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REVIEW OF NEW ZEALAND URBAN PASSENGER RAIL SERVICES

ABSTRACT

In March 1985 the recently elected Labour Government in New Zealand announced a return to the full funding of urban rail deficits by central government and its intention to establish a task force to examine the nature of urban rail in New Zealand; its efficiency, investment future and funding. This paper reports on the findings of this task force (the background to the study, its structure and conclusions) which reported back to the Minister of Transport on 24 December 1985.

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The comments expressed in this paper remain the responsibility of the author alone and do not purport to represent the views of the Ministry of Transport.

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INTRODUCTION

The 1980's have marked a time of significant change in the planning and funding of urban passenger transport in New Zealand. The principal catalyst for this change has been the Urban Transport Act 1980. The nature of this legislation and its impact since it took effect on 1 April 1981 was outlined at an earlier Forum (Gollin, 1984). Its stated objective is:

> "... to promote the establishment and maintenance within New Zealand of appropriate and efficient urban transport systems; ..."

For this purpose an Urban Transport Council (UTC) was established under the Urban Transport Act, and has operated since 1981. Its functions and powers are set out in Section 15 of the Act and include responsibility for co-ordinating taxpayer assistance to urban transport, including suburban passenger rail services. Local responsibility for determining the level of financial assistance for these services is given by the Act to regional and territorial local authorities in each urban area.(1)

Financial support for urban transport services comes from two primary sources: local subsidy through rates or other local revenue sources (e.g., loan finance); and taxpayer subsidy following application to the UTC. It is the responsibility of the regional or territorial local authority concerned to determine the merit of the financial assistance proposed(2) and, where appropriate, to make application to the UTC for such assistance, either in full or in part. The UTC, in turn, examines the merit of the proposed financial assistance when considering these applications. Any assistance provided by the UTC "... may be given on such terms and conditions the Council thinks fit".(3)

This funding mechanism is intended to support the principal objective of the Act, namely, to provide a legislative framework to integrate the financing and planning of urban transport services and systems within broader regional and land-use plans. The primary planning document for this purpose is the urban transport scheme, and any financial assistance offered by a regional authority within the scope of the Act must comply with the provisions of this scheme.

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1 Four regional authorities are nominated under the Act: Auckland Regional Authority; Wellington Regional Council; Canterbury United Council; and the Coastal-North Otago United Council. These regional authorities are responsible for the planning and funding of urban transport services of regional significance within their statutory urban transport areas. Outside these four statutory urban transport areas, territorial local authorities are responsible for urban transport services operating within their local authority boundaries.

2 For example, in the case of regional authorities section 31(2) of the Act requires:
"The amount of any financial assistance offered or given by a regional authority to support the operation of an urban transport service shall not exceed the amount necessary to support the operation of an efficient and economic service of that kind". (Emphasis added)

3 Section 35(1)

Coinciding with the introduction of the urban transport legislation was the establishment on 1 April 1982 of the New Zealand Railways Corporation (NZRC). The NZRC, replacing the previous Railways Department of the New Zealand Government, was established as a separate commercial entity with its own Board of Directors and with functions set out under its empowering legislation[1] including:

> "To establish, maintain and operate, or otherwise arrange for, safe and efficient rail freight and passenger transport services within New Zealand."
>
> "To endeavour to carry on the operations of the Corporation in such a way that revenue exceeds cost, including interest and depreciation, and to provide for a return on capital that may be specified from time to time by the Minister of Finance".

The establishment of the NZRC as a separate commercial entity empowers it to enter into agreements with the Crown or any local authority or person for the provision of services. Under its Act, NZRC is entitled to compensation for any loss-making services it is expected to provide. Since the establishment of the Corporation such services have been explicitly identified in the NZRC accounts and separate provision for financial assistance towards the support of services has been made by the UTC.

Under agreements for the provision of urban rail services, NZRC is generally responsible for operating and managing the services while the regional or territorial local authorities are responsible for matters such as service levels, fares and marketing

Prior to the introduction of the Urban Transport Act all NZRC urban services, both rail and bus, received full taxpayer funding to cover any losses incurred. This situation continued until 31 March 1983 and in the 1982/83 financial year resulted in subsidies amounting to $38.9 million[2] being paid to NZRC to cover all losses on urban services.

For the 1983/84 financial year, however, the UTC revised the basis of its funding policies with a view to introducing a common cost-sharing formula for all modes and services. In the case of rail, expenditure relating to urban passenger services was divided into two categories:

* Direct expenditure - expenditure regarded as directly attributable to urban passenger services, and therefore to be shared between the UTC and the regional or territorial local authority concerned.

* Indirect expenditure - expenditure regarded as of a shared (joint) nature between urban passenger and other rail services and therefore outside the influence of the regional or territorial local authorities concerned. This expenditure would remain fully funded by the UTC.

Based on these cost divisions, the UTC decided to fund the Direct component of rail expenditure on a comparable basis to other modes i.e. shared 50/50 between the UTC and local authorities. This resulted in an overall reduction in subsidy available to regions, which translated into a substantially increased burden upon ratepayers in some areas. The policy was to be introduced over 5 years with no reduction in the UTC subsidy in the first year (1983/84) The subsidy was then to be reduced by one-fifth of the 1983/84 expenditure level per annum until full cost-sharing i.e. 50/50, was achieved in 1988/89.

1 New Zealand Railways Corporation Act 1981

2 In September 1982 $1NZ = $0.75 Australian At February 1986 $1NZ = $0.74 Australian.

The first reduction in UTC subsidy took effect from 1 April 1984. The most severe impact was in the Wellington region and outlying areas (Kapiti and Wairarapa) where rail is the predominant urban passenger service. Traditionally, with the exception of Wellington City, ratepayers in the areas served had made no contribution to the provision of urban transport services. It was not surprising therefore that the funding policy introduced by the UTC proved to be unpopular. Although the UTC subsequently agreed to a substantial concession by agreeing to continue full funding of capital expenditure for the recently purchased Hungarian (Ganz Mavag) rail units operating in the Wellington region and Kapiti, local opposition to the policy led to a commitment by the Labour Party, at that time in opposition, to undertake to review the Act and in particular the basis for funding urban passenger rail services in the event it became the Government.

In keeping with this commitment the Labour Government in March 1985 reintroduced full funding for urban rail services as part of its approval of the UTC's budget for 1985/86. At the same time the Government announced its intention to set up a task force for the purposes of reviewing urban rail services, to report back to the Government by December 1985. The Terms of Reference for the review were as set out below:

(a) To examine the cost and revenue structure of urban rail transport and, in particular, to examine and report on its efficiency and cost-effectiveness with respect to marketing strategies, manning levels, ticketing methods, service levels, operational procedures and management structures.

(b) To examine and report on the type and level of capital investment which is necessary in the medium/longer term for the operation of an efficient and cost-effective urban rail network, and on extensions or contractions to the existing route network.

(c) To review current funding and budgeting procedures to promote local accountability and to see if any improvement can be made in the estimation of future rail costs and the presentation and consideration of these estimates by the respective funding agencies

(d) To examine and report on such other matters as may be relevant, including the impact of urban rail expenditure on other urban transport modes.

The task force was established in July 1985. It comprised a working party and technical support group, was chaired by Mr I.A. McCutcheon (also Chairman of the UTC) and included representation from the Ministry of Transport, NZRC, Treasury and UTC. In addition, the Australian consultancy firm of Travers Morgan Pty Ltd was engaged to provide a detailed report on parts (a) and (b) of the Terms of Reference.

NZRC URBAN RAIL SERVICES

New Zealand's Railway system has been in operation for over a century and has played a major role in the country's economic development. The "Railways" system includes about 4,500 kms of rail network, more than 10,000 kms of road services and the Cook Strait Ferry services. It employs some 18,000 people and provides freight and passenger services, both long distance and urban.

At the present time, NZRC provide urban rail services in Auckland, Wellington, Kapiti and Wairarapa Urban rail services comprise only a small proportion of NZRC's total business, accounting for approximately six percent of its total revenue.

