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State Highway Investment in New Zealand
the decline and fall of economic efficiency

A decade ago, the benefit-cost ratio (BCR) – the economic measure of efficiency in investment spending – was the most important criterion used by the predecessors of the New Zealand Transport Agency (NZTA) to determine which land transport projects to fund. However, from 2003 there was a gradual shift away from a reliance on the BCR, and since 2009 it has been only one of three criteria used. In this article I examine how this change has come about, and demonstrate that it has resulted in the funding of a mix of state highway projects that is far from being economically efficient. Average BCRs have dropped so much that the estimated benefit from the allocated funding is far smaller than it would have been had the reliance on the BCR been retained.

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This issue is an important one. The NZTA is responsible for spending about $3 billion each year on land transport projects. Recently, about half of the funding has been allocated for the maintenance, improvement and building of state highways.[1] Over the next ten years the funding is projected to increase,[2] with a substantial proportion of this larger amount to be devoted to the government's roads of national significance programme. The NZTA's approach to project selection is therefore of great importance, both in determining the economic efficiency of its funding of road infrastructure investments, and for the impact on the wider economy.

The article is organised as follows. The first section looks briefly at the institutional and statutory background. This is followed by a brief description of how social cost-benefit analysis is used to evaluate investments in road improvement projects. Section three reviews the recent pattern of spending of the NZTA on state highway projects, and shows that the average BCR generated has declined sharply. Section four shows that changes in the NZTA's decision criteria are responsible. The impact of

these changes on economic efficiency is then considered. The final section considers the implications for the NZTA's investment in the roads of national significance programme.

Institutional and statutory background

There were two principal forerunners of the NZTA: Transfund New Zealand, which funded land transport infrastructure services; and Transit New Zealand, which provided these services. This separation aimed to avoid the potential for a conflict of interest from having both roles performed by a single organisation.

Transfund's objective was to 'allocate resources to achieve a safe and efficient roading system' (Heggie, 1999, pp.5-7). The government set the charges that determined the inflow of funds to the road fund, but only Transfund could determine how the funds were spent. The National Roading Programme was built up from bids submitted by Transit New Zealand for state highways and by local territorial authorities for local roads. The bids were subjected to checks on the reasonableness of their supporting BCR calculations, and then projects were ranked. Maintenance projects were given the highest priority, with other projects being ranked in order until the available funds were exhausted. Given limits in the funding relative to project demand, a cut-off BCR of four was set by Transfund for projects to be accepted.

Recent changes in the approach started with the introduction of the Land Transport Management Act 2003 (LTMA). This act widened the range of objectives to be considered in assessing a proposed land transport project for funding. The aim was to achieve an affordable, integrated, safe, responsive and sustainable land transport system.[3] In 2004 this led the NZTA to add two additional criteria to the 'economic efficiency' factor, namely 'seriousness and urgency' and 'effectiveness', a change which was justified as follows:

> Before the current assessment framework was introduced in 2004, the government's transport funding agency used economic efficiency measures as the primary tool for prioritising projects. The addition of the two other assessment factors was designed to gain more information about an activity and to reflect the multiple objectives for transport investment introduced with the LTMA 2003. (Ministry of Transport/ NZTA/Local Government New Zealand, 2008, p.56)

Later, the 2008 amendment to the LTMA merged the former 'funder' and 'provider' agencies to form the NZTA,[4] and introduced the requirement that the NZTA must ensure that the National Land Transport Programme 'gives effect to the GPS', the new government policy statement on land transport. The GPS, to be issued every three years, is intended to 'guide the Agency and land transport sector on the outcomes and objectives, and the short- to medium-term impacts, that the Crown wishes to achieve'. Since 2009 the government, through the minister of transport, has had a strong influence over the NZTA's activities by setting high-level funding and investment priorities.

Under the NZTA's internal procedures, a minimum requirement for a project to be funded is that it has a [benefit-cost ratio] of at least one.

Cost-benefit analysis of road projects

Like its counterparts overseas, the NZTA uses social cost-benefit analysis (SCBA) to assess the impact on economic efficiency of investment projects. It has developed an *Economic Evaluation Manual* (EEM) (NZTA, 2010), and requires that projects to be funded from the national land transport fund and costing more than $250,000 must be subject to an SCBA using the framework in the EEM.

