ALLOWABLE GROSS COMBINATION MASS FOR TWIN-STEER PRIME MOVER AND SEMI-TRAILER COMBINATIONS

DRAFT PROPOSAL AND REGULATORY IMPACT STATEMENT

October 2006

National Transport Commission

Prepared by
Pearsons Transport Resource Centre Pty Ltd
Economic Associates Pty Ltd

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Abstract:

The Regulatory Impact Statement considers whether seven-axle articulated vehicles, incorporating twin-steer axle group and a triaxle semi-trailer, should be permitted to operate at a general mass limit of 47.5 tonnes and on approved routes at higher mass limits, of 50.5 tonnes.

The impact analysis shows that either the Regulatory Proposal or Alternative 1 would be economically viable. Net present values for the two, range between $34 million and $52 million and benefit cost ratios between 2.5 and 3.4. The Regulatory Proposal would be preferred, having the higher of these results.

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Comments by:	30 November 2006
Comments to be addressed to:	Chief Executive National Transport Commission L15/628 Bourke Street MELBOURNE VIC 3000 OR Email to: The Project Manager, Ron Smith at rsmith@ntc.gov.au

FOREWORD

The National Transport Commission is an independent, statutory body, established by the *National Transport Commission Act 2003*, pursuant to the 2003 Inter-Governmental Agreement for Road, Rail and Intermodal Regulatory Reforms. The Commission has a continuing responsibility to develop and maintain uniform, or nationally consistent, road, rail and intermodal transport reforms, to improve safety, productivity and environmental outcomes.

This Regulatory Impact Statement has been prepared to support a vote by members of the Australian Transport Council: to allow twin-steer prime mover and semi-trailer combinations to operate at a gross mass limit of 47.5 tonnes. An amendment the *Road Transport Reform (Mass and Loading) Regulations 1995*, is required to apply this policy.

Two rounds of consultations have been undertaken to date. The first, in 1998, sought road agency comments on a general proposal circulated by VicRoads. It proposed increases in the gross mass for seven-axle, articulated, combinations with a twin-steer axle group. It also considered a report prepared by Roaduser Research, relating to the operation of twin-steer articulated combinations.

Further comments were sought from government and industry, by means of the wide circulation and availability of the *Twin-Steer Axle Mass Limits Project: Discussion Paper July 2004* (Pearson et al 2004). The Discussion Paper canvassed a range of technical and policy issues. It also discussed the possibility that a road friendly twin-steer axle group should be permitted increased load, which is not part of the Regulatory Proposal. However, there was little opposition to the concept of summing the axle group masses, either from industry or road agencies.

Further input into the project was obtained at a workshop held at VicRoads on 27 July 2004, with participants from both government and industry. The main focus of the workshop was the Discussion Paper. However, other relevant issues discussed dealt with industry take-up, ability to achieve the load on the twin-steer axle group, interchangeability of semi-trailers and methodology for calculating impacts.

Further consultation will take place with the circulation of this draft Regulatory Impact Statement.

The National Transport Commission would like to sincerely thank all those parties who have contributed to the many phases in developing this proposal. Special thanks are due to VicRoads, as lead agency for the project, and those who participated in workshops or responded to the Discussion Paper.

I wish to acknowledge the significant contributions made by: Mr Don Hogben and Mr John O'Regan of VicRoads, Mr Bob Pearson (Pearsons Transport Research Centre Pty Ltd), Mr Damian Yeo (Economic Associates Pty Ltd) and Dr Hans Prem (Mechanical System Dynamics Pty Ltd). I thank them for their work in the preparation of the succession of discussion papers and this Regulatory Impact Statement, and commend former National Transport Commission officers, John Edgar and Barry Hendry, for their enthusiasm and commitment to this project.

Michael Deegan
Chairman

Comments are due by: **30 November 2006.**

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SUMMARY

The national *Road Transport Reform (Mass and Loading) Regulations 1995*, limits all articulated truck combinations with general access to 42.5 tonnes gross combination mass irrespective of the number of axles fitted to the combination. Consequently, a twin-steer combination for which the individual axle group mass limits add to 47.5 tonnes gains no productivity benefit from having a seventh axle. In fact it loses productivity because it must carry the tare mass of the additional steer axle. Some specialist applications that need very high steer axle masses, for example vehicles fitted with truck mounted cranes, are presently the main combinations using a twin-steer prime mover and tri-axle trailer.

Basing the permitted gross mass for twin-steer prime mover and semi-trailer combinations on the sum of axle weights would allow operators to make efficient choices about the use of these vehicles relative to other vehicle types, such as 19 metre B-doubles and truck-trailers. More operators would also be able to accommodate vehicle mounted cranes for loading and unloading an advantage from an occupational health and safety perspective.

Following the Mass Limits Review in the mid 1990s, a number of Australian jurisdictions introduced higher mass limit regime for vehicles fitted with road friendly suspension systems. Vehicles operating under the Higher Mass Limits regime are restricted to operating on approved routes on the road network and may have a gross combination mass of 45.5 tonnes, which is also less than the sum of the individual axle group limits.

The Regulatory Proposal being considered is that:

Seven-axle articulated vehicles, incorporating a twin-steer axle group and a tri-axle semi-trailer, should be permitted to operate under:

a) general mass limits (legislation equivalent to the *Road Transport Reform (Mass and Loading) Regulations 1995)*, at a gross mass not exceeding 47.5 tonnes (the sum of the maximum axle group limits); and

b) Higher Mass Limits (in the States and Territories that allow increased mass limits for vehicles fitted with road friendly suspension systems) at a gross mass not exceeding 50.5 tonnes (the sum of the maximum axle group limits).

Two other regulatory options were considered. The Base Case provides that the present gross combination mass limits remain. Alternative 1 would limit gross combination mass limits to levels below the sum of axle group masses i.e. 46.5 tonnes for general mass limits and 49.5 tonnes for Higher Mass Limits to minimise any increases in road wear. These gross mass limits were chosen as the levels at which the twin-steer vehicles would cause the same road wear as the six-axle articulated vehicles in the Base Case.

As the gross mass is presently regulated, non regulatory options are not available.

The current twin-steer fleet is estimated to be around 500 vehicles, of which it is assumed 50% will take up either the Regulatory Proposal or Alternative 1. The Regulatory Impact Statement estimates total take-up to be approximately 950 vehicles in the Regulatory Proposal and in Alternative 1. The balance of 700 vehicles representing migration from the existing six-axle articulated vehicle fleet to twin-steers in response to the Regulatory Proposal or Alternative 1.