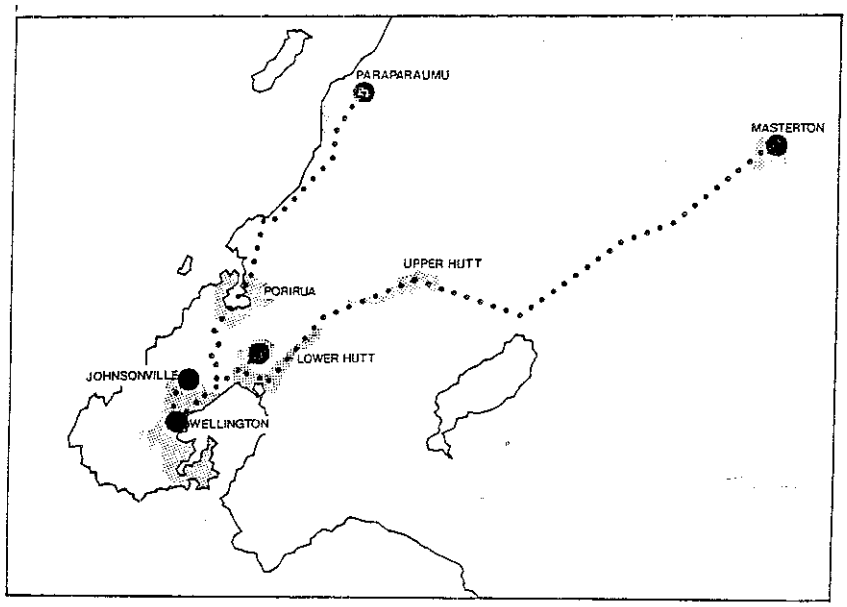


FIGURE 1 WELLINGTON KAPITI AND WAIRARAPA RAIL NETWORK

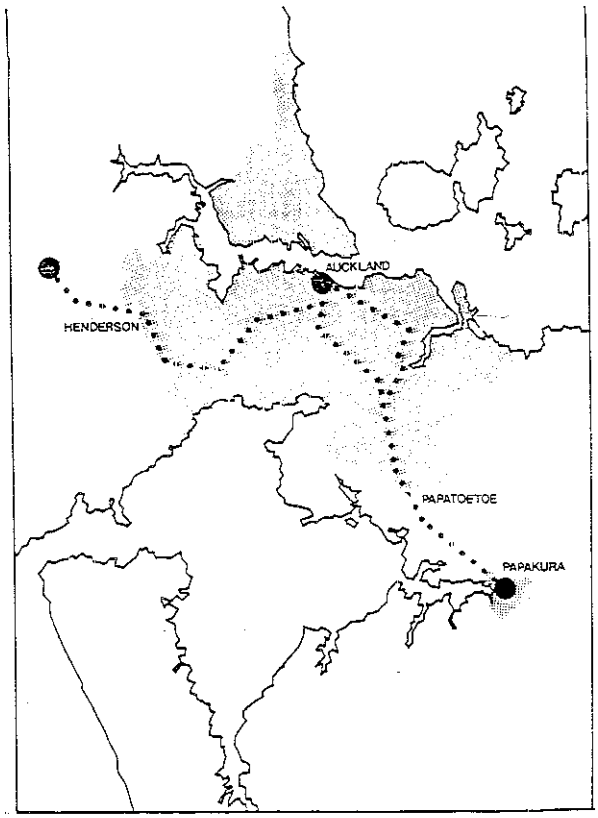


FIGURE 2 AUCKLAND RAIL NETWORK

The Kapiti and Wairarapa rail services (Figure 1) operate as extensions to the Wellington rail network and the combined services (i.e., including Wellington) carry approximately 11.8 million passengers per annum: this is slightly lower than the number using the Adelaide suburban rail system. The Kapiti service is closely integrated with the Wellington suburban service, forming part of an electrified network with rolling stock interchangeable on most sections of the Wellington network. The Wairarapa service, on the other hand, consists only of two morning and two afternoon weekday commuter trains hauled by diesel locomotives and carries a total patronage of 343,000 per annum. For the purpose of the analysis therefore the Kapiti service was considered in conjunction with the Wellington rail network, and the Wairarapa service was considered as a separate service.

In contrast to Wellington the Auckland rail service (Figure 2) plays a far less significant role in urban transport, carrying in total approximately 2.0 million passengers per annum on the north-western (Waitakere) and southern (Papakura) lines: this is somewhat fewer than carried by the Port Melbourne plus St. Kilda buses in Melbourne. Trains on the Auckland services are all hauled by diesel locomotives.

Table 1 provides summary statistics for all the suburban passenger services.

TABLE 1 URBAN PASSENGER SERVICES - SUMMARY STATISTICS

ITEM	Wellington				Wellington		Auckland		
	Johnsonville	West Coast	Melling	Hutt Valley	Total	Wairarapa	Papakura	Waitakere	Total
Passengers (000 pa)	1 811	4 366	596	4 713	11.486	343	1 311	652	1 963
Typical Frequencies (Mins)									
Peak	13	10	30	10		60	30	30	
Interpeak	30	30	60	60		-	60	120	
Saturday	60	60	-	60		-	-	-	
Sunday	-	60	-	60		-	-	-	
Return Trips per Day (1)									
Weekday	42	53	21	43	159	2	20	11	31
Saturday	21	22	-	25	68	-	-	-	-
Sunday	-	21	-	17	38	-	-	-	-
Peak Car Requirement	18	44	8	52	128(2)	12	24	10	40(6)
Train hours pa (000)	9 6	25 4	4 3	23 2	62 6	2 0	13 2	7 9	21 1
Car Hours pa (000)	31 0	86 3	11 5	93 4	222 2	11 7	43 5	21 4	64 9
Car kms pa (000)	778	3375	363	3358	7874	546	1412	558	1970
Route kilometres (3)	10	48	3(4)	32	93	59(5)	42	30	72
Track kilometres (3)	10	87	3(4)	61	161	59(5)	84	42	126

Notes: (1) Not all trips operate the full length of all lines
(2) Includes 6 cars which are required jointly between West Coast and Hutt Valley lines.
(3) The West Coast and Hutt Valley lines are used jointly by urban passenger services long distance passenger services and freight.
(4) Figures additional to those on the Hutt Valley main line
(5) Figures relate to Upper Hutt - Masterton section only.
(6) Includes 6 cars which are required jointly between the two lines

In the Wellington area, the services operate over 93 route kilometres on the four lines. The Johnsonville line (10 kilometres) and the Melling branch (three kilometres) are used by suburban services only. The other suburban services run over lines also used by long distance passenger and freight services, although the amount of double track could be reduced if the suburban services ceased

The Wairarapa suburban services operate 91 kms between Masterton and Wellington on a line also used by other passenger and freight services. The two weekday peak passenger trains in either direction are defined as 'urban' services for funding purposes (and hence were of relevance to the Review), whereas the other passenger services on the line are classed as long distance.

The Auckland urban system covers 72 route kilometres, all of which is also used by other services and most of which is double track.

There are 39 suburban stations in the Wellington area, 35 in the Auckland area and an additional nine served by the Wairarapa services.

STUDY APPROACH

In the discussion during proceedings at the 9th ATRF in Adelaide (May 1984) railways were likened to a fat man within which there was a thin man struggling to break out. This comparison is very relevant to the approach adopted in the Review and is reflected in parts (a), (b) and (c) of the Terms of Reference. (Part (d) of the Terms of Reference is a catch-all requirement that other matters relevant to the Review be considered, as appropriate, as part of the main headings.) Carrying the analogy further, the objective of the Review was to provide a diagnosis of current New Zealand urban rail services in order to define the 'thin man' from the point of view of both operational and investment efficiencies. Following this diagnosis it was then necessary to establish the appropriate diet, and how it should be applied in terms of funding, so that the 'thin man' could emerge.

The approach adopted is illustrated in Figure 3. Part (a) of the Terms of Reference was subdivided into an examination of the existing cost and revenue structure of urban rail (A1) followed by an appraisal of its effectiveness and efficiency potential (A2). This examination provided the potential 'thin man' for each urban rail service to compare against alternative public transport options (part B) - either rail related (e.g., light rail) or bus. The appropriate level of funding to achieve this 'thin man' was then analysed (C), including who should provide the funds and how, so that the potential rail efficiencies are in fact achieved.

The principal findings and conclusions under each of these headings are now outlined. The interested reader will find further details of the Review in the report of the Review Committee and associated working papers.

EXISTING COST AND REVENUE STRUCTURE

Under Terms of Reference (A1), estimates were made of the operating costs, revenues and likely future capital expenditures on urban rail services if current policies and service levels were to continue. Four main areas of work were involved, as summarised in this section:

i. determination of 'base' capital requirements;
ii. determination of base operating costs;
iii. estimation of current patronage and revenue statistics; and
iv. derivation of overall financial contribution results.

For reasons of brevity, the description given in this and the next two sections relates primarily to the Wellington area services, which account for the greater part of total patronage and expenditure on urban rail services in New Zealand. The approach adopted in the Review towards the Wairarapa and Auckland services was similar, and some of the results for these services are included in summary tables presented.