In brief, an SCBA estimates the annual streams of future costs and benefits that would flow from a road improvement (or other land transport) investment project, compared to a 'do-minimum' counterfactual of what would happen without the project, thereby allowing an assessment of its economic efficiency. The costs of a road project typically include design, property acquisition, construction, and annual operating and maintenance. Some other social costs, such as possible adverse impacts on noise and pollution levels, are typically not included, although in principle they should be. The benefits from road investment projects usually include travel time savings, travel time reliability, vehicle operating cost savings, avoidance of accident costs and savings in vehicle emissions. Travel time savings usually make up around three-quarters of the benefits. An 8% real rate (a relatively high rate by international standards), as prescribed by the Treasury (2008, p.3) for infrastructure projects, is used to discount costs and benefits to their present values (PVs).

The BCR is the efficiency criterion used by the NZTA to assist it in determining which land transport projects to undertake, and which to delay or discard (NZTA, 2010, p.1.2). The BCR is the ratio of the present values of the benefits to the costs. The use of the BCR (rather than alternative measures, such as the net present value (NPV)) reflects the funding constraint under which the NZTA operates. Maximising economic efficiency means extracting the maximum benefit from the limited budget, and this, basically, is accomplished by ranking projects according to their BCRs and accepting those with the highest BCRs until the funding is exhausted.[5]

Under the NZTA's internal procedures, a minimum requirement for a project to be funded is that it has a BCR of at least one. However, this stance should be (but in practice is not) subject to the qualification concerning opportunity cost. If an agency like the NZTA is capital-constrained, so that alternative uses of the funds exist, and the agency seeks to maximise economic efficiency (as arguably it should), then a BCR exceeding

Table 1: Breakdown of costs of approved state highway projects by BCR

1(a)

BCR	2005/06	2006/07	2007/08	2008/09	2009/10
High	$88,037,900	$273,010,700	$507,159,600	$94,495,300	$21,248,200
Medium	$78,682,200	$205,620,700	$49,155,000	$841,507,200	$206,089,468
Low	$0	$37,169,100	$104,221,800	$391,738,000	$484,421,500
TOTAL	$166,720,100	$515,800,500	$660,536,400	$1,327,740,500	$711,759,168

1(b)

BCR	2005/06	2006/07	2007/08	2008/09	2009/10
High	53%	53%	77%	7%	3%
Medium	47%	40%	7%	63%	29%
Low	0%	7%	16%	30%	68%
TOTAL	100%	100%	100%	100%	100%

1(c)

	2005/06	2006/07	2007/08	2008/09	2009/10
Weighted average BCRs	4.06	3.96	4.30	2.69	2.04
		4.14		2.46	

one is a necessary, but not a sufficient, condition for the acceptance of a project on economic efficiency grounds. I return to this important point later.

Recent patterns of spending on state highways

The BCRs achieved on state highway projects funded by the NZTA are presented in Table 1.[6] Table 1(a) shows the total spending, and Table 1(b) its percentage breakdown, for the years 2005/06 to 2009/10, between the NZTA's three BCR size classes: 'low', 'medium' and 'high'. 'Low' is 1 to less than 2; 'medium' is 2 to less than 4; and 'high' is 4 or more (NZTA, [2012], p.14). Table 1(b) indicates that over the period, the proportion of spending on projects with low BCRs has increased sharply, with a corresponding fall in projects with medium and high BCRs.

The weighted average BCR for each year is shown in Table 1(c), assuming that the weighted average BCRs in each of the size classes were the midpoint values of 1.5 and 3 for the low and medium classes respectively, and 5 for the open-ended high size class. The weighted average BCR for 2005/06 was 4.06, indicating that each dollar approved for spending in that year was anticipated to generate $4.06 in benefits (in present value terms). Similar weighted average BCRs were achieved in 2006/07 (3.96) and 2007/08 (4.30). The weighted average for this three-year period was 4.14. However, in the subsequent two years the weighted average BCRs declined sharply to 2.69 in 2008/09, and to 2.04 in 2009/10, as the proportion of spending on low BCR projects increased. In the latter two years the return per dollar of spending almost halved.

