Ministry of Transport

Independent Advice on the Economic Costs and Benefits of Rail Freight Stage 3

Final Report

April 2010

CONFIDENTIAL

Contents

1 Introduction

This final report has been prepared by John Bolland Consulting for the New Zealand Ministry of Transport. The report presents the findings of Stage 3 of a study into the costs and benefits of rail in the movement of freight in NZ. The April 2010 version of the report takes account of comments made by the peer reviewer, Dr Murray King.

This aim of Stages 1 and 2, completed in November 2009, was to provide the Ministry with independent advice on the economic costs and benefits of moving freight either from rail to road or vice versa. The Ministry needed this in order to advise the Minister on any case for ongoing government financial support of rail.

The study looked at both:

- Short run marginal cost (SRMC): the economic impact for both road and rail of small changes in rail traffic which do not affect infrastructure requirements
- Long run marginal cost (LRMC): the economic impact of significant rail changes such as the closure of lines or changes in expenditure on infrastructure maintenance and renewals.

Stage 3 looks at forecasts of future rail volumes and costs over the period 2010 – 2020, while the basis of Stages 1 and 2 was the freight traffic carried by Kiwirail in the year to June 30th 2009. Additionally Stage 3 updates the previous analysis to cover the calendar year 2009.

A critical aim of the study has been, as far as possible, to compare road and rail modes like-for-like. The background to the study is one of increasing movement of freight in recent years (at least until the recession) and expected future growth; it has been estimated that the 2007 freight task will increase by about 40% by 2020 and double by around 2040 [source: NFDS].

The current mode split of freight tonne-km in NZ is estimated [NFDS] to be 67% road, 18% rail and 15% coastal shipping. There are many different types of freight and only some of the freight transported in NZ is contestable by rail; on the other hand some freight could potentially be moved by any of the three modes. Mode choice is dependent on many factors other than cost, for example reliability and the ability to meet specific time slots.

This study has not looked at mode choice as such, but clearly the costs being analysed affect charges, which are part of the decision on mode choice. If current rail charges were increased then there would be a switch away from rail but such a change would have an economic impact and the likely quantum of this is a key output of the study. If the standard of service offered by rail falls as a result of lack of investment there would be mode shift to road and this too would have an economic impact.

2 Stages 1 & 2

2.1 Conclusions from Stages 1 & 2

The full findings of Stages 1 and 2 have been reported separately. The conclusions from that report can be found in Appendix A of this report.

The key findings from the earlier work were:

- The short-run marginal cost of rail is about half that of road on average and for only a few minor lines of business (LOBs) is road cheaper than rail; even so the results for those few LOBs may reflect network effects or be due to the averaging of road costs
- Looking at the rail network as a whole the resource costs required to shift a similar amount of freight by road would be about $200m more; this is a benefit of the existing rail network
- The $200m figure does not include the costs of road strengthening or passing lanes which would be needed if all rail freight transferred to road
- There is value in having the option of the rail network, for example it would be needed in the event of a rationalisation of ports by international shippers
- Fuel consumption and GHG emissions are appreciably lower for rail than road, which is important in an era of rising fuel prices and emissions trading.

2.2 Changes for Stage 3

Two significant changes have been made to the methodology used in Stage 3 when compared to the earlier work.

Firstly, the RUC paid by trucks is not now netted off the road maintenance costs as it was before. This is because RUC is not a resource cost whereas all the other costs which have been included are; since RUC is a tax it does not fit in with the other costs in the analysis. Put another way, the analysis should look at the national economic viewpoint, whereas including RUC is taking the point of view of the Government as road provider.

Secondly, data on the long run costs of roading have now been supplied by NZTA. This reflects the fact that if significant volumes of freight currently carried by rail were to transfer to road then additional expenditure would be required to bring parts of the State Highway network up to the required standard.

NZTA report that the result of their analysis is a very high level, broad brush and preliminary estimate based on the increased loading on the national network and the length of network affected.

The estimated growth in loading being imposed on the SH network was estimated by NZTA as approximately 40%-50%. The loading increase varies from a 20% to 300% increase, depending on the route, but on average would add around 40-50% additional loading to the entire SH network or an average 75% increase in loading across the relevant routes.