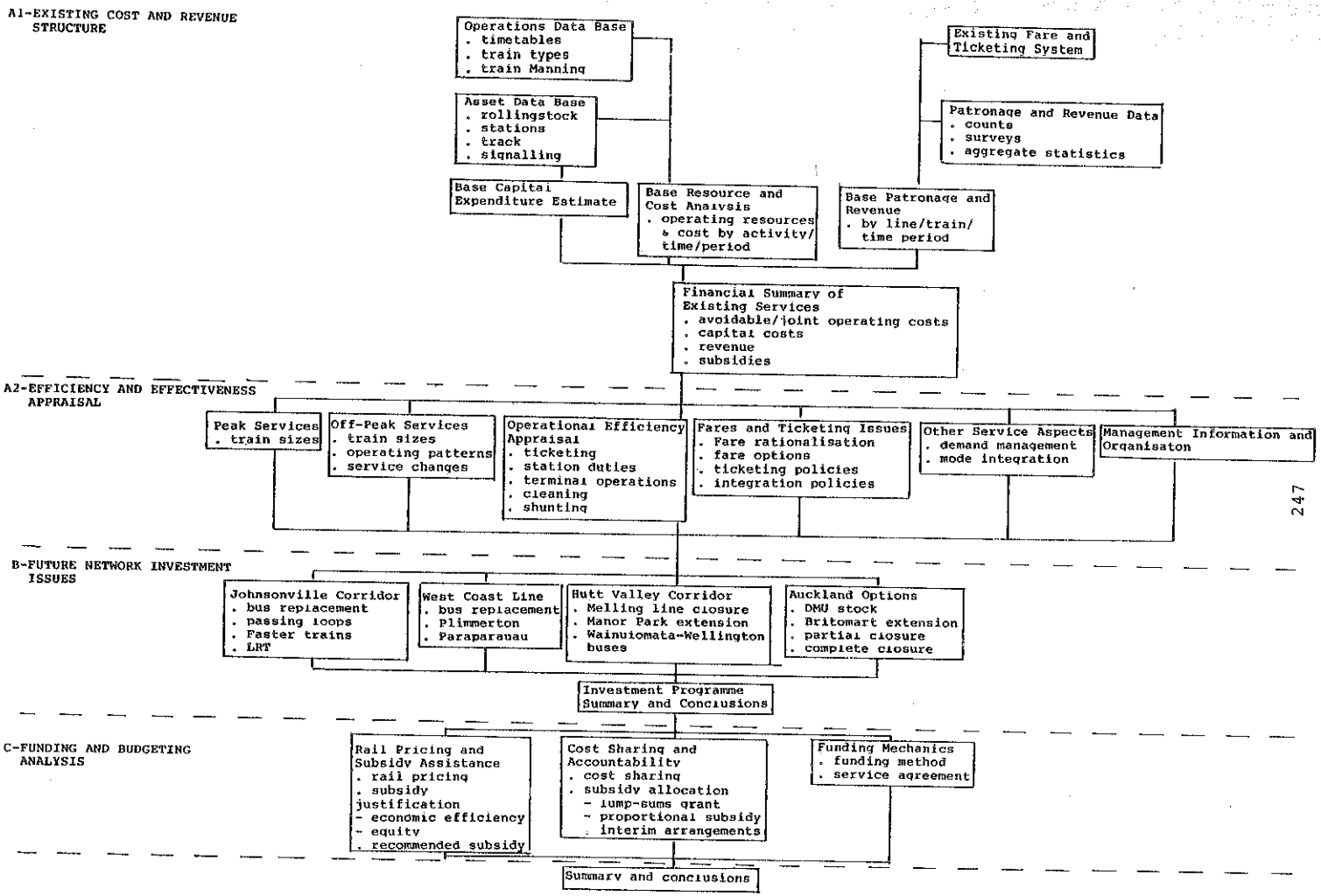
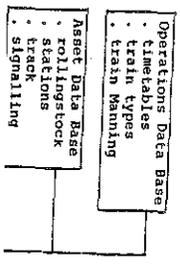
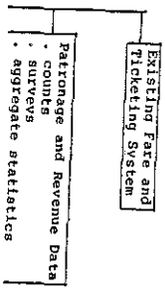


FIGURE 3 STUDY OUTLINE





'Base' Capital Requirements

One of the major issues to be addressed by the Review was the likely capital requirements for the urban rail system over the medium/longer term (i.e. the next 10-15 years). There was concern that very large expenditures might be involved, particularly to replace ageing rollingstock in both Wellington and Auckland. However, the likely magnitude of these expenditures was not clear, nor was it clear what alternatives might be available and whether the expenditures would be justified.

Our broad approach to these issues was:

* First, to establish 'base' capital expenditure requirements relating to urban rail services over the next 15 years. This 'base' largely represents a policy of status quo, reflecting NZRC's present expectations of future investment needs after allowing for efficiency improvements currently under way. This is part of item (A1) of the Terms of Reference and is covered in this section.

* Secondly, to assess the scope for efficiency improvements and service changes on the existing network and hence determine the effects of these on the 'base' capital (and operating) requirements. This relates to item (A2) of the Terms of Reference and is discussed later.

* Thirdly, to examine the economic case for network extensions or contractions, or radical operating changes, by comparison with the status quo situation and hence determine the further effects of these on future capital (and operating) requirements. This is item (B) in the Terms of Reference and is also discussed later.

In determining future capital requirements for rollingstock for the Wellington service, the first stage was to derive the base rollingstock requirements. These are determined by the maximum cars required for peak services on weekdays plus the additional spare cars necessary to cover for routine maintenance, breakdowns and longer overhauls.

Until February 1985 the peak traffic requirement was 143 cars. Following a recent review of loading levels on the West Coast line, a proposal was being implemented by NZRC to reduce the peak requirement to 128 cars, by reduction in train sizes rather than by timetable changes. Table 2 shows the composition of the peak cars in this situation.

Detailed analysis of spare car requirements to cover overhauls and routine maintenance established a requirement for 26 spare cars, giving a total fleet requirement of 154 cars. While this spares ratio (20 percent) is relatively high, it results from the need for major overhauls of the English Electric stock, now about 35 years old, to extend their life by 5-10 years. The required total of 66 English Electric cars compares with the 101 currently in the fleet and means that the remaining 35 may be progressively written off rather than being further overhauled.

NZRC had already developed a program for overhauls of the English Electric stock, and this was reviewed in the light of the fleet requirements established. Estimates of costs for replacing this stock in the late-1990s were also developed. The newer, Ganz Mavag, stock would also start needing overhauls within a few years: these are to comprise major overhauls every 10 years with 'half-life' overhauls at intermediate 5-year periods.

The resulting costs are shown in Table 3. Total expenditure is estimated at $72 million in current prices, of which $50 million relates to the replacement of the English Electric units in the late-1990s.

Besides rollingstock, the other major capital project expected for the Wellington urban services in the next 15 years is the complete resignalling of the Wellington Station area. This is expected to take place within the next few years and was not re-examined in detail in the Review. All other proposed capital projects are relatively minor. These are included in Table 3, which indicates an expected total 'base' capital expenditure of some $100 million over 15 years for the Wellington services. A further $34 million was estimated for the Auckland services over the same period.

Base Operating Costs

The Review derived the 'base' annual working expenses associated with operating the urban rail services. These costs, plus the base capital costs derived in the previous section, represent the total urban rail costs which are likely to be incurred in future years given present policies, operations and efficiency levels. This forms a base against which the impacts of efficiency measures and investment proposals may be evaluated.

The costs of relevance to this analysis are the 'long run avoidable' costs for suburban services, based on present operations and efficiencies (and expressed in September 1985 prices.) These long run avoidable costs represent all costs which, in the long term, one would expect to be eliminated if the urban passenger services ceased. They include a proportion of the supervisory and administrative overheads at all levels in NZRC up to and including Branch management. Operating cost joint between the urban passenger services and other services were also identified, e.g. for track maintenance in the Wellington area.

The starting point for the cost analyses was NZRC's 1984/85 expenditure as recorded in its General Ledger, supplemented by estimates of operating statistics. The approach then taken to establishing the required costs was as follows:

i. Establish the total cost for each NZRC activity relevant to urban services (e.g. station maintenance).

ii. Establish a set of overhead rates for each cost centre so that the costs of supervision and administration are correctly identified and allocated.

iii. Hence derive the 1984/85 costs for each activity of relevance to suburban services.

iv. Where appropriate, estimate the operating resources associated with the 1984/85 services (e.g. train kilometres) and hence derive unit costs at 1984/85 prices.

v. Update the 1984/85 costs to September 1985 prices, to allow for inflation. Adjustments were also made at this stage to allow for:
   - changes in service levels between 1984/85 and the present (base) levels;
   - cases where the 1984/85 costs were not judged to be a good reflection of long run future costs (e.g. maintenance costs of the Ganz Mavag units);
   - exclusion of a number of costs of a 'lumpy' nature (which are accounted for in the base capital expenditure).

   This stage results in estimates of total costs and unit costs, at September 1985 prices, for the Wellington, Wairarapa and Auckland services.

vi. Allocate these costs by line, day of week (weekday/Saturday/Sunday) and period of the day (peak/daytime/evening and night) on an avoidable cost basis, according to the manner of cost causality of each item and the resources required to operate each segment of the service.

Table 4 provides our summary of long run avoidable operating costs for the Wellington services, consistent with the 'base' train operations currently existing. This shows a total annual operating cost of $18.3 million (at September 1985 prices). Some 71 percent of this relates to train operations, 14 percent to terminal handling (including signal operations, ticketing and other station duties) and 15 percent to track and infrastructure maintenance. The main elements within train operations are train crew (36 percent of total costs), rollingstock maintenance, examination and cleaning (17 percent) and electricity (11 percent).