NZTA'S project selection criteria

The shift towards favouring projects with low BCRs was not a random event, but reflected a change in the NZTA's project selection criteria. When one of its senior managers was asked, 'Please explain why the proportion of "low" BCR spending has increased so greatly in recent years', he responded:

> The passing of the Land Transport Management Act (LTMA) in 2003 signalled a change to the way land transport projects could be assessed and prioritised for funding. As this change evolved, the benefit to cost ratio (BCR) ceased to be the NZTA's sole method of assessment and prioritisation, but became a contributor to an assessment methodology, which now includes 'strategic fit' and 'effectiveness' as project attributes contributing to project prioritisation. Hence the composition of the BCR graph has changed in recent years to reflect the approval of projects with these other attributes.[7]

The NZTA's new approach to project selection, in which 'strategic fit' and 'effectiveness' were added to the traditional 'efficiency' criterion based on the BCR, came into effect in July 2009 with its first Investment and Revenue Strategy (IRS).[8] The IRS provides 'the tool we use to ensure our investment decisions give effect to the GPS 2012' (NZTA, [2012], p.2). Every proposed project is rated on each criterion as being either 'high' (H), 'medium' (M) or 'low' (L). These ratings are combined to form an 'assessment profile' which is used to prioritise the project. For example, a project having high 'strategic fit', high 'effectiveness' and low 'efficiency' would be H, H, L, giving it the third-highest ranking out of 11 (H, H, H being the highest and L, L, L being the lowest).[9]

Under the new assessment profile approach, a project rated low on efficiency can be preferred over another with a high efficiency rating if it rates more highly on strategic fit and/or effectiveness. As a consequence, the selected portfolio of projects can generate an aggregate economic efficiency improvement (a weighted-average BCR) that falls well short of the optimal level, as Table 1 shows. An important question, then, is what benefits are produced by strategic fit and effectiveness, such that these can trump efficiency.

The three criteria are defined in the IRS. Firstly, to receive a high rating for strategic fit a project must:

- be a 'road of national significance'; and/or
- have the 'potential for a nationally significant contribution to economic growth and productivity … through significant improvements in *one or more* of: journey time reliability; easing of severe congestion in major urban areas; relieving capacity constraints; more efficient freight

supply chains; or a secure and resilient transport network'; and/or

- have the 'potential to significantly reduce the actual crash risk involving deaths and serious injuries in accordance with the Safer Journeys strategy'. (NZTA, [2012], p.6) [10]

The wording suggests that the satisfaction of any one of these attributes can be sufficient for a high strategic fit rating. For example, a project being part of a 'road of national significance' would appear to be sufficient, even though this GPS-based designation seems to reflect no more than a government decision to give priority to a certain road. Similarly, the judgement that a project would significantly improve journey time reliability would seem to guarantee a high rating, yet this factor is typically a small component of the benefits of a road project, usually amounting to only about 5% of the travel time savings.

In short, the attributes listed above appear largely to restate, and hence to double-count, certain benefits that are already included in the BCR. More insidiously, the criteria allow one benefit to give rise to a high strategic fit rating, even when the sum of all of the costs and benefits, as encapsulated in the BCR, may lead to a low efficiency rating. In effect, strategic fit means whatever the NZTA wants it to mean, however economically irrational it might be.

The IRS defines 'effectiveness' as follows: 'The effectiveness assessment considers how the proposed solution helps achieve the potential identified in the strategic fit assessment, and the purpose and objectives of the LTMA. Higher ratings are provided for those proposals that provide long-term, integrated and enduring solutions' (NZTA, [2012], p.13). A high rating requires the satisfaction of numerous, and generally vaguely defined, conditions: for example, 'is a key component of an NZTA supported strategy, endorsed package, programme or plan'; 'is significantly effective (delivers a measurable impact or outcome) in achieving the potential impact or outcome identified in the strategic fit assessment'; 'provides a solution that significantly contributes to multiple GPS impacts, where appropriate to the activity'; 'provides a long term solution with enduring benefits appropriate to the scale of the solution'; and 'is an affordable solution with a funding plan.'

Some of these refer to meeting strategic fit expectations, and others to promoting desired outcomes, which, for investment projects, might be better assessed by the traditional SCBA. For example, a new road is long-lived, and if properly scaled will tend by its nature to satisfy the requirement that it 'provides a long term solution with enduring benefits appropriate to the scale of the solution'. The EEM requires the measurement of a project's impact over a 30-year period – long enough to incorporate enduring benefits – and the scale is measured by the costs. Both factors are combined in the project's BCR.

Under the new assessment profile approach, a project rated low on efficiency can be preferred over another with a high efficiency rating if it rates more highly on strategic fit and/or effectiveness.

