Regulatory Impact Statement for Consultation

PERMITTING HIGH-PRODUCTIVITY URBAN BUSES

Agency Disclosure Statement

This Regulatory Impact Statement has been prepared by the NZ Transport Agency.

It provides an analysis of options to address capacity issues for passenger transport provided by buses in Auckland and other metropolitan centres.

The preferred option is to enable the introduction of higher-capacity buses. The buses considered in this document have higher axle loadings than currently allowed.

To establish costs and benefits, the paper analyses the combined use of two representative bus types:

- A three-axle single level bus, with 48 passenger seating positions and a maximum loading of 60 persons (a "conventional bus") and
- A three-axle double-decker bus, with 80 or more seating positions and a maximum loading of approximately 90-100 passengers.

The conventional bus used for this analysis is already widely used for commuter and other bus services in our major cities.

The double-decker bus is a design under consideration for entering service on routes in Auckland where capacity constraints have been identified, while passenger demand is increasing.

No comparative analysis of other bus types is provided in this document.

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Executive Summary

In Auckland in the near term, there are capacity constraints around key corridors on the rapid and frequent networks such as the Northern Express, reflecting increased passenger numbers. These trends are reflected in other metropolitan centres, but will take longer to reach over-capacity limits.

A solution based on higher frequency services (less of a gap between buses, more buses on each route) is subject to a number of constraints (see below).

While bus designs with higher passenger loading limits are available, and are in use in other countries, these have higher axle loadings and gross vehicle weights when fully loaded. The axle loadings in particular exceed those currently allowed under Land Transport Rule: Vehicle Dimensions and Mass 2002 ("the VDAM Rule").

Not all high-capacity bus designs are suitable for use in New Zealand – there is always a balance to be struck between increased pavement wear (as axle loadings increase) and higher productivity/ reduced capital costs.

The draft amendment Rule proposes that road controlling authorities (RCAs) would, if they considered it appropriate, be authorised to grant permits to high-capacity buses.

The amendment Rule as proposed is seen as an interim solution, in the context of the wider review of VDAM limits and processes which is currently under way.

Status quo and problem definition

The Government Policy Statement on land transport (2015-16 to 2024-25) supports the need for public transport to unlock the potential of our urban areas by providing additional capacity on key corridors and a choice of ways to move around, particularly during peak commuting periods. This is particularly relevant for our largest cities of Auckland, Wellington and Christchurch.

The Auckland Transport Plan[1] is aiming to double public transport trips to 140 million in 2022. In the short term there is a need to address capacity constraints and to improve efficiency and effectiveness of the bus network in Auckland to meet demand and continue to grow patronage, particularly on Rapid and Frequent public transport services operating on busy road corridors, without significantly increasing the number of buses providing services on them.

In Auckland there are capacity constraints on the rapid and frequent services travelling to the central business district (CBD) from the North Shore, Mt Eden, Dominion Road, Sandringham Road and New North Road, and Mission Heights.

These routes account for around 12 million public transport passengers per annum, with growth rates in recent times on these corridors ranging from 6 to 10 percent, and passenger capacity utilisation in the peak ranging between 80 and 95 percent. Demand on these routes is predicted to continue to grow at these rates for the foreseeable future.

These trends are reflected in other major urban areas. Wellington will need to address capacity constraints within existing corridors in order to meet public transport demand and its regional targets, particularly on the public transport spine e.g. Wellington railway station to the Wellington Hospital or Kilbirnie. In addition, Christchurch is experiencing significant congestion on some key corridors at peak times, but overall, capacity is still available after a significant loss of patronage following the Christchurch earthquakes, and problems will take longer to eventuate.

The Auckland Council City Centre Future Access Study[2] highlights the capacity problem. A key finding was that by 2021 *most* bus networks approaching the City Centre, as well as within the City Centre, will be at capacity in terms of what can be physically provided for within the existing road corridor. In other words, it is not possible to keep inserting more single deck buses into the road corridor to alleviate capacity issues due to bus bunching problems and limited bus stop space, particularly in the City Centre; higher capacity vehicles must be part of the solution.

As buses reach capacity, they continue past people waiting at bus stops and this falls below an acceptable level of customer service.