The total operating cost was then analysed by line and time period. Table 5 gives a summary presentation of the resulting costs by period. The first column shows, for example, that withdrawal of daytime (inter-peak) services over the system as a whole would save $1.194 million. A substantial element of costs ($1.917 million) is joint between weekday time periods and would only be saved if all services were withdrawn. The second column illustrates that:

- only 10 percent of total costs would be saved if weekend services ceased, i.e. 5.9 percent for Saturdays and 4.1 percent for Sundays (a small component of terminal costs would also be saved in practice); and
- a high proportion of train running costs is associated with peak services.

The third column expresses the costs on a per car hour basis. The total system cost averages $82 per car hour, of which $57 relates to train running with the remainder divided between terminal costs and fixed infrastructure maintenance. Train running costs are significantly higher at weekends (average $77 on Saturdays, $88 on Sundays) than on weekdays (average $54) reflecting the higher crew payments at weekends. Within weekdays, the peak avoidable cost ($53) is twice that for the daytime services ($26). It needs to be noted that these costs exclude all rollingstock capital costs, which would further increase peak period costs. Further analysis showed little difference between the lines in terms of costs per car hour.

Patronage and Revenue

The Review undertook analyses of current patronage and revenue patterns by each service, and hence by line and time period. Appropriate data are not readily derivable from the ticketing system and NZRC undertook passenger surveys to provide the information required: these were supplemented by analysis of maximum loading estimates made by guards on all trains.

Table 5 includes estimates of total Wellington revenue by time period and also on a per car hour basis. The peak period accounts for about 60 percent of revenue and the interpeak period for a further 19 percent (for analysis purposes the peaks were defined on the basis of operating patterns and cover about five hours per day). Average revenues per car hour vary relatively little between the peak average ($60) and the night average ($39). This suggests a relatively good adjustment of train lengths and frequencies to match demand levels.

Financial Contribution Results

The operating cost and revenue analyses were brought together to summarise the contribution (profitability) results for each service segment. (These results relate to working expenses only, and exclude all expenditure of a capital nature).

The last two columns of Table 5 summarise the findings for the Wellington services by time period. Overall the services cover 64 percent of their working expenses (a relatively good result by the standard of comparable Australian systems). Leaving aside the relatively fixed costs (for terminals/pilots and infrastructure maintenance), the highest cost recovery is achieved on daytime services (192 percent of avoidable train running expenses), followed by peak services (115 percent), night services (93 percent) and then weekend services. If terminal/pilot costs are assumed to vary in line with train running costs and if weekday joint costs are re-allocated against peak periods (on the basis that these are the 'prime' service operated), then the cost recovery in the peak deteriorates markedly and it accounts for approaching half the total loss on working expenses. The peak loss would increase further when capital expenditures are taken into account. The weekend services together, if regarded as marginal segments of the operation, account for less than 20 percent of the total loss.

Table 6 provides a summary of the working expenses, revenues, patronage and financial contributions by line for all the urban passenger services. The cost recovery is poorest on the Auckland services (average 28 percent on working expenses) and on the Johnsonville line in Wellington (47 percent).

Table 7 combines these figures with the base capital expenditure estimates derived earlier to provide base estimates of the net expenditures on the urban rail system over the next 15 years. This shows a net recurrent expenditure requirement (based on current operations, efficiencies, patronage and prices) of about $11.0 million per year, plus annual capital requirements of some $7 million per annum for the next five years, $5 million per annum in the early 1990s and $15 million per annum in the late 1990s. These figures form a base against which possible efficiency improvements are now discussed.

EFFICIENCY AND EFFECTIVENESS APPRAISAL

Under Item (A2) of the Terms of Reference, the Review examined a number of key areas in which the efficiency and effectiveness of the present urban rail services might be improved over the next few years. Efficiency and effectiveness improvements are likely to be crucial to the continued existence and development of the services. They will enable better use to be made of scarce public funds. They will also be essential in persuading the parties concerned to invest in the rail services rather than in alternative modes: it was found in the longer-term investment aspects of the Review that the case for retention of rail service, rather than replacement by buses, was in some circumstances critically dependent on the achievement of rail efficiency improvements.

The depth of examination of efficiency and effectiveness aspects possible and appropriate within the Review differs between different areas. In some areas we were able to provide well-developed recommendations which could be implemented very shortly (within a few months); in others we gave recommendations which would need to be introduced over a longer period; while in other areas we indicated possible priorities and directions and suggested more detailed investigations be carried out. Inevitably a study such as this carried out within a compressed timescale (effectively about four months) is unable to produce detailed action plans in all relevant areas.

The main areas covered under the efficiency and effectiveness heading were:

* Wellington peak train lengths and service standards
* Wellington off-peak services
* Auckland peak train lengths and service standards
* General operational efficiency aspects
* Fares and ticketing system
* Various service effectiveness aspects
* Management information and organisational aspects

Table 8 provides a summary of the topics covered within these headings, the potential savings where identified and the directions for further work required.

It is not possible at this time to fully identify the likely extent of savings. Where efficiency savings have been estimated, these add up to well over $1 million per year in operating savings in the short term and maybe up to $2 million per year in the medium term. In addition, there would be 'capital' savings of at least $2 million over the next five years and considerably more in the 1990s. The areas where savings have not yet been quantified are likely to result in considerable additions to these totals once further investigations have been undertaken.

There is not space in this paper to discuss all items listed in Table 8. However, by way of example, we comment on the work undertaken relating to peak train lengths and service standards in both Wellington and Auckland. The peak train and rollingstock requirements are the prime determinant of the total costs of operating the urban services, as is evident from the analysis already presented. It is vital therefore that no excess capacity should be provided at the height of the peak periods if a cost-efficient service is to result. At these periods the supply of services should be closely tailored to the demand and a relatively high level of standing passengers is justified on economic and financial grounds.

We therefore undertook a detailed appraisal of peak period service levels in both Wellington and Auckland in an attempt to attain a closer match between supply and demand. It was assumed that the present timetables would be unchanged and only the number of cars per train would be varied (further savings might be possible if timetables were also varied). The approach taken was:

* to analyse data on peak period maximum passenger loads on each train;
* to compare these against the current passenger loading standards, and where appropriate, to put forward proposals for varying train sizes;
* to develop these proposals into a detailed operating plan and hence deduce savings in peak car requirements.

NZRC's current loading standard (in Wellington) allows for full seated loads by 1.9 standing passengers per square metre of available floor area at the maximum loading point on an average day: this represents 107 passengers (74 seated, 33 standing) in the new (Ganz Mavag) cars in Wellington. Adopting this standard, it was found that a number of peak trains could be reduced in length and a saving of six cars could be made in the morning peak, 12 cars in the afternoon peak. This translated into a reduction of the Wellington fleet by six cars overall: total savings were about $300,000 pa in operating costs and $6.3 million in capital costs due to savings in car overhauls and later replacements.

The NZRC standard of 1.9 standing passengers per square metre at the maximum load point is relatively modest (although it is greater than that on some Australian suburban systems). It was found that, if the standard were increased to 3.0 passengers per square metre (a not unreasonable level), then the Wellington fleet could be reduced by a further six peak cars, with substantial further cost savings. It is suggested that the case for adopting such a greater loading standard be reviewed after the initial proposals have been implemented and monitored.

A similar analysis of peak loadings in Auckland against NZRC's own standards showed that the 10 peak trains could be operated with 29 peak carriages, as against the 40-45 currently in use. A proposed carriage refurbishment and re-seating program would enable the peak requirement to be reduced still further to 24 peak carriages. The result of these proposals would be a reduction in operating costs of 15 percent - 20 percent from the present level of $5.9 million pa.

The savings possible on peak period services illustrate, more generally:

* the importance of 'fine-tuning' supply and demand at peak periods;
* the substantial impact on cost levels of the loading standards adopted;
* the better matching of supply and demand and therefore the lower cost possible with more flexible coupling arrangements (e.g. the new Wellington cars may be coupled into sets of two, four or six cars, whereas the newest Melbourne cars are restricted to three or six car sets).

FUTURE NETWORK AND INVESTMENT ISSUES

Under item (B) of the Terms of Reference, the Review examined the appropriate capital investment for the urban rail system in the medium and longer term. This required appraisal of the merits of alternative public transport modes and services types by comparison with continuing rail investment. The approach adopted was first to assess what investments would be required to continue the rail services at the present level on the present network, incorporating the efficiency improvements identified earlier; and then to evaluate the economic merits of this investment by comparison with other public transport investments (in rail or bus) which would perform a similar transport task.