It is considered that growth in loading is reasonably well aligned with growth in maintenance expenditure. The current maintenance and renewal expenditure is $500million, so the resulting additional costs would be in the region of $200 - $250 million per year. This is likely to reduce in time, as the roads' pavement structures are improved to take account of the additional loading; to allow for this the lower figure of $200m has been assumed for each year of the analysis.

While the road costs take account of pavement strengthening, they do not include any capacity improvements, such as passing lanes, in rural areas.

The results of these two changes are presented in detail in chapter 4 of this report. In summary, however, using the updated (Stage 3) methodology:

- The short run costs of rail are about 40% of those of road
- In the long run, looking at the rail network as a whole, the resource costs required to shift a similar amount of freight by road would be about $460m more.

Note also that the Economic Evaluation Manual (EEM) was updated in January 2010 and the changes in that have been incorporated in Stage 3; however the impact was found to be very small.

3 Stage 3 Methodology

3.1 Short and Long Run Marginal Costs

Short run marginal cost (SRMC) is defined as the change in the total social cost resulting from a unit increase in demand at the current level of infrastructure provision. In contrast, long run marginal cost (LRMC) is the change in the total social cost from a unit increase in demand allowing for capacity and infrastructure provision being adjusted for the level of demand. It follows that SRMC are relevant for efficient pricing of demand for existing infrastructure while LRMC signals the cost of financing additional infrastructure (or the costs avoided from reductions in infrastructure).

The nature of rail costs is such that they include a high proportion of fixed costs; a consequence of this is that for small changes (e.g. adding a wagon to a train) the marginal costs are low.

As the main purpose of Stage 3 is to look at investment in rail infrastructure, the emphasis will be on long run costs. Additionally, the long run analysis has looked at total (rather than marginal) costs.

3.2 Approach to Stage 3

Kiwirail have provided forecasts for use in Stage 3 which cover, for each of the financial years 2010 to 2020:

- Their expected additional costs, split by six "Regions":
  - Auckland to Christchurch
  - Central North Island
  - Golden Triangle (Auckland – Hamilton – Tauranga)
  - South of Christchurch
  - West Coast
  - Minor Lines
- Their expected growth in volumes, broken down by both Region and one of seven commodities (e.g. steel, coal).

This contrasts with the 2008/09 data provided for Stages 1 & 2, which was broken down into thirty Lines of Business (LOBs). In order to provide continuity between the Stages of the study, each LOB was allocated to a region for the costing and to a combination of Region and commodity for use with the volume forecasts. To illustrate the process used, the LOB for CHH Kinleith was allocated to the Golden Triangle Region and the commodity "Forestry", thus allowing volume growth on that LOB to be forecast.

An inevitable consequence of this approach is that the study outcomes can only be presented on a Regional basis, since for example expenditure on the Golden Triangle cannot be broken down into specific LOBs.

The first part of the previous analysis related to ***short-run*** marginal costs (SRMC). This looked at the comparative costs and benefits of moving a single trainload, taken as 400 tonnes net, from rail to road.

For the Stage 3 SRMC, the unit of analysis (400 net tonnes) did not change. The main contributors to rail SR costs are typically fuel and drivers, plus some small semi-variable costs. If these costs change then the cost of the road alternative will also change; this is in contrast to long-run costs, where Kiwirail can be relatively certain about, say, the need for expenditure on new wagons but this does not affect road costs. Similarly if the costs of externalities such as greenhouse gases changes in future, both modes will be affected.

Of equal importance, we do not know how factors such as oil prices will change in future. To address this, for the SRMC in future years a number of sensitivity tests, e.g. of oil prices, were carried out. However the Stage 3 SRMC does not depend on the Kiwirail forecasts of volumes and costs since by definition short-run marginal costs are based on a single unit of output. In other words, the Stage 3 SRMC looked at "what if", e.g. how do road and rail SRMC compare if in some future year the cost of GHG is twice its current value?

