There are many reasons why efficient price structures might depart from marginal cost for roads as for other commodities. The dominant current reason is the absence of a conventional billing system and the reliance instead on user-taxes and charges to raise funds and (imperfectly) align incentives. Other potential reasons include:

- recourse to two-tier pricing (e.g. an access charge plus a use charge). This can potentially overcome the disincentive to investment which is possible where marginal cost is below average cost for an investment of economic size;

- long-term contracts or institutional arrangements protecting the incumbent's ability to recoup past costs (e.g. by average cost pricing) may be efficient – even if, after the network is installed, they look *ex post* inefficient because prices are above contemporaneous marginal cost;

- common and joint costs provide an additional reason why forward-looking efficient prices in the marketplace might differ from marginal cost; and

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minimum average cost, so the number of firms in the industry may be simply determined by total demand divided by the amount which can be economically produced by any one firm when the price is equal to minimum average cost.

- the incumbent's incentive to provide users with more rather than less predictable prices, and to communicate future resource scarcity accurately to those making sunk-cost investment decisions, may also foster greater stability in product prices than would be warranted if prices were to closely track changes in short-run marginal cost through time.

A.3 Tax-Funding of Roads

A.3.1 The discussion to this point has presumed the existence of full user-pays charges for the marginal unit of service. Such a billing system does not currently exist for roads. Instead road users fund the roads variously through excise duties, registration fees, petrol duty and road user charges. (Central government retains for general expenditure purposes some of the revenues so derived. This could have the effect of reducing central government taxes and raising local government rates.)

A.3.2 Current charging systems take no account of variations in the marginal cost of road network services from one period to another or from one location to another. They do, however, permit crude differentiation of charges between vehicle types. As a technique for confronting road users with network costs, the various imposts must be interpreted as a system-wide averaging of costs across time, locations and vehicle types. The question arises as to what would be the most efficient balance in setting petrol duties and road user charges between the options of short-run marginal costs, long-run marginal costs and average costs.

A.3.3 Obviously there needs to be a balance. It would surely not be efficient to set petrol duties and road user charges across the country equal to the highest marginal cost in the network. Since this marginal cost would incorporate the cost of expanding capacity, or putting in a bridge or tunnel, it would vastly exceed the short-run marginal cost of catering for an extra vehicle in most parts of the network where capacity is more than adequate most of the time.

A.3.4 Conversely, setting duties and charges at short-run marginal cost would put greater reliance on congestion as a rationing mechanism in sections of the network in which capacity was limited relative to demand. (Other personal expenses aside, the shadow price of a trip to users would then be the sum of trip-dependent government duties and charges and the shadow price of congestion-augmented travelling time.)

A.3.5 Given the costs of additional road capacity, the network operator's marginal cost, at the few locations at which peak-time congestion occurs, exceeds short-run marginal cost. In these locations at these times, confronting uses with a shadow price for a trip which is higher than the price embodied in trip-dependent government duties and charges may be welfare-enhancing. As congestion increases, however, the shadow price for a trip may increase to such a degree that it would become welfare-enhancing, in national cost-benefit terms, for the network operator to increase capacity in that location to ease the congestion. In principle, cost-benefit procedures for evaluating road expenditures will identify these occasions.

A.3.6 Like all queuing systems, congestion is an inconvenient means of rationing access to a scarce resource. Road users are sufficiently powerful politically to cause politicians considerable inconvenience as road congestion becomes a problem. Political pressures create a risk that the rise in congestion will force a premature (i.e. uneconomic) increase in the capacity of the network or in the capacity of competing services.

A.3.7 Of course, it may not be optimal to rely on congestion alone to supplement direct user charges based on a fuel tax and road user charges. For example, it may be economic to introduce peak-time charges through windscreen stickers supplemented by toll booths for those who do not have stickers. More problematically, it might be efficient, in principle, for the government to tax non-motorist commuters when the marginal cost to the network operator of another trip by a motorist is below the use-related duty or charge and to subsidise them in the contrary situation. Of course, competing transport network operators which do not have full pricing flexibility might look at the situation symmetrically and argue for taxes on road users when their own network has excess capacity in return for subsidies for road users when their own systems are facing capacity constraints.