Total vehicle related capital costs, representing the incremental costs of manufacturing a seven-axle twin-steer vehicle relative to a conventional six-axle articulated vehicle, are estimated to be $25,000 per vehicle. Initial vehicle-related capital costs over a three year take-up period would be $16.5 million in the Regulatory Proposal and $17.1 million in Alternative 1, as existing six-axle semi-trailer combinations are replaced with seven-axle twin-steer combinations (no additional capital costs would be incurred for existing seven-axle twin-steer combinations that take up the Regulatory Proposal or Alternative 1). In addition, each jurisdiction is estimated to incur costs totalling $30,000 (equal to $240,000 nationally) over three years, in changing present legislative requirements (Regulations or Gazette notices) and in associated tasks.

The larger part of the benefits is estimated to comprise reductions in vehicle operating costs, as fewer vehicle kilometres of travel are needed to deliver the same transport task. In addition, estimated capital cost savings of between $2 million and $3 million per year would accrue, in avoided replacement costs for six-axle semi-trailer combinations, displaced by take-up of the Regulatory Proposal or of Alternative 1.

Pavement cost impacts would be slight, with an increase of $0.3 million annually under the Regulatory Proposal and a reduction of $1.1 million annually under Alternative 1. These impacts do not include any consideration of costs recovered for road wear, which are included in registration charges, and the allocated portion of fuel excise. These are considered transfer payments. Nevertheless, the registration charge for a four-axle prime mover is nearly 30% higher at $5,025, compared to the registration charge for a three-axle prime mover, which is $3,883. Therefore, a twin-steer articulated combination is already contributing to the road wear it creates.

The impact analysis shows that either the Regulatory Proposal or Alternative 1 would be economically viable, with net present values ranging between $34 million and $52 million and benefit cost ratios between 2.5 and 3.4. The Regulatory Proposal would be preferred, having the higher of these results.

Sensitivity testing of the input parameters of discount rate and vehicle-related capital cost has shown the results of the impact analysis to be robust.

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1. INTRODUCTION

1.1 The Regulatory Issue

All articulated truck combinations with general (that is, unrestricted) access to the road network are limited to 42.5 tonnes gross combination mass under the national *Road Transport Reform (Mass and Loading) Regulations 1995*, irrespective of the number of axles fitted to the combination. The maximum of 42.5 tonnes gross combination mass is achieved with a standard six-axle combination, comprising a single-steer axle (allowed 6 tonnes), a tandem axle drive group (allowed 16.5 tonnes) and a tri-axle trailing group (allowed 20 tonnes).

Consequently, a twin-steer (with an allowable group mass of up to 11 tonnes) articulated combination towing a tri-axle trailer gains no benefit from a productivity perspective. In fact, it loses productivity because it must carry the tare mass of the additional steer axle. Some specialist applications that need very high steer axle masses, for example vehicles fitted with truck mounted cranes, are presently the main combinations using a twin-steer prime mover and tri-axle trailers.

Basing the gross mass for twin-steer prime mover and semi-trailer combinations on the sum of the allowable group axle masses, would allow operators to make efficient choices about the use of these vehicles relative to other vehicle types (such as 19 metre B-doubles and truck-trailers that are permitted a gross mass in excess of 42.5 tonnes). More operators would also be able to accommodate vehicle mounted cranes for loading and unloading; an advantage from an occupational health and safety perspective. Operators would also be able to mount larger fuel tanks, for more cost effective travel in areas with higher fuel costs.

In addition, the Mass Limits Review (National Road Transport Commission 1996) recommended higher mass limits for tandem and tri-axle groups fitted with road friendly suspension systems. These vehicles operate under the Higher Mass Limits regime and may travel on approved routes only. Under this regime, six-axle articulated combinations are permitted 45.5 tonnes.

Consequently, two different mass issues arise:

- allowable gross mass limits for twin-steer articulated combinations at the general mass limits specified in the *Road Transport Reform (Mass and Loading) Regulations 1995*; and
- allowable gross mass limits for twin-steer articulated combinations under the Higher Mass Limits regime.

Concessional Mass Limits[1] are not considered here, as present twin steer tri-axle trailer combinations are eligible for Concessional Mass Limits and that would not change.

[1] Concessional Mass Limits allow for increased loading, provided the operator has an auditable Mass Management System in place to guarantee the mass on the vehicle prior to the commencement of a trip.

1.2 Background

In the past, twin-steer vehicles have not been favoured by industry because of their poorer tyre wear performance and limited manoeuvrability. This is due to low wheel cut associated with the needs of two steering axles. Accordingly, there has been little industry demand for an increase in the maximum gross combination mass above 42.5 tonnes. However, modern twin-steer trucks have significantly improved steering systems. Concern about the manoeuvrability and maintenance of twin-steer vehicles has all but dissipated.

In November 1998, the Victorian Road Freight Advisory Council requested VicRoads to approach the National Road Transport Commission [now the National Transport Commission (NTC)], to seek a national position on a proposal to increase the maximum gross mass limit for a twin-steer prime mover and semi-trailer combination. The project is part of the NTC's Third Heavy Vehicle Reform Package, with its purpose: '*To establish a national mass limit for a twin-steer prime mover and single semi-trailer vehicle combination*'. VicRoads was the lead agency for this national project.

Twin-steer rigid trucks are being used successfully in the waste, quarry, premix concrete and recycling industries; benefiting from the additional load capacity. These vehicles, all with less than six-axles, are able to operate at the sum of axle weights (including 11 tonnes on the steering group), as the gross mass remains below 42.5 tonnes. However, twin-steer prime movers are not currently viable in many industries. The additional tare mass of the second steer axle is not compensated for by additional payload; because both six-axle and seven-axle articulated vehicles are limited to 42.5 tonnes under the general mass limits regime.

If twin-steer single articulated vehicles were permitted to operate at the sum of their allowable axle group mass limits, the resultant gross mass will increase, as shown in Table 1.