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[1] Auckland Regional Public Transport Plan, September 2013

[2] Auckland Council City Centre Future Access Study, Sinclair Mertz, December 2012

The constraints which limit a solution based on higher frequency services (less distance between buses, more buses on each route) include:

- the capacity of current roads (most routes are shared with all other traffic, and some core intersections are highly congested at peak times);
- space allowances at bus stops (how many buses can be accommodated at a stop at any one time); and
- layover capacity within the CBD (how many buses can be "held" in the area at any one time).

The use of higher capacity vehicles, such as double-decker buses, is an important part of the solution. Other initiatives include bus priority treatment along key corridors and within the City Centre, and the further introduction of bus lanes and dedicated busways are also being considered as part of an overall plan. The plan to address passenger growth is to move from bus lanes, to dedicated busways and Bus Rapid Transit, and potentially light rail if the demand and population/ employment density on key corridors is sufficient to support such systems.

Options considered

Status quo

Rule is not amended: higher-capacity buses could not enter service.

Benefits	Costs
No costs incurred for: • permit applications • changes in PT contracting Reduced capital costs (less investment in newer, more expensive vehicles)	Capacity limits on core routes will be exceeded if only conventional buses are available Higher congestion in CBD and main corridors as more buses enter service Lower PT quality (passengers cannot find space on buses as capacity is exceeded) Higher congestion as individuals use private rather than public transport

Provide “as of right” access for larger buses

Rule sets higher axle limits for defined buses but does not require them to seek a permit prior to operating.

Benefits	Costs
Reduced costs for applications and processing permits	RCAs have reduced visibility of where these larger buses are operating Larger buses could be operated on roads with lower construction quality Some readjustment of existing RUC rates would be required (to distinguish double-deckers from conventional buses)

Allow a wide range of larger buses to be permitted

Heavier axle limits than those in the proposal would allow two axle double-deckers (for example); these impose higher point loads than allowed in the proposal.

Benefits	Costs
Reduced capital costs for new buses (around $180K less when compared to 3 axle equivalent) Wider range of bus suppliers could be considered by operators	Much higher loading on drive axle and therefore higher road wear RUC rates would have to be higher than those for 3 axle buses Slightly lower seating capacity per bus.

(Preferred) allow larger buses that meet design limits to be permitted

Benefits	Costs
RCAs can control the routes on which higher capacity buses operate Pavement wear kept to acceptable levels Allows higher capacity on core PT corridors	Imposes costs to apply for and process permits Higher capital costs (3-axle double-decker buses compared to 2-axle equivalents) Limited range of suppliers RUC rates increase over conventional buses

Benefits and Costs

The proposed changes will impose limited costs on bus operators who apply for permits, and RCAs who must create and consider a new class of overweight permit. However, this is expected to be offset by greater efficiency for the service provided and ease congestion on the authorities' roads. Higher capacity buses provide greater passenger throughput on high demand routes and central city spaces with the same or preferably reduced number of vehicles. Due to significant bus volumes and limited road and bus stop space, Auckland Transport plans to reduce the number of buses overall by supplementing the single-decker fleet with double-deckers on key corridors. This will alleviate bus bunching and bus congestion problems in the City Centre, and still meet growing demand. This is a proposition Auckland Transport and NZ Bus are working on delivering for five key isthmus routes involving 141 single-decker buses. These services account for 8.5 million passenger boardings annually.

This solution has higher net benefits if the routes travelled do not require extensive engineering work to accommodate larger vehicles. Auckland Transport has accounted for one-off capital and on-going corridor maintenance costs in an updated economic analysis undertaken in October 2014 (refer to following section). For example, an estimated budget of $5.8m has been established for one-off infrastructure work on the Botany and Mt Eden corridors.

Auckland Transport has analysed replacing 14 single deck vehicles on the Northern Express with 14 double-deckers. Ritchies operate the Northern Express service carrying 2.3 million passengers annually. Buses on this service run every three minutes in the peak periods, and capacity utilisation is at 93 percent. Replacing the single deck buses with double-deckers would offer approximately 30 percent extra peak seated capacity for an increase in contract costs of approximately $554k per annum on the Northern Express services. Auckland Transport's financial modelling suggests that by year two after the introduction of the double-deckers the fare revenue from additional passengers will exceed the increase in contract costs. Over three years, farebox recovery was modelled to improve by 9 percent and the subsidy per passenger reduces by 30 percent.