The evaluations were carried out within a social cost-benefit framework, with user behaviour functions being derived from a disaggregated analysis of previous survey data collected in Wellington. The main cost and benefit elements in the evaluations were:

- differences in capital costs (rollingstock and infrastructure);
- differences in operating costs (bus and rail);
- public transport user benefits (principally changes in travel time);
- differences in road congestion costs.

The evaluations adopted a 10 percent real discount rate (the standard figure used by the NZ Treasury) and covered a 30 year evaluation period.

The evaluation work covered five separate projects for the Wellington system (most having various sub-options) and seven projects for the Auckland system. We do not attempt to describe all the findings here and the following discussion focusses on two of the more controversial projects:- the possible closure of the Johnsonville line in Wellington and the possible closure of the whole of the Auckland suburban rail system.

Wellington Services

Table 9 summarises the Review findings relating to the Wellington rail system. While a range of system contraction options were investigated, complete closure of the 'core' services in Wellington was not considered. On economic grounds there is unlikely to be justification for closure of these services prior to the life expiry of the Ganz Mavag units (probably beyond year 2010).

From Table 9 it appears that the only major change to the Wellington network warranted in the short term is the closure of the Johnsonville line and its replacement by bus. Features of this line relevant to the evaluation findings include:

* only 10.5 kms long (Figure 1);
* takes an indirect route (due to topography), whereas the bus alternative could provide a more direct and faster route for many travellers;
* used by urban passenger services only (and hence full infrastructure costs would be saved by its closure);
* carries about 7,000 passenger trips per weekday, of which 70 percent are in peak periods;
* serves a relatively high income area (this contributes to the peakiness of its usage patterns);
* can only be served by English Electric stock at present (due to restricted tunnel cross-section) and hence would require new rollingstock in the 1990s.

Table 10 summarises the results of the cost-benefit evaluation of closure of the line and its replacement by bus services, either in the short term or on the life expiry of the current rollingstock. This shows that there would be substantial economic benefits from closure: these are principally through savings in public transport operating and capital costs, plus benefits to travellers in terms of reduced travel times and increased service frequencies. The results indicate that there is a strong case for closure in the short term, and this is economically preferable to waiting until the English Electric units are due for replacement in some 10 years time. It was further found that, while the economics of the rail services might be somewhat improved (e.g. by reducing peak rollingstock and running supplementary bus services), the economic benefits resulting would be small compared with those from complete closure.

The figures in Table 10 may be used as a basis for comment on the results of the Review evaluations in general:

* Operating costs: it was generally found that the incremental operating costs of replacement bus services were 60 percent - 80 percent of the rail operating costs saved from a rail contraction/closure project.
* Capital costs: at the optimum time for rail replacement (in place of purchasing new rollingstock), it was generally found that the (discounted) capital costs for replacement bus services were in the order of half those for continuing the rail services. At other times, the comparison would be less favourable to buses.
* Public transport user benefits and road congestion savings: in most of the projects evaluated, there would be significant disbenefits to travellers from rail closure as public transport travel times would increase and some public transport users would switch to car travel. However, the reverse was the case in Johnsonville as for many travellers the bus was faster (and more frequent) than the train.

Thus in the Johnsonville case, there were savings in all major cost groups in the evaluation if the line was replaced by buses, i.e. capital costs, operating costs and user/external costs. The result is clear cut. In most of the other evaluations, the economic case for bus replacement depends on the balance between operating cost savings, capital cost savings (or sometimes losses, depending on timing) and user/external disbenefits. In a number of cases, different solutions are indicated on economic grounds in the short term and in the longer term (when rollingstock has to be replaced).

At the time of writing, no decision has been taken by Government on the future of the Johnsonville line.

The Auckland suburban rail services (Figure 2) have been operating under threat of closure for some time, with a 1983 study recommending that they be closed in preference to refurbishing the carriages. Relevant features of the services are:

* they operate on lines which would, in any event be retained for freight services;
* they are loco hauled with the carriages being some 40 years old;
* their locos and to some extent crew are used jointly with freight services;
* the main Auckland Station is situated away from the main CBD area, and thus the services are generally unattractive for CBD workers;
* as a result, a large proportion of their users are industrial workers and school children, often on short trips and many in the contra-peak direction;
* they generally compare favourably with the bus services in terms of in-vehicle time, but often less favourably once access and waiting time are taken into account;
* the extent of bus-rail integration is rather limited;
* their total patronage is about 8,000 per weekday, only slightly higher than that on the Johnsonville line on a much larger network (some 72 route kilometres as against 10 route kilometres for Johnsonville);
* their present cost recovery is only 28 percent (on working expenses) and the loss is over $2.00 per passenger trip (Table 6).

Given these characteristics, it might have been expected that any cost-benefit analysis would conclude that closure of the services was the optimum economic solution. However, the Review reached the following conclusions:

* In the **short term**, the preferred option on economic grounds would be to continue the rail services, with refurbishment of the loco hauled carriages and a reduced peak carriage requirement.
* In the **longer term**, it would probably be economically preferable to replace the rail service by buses, but this conclusion is sensitive to the assumptions made. If rail services are to be continued after the life expiry of the existing carriages (in the 1990s), then diesel multiple units should be purchased in preference to new carriages.

Reasons for these perhaps surprisingly favourable findings for rail include:

* The present annual operating costs ($5.9 million pa) could be reduced by some $1.0 million pa by rationalising the peak consist sizes (as discussed earlier) and by a further $1.0 million by replacing loco hauled services by diesel multiple units. A much 'thinner' railway would thereby result, more competitive with buses on cost grounds.

* In the short term the capital requirements to continue the services are significantly less than those to replace them by buses.
* The infrastructure costs saved by closure of suburban services are limited, as the lines are still required for freight services.
* The travel time advantage of the rail services for many of its users would result in significant user disbenefits from closure; and the resulting increase in road congestion would give further disbenefits.

As the economic evaluation results did not indicate any strong preference between an improved railway system for Auckland and the replacement of rail services by buses, Government may well choose to make the decision primarily on non-economic grounds. The Review recommended that, if the rail services are to continue, then strenuous efforts should be directed at:

* a bus-rail integration programme to ensure that the overall public transport system in Auckland operates in the most efficient and cost-effective manner;
* reducing operating costs and improving the efficiency of the rail services;
* better promotion of the services.

TABLE 2
WELLINGTON BASE ROLLING STOCK REQUIREMENTS

		Peak Cars	Spares	Total
Ganz Mavag (1)	(40 x 2)	80	8	88
English Electric: (2)				
Johnsonville Line	(9 x 2)	18	3	21
Other Lines	(10 x 3)	30	15	45
Total		128	26	154

Note: (1) Purchased 1981-83
(2) Purchased 1949-54

TABLE 3
WELLINGTON BASE CAPITAL EXPENDITURE SUMMARY(3)
ALL COSTS IN $MILLION, 1985/86

Year	Rollingstock				Infrastructure		
	EE Overhaul	EE Replacement	GM Overhaul	Sub-Total	Wellington(1) Resignalling	Other(2)	Grand Total
1986/87	1.5		0.9	2.4	1.3	0.9	
1987/88	0.9		1.3	2.2	6.2	1.0	
1988/89	2.4		1.3	3.7	4.1	0.9	
1989/90	3.8		0.4	4.2	1.4	0.5	
1990/91	2.7		0.3	3.0	-	1.2	
5-year Total	11.3	-	4.2	15.5	13.0	4.5	33.0
1991/92 - 1995/96	-	-	6.7	6.7	-	5.5	12.2
1996/97 - 2000/01	-	45.5	4.2	49.7	-	5.5	55.2
15-year Total	11.3	45.5	15.1	71.9	13.0	15.5	100.4

(1) Includes only that proportion of the project allocated to urban services (para 2.34).
(2) Excludes track and signalling expenditures on jointly used lines (para 2.35).
(3) Capital expenditure includes refurbishment designed to prolong the life of rollingstock plus other rollingstock expenditures of a lumpy nature.