Table 1: Allowable loads for twin-steer articulated vehicles, if allowed the sum of axle group limits

Mass regime (note 1)	Twin-steer axle group (note 2)	Tandem drive axle group	Tri-axle trailing group	Gross mass
General mass limits	11 tonnes	16.5 tonnes	20.0 tonnes	47.5 tonnes
Higher Mass Limits	11 tonnes	17.0 tonnes	22.5 tonnes	50.5 tonnes

Notes:

1. Present regulations restrict the gross mass to 42.5 tonnes for general mass limit vehicles and 45.5 tonnes for Higher Mass Limit vehicles.
2. 11 tonnes permitted for a load sharing, twin-steer group, the limit drops to 10 tonnes if a load sharing suspension is not fitted.

Twin-steer vehicles, typically rigid trucks, are presently used for carrying high density loads, such as concrete, waste and similar bulk products. Twin-steer semi-trailer configurations were popular in Western Australia for many years as they are able to operate under permit at a gross combination mass of 47.5 tonnes. Their popularity has declined in recent years as other larger and more productive combinations were permitted. Use of twin-steer configurations in general freight semi-trailer configurations in other States is low because of the 42.5 tonnes gross combination mass limit. In Tasmania, twin-steer combinations are permitted in logging operations at a gross mass of 47.5 tonnes.

This Regulatory Impact Statement does not deal with combinations other than a four-axle prime mover incorporating a twin-steer axle group towing a tri-axle semi-trailer. In particular, B-doubles fitted with twin-steer axles are not considered.

1.3 Objective of the Regulatory Proposal

The objective of the Regulatory Proposal is to increase economic efficiency without reducing road safety by increasing the permitted gross combination mass of seven-axle single articulated vehicles with twin-steer axle groups.

1.4 Road Safety Aspects

Road Safety is an important community issue; hence its inclusion in the Objective outlined in Section 1.3. As part of the project examining the mass of twin-steer vehicles, the road safety aspects of a number of alternative twin-steer articulated combinations were investigated using a Performance Based Standards approach. Performance Based Standards is an outcome oriented regime that will be an optional alternative to the prescriptive regulations presently in operation. They have been developed for both safety and infrastructure. There are four groups of safety standards:

- longitudinal performance (low speed) − that is, travel in a straight line at low speed;
- longitudinal performance (high speed) − that is, travel in a straight line at high speed;
- directional performance (low speed) − that is, low speed turning/lane change manoeuvres; and
- directional performance (high speed) − that is, high speed turning/lane change manoeuvres.

More details of the Performance Based Standards approach can be obtained from the website of the NTC at www.ntc.gov.au.

The investigations in this project used computer modelling to simulate the response of five different twin-steer combinations that were considered the most likely users of seven-axle articulated combinations:

- a flat top as used in the construction industry;
- a general freight curtain–sided van;
- a logging jinker;
- a petrol tanker; and
- a skel trailer carrying containers.

The results of the simulations are given in NTC (2005a). Apart from a minor non-conformance against a dimensional standard (which would be met if different dimensions were used), the only standard that some of the twin-steer single articulated vehicles did not meet was the Static Roll Threshold. The Static Roll Threshold is an important safety standard indicating the propensity of a vehicle to roll over during cornering. The report concluded that, given the range of assumptions necessary to assess the vehicle, together with the minor design changes necessary to meet the standard, this non-conformance was not considered a cause for concern.

Nevertheless, because of the importance of the Static Roll Threshold standard for safety, further refinement was undertaken NTC (2005b). It was then found that, for all practical purposes, twin-steer prime movers towing tri-axle trailers and loaded to the sum of the allowable axle group loads, would be likely to meet the Performance Based Standards standard for Static Roll Threshold. This would be so irrespective of whether the vehicle was loaded to general mass limits or higher mass limits. However, the tanker vehicles were not

able to meet the more stringent Static Roll Threshold value stipulated for vehicles carrying dangerous goods in bulk.

Given this finding, together with the reduced road travel associated with greater payloads (as noted in Section 3.2.6), road safety does not appear to be a barrier to allowing twin-steer and tri-axle trailer combinations to load to the sum of the axle mass limits. This is the basis for the Regulatory Proposal.

2. THE REGULATORY PROPOSAL AND ALTERNATIVES

2.1 The Regulatory Proposal

The Regulatory Proposal being considered is that:

Seven-axle articulated vehicles, incorporating a twin-steer axle group and a tri-axle semi-trailer, should be permitted to operate under:

a) general mass limits (legislation equivalent to the *Road Transport Reform (Mass and Loading) Regulations 1995*, at a gross mass not exceeding 47.5 tonnes (the sum of the maximum axle group limits); and

b) Higher Mass Limits (in the States and Territories that allow increased mass limits for vehicles fitted with road friendly suspension systems) at a gross mass not exceeding 50.5 tonnes (the sum of the maximum axle group limits).

Under the present Higher Mass Limits regime, an operator with a vehicle incorporating a tri-axle is required to be accredited under the National Heavy Vehicle Accreditation Scheme (Mass Management Module). It is proposed that this policy remain unchanged, meaning that an operator of a seven-axle articulated vehicle with twin-steer and tri-axle semi-trailer, would require accreditation to operate at higher mass limits.

2.2 Alternatives to the Regulatory Proposal

It can be seen from Table 1 that gross mass gains of up to 5 tonnes would be possible if single articulated vehicles were permitted to realise the sum of the allowable axle group loads. Allowing for an increase in tare mass of approximately 1.5 tonnes, an increase in payload of 3.5 tonnes would be possible. These increases apply to vehicles operating under both the general mass limits and the higher mass limits regimes.

However, twin-steer axle groups operating at masses approaching the maximum allowable of 11 tonnes, are relatively more damaging for road pavements than single-steer axles. Any twin-steer load greater than 10.1 tonnes will theoretically cause more road wear than a single-steer axle. Restricting the gross mass and the twin-steer mass to levels below the maximum is an option that would assist in reducing additional pavement wear.

In addition, achieving the full payload advantages with twin-steer prime movers could be difficult. The fifth wheel needs to be positioned up to one metre ahead of the drive axle group to transfer sufficient load on to the steer axle group. This compares to normal six-axle articulated vehicles, which typically will have the fifth wheel positioned 100 millimetres to 250 millimetres ahead of the centre of the drive axle group. This would lead to a need for semi-trailers specifically designed for towing behind a twin-steer prime mover. An alternative arrangement might be to place some freight on the prime mover. This arrangement may be attractive for non-specialist applications such as general freight operations. Restricting the allowable mass on the twin-steer for pavement wear reasons may therefore not have the productivity disadvantages for some applications that might be initially apparent. The impact analysis takes this effect into account.