The efficiency criterion as described in the IRS has been downgraded to measuring 'how well the proposed solution maximises the value of what is produced from the resources used'. It is no longer *the basis* for measuring a project's impact on economic efficiency. Note that 'efficiency' under SCBA analysis should include broader costs and benefits, such as environmental effects, although it rarely does, perhaps because they are regarded as being difficult to quantify.

To sum up, the new strategic fit and effectiveness criteria appear to add little new or relevant information to project evaluation and ranking, apart from incorporating the government's priorities expressed in the GPS. Rather, they are based mainly on stressing certain components of the efficiency analysis, which have already been given their due weight. Hence, it is not surprising that the projects chosen using this triple-criteria approach often have low BCRs. This finding is consistent both with the data in Table 1 and with the statements of NZTA senior managers.

Implications for economic efficiency

The impact of the triple-criteria approach on economic efficiency at the macro funding level can be estimated using the Table 1 data. Approved spending on new state highway projects in 2008/09 and 2009/10 was $1,327,740,500 and $711,759,168 respectively, and this spending had estimated weighted average BCRs of 2.69 and 2.04 respectively. If these sums had been invested to realise the estimated BCR of 4.14 that had applied over the previous three years, the total benefits generated (in present value terms) would have been larger by $1.925 billion and $1.495 billion respectively.[11] The replacement of the efficiency approach by the triple-criteria approach reduced the prospective benefits from state highway spending in those two years alone by over a third and over half respectively. Furthermore, these losses do not include those likely from similar project selection criteria being applied to local roads, where investment spending is also large.

For a micro level illustration, I use the Kapiti Expressway project, which is one section of the proposed Wellington Northern Corridor road of national significance. Table 2 (row 1) shows that the present values of costs and benefits were $452.5 million and $429.2 million respectively, giving a BCR of 0.95 and an NPV of minus $23.3 million.[12] The negative NPV indicates that acceptance of the project immediately imposes a loss of $23.3 million on the economy in PV terms. However, this figure greatly understates the true loss, because it does not allow for the opportunity cost of the funds used.

Table 2: The gain from switching spending from the Kapiti Expressway to alternative state highway projects

Opportunity cost	BCR	PV cost	PV benefit	NPV	Overall change in NPV
BCR = 1.00	0.95	$452.5m	$429.2m	–$23.3m	–
BCR = 1.50	1.50	$452.5m	$678.8m	$226.3m	$249.6m
BCR = 3.00	3.00	$452.5m	$1,357.5m	$905.0m	$928.3m

Efficient resource allocation requires that a project's costs are measured by the value of those resources in their best alternative use. As the NZTA is capital-constrained, the next best projects have BCRs substantially above one. It is the value of these benefits foregone that should be used to value those resources, not their monetary cost as conventionally measured.[13]

To calculate the economic ('opportunity') cost of the project, an assumption is required about the BCRs of the projects that would be displaced by the project's funding. The economically rational approach would entail the NZTA displacing projects with the lowest BCRs, all else being equal. Table 1 shows that in 2005/06 the displaced projects would have come from the medium BCR category, with BCRs averaging perhaps 3.00. By 2009/10 a large proportion of projects had low BCRs, suggesting that displaced projects would come from the low BCR category, with BCRs averaging 1.5. I use both as alternative measures of opportunity cost.[14]

The second and third rows in Table 2 show the net benefits (in present value terms) if the $452.5 million of Kapiti Expressway project costs were diverted to state highway projects that have weighted average BCRs of 1.5 and 3 respectively. The opportunity cost BCR of 1.5 would generate benefits of $678.8 million, giving a NPV of $226.3 million,[15] plus the avoidance of the loss of $23.3 million, giving an overall net benefit of $249.6 million. On this basis, the economy would sacrifice net benefits of $249.6 million from the decision to invest in the Kapiti Expressway project rather than in the other, higher-BCR projects available.

