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Economics

REPORT

EFFECT OF ALTERNATE HEAVY VEHICLE CHARGES ON AUSTRALIA'S RED MEAT INDUSTRIES

Results

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Prepared for:

Meat and Livestock Australia
Brisbane
Australia

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Verve Economics

Verve Economics is a Canberra-based economic consulting firm offering expert advisory services in the areas of competition policy, regulatory analysis, transport economics, agricultural economics, productivity analysis, economic modelling, economics of innovation, public policy analysis and business strategy.

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EXECUTIVE SUMMARY

The COAG Road Reform Project (CRRP) is currently undertaking an assessment of the costs and benefits of alternative registration and road use charges for Australia's heavy vehicle fleet.

Five broad pricing options are being assessed. These include;

- Option 1: Fuel based distance price. The fuel excise system is used as the basis for road pricing.
- Option 2: Kilometre based distance price. The road price is based on a system that attempts to measure the actual distance travelled.
- Option 3: Distance location based price. The road price is based on a system that attempts to measure distance travelled taking into account the type of roads the vehicle travels on.
- Option 4: Mass distance based price. The road price is based on a system that attempts to measure distance travelled taking into account the actual mass of the vehicle. and
- Option 5: Mass distance location based price. The road price is based on a system that attempts to measure distance travelled and vehicle mass taking into account the type of roads the vehicle travels on.

CRRP evaluated the introduction of the 5 heavy vehicle charges compared to a situation where charges continued to be calculated using the existing PAYGO methodology. On the basis of the analysis the CRRP Board found that[1]:

> *charging multi-combinations and heavy truck trailers on the basis of a static measure of mass, actual distance travelled, and location is both technically and economically feasible*

Given the significant role road transport plays in the production of goods in Australia's red meat industries Meat and Livestock Australia (MLA) identified an important need for initial strategic research to examine the potential impact of possible road transport price changes on the red meat and livestock industry as well as the impacts along the supply chain, particularly how changes could affect Australia's global competitiveness in red meat and livestock markets.

To investigate the effect of alternate heavy vehicle charges on Australia's global competitiveness in red meat and livestock markets a series of case studies were undertaken. The case studies were designed to enable the calculation of the direct change in road transport costs sectors of the red meat industry would incur assuming alternate heavy vehicle charges were introduced. The case studies undertaken include:

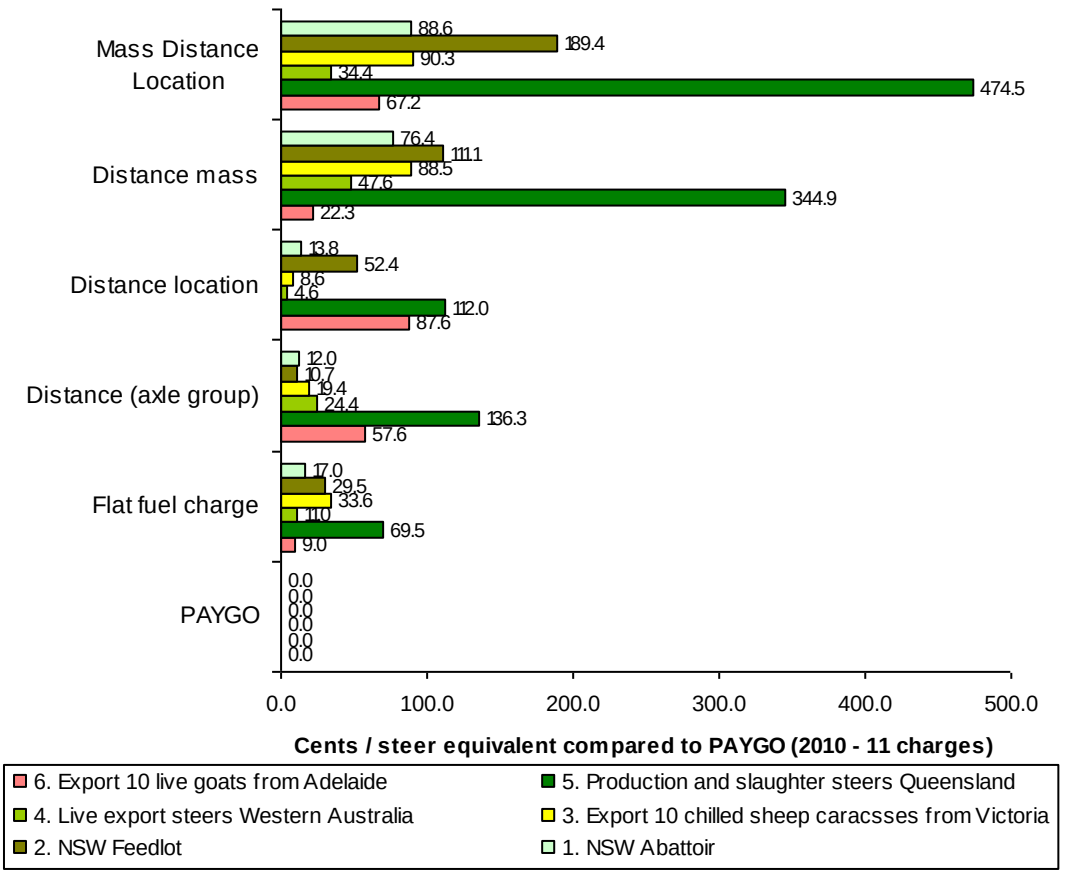
- Case study 1: Slaughter of grain feed cattle and grass fed cattle at a large abattoir located in NSW;

[1] COAG Road Reform Plan 2011,"Preliminary Findings Consultation-Draft, p.V.

- Case study 2: Feedlot in New South Wales.
- Case study 3: Purchase of sheep at a saleyard in Victoria and the slaughter of the sheep in a Victorian abattoir and subsequent export of chilled sheep carcasses;
- Case study 4: Live export of cattle from Western Australia;
- Case study 5: Production of steers in Queensland and the slaughter of the steers in a Queensland abattoir. and
- Case study 6: Live export of goats from South Australia

The case study results indicate that all heavy vehicle charging mechanisms being considered by CRRP would increase the cost of road transport borne by Australia's red meat industries. Cost increases would be higher for charging mechanisms that are based on the weight of the loaded truck and the distance the truck travelled on different sorts of roads (Chart 1).

Chart 1 **Increase relative to PAYGO of road transport costs per steer equivalent associated with alternate heavy vehicle charges (cents / steer equivalent, 2010 – 11 charges)**



[a] Data source: Author's calculations. To facilitate comparison across the case studies, the results for the sheep carcass case study and the goat case study are presented in steer equivalents where a steer equivalent was assumed to equal 10 sheep or goats.

The majority of the cost increases detailed in Chart 1 resulted from increases in road transport costs associated with the road transport of livestock rather than the road transport of processed meat products.

Impact on output, price and competitiveness

The case study results indicate that alternate heavy vehicle charges could lead to small but still significant increases in road transport costs faced by Australia's red meat industries. For example, the case studies covering beef production indicate that mass distance location and mass distance pricing could increase road transport costs by between 2.09 per cent to 2.49 per cent respectively or an average of 2.3 per cent.

To estimate the impact of a 2.3 per cent cost increase in road transport costs on the competitiveness of the beef sector a simple net trade model of the world beef and veal market was developed drawing on data on demand, supply and exports of beef and veal and using estimates of the price elasticities of demand and supply of Australian beef and veal derived from previous research summarised in two NSW Agriculture Research reports.[2,3] Two models were developed. Model 1 parameters were set at the average of the parameter estimates derived from previous research. In Model 2 parameters were set to approximate the main parameter settings common in most Computable General Equilibrium Models. That is relatively high farm supply elasticities and relatively high export demand elasticities.

A 2.3 per cent increase in the road transport costs of grain fed steers would represent a direct increase in the at port cost of products produced from a 600 kilogram grain fed steers of approximately $2.48 per steer. The model results indicate that this cost increase would lower the farm return from grain fed steer production by between $1.56 per steer to approximately $1.59 per steer. Processors would incur a reduction in the return from processing grain fed steers of approximately $0.31 per steer to $0.32 per steer.

The reduction in farm and processor net returns was simulated to lead to a small reduction in beef and veal production and exports in Model 1 (Chart 2). The small reduction in output of beef and veal reflects the fact that the simulated rise in road transport costs was relatively small, equivalent to 0.125 per cent of the at port value of products produced from a steer.[4] This small change in road transport costs resulted in a relatively small initial reduction in beef and veal supply in the model. Consequently only small changes in supply and demand were required to bring the market back into equilibrium following the simulated rise in road transport costs (Chart 2).

In contrast under Model 2 assumptions a more significant reduction in beef and veal production is indicated (Chart 2). In Model 2 the reduction in competitiveness of beef and

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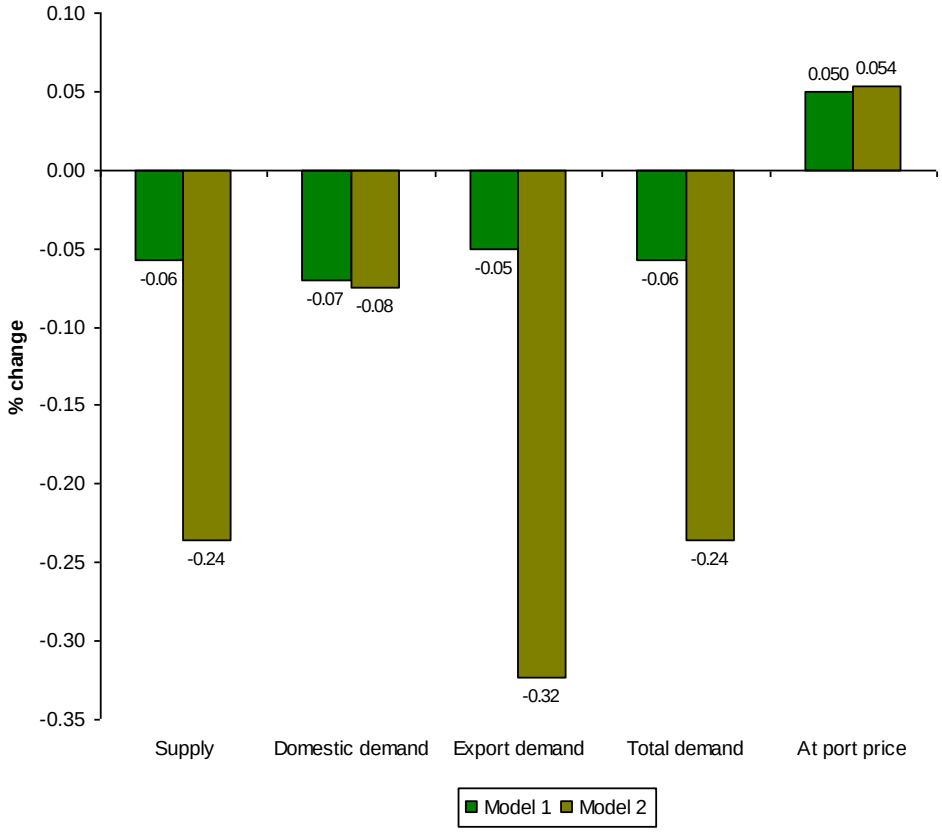
2 Demand elasticities were obtained from: Garry Griffith, Kym I'Anson, Debbie Hill, Roland Lubett, David Vere2001, "Previous Demand Elasticity Estimates For Australian Meat Products, NSW Agriculture Economic Research Report No. 5, January.

3 Supply elasticities were obtained from: Garry Griffith, Kym I'Anson, Debbie Hill, David Vere 2001, "Previous Supply Elasticity Estimates For Australian Broadacre Agriculture", NSW Agriculture Economic Research Report No. 6, August.

4 The at port cost of products produced from a 600 kilogram gain fed steer was estimated to be approximately 1,980 per steer. This value includes the value of by products plus the value of boneless beef 80 per cent chemically lean, boneless beef 80 per cent chemically lean, shank 90 per cent chemically lean and full sets. Unit values for these products were obtained mainly from Meat and Livestock Weekly, Friday 2 September 2011. Direct road transport costs for a steer and products produced from a steer were estimated to be approximately $108 / steer.

veal production caused by higher road transport costs has a greater impact on exports because Model 2 has higher export demand elasticities. Consequently, a bigger drop in beef and veal exports is observed in Model 2 (Chart 2) which generates a bigger drop in beef and veal production in Model 2.

Chart 2 **Partial equilibrium model estimates of the impact of road transport price changes on the beef and veal industry (% change)**



Data source: Author's calculations.

An increase in road transport costs faced by the livestock and meat processing sectors was also simulated in the Deloitte Access Economics Regional General Equilibrium Model (DAE-RGEM) of the Australian economy. Drawing on the average results of the case studies for mass distance location pricing and mass distance pricing, a 2.1 per cent increase in road user charges incurred by the livestock and meat processing industries in Australia was simulated. Other industries were simulated to incur an additional 1 per cent increase in road transport costs.

The modelled increase in road transport costs was found to reduce production of meat animals and meat products by approximately 0.9 per cent and 0.7 per cent respectively over the longer term. These declines were significantly greater than the decline in beef and veal production derived from the partial equilibrium results given in Chart 2. This indicates that indirect effects of higher road transport costs play a significant role in determining the total impact on Australia's red meat industries of higher road transport costs.

The DAE-RGEM simulation results also indicate that when all industries face increases in transport costs the competitiveness of Australia's red meat industries deteriorates by less than when road transport costs are increased for Australia's red meat industries in isolation. However, the magnitude of this effect must be treated with caution as the result was generated through road transport price increases for non red meat industries that were calculated without the benefit of detailed case study results for non red meat industries.

Overall, the case study evidence presented in this report indicates that heavy vehicle charges being considered by CRRP that are based on the mass of trucks, distance travelled and location of travel have the potential to directly raise costs of production in Australia's red meat industries by a small but significant amount. Any cost increase would be borne mainly by farmers in terms of a reduction in the net return received from the production of red meat animals.

Modelling these cost increases in both a partial equilibrium model and in the DAE-RGEM model indicated that the increase in heavy vehicle charges is likely to reduce the competitiveness of Australia's red meat industries which would result in a reduction in export sales of red meat products and a reduction in the on farm production of red meat animals.

1. INTRODUCTION

The COAG Road Reform Project (CRRP) is currently undertaking an assessment of the costs and benefits of alternative registration and road use charges for Australia's heavy vehicle fleet.

Currently heavy vehicle charges are based on the PAYGO methodology. Under this methodology eligible expenditure incurred by road authorities are recovered via registration charges and a road use fee collected via a 22.6 cents per litre levy per litre of fuel used by heavy vehicles operating on Australia's road network.

As part of its evaluation of alternate heavy vehicle charges CRRP have evaluated 5 high level road pricing models.[5] Within 4 of the 5 broad pricing models two options have generally been proposed.[6] These include a so called Option 1 that incorporates a relative low registration charge and relatively high road use charge. A second option known as Option 2 incorporates a relatively high registration charge and relatively low road use fees.

In evaluations undertaken by CRRP only the Option 1 pricing models appear to have been evaluated to date within a benefit cost framework.

The five broad pricing options include;

- Option 1: Fuel based distance price. The fuel excise system is used as the basis for road pricing. This is a proxy for pricing for distance and mass as fuel usage varies with distance travelled and the mass carried.
- Option 2: Kilometre-based distance price. The road price is based on a system that attempts to measure the actual distance travelled;
- Option 3: Distance- location based price. The road price is based on a system that attempts to measure distance travelled taking into account the location of the vehicle;
- Option 4: Mass-distance based price. The road price is based on a system that attempts to measure distance travelled taking into account the actual mass of the vehicle; and
- Option 5: Mass-distance location-based price. The road price is based on a system that attempts to measure distance travelled and vehicle mass taking into account the location of the vehicle.

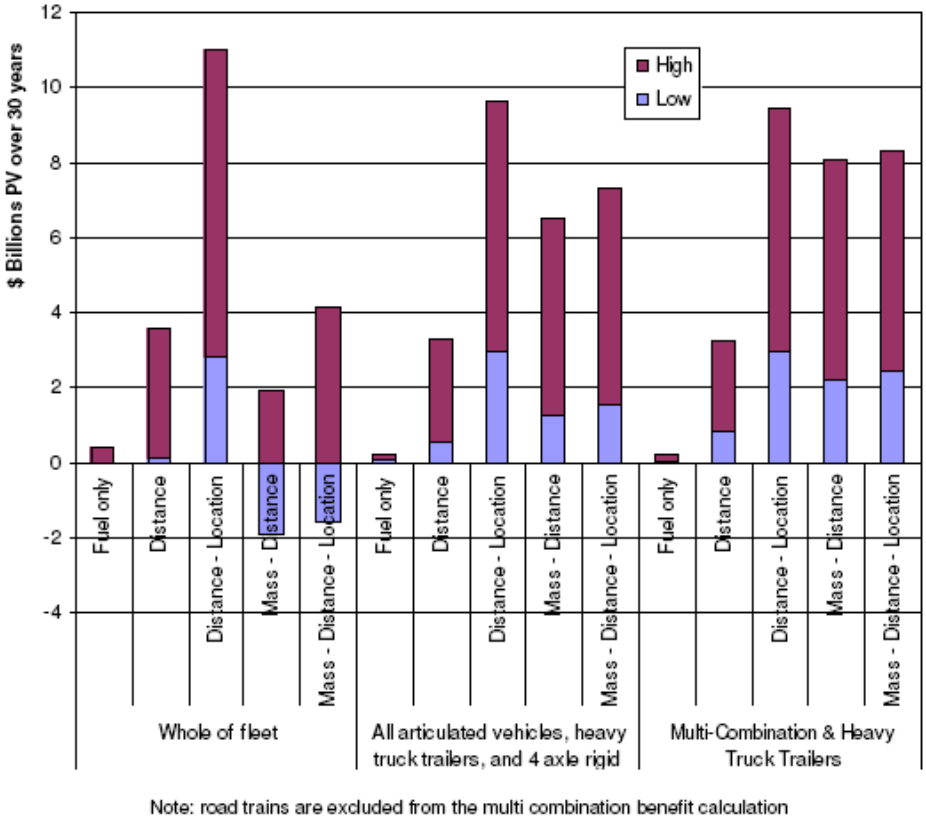
CRRP evaluated the 5 heavy vehicle charging mechanisms in a benefit cost framework by comparing the benefits the alternate charging mechanisms generated compared to a situation where charges based on the PAYGO methodology were retained. Similarly costs incurred under the different charging mechanisms were compared to costs generated given

[5] CRRP also indicated that some roads could be funded via a community service payment although such payments do not appear to have been incorporated into the 5 heavy vehicle charging mechanisms evaluated by CRRP.

[6] CRRP provided a copy of a spread sheet to the Australian Livestock and Rural Transport Association that contained a sheet titled "Indicative prices" in which were detailed the registration and road use fees under alternate pricing regimes considered by CRRP. In the spreadsheet 4 of the 5 pricing regimes considered by CRRP contained the two pricing options.

that charges based on the PAYGO methodology were retained. Charges based on a distance location charging mechanism were found to generate the highest net benefits of all pricing options evaluated (see Chart 3).

Chart 3 **CRRP's estimates of the Net Benefits of Introducing More Direct Road Use Charges and associated funding and expenditure reforms by Vehicle Type ($2011 present value)**



Note: road trains are excluded from the multi combination benefit calculation

Data source: Reproduced from: COAG Road Reform Plan 2011,"Preliminary Findings Consultation-Draft, p.V.

Based on the analysis of the alternate heavy vehicle charging mechanisms evaluated the CRRP Board found that[7]:

> *- charging on the basis of mass, distance and location is technically feasible; and*
>
> *- charging multi-combinations and heavy truck trailers on the basis of a static measure of mass, actual distance travelled, and location is both technically and economically feasible.*

Given the significant role road transport plays in the production of goods in Australia's red meat industries Meat and Livestock Australia (MLA) identified an important need for initial strategic research to examine the potential impact of transport price changes on the red meat and livestock industry as well as the impacts along the supply chain, particularly how changes could affect Australia's global competitiveness in red meat and livestock markets.

VERVE Economics were engaged to undertake the research task identified by MLA. A case study approach was proposed which aimed to identify the cost of road transport to various

[7] COAG Road Reform Plan 2011,"Preliminary Findings Consultation-Draft, p.V.

sectors of Australia's red meat industries, how this cost would change under alternate heavy vehicle charging regimes and the effect of any measured changes in road transport costs on the competitiveness of Australia's red meat industries.

A change in heavy vehicle charges can directly affect the costs faced by heavy vehicle operators as registration and road use fees represent a small but significant component of the total cost of owning and operating a heavy vehicle.

Changes in heavy vehicle charges can also indirectly affect the cost of operating heavy vehicles by changing the cost of inputs used in heavy vehicle operations. For example, an increase in heavy vehicle charges would increase the cost of transporting fuel used by heavy vehicles and hence the cost of fuel used by heavy vehicles. Thus the total impact of a change in heavy vehicle charges consists of both the direct impact on the cost of operating a heavy vehicle plus any indirect impact of the change in charges on the cost of inputs used by heavy vehicle operators.

Only the direct impact of changes in heavy vehicle charges on the cost of owning and operating heavy vehicles are considered in the case studies undertaken for this report.

This report details the main findings from the case studies. This report is structured as follows. Section 2 outlines the case studies that were undertaken. This is followed in Section 3 by documentation of the results of the NSW abattoir case study. Section 4 details the results of the NSW feedlot case study. Section 5 details the results of an analysis of the effects of heavy vehicle charges on the export of chilled sheep carcasses from Victoria. Section 6 details the results of the case study of the live export of cattle from Western Australia and Section 7 presents the results of the case study of the production and slaughter of steers in Queensland. Section 8 presents the results from the case study of the live export of goats from South Australia and Section 9 provides an analysis of the effects of higher heavy vehicle charges on the competitiveness of Australia's red meat industries. Section 10 concludes the study.

The case studies undertaken in this study are detailed in the following section.

2. THE CASE STUDIES

To evaluate the effect of heavy vehicle charges on the red meat industries case studies were undertaken. The case studies aimed to identify the value of road transport involved in various components of the red meat industries. The effect of alternate heavy vehicle charges were then estimated by comparing the identified road transport charges given the maintenance of current heavy vehicle registration and road use charges (PAYGO) and given the magnitude of alternate heavy vehicle charges proposed by CRRP.[8,9]

In a Preliminary Findings Consultation Paper CRRP[10] presented estimates of the net benefits from the alternate types of heavy vehicle charges CRRP had evaluated. That evaluation revealed that a distance- location based price yielded the highest net benefit. The distance location based price evaluated by CRRP involved all heavy vehicles paying a registration charge of $447.8 per vehicle and a charge per kilometre for travel on 4 types of roads including freeways, urban arterials, rural arterials and local roads.

The distance location based charges evaluated by CRRP involve relatively large charges for heavy vehicles using local roads. These charges are particularly high for triple road trains and double roads trains. For example, the charge for a triple Road train using a local road is $1.4 per kilometre. Under PAYGO, assuming fuel consumption of 1 litre per kilometre for a triple Road train using a local road, the road use fee would be $0.226.

Thus the distance location based pricing model evaluated by CRRP involved large increases in road use fees for heavy vehicles using local roads. Location based charges have the potential to significantly increase the cost of transporting live animals as the transport of live animals from farms to and from livestock centres can involve significant travel on local roads.

In this exercise the effects of alternate heavy vehicle charges were evaluated by comparing the registration and road use fees that would be paid by operators of road transport vehicles in the selected case studies assuming charges based on PAYGO continued to apply and assuming alternate heavy vehicle charges were introduced.

The following case studies were agreed in consultation with industry stakeholders.

- Case study 1: Slaughter of grain feed cattle and grass fed cattle at a large abattoir located in NSW;
- Case study 2: Feedlot in New South Wales.
- Case study 3: Purchase of sheep at a saleyard in Victoria and the slaughter of the sheep in a Victorian abattoir and subsequent export of chilled sheep carcasses;

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8 The 'indicative prices' published by the NTC are derived from one particular price-setting approach. Other approaches to assigning costs and prices could be applied if a new scheme was to proceed. If adopted, the alternate approaches could produce different heavy vehicle charges. However, in this exercise modelling of alternate price setting strategies was not possible as only one strategy and one set of indicative prices was released by government.

9 To facilitate analysis of possible alternate heavy vehicle charges in this report it is assumed that the 'indicative charges' published by the NTC as part of their input to the CRRP Feasibility Study would be implemented by governments without modification or moderation.

10 COAG Road Reform Plan 2011, "Preliminary Findings Consultation Paper", 27 June, p.V.

- Case study 4: Live export of cattle from Western Australia;
- Case study 5: Production of steers in Queensland and the slaughter of the steers in a Queensland Abattoir.
- Case study 6: Live export of goats from South Australia.

In the following section the case study of the NSW beef abattoir is presented.

3. THE NSW ABATTOIR CASE STUDY

The abattoir involved in the case study facilitated the collection of data on all road transport movements into and out of the NSW abattoir on a typical day of operations. The data was collected via interviews with drivers that entered or left the abattoir on the day chosen for the case study.

On the survey day, there were approximately 25 inbound livestock truck movements. In addition, some of the cattle slaughtered on the case study day were purchased at a saleyard and transported to the abattoir in the previous week. The cattle purchased at the saleyard were transported to the abattoir in 3 B double truck movements. Thus in total the case study involved 28 inbound livestock truck movements to the abattoir.

Data collected from the interviews with livestock transport operators delivering stock to the NSW abattoir indicated that that the abattoir aimed to slaughter approximately 1,200 cattle per 10 hour shift. Three broad types of cattle were slaughtered consisting of:

- Steers that weigh up to around 450 kilograms per head that are contract slaughtered;
- Grain fed cattle that generally weigh between 650 kilograms to 750 kilograms per head and are derived from feedlots; and
- Grass fed steers that weigh approximately 550 kilograms per head and are purchased by the NSW abattoir from saleyards or directly from farmers via a “paddock sale”.

The data provided by drivers indicated that the steers were sourced from an area ranging from south west of the abattoir to northern NSW and on average the cattle slaughtered were transported 457 kilometres to the abattoir.

3.1. EFFECTS OF ALTERNATE HEAVY VEHICLE CHARGES ON INBOUND LIVESTOCK TRANSPORT REQUIREMENTS

Using data provided by drivers the number of stock that could be transported legally at General Mass Limits[11] were calculated given the weight of the animals and given the TARE of the truck undertaking the transport movement. These calculations were undertaken using a Livestock Loading Calculator. The calculated numbers of steers that could be transported legally and the origins of the steers and distance the steers were transported are given in Table 1. Also given in Table 1 are the estimated distances of each truck movement that took

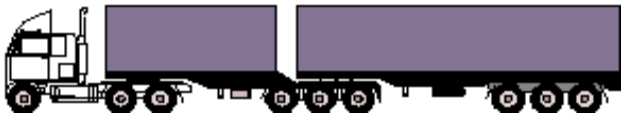
[11] All Australian jurisdictions, other than NSW, allow volumetric loading of livestock. Livestock trucks operating in New South Wales must comply with the mass limit the vehicle is eligible to operate under. In the previous study vehicles were assumed to operate under general mass limits.

place on Freeways, Urban arterials, Rural Arterials and local roads. These distances were estimated using routes derived using Google Maps.

Heavy vehicle Charges data provided by CRRP can be used to calculate alternate heavy vehicle charges for each livestock movement given in Table 1. We provide in Chart 4 a more detailed example of the calculations for the first transport movement detailed in Table 1. That is the movement of 69 steers to the abattoir.