The main alternatives to the Regulatory Proposal would be to retain the present gross mass limits (the Base Case), or to allow the vehicles to operate at a gross mass less than the sum of the axle group mass limits to limit road wear. A variety of combinations of axle group and gross mass limits could have been adopted as alternatives. However, it was considered that

Alternative 1 to the Regulatory Proposal should be a proposal to limit the road wear to a total that is the same as for the most common similar freight vehicles (the six-axle articulated vehicle (A123) at their maximum mass limits). For Alternative 1 therefore, the gross mass under gross mass limits would be restricted to 46.5 tonnes (and the twin-steer limited to 10.5 tonnes), so that the road wear of a twin-steer vehicle would be the same as is presently imposed by a six-axle articulated vehicle operating at 42.5 tonnes. Under High Mass Limits, the equivalent limits would be 49.5 tonnes gross mass maximum and 10.5 tonnes twin-steer group limit.

As the gross mass of seven-axle articulated vehicles is limited by regulation, non-regulatory options are not available.

Therefore, in this Regulatory Impact Statement, the alternatives considered are:

The Base Case: retain the present gross mass limits

The Regulatory Proposal: as outlined above

Alternative 1: allow the vehicles to operate under:

a) general mass limits, at a gross mass not exceeding 46.5 tonnes, provided the twin-steer axle group does not exceed 10.5 tonnes; and

b) Higher Mass Limits, at a gross mass not exceeding 49.5 tonnes provided the twin-steer axle group does not exceed 10.5 tonnes.

No change is proposed to the present requirement that the mass of any twin-steer axle group without a load sharing suspension system, must not exceed 10 tonnes.

3. IMPACTS OF THE REGULATORY PROPOSAL

3.1 Fleet Estimates

3.1.1 Present Fleet of Seven-axle Combinations

Data from the Australian Bureau of Statistics' Survey of Motor Vehicle Use for 2004 shows that there are between 375 and 625 (that is, 500 plus or minus 25%) twin-steer prime movers hauling tri-axle semi-trailers, travelling on average 115,500 km per year. This compares to 96,600 km per year on average for all articulated trucks and 91,000 for the 34,000 six axle articulated trucks. Twin-steer prime movers hauling tri-axle semi-trailers perform less than 1% of total articulated truck travel. However, there is a relatively large error associated with the data on twin steer prime movers (due to the very small numbers in total). Consequently, there can be no certainty that their present average travel is any different to that of other articulated trucks, or that of six axle articulated trucks.

Twin-steer prime movers hauling tri-axle semi-trailers are referred to hereafter as A223, this coding using a standard vehicle notation.

3.1.2 Estimated Take-up by Existing Seven-axle Combinations

It is most unlikely that all existing vehicles would be able to take advantage of increased payload. Vehicles in the construction industry, believed to be the most common present user of A223 vehicles, are often below allowable gross mass due to restrictions on order sizes. Many existing vehicles use a twin-steer to support a large crane for long reach at the point of delivery, and loads are often not of sufficient size to utilise the additional payload. Therefore, of the existing twin-steer vehicles, it is estimated[2] that only 50%, or 250, would take advantage of the increased payload made possible by the Regulatory Proposal.

The numbers of A223 vehicles under the Higher Mass Limits[3] regime are low because of the restrictions on local access for Higher Mass Limit vehicles and the mainly urban nature of A223 vehicles. The numbers in the future are also expected to be too small to affect the estimates of road wear impacts. Relative to vehicles operating at general mass limits (comparing either the Regulatory Proposal or Alternative 1 to the Base Case), the individual impacts may be marginally greater at Higher Mass Limits. They would not be expected to be significantly different as steer axle masses are the same in both the general mass limits and at Higher Mass Limits. In addition, the safety analysis did incorporate this Higher Mass Limits level and did not indicate that any problems would occur.

Twin-steer Higher Mass Limits combinations are therefore not considered in this analysis; although, under the Regulatory Proposal or Alternative 1, Higher Mass Limits A223 vehicles would be permitted where Higher Mass Limits routes are available.

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[2] Based on an educated guess

[3] Higher Mass Limits vehicles are required to have road friendly suspensions and, on approved routes, may operate at mass limits allowing an additional 2.5 tonnes for triaxles and 0.5 tonnes for tandem axles

3.1.3 Estimated Transfer from Six-axle to Seven-axle Articulated Vehicles

The numbers of six-axle combinations transferring to seven-axle combinations is likely to be influenced by the payload advantage of twin-steer combinations, the purchase cost and operating cost increments of these combinations, and their suitability for different tasks (for example, bricks versus general freight).

It is assumed that only operators of six-axle articulated vehicles will take up the option of migrating to seven-axle articulated vehicles. However, it is possible that some operators with twin-steer prime movers to accommodate the mass of a crane, may only operate tandem axle semi trailers due to the present disadvantage of a tri-axle. Take-up estimates for different industries are given in Table 2. Again, Higher Mass Limits vehicles are excluded, due to limited access provisions. All of these vehicles are assumed to operate at general mass limits.

Table 2: Estimated take-up percentage by industry segment

Industry segment	%	Industry segment	%
Agriculture	2	Grain	2
Mining	10	Petrol	2
Manufacturing	2	Bulk liquid	2
Construction	2	Logs	2
Wholesale/retail	2	Food	2
Livestock	0	Waste	0
Mineral	10	General freight	2
Car	0	Parcels	0
Quarry	2	Containers	10

These estimates would result in a new fleet of 700 seven-axle articulated vehicles in addition to 250 existing twin-steer vehicles that are estimated to take up the Regulatory Proposal. Lowest take-up would be in Western Australia, which already permits the sum of axle masses, and the traditional road train areas, including the Northern Territory and large parts of Queensland and South Australia.

Factors that influence these take-up estimates include the:

- high penetration into the traditional mass sensitive markets (e.g. petrol and bulk liquid) of "pocket" B-doubles at 19 metres, which are permitted a gross mass of 50 tonnes and are allowed general access;
- use of truck and trailer combinations of a similar gross mass in the quarry, grain and fertiliser industries;
- need to purchase both a new prime mover and a specially designed trailer for complete utilisation of the benefits of a twin-steer prime mover; and
- difficulty with the inter-changeability of twin-steer prime movers and traditional semi-trailers.