Alternatively, using the average BCR of 3 would generate an NPV of $905 million from the diversion of the spending, plus the $23.3 million, giving a total opportunity cost of $928.3 million. Again, this is a measure of the outright loss to the economy from the sub-optimal investment in the Kapiti Expressway. The correct BCR for the Kapiti Expressway project, based on these opportunity costs, would be 0.63 (at an opportunity cost BCR of 1.5) and 0.32 (at an opportunity cost BCR of 3.0).[16]

Table 3: BCRs of the roads of national significance, 2011

Project	BCR	BCR plus WEBs*
1. Puhoi to Wellsford	0.8	1.1
2. Auckland Western Ring route	2.1	2.7
3. Victoria Park Tunnel	3.2	n/a
4. Waikato Expressway	1.4	1.8
5. Tauranga Eastern Link	1.4	1.8
6. Wellington Northern Corridor	1.1	1.4
7. Christchurch Motorways	2.0	2.4
Simple average (all)	1.7	n/a
Simple average (all except 3.)	1.5	1.9

* wider economic benefits

The roads of national significance

Over the next decade the NZTA plans to use a substantial proportion of land transport funding to build the roads of national significance. The political decision to spend (what then was) over $10 billion on these roads was made in March 2009 before the BCRs were calculated by SAHA consultants.[17] The BCRs are listed in Table 3.[18] Four of the seven roads of national significance have standard BCRs of less than 2. The unweighted average is 1.7, or 1.5 excluding the Victoria Park Tunnel project, which has been completed and has a relatively high BCR.[19]

The 2009 GPS stated that the roads of national significance were 'national road development priorities', and set out how investment in this programme was expected to 'contribute to economic growth and productivity', citing factors similar to those used to assess 'strategic fit' (NZ Government, 2009, p.11). As noted, these factors are already incorporated in the measure of benefits that underpin the BCR. However, a significant feature of the economic evaluation of the roads of national significance projects is the inclusion of 'agglomeration' and 'wider economic' benefits in their BCRs.

Agglomeration economies are thought to be generated both from the localisation of an industry (i.e., the concentration of firms in a particular locality) and from the urbanisation of economic activity (i.e., its concentration in large cities). Businesses may become more productive because they benefit from economies external to themselves, but internal to the locality and city respectively. These may arise from the facilitation of knowledge transfers between businesses, access to deep or specialised labour markets, and the development of specialised input suppliers. Although improvements to transport infrastructure are thought unlikely to create the clusters of activity that generate agglomeration economies, they could encourage the further development of a cluster by reducing travel times and improving connectivity, either by extending its reach or by reducing congestion within it (see Department for Transport, 2002).

The improvement of business productivity via enhanced agglomeration economies provides the rationale for including agglomeration benefits in transport SCBA. In essence, agglomeration elasticities, which measure the extent to which average firm productivity is higher when the effective density in a locality (as measured by employment) is higher, are estimated econometrically. An NZTA-

sponsored study by Maré and Graham produced a weighted average elasticity across one-digit industry sectors of 0.065, suggesting that a 10% increase in effective density increases firm productivity by 0.65% (Maré and Graham, 2009, p.26).

The elasticities by industry sector are provided in the EEM as the basis for calculating agglomeration benefits (NZTA, 2010, pp. A10-3, A10.5). Thus, a transport infrastructure project, by reducing travel times, inevitably leads to some increase in effective density in the district affected, and this is turn, through the application of the relevant weighted average agglomeration elasticity, leads to an increase in local labour productivity and hence output. The increase in output is the measure of the agglomeration benefit.

The NZTA was quick to embrace the concept of agglomeration benefits, yet their evaluation is far from being settled or free of controversy. SAHA (2009, pp.13, 41) noted that the measurement of wider economic benefits (which included agglomeration benefits) was relatively new and untested internationally, and urged caution as there were few precedents for their inclusion in project evaluations. Indeed, Maré and Graham (2009) expressed reservations about the use of their estimated elasticities to calculate agglomeration benefits:

> It is clear that denser areas are more productive but this may reflect other factors that are positively associated with both density and productivity. It is more difficult to establish that an increase in density would necessarily lead to an increase in productivity. The challenge is even greater for studies that analyse the relationship between public infrastructure, such as transport infrastructure, and productivity ... In this case, there is the confounding issue that infrastructure investments may be deliberately directed towards high-productivity areas, meaning that simple correlations between investments and performance may further overestimate the productivity impacts of infrastructure. (Maré and Graham, 2009, p.11)

In addition, there is a debate over whether standard SCBA already captures agglomeration benefits. To the extent that it does, the separate calculation of these benefits would lead to double-counting. A major study sponsored by the UK government, which looked at transport's role in promoting productivity and competitiveness, considered the nature and significance of agglomeration economies (Eddington Transport Study, 2006). It found that where 'journey time savings are of work time, i.e. savings mainly to business and freight, there is an equivalent gain in GDP' (para 2.17, p.23), and that these time savings capture the 'majority of the productivity benefits from agglomeration' (Figure 2.5, p.26).