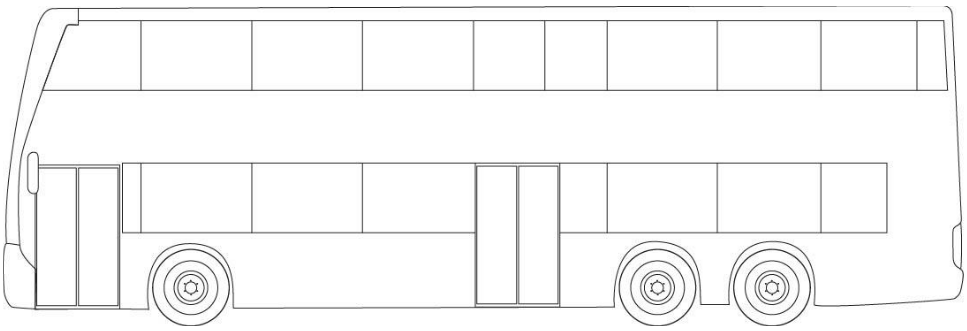
The availability of permits, even though these are intended to be applied only on high-capacity routes, will provide the option for bus operators to consider the purchase of more productive vehicle types, which would not be allowed under the current VDAM Rule.

While there may be marginal inefficiencies for the time required for loading and unloading of passengers at bus stops, Ritchies indicates that an increase in dwell times[3] is not posing a problem for the single double-decker they are operating on the Northern Express currently. These times increase whenever buses have to take on or offload high volumes of passengers at any stop, and will also increase where passengers have to go up to or descend from an upper deck. However, these inefficiencies are outweighed by the ability to operate at the desired regular headways with a reduced number of buses to meet the demand and frequency requirements on main corridors.

Higher axle loadings will impose greater wear (and therefore maintenance costs) on the routes where these vehicles will operate. This can be indirectly offset by increased revenue through Road User Charges (RUC). See below for some indicative figures.

Vehicle Descriptions

Double-decker buses



This form of vehicle provides an approximately 50% increase in the number of passengers but imposes axle loadings beyond those currently allowed by the VDAM Rule. These are in regular use in a number of overseas metropolitan areas (e.g. London, Hong Kong) where road space is at a premium and passenger numbers are high. Note that the comparison vehicle used in this document is a three axle bus; two axle double-deckers are more common in cities such as London.

A key advantage for this form of vehicle is that its "footprint" is equivalent to existing conventional buses.

The potential disadvantages for operating double decker buses are:

- higher road wear
- slightly less efficiency for loading/ unloading
- constraints where the route has restricted height limits (e.g. a few urban tunnels, overhanging verandahs, protected trees etc.) and
- the requirement for a higher driver licence class than a conventional bus because of the higher GVM (class 4, not class 2).

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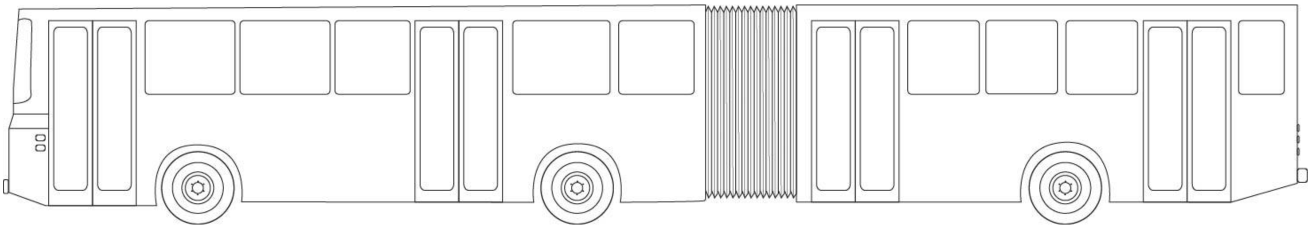
[3] Time taken at a bus stop to load/ unload passengers.