A.3.8 The above discussion suggests that road user duties and charges for the network as a whole might be set so as to balance the efficiency losses from inadequate use of much network capacity (presuming fees are above marginal cost for much of the network) against the efficiency losses which result because marginal costs exceed these fees in some periods in particular parts of the network.

A.3.9 Two-tier charges – a charge for access and a charge for usage – may better align incentives than sole reliance on use-related charges where it is desired to fund network costs entirely from road users and average use-related fees are below average cost. The optimal balance between the charge for use and the charge for access is found where, for a given increase in revenue, the efficiency losses from losing users who would refuse to pay a higher access charge are balanced by the efficiency losses which would occur if use-related charges were raised. Note that, compared with peak-time pricing, using congestion to ration demand deprives the supplier of some of the cash flows required to fund an expansion of network capacity. Rationing by congestion thereby aggravates the network provider's potential funding problem.

A.4 The Optimal Investment Decision

A.4.1 Pricing roads so as to achieve a capital-charge-inclusive required return on book value, or incurred capital cost, would not in general give the correct signal to road users about the marginal cost of an extra trip. Nor would it necessarily be compatible with current cost-benefit procedures which aim to relate marginal social benefit to marginal social cost. Additional investments are only made at the margin if the expected additional net benefits are zero or positive in present value terms.

A.5 Implicit or Explicit Contract Considerations

A.5.1 A case might be made for basing current and future prices on past rather than future costs if those past costs would never have been incurred without an implicit or explicit assurance that future prices would reflect past costs, regardless of future marginal cost. For example, if the marginal cost and net present value of a contemplated investment were positive, but the investment would be of a size which would permit future marginal cost to be much lower for a prolonged period, the investment might not occur unless the users found some means of assuring the investor a greater return on the investment than could be expected from future marginal cost pricing. This is an issue of risk sharing.

A.5.2 Implicit or explicit price (or tax) arrangements might occur in such cases which warrant a continuing departure from the benchmark marginal cost pricing case. Such arrangements tie future pricing policies to past investments to a degree which unfettered efficiency considerations, or open competition, might otherwise not permit.

A.5.3 However, the CRI report makes no reference to forward-looking network infrastructure costs and does not make a case that there are explicit or implicit understandings with road users in respect of the recovery of past infrastructure costs. It does not, therefore, establish the relevance of an estimate of the depreciated replacement cost of the network to the efficient pricing of network services.

A.6 Economic Depreciation

A.6.1 The CRI report's use of this term is loose, as it appears to acknowledge. Normally repairs and maintenance expenditures and economic depreciation would be deducted from revenues in calculating an operating balance.

A.6.2 In an accrual accounting framework it would be correct to include deferred maintenance with actual maintenance in calculating the total maintenance charge. However, in economic terms this should not be confused with economic depreciation.

A.6.3 Economic depreciation is the change in the value of the asset which occurs as a result of relative price changes. A depreciating asset is one for which the relative price is dropping even if it is being maintained in a pristine, brand-new condition.

A.6.4 Some assets are expected to rise in price through time (such as land values). While the gains might be thought of as negative economic depreciation, the change is conventionally thought of as a capital gain, the expectation of which is built into required returns and which allows for a lower required operating balance than would be the case without the expected capital gains.

A.6.5 Capital gains or losses can arise from economic depreciation or appreciation. Roads can depreciate or appreciate in value (even if no maintenance is deferred) because supply and demand is continually changing due to such factors as changing incomes and spending patterns, competition from other modes (sea, air and rail, telephone, facsimile, email and post), changing location decisions of residents and tourists and improvements in vehicle design and road-building technologies. In the short run, unexpectedly strong growth in traffic volumes could cause the asset value to rise.