For the roads of national significance, the wider economic benefits comprised the agglomeration and employment benefits.

Similarly, Australia's Bureau of Transport Economics (1999, pp.13-17) argued that the indirect effects of transport infrastructure investments are often captured by SCBA through the inclusion of induced and diverted transport demand effects. Wallis, of Booz and Company (NZ), in a report for the NZTA, examined the question of the 'missing benefits' and concluded that 'claims that SCBA is dramatically underestimating the quantum of benefits flowing from transport investment should be viewed with considerable scepticism' (Wallis, 2009, p.58).

For the roads of national significance, the wider economic benefits comprised the agglomeration and employment benefits.[20] Estimates of the latter were based on two UK case studies, for the M62 motorway and the Severn Bridge. These estimated increases in employment in their respective potential 'areas of influence' of 0.4% and 4.0% respectively. The figure of 0.4% was chosen conservatively as the basis for the assessment of the roads of national significance, although slightly lower figures were mostly used, and the impact was assumed to take ten years to emerge fully. The analysis was undertaken at the territorial local authority level, using employment figures from the 2006 census. The predicted changes in employment were valued at the 2006 average GDP per worker (increased to 2008 prices) for the region in which the jobs were forecast to be created.

Apart from the arbitrariness of the assumptions used, the assumption of a positive economic growth potential of the roads of national significance conflicts with the evidence from overseas economic impact studies, which suggest that significant local employment effects are unlikely. Professor Crompton, an expert in this area, is highly critical of the methodologies commonly used by such studies in the United States. In 2006 he wrote:

> The available evidence suggests that not only is the substitution effect likely to result in no net economic gain when the impact of construction projects in a community is measured but, often, there will be no net economic gain even within the construction sector of the local economy. An economic gain would occur within that sector only if those workers employed on the capital projects would not have been otherwise employed. (Crompton, 2006, p.70)

Further, the NZTA's projects are evaluated against a counterfactual of the 'do minimum', whereas the practical reality is that in the alternative, the funding available for the project would be released for other state highway projects. To the extent that roading investments do generate new jobs, these other projects could also do so, thereby reducing or eliminating any net job creation associated with the project in question.

Table 3 shows the BCRs with wider economic benefits added for six of the seven roads of national significance.

TABLE 4: BCRs for the Wellington roads of national significance

Project	2009 BCRs (1)	Updated BCRs (2)
1. Airport to Mt Victoria	0.4	0.4
2. Basin Reserve	2.7	2.7
3. Terrace tunnel	0.5	0.5
4. Aotea Quay to Ngauranga Gorge	3.2	3.2
5. Ngauranga to Linden	1.8	–
6. Transmission Gully	0.6	0.8
7. MacKays to Peka Peka	1.2	0.9
8. Peka Peka to Otaki	0.8	0.5
9. Otaki to Levin	2.2	–
(A) Weighted average	1.0	0.8
(B) (A) + agglomeration benefits	1.2	1.0
(C) (B) + wider economic benefits	1.4	1.2

The wider economic benefits increase the unweighted average BCR for the six from 1.5 to 1.9, or by 26.7%. This suggests that the wider economic benefits, even if accepted despite the caveats discussed above, are not particularly significant. This is perhaps not surprising, as the agglomeration component must ultimately be related to the time savings benefits, which in developed countries like New Zealand are apt not to be large:

> many of the projects ... are modest additions to an already well-developed transport network. Such projects reduce the cost of transport by only a small proportion. The increase in transport demand will also be marginal, unless demand is highly cost-sensitive. (Bureau of Transport Economics, 1999, pp.16-17; see also Wallis, 2009, p.58)

Further concerns about the efficiency of the roads of national significance arise when the BCRs for the component projects are considered. In November 2009 the NZTA estimated a BCR of 1.1 for the Wellington Northern Corridor, and 1.2 with agglomeration benefits added. Table 4 lists the component projects; their BCRs are shown in column 1.[21]

The NZTA asserts that the Wellington roads of national significance must be viewed as a whole because the agglomeration and wider benefits accrue to the entire road. It is probably true that any such benefits would tend to increase with the length of the road. However, merging the component projects means that the low BCRs on some are disguised by the higher BCRs on others. This allows the low BCR projects to survive the screening process, even though normally they would be rejected.