The second part of the previous analysis looked at ***long-run*** costs of the rail network. As with the SRMC, there are some costs which are exogenous and cannot be forecast, such as oil prices. These were the subject of sensitivity testing in a similar way to the SR analysis.

There are essentially two dimensions to the Kiwirail forecasts, volumes and costs, for each of the financial years 2011-2020. Changes in ***volumes*** for future years were applied directly to the previous analysis and the LR costs for road and rail were then re-worked. As discussed above, the key input to this is how forecast rail growth varies across the Lines of Business which were used in Stages 1 & 2 and this was derived from the Kiwirail forecasts. The LR analysis was also subject to sensitivity testing of Kiwirail's growth assumptions, examining the impact if volumes grow at 75% or 125% of the forecast rate.

The ***cost*** forecasts from Kiwirail relate to their future expected expenditure, for example on track upgrades. These are one-off, additional costs that apply only to rail and will not affect road costs.

Most of the cost forecasts provided by Kiwirail are capital costs to cover additional investment in items such as rolling stock and track infrastructure. To reflect the fact that these are assets with long lives (of the order of decades), the costs have been annualised over a 30-year period using the method set out in volume 2 of EEM for calculating the "Funding Gap". The required rate of return in this calculation was 8.95%, which is the WACC currently used by Kiwirail. The exception to this is renewals costs, which have been calculated on a "paygo" basis and so are included only in the year in which they are incurred.

Also to be consistent with EEM, inflation has been removed from all cost forecasts.

To reflect changes in ongoing rail costs the following process was used:

- Variable and semi-variable costs were increased from 2009 in line with volumes (e.g. 5% more traffic requires around 5% more diesel)
- Fixed costs such as management were assumed constant at 2009 levels.

Road LR costs were changed in line with expected growth in volumes and additional costs were included to take account of the need to upgrade parts of the State Highway network, as discussed in section 2.2.

Table 3.1 below summarises how the Stage 3 analysis of future years was undertaken.

Item	Short run	Long run
Volume	Not needed	Start with 2008/09 volumes and apply KRG forecast of growth by LOB. Road costs adjusted in line with volumes
Variable and semi-variable costs	Sensitivity tests, e.g. of oil prices, applied to road and rail	2008/09 costs by LOB adjusted in line with volumes Sensitivity tests as for short run
Fixed costs	Not needed	2008/09 costs assumed unchanged Add KRG forecast costs for rail capital, annualised Add KRG renewal costs in each year Include NZTA forecast for additional roading expenditure

Table 3.1

4 Study Findings

4.1 Calendar Year 2009

As discussed in 4.2 below, using the Stage 3 approach for the year 2008/09 the SRMC of road was found to be 155% that of rail. For the calendar year 2009 the corresponding figure was higher, with road exceeding rail by about 170%. In general the pattern of the SRMC by LOB in comparing modes is similar for the calendar and financial years, with one LOBs on which the road SRMC is less than rail.

Table 4.1 summarises key statistics relating to the long run costs. As would be expected the difference between the two years is small. It should however be noted that although volumes have fallen in the later period, the saving in economic costs for rail have increased slightly.

Year	NTK (million)	Total Road LR costs ($m)	Total Rail LR costs ($m)	Road minus Rail ($m)
FY 2008/09	4,046	$1,064.8	$603.6	$461.2
Calendar 2009	3,920	$1,037.1	$570.0	$467.1

Table 4.1

Information withheld under Section 9(2)(b)(ii) of the Official Information Act.

The findings for the various lines of business show that the marginal cost of road is of the order of 50% to over 200% higher than rail for the majority of lines, with the average road SRMC 24.9¢ compared to 9.7¢ for rail. In other words, road is around 155% higher than rail. This is consistent with findings overseas and in part reflects the fact that for road the resource requirements are higher than rail; e.g. for fuel and driver time, one train would be replaced by several trucks. However the proportion of rail costs which are fixed is generally higher than for road.

Information withheld under Section 9(2)(b)(ii) of the Official Information Act.