It is unlikely that all operators of seven-axle vehicles transferring from six-axle articulated combinations would be able to take advantage of the full payload advantages under either the Regulatory Proposal or Alternative 1. Some will utilise part of the increase in available gross combination mass to fit a crane and utilise some additional payload.

In these circumstances, the best-guess assumptions for these twin-steer vehicles operating under general mass limits are as follows:

- 50% will utilise the full potential payload advantages;
- 25% will utilise half the potential payload advantages, due to partial loading; and
- 25% will take advantage of some increased gross mass to fit a crane to reduce the time (and therefore cost) of loading and unloading of freight, and reduce also the need to relocate goods after being unloaded, again reducing overall costs.

3.1.4 Estimated Future Fleet of Seven-axle Articulated Vehicles

It is expected that the operators transferring from six-axle to seven-axle articulated vehicles will take three years to fully transfer. This is a typical period over which investment in new equipment may occur.

Given the take-up assumptions and the present fleet of seven-axle articulated vehicles, the estimates of vehicle numbers are given in Table 3. Note that due to the lower payload of Alternative 1, the numbers of vehicles at full mass is greater in Alternative 1 than for the Regulatory Proposal.

Table 3: Estimated fleet composition for the impact analysis

	Base Case		Regulatory Proposal			Alternative 1		
Configuration	A123	A223	A223	A223	A223	A223	A223	A223
Description (see note 1)	General Mass Limits	General Mass Limits	General Mass Limits (Full)	General Mass Limits (Half)	General Mass Limits (Crane)	General Mass Limits (Full)	General Mass Limits (Half)	General Mass Limits (Crane)
Estimated future fleet (see note 2)	813	250	470	240	240	494	240	240
Gross mass (t)	42.5	42.5	47.5	44.5	47.5	46.5	44.5	46.5
Tare mass (t)	16.0	19.0	17.5	17.5	19.0	17.5	17.5	19.0
Payload (t)	26.5	23.5	30.0	27.0	28.5	29.0	27.0	27.5

Notes: 1. The notations of the vehicles in the Regulatory Proposal and Alternative 1 relate to the loading assumptions in Section 3.1.3, with General Mass Limits (Full) being full to gross mass limits loads, General Mass Limits (Half) being half loaded to general mass limits loads and General Mass Limits (Crane) being a vehicle with a crane.

2. The numbers of A123 vehicles in the Base Case (813) and the number of General Mass Limits (Full) vehicles in Alternative 1 (494) were calculated based on the same freight task (in tonne kilometres) for each of the three optional loading scenarios.

3. A123 represents a single steer prime mover towing a 3 axle semi-trailer. A223 represents a twin-steer prime mover towing a tri-axle semi-trailer.

Average travel by the future fleet of seven-axle articulated combinations is difficult to estimate. As noted in Section 3.1, the Survey of Motor Vehicle Use shows that present vehicles travel, on average, 115,000 km per year (but with a large relative standard error). However, nearly two thirds of the new fleet are likely to be from industries characterised by shorter distance travel, such as quarry, construction, container and even general freight. Few twin-steer vehicles are likely to be interstate vehicles, which have the largest travel distances. Therefore, an average distance of 80,000 km per year has been assigned to the future fleet.

3.2 Estimation of Impacts

3.2.1 General

Both the Regulatory Proposal and Alternative 1 are likely to have both benefits and costs in a number of categories. Benefits and costs are calculated as the difference between the impacts of the current regulatory requirements (the Base Case) and those in the Regulatory Proposal and Alternative 1. Vehicles that would take advantage of the Regulatory Proposal would be either:

- existing seven-axle articulated vehicles that are presently limited to 42.5 tonnes gross mass; or
- current six-axle articulated vehicles that would become seven-axle articulated vehicles by changing the prime mover into a twin-steer prime mover.

The benefits and costs for these two groups of vehicles will be different, although some commonality will exist. A general description of the benefits is given in Table 4.

Table 4: General description of benefits of the Regulatory Proposal and Alternative 1

Description of benefit	For existing seven-axle combinations	For six-axle combinations transferring to seven-axle combinations
Reduced operational costs due to reduced vehicle kilometres facilitated by higher vehicle payload	Significant, greater for the Regulatory Proposal	Some, greater for the Regulatory Proposal
Reduced road safety risk associated with a reduced number of vehicle trips for the same freight task	Similar for each group	
Reduced pavement wear for the amount of freight carried	Some vehicles only (see detail later)	
Greater flexibility for operators in the choice of vehicles	Not applicable	Significant
Greater flexibility in loading and unloading arrangements, in that the use of a truck mounted crane is more commercially viable	Applies only if a crane is fitted, and applies mainly to present six-axle combinations transferring to seven-axle combinations	
Reduced injury and fatality costs, including indirect employer and community costs, as driver and/or loader safety is improved by the use of vehicle mounted cranes for loading and unloading	Applies only if a crane is fitted where there was none before and applies mainly to present six-axle combinations transferring to seven-axle combinations	
Savings in capital costs of replacing six-axle semi-trailers displaced by the higher productivity of the Regulatory Proposal	Not relevant	Significant capital cost saving

It can be seen from Table 4 that the benefits will vary according to whether the vehicle is an existing seven-axle combination and whether it is already fitted with, or the operator chooses to fit, a crane. The benefits for existing seven-axle combinations are likely to be higher than for current six-axle combinations transferring to seven-axle combinations.

A general description of the expected costs is given in Table 5. Again, it will be noted that there are different costs for existing combinations and for six-axle combinations transferring to seven-axle combinations.

Table 5: General description of costs of the Regulatory Proposal and Alternative 1

Description of cost	For existing seven-axle combinations	For six-axle combinations transferring to seven-axle combinations
Vehicle replacement or accelerated replacement (prime movers and trailers) to take advantage of the increased payload	Minor cost	Could be significant cost
Additional vehicle operating costs caused by operation at higher mass	Some	Some, greater for this group of vehicles
Increased pavement wear for the amount of freight carried	Some vehicles only (see detail later)	
Initial cost of cranes to facilitate loading and unloading (where not already fitted)	Similar cost for both groups	
Agency costs in preparing and issuing changes to regulations and/or Gazette notices	Applies to both groups	
Some bridge costs due to higher bridge stresses, depending on the type of bridge	Applies to both groups	

Accreditation costs have not been included, as it is assumed that the same policies will apply to seven-axle combinations at gross mass limits as for six-axle combinations, i.e. no accreditation will be required.