Chart 4 **Registration and road use charges for the truck used to transport 69 steers ($, 2010/11 values)**

Trip details	
Vehicle	9-axle b-double
Mass carried above tare	29.3
Gross vehicle mass	59.5
Fuel use (L/100km)	66.6
ESAs	5.7
Average kms by	200,000
Origin	Northe west of abattoir
Destination	NSW abattoir
Distance travelled (Kms)	260
Freeway	*0*
Urban Arterial	*0*
Rural Arterial	*179*
Local	*81*
Fuel usage (L)	173.2



	PAYGO (2010/11)	Fuel (flat charge)	Distance (axle group)	Distance Location	Distance Mass	Mass Distance Location
Annual registration	$ 15,340.00	$ 447.80	$ 757.18	$ 447.80	$ 447.80	$ 447.80
Est. per trip registration	$ 19.94	$ 0.58	$ 0.98	$ 0.58	$ 0.58	$ 0.58
Variable trip cost	$ 39.14	$ 58.19	$ 57.20	$ 87.17	$ 68.90	$ 117.58
Total cost per trip	**$ 59.08**	**$ 58.77**	**$ 58.18**	**$ 87.75**	**$ 69.48**	**$ 118.16**
Increase relative to PAYGO (%)	**0.0%**	**-0.5%**	**-1.5%**	**48.5%**	**17.6%**	**100.0%**

Data source: Authors calculations using the methodology presented in: COAG Road Reform Plan 2011, "Evaluation of Options – Draft", pages 21 and 22, 26 July, Heavy vehicle charges data used in the calculations was obtained from data provided by CRRP to the Australian Livestock and Rural Transporters Association.

To undertake the calculations it was assumed that the B Double involved in the transport of the steers travelled on average 200,000 kilometres per annum, achieved a fuel efficiency of 66.6 litres per 100 kilometres travelled[12] and the truck would generate a load on the pavements travelled on equivalent to 6.4 Equivalent Standard Axles.[13] It was also assumed that altering heavy vehicle charges would not alter the choice of vehicle to undertake the transport task or the route taken from the origin to destination of the transport task.[14]

The charges detailed in Chart 4 were calculated using the methodology presented by CRRP in its report titled "Evaluation of Options – Draft".[15] The calculations indicate that for the

12 Fuel efficiency was calculated using a fuel efficiency equation built into the model detailed in Chart 4. The equation is: Litres consumed per 100 kilometres = 25.7 + 0.688 * gross vehicle mass.

13 The methodology used to calculate equivalent standard axles (ESAs) is given in: National Transport Commission 2011, "Modelling the Marginal Cost of Road Wear, Research Paper, 16 May, p. 27.

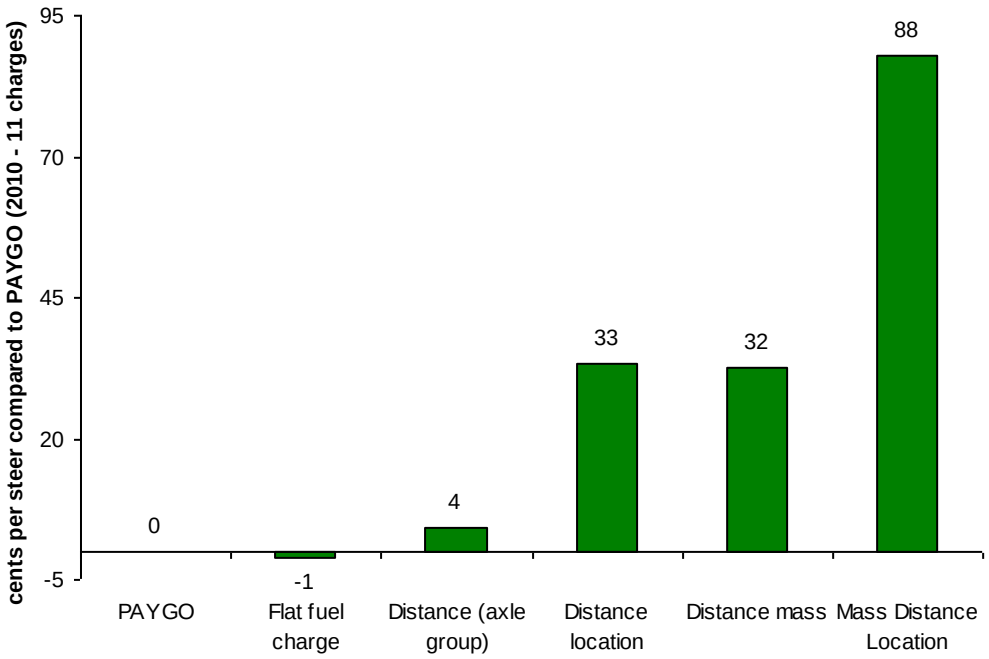
14 The latter two assumptions were assumed to hold for all calculations of alternate heavy vehicle charges presented in this report.

15 COAG Road Reform Plan 2011, "Evaluation of Options –Draft", 26 July, p. 22

transport example evaluated, registration and road use fees would be similar under PAYGO, a Flat Fuel charge or Distance based heavy vehicle charging regime (Chart 4). However, heavy vehicle charges that incorporate elements of charges based on the mass of the truck, the location of roads used by the truck, or both these factors, generate much higher road use and registration charges than would apply under the maintenance of PAYGO (Chart 4).

The methodology developed by the CRRP project to calculate registration and road use charges was used to calculate charges for all livestock movements given in Table 1. These calculations are provided in the last 6 right had side columns of Table 1. At the bottom of these columns are the estimated road use and registration charges for all livestock movements into the abattoir during a typical day of operations. Dividing these totals by the 1,200 steers slaughtered per day gives the effect per steer of alternate heavy vehicle charges graphed in **Error! Reference source not found.**. Charges based on the mass distance and location of travel could add approximately 90 cents per steer transported to the abattoir (**Error! Reference source not found.**).

Chart 5 **Estimated registration and road use charges of livestock transported to the NSW abattoir on a typical day of operations (cents / steer compared to PAYGO, 2010-11 charges)**



[a] Data source: Author's calculations.

Heavy vehicle charges based on a flat fuel charge would not materially affect road use and registration charges applicable to livestock trucks delivering cattle to the NSW abattoir.

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Table 1 Registration and road use charges for vehicles transporting livestock to the NSW abattoir on a typical day of operations ($ 2010/11 charges)

Origin of stock	Truck type used to transport the livestock	Number of beasts (No.)	Average weight (kg.)	Distance from origin of stock to abattoir (km.)	Travel on Freeway (km.)	Travel on Urban arterial (km.)	Travel on Rural arterial (km.)	Travel on Local road (km.)	PAYGO ($)	Flat fuel charge ($)	Distance (axle group) ($)	Distance location ($)	Distance mass ($)	Mass Distance Location ($)
North West	9 axle B Double	69	425	260	0	0	179	81	59.1	58.8	58.2	87.7	69.5	118.2
North East	6 axle	32	460	132	0	0	69	63	18.9	22.9	21.6	43.9	25.6	54.4
North	6 axle	32	450	152	0	0	144	8	21.7	26.3	24.9	22.5	26.4	23.3
North	9 axle B Double	46	668	117	0	0	40	77	26.8	26.8	26.2	63.2	32.6	93.9
North	9 axle B Double	40	682	117	0	0	40	77	26.2	25.9	26.2	63.2	29.6	81.7
North	9 axle B Double	43	680	677	0	0	641	36	153.7	152.9	151.5	126.2	180.5	154.4
North	9 axle B Double	39	716	562	0	0	554	8	126.5	125.2	125.8	91.9	144.5	106.2
North	9 axle B Double	43	696	562	0	0	554	8	128.2	127.8	125.8	91.9	152.8	110.7
North	9 axle B Double	45	692	562	0	0	554	8	129.3	129.4	125.8	91.9	158.3	113.7
North	9 axle B Double	44	700	562	0	0	554	8	129.0	128.9	125.8	91.9	156.7	112.9
North	9 axle B Double	49	630	429	0	0	374	55	98.5	98.5	96.0	98.8	119.9	132.3
South West	9 axle B Double	43	647	517	161	0	222	134	116.3	115.1	115.7	155.1	132.5	195.5
South West	9 axle B Double	48	634	517	161	0	222	134	118.4	118.2	115.7	155.1	142.6	213.9
South West	9 axle B Double	42	700	517	161	0	222	134	117.5	116.9	115.7	155.1	138.4	206.3
South West	9 axle B Double	40	639	517	161	0	222	134	114.4	112.4	115.7	155.1	124.9	181.7
North	9 axle B Double	49	629	284	0	0	59	225	65.2	65.2	63.6	175.7	79.2	264.6
North	9 axle B Double	44	700	117	0	0	40	77	26.9	26.8	26.2	63.2	32.6	94.2
East	6 axle	29	530	341	140	0	107	94	49.2	59.7	55.9	81.1	67.5	100.5

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Table 1 (continued) Legal livestock truck movements required to achieve an anticipated daily kill of 1,200 steers at the NSW abattoir

Origin of stock	Truck type used to transport the livestock	Number of beasts (No.)	Average weight (kg.)	Distance from origin of stock to abattoir (km.)	Travel on Freeway (km.)	Travel on Urban arterial (km.)	Travel on Rural arterial (km.)	Travel on Local road (km.)	PAYGO ($)	Flat fuel charge ($)	Distance (axle group) ($)	Distance location ($)	Distance mass ($)	Mass Distance Location ($)
Local region	Rigid[a]	12	535	100	0	0	75	25	8.6	12.6	11.0	17.1	18.5	28.1
Local region	Rigid[a]	17	535	100	0	0	75	25	9.1	13.2	0.2	17.1	11.8	15.8
Warren	9 axle B Double	56	535	472	0	0	433	39	107.7	107.4	105.6	96.1	128.4	122.2
North East	9 axle B Double	58	535	364	0	0	277	87	83.7	83.7	81.5	107.4	102.2	151.1
North	9 axle B Double	19	535	400	0	0	397	3	79.0	72.7	89.5	63.9	72.9	58.3
South West	9 axle B Double	57	535	845	424	23	271	127	157.4	139.6	189.1	196.0	144.4	154.0
South West	9 axle B Double	57	535	845	424	23	271	127	156.1	137.6	189.1	196.0	143.5	152.9
South West	9 axle B Double	57	535	845	424	23	271	127	193.5	193.3	189.1	196.0	233.5	259.3
South West	9 axle B Double	56	540	259	126	0	113	20	59.2	59.1	58.0	49.1	71.0	61.8
East	6 axle	34	601	341	140	0	107	94	51.9	63.7	55.9	81.1	81.5	127.0
								Total increase in registration and road use fees per day of operations	2,432.2	2,420.6	2,485.0	2,833.5	2,821.7	3,488.8

Source. Author's calculations.

To put the additional registration and road use charges in perspective and assuming the kill floor operates for 220 operational days in a typical year, the changes in registration and road use charges are:

- A reduction of $2,500 per annum under a flat fuel fee;
- $12,000 per annum under a distance based fee;
- $88,000 per annum under distance location prices;
- $86,000 under mass distance pricing; and
- $232,000 per annum under mass, distance, location based pricing.

In the following section the effect of alternate heavy vehicle charges on the NSW abattoir's outbound transport requirements are detailed.

3.2. EFFECTS OF ALTERNATE HEAVY VEHICLE CHARGES ON OUTBOUND LIVESTOCK TRANSPORT REQUIREMENTS

The output produced at the NSW abattoir during a typical day of operations was derived by estimating the product yields available from steers of different weights using a spreadsheet model developed for Meat and Livestock Australia by Kurrajong Meat Technologies. The spreadsheet model calculates by product yields and carton meat yields from steers of different weights and feed regimes.[16]

The Co-product values V2.xls spreadsheet provides meat and by product yields for 7 types of cattle. The cattle slaughtered on a typical day of operations at the NSW abattoir were represented by 3 types of cattle covered by the Co-product values V2.xls spreadsheet model. These were:

- Yields from contract killed steers were assumed to be approximated by yields from a "Steer 220-280 kg";
- Yields from Grain fed steers were approximated by yields from a "grain-fed steer 280-400 kg"; and
- Yields from grass fed steers were approximated by yields from a "grass fed steer 280-350 kg").

Given the number of the three types of cattle slaughtered on a typical day of operations at the NSW abattoir and given the average weight of the different types of cattle the product yields from a typical day kill at the NSW abattoir are given in Table 2. Products derived from a kill of 1,200 steers assuming the yields given in Table 2 are graphed in Chart 6.

In a typical day of operations the abattoir would produce approximately 270 tonnes of beef in cartons, 100 tones of tallow and approximately 70 tonnes each of hides and meat meal (Chart 6).

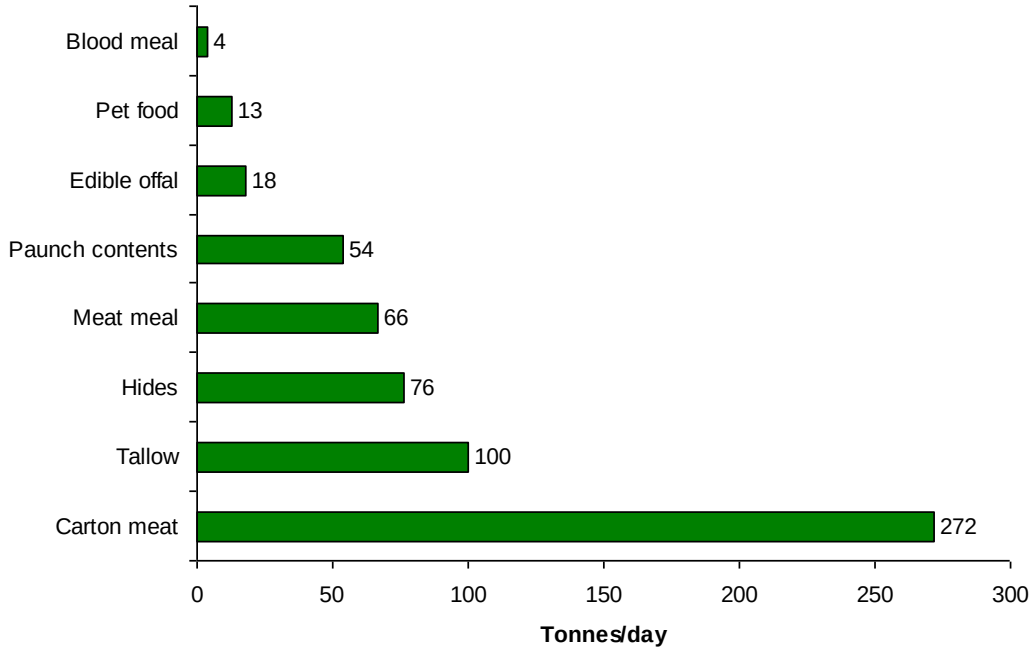
[16] The spreadsheet was kindly provided by Bill Spooncer of Kurrajong Meat Technology. The spreadsheet is named "Co-product values V2.xls".

Table 2 Product yields from a typical days kill at the NSW abattoir

	Product yields per steer (kg. / steer)		
Number of steers	132	406	662
Product	**Contract kill steers**	**Grass fed steers**	**Grain fed steers**
Carton meat	171.75	209.25	247.71
Edible offal	12.93	14.05	16.09
Pet food	9.05	9.36	11.50
Meat meal	44.37	48.87	61.54
Tallow	47.75	64.55	101.60
Blood meal	2.28	2.78	3.49
Hides	26.98	32.92	41.30
Paunch contents	49.76	66.69	79.41

Data source: Author's calculations.

Chart 6 Outputs produced from a typical days kill (tonnes)



Data source: Author's calculations.

The abattoir indicated that approximately 2/3 of the daily output of 272 tonnes of carton meat and 18 tonnes of edible offal in cartons were transported by road. The remaining third of carton meat and carton offal production was transported by rail.

Of the meat and edible offal that is transported by road approximately 70 tonnes was sold on the domestic market and the remainder exported in containers.

The number of truck movements required to transport the output from a typical day of operations at the NSW abattoir were then estimated by dividing the product produced and

transported by road by the legal load that could be carried by trucks operating at general mass limits. The truck type assumed to undertake the transport of the different products produced at the NSW abattoir and the calculated number of truck movements for the different products are given in Table 3.

Table 3 **Calculated truck movements required to transport output from typical days kill at the NSW abattoir**

Product	Type of truck	Quantity produced per typical kill at the abattoir (tonnes)	Assumed typical TARE weight of vehicle (tonnes)	GVM at GML (tonnes)	Trips/ day (no.)
Meat, domestic	6 axle semi, refrigerated van	69	23.4	42.5	3.0
Hides	6 axle aluminium tipper	76	16	42.5	2.9
Tallow	9 axle B Double tanker	100	19.5	62.5	2.3
Meat, export road to port	9 axle B Double skillion trailer[a]	125	27.89	62.5	3.6
Meat meal	6 axle aluminium tipper	66	16	42.5	2.5
Blood meal	6 axle Pantech	4	16	42.5	0.1
Pet food	6 axle Pantech	13	20	42.5	0.6
Paunch contents	4 axle rigid	54	10.1	26.5	3.3

Data source: Author's calculations. A. The tare weight for the 9 axle B Double skillion trailer includes the weight of the container and an allowance for unused vehicle mass allowances that arise when transporting a 40 foot container and 20 foot container

The destinations of products delivered by road transport were provided by the NSW abattoir. Distances to these destinations were derived using Google Maps and based on the routes suggested by Google Maps a breakdown of the route into freeway travel, urban arterial travel, rural arterial travel and travel on local roads were also derived and this data is given in the first 8 columns of Table 4.

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Table 4 Registration and road use charges for vehicles transporting livestock products from the NSW abattoir ($ 2010/11 charges)

								Registration and road use charges per trip ($ / trip)(					
Product	Destination	Truck type used to transport product	Distance from abattoir to destination (km.))	Travel on Freeway (km.)	Travel on Urban arterial (km.)	Travel on Rural arterial (km.)	Travel on Local road (km.)	PAYGO	Flat fuel charge	Distance (axle group)	Distance location	Distance mass	Mass Distance Location
Meat, domestic	North east	6 axle	1259	19.1	0	1226.9	13	175.0	210.5	206.3	163.0	210.8	163.3
Meat, domestic	South	6 axle	459	330	9	114	6	70.2	86.3	75.2	54.4	107.5	66.3
Meat, domestic	North east	6 axle	461	405	7	39	10	70.5	86.7	75.5	55.2	107.9	67.5
Hides	North	6 axle	666	0	0	636	30	101.4	124.4	109.1	96.4	152.2	125.5
Tallow	North	9 axle B double	318	0	0	284.3	33.7	73.8	74.1	71.2	69.1	91.0	93.7
Tallow	North	9 axle B double	281	0	0	248	33	65.2	65.5	62.9	62.9	80.4	85.9
Tallow	North east	9 axle B double	1259	19.1	0	1226.9	13	292.0	293.4	281.7	202.6	360.2	252.2
Tallow	South	9 axle B double	459	330	9	114	6	106.5	107.0	102.7	67.5	131.3	80.8
Tallow	South west	9 axle B double	319	125	0	169.4	24.6	74.0	74.3	71.4	61.2	91.3	80.2
Tallow	North east	9 axle B double	461	405	7	39	10	106.9	107.4	103.2	68.5	131.9	82.2
Meat, export road to port	South	9 axle B double	459	330	9	114	6	106.5	107.0	102.7	67.5	131.3	80.8
Meat, export road to port	North east	9 axle B double	461	405	7	39	10	106.9	107.4	103.2	68.5	131.9	82.2
Meat meal	North	6 axle	318	0	0	284.3	33.7	48.4	59.4	52.1	54.5	72.7	74.7
Meat meal	North	6 axle	333	283	0	41.6	8.4	50.7	62.2	54.6	40.5	76.1	49.2
Meat meal	North	6 axle	281	0	0	248	33	42.8	52.5	46.0	49.5	64.2	68.5
Meat meal	North east	6 axle	642	544	8	50	40	97.7	119.9	105.2	88.5	146.7	113.1

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Table 4 continued: Registration and road use charges for vehicles transporting livestock products from the NSW abattoir ($ 2010/11 charges)

								Registration and road use charge ($ / trip)					
Product	**Destination**	**Truck type used to transport product**	**Distance from abattoir to destination (km.)**	**Travel on Freeway (km.)**	**Travel on Urban arterial (km.)**	**Travel on Rural arterial (km.)**	**Travel on Local road (km.)**	**PAYGO**	**Flat fuel charge**	**Distance (axle group)**	**Distance location**	**Distance mass**	**Mass Distance Location**
Blood meal	North	6 axle	318	0	0	284.3	33.7	48.4	59.4	52.1	54.5	72.7	74.7
Blood meal	North	6 axle	333	283	0	41.6	8.4	50.7	62.2	54.6	40.5	76.1	49.2
Blood meal	North	6 axle	281	0	0	248	33	42.8	52.5	46.0	49.5	64.2	68.5
Blood meal	North east	6 axle	642	544	8	50	40	97.7	119.9	105.2	88.5	146.7	113.1
Pet food	South	6 axle	157	0	0	79	78	21.1	25.2	25.7	53.5	22.7	41.8
Paunch contents	Local region	4 axle rigid	10	0	0	0	10	1.0	1.4	1.5	5.3	1.4	4.8
Total registration and road use fees related to the transport of outputs from a typical day of operations at the NSW abattoir								1,611	1,826	1,702	1,376	2,138	1,618

Source. Author's calculations.

Also given in the last 6 columns of Table 4 are the calculated registration and road use charges for the journeys in question calculated using the 6 broad heavy vehicle pricing rules considered by CRRP. A breakdown of the heavy vehicle charges into the registration and road use components for the first trip detailed in Table 4 is provided in Chart 7.

Chart 7 **Registration and road use charges for the truck used to transport products from NSW abattoir ($, 2010/11 values)**

Trip Details	
Vehicle	6-axle semi-trailer
Mass carried above tare	13.0
Gross vehicle mass	34.0
Fuel use (L/100km)	49.1
ESAs	2.8
Average kms by	200,000
Origin	NSW Abattoir
Destination	Brisbane
Distance travelled (Kms)	1259
Freeway	*19.1*
Urban Arterial	*0*
Rural Arterial	*1226.9*
Local	*13*
Fuel usage (L)	391.8

	PAYGO (2010/11)	Fuel (flat charge)	Distance (axle group)	Distance Location	Distance Mass	Mass Distance Location
Annual registration	$ 5,612.00	$ 447.80	$ 567.89	$ 447.80	$ 447.80	$ 447.80
Est. per trip registration	$ 35.33	$ 2.82	$ 3.57	$ 2.82	$ 2.82	$ 2.82
Variable trip cost	$ 139.68	$ 207.67	$ 202.70	$ 160.17	$ 207.89	$ 160.46
Total cost per trip	**$ 175.01**	**$ 210.49**	**$ 206.27**	**$ 162.99**	**$ 210.71**	**$ 163.28**
	0.0%	**20.3%**	**17.9%**	**-6.9%**	**20.4%**	**-6.7%**

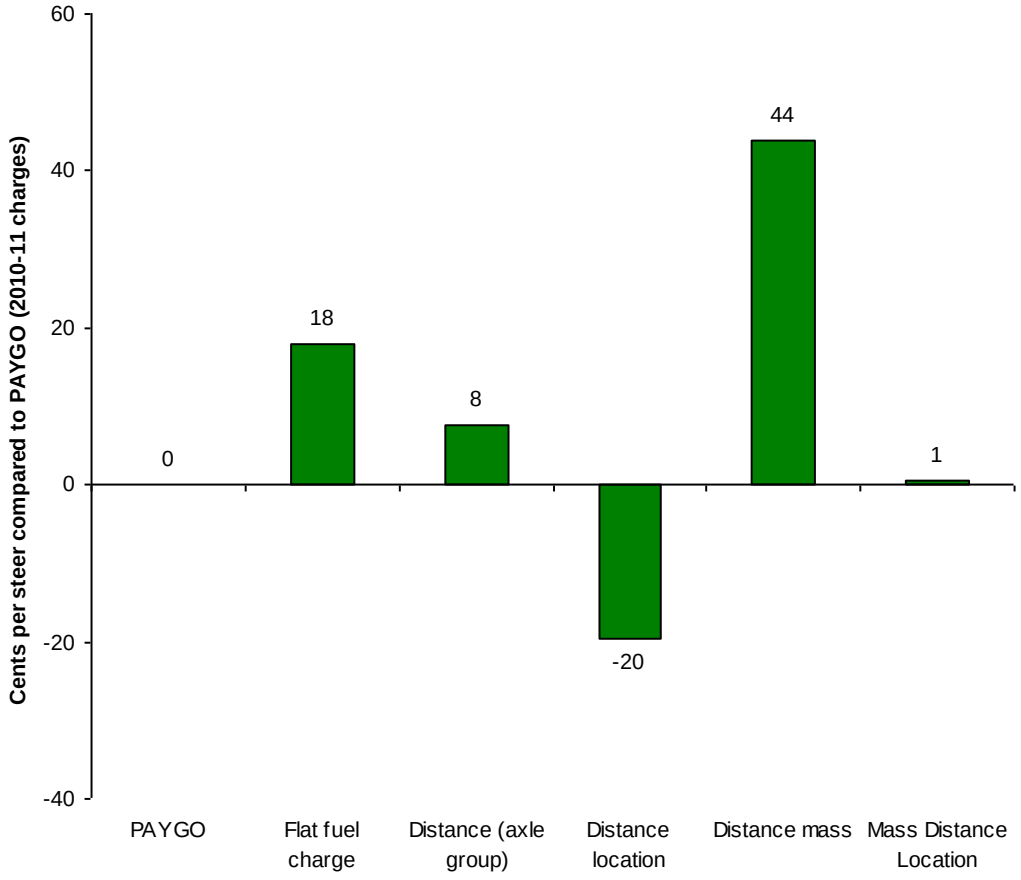
Data source: Authors calculations using the methodology presented in: COAG Road Reform Plan 2011, "Evaluation of Options – Draft", pages 21 and 22, 26 July, Heavy vehicle charges data used in the calculations was obtained from data provided by CRRP to the Australian Livestock and Rural Transporters Association.

As can be seen from Chart 7 all pricing rules generate higher heavy vehicle charges other than a pricing rule which incorporate charges based on where trucks travel. Heavy vehicle charges that incorporate mass and distance would result in a relatively large increase in heavy vehicle charges given the high mass and relatively large distances products produced by the NSW abattoir are transported.

Also in all pricing models detailed in Chart 7 the road use fee (called the Variable trip cost in Chart 7) is by far the largest component of the total trip cost. In part, this reflects the assumption that the truck in question travels 200,000 kilometres per year. As the assumed total kilometres travelled falls the registration component of the total trip cost rises.

The calculated trip costs for all trips are detailed in the last 6 columns to the right of Chart 7. These costs were then adjusted by the number of trips to the destination the NSW abattoir indicated would be undertaken on a typical day of operations. This gave the registration and road use fee associated with the transport of one days products produced at the NSW abattoir under the different heavy vehicle pricing models considered by CRRP (see last row in Table 4). Per steer slaughtered charges based on the distance travelled by trucks and their mass could add up to approximately 40 cents in outbound transport costs to the products produced from each steer slaughtered at the abattoir Chart 8.

Chart 8 **Change in registration and road use fees compared to PAYGO associated with trucks transporting the NSW abattoir's outputs (cents / steer 2010 -11 charges)**



Data source: Authors calculations.

Distance location pricing would result in lower outbound transport costs for the NSW abattoir. As detailed previously, this result principally reflects the lower registration charges for the truck. These lower charges are not fully offset by increases in variable trip costs as the outputs from the abattoir are transported relatively more on freeways and arterial roads which attract lower variable trip fees.