4.2 Long Run, Financial Years 2010-20

For the Financial Year 2009, the Stage 1-2 work found that the full rail network provided a total saving in resource costs of $180m when a long-run approach is adopted. Using the updated Stage 3 methodology this figure increases to around $460m; the majority of this is due to the exclusion of RUC but the additional road maintenance costs supplied by NZTA are about $50m p.a. higher than previously.

Figure 4.5 shows how road and rail LR costs compare over the years to 2020 when the above methodology is applied in the base growth scenario.

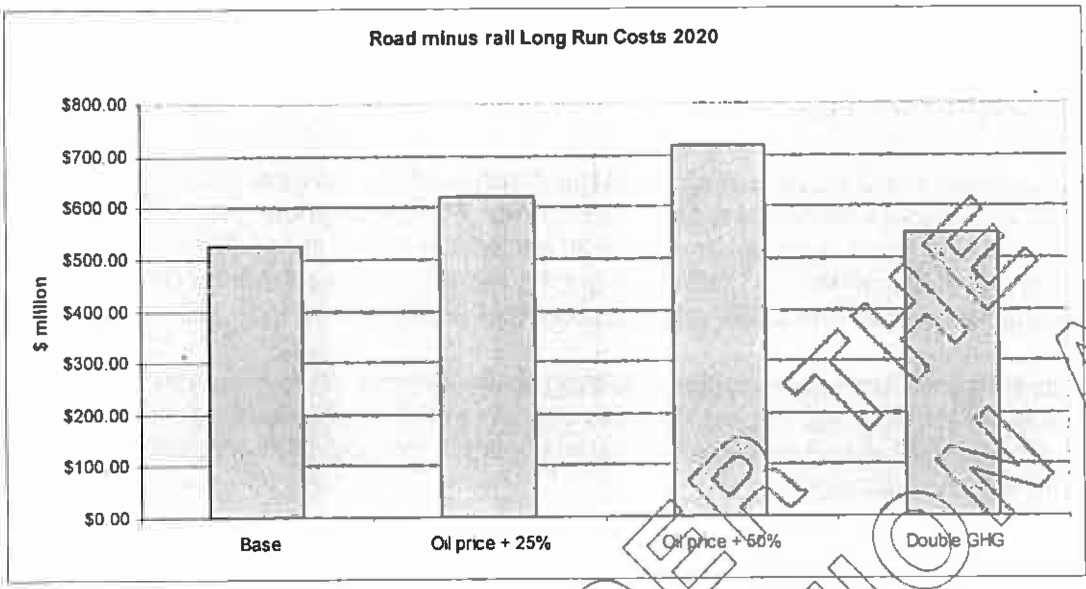

Figure 4.5

It can be seen that the rail network continues to give savings in resource costs which increase in the early years of the analysis but then level out in the later years due to continuing expenditure on rail.

Figures 4.6 and 4.7 show the difference in resource costs for the low and high rail growth scenarios respectively. Figure 4.8 shows how the "gap" between rail and road LR costs varies with growth.

The Figures show that with low growth in rail volumes, the gap between rail and road only increases slightly through to 2020 due to the impact of the additional expenditure. On the other hand, with high growth the gap increases by about 80% by the end of the period. The implication of this is that, even if the Kiwirail volume forecasts do not eventuate to their full extent, the rail network gives a saving in resource costs. If low growth did eventuate it may be possible for Kiwirail to reduce their capital expenditure, which would open up the gap between rail and road.

Information withheld under Section 9(2)(b)(ii) of the Official Information Act.

4.3 Sensitivity Tests

For the financial year 2020 the modal comparison of long run costs has been repeated with three different scenarios:

- Oil price increased by 25%
- Oil price increased by 50%
- Cost of greenhouse gases (GHG) doubled.

The results are shown in Figure 4.11.