3.2.2 Impact on Vehicle Operating Costs

Two factors will influence the operating cost impacts of the Regulatory Proposal: firstly, a higher payload will reduce the vehicle kilometres required to achieve the same freight task. Secondly, offsetting this will be increased fuel, tyres, repair and maintenance costs associated with the additional steer axle and increased gross mass. Based on industry advice, it is assumed that the cost of operating seven-axle combinations is between 5% and 8% higher than an equivalent six-axle combination (assumed to be $1.70 per km), depending on the gross mass.

On this basis, the *annual* fleet operating costs for A223 vehicles (and the 813 six-axle articulated vehicles in the Base Case) are:

Base Case	$146.3 million
Regulatory Proposal	$139.8 million
Alternative 1	$142.7 million

3.2.3 Impact on Vehicle Capital Costs

Twin-steer prime movers cost considerably more than single-steer prime movers. It is expected that specifically designed trailers, required to utilise the more forward position of the fifth wheel, would also be slightly more expensive than standard trailers – an additional capital cost of $25,000 has been estimated. Owners of existing six-axle articulated vehicles wishing to upgrade to twin-steer vehicles, are assumed to do so over a three year take-up period. The additional capital cost would be $17.5 million in the Regulatory Proposal and $18.3 million in Alternative 1.

After year 1, the twin-steer fleet is assumed to grow at 3.8% per year in line with the assumed growth in the freight task, and to remain as a fixed percentage of that fleet. Capital costs are incurred in years two to ten for these new vehicles, amounting to about $4.5 million in present

value terms in the Regulatory Proposal ($4.75 million in present value terms in Alternative 1). The analysis is conservative, in that no allowance is made for residual value at the end of the period of analysis.

Savings in the capital costs associated with replacing six-axle semi-trailer combinations are also anticipated because the regulatory proposal, with its higher productivity, will displace approximately 110 of these vehicles (approximately 90 displaced in Alternative 1). The average replacement cost is assumed to be $250,000. This fleet displacement is assumed to occur evenly over the ten years covered by the analysis and to amount to $2 million to $3 million per year. In present value terms over the ten years, total savings would be between $19 million for Alternative 1 and $24 million for the Regulatory Proposal.

3.2.4 Impacts on Roadwear

Estimations of road wear are made on the following basis:

- seven-axle articulated vehicles are more likely to be urban vehicles with lower proportions of 4th power roads, but the relative proportions are not known. Therefore, the road proportions given in Table 6 are taken from Jameson (2002);

Table 6: Assumed proportions of road types

Roads where the 4th power is appropriate	84.2%
Roads where the 5th power is appropriate	13.3%
Roads where the 12th power is appropriate	2.5%

- the Standard Axle Repetitions per vehicle for the different road types are given in Table 7;

Table 7: Standard Axle Repetitions per vehicle for different road types

	A123	A223			
Gross mass (t)	42.5	42.5	44.5	46.5	47.5
Standard Axle Repetitions 4th power	4.9	3.4	4.1	4.9	5.5
Standard Axle Repetitions 5th power	5.6	3.6	4.5	5.5	6.4
Standard Axle Repetitions 12th power	14.6	5.5	8.2	13.5	19.8

- pavement costs are based on 4.22 cents per Standard Axle Repetitions per km (Equivalent Standard Axle km in NTC 2004).

On this basis, the likely impacts on road wear are illustrated in Table 8.

Table 8: Likely impacts on road wear

	Base Case		Regulatory Proposal			Alternative 1		
	A123	A223	A223	A223	A223	A223	A223	A223
	General Mass Limits		General Mass Limits (Full)	General Mass Limits (Half)	General Mass Limits (Crane)	General Mass Limits (Full)	General Mass Limits (Half)	General Mass Limits (Crane)
Total Standard Axle Repetition kms (4th)	270,200	57,451	173,215	66,479	88,450	162,695	66,479	78,965
Total Standard Axle Repetition kms (5th)	48,562	9,484	31,958	11,399	16,319	29,092	11,399	14,120
Total Standard Axle Repetition kms (12th)	23,781	2,770	18,656	3,936	9,526	13,314	3,936	6,462
Total each vehicle	342,543	69,704	223,829	81,815	114,295	205,101	81,815	99,547
Total Standard Axle Repetitions	412,247		419,939			386,463		
cf Base Case	100%		101.9%			93.7%		
Pavement costs	$17.4 million		$17.7 million			$16.3 million		

Notes: 1. Road friendly, road wear reduction factors, were not applied in this analysis.

These impacts do not include any consideration of costs recovered for road wear, which are included in registration charges, nor the allocated portion of fuel excise, as these are considered transfer payments. Nevertheless, it should be noted that the registration charge for a four axle prime mover is nearly 30% higher at $5,025, compared to the registration charge for a three axle prime mover, which is $3,883. Therefore, a twin-steer articulated combination is already contributing to the cost of the road wear it creates.

3.2.5 Impacts on Bridges

In general, the effects of the Regulatory Proposal or Alternative 1 on bridges are no worse than for current vehicles under the Base Case. Only a small number of bridges, those that are continuous for live load and with spans in the range from 10.5 metres to 13.5 metres, exhibit effects under the Regulatory Proposal that are worse than for the Base Case. Even for that small number of bridges, the effects would be minimal. The number of affected bridges is not known but is expected to be very small, with the majority likely to be located in Victoria. The effects are limited to the general access network and do not apply to the higher mass limit network.

One approach to the difficulties with this group of bridges would be to attempt to include an estimate of bridge strengthening costs in the impact analysis. This can not be done because the number of affected bridges is not known. However, the preferred and most practicable approach is that vehicles should be prohibited from using this small group of bridges. That approach would have a minor impact on the operating network, which will in turn slightly reduce operating benefits.

In these circumstances, no costs are assigned to the impacts on bridges.

3.2.6 Road Crash Costs

Three separate aspects of road safety are relevant:

- crash severity;
- crash exposure; and
- Stability and handling effects.

On crash severity, NRTC (1996b) notes that heavy vehicle operations in Australia are already above the threshold limits for occupant survival in impacts with smaller vehicles. An increase is unlikely to make any material difference.