Furthermore, the specification of the roads of national significance is arbitrary. In 2009 it was defined as the expressway from Wellington airport to Levin, yet the Otaki–Levin section was abandoned recently because of lower traffic forecasts. Rightly, there is no justification for pursuing a low BCR project simply to gain an uncertain, and at best small, increment in wider benefits. Table 4 suggests that four other projects with BCRs of less than 1 fall into this category.

The 2009 BCRs can be updated by incorporating recent developments – see column 2 of Table 4. The NZTA's resource consent applications have cited new BCRs for projects 6, 7 and 8, and the discarded projects 5 and 9 can be removed. These changes cause the conventional BCR to decline from 1 to 0.8, and the BCR with agglomeration benefit from 1.2 to 1.[22] Only two of the seven projects now have conventional BCRs exceeding 1, and the impact of the agglomeration and wider economic benefits – the measure of the government's desired growth benefits – barely raises the overall BCR above 1.

On this evidence, economic support for the Wellington roads of national significance as presently conceived is weak, especially given the opportunity cost of funding discussed above.[23]

Conclusions

In this article I have shown that there has been a seismic shift in the approach used by the New Zealand Transport Agency in determining how it spends around $3 billion annually on land transport projects, over half of which is devoted to state highways. The role of the BCR efficiency criterion has been watered down by adding new, nebulous 'strategic fit' and 'effectiveness' decision criteria, with the result that there has been a loss of prospective benefits of many hundreds of millions of dollars. This change reflects the NZTA's response both to an amendment in its governing legislation, and to the government's new ability under this legislation to influence the NZTA's spending decisions through the GPS process.

Yet the inaugural GPS of 2009 on land transport was strongly supportive of economic efficiency:

> There will be an increased focus on economic efficiency. The NZTA's evaluation processes will be adjusted to give projects with high benefit cost ratios (BCR) higher funding and programming priority and to give projects with low BCRs more scrutiny (high BCR is greater than four; low BCR is less than two). (NZ Government, 2009, para 55, p.16)

Three and a half years later, in November 2012, when the minister of transport, Gerry Brownlee, was asked to comment on a leaked NZTA report of December 2011 that the Kapiti Expressway's BCR had fallen from 0.95 to 0.23 (BECA Infrastructure Ltd, 2011), he said that the BCR is only one factor considered. He suggested that if BCRs had been available in Julius Vogel's day, Vogel 'would not have bothered getting out of bed', implying that the development projects that Vogel had championed in the 1870s would never have been approved if their BCRs had been known.[24] A few months earlier he had said that the roads of national significance would 'cost what they cost', and that falling traffic volumes did not warrant a reconsideration of the projects because 'if we build it, they will come'.

These comments raise serious doubts about the rationality of the decision-making process. It is ironic that a

government that places economic growth and efficiency at centre stage is, through its approach to the evaluation of state highway projects, undermining the very process needed to advance those goals. The inconvenient truth is that the current approach to the ranking and selection of state highway projects, including the roads of national significance, under which the role of economic efficiency has been greatly diluted, has resulted in many hundreds of millions of dollars of benefits annually being squandered in pursuit of the empty goals of 'strategic fit' and 'effectiveness'.