To put the changes in outbound heavy vehicle fees into perspective the per day registration and road use fees were scaled by the assumed number of operational days the kill floor operates at the NSW abattoir to find the total registration and road use fees that would apply under the alternate heavy vehicle pricing rules for a full year of operation at the NSW abattoir. These calculations indicated that, compared to charges based on the PAYGO methodology:

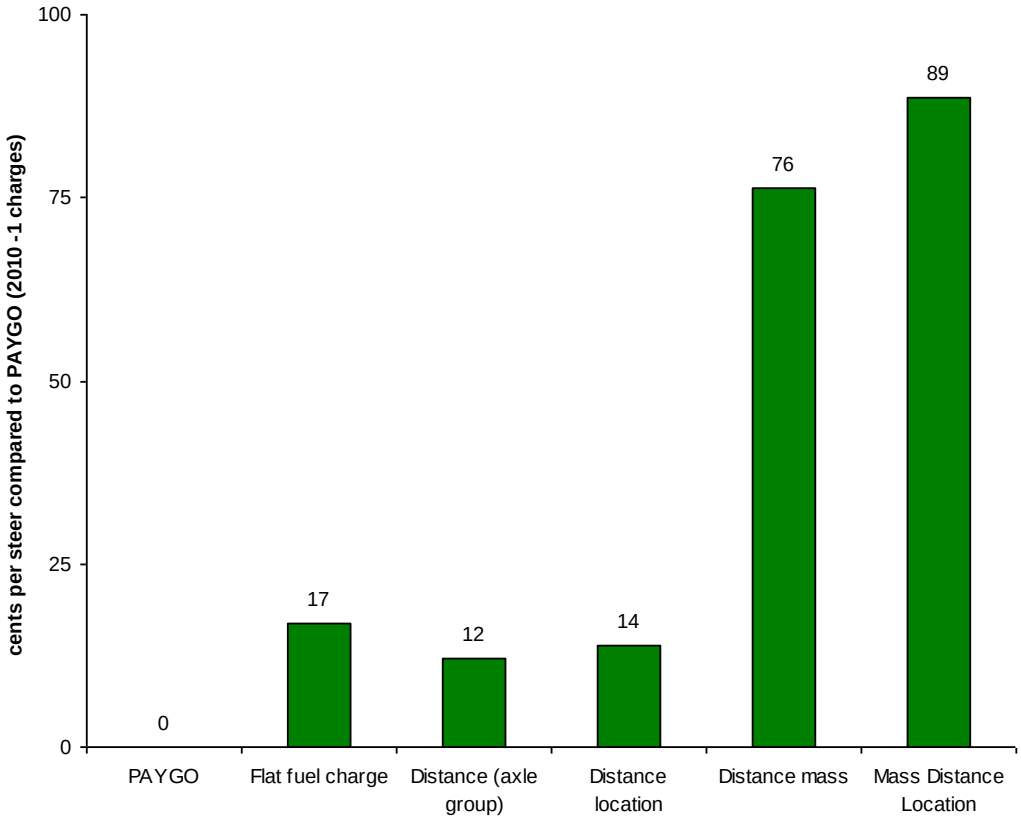
- $47,000 per annum under a flat fuel fee;
- $20,000 per annum under a distance based fee;
- a reduction of $50,000 per annum under distance location prices;
- $115,00 per annum under distance mass pricing; and

- $2,000 per annum under mass, distance, location based pricing.

3.3. TOTAL IMPACT ON THE NSW ABATTOIR

The total estimated impact on the NSW abattoir of alternate heavy vehicle charging mechanisms can be found by adding together the additional charges associated to inbound transport of livestock at the NSW abattoir to the additional charges associated with outbound transport of products produced at the NSW abattoir (Chart 9). All heavy vehicle charging mechanisms considered by CRRP would increase registration and road use fees paid by transport operators that service the NSW abattoir's inbound and outbound road transport requirements (Chart 9).

Chart 9 **Increase in registration and road use fees compared to PAYGO for alternate heavy vehicle charging mechanisms (cents / steer, 2010-11 charges)**



Data source: Author's calculations

Over a whole year of operations at the NSW abattoir alternate heavy vehicle charges would increase road transport costs to and from the abattoir by:

- $44,000 per annum under a flat fuel fee;
- $32,000 per annum under a distance based fee;
- $36,000 per annum under distance location prices;

- $201,000 under mass distance pricing; and
- $234,000 per annum under mass, distance, location based pricing.

In the following section the case study of the NSW feedlot is presented.

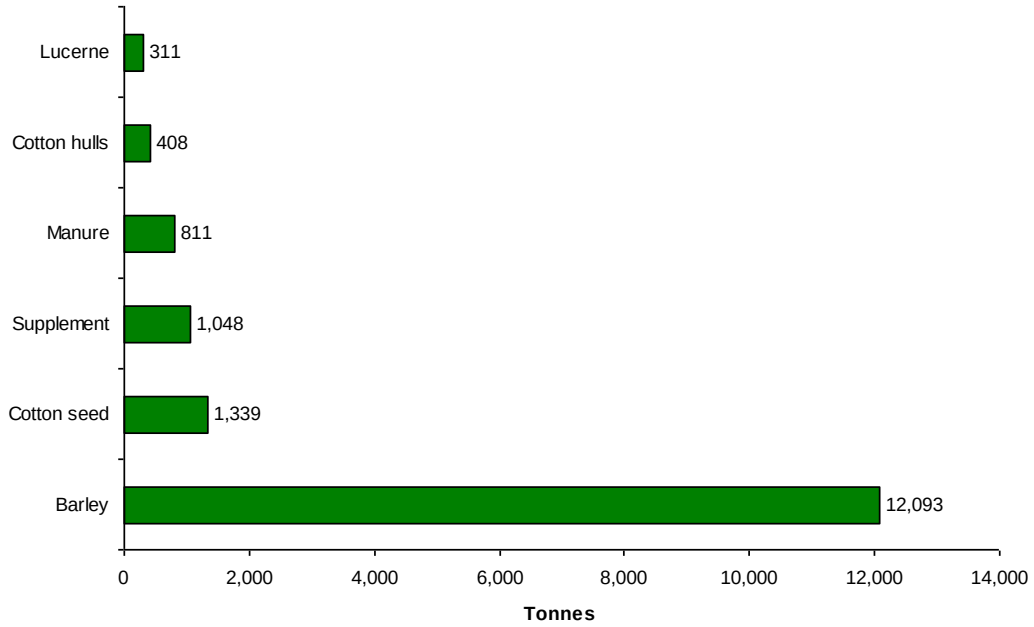
4. THE NSW FEEDLOT CASE STUDY

To undertake the case study of the NSW feedlot, data was provided by the feedlot on all inbound and outbound road transport movements at the feedlot for a period of 136 days.

Over the 136 day data collection period 10,813 steers were delivered to the feedlot. The steers had an average weight of 454 kilograms and they were delivered in 231 truck movements. The steers were transported approximately 240 kilometres on average and the steers were sourced from an area ranging from South Australia to northern NSW.

In addition to the steers, during the 136 day data collection period almost 16,000 tonnes of commodities were transported to and from the feedlot (See Chart 10).

Chart 10 **Commodities delivered to the feedlot and manure transported from the feedlot (tonnes)**



[a] Data source: Data provided by the Feedlot.

Also included in Chart 10 is the manure that is sold by the feedlot and the transport of the manure is also considered in this case study.

The feedlot also provided data on the delivery of cattle from the feedlot over the 136 day data collection period. Over this period the feedlot dispatched for slaughter 11,589 steers

weighing on average 678 kilograms each. 234 9 Axle B Doubles truck movements were required to transport the steers.

In the following section the effect of alternate heavy vehicle charges on inbound transport costs at the feedlot are considered. This is followed in Section 4.2 by an analysis of the effect of alternate heavy vehicle charges on the cost of transporting the steers for slaughter. Section 4.3 concludes the case study.

4.1. EFFECTS OF ALTERNATE HEAVY VEHICLE CHARGES ON INBOUND LIVESTOCK AND COMMODITY TRANSPORT REQUIREMENTS

Data provided by the Feedlot on the source of commodities delivered to the feedlot indicated that Barley is sourced from locations relatively close to feedlot but the molasses based supplement comes from South East Queensland. The commodities and cattle were transported on average the following approximate distances[17]:

- feeder cattle, 246 kilometres
- barley, 109 kilometres;
- cotton hulls and cotton seed, 413 kilometres;
- Manure, 57 kilometres;
- supplement, 1,034 kilometres; and
- lucerne hay, 172 kilometres.

For each origin of the commodities and steers used to derive the above average distances, Google Maps were used to derive the route from the origin of the commodity to the feedlot. Based on the route suggested by Google Maps the travel that took place on freeways, urban arterials, rural arterials and local roads was estimated. A weighted average of this data was then obtained for each commodity and the feeder steers and the results are given in Table 5.

Table 5 Transport of commodities and feeder steers on different roads (% of journey)

Product	Travel on Freeway (%)	Travel on Urban arterial (%)	Travel on Rural arterial (%)	Travel on Local road (%)	Total (%)
Cattle	10	0	63	27	100
Supplement			1		100
Barley	0	0	72	28	100
Cotton hulls	0	0	72	28	100
Cotton seed	0	0	95	5	100
Lucerne	0	0	71	29	100
Manure	0	0	83	18	100

Data source: Author's calculations.

The truck movements involved in the transport of commodities and feeder steers to the feedlot are summarised in Table 6. Also given in Table 6 are the estimated equivalent standard axle (ESA) loads involved in the transport of commodities to the feedlot. The ESAs

[17] Distances were calculated using Google Maps and represent the distance from one city/town centre to the Google Maps address for the feedlot.

were estimated using a spreadsheet model provided by the National Transport Commission to the New South Wales Livestock and Bulk Carriers Association that was made available to the author for this study.

Table 6 **Trucks used to transport commodities and feeder steers**

Commodity	Truck type	Number trips (no.)	Average weight (tonnes)	Tare weight (tonnes)	Load (tonnes)	Estimated ESAs (no.)
Supplement	9 Axle B Double	34	60.7	30.5	30.2	5.7
Supplement	6 axle semi trailer	1	44.3	21.7	22.6	5.9
Manure	3 axle rigid 2 axle pig	2	27.0	13.5	13.5	1.3
Manure	3 axle rigid 3 axle dog	2	45.5	16.1	29.4	5.8
Manure	6 axle semi trailer	28	42.0	17.6	24.4	4.7
Manure	9 Axle B Double	1	65.0	24.3	40.7	7.4
Lucerne Hay	6 axle semi trailer	10	41.5	17.7	23.8	4.5
Lucerne Hay	9 Axle B Double	2	59.7	23.1	36.6	5.3
Feeder cattle	2 axle rigid	11	14.4	8.4	6.0	2.6
Feeder cattle	3 axle rigid	12	19.9	12.2	7.8	2.2
Feeder cattle	3 axle rigid 2 axle dog	4	29.3	17.8	11.5	1.9
Feeder cattle	3 axle rigid 2 axle pig	1	27.8	17.0	10.8	1.5
Feeder cattle	3 axle rigid 3 axle pig	1	30.5	18.2	12.4	1.2
Feeder cattle	5 axle semi trailer	6	29.9	18.9	11.0	2.0
Feeder cattle	6 axle semi trailer	122	40.4	21.1	19.3	4.1
Feeder cattle	7 axle B Double	4	54.3	25.6	28.7	5.1
Feeder cattle	9 Axle B Double	70	61.9	31.2	30.7	6.1
Cotton Seed	3 axle rigid 4 axle dog	24	49.6	19.2	30.4	8.2
Cotton Seed	6 axle semi trailer	3	43.4	19.3	24.0	5.4
Cotton Seed	7 axle B Double	1	51.8	21.2	30.6	5.9
Cotton Seed	9 Axle B Double	13	63.3	24.3	39.0	6.7
Cotton Hulls	6 axle semi trailer	16	43.4	19.4	24.0	5.4
Cotton Hulls	9 Axle B Double	1	47.8	23.7	24.1	2.2
Barley	3 axle rigid 2 axle dog	2	40.5	15.1	25.4	6.8
Barley	3 axle rigid 3 axle dog	7	45.4	17.9	27.5	5.7
Barley	3 axle rigid 3 axle pig	1	40.3	15.2	25.1	3.6
Barley	3 axle rigid 4 axle dog	4	49.7	18.0	31.7	8.2
Barley	4 axle rigid	7	29.1	12.7	16.4	3.1
Barley	4 axle rigid 3 axle dog	4	48.3	17.4	30.9	2.7
Barley	6 axle semi trailer	215	42.7	16.3	26.4	5.1
Barley	8 axle b double	3	56.9	19.9	37.0	6.1
Barley	8 axle b double	5	58.5	20.9	37.5	6.8
Barley	9 Axle B Double	134	64.2	23.4	40.8	7.1

Data source: Author's calculations based on data provided by the feedlot.

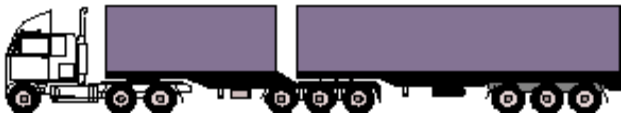
The heavy vehicle charges data that was provided by CRRP can be used to calculate alternate heavy vehicle charges for individual groups of road transport movements summarised in Table 6. Chart 11 provides an example of the calculation of the alternate heavy vehicle charges for the first group of commodity movements given in Table 6 i.e. the road transport of supplement to the feedlot in 9 axle B doubles.

To undertake such calculations it was assumed that the B Double involved in the transport of the supplement travelled on average 200,000 kilometres per annum, achieved a fuel efficiency of 67.5 litres per 100 kilometres travelled and the truck would generate a load equivalent to 5.7 Equivalent Standard Axles.[18]

The charges detailed in Chart 11 were calculated using the methodology presented by CRRP in its report titled "Evaluation of Options – Draft".[19] The calculated charges for the journey are given in Chart 11 where it can be seen that the registration and road use fees associated with the transport of supplement to the feedlot could be lower than PAYGO based charges for all alternate heavy vehicle charges other than charges based on the Distance Mass pricing methodology. This is mainly because of relatively low registration charges under the alternate pricing rules (see row titled Est. per trip registration in Chart 11).

Chart 11 **Registration and road use charges for the truck used to transport supplement from Queensland to the feedlot ($, 2010/11 values)**

Trip details	
Vehicle	9-axle b-double
Mass carried above tare	30.2
Gross vehicle mass	60.7
Fuel use (L/100km)	67.5
ESAs	5.7
Average kms by	200,000
Origin	Queensland
Destination	NSW feedlot
Distance travelled (Kms)	1034
Freeway	*0*
Urban Arterial	*0*
Rural Arterial	*1034*
Local	*0*
Fuel usage (L)	697.6



	PAYGO (2010/11)	Fuel (flat charge)	Distance (axle group)	Distance Location	Distance Mass	Mass Distance Location
Annual registration	$ 15,340.00	$ 447.80	$ 757.18	$ 447.80	$ 447.80	$ 447.80
Est. per trip registration	$ 79.31	$ 2.32	$ 3.91	$ 2.32	$ 2.32	$ 2.32
Variable trip cost	$ 157.65	$ 234.38	$ 227.48	$ 158.20	$ 274.00	$ 185.93
Total cost per trip	**$ 236.95**	**$ 236.69**	**$ 231.39**	**$ 160.52**	**$ 276.31**	**$ 188.24**
Increase relative to PAYGO (%)	**0.0%**	**-0.1%**	**-2.3%**	**-32.3%**	**16.6%**	**-20.6%**

Data source: Authors calculations using the methodology presented in: COAG Road Reform Plan 2011, "Evaluation of Options – Draft", pages 21 and 22, 26 July, Heavy vehicle charges data used in the calculations was obtained from data provided by CRRP to the Australian Livestock and Rural Transporters Association.

The methodology used to calculate road use fees and registration charges used to produce the charges given in Chart 11 was used to calculate the heavy vehicle charges for the entire commodity by truck type movements detailed in Table 6 and the results are detailed in Table 7. These are the numbers given in the last 6 columns of Table 7. These charges are then multiplied by the number of trips for each truck type and commodity given in the third column of Table 7 and the products are then summed and the results are given in the last row of Table 7.

[18] The methodology used to calculate equivalent standard axles (ESAs) is given in: National Transport Commission 2011, "Modelling the Marginal Cost of Road Wear, Research Paper, 16 May, p. 27.

[19] COAG Road Reform Plan 2011, "Evaluation of Options –Draft", 26 July, p. 22

V·E·R·V·E Economics

Table 7 Registration and road use charges for vehicles transporting livestock and commodities to the NSW feedlot ($ 2010/11 charges)

Commodity	Truck type	Number trips	Distance from origin to destination (km.)	Travel on Freeway (km.)	Travel on Urban arterial (km.)	Travel on Rural arterial (km.)	Travel on Local road (km.)	PAYGO ($)	Flat fuel charge ($)	Distance (axle group) ($)	Distance location ($)	Distance mass ($)	Mass Distance Location ($)
Supplement	9 Axle B Double	34	1034	0	0	1,034	0	236.95	236.7	231.4	160.5	275.6	187.9
Supplement	6 axle semi trailer	1	1034	0	0	1,034	0	160.23	197.4	169.4	129.5	262.2	171.2
Lucerne Hay	6 axle semi trailer	10	172	0	0	122	50	25.91	31.7	28.2	43.4	37.1	60.5
Lucerne Hay	9 Axle B Double	2	172	0	0	122	50	39.15	39.0	38.5	56.2	44.1	71.5
Cotton Seed	6 axle semi trailer	3	413	0	0	394	19	63.42	78.0	67.7	60.2	99.4	82.1
Cotton Seed	9 Axle B Double	13	413	0	0	394	19	96.30	97.0	92.4	75.5	122.0	100.6
Cotton Seed	3 axle rigid, 4 axle dog	24	413	0	0	394	19	60.25	83.9	90.8	77.1	138.9	112.8
Cotton Seed	7 axle B Double	1	413	0	0	394	19	84.09	86.0	99.4	79.3	112.5	93.7
Cotton Hulls	6 axle	16	413	0	0	394	19	63.46	78.0	67.7	60.2	99.4	82.1
Cotton Hulls	9 Axle B Double	1	413	0	0	394	19	86.36	82.2	92.4	75.5	69.8	62.9
Barley	8 axle b double	3	109	0	0	78	31	23.06	24.0	26.2	37.9	30.4	49.5
Barley	3 axle rigid 4 axle dog	4	109	0	0	78	31	15.92	22.2	24.0	36.0	36.9	62.6
Barley	3 axle rigid 3 axle dog	7	109	0	0	78	31	15.19	21.1	24.0	36.0	29.2	47.1
Barley	8 axle b double	5	109	0	0	78	31	23.33	24.4	26.2	37.9	32.6	53.9
Barley	9 Axle B Double	134	109	0	0	78	31	25.57	25.8	24.4	35.0	33.4	55.6
Barley	4 axle rigid	7	109	0	0	78	31	11.76	17.0	16.1	24.4	17.1	31.0
Barley	4 axle 3 axle dog	4	109	0	0	78	31	19.14	21.8	32.2	45.4	20.0	28.4
Barley	3 axle 2 axle dog	2	109	0	0	78	31	14.13	19.9	19.8	31.4	32.6	53.9

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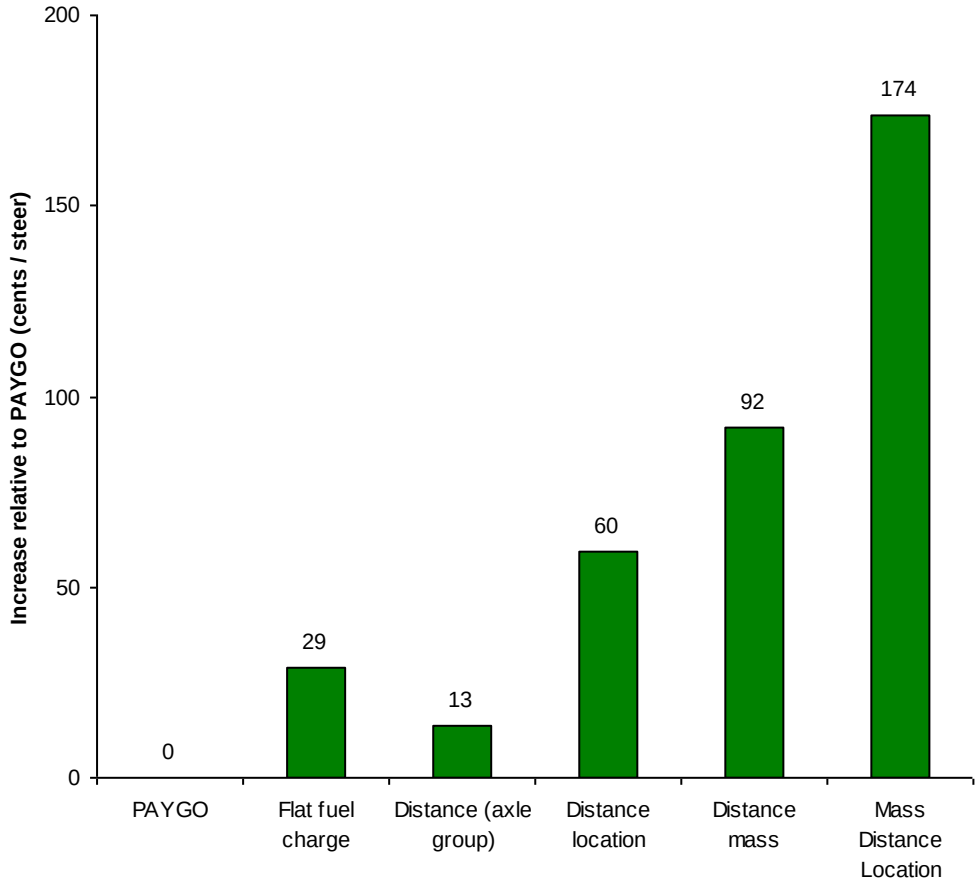
Table 7 (continued) **Registration and road use charges for vehicles transporting livestock and commodities to the NSW feedlot ($ 2010/11 charges)**

Commodity	Truck type	Number trips	Distance from origin to destination (km.)	Travel on Freeway (km.)	Travel on Urban arterial (km.)	Travel on Rural arterial (km.)	Travel on Local road (km.)	PAYGO ($)	Flat fuel charge ($)	Distance (axle group) ($)	Distance location ($)	Distance mass ($)	Mass Distance Location ($)
Barley	3 axle 3 axle pig	1	109	0	0	78	31	14.33	19.8	24.0	36.0	22.6	33.8
Barley	6 axle semi trailer	215	109	0	0	78	31	16.63	20.4	17.9	27.1	25.2	41.1
Manure	3 axle rigid, 2 axle pig	2	57	0	0	47	10	6.19	8.6	10.4	13.4	8.3	9.2
Manure	6 axle semi trailer	28	57	0	0	47	10	8.63	10.6	9.3	11.5	12.7	15.9
Manure	9 axle B Double	1	57	0	0	47	10	13.44	13.6	12.8	14.7	18.0	23.1
Manure	3 axle rigid, 3 axle trailer	2	57	0	0	47	10	7.96	11.0	12.5	15.1	15.4	19.3
Feeder cattle	7 axle B Double	4	246	26	1	154	66	51.13	52.7	59.3	82.3	61.5	93.3
Feeder cattle	9 Axle B Double	70	246	26	1	154	66	56.94	57.1	55.2	76.3	68.8	107.3
Feeder cattle	3 axle rigid, 2 axle dog	4	246	26	1	154	66	27.65	38.5	44.8	68.4	39.5	51.2
Feeder cattle	3 axle rigid, 3 axle pig	1	246	26	1	154	66	28.66	39.2	54.2	78.3	34.7	42.0
Feeder cattle	6 axle semi trailer	122	246	26	1	154	66	36.73	44.9	40.4	59.0	50.0	75.6
Feeder cattle	5 axle semi trailer	6	246	26	1	154	66	32.00	38.9	45.3	65.7	35.5	47.9
Feeder cattle	3 axle, 2 axle pig	1	246	26	1	154	66	27.09	37.7	44.8	68.4	37.1	46.6
Feeder cattle	3 axle rigid	12	246	26	1	154	66	22.82	33.2	27.1	43.1	32.5	46.4
Feeder cattle	2 axle rigid	11	246	26	1	154	66	20.35	30.1	17.7	33.2	35.0	51.1
							Total 1 trip for each commodity by truck type	1,435	1,642	1,646	1,794	1,990	2,111
							Total all trips	29,996	33,337	31,555	36,898	40,671	50,126

Source. Author's calculations.

The change in registration and road use fees compared to the maintenance of the existing basis of deriving heavy vehicle charges (i.e. the PAYGO system) was then found by deducting the PAYGO charge at the bottom of Table 7 from the total charges for the other pricing rules also given at the bottom of Table 7. The differences in charges were then divided by the number of steers delivered to the feedlot to determine the impact of alternate charges on the cost of feeding steers. Mass Distance Location pricing could add over $1.7 to the cost of transporting commodities and feeder steers to the feedlot (Chart 12).

Chart 12 **Estimated registration and road use charges of livestock and commodities transported to the NSW feedlot (cents per steer compared to PAYGO, 2010-11 charges)**



[a] Data source: Author's calculations. Costs per steer are calculated by dividing the total increase in heavy vehicle fees associated with the transport of feeder steers and commodities to the feedlot by the number of steers delivered to the feedlot over the 136 data recording period.

Over a whole year of operations at the feedlot alternate heavy vehicle charges would increase in bound road transport costs at the feedlot by:

- Fuel only, extra $9,000 per annum;
- Distance (axle group), extra $4,000 per annum;

- Distance location pricing, extra $19,000 per annum;
- Mass distance pricing, extra $29,000 per annum; and
- Mass distance location pricing, extra $54,000 per annum.

In the following section are detailed the effects of alternate heavy vehicle charges on the cost of transporting steers for slaughter from the feedlot.

4.2. EFFECTS OF ALTERNATE HEAVY VEHICLE CHARGES ON OUTBOUND LIVESTOCK TRANSPORT REQUIREMENTS

Over the 136 day data recording period the feedlot dispatched for slaughter 11,589 steers weighing on average 678 kilograms each. On a typical day of operations approximately 200 steers are dispatched for slaughter although this number can rise to almost 300 slaughter steers depending on market circumstances. The slaughter steers were all transported in 9 Axle B Doubles.

Over the 136 day data recording period there were 234 shipments of slaughter cattle from the feedlot and on average each truck of steers contained approximately 50 steers.

The steers are dispatched, in general, prior to the opening of the weigh bridge at the Feedlot. Consequently the feedlot could not supply data on the tare weight of trucks used to transport the slaughter steers. However, the company responsible for the transport of steers from the Feedlot estimated that a typical 9 axle B Double undertaking the transport of the slaughter steers from the feedlot would have a representative tare weight of 31 tonnes. Drivers delivering the steers to the abattoir also indicated a distance of 117 kilometres between the abattoir the steers were delivered to and the feedlot.

To calculate heavy vehicle charges that are based in part on the mass of the truck required an estimate of the equivalent standard axles that would be generated by a 9 Axle B Double transporting 50 slaughter steers with an average weight of 677 kilograms. The axle loads were estimated using a Livestock Loading Calculator set up to represent a typical cattle truck transport steers from the feedlot (i.e. a truck with a tare weight of 31 tonnes). Such a truck loaded with the 50 steers was estimated to generate a load on pavements equivalent to 7.42 Equivalent Standard Axles (Chart 13).