For crash exposure, reductions in vehicle kilometres, and hence in trip exposure, associated with higher payload for twin-steer combinations would reduce accident risk. ATSB (2004), Road Safety Working Paper No 2, *Fatal Road Crashes Involving Articulated Trucks*, estimates that there are 2.6 fatal crashes per 100 million kilometres of articulated truck travel. Based on this estimate, both the Regulatory Proposal and Alternative 1, would save one road death about every four to five years.

Fatal crashes are estimated to cost $1.7 million each, BTRE (2000), resulting in annual fatal crash costs for the relevant fleet being:

Base Case	$3.8 million
Regulatory Proposal	$3.4 million
Alternative 1	$3.5 million

It might be possible to deduce the rate of non-fatal crashes per 100 million kilometres of travel, but the actual rate has not been subject to recent research and therefore no estimates can be made.

Potentially offsetting the safety gains from reduced risk exposure in the Regulatory Proposal and Alternative 1 are stability and handling effects. These were investigated for a range of body types in the earlier twin-steer project reports (NTC 2005a and NTC 2005b), as explained in Section 1.4. While the vehicles generally met the Static Roll Threshold values stipulated in Performance Based Standards, an increase in payload will normally raise the height of the centre of gravity of the vehicle. The resultant stability for vehicles built to the Regulatory Proposal would have a similar, albeit slightly lower, Static Roll Threshold to equivalent six-axle articulated vehicles. For purpose built vehicles (e.g. tankers), the increase in capacity would most likely exceed existing semi-trailers. Newer designs would allow the Static Roll Threshold to be improved. Alternative 1 would have a slightly lower risk than the Regulatory Proposal because of the lower gross mass and a slightly lower centre-of-gravity.

Although there is a slightly lower risk of rollover crashes for Alternative 1 compared to the Regulatory Proposal, and a slightly lower risk for the Base Case compared to Alternative 1, the differences would be so small as to be unmeasurable, within the bounds of any assumptions. In the absence of better estimates, therefore, it is assumed that any increase in rollover crashes in the Regulatory Proposal and Alternative 1 will be off-set by the reduction in crashes due to the reduced exposure outlined above. In other words, the road crash costs for each of the Base Case, the Regulatory Proposal and Alternative 1 are assumed to be the same at $3.8 million.

3.2.7 Occupational Health and Safety Costs

An advantage of the Regulatory Proposal is that the increased prime mover mass would facilitate the installation of vehicle mounted cranes. The use of cranes, such as in loading/unloading pipes, bins, bales or crates, or to assist in the placement of tarps, would reduce the risk of drivers and other workers falling during these tasks. Transport and storage is a major risk area for falls from heights.

In Victoria, for example, in the fifteen months to March 1998, 51 truck drivers and transport workers made WorkCover claims for injuries sustained in falls from less than one metre, at an average cost per claim of $48,000. The injury severity of those claims was 25% greater than that of the average WorkCover claim (all injury types). A further nine claims were made for falls from heights greater than two metres, at an average cost per claim of $36,000. The injury severity of those claims was over four times that of the average WorkCover claim. (Field et al 2000).

In Victoria, injury claims from truck related falls between June 2000 and June 2003 amounted to $10,872,000. However, it is expected that a significant number of injuries from falling from vehicles would not be reported. Data collected by the Victorian WorkCover Authority between the years of 2002 and 2004 indicated that:

- each year, one person is killed in a fall from a truck in Victoria;
- each year, 150 truck drivers in Victoria suffer a serious injury in falling from a truck; and
- about 70% of fall injuries occur in falls from, or jumping down from, the cargo area of trucks.

Occupational health and safety benefits associated with any migration to twin-steer vehicles are not estimated here. The estimation of benefits is extremely difficult and, accordingly, the impact results reported below will be conservative. However, it is most unlikely that the cost of a crane would be incurred by operators unless long term costs were lower, including costs for insurance premiums. Handling times, associated with loading and unloading, can be expected to be significantly better where a crane is installed. It reduces not only injury risks but also dead time for the vehicle, thus allowing better utilisation of the capital investment in the truck itself.

3.2.8 Agency Costs

Agency costs to implement the Regulatory Proposal are expected to be limited to the costs associated with changing present legislative requirements (Regulations or Gazette notices) and related publicity. These are estimated to total a one off cost of around $20,000 for each jurisdiction, or $160,000 nationally, in year one. In addition, for each of years two and three, a recurrent cost allowance equal to 25% of agency upfront cost is made to cover costs associated with take-up in those years. Total agency costs over three years would therefore be $30,000 per agency, equal to $240,000 nationally.

3.3 Assessment of the Regulatory Proposal and Alternatives

A summary of the analysis of the Regulatory Proposal and Alternative 1 relative to the Base Case, is shown in Table 9 below.

Table 9: Cost comparison of the Regulatory Proposal and Alternative 1

	Base Case	Regulatory Proposal	Alternative 1
Costs/yr			
Pavement cost	$17.4 million	$17.7 million	$16.3 million
Fleet running cost	$146.3 million	$139.8 million	$142.7 million
Crash costs	say $3.8 million	say $3.8 million	say $3.8 million
Total costs	$167.5 million	$161.4 million	$162.8 million
Difference relative to Base Case/yr	$0.00 million	-$6.11 million	-$4.63 million
Capital costs in years 1 to 3	$0.0 million	$16.5 million	$17.1 million
Agency costs (upfront)	$0.0	$0.2 million	$0.2 million

Against initial costs, including vehicle-related capital costs and agency costs of $16.7 million over three years for the Regulatory Proposal, there would be annual savings at full take-up of $6.1 million in vehicle running costs net of a small increase in pavement costs. Further capital costs would be incurred after year one, as additional six-axle semi-trailer combinations are replaced by seven-axle twin-steer combinations. Annual savings in replacement costs of displaced six-axle semi-trailers, would be approximately $3 million.

Alternative 1 would differ from the Regulatory Proposal in that:

- operational costs would be greater than for the Regulatory Proposal, due to greater vehicle kilometres of travel;
- pavement wear for the amount of freight carried would be lower for each twin-steer combination loading to 46.5 tonnes; and
- take up among existing operators might be lower (with implications for benefits and costs), because operating costs per tonne of payload are higher, but no account of this effect has been made.