TABLE 4
WELLINGTON LONG RUN ANNUAL OPERATING COSTS
BASE OPERATIONS. SEPTEMBER 1985 PRICES

Item	Annual Cost $000			Unit Cost
Train Operations				
Car Cleaning		544	(3.0%)	$4250 per peak car
Multiple Unit Maintenance & Examination:				
Ganz Mavag Maintenance	1544			$0.374 per power car km + $0.124 per trailer car km
English Electric Maintenance	994			$0.977 per power car km + $0.326 per trailer car km
Multiple Unit Examination	150			$0.019 per car km
		2688	(14.7%)	
Traction Electricity		2090	(11.4%)	$7.68 per 000 gross tonne kms
Track Maintenance (Variable)(1) $2.23 per 000 gross tonne kms		607	(3.3%)	
Shunting and Pilots(2)		593	(3.2%)	$4630 per peak car
Drivers	2709			$139 per weekday shift(3)
Guards	2200			$123 per weekday shift(3)
Traffic Operators (permanent)	1438			$85 per weekday shift(3)
Temporary Ticket Assistants	157			$1163 per peak car
		6504	(35.6%)	
Sub total		13026	(71.2%)	
Terminal Handling				
Ticketing	932			$0.08 per passenger (average)
Signal Operation	722			
Station Cleaning	526			
Platform Duties	301			
Sub total		2481	(13.6%)	

TABLE 4 (CONTINUED)
WELLINGTON LONG RUN ANNUAL OPERATING COSTS
BASE OPERATIONS, SEPTEMBER 1985 PRICES

Item	Annual Cost $000		Unit Cost
Infrastructure Maintenance(4)			
Track Maintenance (fixed)(1)	443		$5270 per track km
Way	201		$2688 per route km + $1982 per track km
Signalling	673		$1873 per track km + $0.22 per train km
Communications	29		$2234 per route km
Overhead Maintenance	1442		$8846 per track km
Sub total		2788 (15 2%)	
Grand Total		18295 (100 0%)	

Notes:

(1) Track maintenance divided into traffic variable element and fixed element.
(2) Includes shunting locos and drivers, ground shunters and pilots.
(3) Separate (higher) cost also derived for Saturdays and Sundays
(4) Refers to the long run avoidable components relating to urban services (assuming change to single track on West Coast and Hutt Valley lines if suburban services ceased)

TABLE 5
OPERATING COST AND REVENUE STRUCTURE BY TIME PERIOD:
WELLINGTON SERVICES

Period	Costs			Revenues			Cost -Rev	Rev: Cost
	Total Cost $000	% Total	Cost per Car Hour $	Total Revenue $000	% Total	Cost per Car Hour $	$000	%
Weekday(1)								
Peak	6187	33.8	53	7103	60.4	60	-916	115
Day	1194	6 5	26	2286	19.4	49	-1092	192
Night	1472	8.1	41	1374	11.7	39	98	93
Joint	1917	10 5	10	N/A			1917	-
Sub Total	10770	58 9	54	10763	91.5	54	7	100
Saturday(1)	1072	5 9	77	656	5.6	47	416	61
Sunday/ P Holiday(1)	750	4 1	88	346	2 9	41	404	46
Sub Total	12592	68 8	57	11765	100.0	53	827	93
Terminal/ Pilots	2913	15.9	13	N/A			2913	-
Inf/structure Mtce	2787	15.2	13	N/A			2787	-
Total	18292	100.0	82	11765	100.0	53	6527	64

Notes: (1) Cost split by period are 'train running' costs only, i e exclude terminal and infrastructure maintenance costs.

TABLE 6
SUMMARY OF OPERATING COST AND REVENUE STRUCTURE - ALL SERVICES (1)

Line	Avoidable Cost $M pa	Revenue $M pa	Passengers M pa	Deficit $M pa	Cost Recovery %	Loss per Passenger $
WELLINGTON						
Johnsonville	2.43	1.13	1.81	1.30	47	0.72
Paraparaumu	7.09	4.82	4.37	2.27	68	0.52
Melling	0.88	0.58	0.60	0.30	66	0.50
Upper Hutt	7.24	5.24	4.71	2.00	72	0.42
Joint/Unallocated	0.66	-		0.66	-	-
Total	18.29	11.76	11.49	6.53	64	0.57
WAIRARAPA TOTAL	0.94	0.71	0.34	0.23	75	0.68
AUCKLAND						
Waitakere	2.02	0.55	0.65	1.47	27	2.26
Papakura	3.73	1.11	1.31	2.62	30	2.00
Joint/unallocated	0.12	-		0.12	-	-
Total	5.87	1.66	1.96	4.21	28	2.15
GRAND TOTAL ALL SERVICES	25.10	14.13	13.79	10.97	56	0.80

Notes: (1) Based on current operations, fares and patronage, with unit costs from 1984/85 adjusted for inflation to September 1985 prices. Excludes all capital expenditures and refurbishment/overhaul expenditures of a 'lumpy' nature.

TABLE 7
BASE NET EXPENDITURE SUMMARY
ALL COSTS IN $MILLION, SEPTEMBER 1985 PRICES

Item	Wellington & Wairarapa Services	Auckland Services	Total Urban Passengers
Annual Operating Cost	19.2	5.9	25.1
Annual Revenue	12.4	1.7	14.1
Base Net Recurrent Expenditure pa	6.8	4.2	11.0
Base Capital Expenditure pa			
1986/87 - 1990/91 average	6.6	0.6	7.2
1991/92 - 1995/96 average	2.4	2.5	4.9
1996/97 - 2000/01 average	11.0	3.6	14.6

TABLE 8
SUMMARY OF EFFICIENCY AND EFFECTIVENESS INVESTIGATIONS

Wellington Peak Services			
1	Short term:	reduce train length to match NZRC current loading standards	Saving 6 EE Cars Capital saving $1.9M overhauls (1989/90)and $4.4m replacement (late 90's) Operating saving $300,000 p.a.
2.	Medium term:	review loading standards with view to further reductions in train lengths	Possible savings 6 EE Cars Capital saving $0.9m overhauls (1989/90) and $4.4m replacement (late 90's) Operating saving $200,000 p.a
Wellington Off-Peak Services			
1 2 3.	Weekend reduction in train length. Night services - withdraw poorly patronised services or replace by buses. Off-peak service pattern - review tiered services etc.		Saving $100,000 pa operating costs. Saving $250,000 - $300,000 p.a. - (withdrawal) or $150,000 - $200 000 p.a (replacement)
Auckland Peak Services			
1.	Short term:	reduce to 29 peak carriages	Saving $800,000 - $900,000 p.a operating costs
2	Medium term:	reduce further to 24 peak carriages after refurbishment	Saving $150,000 - $200 000 p.a. operating costs
Operational Efficiency Aspects			
1.	Ticket issuing and checking efficiency		- train manning levels - station manning/ticket machines
2	Train advice notices		- develop more efficient methods
3.	General terminal operations		- review station cleaning, platform duties and associated activities
4.	Carriage cleaning		- review, possibly with capital investment (Auckland) for more efficient external cleaning
5.	Shunting duties (Auckland)		- review pilot duties and passenger yard duties
Fares and Ticketing Aspects			
1	Rationalisation of existing rail fare system e.g. remove irregularities in fare structure, review fare relativities (para 3.62)		
2.	Wider rail fare options e.g. increased charges for school term tickets, off-peak discount fares, combined rail/bus tickets (para 3.63)		
3.	Rail ticketing policies e.g installation of ticket machines, higher prices for on-train sales (para 3.64)		
4	Extended bus-rail fare integration (para 3.65)		
Service Effectiveness Aspects			
1.	Information improvements:		- common enquiry office for all services - comprehensive route maps for all services - sub-regional public transport booklets
2.	Service Integration and Coordination:		- service integration programmes (particularly Auckland) - bus/rail interchange arrangements - timetable and fare coordination
3	Vehicle Design:		- attention to facilities for standing passengers

TABLE 8 (CONTINUED)
SUMMARY OF EFFICIENCY AND EFFECTIVENESS INVESTIGATIONS

	Management Information and Organisation	
1.	Management Organisation Issues:	- regional councils should secure improved understanding of suburban rail issues - NZRC should be given incentives to efficient and effective operation of services
2.	Management Information Aspects:	- establish suburban services as NZRC profit centre - provide improved allocation and presentation of suburban costs - introduce internal transfer pricing system - improve patronage and revenue information

TABLE 9
SUMMARY OF WELLINGTON NETWORK AND INVESTMENT FINDINGS

Corridor/Project	Conclusions
Johnsonville Corridor	
Johnsonville Rail Line	Line closure in short term (other options examined are much less effective on economic grounds)
West Coast Corridor	
Plimmerton-Paraparaumu Service withdrawal (with bus replacement)	(a) Retain rail services in short term (b) Review in 1990 s (preferred option uncertain)
Hutt Valley Corridor	
1 Melling Branch closure	(a) Uncertain in short term (more detailed appraisal required to determine preferred option) (b) Review in 1990's (closure appears preferred option)
2. Melling-Manor Park Railway Line	Not warranted
3. Direct Bus Service ex Wainuiomata	(a) No change in short term (i.e. feed to rail) (b) Review in 1990's (direct buses appear preferred option)

TABLE 10
REPLACEMENT OF JOHNSONVILLE RAIL SERVICES BY BUSES -
SUMMARY OF EVALUATION
All costs in $Million (1985/86 prices) discounted
at 10% pa over 30 years

Item	Immediate Closure Option		1996/97 Closure Option	
Capital Cost Savings				
Rail Capital	9.4		5.8	
Bus Capital	-8.4		-2.9	
		1.0		2.9
Operating Cost Savings				
Rail Operating	24.2		8.5	
Bus Operating	-17.7		-6.5	
		6.5		2.0
User & External Cost Savings				
Public Transport User Savings	2.8		1.0	
Revenue Correction	0.7		0.2	
Road User Resource Correction	0.4		0.2	
Road Congestion Savings	-0.3		-0.1	
		3.6		1.3
Total Saving (Net Present Value)		$11.1M		$6.2M

FUNDING AND BUDGETING

The analysis under parts (a) and (b) of the Terms of Reference provided a basis for determining what urban rail services should be provided in the medium to long term. Issues concerning who should provide the funds for these services and how they should be provided were then considered.