1 Indicative funding for NZTA for the period 2009/10–2011/12 shows that of the total projected amount of $8.668 billion, over half (52.9%) or $4.585 billion is allocated to spending on state highways (NZ Government, 2009, p.14).
2 Taking the midpoints of ranges for the 2021/22 projections, total funding is expected to increase by 25.7% on the 2011/12 figure, with the spending on state highways to increase by 34.1%, from $1.538 billion to $2.063 billion, over this period. Hence, it is anticipated that the proportion of the total funding spent on state highways may increase from 53.8% to 57.4% over the period (NZ Government, 2011, Table 2, p.14).
3 'Affordable' was added in a 2008 amendment.
4 In 2004 Transfund had been merged with the Land Transport Safety Authority to form Land Transport New Zealand. It was Land Transport NZ that was merged with Transit NZ to become the NZTA in 2008.
5 The NPV is defined as the present value (PV) of the benefits minus the PV of the costs. A project, because of its sheer size, can have an absolutely large NPV, but a low BCR. When funding is constrained, total benefit generated is maximised when projects with the largest BCRs are selected. Note that since the initial costs of projects are lumpy and can extend over more than one year, and there may be interrelationships between projects, the process of choosing the best mix of projects over time can involve complex programming procedures.
6 The original source was Ministry of Transport, 2011, Figure 10, p.22. The underlying data were obtained from the NZTA by letter from Dave Brash (general manager, planning and investment, NZTA), dated 24 September 2012. In what follows I assume that the NZTA's BCR estimates are accurate, although they are in practice subject to error because they involve projections of uncertain costs and benefits many years into the future.
7 Letter from Dave Brash (general manager, planning and investment, NZTA), 24 September 2012. In a follow-up email exchange with Murray Riley (NLTP delivery manager, NZTA), Riley ruled out the possibility that increasing expenditure had resulted in a diminishing returns effect: i.e., that as expenditure increased, only low BCR projects were left to be invested in.
8 As stated in a letter dated 20 June 2012 from Ernst Zöllner (group manager, strategy and performance, NZTA).
9 The process is explained in NZTA (2008), chapter G1. The IRS shows that the ratings for the 'efficiency' component of the assessment profile are determined by the project's BCR, using the size classes defined above in connection with Table 1.
10 Italics as in the original. Different criteria are used to assess 'activity classes' other than state highways.
11 2008/09: $1,327,740,500 (4.14 – 2.69) = $1,925,223,725; and 2009/10: $711,759,168 (4.14 – 2.04) = $1,494,694,253.
12 Source: NZTA (2012), appendix A. This information was augmented by detailed spreadsheets obtained by Official Information Act request. The BCR of 0.95 had fallen slightly by November 2012 because of an increase in the estimated costs.
13 If the NZTA were not capital-constrained, it would be able to invest in all projects having BCRs even slightly above one. In this case, the resources used in a project would generate a BCR of one in their alternative use, in which case the costs of the resources would accurately measure the benefits that they would generate in that use. Here, the minimum requirement for a project to be acceptable on economic efficiency grounds – that the BCR is greater than one – would apply.
14 The BCR of 1.5 is arguably conservative, as it reflects an environment in which many low BCR projects were favoured over those with high BCRs, meaning that the opportunity cost of the Kapiti Expressway project is being assessed against what arguably is an economically irrational approach to project selection.
15 Benefit = $452.5m x 1.5 = $678.8m; NPV = $678.8m – $452.5m = $226.3m.
16 BCR = $429.2m/$678.8m = 0.63 (for BCR of 1.5); and BCR = $429.2m/$1,357.5m = 0.32 (for BCR of 3.0).
17 See also NZ Government (2009), p.9; and SAHA (2009), later replaced by SAHA (2010).
18 Source: letter from Stephen Joyce, then minister of transport, 30 March 2011.
19 Note that large-scale, one-off public investment projects are prone to have their benefits overestimated and their costs underestimated, a phenomenon called 'optimism bias'. See NZ Treasury (2005), p.36; HM Treasury, 'Supplementary Green Book Guidance – optimism bias', 2003; and UK Department for Transport, 'Procedures for Dealing with Optimism Bias in Transport Planning: guidance document', June 2004.
20 Both were evaluated by Richard Paling Consulting (2009). The EEM includes a section on estimating agglomeration benefits, but provides no guidance on how the employment benefits are to be evaluated.
21 Source: NZTA (2009), Table 6.13, p.49. A check of the calculations reveals that the conventional BCR is actually 1 (or 1.035 to 3 d.p.), not 1.1.
22 The 2009 component project BCRs were inflated through an extension beyond the prescribed 30-year period over which benefits were assessed. The analysis period for all projects was set to end at year 30 of the last-completed project (ibid., p.44). I assumed that the 2009 agglomeration and wider benefits remained changed with the amendments.
23 As this article was going to press, I learned that the BCRs of the Wellington roads of national significance were being revised, in part to take account of the following changes to the EEM agreed by the NZTA Board on 5 July: reduction of the discount rate from 8% to 6%; extension of the analysis period from 30 to 40 years; and incorporation of the WEBs as standard. These changes will increase the BCRs for these roads, but also increase their opportunity cost, as the BCRs for alternative state highway projects will also rise.
24 Campbell Live interview, TV3, 29 November 2012. Brownlee was presumably implying that the Vogel projects would have had low BCRs but were implemented anyway, and had obviously brought substantial benefits (all of which are unknowns), and using this to justify prospective road investments having low BCRs.

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