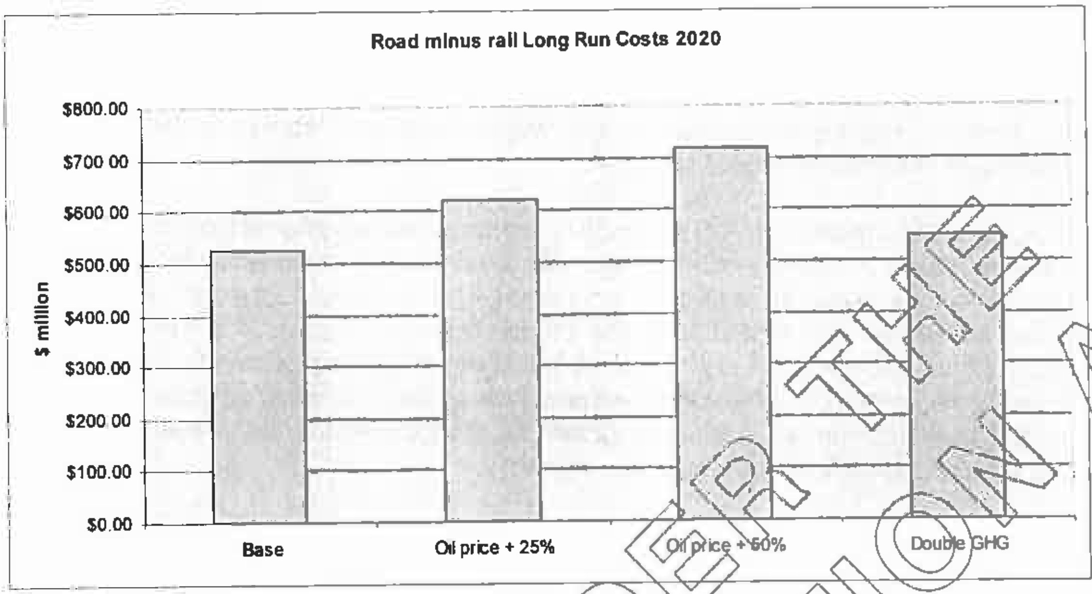

Figure 4.11

As discussed in relation to short run costs, the cost of oil is a significant contributor to total resource costs, especially for road freight. This is underscored in Figure 4.11, where a 25% increase in oil costs increases the "gap" between road and rail by almost $100m in 2020. For a cost increase of 50% the latter figure is doubled.

As was established in Stages 1 & 2, there is considerable variation in the cost of GHG as given by different sources. It is quite plausible that the current EEM figure could double in future as the full impacts of climate change are better understood. In this event road costs would exceed rail by over $20m more than in the base.

4.4 Caveats

As with any other modelling exercise of this nature there are some limitations in the approach which has been used.

Firstly, there has been no attempt to "optimise" the capital expenditure profile proposed by Kiwirail. It is likely that some aspects of the expenditure being proposed offer a higher return than others but this would not be apparent in our analysis.

Secondly, the analysis has not looked at the "counterfactual" in which no investment is made in rail. In this event it is possible that rail would lose mode share to road which would increase resource costs overall.

The third point relates to the data supplied by NZTA on the roading costs associated with long term changes to truck volumes on the country's roads. Due to time constraints this was a high level, preliminary estimate. Additionally, the split of costs by the six Kiwirail regions was based purely on NTK and did not take any local factors into account. NZTA specifically excluded consideration of "the current pavement constructions and condition of each section of the state highway affected".

The response of the road will depend on its design and strength; the extra traffic would not result in a uniform decline in relation to the load added. Imposing significant extra traffic on a weak road is likely to cause an early failure of the road.

For strong roads, the mode of failure will be fatigue, and they will wear more slowly with the additional traffic. The impact though will not be linear, with significantly increased traffic disproportionately accelerating the wear on these roads. There has been no work to identify which roads are in which category in relation to the hypothetically transferred freight tonnage.

The fourth point is that the safety analysis recognises that additional trucks would increase fatalities, but does not offset this with any increase in rail accidents. The international data generally regard any increase in rail accidents as small. EEM SP8 does not provide for it at all (although the full procedure in Chapter 7 of EEM Volume 2 does indicate offsetting rail and shipping accidents should be counted). However it must be borne in mind that the safety externalities of the road alternative are about 4% of the total long run costs so even if half these were offset by rail safety costs the impact on the overall findings would be negligible.