As a starting point it was necessary to address the question: Why subsidise urban rail services? If there is no satisfactory answer to this question, then the secondary questions concerning who should provide funds and how the funds should be provided can be resolved simply by answering: the fare paying passenger on the service. This is the situation that exists under normal commercial conditions, where average revenues for a good or service equate with average costs.

If such a condition was to apply in the case of urban rail services then average revenues would need to go beyond the long run avoidable costs established under part (a) of the Terms of Reference; to include provision for ongoing capital replacement at the 'thin man' level determined under part (b) of the Terms of Reference. Although ideally annual capital charges should be based on replacement cost in order that the appropriate long run pricing signals are given, modified historic cost was in fact used to assess capital charges for the purposes of the Review. This approach, recommended in an earlier and separate analysis of rail capital charges (Young, 1985), was considered to be a reasonable compromise between the extremes of historic and replacement cost accounting for rail assets. Under this approach fixed assets such as land and buildings were assessed at current market values, while less readily assessable assets such as track, signals and rolling stock were assessed at historic cost. A 10 percent return on these assets was used for the purpose of establishing indicative revenues, although it is acknowledged that in practice the actual rate of return would be determined according to what the market will bear.

Combining long run avoidable costs with assessed capital charges, and attributing capital charges and joint avoidable costs to peak services (as the prime determinant of rail network size), gives an indication of the aggregate revenue levels required by line (Tables 11, 12 and 13). Joint fixed costs between urban and non-urban rail operations (freight and passenger) are included in these estimates.

In aggregate the assessed revenues required to fully recover costs on all services, compared to current revenues as at September 1985, are shown in Table 14. Just under a three-fold aggregate increase in current revenues would be required if revenues were to be equated to long run costs.

TABLE 11
MARGINAL COST PRICING : WELLINGTON ($000 pa)

Period	Line				
	Johnsonville	Paraparaumu	Melling	Upper Hutt	Total
Weekday Peak					
Avoidable	1,086	2,355	479	2,399	6,319
Joint between time of day	184	720	70	811	1,785
	1,270	3,075	549	3,210	8,104
Adjustment (1)	(115)	(278)	(50)	(290)	(733)
	1,155	2,797	499	2 920	7,371
Terminal/Pilots	353	1,110	163	1 287	2 913
Capital Charges					
- rolling stock	-	2 955	295	2,659	5,910
- other		2 075	208	1 868	4 150
	1,508	8 937	1,165	8 734	20,344
Day	260	549	138	529	1,476
Night	464	591	146	722	1,923
Saturday - Avoidable	130	416	0	394	940
- Joint	18	59	0	55	132
	148	475	0	449	1,072
Sunday/Holiday					
- Avoidable	0	414	0	261	675
- Joint	0	46	0	29	75
	0	460	0	290	750
Subtotal	2,380	11,012	1,449	10,724	25,565
Infrastructure/Overheads					
Infrastructure	282	1,271	100	1,134	2,787
Head Office/ Joint Fixed Costs					1,800
Subtotal	282	1,271	100	1,134	4,587
TOTAL	2,662	12,283	1,549	11,858	30,152

(1) To reduce joint costs from "time of day" analysis to "day of week" analysis.

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TABLE 12
MARGINAL COST PRICING : AUCKLAND ($000 p.a.)

Period		Line		
(1) (2)		Papakura	Waitakere	Total
WEEKDAY				
PEAK	- Avoidable	1,640	805	2,445
	Joint adjustment	64	31	95
		1,704	836	2,540
	Capital charges - rolling stock	352	189	541
	- other	696	375	1 070
	Terminal	800	392	1,192
		3,551	1,792	5,343
OFFPEAK		631	361	992
SUBTOTAL		4,182	2,153	6,335
INFRASTRUCTURE/OVERHEADS				
Infrastructure		95	45	140
Head Office/Joint Fixed Costs				1,300
SUBTOTAL		95	45	1 440
TOTAL		4,277	2,198	7,775

NOTES:

(1) No weekend services

(2) Assumes long run operating efficiencies, refer WP20 table A-7

TABLE 13
MARGINAL COST PRICING : WAIRARAPA ($000 pa)

Weekday Peak - avoidable	942
Head Office/Joint Fixed Costs	147
TOTAL	1,089

TABLE 14
REVENUES REQUIRED FOR FULL COST RECOVERY
ON URBAN RAIL SERVICES

	REVENUES ($000 pa)	
	Required	Actual
Wellington	30 152	11 765
Auckland	7 775	1 661
Wairarapa	1,089	709
	39,016	14,135

Typically, however, subsidy assistance for urban public transport is a common phenomenon throughout the world. The economic justifications for this fall under two broad headings:

* Economic efficiency

* Equity

In terms of economic efficiency the arguments in favour of subsidy assistance can be categorised on the following grounds (Gwilliam, 1984):

* Economies of scale (or density)

* Externalities

* Imperfect information

* Public goods

Equity arguments in favour of subsidy assistance for public transport, on the other hand, are by nature more subjective and politically motivated. Typically they involve the use of transport subsidies as a form of income redistribution in favour of low income households or other target groups such as the disabled.

The merit of each of these arguments in the context of New Zealand urban rail services was examined.

Economies of Scale

Simply stated, economies of scale exist where average unit costs (e.g., $ per passenger carried) decrease with an increase in the level of activity undertaken. In such situations the marginal cost of operations is below the average cost. Efficiency occurs where price equals marginal cost, at which stage a subsidy equal to the difference between average and marginal costs at that level is required to meet the deficit.

The argument has some attraction given the degree of fixity of rail assets, although its relevance in practice is the subject of some debate (Lapsley, 1984). Certainly the existence of long run scale economies resulting from the operating size of the rail network is doubtful, however within a given network size there are arguable economies associated with the intensity of rail operation, referred to as density economies (Propper et al, 1984). These economies include both production and user costs (Turvey & Mohring, 1975). It was not possible to evaluate the extent of user cost economies in the time available for the Review, however, from the point of view of production costs alone, infrastructure and shared head office and joint fixed costs were regarded as non-variable within a given scale of operation and therefore eligible for subsidy assistance. In aggregate these amounted to:

	($000)
Wellington	4,587
Auckland	1,440
Wairarapa	147
	6,174

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Externalities

The externality justification for public transport subsidies is based on the premise that there are costs and benefits associated with the consumption of private car versus public transport which are not taken into account in (and therefore are 'external' to) the price associated with the consumption of either service. The most noteworthy example of such an externality is roading congestion, where at peak capacity the additional marginal road user experiences his own operating and travel time costs resulting from congestion, and these influence his choice of travel at peak times, but does not experience those additional operating and travel time costs imposed on existing road users resulting from his decision to travel at that time. Consequently, there is an over consumption of roading because of the price distortion.

Ideally road pricing should reflect these externally imposed costs, and initiatives such as area licensing, toll charges, and electronic pricing are movements in this direction. There are practical difficulties associated with these measures however and a 'second best' pricing option is to provide a compensating price distortion in the competing public transport option (Jackson, 1975). The extent to which such a price distortion is successful in reducing demand for car travel depends on the relative cost of each mode at the margin and the degree of substitution between car and train, and between peak and off-peak rail travel.

Time did not permit a sophisticated analysis of the relevance of the externality argument for subsidy in the New Zealand context, however the working party considered that a 20 percent differential on peak service marginal costs would be a generous although admittedly arbitrary, allowance bearing in mind available research in this area (Glaister and Lewis, 1978; Amos and Starrs, 1984). This differential applied only to the Wellington and Auckland rail networks where justified subsidies of $4.069 million and $1.069 million, respectively, were identified on this basis.

Imperfect Information

The imperfect information justification often given in support of public transport subsidies refers to the short-sightedness of decision-makers and the consequent misperception of relative costs and benefits leading to suboptimal transport decisions. In the regional planning sense in particular it is argued that transport subsidies should be used to influence location choices and promote particular land use patterns. This justification is based on what is perceived to be the shortsightedness of operators or consumers in promoting desirable land use patterns without such an inducement. The main effects are twofold:

* low fare policies have the effect of aiding centrally located employment (particularly on a radially orientated system such as rail in Wellington); and

* lower price and less congested residential development will occur at the periphery of the CBD.

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The policy has a number of drawbacks. Firstly, there must be some doubt cast on whether such a land use planning orientation focussing on the CBD is desirable. Secondly, public transport subsidies are indiscriminate and have to be paid to all users even though only a few may represent the effective target group for the land use policies being pursued. Thirdly, the existence of location monopolies and inertia in locational decisions means that such subsidies could in fact redistribute income in directions which are both unintentional and undesirable. Such a policy therefore is likely to be a relatively weak and expensive means of achieving any desired land use planning objective and was not supported as a relevant justification for subsidy assistance.