Articulated buses (“bendy” buses)



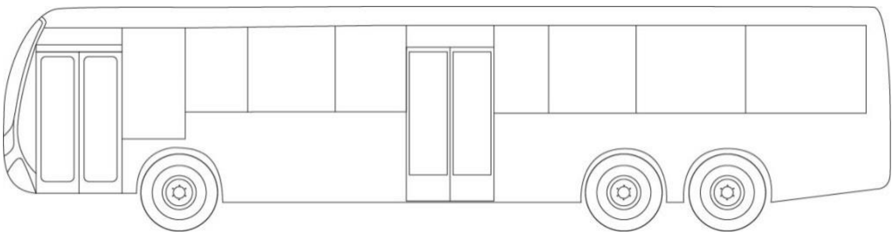
This form of vehicle also provides higher capacity, close to that of the double decker buses discussed above.

These vehicles can be configured to meet current VDAM axle weight limits and, if appropriately designed, they can track through corners with a similar swept path to conventional buses.

Prior trials and evaluations (primarily in Auckland) of articulated buses, however, concluded that these vehicles create some disadvantages:

- the longer footprint of these vehicles may require major reconfiguration of parts of the road space (e.g. to allow stacking at intersections);
- existing bus stops do not have sufficient space to accommodate more than one of these vehicles at any time and
- there are constraints on the ability to accommodate these vehicles within the city centre when not in service.

Large conventional buses



This form of vehicle is in wide use for urban bus services. A typical vehicle has three axles, with a total length of 13.5 m. These vehicles are already allowed a slightly longer overhang (the distance between the last axle and the back of the vehicle) than other heavy vehicles. Effectively, these vehicles are at the limit of length versus their ability to fit on the available road network, especially in suburban areas.

The amendment Rule does not propose an option to issue permits to these vehicles.

Analysis: mixing single and double-decker buses

Auckland Transport commissioned an economic analysis comparing the introduction of double-deckers on key corridors – a mix of single-decker and double-decker buses in the **Option** case – compared to a **Do minimum** base case which uses single-decker buses only while increasing peak capacity (i.e. providing more single-deckers) in line with patronage growth. The analysis found that all the modelled corridors had positive net present values, indicating that the Option case is economically viable.

The table below shows the economic outcome of double-decker bus operation on the corridors that were modelled. All figures are the present value (PV) in $ millions, discounted at 8 percent (6 percent was used for sensitivity testing). The net PV is the sum of benefits and cost savings:

Corridor	$ million		
	PV(costs)	PV(bens)	Net PV
Mt Eden Road	- $3.46	$6.55	$10.01
Dominion Road	- $8.04	$5.76	$13.81
Sandringham Rd	- $1.06	$5.80	$6.86
Manukau Rd	- $5.20	$5.98	$11.18
New North Rd	- $5.77	$5.82	$11.59
Remuera Rd	- $4.49	$6.18	$10.67
Northern Express 2 (881 to Newmarket)	$0.63	$1.13	$0.50

Cost inputs into the analysis

Capital costs

Bus capital costs have been annualised and include financing:

Item	Single	Double
Assumed equivalence SD/ DD	10	6
Capital cost, $k	$450.00	$680.00
Expected life, years	10	15
Final value, $k	$45.00	$68.00
Annual cost $, at 7% p.a.	$65,437	$75,479

Time-based costs

The cost of the bus driver has been taken as $25 /hour. In general it would be expected that there would be a saving in driver hours in the option due to fewer total vehicles being required. A saving of one driver is estimated to save $62.50 for an "average" peak of 2.5 hours or about $30,000 p.a.

Distance-based costs

These costs cover items such as fuel, oil, tyres and Road User Charges (RUC). A value of $0.90 per km has been used for single-decker buses, based on analysis associated with the introduction of new procurement models in Auckland.

The cost per km for a double-decker bus has been taken to be 25% higher than for a single-decker to reflect factors such as increased fuel consumption and RUC.

As with time-based costs, there is likely to be saving in distance costs with the option due to fewer total vehicles; this is illustrated in the table below, which shows how the same capacity can be provided by either single or double-decker buses.

Item	Single	Double
Fleet	10	6
Km per bus	100	100
Bus-km	1000	600
Cost per km	$0.90	$1.13
Total cost	$900.00	$675.00

Street maintenance costs

There will be an initial cost to prepare each corridor for double-decker bus operation, for example to trim or remove trees or verandas. This one-off cost varies by corridor and has been assessed by Auckland Transport in October 2014.