Chart 13 **Calculated ESAs for a 9 Axle B Double transporting 50 steers with average weight of 678 kilograms**

Axle weight summary for a 9 Axle B Double transporting 50 steers with average weight of 677 kg.					
Weight	Steer axle	Drive axle	A Trailer tri axle	B Trailer tri axle	Total Vehicle
Tare (kg.)	6,400	7,333	9,127	8,140	31,000
Load (kg.)	169	8,269	12,660	12,752	33,850
Gross (kg.)	6,569	15,602	21,787	20,892	64,850
ESAs	**2.18**	**1.65**	**1.94**	**1.64**	**7.42**

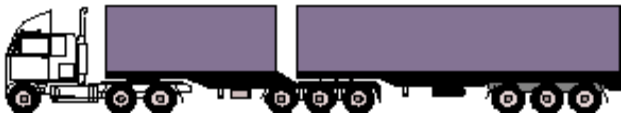
[a] Data source: Author's calculations.

The calculated heavy vehicle charges assuming a trip of 117 kilometres with a gross vehicle mass that would generate 7.42 Equivalent Standard Axles of load on pavements are given in

Chart 14 for one trip from the feedlot to the abattoir.

Chart 14 **Calculated heavy vehicle charges for a 9 axle B Double transporting 50 steers with average weight 677 kilograms ($/trip)**

Trip details	
Vehicle	9-axle b-double
Mass carried above tare	33.9
Gross vehicle mass	64.9
Fuel use (L/100km)	70.3
ESAs	7.4
Average kms by	200,000
Origin	Feedlot
Destination	Abattoir
Distance travelled (Kms)	117
Freeway	*0*
Urban Arterial	*0*
Rural Arterial	*107*
Local	*10*
Fuel usage (L)	82.3



	PAYGO (2010/11)	Fuel (flat charge)	Distance (axle group)	Distance Location	Distance Mass	Mass Distance Location
Annual registration	$ 15,340.00	$ 447.80	$ 757.18	$ 447.80	$ 447.80	$ 447.80
Est. per trip registration	$ 8.97	$ 0.26	$ 0.44	$ 0.26	$ 0.26	$ 0.26
Variable trip cost	$ 18.59	$ 27.64	$ 25.74	$ 23.75	$ 36.70	$ 35.10
Total cost per trip	**$ 27.57**	**$ 27.90**	**$ 26.18**	**$ 24.01**	**$ 36.96**	**$ 35.36**
Increase relative to PAYGO (%)	**0.0%**	**1.2%**	**-5.0%**	**-12.9%**	**34.1%**	**28.3%**

Data source: Authors calculations using the methodology presented in: COAG Road Reform Plan 2011, "Evaluation of Options – Draft", pages 21 and 22, 26 July, Heavy vehicle charges data used in the calculations was obtained from data provided by CRRP to the Australian Livestock and Rural Transporters Association.

Adjusting these charges for the 234 trips that took place over the 136 data recording period gave the following impacts of alternate heavy vehicle charges on the cost of transporting the slaughter steers relative to PAYGO charges were:

- Fuel only, an extra $79 for the 234 trips;
- Distance (axle group), reduction of $324 for the 234 trips;
- Distance location pricing, reduction of $832 for the 234 trips;
- Mass distance pricing, extra $2,200 for the 234 trips; and
- Mass distance location pricing, extra $1,800 for the 234 trips.

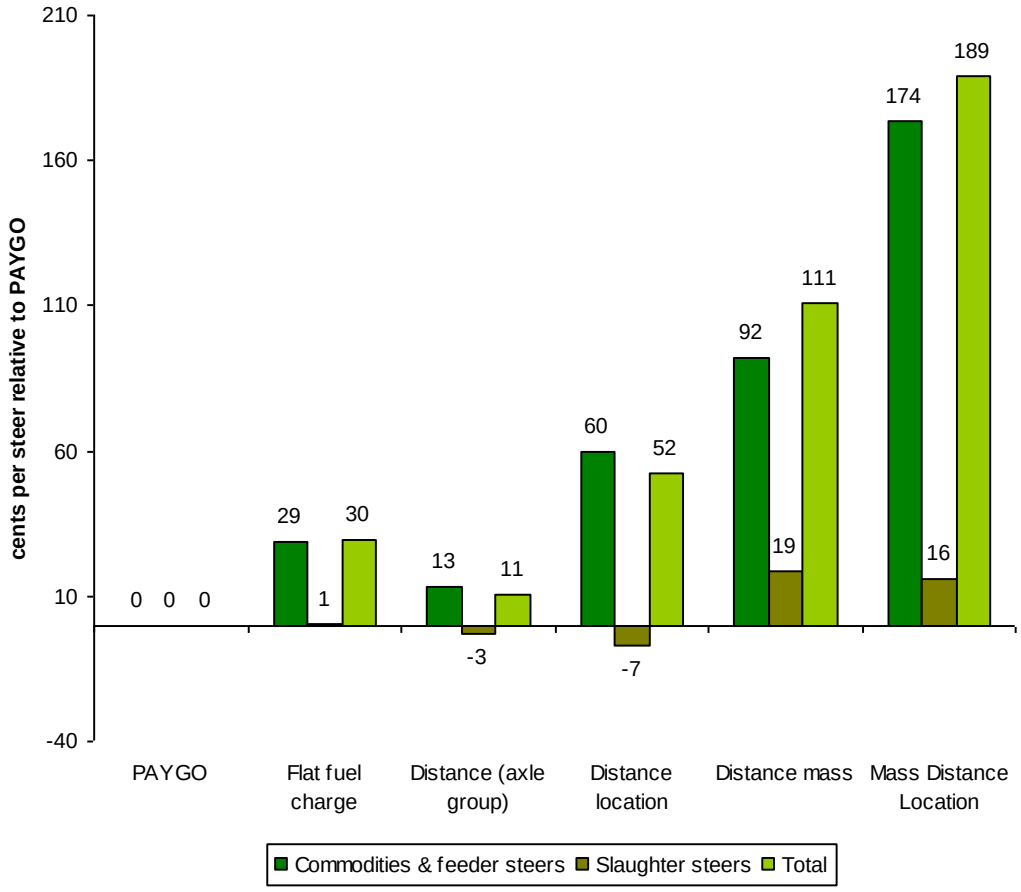
In the following section an overall estimate of the direct effect of alternate heavy charges on the cost of steers on feed at the feedlot is derived by combining the estimates of the effects on inbound road transport costs derived in Section 4.1 to the estimates of the effects of the charges on outbound road transport costs derived in Section 4.2.

4.3. TOTAL IMPACT ON THE NSW FEEDLOT

The total estimated impact on the NSW feedlot of alternate heavy vehicle charging mechanisms can be found by adding together the additional charges associated with inbound

road transport of feeder steers and commodities to the charges associated with outbound road transport of slaughter steers (Chart 15).

Chart 15 **Increase in registration and road use fees compared to PAYGO for alternate heavy vehicle charging mechanisms NSW Feedlot (cents/steer, 2010-11 charges)**



Data source: Author's calculations. In the case of commodities and feeder steers, costs per steer are calculated by dividing the total increase in heavy vehicle fees associated with the transport of feeder steers and commodities to the feedlot by the number of steers delivered to the feedlot over the 136 data recording period. In the case of slaughter steers costs per steer are calculated as the change in heavy vehicle charges on trucks delivering slaughter steers divided by the number of slaughter steers delivered to the abattoir.

All heavy vehicle charging mechanisms considered by CRRP would increase registration and road use fees paid by road transport operators that service the NSW feedlot's inbound and outbound road transport requirements (Chart 15). Introduction of mass distance location pricing could directly add approximately $1.90 to the road transport cost of grain feed steers supplied to the abattoir where they are slaughtered (Chart 15).The majority of the additional heavy vehicle charges resulted from additional charges on the transport of commodities and feeder steers rather than additional charges on the transport of the slaughter steers (Chart 15).

Over a whole year of operations at the feedlot alternate heavy vehicle charges would add:

- Fuel only, extra $9,000 per annum;

- Distance (axle group), extra of $3,000 per annum;
- Distance location pricing, extra of $16,000 per annum;
- Mass distance pricing, extra $35,000 per annum; and
- Mass distance location pricing, extra $59,000 per annum.

In the following section the results of the case study of the export of chilled sheep carcasses from Victoria is presented.

5. CASE STUDY OF THE EXPORT OF CHILLED SHEEP CARCASSES FROM VICTORIA

An abattoir located in Victoria's Western Districts agreed to supply data on the road transport of stock to the abattoir and the road transport of products from the abattoir to markets. The abattoir slaughters sheep, lambs, grass fed cattle and calves. Data was provided for an operating day in early July 2011.

The sheep that are slaughtered at the abattoir are mainly exported to the Middle East as chilled carcasses although some carcasses may be exported as frozen product depending upon market circumstances.

This case study tracks the road transport operations associated with:

- the transport of sheep from farms to a sale yard located in Central Victoria;
- the road transport of the sheep purchased by the abattoir at the saleyard in Central Victoria to the abattoir;
- the road transport of the chilled carcasses derived from the purchased sheep to Melbourne airport for export: and
- the road transport of by products that were produced from the slaughtered sheep.

To enable the case study to be undertaken, a saleyard was selected that historically had been the source of a significant number of sheep slaughtered at the case study abattoir. The saleyard was contacted and saleyard management agreed to provide details on the origins and destinations of stock sold at a sale in early July 2011.

The data provided by sale yard management contained the Property Identification Code of each vendor. The Property Identification Code contains codes that enable the Parish the sheep were sourced from to be identified. Similarly, Property Identification Codes were provided by saleyard management for all entities that purchased sheep at the sale. This enabled the sheep purchased by the case study abattoir to be identified.

Analysis of the data provided by the saleyard management indicated a total of 583 sheep and lambs had been purchased at the sale in early July 2011 although the abattoir indicated that 602 sheep and lambs were actually purchased at the sale. The sheep and lambs purchased by the abattoir came from properties mainly located in Victoria although some sheep were

derived from a property in New South Wales and one property located in South Australia (Table 8).

Also provided in Table 8 is an indication of the truck that was most likely used to transport the sheep to the sale. The selection of truck type for each sheep movement given in Table 8 was based on interviews with 13 drivers delivering sheep and lambs to the saleyard on the afternoon and night prior to the sale. Of 13 truck drivers interviewed, 9 were driving 6 axle articulated trucks, 2 were driving 9 axle B Doubles and 2 were driving a 3 axle rigid truck with a 3 axle trailer.

The interviews with drivers revealed that most trucks delivering sheep to the sale were loaded to their volumetric capacity. In addition, most of the drivers interviewed indicated that they were transporting stock for several vendors.

Table 8 **Approximate location of vendors of sheep purchased by the case study abattoir**

Approximate origin of sheep	Mob size (head)	Number purchased by abattoir (head)	Truck type assumed to transport stock	Capacity of truck (head of 50 kg sheep)
Near Burramboot	40	7	6 Axle semi trailer	416
Near Burramboot	30	22	6 Axle semi trailer	416
Near Mandurang	14	14	B Double	608
Near Heathcote	233	15	6 Axle semi trailer	416
Near Buttlejorrk	186	9	6 Axle semi trailer	416
Near Mologa	230	77	6 Axle semi trailer	416
Near Salisbury	144	32	6 Axle semi trailer	416
Near Berrimal	150	36	6 Axle semi trailer	416
Near Berrimal	66	66	6 Axle semi trailer	416
Near Berrimal	212	43	6 Axle semi trailer	416
Near Brenanah	11	11	6 Axle semi trailer	416
Near Bridgewater	20	20	B Double	608
Near Laanecoorie	505	4	B double	608
Near Ghin Ghin	221	19	6 Axle semi trailer	416
Near Harcourt	5	5	6 Axle semi trailer	416
Near Maffra	85	27	6 Axle semi trailer	416
Near Deniliquin, NSW	353	81	6 Axle semi trailer	416
Near Loxton, SA	401	95	6 Axle semi trailer	416

Data source: Author's calculations.

Using the information obtained from interviews with truck drivers the truck that was likely to have delivered the sheep to the saleyard was estimated and the results are given in fourth column of Table 8. For example, the 505 sheep delivered from near Laanecoorie would have required a 9 axle B Double to transport the sheep given they weighed on average approximately 50 kilograms a head which was the average weight of stock sold at the sale. [20] The sheep sourced from Mandurang and Bridgewater Parishes were also assumed to travel on this truck given that these parishes are located close to Laanecoorie Parish.

[20] A meat and Livestock Market report of the sale contained data that indicated the wethers sold at the sale had an average weight of approximately 49 kilograms and the lambs sold had an average weight of approximately 50 kilograms.

All other movements of sheep given in Table 8 were assumed to take place using 6 axle trucks. Such a truck has the capacity to transport approximately 416 sheep with an average weight of 50 kilogram and carrying a 35 to 40 millimetres skin. [21]

The 603 sheep and lambs purchased at the sale by the case study abattoir could have been transported to the abattoir in a 9 Axle B double. However, the sheep and lambs were transported in a 6 Axle semi trailer and a 9 axle B Double. The use of two trucks enabled other stock purchased by the abattoir (calves) to be transported to the abattoir.

In the following section the effect of alternate heavy vehicle charges on the cost of transporting the sheep to the saleyard and subsequently to the case study abattoir are assessed.

5.1. EFFECTS OF ALTERNATE HEAVY VEHICLE CHARGES ON THE COST OF TRANSPORTING THE SHEEP AND LAMBS PURCHASED BY THE CASE STUDY ABATTOIR

To calculate the effect of alternate heavy vehicle charges on the cost of sheep purchased by the abattoir data was required on the distance the sheep were transported and the gross vehicle mass of vehicles transporting the sheep.

The distances the sheep were transported from the origins given in Table 8 to the saleyard were calculated using Google Maps. The Google Map data was also used to determine the kilometres of the trip that took place on freeways, rural arterials, urban arterials and local roads and the details are given in Table 9.

Also given at the bottom of Table 9 are the calculated distances between the saleyard and the case study abattoir.

The overwhelming impression generated by the travel distance data given in Table 9 is that relatively short distances were involved in the transport to the sale of the sheep and lambs purchased by the case study abattoir (see last line Table 9). On average the sheep purchased by the abattoir were transported 141 kilometres from their place of origin to the abattoir. Most of this travel took place on rural arterial roads although significant travel on freeways and local roads also took place (Table 9).

[21] These capacities were derived using a Livestock Loading density equation that takes into account the weight of the sheep and the length of wool on the sheep The equation is given by: Area per sheep= (0.0278 * [sheep weight^ $^{0.5724}$]) * (1+ .00264*wool length). See: John Zeitsch 2009, "A loading density equation for sheep", Paper prepared for the New South Wales Roads and Traffic Authority, 10 October. .

Table 9 **Transport of sheep from the property of origin to the saleyard and from the saleyard to the abattoir (km. of journey on different roads)**

Approximate origin of sheep	Distance to saleyard (km.)	Freeway (km.)	Urban Arterial (km.)	Rural Arterial (km.)	Local Road (km.)
Near Burramboot	50			43	7
Near Burramboot	50			43	7
Near Mandurang	19			9	10
Near Heathcote	74			23	50
Near Buttlejorrk	132	95		36	2
Near Mologa	80			4	77
Near Salisbury	279			262	17
Near Berrimal	102			66	37
Near Berrimal	102			66	37
Near Berrimal	102			66	37
Near Brenanah	72			37	35
Near Bridgewater	47			29	18
Near Laanecoorie	51			16	35
Near Ghin Ghin	148			119	29
Near Harcourt	42			40	2
Near Maffra	387	272		113	2
Near Deniliquin, NSW	162			160	2
Near Loxton, SA	536			431	105
Saleyard	190	73		113	4
Average	141	26		89	26

Data source: Author's calculations using Google Maps data.

To calculate the alternate heavy vehicle charges, data is also required on the Equivalent Standard Axles[22] generated by the truck transporting the sheep purchased by the abattoir and the trucks gross vehicle mass. This data can be estimated using Livestock Loading calculators and the output from such calculators assuming sheep of 50 kilograms average weight and a skin of 35 to 40 millimetres are given in Chart 16.

The National Transport Commission provided to the New South Wales Livestock and Bulk Carriers Association a spreadsheet model containing the indicative heavy vehicle charges CRRP used in its benefit cost analysis of alternate heavy vehicle charges. The spreadsheet model provided to New South Wales Livestock and Bulk Carriers Association was made available to the author for this study.

The heavy vehicle charges data and the distance and axle weight data presented in Chart 16 and Chart 8 was used to calculate the registration and road use fees that would be associated with the transport of sheep and lambs for the first transport movement given in Chart 8 (i.e. the transport of sheep for approximately 40 kilometres from near Burramboot to the saleyard) and the results are given in Chart 17. The charges detailed in Chart 17 were calculated using the methodology presented by CRRP in its report titled "Evaluation of Options – Draft"[23].

[22] The methodology used to calculate equivalent standard axles (ESAs) is given in: National Transport Commission 2011, "Modelling the Marginal Cost of Road Wear, Research Paper, 16 May, p. 27.

[23] COAG Road Reform Plan 2011, "Evaluation of Options –Draft", 26 July, p. 22

Chart 16 **Axle loads of trucks transporting sheep and lambs weighing 50 kilograms**

Axle weight summary for a 9 axle B Double transporting 608 sheep weighing 50 kilograms each					
Weight	Steer axle	Drive axle	A Trailer tri axle	B Trailer tri axle	Total Vehicle
Tare (kg)	6,400	7,830	9,670	8,560	32,460
Load (kg)	144	7,036	11,448	11,773	30,401
Gross (kg)	6,544	14,866	21,118	20,333	62,861
Esa's	2.1	1.4	1.7	1.5	6.7

Axle weight summary for a 6 axle articulated truck transporting 416 sheep weighing 50 kilograms each				
Weight	Steer axle	Drive axle	A Trailer tri axle	Total Vehicle
Tare (kg)	6,400	8,190	8,560	23,150
Load (kg)	171	8,393	12,236	20,800
Gross (kg)	6,571.0	16,583.0	20,796.0	43,950.0
Esa's	2.2	2.1	1.6	5.9

a Data source: Derived from output of a Livestock Loading Calculator.

For the transport movement evaluated, all the heavy vehicle charges being considered by CRRP would increase the registration and road use fees paid by the truck operator transporting the sheep and lambs to the saleyard (Chart 17). Mass distance location pricing could almost doubler the costs of transporting sheep and lambs to the saleyard (see last column in Chart 17).

Chart 17 **Registration and road use charges for the truck used assumed to transport sheep and lambs from near Burramboot to the saleyard ($, 2010/11 values)**

Trip Details	
Vehicle	6-axle semi-trailer
Mass carried above tare	20.8
Gross vehicle mass	44.0
Fuel use (L/100km)	55.9
ESAs	5.9
Average kms by vehicle type	200,000
Origin	Near Burramboot
Destination	Saleyard
Distance travelled (Kms)	50.3
Freeway	*0*
Urban Arterial	*0*
Rural Arterial	*43.16*
Local	*7.14*
Fuel usage (L)	28.1

	PAYGO (2010/11)	Fuel (flat charge)	Distance (axle group)	Distance Location	Distance Mass	Mass Distance Location
Annual registration	$ 5,612.00	$ 447.80	$ 567.89	$ 447.80	$ 447.80	$ 447.80
Est. per trip registration	$ 1.41	$ 0.11	$ 0.14	$ 0.11	$ 0.11	$ 0.11
Variable trip cost	$ 6.36	$ 9.45	$ 8.10	$ 9.29	$ 12.69	$ 14.73
Total cost per trip	**$ 7.77**	**$ 9.57**	**$ 8.24**	**$ 9.40**	**$ 12.80**	**$ 14.84**
Increase relative to PAYGO	**0.0%**	**23.1%**	**6.1%**	**21.0%**	**64.8%**	**91.0%**

Data source: Authors calculations using the methodology presented in: COAG Road Reform Plan 2011, "Evaluation of Options – Draft", pages 21 and 22, 26 July, Heavy vehicle charges data used in the calculations was obtained from data provided by CRRP to the Australian Livestock and Rural Transporters Association.

However, given the relatively small distances travelled in this movement of sheep and lambs the absolute increase in registration and road use fees was relatively small at $7.07 for mass distance location pricing (Chart 17). This increase is equivalent to 2 cents per sheep given that the truck in question was assumed to carry 416 sheep and lambs.

Thus relatively large increases in registration and road use fees generate small absolute changes in the cost of transporting sheep.

The methodology used to calculate road use fees and registration charges given in Chart 17 was used to calculate the heavy vehicle charges for all livestock movements detailed in Table 9 and the results are detailed in Table 10. These are the numbers given in the last 6 columns of Table 10. These charges are then multiplied by the number of trips of each sheep movement given in the third column of Table 10.

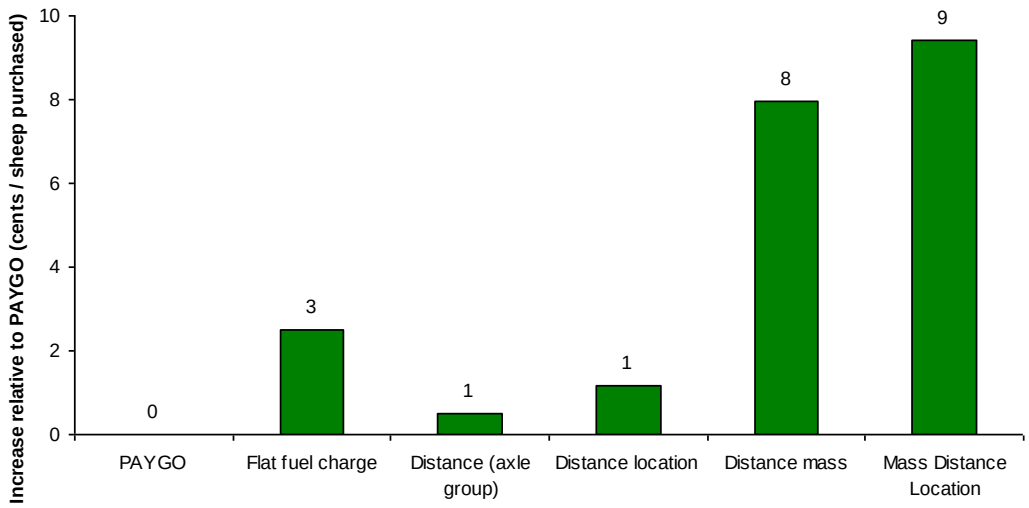
The calculation of the truck movements requires a little explanation.

The truck movements represent the proportion of a load of sheep delivered to the saleyard that were purchased by the case study abattoir. For example, in the first sheep and lamb movement given in Table 8 the case study abattoir purchased 7 sheep from a truck movement that was assumed to involve 416 sheep and lambs. Thus the number of truck movements the case study abattoir was responsible for was 0.02 (calculated as 7/416 = 0.02).

The heavy vehicle charges given in the last 6 columns of Table 10 were multiplied by the respective number of trips of each sheep movement given in the third column of Table 10 and the products were then summed and the results are given in the last row of Table 10. The numbers in the last row of Table 10 thus represent the total registration and road use fees attributable to the sheep purchased by the case study abattoir.

The added registration and road use fees represent up to approximately 9 cents per sheep purchased by the case study abattoir (Chart 18).

Chart 18 **Increase in the road transport cost associated with sheep and lambs purchased by the case study abattoir (cents / sheep 2010-11 charges)**



a **Data source: Author's calculations.**

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Table 10 Registration and road use charges for vehicles transporting sheep and lambs to the saleyard and case study abattoir ($ 2010/11 charges)

Origin	Truck type	Number trips (no.)	Distance from origin to destination (km.)	Travel on Freeway (km.)	Travel on Urban arterial (km.)	Travel on Rural arterial (km.)	Travel on Local road (km.)	PAYGO ($)	Flat fuel charge ($)	Distance (axle group) ($)	Distance location ($)	Distance mass ($)	Mass Distance Location ($)
Near Burramboot	6 Axle semi trailer	0.02	50			43	7	8	10	8	9	13	15
Near Burramboot	6 Axle semi trailer	0.05	50			43	7	8	10	8	9	13	15
Near Mandurang	B Double	0.02	19			9	10	4	4	4	9	6	14
Near Heathcote	6 Axle semi trailer	0.04	74			23	50	11	14	12	31	19	58
Near Buttlejorrk	6 Axle semi trailer	0.02	132	95		36	2	20	25	22	16	34	20
Near Mologa	6 Axle semi trailer	0.19	80			4	77	12	15	13	43	20	83
Near Salisbury	6 Axle semi trailer	0.08	279			262	17	43	53	46	42	71	61
Near Berrimal	6 Axle semi trailer	0.09	102			66	37	16	19	17	29	26	50
Near Berrimal	6 Axle semi trailer	0.16	102			66	37	16	19	17	29	26	50
Near Berrimal	6 Axle semi trailer	0.10	102			66	37	16	19	17	29	26	50
Near Brenanah	6 Axle semi trailer	0.03	72			37	35	11	14	12	24	18	44
Near Bridgewater	B Double	0.03	47			29	18	11	11	11	18	14	28
Near Laanecoorie	B double	0.01	51			16	35	12	12	11	28	15	46
Near Ghin Ghin	6 Axle semi trailer	0.05	148			119	29	23	28	24	31	38	51
Near Ghin Ghin	6 Axle semi trailer	0.02	50			43	7	8	10	8	9	13	15

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Table 10 (continued) **Registration and road use charges for vehicles transporting sheep and lambs to the saleyard and case study abattoir ($ 2010/11 charges)**

Origin	Truck type	Number trips	Distance from origin to destination (km.)	Travel on Freeway (km.)	Travel on Urban arterial (km.)	Travel on Rural arterial (km.)	Travel on Local road (km.)	PAYGO ($)	Flat fuel charge ($)	Distance (axle group) ($)	Distance location ($)	Distance mass ($)	Mass Distance Location ($)
Near Harcourt	6 Axle semi trailer	0.01	42			40	2	6	8	7	6	11	9
Near Maffra	6 Axle semi trailer	0.06	387	272		113	2	60	74	63	45	98	57
Near Deniliquin	6 Axle semi trailer	0.19	162			160	2	25	31	27	21	41	29
Near Loxton	6 Axle semi trailer	0.23	536			431	105	83	102	88	113	136	185
Saleyard	B Double	0.48	190	73	0	113	4	44	44	43	30	56	38
Saleyard	6 Axle	0.71	190	73	0	113	4	29	36	31	24	48	33
							Total 1 trip	211	254	221	347	338	585
			Total attributable to sheep purchased by the case study abattoir					84	99	87	91	131	139

Source: Author's calculations.

Over a whole year of exports of chilled sheep carcasses alternate heavy vehicle charges could increase the cost of transporting sheep destined for the chilled sheep carcass market by approximately:

- Fuel only, extra $1,800 per annum;
- Distance (axle group), extra of $400 per annum;
- Distance location pricing, extra of $800 per annum;
- Mass distance pricing, extra $5,600 per annum; and
- Mass distance location pricing, extra $6,600 per annum.

In the following section the effect of alternate heavy vehicle charges on the cost of transporting the sheep carcasses for export and other products derived from the slaughtered sheep derived from the saleyard.

5.2. EFFECTS OF ALTERNATE HEAVY VEHICLE CHARGES ON THE ROAD TRASNPORT COST OF CHILLED SHEEP CARCASSES

On the day the case study abattoir was visited approximately 800 sheep carcasses were exported as chilled product to the Middle East. Of the 800 carcasses approximately 490 were derived from sheep slaughtered on the day the case study abattoir was visited.

In addition on the day the case study abattoir was visited the abattoir slaughtered approximately 100 calves, 1,400 lambs and approximately 460 grass feed steers.

The products produced from the kill described above were estimated using spreadsheet models developed by Kurrajong Meat Technologies for Meat and Livestock Australia. The first of these models calculates by product yields and carton meat yields from steers of different weights and feed regimes.[24] Kurrajong Meat Technologies has also developed a similar spreadsheet model that can be used to estimate yields from slaughtered lambs and sheep.[25]

The spreadsheet models allow the user to specify the hot carcass weight of the animal to be slaughtered and the spreadsheet models then calculate the weight of various by-products that can be expected to be generated as a result of processing the animal after it is slaughtered.