Bias in cost perception, on the other hand, generally refers to the comparison of money outlays on public transport on a trip by trip basis with the more occasional and generally lumpy payments associated with motoring, which are therefore not specifically related to individual trips. It is argued that because the incidence of cost and payment is not matched this leads to a biased perception of the avoidability of costs between modes. The problem is accentuated further in cases where company cars are provided. In these situations the costs of the marginal trip are effectively incurred by a third party and are therefore largely irrelevant to the driver.

Empirical evidence in these areas is generally inconclusive, particularly when travel time is taken into account. Two immediate difficulties are faced. Firstly, as in the case of the externality argument, the likely low cross price elasticity between public transport and private car severely restricts the impact of a subsidy instrument of this sort. Secondly, again it is difficult to be sufficiently discriminatory in the imposition of the subsidy for it to be an effective instrument.

Public Goods

The joint consumption, or public goods, argument in favour of subsidy assistance for public transport is a final area in terms of economic efficiency which merits consideration. The term 'public goods' refers specifically to a commodity or service which once provided is available for all irrespective of whether those enjoying the benefit pay for it. The benefits provided cannot be limited to a particular consumer (e.g. a public health service provides health benefits to the total community irrespective of actual use of health facilities). As consumers can be excluded from rail and bus transport, the public good argument is not valid in this context. Those who use the term are generally referring to the existence of a facility as a fallback in the event of the failure of one or other competing modes e.g. the provision of rail in case there is a bus strike. The argument is weak, as it is unlikely that an event of this nature is sufficient to cause major disruption. It could apply more forcefully to many other forms of economic activity and therefore was not considered to be a valid reason for subsidising rail any more than any other market commodity.

Equity

Equity is often an underlying justification for urban transport subsidies. The objective under this heading is to redistribute income to lower income commuters, or to particular target groups such as the elderly or infirm. Whether, in fact, this objective is achieved depends on the net

incidence of the urban transport subsidy in terms of who receives the benefit of the subsidy relative to the burden of taxation for its provision. The incidence is progressive (i.e. a net transfer from high to low income groups) if the ratio of subsidy to tax as a proportion of income decreases as income increases. Conversely, the incidence is regressive (i.e., a net transfer from low to high income groups) if the ratio of subsidy to tax as a proportion of income increases as income increases.

Overseas evidence suggests that the subsidy incidence on urban rail is regressive in that it favours higher income commuters (Frankena, 1973). New Zealand evidence supports these findings (Guria et. al., 1985). It should be stressed, however, that these findings reflect only the average position with respect to the incomes of rail users. While, on average, rail users have higher incomes than those commuters using buses, some rail passengers do in fact come from lower income groups.

The working party concluded that the use of blanket subsidies for the support of urban public transport services is an extremely blunt instrument for redistributing income. As evidence would suggest that rail travellers tend, on average, to come from higher income groups, the use of blanket subsidies for rail may be even less effective than for bus where passengers tend to be, on average, from lower income groups. If equity objectives are to be addressed by the provision of subsidies for urban public transport it would appear that they would be more likely to be achieved by means of concessionary fares for particular groups e.g. the elderly. Better still, such assistance should be provided by means of direct income supplements to such individuals or to targeted low income household groups.

One particular area of concessionary fares identified as part of the cost and revenue analysis in the Review were peak revenue shortfalls resulting from school pupil concessions. These were estimated to be in the order of $3.1 million in Wellington and $0.245 million in Auckland. These costs are imposed on the urban rail (and bus) network for education purposes and have a significant impact on peak capacity requirements - particularly in the morning peak. While they persist, these concessionary fares were recognised as a notional educational subsidy to be funded separately from fare revenues.

The aggregate subsidies identified on the basis of scale economies, congestion and equity (notional education subsidies) are shown in Table 15.

TABLE 15
RECOMMENDED RAIL SUBSIDIES ($000)

	Economies of Scale	Externalities	Education	Total	Per Cent of Gross Expenditure
Wellington	4,587	4,069	3,100	11,756	39
Auckland	1,440	1,069	245	2,754	35
Wairarapa	147	-	-	147	13
TOTAL	6,174	5,138	3,345	14,657	38

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Subsidy Mechanism

Once the extent of potential subsidy was identified, the respective central and local government contributions were then considered. Relevant to this consideration were questions of relative national versus regional benefit arising from the subsidies, and the appropriate basis of allocation to ensure that the relevant subsidy objectives were achieved without the dynamic inefficiencies recognised in some payment systems (Bly, et. al., 1980; Cervero, 1984).

The working party concluded in favour of a return to the policy of local and central government cost-sharing in the financing of urban rail deficits. The overriding consideration in reaching this decision was the desirability of encouraging local accountability in determining the extent of subsidy justified on each mode. Two principal mechanisms to achieve this were examined:

* lump sum grant

* proportional subsidy

The first approach would involve a central government grant, via the UTC, to each local funding authority on an allocation basis such as population, passenger-kilometres, revenue, etc. The second approach would relate the UTC subsidy to either gross or nett expenditure incurred in providing individual rail services. Of the two approaches a proportional subsidy in relation to nett expenditure (i.e. the deficit after revenues) being chosen as the preferable subsidy basis. The main reason for this choice being the desirability of continually drawing attention to the level of the deficit and encouraging an ongoing review of the justification for this deficit in the light of the preceding subsidy evaluation.

In view of the difficulty distinguishing between the relative national versus local or regional benefits bestowed by each form of subsidy, and the likelihood that the relative incidence of these benefits will differ between services, by location, and over time, the working party concluded that the matching subsidy (or 'dollar for dollar') concept should apply (as is currently the case with non-rail services funded by the UTC). As an interim measure because of the substantial revenue increases required, however, it was recommended the Government adopt a four year phase-in to achieve the matching subsidy position. For the first three years of this phase-in the existing urban rail deficits fully funded by central government would reduce in real terms to the level recommended in Table 15. In the fourth year matching local contributions towards these deficits would be required. The recommended subsidies from central government over the four year phase-in period are shown in Table 16 (expressed in September 1985 prices).

Finally, the working party concluded in favour of retaining service contracts between the local funding authority and NZRC as the basis for providing subsidy assistance. (For 1985/86 a one year contract between the Regional Council and NZRC exists in Wellington. The Auckland Regional Authority was in the process of negotiating a similar contract with NZRC for 1986/87). A one year contract was regarded as providing insufficient time, however, to encourage NZRC to implement efficiency improvements (and to reap the benefit of these improvements in terms of a fixed contract price). As an alternative the working party recommended a five year contract with the qualifying subsidy being assessed at the beginning of the term of the agreement after a detailed examination of costs, revenues, operating practices, capital requirements and patronage. The results of this examination would be used to establish a contract price by estimating the avoidable costs incurred by a service or group of services, and the value of

the capital assets required to operate those services and to meet demand in an efficient manner (the 'thin man'). Where the costs of providing the agreed level of service exceed the contract price plus revenues the loss would be borne by NZRC. Conversely, any savings would be retained by NZRC, thus providing an incentive for improvements in efficiency.

CONCLUSION

The urban rail review reported on in this paper was a wide-ranging and comprehensive exercise. Unfortunately, because of the short time available for an analysis as complex as that required by the Terms of Reference it was not possible to explore all issues in as great a depth as was perhaps justified. In the area of subsidy justification in particular the working party noted the need for more sophisticated analysis into both of the efficiency arguments (scale economy and externalities) put forward to justify subsidy for urban rail. More work in these areas is a matter of urgent concern.

Nevertheless, the study provides an extremely important resource base upon which to develop future financial and investment decisions concerning urban rail services. There is merit in repeating the analysis at regular intervals in order to continually monitor the implementation of these decisions. Ideally such reviews should coincide with the five yearly determination of rail contract prices and service levels proposed by the working party.

In the short term the Review serves as a starting point for determining Government budget allocations for urban rail in 1986/87. This decision should be followed by the development of a detailed programme for implementing the efficiency improvements identified and should cover the next five - six years to also coincide with the establishment of five year service contracts. It is not likely to be possible from a practical point of view to commence such long term contracts before 1 April 1987.

In the meantime the report of the working party and the voluminous technical appendices on which it is based is likely to provoke considerable debate, both technical and emotive. This was anticipated from the outset and is unavoidable however. This debate, and the better informed public opinion that arises from it is an important component in the decision making process embodied in the planning processes of the Urban Transport Act 1980.

TABLE 16
PROPOSED CENTRAL GOVERNMENT CONTRIBUTIONS TO URBAN RAIL DEFICITS ($000)

	Year			
	1986/87	1987/88	1988/89	1989/90
Wellington	16,177	13,966	11,756	5,878
Auckland	4,994	3,874	2,754	1,377
Wairarapa	302	225	147	74
TOTAL	21,473	18,065	14,657	7,329

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