In addition there will be an ongoing maintenance cost which has been taken as $10k p.a. for all Auckland corridors.

Road wear estimates

Road construction in New Zealand is largely granular pavements with a thin sealed surfacing on soft soils (highways generally have more resilient foundations and thicker seal than local roads). This is in contrast to structural concrete or asphaltic concrete pavements on strong continental soils in Europe, Australia and the USA.

This difference in road construction is reflected in the way we calculate wear and allocate costs to heavy vehicles. We calculate the increase in pavement damage by reference to a power depending on the pavement strength. For simplicity we use an average pavement to the 4th power.

For the assumed 3-axle double-decker, operating when full at close to the proposed Part C axle limits:

- the front axle should be close to existing allowances
- for the rear axle set, take 16 tonnes (new allowance) to the 4^{th} power and divide it by 14.5 tonne (exisiting allowance) to the fourth power. The result is 1.48 (the road wear estimate is about 48% higher).

For comparison, the existing 107% higher axle loadings allowed for (freight) High Productivity Motor Vehicles are calculated to produce additional 4^{th} power pavement wear of 130%.

A two axle double decker would have the rear axle loaded above the standard 8.2 tonne limit. While this does vary by vehicle model, a typical loading would be 10 tonnes on the rear twin-tyred drive axle. 10 tonnes represents 120% above the standard weight allowance, and is calculated to produce increased pavement wear (at 4^{th} power) of 207%.

The 4^{th} power calculation is part of the Cost Allocation Model that is used to determine appropriate RUC rates. However, the model also allows for the use of a load factor and is based on an assumption that load is distributed optimally over all the axles on a vehicle. In this instance, the rear axle set on the representative three axle double-decker, while load sharing, does not have even weight distribution.

It is therefore important to recognise that estimates of increased wear do not translate directly into the RUC rates calculated for a vehicle type.

Cost transfer

While higher axle loadings (linked to a permit) are balanced by the payment of higher RUC rates, this does not translate directly into increased funding for an RCA that may be required to increase spending on road repair and upgrading resulting from the operation of heavier vehicles.

RUC payments are classed as “land transport revenue” and must be paid into the National Land Transport Fund[4]. While funds are allocated to RCAs for road construction and repair, these are not calculated on the basis of heavy vehicle permits issued for the relevant routes.

Benefits inputs into the analysis

Passengers

Passengers who use double-decker buses will experience a number of benefits such as more room, no standing on the upper deck, and a high level of specification, as well as the “novelty” value. As explained in the Transport Agency’s Economic Evaluation Manual (volume 2, section 7.2) these benefits can be represented in minutes of in-vehicle time (IVT), which is converted to a dollar value using the appropriate value of time. The benefit per passenger has been taken as 1 minute of IVT, which is the same as the manual’s value for air conditioning.

Traffic

The use of double-deckers as part of the bus fleet is expected to lead to a reduction in the overall number of buses. From the point of view of other traffic, the contribution to congestion made by a bus will not vary whether it is a single or double-decker. It follows that with fewer buses overall there will be benefits to all road users from less congestion although the impact is likely to be felt primarily in the peaks.

The decongestion benefits in the business case have been calculated from the reduction in peak bus-km combined with the PCU value[5] of a bus, which is 3 for both single and double-deckers, representing the fact that a bus will typically cause congestion equivalent to three cars. The decongestion benefit of each car-km has been taken from SP9 in the Economic Evaluation Manual.

The analysis also takes account of bus priorities, where general traffic and buses do not usually interact, by halving the total traffic benefits. However no account has been taken of specific areas of bus congestion e.g. Lower Queen St.

Context: VDAM Review

The amendment Rule to which this RIS refers deals with a specific issue (the introduction of high-capacity buses) and does not consider the wider question of allowable axle weights for existing buses or other vehicle classes. Last year, the Ministry of Transport initiated a full review of the VDAM regime, and a public discussion document is scheduled for release later this year. The review is the appropriate mechanism for determining permitted axle weights for heavy vehicles.

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[4] Sections 6 and 10, Land Transport Management Act 2003. This then provides funding for the projects and expenditures included in the National Land Transport Programme.

[5] “Passenger Car Unit” value of a bus –used for calculating throughput.