In this study yields from the cattle slaughtered by the case study were approximated by selecting yields from a “grass fed steer 280-350 kg”, and proportional yields from slaughtered calves were derived using the yields for a “Vealer 70-100 kg” and lamb and sheep yields were derived from the “Lamb_Yields” spreadsheet. The products produced, given the assumed yields given in Table 11, and are graphed Chart 19.

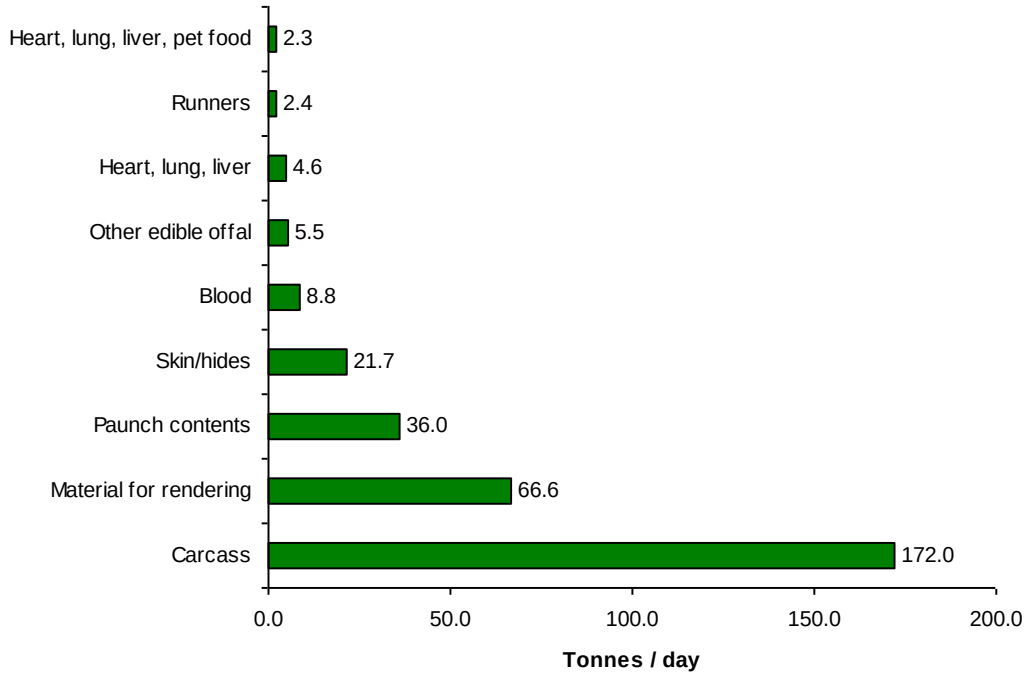
[24] The spreadsheet was kindly provided by Bill Spooncer of Kurrajong Meat Technology. The spreadsheet is named “Co-product values V2.xls”.

[25] The spreadsheet was also provided by Bill Spooncer of Kurrajong Meat Technology. The spreadsheet is named “Lamb_Yields.xls”.

Table 11 Product yields per animal slaughtered (kilograms)

Yields per animal slaughtered (kg. / animal)				
Component	**Cattle**	**Sheep**	**Lambs**	**Calves**
Carcass weight loss	6.2	0.7	0.7	0.45
Runners	2.4	0.7	0.7	0.00
Heart, lung, liver	6.5	0.0	1.2	0.40
Heart, lung, liver, pet food	2.2	1.5	0.4	0.13
Other edible offal	11.8	0.0	0.0	0.78
Skin/hide	30.0	4.0	4.0	2.17
Blood	12.7	1.5	1.5	1.06
Carcass	278.3	21.8	21.8	20.00
Paunch contents	62.3	3.8	3.8	1.24
Material for rendering	76.3	16.0	16.0	9.31
Sum of above equals live weight	488.6	50.0	50.0	35.5
Number slaughtered (no.)				
	462	491	1405	104
Products produced (tonnes)				
Component	**Cattle**	**Sheep**	**Lambs**	**Calves**
Runners	1.1	0.3	0.9	0.0
Heart, lung, liver	3.0	0.0	1.6	0.0
Heart, lung, liver, pet food	1.0	0.8	0.5	0.0
Other edible offal	5.4	0.0	0.0	0.1
Skin/hides	13.9	2.0	5.6	0.2
Blood	5.9	0.7	2.1	0.1
Carcass	128.6	10.7	30.7	2.1
Paunch contents	28.8	1.8	5.3	0.1
Material for rendering	35.2	7.9	22.5	1.0
Total	222.9	24.2	69.3	3.6

Chart 19 **Products produced from the days kill at the case study abattoir (tonnes / day)**



a Data source: Author's calculations.

The case study abattoir provided details on the truck movements associated with the transport of the products produced given in Chart 19. Truck movements associated with the export of chilled sheep carcasses and by products produced from the sheep slaughtered to produce the chilled carcasses included:

- 1 by 6 axle flat top semi trailers transporting hides and skins;
- 1 by 6 axle tanker transporting blood derived from slaughtered animals;
- 1 by 6 axle aluminium tipper used to transporting pet food;
- 2 by 6 axle aluminium tippers used to transport material for rendering; and
- 1 by 6 axle refrigerated semi trailer used to transport approximately 800 chilled sheep carcasses to an airport.

The gross vehicle mass associated with the transport of the above products are given in Chart 20 along with estimates of the equivalent standard axles generated by the loaded trucks given the assumed TARE weights of the respective trucks.[26]

[26] The tare weights of the trucks detailed in Chart 20 were derived from: CRA and Centre for Policy Analysis 2007, "Economic and Fiscal Analysis of Higher Mass Limits in New South Wales", Report prepared for the New South Wales Roads and Traffic Authority, p.27, unpublished.

Chart 20 **Calculated ESAs for trucks transporting products derived from sheep slaughtered to produce chilled sheep carcasses**

Axle weight summary refrigerated van transporting 800 sheep carcasses				
Weight	Steer axle	Drive axle	A Trailer tri axle	Total Vehicle
Tare (kg)	6,400	8,265	8,635	23,300
Load (kg)	141	6,900	10,059	17,100
Gross (kg)	6,541.1	15,164.7	18,694.2	40,400.0
Esa's	2.1	1.5	1.1	4.7

Axle weight summary aluminium tipper transporting 2.3 tonnes pet food				
Weight	Steer axle	Drive axle	A Trailer tri axle	Total Vehicle
Tare (kg)	5,000	5,500	5,500	16,000
Load (kg)	19	929	1,355	2,303
Gross (kg)	5,019.0	6,429.3	6,854.9	18,303.2
Esa's	0.7	0.0	0.0	0.8

Axle weight summary flat top semi trailer transporting 22 tonnes skins and hides				
Weight	Steer axle	Drive axle	A Trailer tri axle	Total Vehicle
Tare (kg)	5,000	6,250	6,250	17,500
Load (kg)	179	8,751	12,758	21,688
Gross (kg)	5,178.9	15,001.0	19,008.3	39,188.2
Esa's	0.8	1.4	1.1	3.4

Axle weight summary tanker transporting 9 tonnes blood				
Weight	Steer axle	Drive axle	A Trailer tri axle	Total Vehicle
Tare (kg)	5,000	4,250	4,250	13,500
Load (kg)	73	3,560	5,190	8,823
Gross (kg)	5,072.8	7,810.1	9,440.4	22,323.3
Esa's	0.8	0.1	0.1	0.9

Axle weight summary aluminium tipper transporting 30 tonnes material for rendering				
Weight	Steer axle	Drive axle	A Trailer tri axle	Total Vehicle
Tare (kg)	5,000	5,500	5,500	16,000
Load (kg)	243	11,903	17,354	29,500
Gross (kg)	5,243.3	17,403.0	22,853.6	45,500.0
Esa's	0.9	2.6	2.4	5.8

[a] Data source: Author's calculations.

Google Maps was used to obtain an estimate of the distance the products were transported and the kilometres of each journey that was undertaken on freeways, urban arterials, rural arterials and local roads. The distance information along with the information on vehicle gross mass given in Chart 20, and the heavy vehicles charges data provided by the National Transport Commission to the ALTRA was used to calculate the heavy vehicle charges that would apply to vehicles transporting outputs from the case study abattoir.

An example of the calculations is provided for the transport of the chilled sheep carcasses from the case study abattoir to the airport (Chart 21). As can be seen from Chart 21 the registration and road use fees associated with this trip are relatively low at about $11 under PAYGO and could be even lower than this value under heavy vehicle charges based on the type of road trucks travel on. In the trip evaluated in Chart 21 location based charges would result in lower heavy vehicle charges as the truck travels a large proportion of the trip on freeways which have relatively low charges under location based charges.

Chart 21 **Calculated heavy vehicle charges for a 6 axle refrigerated van transport 800 chilled sheep carcasses ($/trip)**

Trip Details	
Vehicle	6-axle semi-trailer
Mass carried above tare	17.1
Gross vehicle mass	40.4
Fuel use (L/100km)	53.5
ESAs	4.7
Average kms by vehicle type	200,000
Origin	Abattoir
Destination	Airport
Distance travelled (Kms)	75.7
Freeway	*73.3*
Urban Arterial	*0*
Rural Arterial	*0*
Local	*2.4*
Fuel usage (L)	40.5

	PAYGO (2010/11)	Fuel (flat charge)	Distance (axle group)	Distance Location	Distance Mass	Mass Distance Location
Annual registration	$ 5,612.00	$ 447.80	$ 567.89	$ 447.80	$ 447.80	$ 447.80
Est. per trip registration	$ 2.12	$ 0.17	$ 0.21	$ 0.17	$ 0.17	$ 0.17
Variable trip cost	$ 9.15	$ 13.61	$ 12.19	$ 9.11	$ 16.49	$ 10.85
Total cost per trip	**$ 11.28**	**$ 13.78**	**$ 12.40**	**$ 9.28**	**$ 16.66**	**$ 11.02**
Increase relative to PAYGO	**0.0%**	**22.2%**	**10.0%**	**-17.7%**	**47.7%**	**-2.2%**

Data source: Authors calculations using the methodology presented in: COAG Road Reform Plan 2011, "Evaluation of Options – Draft", pages 21 and 22, 26 July, Heavy vehicle charges data used in the calculations was obtained from data provided by CRRP to the Australian Livestock and Rural Transporters Association.

The methodology used to calculate road use fees and registration charges given in Chart 21 was used to calculate the heavy vehicle charges for the output truck movements detailed previously in the section and the results are detailed in Table 12. These are the numbers given in the last 6 columns of Table 12. Total charges are found by multiplying these numbers by the truck movements given in the third column of Table 12.

The truck movements given in the third column of Table 12 represent the proportion of a trip that was accounted for by the 491 sheep that were slaughtered on the day the case study was visited and which formed part of the export of the 800 chilled sheep carcasses on the same day. For example, the slaughter of the 491 sheep generated 7.9 tonnes of material for rendering out of a total amount of material for rendering of 66.6 tonnes. Two trucks were used to transport the material for rendering. Hence the number of truck movements associated with material for rendering that were generated as a result of the slaughter of the 491 sheep was 0.24 (calculated as 7.9 /66.9 * 2 = 0.24).

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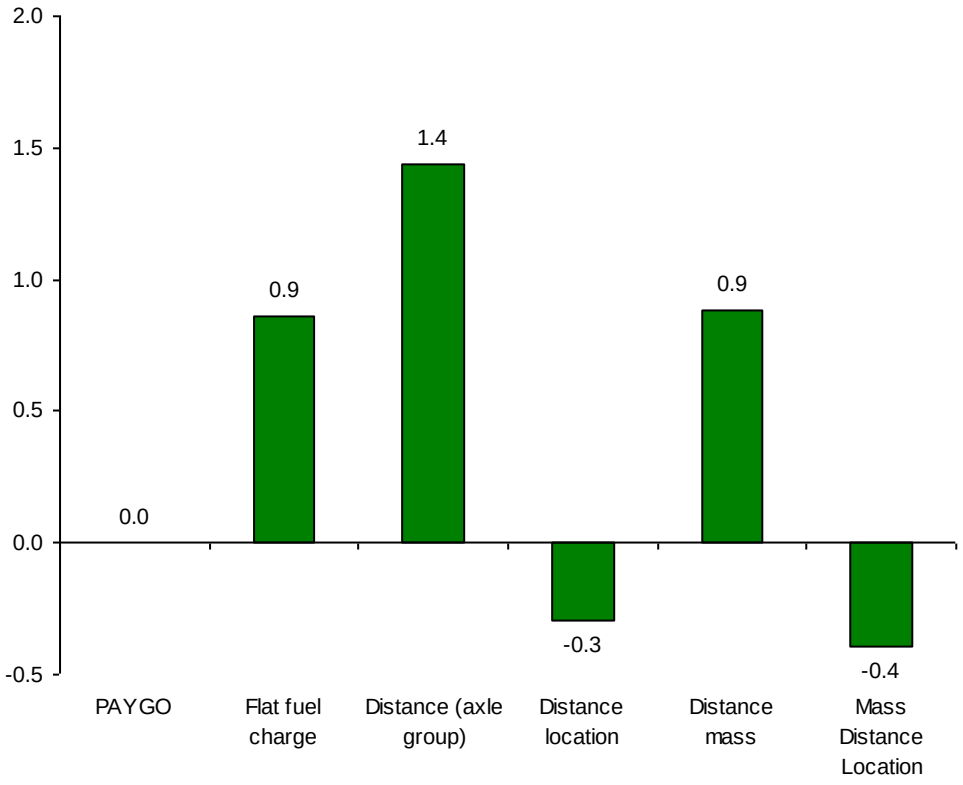
Table 12 **Registration and road use charges for vehicles transporting chilled sheep carcasses and products produced from the sheep slaughtered to produce the chilled sheep carcasses ($ 2010/11 charges)**

Product	Truck type	Number trips	Distance from origin to destination (km.)	Travel on Freeway (km.)	Travel on Urban arterial (km.)	Travel on Rural arterial (km.)	Travel on Local road (km.)	PAYGO ($)	Flat fuel charge ($)	Distance (axle group) ($)	Distance location ($)	Distance mass ($)	Mass Distance Location ($)
Chilled sheep carcases for export	6 Axle semi trailer	0.47	76	73	0	0	2	11	14	12	9	17	11
Material for rendering	6 Axle semi trailer	0.24	55	50	1	0	4	9	11	9	8	14	11
Hides skins	6 Axle semi trailer	0.09	53	50	1	0	3	8	10	9	7	10	7
Blood	6 Axle semi trailer	0.08	53	50	1	0	3	6	7	9	7	6	6
Pet food	6 Axle semi trailer	0.33	372	349	0	18	5	43	49	61	43	42	36
Total 1 trip for each commodity by truck type ($)							77	90	100	74	88	71	77
Total attributable to the 491 sheep slaughtered ($)							22	26	29	21	26	21	22

Source: Author's calculations.

As indicated above, the heavy vehicle charges given in the last 6 columns of Table 12 were multiplied by the respective number of trips associated with the transport of products given in the third column of Table 12 and the products were then summed and the results are given in the last row of Table 12. The numbers in the last row of Table 12 thus represent the total registration and road use fees attributable to outputs derived from the slaughter of the 491 sheep by the case study abattoir. Dividing these numbers by 491 gave the change in charges per chilled sheep carcass given in Chart 22.

Chart 22 **Registration and road use fees on vehicles transporting chilled sheep carcasses (cents / chilled sheep carcass, 2010-11 charges)**



[a] Data source: Author's calculations.

Per chilled sheep carcass exported, registration and road use fees could actually fall marginally if charges based on the distance and location of travel were introduced (Chart 22). This reflects the location of the abattoir which enables it to access a greater proportion of freeways and major arterial roads when transporting stock to the abattoir and products from the abattoir to market. However, charges which do not incorporate the location of travel of vehicles could result in increased heavy vehicle charges associated with the export of chilled sheep carcasses (Chart 22).

Over a whole year of exports of chilled sheep carcasses alternate heavy vehicle charges would alter the road transport cost of chilled sheep carcasses from the abattoir to the airport by:

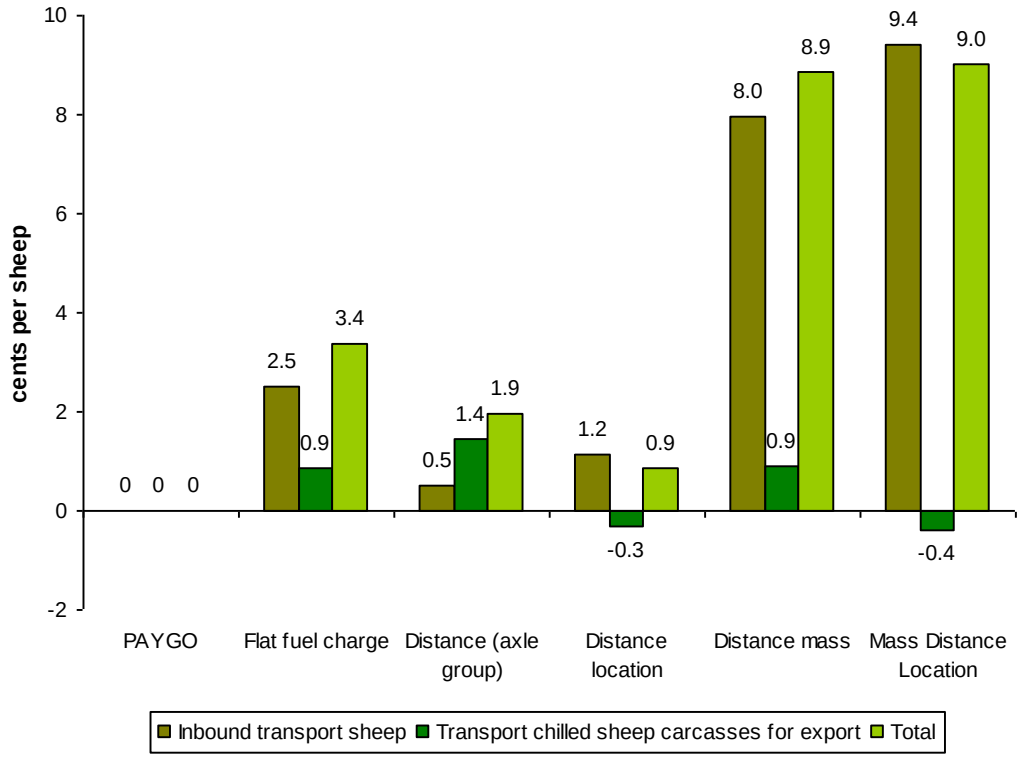
- Fuel only, extra $500 per annum;
- Distance (axle group), extra of $1,000 per annum;
- Distance location pricing, reduction of $200 per annum;
- Mass distance pricing, extra $500 per annum; and
- Mass distance location pricing, reduction of $300 per annum.

In the following section an estimate is provided of the effect of alternate heavy vehicle charges on the total road transport costs 0of chilled sheep carcasses from Victoria.

5.3. TOTAL IMPACT ON THE COST OF EXPORTING CHILLED SHEEP CARCASSES

The total estimated impact on the export of chilled sheep carcasses from Victoria of alternate heavy vehicle charging mechanisms can be found by adding together the additional charges associated with inbound road transport of sheep to the additional costs associated with the export of chilled sheep carcasses and products derived from the sheep slaughtered to produce the chilled sheep carcasses (Chart 23).

Chart 23 **Increase in registration and road use fees compared to PAYGO for alternate heavy vehicle charging mechanisms associated with the export of chilled sheep carcasses (cents/chilled sheep carcass, 2010-11 charges)**



Data source: Author's calculations.

All heavy vehicle charging mechanisms considered by CRRP would increase registration and road use fees paid by road transport operators that service the case study abattoir's inbound and outbound road transport requirements associated with the export of chilled sheep carcasses (Chart 23). The majority of the additional heavy vehicle charges resulted from additional charges on the transport of sheep for slaughter rather than additional charges on the transport of products produced from the slaughtered sheep (Chart 23).

Over a whole year of exports of chilled sheep carcasses alternate heavy vehicle charges would add:

- Fuel only, extra $2,500 per annum;
- Distance (axle group), extra of $1,500 per annum;
- Distance location pricing, extra of $500 per annum;
- Mass distance pricing, extra $6,000 per annum; and
- Mass distance location pricing, extra $6,500 per annum.

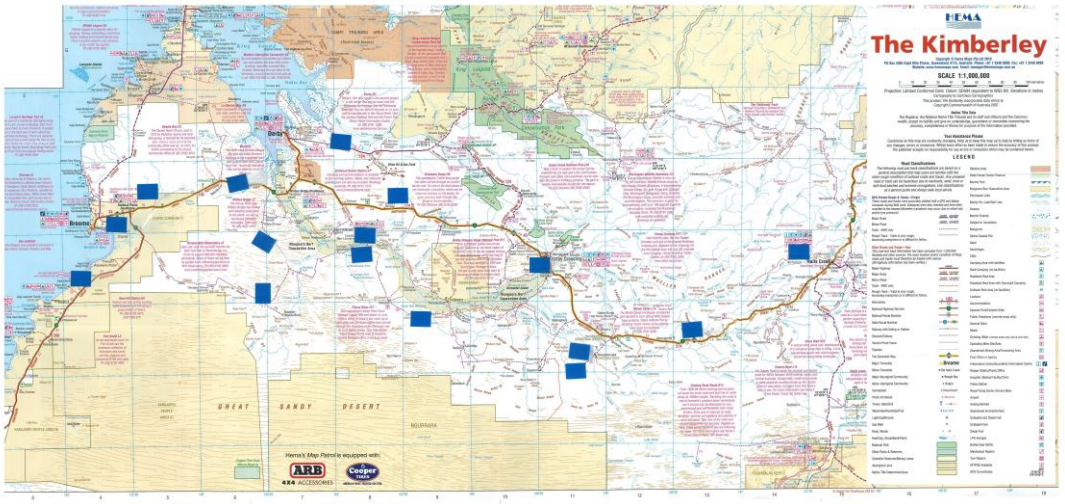
In the following section the case study of the export of live cattle from Western Australia is presented.

6. LIVE EXPORT OF CATTLE FROM WESTERN AUSTRALIA

A Company that exports live cattle and sheep from Australia agreed to provide data on the road transport of steers that comprised a shipment of approximately 9,000 live steers that took place from Western Australia in July 2011.

The export of live cattle from Western Australia took place in early July 2010. The cattle were loaded in Broome and were sourced from Western Australian cattle stations located along the Great Northern Highway to the east of Broome. In almost all cases, the cattle stations accessed the Great Northern Highway via unsealed roads (Chart 24).

Chart 24 **Location of cattle stations that supplied cattle for live export**



[a] Data source: HEMA Maps, The Kimberly, Western Australia. A blue square indicates the location of a station that supplied steers.

The steers were first transported from the cattle station they were purchased from to holding yards where they were introduced to the ration they would be fed on the overseas leg of the journey to the end market. After spending approximately a week in the holding yards the cattle were then transported to Broome port in triple road trains.

To calculate the effect of alternate heavy vehicle charges on the cost of transporting the steers, data was required on the type of truck used to transport the steers. This information was obtained through the use of a loading density equation that was estimated using the loading densities for cattle provided in the Australian Standards and Guidelines for the Welfare of Animals — land transport of livestock. [27]

The loading density equation was used to determine the number of steers that could be loaded per deck given the average weight of animals to be transported. The truck type used to transport the stock was then determined given the number of decks required to transport the stock. In the vast majority of cases the steers were transported in triple road trains

[27] Australian Standards and Guidelines for the Welfare of Animals — land transport of livestock, Public Consultation Version, Version 29 February 2008.

although several mobs were transported in B Doubles. There were also 3 mobs of cattle that were most likely transported in 6 axle semi trailers (Table 13).

Table 13 Trucks required to transport the steers

Origin of cattle	No of steers (No.)	Average weight / animal (kg.)	Loading density (head /deck)	Number decks (no.)	Trucks used to transport cattle
Carnarvon	96	350	32	3.0	B double
Derby	799	379	30	26.6	4 Triple road trains & 1 B double
Derby	256	357	30	8.5	1 Triple road train & 1 B double
Fitzroy Crossing	2918	382	30	97.3	16 triple road trains
Camballin	750	326	32	23.4	4 Triple road trains
Roebuck	402	388	30	13.4	2 Triple road trains
Broome	514	419	28	18.4	3 Triple road trains
Broome	109	323	32	3.4	Double road train
Fitzroy Crossing	170	360	30	5.7	1 Triple road train
Derby	575	328	32	18.0	3 Triple road trains
Halls Creek	148	375	30	4.9	1 Triple road train
Fitzroy Crossing	341	375	30	11.4	2 Triple road rrains
Camballin	94	393	28	3.4	Double road train
Port Headland	563	295	34	16.6	3 Triple road trains
Derby	19	308	34	0.6	6 axle semi trailer
Derby	950	344	32	29.7	5 Triple road trains
Broome	99	336	32	3.1	B Double
Fitzroy Crossing	29	369	30	1.0	6 axle semi trailer
Broome	14	384	30	0.5	6 axle semi trailer
Fitzroy Crossing	100	433	26	3.8	Double road train
Holding Yards	8989	364	30	300	50 Triple Road Trains

The distances the steers were transported were derived from the HEMA Map titled "Kimberly Western Australia" a portion of which is reproduced in Chart 24. On average the steers were transported 400 kilometres from station to port, of which approximately 30 kilometres took place on unsealed roads.

Given the data on the truck type used to transport the steers and the distance the steers were transported, the registration and road use fees that would apply under alternative heavy vehicle charges were calculated. An example of how the charges were calculated is given in Chart 25 for the transport of the steers from the holding yards to Broome Port. The charges were calculated using the methodology presented by CRRP in its report titled "Evaluation of Options – Draft".[28]

To undertake the calculations it was assumed that the Triple Road Train involved in the transport of the steers travelled on average 200,000 kilometres per annum, achieved a fuel efficiency of 117 litres per 100 kilometres travelled and the truck would generate a load on the pavements travelled on equivalent to 12.9 Equivalent Standard Axles[29]

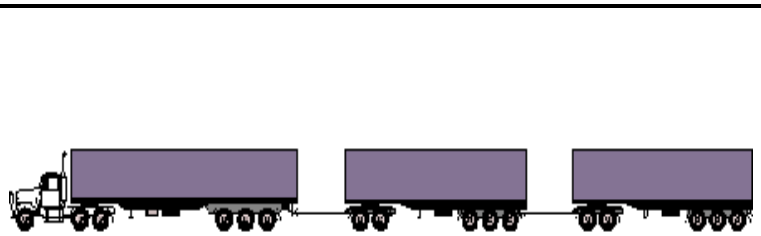
[28] COAG Road Reform Plan 2011, "Evaluation of Options –Draft", 26 July, p. 22

[29] The methodology used to calculate equivalent standard axles (ESAs) is given in: National Transport Commission 2011, "Modelling the Marginal Cost of Road Wear, Research Paper, 16 May, p. 27.

The calculations indicate that for the transport example evaluated, registration and road use fees would be similar under PAYGO, Distance location, Mass Distance Location and fuel based charges (Chart 25). However, heavy vehicle charges that incorporate elements of charges based on the distance travelled and mass of trucks would generate greater charges than would apply under the maintenance of PAYGO (Chart 25).