Finally, all Kiwirail administration and overheads were included but no administration or overhead was included on the road side. Such costs will arise in NZTA, in the local bodies, and in trucking firms themselves. These are likely to be important costs, but have not been quantified. For comparability they should have been included (or excluded from rail). There are other areas where comparability between road and rail was not possible but the analysis would likely have favoured rail, for example externalities such as noise and water quality.

5 Conclusions

- Over the period 2011 – 20, using Kiwirail's forecasts of volume growth, rail gives a saving in resource costs when compared to road of the order of $350 to $500 million p.a.
- In the event of lower growth the modal advantage of rail only grows slightly but this could possibly be offset by reducing rail expenditure
- With high growth the saving due to rail increases by 80% over the period 2011 – 20
- With no investment in rail there could be a move away from rail which would have adverse resource cost implications
- Overall there is a case for investment in rail because of the resulting savings in resource costs
- However our analysis does not indicate whether the proposed expenditure is optimal
- In the present economic climate it can be expected that oil prices will rise in real terms; if an increase of 25% is assumed by 2020 the resource cost of road exceeds rail by around $620m in that year (assuming base volume growth)
- The true costs of climate change are not yet fully understood but work such as the Stern report in the UK indicates that they are very likely to rise; this would further increase the resource cost advantage of rail over road
- Increasing freight traffic on rail can give benefits to existing users, e.g. because the service becomes more reliable or frequent
- There is value in having the option of the rail network, for example it would be needed in the event of a rationalisation of ports by international shippers or other changes in the pattern of international shipping
- In a country such as NZ which is dependent on exports, the ability of rail to rapidly deliver a shipload of goods is a clear advantage
- The use of rail contributes to NZ's "clean green" image and reduces the energy consumed for exported food
- Other countries (e.g. the UK and Australia) have found that in times of economic growth it is difficult to recruit the required number of truck drivers; this represents a shortage of resource costs which is not in the evaluation
- There are some minor aspects of the analysis where strict comparability between modes has not been possible; overall the impact of this is that the case for rail as given in this report is probably conservative.

Finally, as pointed out in Dr King's peer review, one reason the gap between the modes is so large is that the current traffic mix is by and large rail's natural market. It will have a large advantage over road for bulk commodities, containers, and the like. It is misleading to ask the question if there is such a gap, why can't rail do better with its prices. For a large number of those commodities the pressure on rates can come from the strong market power of the buyers, or the low margins available to cover transport if the commodity is to move at all, or from shipping alternatives, and not from a hypothetical road transfer. Where the commodity value is low, this is also part of the option value argument, since many shippers would not have a realistic choice of going to road if there was no railway.

Appendix A

Conclusions from Stages 1 & 2

- Our findings on the relativities of road and rail costs are consistent with those from similar studies around the world
- The short-run marginal cost of rail is about half that of road on average and for only a few minor lines is road cheaper than rail; even so the results for those few lines may reflect network effects or be due to the averaging of road costs
- Looking at the rail network as a whole the resource costs required to shift a similar amount of freight by road would be about $200m more; this is a benefit of the existing rail network
- The $200m figure does not include the costs of road strengthening or passing lanes which would be needed if all rail freight transferred to road
- The safety benefits of rail freight are over $40m p.a., equivalent to twelve fatal accidents
- If all rail traffic shifted to road the number of trucks on State Highways would increase in different parts of the network by factors ranging from a few % to over 300%
- The options for traffic to shift from rail to coastal shipping are limited and may increase consignor costs; they would also require investment in tonnage
- On the basis of the analysis there is an inherent benefit in rail improvements which attract freight from road to rail and this would be part of the justification for such measures
- Some growth in rail freight traffic could be accommodated at minimal extra cost
- Increasing freight traffic on rail can give benefits to existing users, e.g. because the service becomes more reliable or frequent
- There is value in having the option of the rail network, for example it would be needed in the event of a rationalisation of ports by international shippers
- Rail fuel consumption and GHG emissions are appreciably lower than road, which is important in an era of rising fuel prices and emissions trading.

Information withheld under Section 9(2)(b)(ii) of the Official Information Act.