Initial costs for Alternative 1, including vehicle-related capital costs and agency costs, would be $17.3 million. Annual savings in vehicle running costs and pavement costs would be $4.7 million at full take-up. As in the Regulatory Proposal, additional six-axle semi-trailers would be replaced by seven-axle combinations over the period analysed. Displacement of six-axle semi-trailer combinations would also occur, with capital cost savings of $2 million annually.

Both the Regulatory Proposal and Alternative 1 are positive in economic terms, as measured by net present values of between $34 million and $52 million. Benefit cost ratios are between 2.5 and 3.4. The Regulatory Proposal would be preferred having the higher of the net present values and benefit cost ratios.

Table 10: Results of the impact analysis

	Regulatory Proposal	Alternative 1
Net present value	$51.7 m	$33.8m
Benefit cost ratio	3.4	2.5

Notes:

1. Based on a freight growth of 3.8% per annum.
2. At a 3% real discount rate over 10 years.

3.4 Sensitivity Tests

Sensitivity tests show the results to be robust. An increase in the discount rate from 3% to 10%, leaves the net present values at between $20 million and $32 million (the latter for the Regulatory Proposal). With capital costs assumed to be twice those estimated, net present values would be between $11 million and $30 million for Alternative 1 and the Regulatory Proposal respectively. Different take-up rates were not tested, because costs and benefits (other than the relatively small agency costs) are directly proportional to take-up. Results are shown in Table 11.

Table 11: Results of sensitivity tests

	Regulatory Proposal		Alternative 1	
	Net present values	Benefit cost ratio	Net present values	Benefit cost ratio
Main case analysis	$51.7 million	3.4	$33.8 million	2.5
Sensitivity tests				
Discount rate increased to 10%	$31.9 million	2.8	$19.6 million	2.0
Capital costs doubled	$ 29.8 million	1.7	$11.2 million	1.2

3.5 Conclusion

The impact analysis suggests that:

- take-up from the Regulatory Proposal would be approximately 950 vehicles in year 1 and slightly greater in Alternative 1 (974 vehicles) because of lower payloads;
- at this take-up, impacts on pavement costs would be minor, ranging from slightly positive in the Regulatory Proposal (that is, higher costs) to slightly negative in Alternative 1 (lower costs);
- the Regulatory Proposal would be preferred on economic grounds, but both it and Alternative 1 are positive in economic terms; and
- sensitivity tests show the results of the impact analysis to be robust.

4. CONSULTATIONS

Two rounds of consultations have been undertaken to date. The first, in 1998, sought road agency comments on a general proposal circulated by VicRoads. It proposed increases in the gross mass for seven-axle articulated combinations with a twin-steer axle group. It also considered a report prepared by Roaduser Research relating to the operation of twin-steer articulated combinations. The original proposal was for combinations with road friendly suspensions to be allowed a gross mass of up to 50 tonnes, but was conditional upon meeting Performance Based Standards. As a result of reservations expressed by stakeholders about the need for vehicles operating under prescriptive limits to meet performance standards, that requirement was abandoned.

Discussions between industry and the NTC occurred before the project became part of the Commission's Third Heavy Vehicle Reform Package. Additional consultations took place at forums attended by Chief Executives of road agencies when discussing the reform packages.

Further comments were sought from government and industry by means of the wide circulation and availability of the *Twin-Steer Axle Mass Limits Project: Discussion Paper* (Pearson et al 2004). The Discussion Paper canvassed a range of technical and policy issues. It also discussed the possibility that a road friendly twin-steer axle group should be permitted an increased load, which is not part of the Regulatory Proposal. However, there was little opposition to the concept of summing the axle group masses, either from industry or road agencies.

Further input into the project was obtained at a workshop held at VicRoads in July 2004, with participants from both government and industry. The main discussions at the workshop related to the Discussion Paper, but relevant issues discussed dealt with industry take-up, ability to achieve the load on the twin-steer axle group, interchangeability of semi-trailers and methodology for calculating impacts.

Further consultations will take place with the circulation of this draft Regulatory Impact Statement.

5. REVIEW / IMPLEMENTATION

The Regulatory Proposal would be implemented by changing the national *Road Transport Reform (Mass and Loading) Regulations 1995*. .It would require adoption by States and Territories of these changes, together with changes to the regulatory arrangements for Higher Mass Limits, in the States and Territories that have adopted the Higher Mass Limits regime.

The *Road Transport Reform (Mass and Loading) Regulations 1995* are reviewed on a five and ten yearly basis by the NTC and approved by the Australian Transport Council.

6. COMPETITION ASSESSMENT

There are a number of ways in which regulations on vehicle mass might potentially restrict competition. The major possibilities are:

- directly restricting the number of operators in the industry;
- advantaging large operators relative to small operators;
- erecting barriers to entry to the industry; and
- limiting the range of individuals or organisations able to supply services related to implementation or operation of the Regulatory Proposal.

6.1 Directly Restricting the Number of Operators in the Industry

The Regulatory Proposal contains no restriction that would limit the number of operators in the industry and hence is not anti-competitive in this respect.

6.2 Advantaging Large Operators Relative to Small Operators

The Regulatory Proposal would apply equally to large and small operators. Small operators may experience more difficulty in funding fleet replacements, but the difficulty is no greater than for other transport tasks. It is therefore not anti-competitive.

6.3 Erecting Barriers to Entry to the Industry

The Regulatory Proposal would not hinder entry to, or exit from, the industry. The segment of the industry currently using twin-steer articulated combinations is quite small. Access to currently complying, twin-steer combinations, will not be restricted by the Regulatory Proposal. .A resale market for twin-steer trucks should continue to operate and, in fact, strengthen, with widening use of this vehicle type.

Hence the Regulatory Proposal is not anti-competitive in this respect.

6.4 Limiting the Range of Individuals able to Supply Services for Implementation or Operation of the Regulatory Proposal

At this time, there are a limited number of suppliers of twin-steer trucks to the market. They serve the existing seven-axle articulated combinations, as well as twin-steer rigid trucks and twin-steer truck and trailer combinations. The increase in total sales will be relatively small. Other manufacturers have not chosen to supply twin-steer trucks to the present market and are not restricted from doing so. Accordingly, the Regulatory Proposal is not anti-competitive in this respect.

6.5 Conclusion

The Regulatory Proposal will not restrict competition.

7. REFERENCES

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