Chart 25 **Registration and road use charges for the trucks used to transport livestock from the holding Yards to Broome Port ($, 2010/11 values)**

Trip details	
Vehicle	Triple Road Train
Mass carried above tare	65.5
Gross vehicle mass	117.5
Fuel use (L/100km)	106.55
ESAs	12.9
Average kms by vehicle type	200,000
Origin	Roebuck Yards
Destination	Broome port
Distance travelled (Kms)	30
Freeway	*0*
Urban Arterial	*0*
Rural Arterial	*30*
Local	*0*
Fuel usage (L)	32.0



	PAYGO (2010/11)	Fuel (flat charge)	Distance (axle group)	Distance Location	Distance Mass	Mass Distance Location
Annual registration	$ 13,372.00	$ 447.80	$ 1,325.07	$ 447.80	$ 447.80	$ 447.80
Est. per trip registration	$ 2.01	$ 0.07	$ 0.20	$ 0.07	$ 0.07	$ 0.07
Variable trip cost	$ 7.22	$ 10.74	$ 12.66	$ 7.65	$ 15.75	$ 9.93
Total cost per trip	**$ 9.23**	**$ 10.81**	**$ 12.86**	**$ 7.72**	**$ 15.82**	**$ 10.00**
Change relative to PAYGO (%)	**0.0%**	**17.1%**	**39.3%**	**-16.4%**	**71.4%**	**8.3%**

Data source: Authors calculations using the methodology presented in: COAG Road Reform Plan 2011, "Evaluation of Options – Draft", pages 21 and 22, 26 July, Heavy vehicle charges data used in the calculations was obtained from data provided by CRRP to the Australian Livestock and Rural Transporters Association.

Registration and road use fees were calculated for all the transport journeys detailed in Table 13 using the methodology detailed in Chart 25 and the results are given in Table 14. These calculations were undertaken assuming travel on an unsealed road would be priced at travel on a local road.

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Table 14 Registration and road use charges for the transport of the 9,000 steers ($ 2010/11 charges)

Origin of stock	Truck type used to transport the livestock	Number of truck trips (No.)	Average weight (kg.)	Distance from origin of stock to abattoir (km.)	Travel on Freeway (km.)	Travel on Urban arterial (km.)	Travel on Rural arterial (km.)	Travel on Local road (km.)	PAYGO ($)	Flat fuel charge ($)	Distance (axle group) ($)	Distance location ($)	Distance mass ($)	Mass Distance Location ($)
Near Carnarvon	B double	1	350	1483	0	0	1383	100	346.8	349.8	331.9	288.7	449.9	402.2
Near Derby	4 Triple road trains	4	379	385	0	0	285	100	120.1	141.1	165.0	213.8	214.8	349.9
Near Derby	B Double	1	357	385	0	0	285	100	83.7	81.4	86.2	118.3	133.6	174.1
Near Derby	1 Triple road train	1	357	344	0	0	237	107	105.1	122.9	147.4	211.3	176.6	317.4
Near Derby	B Double	1	382	344	0	0	237	107	76.0	74.5	77.0	116.0	107.0	208.6
Fitzroy Crossing	16 triple road trains	16	382	383	0	0	379	4	119.8	140.8	164.2	103.1	215.9	142.9
Camballin	4 Triple road train	4	326	261	0	0	228	33	79.1	92.3	111.9	105.0	129.7	143.6
Roebuck	2 Triple Road Train	2	388	33			23	10	10.4	12.2	14.1	20.0	19.0	34.4
Broome	3 Triple Road Train	3	419	78.4			78.4	0	24.7	29.1	33.6	20.2	45.7	28.2
Broome	double road train	1	323	90			76	14	20.4	23.0	26.8	28.4	24.5	28.6
Fitzroy Crossing	1 Triple Road Train	1	360	424			386	38	127.9	148.9	181.7	152.7	206.6	200.8
Near Derby	3 Triple Road Train	3	328	256			221	35	77.8	90.8	109.7	106.0	128.4	147.0
Halls Creek	1 Triple road train	1	375	509			505	4	148.4	171.1	218.2	135.5	218.6	152.4
Fitzroy Crossing	2 Triple Road Train	2	375	486			465	21	151.0	177.3	208.3	149.1	267.1	211.4
Camballin	Double road train	1	393	240			217	23	49.2	53.7	71.5	64.2	67.9	67.6

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Table 14 (continued) **Registration and road use charges for the transport of the 9,000 steers ($ 2010/11 charges)**

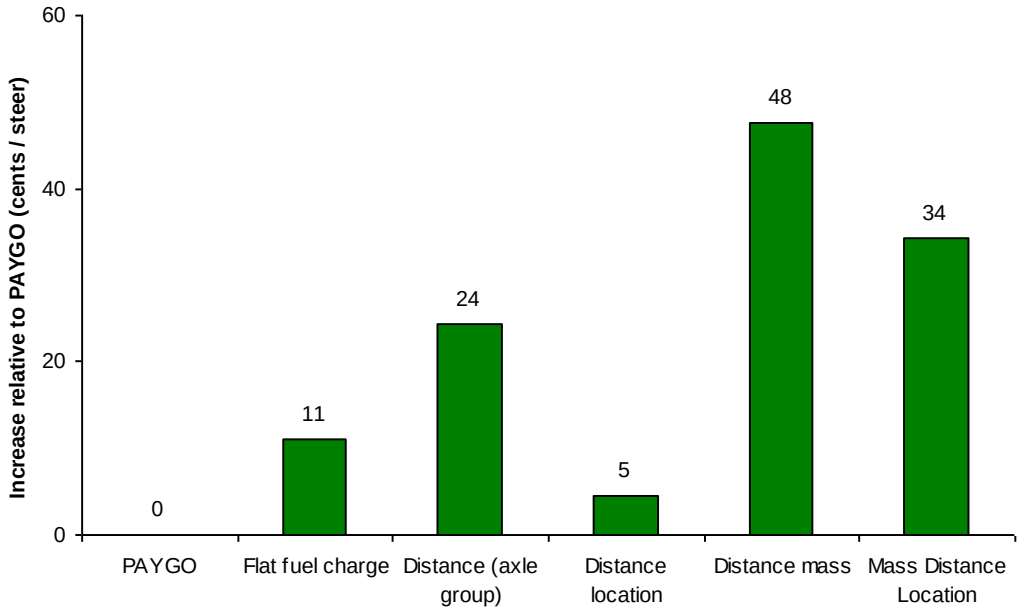
Origin of stock	Truck type used to transport the livestock	Number of trips(No.)	Average weight (kg.)	Distance from origin of stock to abattoir (km.)	Travel on Freeway (km.)	Travel on Urban arterial (km.)	Travel on Rural arterial (km.)	Travel on Local road (km.)	PAYGO ($)	Flat fuel charge ($)	Distance (axle group) ($)	Distance location ($)	Distance mass ($)	Mass Distance Location ($)
Port Headland	3 triple	3	295	295	534			534	0	159.8	185.7	228.9	137.4	252.7
Near Derby	Semi	1	308	308	156			142	14	20.3	24.1	25.6	25.6	24.8
Near Derby	5 triple	5	344	344	511			476	35	157.7	184.8	219.0	171.6	272.8
Broome	B Double	1	336	336	73			58	15	15.9	15.5	16.3	20.1	21.8
Fitzroy Crossing	Semi	1	369	369	392			392	0	54.0	64.8	64.2	49.1	68.8
Broome	Semi	1	384	384	171			164	7	22.1	26.2	28.0	24.5	27.0
Fitzroy Crossing	double road train	1	433	433	383			379	4	91.3	104.8	114.0	76.4	120.1
Near Derby	Semi	1	402	402	344			237	107	50.5	61.5	56.4	89.5	72.0
Roebuck Yards	Triple Road Train	50	364	364	30			30		9.2	10.8	12.9	7.7	15.8
Total increase in registration and road use fees for one truck movement from each cattle station ($)									2,111.8	2,376.2	2,699.9	2,426.6	3,265.5	1,738.6
Total all trips ($)									6,284.0	7,269.1	8,479.0	6,698.5	10,560.5	9,372.5

Source: Author's calculations.

The calculated charges are given in the last 6 columns of Table 14. These charges are then multiplied by the number of trips for each truck type and commodity given in the third column of Table 14 and the products are then summed and the results are given in the last row of Table 14. The numbers in the last row of Table 14 thus represent the total registration and road use fees associated with the transport of the steers for export under alternate heavy vehicle charges.

These totals were then divided by the number of steers exported to derive the effects of alternate heavy vehicle charges on the cost per steer exported. The results of the calculations have been graphed in Chart 26 where it can be seen that heavy vehicle charges based on the mass, distance and locations where trucks travel could add between 30 to 50 cents per steer to the transport cost of the live steers for export (Chart 26).

Chart 26 **Increase in registration and road use fees compared to PAYGO associated with the transport of the 9,000 live cattle to port for export (cents / steer, 2010-11 charges)**



[a] Data source: Author's calculations.

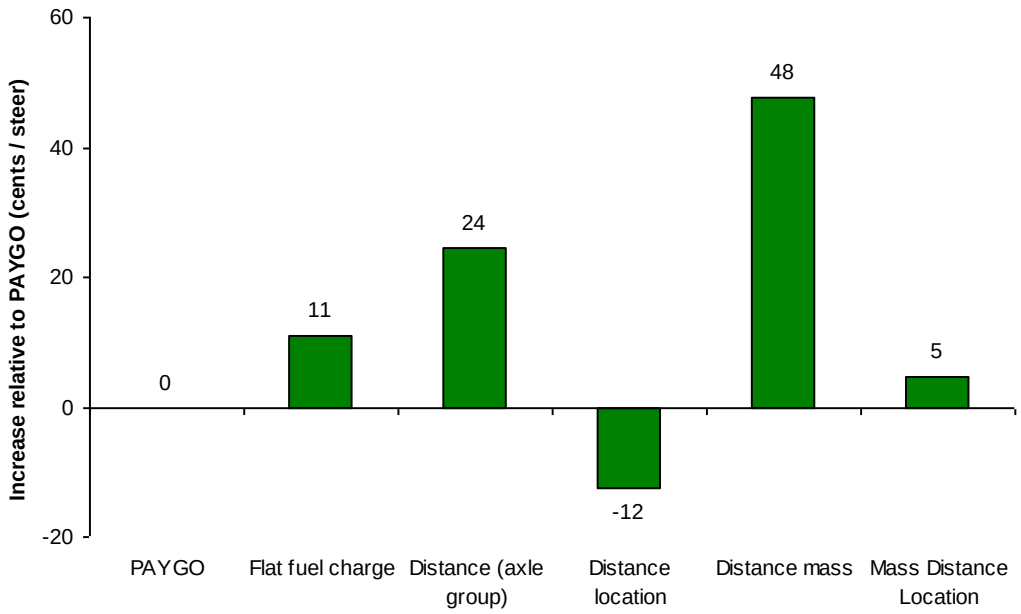
For the entire shipment of steers loaded at Broome alternate heavy vehicle charges would increase heavy vehicle charges by:

- Fuel only, extra $1,000 per annum;
- Distance (axle group), extra of $2,200 per annum;
- Distance location pricing, reduction of $400 per annum;
- Mass distance pricing, extra $4,300 per annum; and
- Mass distance location pricing, reduction of $3,100 per annum.

Heavy vehicle charges based on a flat fuel charge, distance based charge or a distance location charges would have a more modest impact on the cost of moving the steers (see first 3 columns of Chart 26).

As indicated previously, CRRP have yet to indicate how travel on unsealed roads would be charged for. To accommodate this situation a second set of calculations were undertaken where it was assumed that travel on unsealed roads would be valued at the cost of travel on rural arterials. Under this assumption registration and road use fees associated with the transport of live steers would increase by approximately 50 cents per steer if charges were based on the mass of the truck and the distance it travelled (Chart 27). . However, registration and road use charges based on the location of travel be heavy vehicles would be almost the same, or lower, than charges based on PAYGO based charges (Chart 27).

Chart 27 **Increase in registration and road use fees compared to PAYGO associated with the transport of the 9,000 live cattle to port for export, travel on unsealed roads priced at travel on urban arterials (cents / steer, 2010-11 charges)**



Data source: Author's calculations.

Overall, heavy vehicle charges based on the mass and distance travelled could add approximately 50 cents to the cost of exporting steers. More modest increases in the cost of exporting steers would occur under alternate heavy vehicle charging mechanisms if travel on unsealed roads was priced the same as travel on urban arterial roads.

These calculations must be treated with caution as they are based on assumptions related to the charges that would apply to travel on unsealed roads. CRRP have yet to indicate how travel on unsealed roads would be charged for. The calculated impacts on the cost of transport live steers for export could change depending upon the charging mechanism for the use of unsealed roads finally set by CRRP.

In the following section the results of the case study of the production and slaughter of steers in Queensland is presented.

7. PRODUCTION AND SLAUGHTER OF CATTLE IN QUEENSLAND

A Queensland-based company was approached to participate in the study via the supply of information and contacts with sectors of the beef supply chain that would enable the effects of alternate heavy vehicle charges on the cost to breed and slaughter steers to be assessed.

In mid to late July 2011 the company arranged for 2,000 steers to be transported from its cattle stations to a feedlot in South East Queensland. The transport of the steers throughout their lives formed the basis of the Queensland case study.

2,300 steers had originally been bred on two cattle stations located in the North West of Queensland. When the steers reached an average weight of approximately 200 kilograms they were transported to another cattle station owned by the company where the steers were grown out prior to entry into a feedlot.

When the steers reached approximately 450 kilograms per head average weight the top 2,000 of the 2,300 steers were drafted off for transport to the feedlot where it was anticipated that the steers would be on feed for approximately 100 days by which time they would have achieved the desired slaughter weight of approximately 600 kilograms on average per beast.

On reaching the desired average slaughter weight it was anticipated the 2,000 steers would be consigned to an abattoir in South East Queensland. The abattoir anticipates that the steers would be slaughtered over a period of approximately 1 week, depending upon market circumstances. The carcasses derived from the steers would then be boned out and the derived beef and by products sold to markets in Australia and overseas.

In this case study the effects of alternate heavy vehicle charges on the transport of steers is evaluated in the following section. This is followed in Section 7.2 by an assessment of the effects of alternate heavy vehicle charges on the road transport from the abattoir to end markets of beef and by products derived from the 2,000 slaughtered steers. Section 7.3 concludes the case study.

7.1. EFFECTS OF ALTERNATE HEAVY VEHICLE CHARGES ON THE ROAD TRANSPORT COST OF THE 2,000 STEERS

The cattle stations where the 2,300 steers were bred are located to the east of the Wills Development road in North West Queensland. The cattle station where the steers were grown out is located on the on the road between Julia Creek and Kyunna.

The first road transport movement of the steers took place when they were transported from the stations they were bred on to the station where they were backgrounded prior to placement in a feedlot. These movements took place using triple road trains.

After the steers reached approximately 450 kilograms, 2,000 of the 2,300 steers were then transported to the feedlot.

In the journey from the station where the steers were backgrounded to the feedlot, the steers were transported to Mitchell in triple road trains. At Mitchell, the steers were unloaded and fed, watered and rested overnight and then transported to the feedlot in Double Road Trains. Double road trains will also be used to transport the steers from the Feedlot to the abattoir for slaughter.

A Livestock Loading Calculator[30] was used to determine the number of steers that could be loaded per truck given the weight of the steers. Results from the calculator indicate that:

- 10 triple road trains would be required to transport the 200 kg steers with 230 steers loaded per truck;
- 13 triple road trains would be required to transport the 450 kilogram steers with 154 steers loaded per truck;
- 19 double road trains would be required to transport the 450 kilogram steers from Mitchell to the feedlot; and
- 25 double road trains would be required to transport the 600 kilogram steers from feedlot to the abattoir.

Use of the Livestock Loading Calculator also allowed the weight on each axle to be estimated (see Chart 28).

Chart 28 **Axle weight summaries and estimated ESAs associated with the transport of steers**

Axle weight summary for Triple Road Train transporting 230 steers, average weight 200kg.

Weight	Steer axle	Drive axle	A trailer tri axle	B trailer dolly axle	B trailer tri axle	C trailer dolly axle	C trailer tri axle	Total Vehicle
Tare (kg)	6,400	7,984	8,146	6,584	8,146	6,584	8,146	51,990
Load (kg)	130	6,376	9,026	6,627	8,606	6,627	8,606	46,000
Gross (kg)	6,530	14,360	17,172	13,211	16,752	13,211	16,752	97,990
ESA's	**2.13**	**1.18**	**0.75**	**0.85**	**0.68**	**0.85**	**0.68**	**7.12**

Axle weight summary for Triple Road Train transporting 154 steers, average weight 450kg.

Weight	Steer axle	Drive axle	A trailer tri axle	B trailer dolly axle	B trailer tri axle	C trailer dolly axle	C trailer tri axle	Total Vehicle
Tare (kg)	6,400	7,984	8,146	6,584	8,146	6,584	8,146	51,990
Load (kg)	196	9,606	13,598	9,984	12,966	9,984	12,966	69,300
Gross (kg)	6,596	17,590	21,744	16,568	21,112	16,568	21,112	121,290
ESA's	**2.22**	**2.67**	**1.93**	**2.10**	**1.71**	**2.10**	**1.71**	**14.43**

Axle weight summary for Double Road Train transporting 106 steers, average weight 450kg.

Weight	Steer axle	Drive axle	A trailer tri axle	B trailer dolly axle	B trailer tri axle	Total Vehicle
Tare (kg)	6,400	7,984	8,146	6,584	8,146	37,260
Load (kg)	196	9,606	13,598	10,736	13,564	47,700
Gross (kg)	6,596	17,590	21,744	17,320	21,710	84,960
ESA's	**2.22**	**2.67**	**1.93**	**2.51**	**1.91**	**11.23**

Axle weight summary for Double Road Train transporting 80 steers, average weight 600kg.

Weight	Steer axle	Drive axle	A trailer tri axle	B trailer dolly axle	B trailer tri axle	Total Vehicle
Tare (kg)	6,400	7,984	8,146	6,584	8,146	37,260
Load (kg)	197	9,667	13,683	10,804	13,649	48,000
Gross (kg)	6,597	17,651	21,829	17,388	21,795	85,260
ESA's	**2.22**	**2.70**	**1.96**	**2.55**	**1.94**	**11.37**

Data source: Author's calculations using a double road train and triple road train livestock loading calculator.

[30] The livestock loading calculator calculates the load on each axle of a truck given the tare weight on each axle and given the number and weight of cattle assumed to be loaded on the truck.

These weights were then used to estimate the Equivalent Standard Axles involved with each truck movement and also the total mass of each truck movement (Chart 28).

The data given in Chart 28 is required in the estimation of some of the heavy vehicle charges models being considered by CRRP. Other data required to calculate heavy vehicle charges includes the length of each journey and the type of road the trip took place on. This data for the transport moves for the steers is given in Table 15. An example of the calculations of registration and road use fees is provided in Chart 29 for the first transport movement of the steers from the station they were bred on to the property where they were grown out prior to entry into the feedlot.

Chart 29 **Registration and road use charges for the truck used to transport livestock from to the station where they were backgrounded ($, 2010/11 values)**

Trip details	
Vehicle	Triple Road Train
Mass carried above tare	68.1
Gross vehicle mass	105.3
Fuel use (L/100km)	100.0
ESAs	7.1
Average kms by vehicle type	200,000
Origin	Station where steers bred
Destination	Station where steers grown out
Distance travelled (Kms)	180

Freeway	*0*		PAYGO (2010/11)	Fuel (flat charge)	Distance (axle group)	Distance Location	Distance Mass	Mass Distance Location
Urban Arterial	*0*	**Annual registration**	$ 13,372.00	$ 447.80	$ 1,325.07	$ 447.80	$ 447.80	$ 447.80
Rural Arterial	*175*	**Est. per trip registration**	$ 12.03	$ 0.40	$ 1.19	$ 0.40	$ 0.40	$ 0.40
Local	*5*	**Variable trip cost**	$ 40.68	$ 60.48	$ 75.96	$ 51.64	$ 65.33	$ 51.55
Fuel usage (L)	180.0	**Total cost per trip**	**$ 52.71**	**$ 60.88**	**$ 77.15**	**$ 52.04**	**$ 65.73**	**$ 51.95**
Change relative to PAYGO (%)			**0.0%**	**15.5%**	**46.4%**	**-1.3%**	**24.7%**	**-1.5%**

Data source: Authors calculations using the methodology presented in: COAG Road Reform Plan 2011, "Evaluation of Options – Draft", pages 21 and 22, 26 July, Heavy vehicle charges data used in the calculations was obtained from data provided by CRRP to the Australian Livestock and Rural Transporters Association.

To undertake the calculations it was assumed that the Triple Road Train involved in the transport of the steers travelled on average 200,000 kilometres per annum, achieved a fuel efficiency of 100 litres per 100 kilometres travelled and the truck would generate a load on the pavements travelled on equivalent to 7.1 Equivalent Standard Axles[31] as detailed in Chart 28.

The charges detailed in Chart 29 were calculated using the methodology presented by CRRP in its report titled "Evaluation of Options – Draft".[32] The calculations indicate that for the

[31] The methodology used to calculate equivalent standard axles (ESAs) is given in: National Transport Commission 2011, "Modelling the Marginal Cost of Road Wear, Research Paper, 16 May, p. 27.

[32] COAG Road Reform Plan 2011, "Evaluation of Options –Draft", 26 July, p. 22

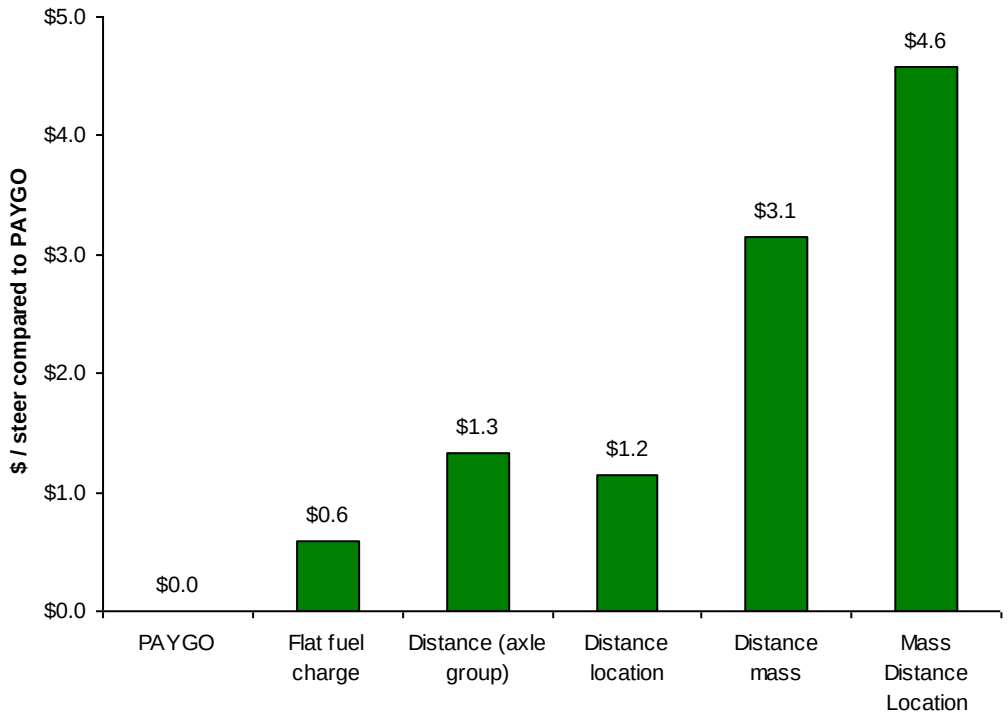
transport example evaluated, registration and road use fees would be similar under PAYGO, Distance location and Mass Distance Location (Chart 29). However, heavy vehicle charges that incorporate elements of charges based on fuel used would generate greater charges than would apply under the maintenance of PAYGO (Chart 29).

The methodology used to calculate the heavy vehicle charges given in Chart 29 was used to calculate the heavy vehicle charges involved in all the movements of the steers. These calculations are provided in the last 6 right hand side columns of Table 15.

At the bottom of the last 6 right had side columns of Table 15 are the estimated road use and registration charges for all livestock movements the steers were involved with. At the bottom of the columns are the increase in registration and road use charges for all road transport livestock movements relative to registration and road use charges that would be derived using the existing PAYGO methodology. Mass Distance Location pricing would have added $9,500 to the cost of transporting the steers (Table 15).

To put the additional registration and road use charges in perspective the additional registration and road use fees were divided by the number of steers transported. These calculations indicate that a move towards the calculation of registration and road use fees based on the mass, distance and the type of roads used could add almost $5.00 to the cost per steer delivered to the abattoir (Chart 30).

Chart 30 **Impact of alternate heavy vehicle charges on the cost of steers delivered to the Abattoir ($/steer relative to PAYGO charges)**



Data source: Author's calculations.

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Table 15 Registration and road use charges for the transport of steers ($ 2010/11 charges)

										Registration and road use by charging option ($)					
Origin	Destination	Truck type used to transport the livestock	Number of beasts /truck (No.)	Average weight per beast (kg.)	Distance from origin of stock to destination (km.)	Travel on Freeway (km.)	Travel on Urban arterial (km.)	Travel on Rural arterial (km.)	Travel on Local road (km.)	PAYGO ($)	Flat fuel charge ($)	Distance (axle group) ($)	Distance location ($)	Distance mass ($)	Mass Distance Location ($)
Breeding	Grown out	Triple road train	240	200	180	0	0	175	5	52.7	60.9	77.2	52.0	65.7	51.9
Breeding	Grown out	Triple road train	240	200	110	0	0	100	10	32.2	37.2	47.1	39.8	40.2	39.4
Grown out	Mitchell	Triple road train	156	450	1039	0	0	1039	0	304.3	351.4	445.3	267.3	591.5	366.6
Mitchell	Feedlot	Double road train	156	450	417	0	0	277	140	102.3	118.4	124.2	191.2	184.2	371.9
Feedlot	Abattoir	Double road train	120	600	180	0	0	114	66	44.5	51.6	53.6	87.0	80.3	172.0
					Total per 1 truck movement per origin/destination pair					536.0	619.5	747.4	637.2	961.8	1,001.9
					Total all truck movements between origin and destinations ($)					7,436.3	8,598.8	10,109.7	9,740.1	13,724.6	16,589.4
					Increase relative to PAYGO ($)					0	1,162	2,673	2,304	6,288	9,153

Source. Derived from data supplied by the case study participant and distances obtained from HEMA Maps and Google Maps.

The change in road transport costs of the steers is estimated to be:

- an increase of approximately $1,200 under a flat fuel fee;
- an increase of approximately $2,700 under a distance based fee;
- an increase of approximately $2,300 under distance location prices;
- an increase of approximately $6,300 under mass distance pricing; and
- an increase of approximately $9,200 under location based pricing.

In the following section are detailed the effect of alternate heavy vehicle charges on outbound road transport costs associated with products produced from the slaughtered steers.

7.2. EFFECTS OF ALTERNATE HEAVY VEHICLE CHARGES ON THE COST OF TRANSPORT OF BEEF AND CO PRODUCTS FROM THE STEERS

The steers that were delivered to the feedlot were still on feed at the time this report was drafted. The beef and by products expected to be produced from these steers was estimated using a spreadsheet model developed for Meat and Livestock Australia by Kurrajong Meat Technologies. The spreadsheet model calculates by product yields and carton meat yields from steers of different weights and feed regimes.[33]

Table 16 Product yields from a 603 kilogram steer (kg/steer)

kg. / steer									
Component of steer	Component weight of live steer	Edible offal	Pet food	Material for rendering	Hide	Blood meal	Paunch contents	Carton meat	Total
Weight loss	7.70								7.70
Hide	63.97				63.97				63.97
Blood	15.69					15.69			15.69
Head	11.06			11.06					11.06
Feet	7.81			7.81					7.81
Cheek (full cheek)	1.82	1.75		0.07					1.82
Heart	1.75		1.75						1.75
Kidney	1.40	1.08		0.32					1.40
Liver	6.30		6.30						6.30
Lung	2.38		2.38						2.38
Spleen	0.71	0.57		0.14					0.71
Tail	1.37	1.23		0.14					1.37
Thick skirt	0.87	0.78		0.09					0.87
Thin skirt	1.05	0.95		0.11					1.05
Caul Fat	6.65			6.65					6.65
Ausmeat trim	34.00			34.00					34.00
Paunch	10.85	4.46		6.39					10.85
Bible & reed	10.78	0.27		10.51					10.78
Intestine	22.75	4.46		18.29					22.75
Tongue	3.12	1.71		1.41					3.12
Trachea and trim	2.98			2.98					2.98

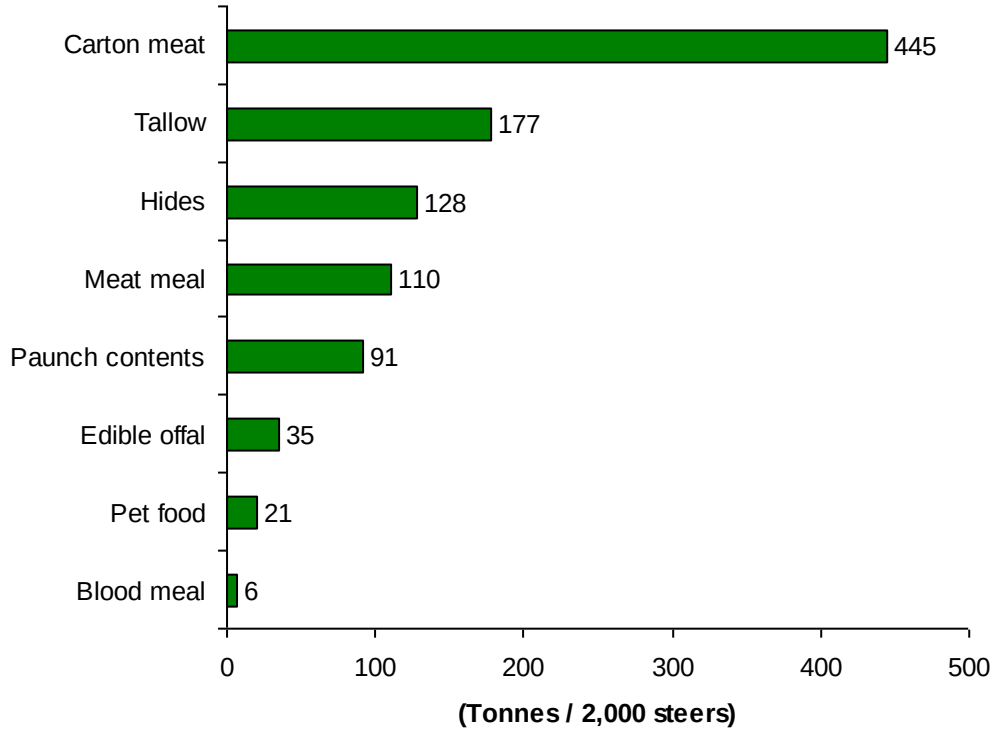
[33] The spreadsheet was kindly provided by Bill Spooncer of Kurrajong Meat Technologies. The spreadsheet is named “Co-product values V2.xls”.

Table 16 (continued) Product yields from a 603 kilogram steer (kg/steer)

Component of steer	Component weight of live steer	Edible offal	Pet food	Material for rendering	Hide	Blood meal	Paunch contents	Carton meat	Total
Gut fill	45.59						45.59		45.59
Boning room fat	61.61			61.61					61.61
Boning room bone	58.19			58.19					58.19
Carton meat	222.50							222.50	222.50
Total	602.87	17.3	10.4	219.7	64.0	15.7	45.6	222.5	602.88

Data source: Co-product values V2.xls.

Chart 31 Estimated outputs derived from the slaughter of 2,000 steers



Data source: Derived from outputs derived from the Co-product values V2.xls spreadsheet.

The abattoir the steers are expected be slaughtered at kindly provided a broad breakdown of the broad market outlets for the different products listed in Chart 31. Using this information the estimated outputs from the 2,000 steers were allocated to different end markets and the results are given in Table 17. Pauch contents were assumed to be transported to a local landfill near the abattoir. Also included in Table 17 are the truck configurations most likely to transport the products and the tare[34] and allowable gross vehicle mass for these vehicles at general mass limits.

[34] The tare weights of the trucks were derived from: CRA and Centre for Policy Analysis 2007, "Economic and Fiscal Analysis of Higher Mass Limits in New South Wales", report prepared for the Roads and Traffic Authority of NSW, p.27.

Table 17 Calculated truck movements required to transport output derived from 2,000 steers

Product	Destination	Type of truck assumed to transport products	Quantity of product (tonnes)	Assumed typical TARE weight of vehicle (tonnes)	GVM at GML (tonnes)	Trips/ output from 2000 steers (tonnes)
Hides	Hemmant Island	6 axle aluminium tipper	127.93	16.00	42.50	4.83
Tallow	Fisherman Island	9 axle B Double tanker	177.48	19.30	42.50	7.65
Meat meal export	Fisherman Island	6 axle skillion trailer	55.19	16.50	42.50	2.63
Meat meal domestic	Beerwah	6 axle aluminium tipper	27.60	16.00	42.50	1.04
Meat meal domestic	Woodford	6 axle aluminium tipper	27.60	16.00	42.50	1.04
Blood meal	Hemmant	6 axle Pantech	6.28	18.70	42.50	0.26
Carton meat export	Fishermen Island	B Double skillion trailer[a]	333.74	27.89	62.50	9.64
Carton meat domestic	Greenacre	6 axle refrigerated van	55.62	23.40	42.50	2.91
Carton meat domestic	Hemmant	6 axle refrigerated van	33.37	23.40	42.50	1.75
Carton meat domestic	Melbourne	6 axle refrigerated van	11.12	23.40	42.50	0.58
Carton meat domestic	Adelaide export park	6 axle refrigerated van	11.12	23.40	42.50	0.58
Paunch contents	Local area	4 axle	91.18	10.10	27.50	5.24
Pet food	Hemmant	6 axle Pantech	20.85	18.70	42.50	0.88
Edible offal export	Fishermen Island	B Double skillion trailer[a]	34.53	27.89	62.50	1.17

Data source: Author's calculations. a. The tare weight for the 9 axle B Double skillion trailer includes the weight of the container and an allowance for unused vehicle mass allowances that arise when transporting a 40 foot container and 20 foot container.

Chart 32 Registration and road use charges for the truck used to transport hides from the Abattoir ($, 2010/11 values)

Trip Details	
Vehicle	6-axle semi-trailer
Mass carried above tare	26.5
Gross vehicle mass	42.5
Fuel use (L/100km)	54.9
ESAs	5.0
Average kms by	200,000
Origin	Abattoir
Destination	Brisbane suburb
Distance travelled (Kms)	101
Freeway	*28*
Urban Arterial	*8*
Rural Arterial	*68*
Local	*3*
Fuel usage (L)	55.5

	PAYGO (2010/11)	Fuel (flat charge)	Distance (axle group)	Distance Location	Distance Mass	Mass Distance Location
Annual registration	$ 5,612.00	$ 447.80	$ 567.89	$ 447.80	$ 447.80	$ 447.80
Est. per trip registration	$ 2.83	$ 0.23	$ 0.29	$ 0.23	$ 0.23	$ 0.23
Variable trip cost	$ 12.54	$ 18.64	$ 16.26	$ 13.95	$ 22.85	$ 17.09
Total cost per trip	**$ 15.37**	**$ 18.87**	**$ 16.55**	**$ 14.17**	**$ 23.08**	**$ 17.31**
	0.0%	**22.7%**	**7.6%**	**-7.8%**	**50.1%**	**12.6%**

Data source: Authors calculations using the methodology presented in: COAG Road Reform Plan 2011, "Evaluation of Options – Draft", pages 21 and 22, 26 July, Heavy vehicle charges data used in the calculations was obtained from data provided by CRRP to the Australian Livestock and Rural Transport Association.

Google Maps was used to obtain an estimate of the distance between the abattoir and the various destinations given in Table 18. Output from Google maps was also used to obtain an

estimate of the length of each route that consisted of freeways, urban arterials, rural arterials and local roads. These distances are given in the fifth to eighth columns of Table 18.

Also given in the last 6 columns of Table 18 are the calculated registration and road use charges for the journeys in question calculated using the 6 broad heavy vehicle pricing rules considered by CRRP. A breakdown of the heavy vehicle charges into the registration and road use components for the first trip detailed in Table 18 is provided in Chart 32.

As can be seen from Chart 32 all pricing rules generate higher heavy vehicle charges other than the Distance location pricing rule.

In all pricing models detailed in Chart 32 the road use fee (called the Variable trip cost in Chart 32) is by far the largest component of the total trip cost. In part, this reflects the assumption that the truck in question travels 200,000 kilometres per year. As the assumed total kilometres travelled falls the registration component of the total trip cost rises.

The calculated trip costs for all trips are detailed in the last 6 columns to the right of Table 18. These costs were then adjusted by the number of trips to the destination required to transport the estimated outputs from the Abattoir derived from the slaughter of the 2,000 steers given in Table 17. This gave the registration and road use fee associated with the transport of the estimated outputs from the abattoir derived from the slaughter of the 2,000 steers under the different heavy vehicle pricing models considered by CRRP (see last row in Table 18).

The calculations indicate there would be modest increases in the cost to transport the outputs derived from the slaughter of the 2,000 steers (Chart 33).

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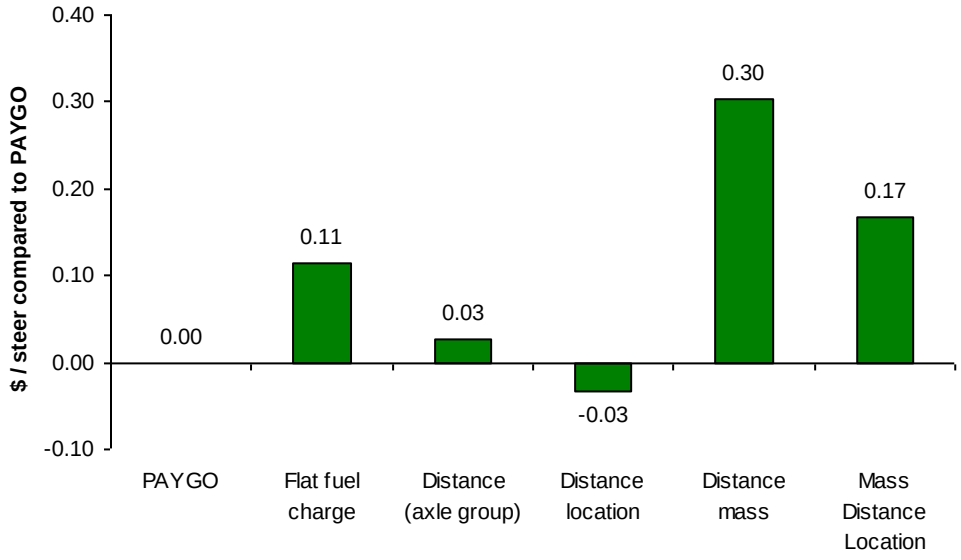
Table 18 Registration and road use charges for vehicles transporting livestock products derived from 2,000 steers ($ 2010/11 charges)

								Registration and road use charges ($/ trip)					
Product	Destination	Truck type used to transport product	Distance from abattoir to destination (km.)	Travel on Freeway (km)	Travel on Urban arterial (km)	Travel on Rural arterial (km)	Travel on Local road (km)	PAYGO ($)	Flat fuel charge ($)	Distance (axle group) ($)	Distance location ($)	Distance mass ($)	Mass Distance Location ($)
Hides	Hemmant	6 axle	101	23	8	68	3	15	19	17	14	23	14
Tallow	Fisherman Island	9 axle B Double	114	51	19	44	0	26	27	26	16	33	18
Meat meal export	Fisherman Island	6 axle	114	51	19	44	0	17	21	19	13	26	16
Meat meal domestic	Beerwah	6 axle	47	0	0	23	24	7	9	8	16	11	26
Meat meal domestic	Woodford	6 axle	23	0	0	23	0	4	4	4	3	5	4
Blood meal	Hemmant	6 axle	101	23	8	68	3	15	19	17	14	23	17
Carton meat export	Fisherman Island	9 axle B Double	114	51	19	44	0	26	27	26	16	33	20
Carton meat domestic	Greenacre	6 axle	1,055	29	50	846	130	161	197	173	188	241	261
Carton meat domestic	Hemmant	6 axle	101	23	8	68	3	15	19	17	14	23	17
Carton meat domestic	Melbourne	6 axle	1,754	374	10	1,324	46	267	328	287	233	401	294
Carton meat domestic	Adelaide export park	6 axle	2,066	21	0	2,045	301	314	386	338	426	472	567
Paunch contents	Abattoir	4 axle	10	0	0	5	5	1	1	1	3	2	3
Pet food	Hemmant	6 axle	101	23	8	68	3	15	19	17	14	23	17
Edible offal	Fisherman Island	9 axle B Double	114	51	19	44	0	26	27	19	16	33	17
							Total per 1 truck movement per origin/destination pair	912	1,102	966	986	1,348	1,290
							Total all truck movements between origin and destinations	1,475	1,703	1,527	1,411	2,084	1,811
							Change relative to PAYGO	0	228	52	-64	609	336

Source. Data derived from application of the Co-Products spreadsheet model.

Chart 33 **Change in registration and road use fees compared to PAYGO associated with trucks transporting outputs derived from the 2,000 slaughtered steers ($ / steer, 2010-11 charges)**



Data source: Authors calculations.

The change in road transport costs of products produced from the steers is estimated to be:

- an increase of approximately $200 under a flat fuel fee;
- an increase of approximately $100 under a distance based fee;
- an decrease of approximately $100 under distance location prices;
- an increase of approximately $600 under mass distance pricing; and
- an increase of approximately $300 under location based pricing.

In the following section the total impact on the road transport cost of the steers and products produced from the steers are presented.

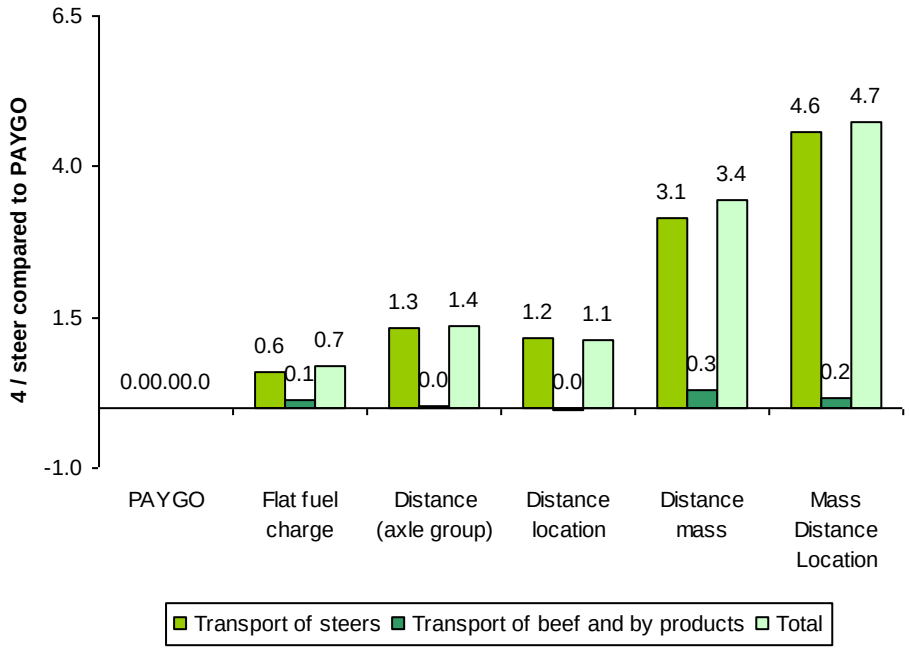
7.3. TOTAL IMPACT ON TRANSPORT COSTS OF THE 2,000 STEERS

The total estimated impact on the transport costs of alternate heavy vehicle charging mechanisms on the transport costs associated with the 2,000 steers can be found by adding together the additional charges associated with the inbound transport cost of the 2,000 steers to the additional charges associated with outbound transport of products produced from the 2,000 steers (Chart 34).

Heavy vehicle charging mechanisms in which the charge is calculated having regard to the distance, mass and or location of the travel undertaken could add up to $4.7 to the

registration and road use fees paid by truck operators associated with the transport of the 2,000 steers and products derived from the slaughter of the 2,000 steers (Chart 34).

Chart 34 **Increase in registration and road use fees compared to PAYGO for alternate heavy vehicle charging mechanisms associated with the transport of the 2,000 steers($/steer, 2010-11 charges)**



Data source: Author's calculations

More modest increase in registration and road use charges would be associated with the introduction of charges based on a flat fuel fee, a distance charge or distance location pricing (Chart 34).

The change in road transport costs of the steers and products produced from the steers is estimated to be:

- an increase of approximately $1,400 under a flat fuel fee;
- an increase of approximately $2,700 under a distance based fee;
- an decrease of approximately $2,200 under distance location prices;
- an increase of approximately $6,900 under mass distance pricing; and
- an increase of approximately $9,350 under location based pricing.

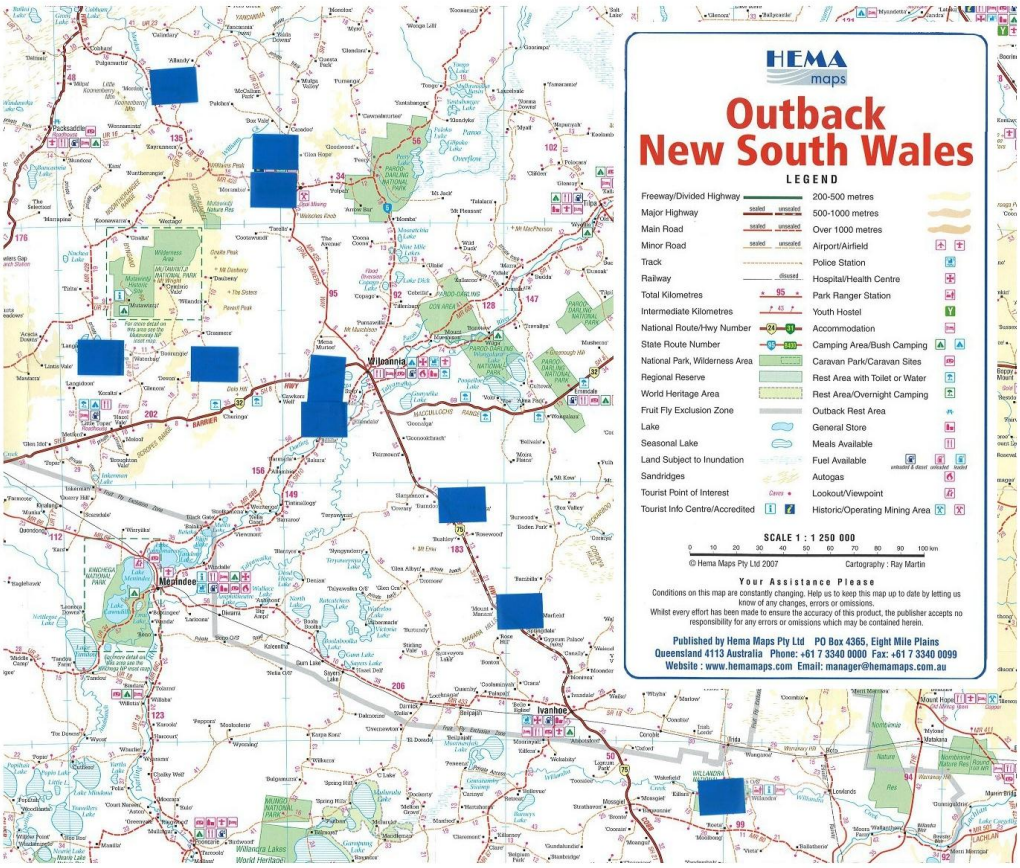
Most of the above increases in registration and road use fees would derive from the increase in costs associated with the transport of the live steers (see light green bars relative to dark green bars in Chart 34).

In the following section the results of the case study of the live export of goats from South Australia are presented.

8. CASE STUDY OF THE LIVE EXPORT OF GOATS FROM SOUTH AUSTRALIA

An operator that is involved in the supply of goats to abattoirs and the live trade agreed to provide data on the road transport of goats. During June and July 2011 the operator received approximately 9,000 goats in 35 deliveries to a depot located south of Wilcannia in New South Wales. These were supplied from properties to the North, West and South of Wilcannia in New South Wales (Chart 35)

Chart 35 **Location of properties that supplied goats to the depot**



a Data source: HEMA Maps and data provided by owner of the goat depot. A blue square represents the approximate area goats were derived from.

During the same period the operator dispatched 20 consignments of goats to abattoirs and the live trade. These consignments consisted of approximately 14,000 goats in total.

The operator provided a representative sample of of goats delivered to the depot. In total the sample of deliveries involved 3,528 goats or approximately a third of all goats delivered to the depot in June and July 2011. The goats that were delivered to the depot weighed 32 kilograms on average and the goats were transported on average 140 kilometres to the depot (Table 19).

Several of the deliveries of goats to the depot involved the use of owner operated tray top vehicles (Table 19). Given the number and weight of the goats delivered it is most likely that the tray top vehicles were 3 axle rigid trucks fitted with 3 deck sheep crates. For example, according to the Australian Standards and Guidelines for the Welfare of Animals [35] 176 goats with an average weight of 30 kilograms can be transported per 40 foot standard deck. A 3 axle rigid with a 20 foot tray and 3 deck sheep crates could thus transport up to 264 goats with an average weight of 30 kilograms. Thus 3 axle rigid trucks would have had the capacity to transport the loads of goats given in Table 19 that are designated to have been delivered using "Owner tray top".

Table 19 Transport of goats on different trucks (kms.)

Origin of Goats	Truck type used to transport the goats	Number of goats (no.)	Average weight per goat (kg.)	Distance from origin of goats to destination (km.)
Property A	Owner tray top	162	35	170
Property A	Owner tray top	162	35	170
Property B	3 deck semi	400	34	196
Property C	Owner tray top	151	24	240
Property D	Owner tray top	202	36	200
Property E	3 deck semi	481	27	50
Property E	3 deck semi	482	27	50
Property F	3 deck semi	384	35	123
Property G	Owner tray top	221	38	230
Property A	3 deck semi	578	35	170
Property H	3 deck semi	305	34	130
Property A	Owner tray top	162	35	170
Total or Average		3,528	32	140

Data source: Data supplied by the operator.

The operator also supplied data on deliveries of goats from the depot to abattoirs and the live trade. In the data supplied by the operator there were two deliveries of goats to the live trade. This consisted of one consignment of 815 goats with an average weight of 28.8 kilograms and a second consignment of 825 goats with an average weight of 32.7 kilograms.

Building on the information provided by the operator this case study tracks the road transport operations associated with:

- delivery of the goats from the properties they were harvested on to the depot located on the Cobb Highway south of Wilcannia;
- transport of the goats from the depot to a feedlot in South Australia located close to Adelaide Airport; and
- the road transport of the goats from the feedlot to Adelaide Airport for live export.

In the following section the effect of alternate heavy vehicle charges on the inbound transport costs of goats to the depot are considered. This is followed in Section 8.2 by an analysis of the effect of alternate heavy vehicle charges on the cost of transporting the goats from the

[35] See Australian Standards and Guidelines for the Welfare of Animals — land transport of livestock, Public Consultation Version, Version 29 February 2008, p.80.

depot to the feedlot and then to Adelaide Airport for live export. Section 8.3 concludes the case study.

8.1. EFFECTS OF ALTERNATE HEAVY VEHICLE CHARGES ON THE COST OF DELIVERING GOATS TO THE DEPOT

The data provided by the operator contained the property name and the distance the goats were transported from the property of purchase to the goat depot. Perusal of a map of outback New South Wales indicated that all properties that supplied goats to the depot were located adjacent to a dirt road that linked up to either the Cobb Highway, Barrier Highway or Opal Miners Way (see Chart 35).

The map of outback New South Wales reproduced in Chart 35 was used along with a map distance wheel to calculate the distance goats travelled on dirt roads on their journey from the property of purchase to the Goat depot. These calculations incorporated travel, where applicable, on the dirt section of the Cobb Highway between Wilcannia and Ivanhoe. Travel on dirt roads accounted for over 40 per cent of the total average distance goats were transported to the depot (Table 20).

CRRP have not yet determined charges for heavy vehicles using dirt roads. In this exercise it was therefore assumed that heavy vehicle travel on dirt roads would be charged at the same rate as heavy vehicle travel on local roads.

Table 20 Transport of goats to the depot on different roads (kms.)

Product	Total distance (km.)	Travel on Freeway (km)	Travel on Urban arterial (km)	Travel on Rural arterial (km)	Travel on Local road (km)	Travel on dirt roads (km.)
Property A	170	0	0	136	0	34
Property A	170	0	0	136	0	34
Property B	196	0	0	142	0	54
Property C	240	0	0	134	0	106
Property D	200	0	0	143	0	57
Property E	50	0	0	0	0	50
Property E	50	0	0	0	0	50
Property F	123	0	0	78	0	45
Property G	230	0	0	47	0	183
Property A	170	0	0	136	0	34
Property H	130	0	0	99	0	31
Average	140	0.0	0.0	84.8	0	58.3

Data source: Author's calculations using HEMA Maps.

To calculate the alternate heavy vehicle charges associated with the delivery of the goats to the depot required estimates of the gross vehicle mass of the trucks delivering goats to the depot. Estimates are also required of the Equivalent Standard Axles generated by trucks delivering goats to the depot exert on the roads they travel on. These calculations were undertaken using a spreadsheet provided by the National Transport Commission to the New South Wales Livestock and Bulk Carriers Association and made available to the author of this report for this study.

The calculated truck loads and Equivalent Standard Axles associated with goat deliveries are given in Table 21.

CRRP also provided to the New South Wales Livestock and Bulk Carriers Association a spreadsheet that contained a sheet called "Indicative Prices". These prices were the heavy vehicle charges CRRP used in its evaluation of the benefits and costs of alternate heavy vehicle charges.

Table 21 Trucks used to transport live goats

Source of goats	Truck type	Vehicle TARE (tonnes)	Vehicle load (tonnes)	Total load (tonnes)	Estimated ESAs
Property A	Owner tray top	11.6	5.6	17.2	1.23
Property A	Owner tray top	11.6	5.6	17.2	1.23
Property B	3 deck semi	21.2	13.5	34.7	2.21
Property C	Owner tray top	11.6	3.6	15.2	0.75
Property D	Owner tray top	11.6	7.4	19.0	1.83
Property E	3 deck semi	21.2	12.8	33.9	2.01
Property E	3 deck semi	21.2	12.8	33.9	2.01
Property F	3 deck semi	21.2	13.5	34.6	2.18
Property G	Owner tray top	11.6	8.3	19.9	2.2
Property A	3 deck semi	21.2	20.3	41.5	4.52
Property H	3 deck semi	21.2	10.5	31.6	1.52

Data source: Author's calculations.

These charges along with the distance data given in Table 20 and the weight and ESA data given in Table 21 were used to calculate alternate heavy vehicle charges for individual deliveries of goats to the depot. Chart 36 provides an example of the calculation of the alternate heavy vehicle charges for the third movement of goats given in Table 19, i.e. the movement of 400 goats from property B to the goat depot using a 3 deck semi trailer owned and operated by the owner of the goat depot.

The owner of the goat depot indicated that the truck in question had travelled 120,000 kilometres over the last 4 years. Thus, in the calculations of the heavy vehicle charges associated with the delivery of the 400 goats to the depot it was assumed that the semi trailer involved in the transport of the goats travelled on average 30,000 kilometres per annum, achieved a fuel efficiency of 49.5 litres per 100 kilometres travelled and the truck would generate a load equivalent to 2.2 Equivalent Standard Axles.[36]

The charges detailed in Chart 11 were calculated using the methodology presented by CRRP in its report titled "Evaluation of Options – Draft".[37] The calculated charges for the journey are given in Chart 36 where it can be seen that the registration and road use fees associated with the transport of goats to the depot would be lower than PAYGO based charges under all alternate charges considered by CRRP. Given the low kilometres travelled by the truck in a year, PAYGO generates relatively high registration costs compared to other heavy vehicle charging mechanisms. Thus even though the variable trip costs given in Chart 36 are much higher under alternate heavy vehicle charges compared to variable trip charges PAYGO (see

[36] The methodology used to calculate equivalent standard axles (ESAs) is given in: National Transport Commission 2011, "Modelling the Marginal Cost of Road Wear, Research Paper, 16 May, p. 27.

[37] COAG Road Reform Plan 2011, "Evaluation of Options –Draft", 26 July, p. 22

row titled Variable trip cost in Chart 36) overall the saving in registration under PAYGO dominates so that the overall trip cost under PAYGO is higher than the alternate heavy vehicle charges evaluated by CRRP (Chart 36).

Chart 36 **Registration and road use charges for the truck used to transport goats from property B to the goat depot ($, 2010/11 values)**

Trip Details	
Vehicle	6-axle semi-trailer
Mass carried above tare	13.5
Gross vehicle mass	34.6
Fuel use (L/100km)	49.5
ESAs	2.2
Average kms by	30,000
Origin	Property B
Destination	Goat depot
Distance travelled (Kms)	196
Freeway	*0*
Urban Arterial	*0*
Rural Arterial	*142*
Local	*54*
Fuel usage (L)	391.8

	PAYGO (2010/11)	Fuel (flat charge)	Distance (axle group)	Distance Location	Distance Mass	Mass Distance Location
Annual registration	$5,612.00	$447.80	$567.89	$ 447.80	$ 447.80	$ 447.80
Est. per trip registration	$36.67	$2.93	$3.71	$2.93	$2.93	$2.93
Variable trip cost	$21.94	$32.62	$31.56	$47.54	$29.18	$41.06
Total cost per trip	$58.60	$35.54	$35.27	$50.47	$32.11	$43.99
Change relative to PAYGO %	**0.0%**	**-39.4%**	**-39.8%**	**-13.9%**	**-45.2%**	**-24.9%**

Data source: Authors calculations using the methodology presented in: COAG Road Reform Plan 2011, "Evaluation of Options – Draft", pages 21 and 22, 26 July, Heavy vehicle charges data used in the calculations was obtained from data provided by CRRP to the Australian Livestock and Rural Transport Association.

The methodology used to calculate road use fees and registration charges used to produce the charges given in Chart 36 was used to calculate the heavy vehicle charges for all movements of goats to the depot detailed in Table 19 and the results are detailed in Table 22. These are the numbers given in the last 6 columns of Table 22 and numbers in the second last row of these columns are the total registration and road use charges under the alternate heavy vehicle charging mechanisms. The totals thus represent the total registration and road use fees associated with the delivery of the 3,528 goats to the depot under alternate heavy vehicle charges.

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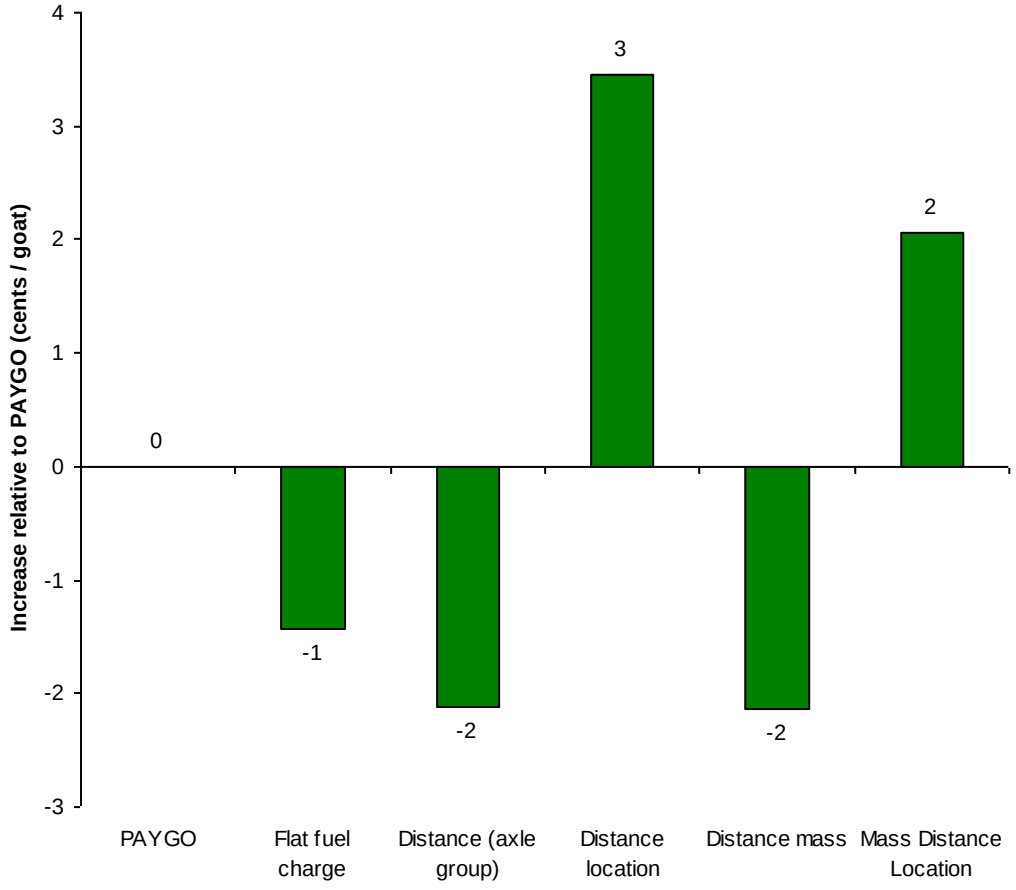
Table 22 Registration and road use charges for vehicles transporting goats to the depot ($ 2010/11 charges)

Origin of Goats	Truck type used to transport the livestock	Number of goats	Average weight per goat (kg.)	Distance from origin of goats to destination (km.)	Travel on Freeway (km.)	Travel on Urban arterial (km.)	Travel on Rural arterial (km.)	Travel on Local road (km.)	PAYGO ($)	Flat fuel charge ($)	Distance (axle group) ($)	Distance location ($)	Distance mass ($)
Property A	Owner tray top	162	35	170	0	0	136	34	18.4	24.0	20.5	28.6	20.0
Property A	Owner tray top	162	35	170	0	0	136	34	18.4	24.0	20.5	28.6	20.0
Property B	3 deck semi	400	34	196	0	0	142	54	58.6	35.6	35.3	50.5	32.1
Property C	Owner tray top	151	24	240	0	0	134	106	25.2	32.7	28.9	58.0	24.9
Property D	Owner tray top	202	36	200	0	0	143	57	22.2	29.0	24.1	38.9	26.8
Property E	3 deck semi	481	27	50	0	0	0	50	14.9	9.0	9.0	28.6	7.9
Property E	3 deck semi	482	27	50	0	0	0	50	14.9	9.0	9.0	28.6	7.9
Property F	3 deck semi	384	35	123	0	0	78	45	36.8	22.3	22.1	36.5	20.0
Property G	Owner tray top	221	38	230	0	0	47	183	25.9	33.9	27.7	80.3	33.2
Property A	3 deck semi	578	35	170	0	0	136	34	52.6	33.5	30.6	38.2	38.8
								Total	326.1	275.6	251.2	448.2	250.5
								Change relative to PAYGO ($ all trips to the depot)	0	-51	-75	122	-76

Source. Author's calculations.

The change in registration and road use fees compared to the maintenance of the existing basis of deriving heavy vehicle charges (i.e. the PAYGO system) was then found by deducting the PAYGO charge at in the second last row of Table 22 from the total charges for the other pricing rules also given in the second last row of Table 22 and these results are given in the last row of Table 22. The differences in charges were then divided by the number of goats delivered to the Depot to determine the impact of alternate charges on the cost of transporting goats to the depot. Mass Distance Location pricing could add 3 cents to the cost of transporting the goats to the depot (Chart 37).

Chart 37 **Estimated registration and road use charges of goats delivered to the Wilcannia depot (cents per goat compared to PAYGO)**



[a] Data source: Author's calculations.

The results given in Chart 37 do not replicate the pattern of results given in Chart 36 in that charges that incorporate the location of travel results in higher registration and road use fees associated with the transport of goats. In contrast, in Chart 37 for a 3 deck semi, location based pricing would lead to lower charges for the truck transporting goats from property B to the depot.

The reason for this difference is due to the use of several rigid trucks to transport goats to the depot and the rigid trucks face an increase in charges under location based charges.

Rigid trucks would face an increase in total fees under location based pricing because the registration charge for rigid trucks under distance location pricing ($447.8 per vehicle) is not that different from the registration charges under PAYGO ($ 701 per vehicle). Consequently, for rigid trucks delivering goats to the depot, variable trip costs are much higher under location based pricing compared to PAYGO. These higher charges are not offset by much lower registration costs so that total charges were higher for rigid trucks under location based pricing of heavy vehicles.

Over a whole year of operations at the goat depot, inbound heavy vehicle charges associated with live goat export operations would change by:

- Fuel only, reduction of $400 per annum;
- Distance (axle group), reduction of $500 per annum;
- Distance location pricing, extra of $900 per annum;
- Mass distance pricing, reduction of $500 per annum; and
- Mass distance location pricing, extra $500 per annum.

In the following section are detailed the effects of alternate heavy vehicle charges on the cost of transporting goats from the depot to the airport.

8.2. EFFECTS OF ALTERNATE HEAVY VEHICLE CHARGES ON THE TRANSPORT OF GOATS FROM THE DEPOT TO ADELAIDE AIRPORT

The goats delivered to the depot are drafted into mobs suitable for the end markets serviced by the operator of the goat depot. Goats destined for the live trade are then transported to a feedlot which is located close to Adelaide airport. Numbers transported depend on the size of the order.

In the data provided by the operator for this study there were two shipments destined for the live trade. These were transported to the feedlot near Adelaide airport in a double road train. When the goats become accustomed to the ration fed at the feedlot they are transported to Adelaide Airport where they are transferred to crates and loaded into planes destined for the overseas market.

The operator of the feedlot indicated that the goats are transported to the airport predominately in 6 axle articulated trucks although contractors that employ rigid vehicles may be used to transport the goats to the airport depending upon market circumstances.

In this exercise it was assumed the goats would be transported to the airport in 6 axle articulated trucks. The calculated gross vehicle mass associated with truck movements of goats from the feedlot to the airport and the Equivalent Standard Axles associated with these journeys are given in Chart 38.

Chart 38 Calculated ESAs for a 9 Axle B Double transporting goats from the goat depot to the feedlot near Adelaide

Axle weight summary for Double Road Train transporting 825 goats, average weight 32.7kg.						
Weight	Steer axle	Drive axle	A trailer tri axle	B trailer dolly ax	B trailer tri axle	Total Vehicle
Tare (kg.)	6,400	7,984	8,146	6,584	8,146	37,260
Load (kg.)	111	5,438	7,697	6,077	7,677	27,000
Gross (kg.)	6,511	13,422	15,843	12,661	15,823	64,260
ESA's	**2.11**	**0.90**	**0.54**	**0.72**	**0.54**	**4.81**

Axle weight summary 6 axle articulated transporting 413 goats, average weight 32.7 kg.				
Weight	Steer axle	Drive axle	A trailer tri axle	Total Vehicle
Tare (kg.)	6,400	8,190	8,560	23,150
Load (kg.)	115	5,643	7,742	13,500
Gross (kg.)	6,515	13,833	16,302	36,650
ESA's	**2.11**	**1.02**	**0.61**	**3.74**

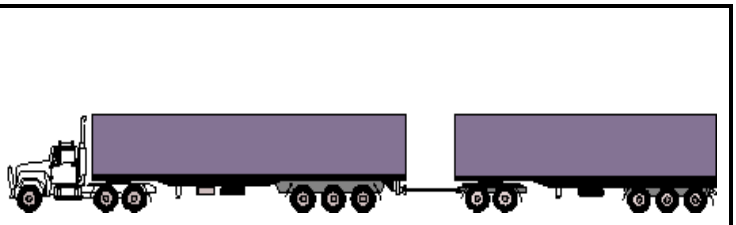
Axle weight summary for Double Road Train transporting 815 goats, average weight 28.8kg.						
Weight	Steer axle	Drive axle	A trailer tri axle	B trailer dolly ax	B trailer tri axle	Total Vehicle
Tare (kg.)	6,400	7,984	8,146	6,584	8,146	37,260
Load (kg.)	97	4,733	6,699	5,289	6,682	23,500
Gross (kg.)	6,497	12,717	14,845	11,873	14,828	60,760
ESA's	**2.09**	**0.73**	**0.42**	**0.55**	**0.42**	**4.20**

Axle weight summary 6 axle articulated transporting 408 goats, average weight 28.8 kg.				
Weight	Steer axle	Drive axle		Total Vehicle
Tare (kg.)	6,400	8,190	8,560	23,150
Load (kg.)	100	4,911	6,739	11,750
Gross (kg.)	6,500	13,101	15,299	34,900
ESA's	**2.09**	**0.82**	**0.47**	**3.38**

[a] Data source: Author's calculations.

Chart 39 Calculated heavy vehicle charges for a Double Road Train transporting 825 goats with average weight 32.7 kg. from the goat depot to the feedlot ($/trip)

Trip details	
Vehicle	Double road train
Mass carried above tare	27.0
Gross vehicle mass	64.3
Fuel use (L/100km)	69.9
ESAs	4.8
Average kms by	200,000
Origin	Goat Depot
Destination	Feedlot near Adelaide
Distance	718
Freeway	*0*
Urban Arterial	*0*
Rural Arterial	*659*
Local	*59*
Fuel usage (L)	502.0



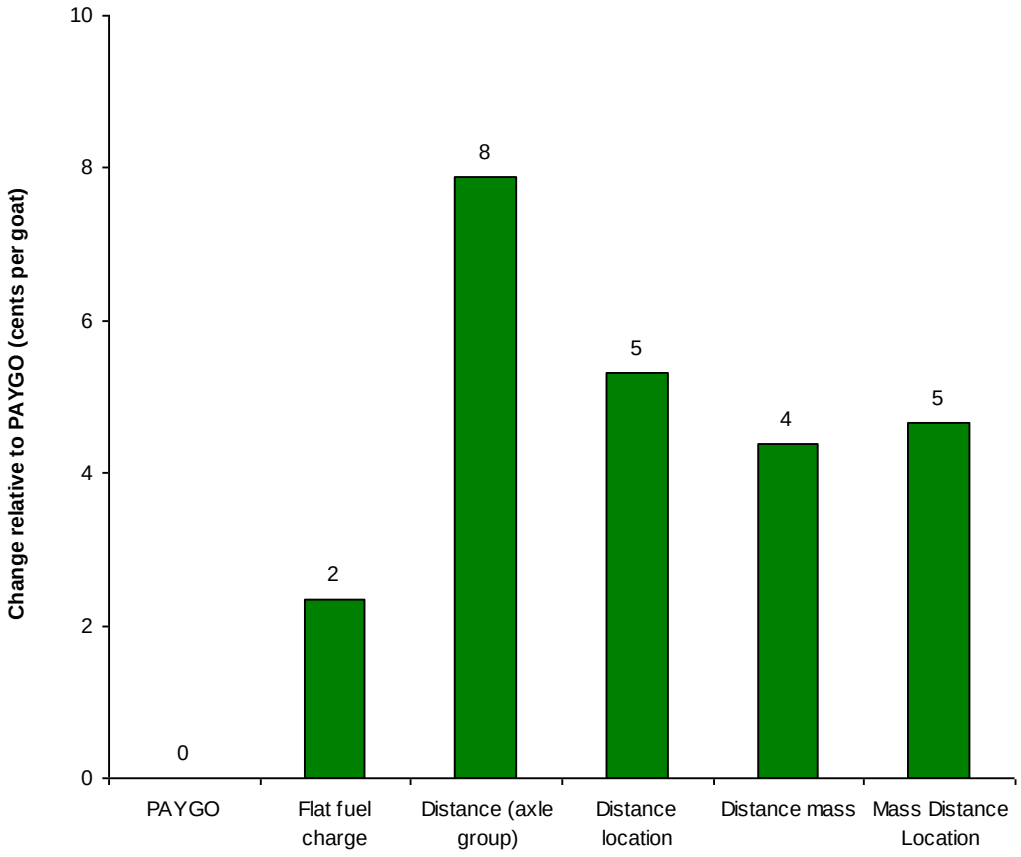
	PAYGO (2010/11)	Fuel (flat charge)	Distance (axle group)	Distance Location	Distance Mass	Mass Distance Location
Annual registration	$11,170.00	$447.80	$946.48	$ 447.80	$ 447.80	$ 447.80
Est. per trip registration	$40.10	$1.61	$3.40	$1.61	$1.61	$1.61
Variable trip cost	$113.44	$168.66	$210.37	$182.67	$186.42	$178.33
Total cost per trip	$153.54	$170.27	$213.77	$184.27	$188.03	$179.93
Increase relative to PAYGO (%)	**0.0%**	**10.9%**	**39.2%**	**20.0%**	**22.5%**	**17.2%**

Data source: Authors calculations using the methodology presented in: COAG Road Reform Plan 2011, "Evaluation of Options – Draft", pages 21 and 22, 26 July, Heavy vehicle charges data used in the calculations was obtained from data provided by CRRP to the Australian Livestock and Rural Transport Association.

Distances between the depot and the feedlot and between the feedlot and Adelaide airport were obtained from Google Maps. The distance data, vehicle mass data given in Chart 38 and the heavy vehicle charges supplied by the National Transport Commission were used to calculate heavy vehicle charges for all trips between the goat depot and Adelaide airport associated with the two shipments of live goats. An example of the calculation for the Double Road Train transporting 825 goats from the goat depot to the feedlot is given in Chart 39. All alternate heavy vehicle charges would result in higher road use fees associated with the transport of the goats from the goat depot to the feedlot (Chart 39).

The methodology used to calculate the charges given in Chart 39 was used to calculate heavy vehicle charges for all truck movements transporting goats from the depot to the airport and the calculated charges are given in Table 23.

Chart 40 **Impact of alternate heavy vehicle charges on the cost of transporting goats from the depot to the airport (cents / goat, 2010 -11 charges)**



Data source: Author's calculations.

At the bottom of Table 23 are the total charges associated with transporting goats from the depot to the airport. Dividing the total fees and charges by the number of goats transported to the airport gave the per goat increase in heavy vehicle charges are given in Chart 40 . The five alternate heavy vehicle charges regimes being considered by CRRP would increase the cost of transporting goats from the depot to the Adelaide airport (Chart 40).

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Table 23 Registration and road use charges for vehicles transporting goats from the depot to Adelaide airport ($ 2010/11 charges)

Origin of Goats	Truck type used to transport the livestock	Number of goats (no.)	Average weight per goat (kg.)	Distance from origin of goats to destination (km.)	Travel on Freeway (km.)	Travel on Urban arterial (km.)	Travel on Rural arterial (km.)	Travel on Local road (km.)	PAYGO ($)	Flat fuel charge ($)	Distance (axle group) ($)	Distance location ($)	Distance mass ($)
Goat depot	Double road train	825	32.7	718	0	0	659	59	153.5	170.3	213.8	184.3	188.0
Feedlot	6 axle articulated	412	32.7	60	21	23	0	16	8.6	10.4	9.8	14.0	11.6
Feedlot	6 axle articulated	413	32.7	60	21	23	0	16	8.6	10.4	9.8	14.0	11.6
Goat depot	Double road train	815	28.8	718	0	0	659	59	149.6	164.5	213.8	184.3	175.9
Feedlot	6 axle articulated	408	28.8	60	21	23	0	16	8.6	10.2	9.8	14.0	11.0
Feedlot	6 axle articulated	407	28.8	60	21	23	0	16	8.6	10.2	9.8	14.0	11.0
								Total	337.5	375.8	466.9	424.5	409.3
								Increase relative to PAYGO ($ all trips from depot to airport)	0	38	129	87	72

Data source. Author's calculations.

Over a whole year of operations at the goat depot, outbound heavy vehicle charges associated with live goat export operations would rise by:

- Fuel only, extra $600 per annum;
- Distance (axle group), extra of $2,000 per annum;
- Distance location pricing, extra of $1,300 per annum;
- Mass distance pricing, extra $1,100 per annum; and
- Mass distance location pricing, extra $1,200 per annum.

In the following section an overall estimate of the direct effect of alternate heavy charges on the live export of goats is derived by combining the estimates of the effects on inbound road transport costs derived in Section 8.3 to the estimates of the effects of the charges on outbound road transport costs derived in Section 8.2.

8.3. TOTAL DIRECT IMPACT ON THE EXPORT OF LIVE GOATS

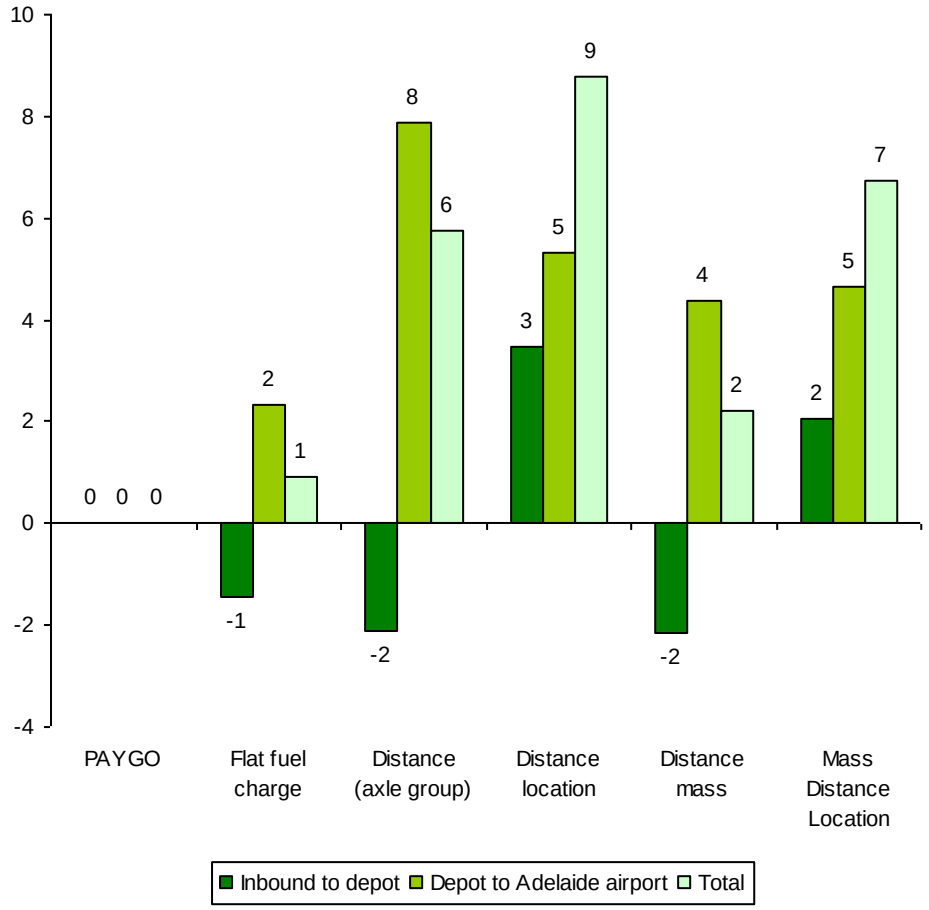
The total estimated impact on the export of live goats of alternate heavy vehicle charging mechanisms can be found by adding together the change in charges associated with inbound road transport of goats to the depot to the changes in charges associated with the transport of live goats from the goat depot to the airport (Chart 41). The five alternate heavy vehicle charges regimes being considered by CRRP would increase charges paid by road transport operators that service the live goat export market out of Adelaide by 9 cents per goat under a distance location heavy vehicle pricing rule (Chart 41).

The majority of the additional heavy vehicle charges resulted from additional charges on the transport of goats from the goat depot to Adelaide airport (Chart 41).

Over a whole year of operations at the goat depot, heavy vehicle charges associated with live goat export operations would rise by:

- Fuel only, extra $200 per annum;
- Distance (axle group), extra of $1,400 per annum;
- Distance location pricing, extra of $2,200 per annum;
- Mass distance pricing, extra $600 per annum; and
- Mass distance location pricing, extra $1,700 per annum.

Chart 41 **Increase in registration and road use fees compared to PAYGO for alternate heavy vehicle charging mechanisms: live export of goats (cents/goat, 2010-11 charges)**



Data source: Author's calculations.

CRRP have not determined road use fees for heavy vehicles that travel on dirt roads. In the current case study significant travel by trucks transporting goats took place on dirt roads. To accommodate this situation the calculations summarised in Chart 41 assumed that heavy vehicle travel on dirt roads would be charged at the rate for travel on local roads. More modest changes in heavy vehicle charges would apply if heavy vehicle travel on dirt roads were to be priced at less than is heavy vehicle travel on dirt roads.

In the following section the impact of alternate heavy vehicle charges on the competitiveness of red meat industries is considered.

9. IMPACT ON OUTPUT, PRICE AND COMPETITIVENESS

To examine the impact of alternate heavy vehicle charges on the output, price and competitiveness of Australia's red meat industries two analyses were undertaken. The first

analysis used a partial equilibrium framework to evaluate the effects of alternate heavy vehicle charges. The second analysis was conducted using a general equilibrium model.

9.1. PARTIAL EQUILIBRIUM ANALYSIS

The case studies undertaken for this study indicate that alternate heavy vehicle charges, if initially passed on in full to customers, could lead to small but still significant increases in road transport costs faced by Australia's red meat industries. The case studies covering beef production indicate that mass distance location and mass distance pricing could increase road transport costs by between 2.09 per cent to 2.49 or an average of 2.3 per cent (Table 24).[38]

Table 24 **Calculated increase in road transport costs observed in the case studies (% compared to costs based on PAYGO charges)**

Case study	PAYGO	Flat fuel charge	Distance (axle group)	Distance location	Distance mass	Mass Distance Location
NSW beef abattoir	0.00	0.21	0.15	0.17	0.94	1.09
NSW feedlot	0.00	0.43	0.16	0.76	1.62	2.77
Chilled sheep carcasses Victoria	0.00	0.61	0.32	0.18	1.66	1.75
Live export steers WA	0.00	0.67	1.49	0.28	2.89	2.09
Queensland steers	0.00	0.59	1.16	0.95	2.92	4.30
Live export goats	0.00	0.15	0.96	1.45	0.37	1.12
Simple average	0.00	0.50	0.65	0.47	2.01	2.34
Average beef case studies	0.00	0.47	0.74	0.54	2.09	2.49

Data source: Author's calculations using case study results.

To estimate the impact of such a cost increase on the competitiveness of the beef sector a simple net trade model of the world beef and veal market was developed drawing on data on demand, supply and exports of beef and veal[39]. Price elasticities of demand and supply of Australian beef and veal were derived from previous research summarised in two NSW Agriculture Research reports and a recent Rural Industries Research and Development Corporation publication.[40,41,42]

[38] The percentage increase in road transport costs was found by dividing the increase in heavy vehicle charges by the estimated unit road transport cost of the respective transport operation. Road transport costs were calculated assuming, amongst other things, that drivers receive award wages. One stakeholder questioned the validity of this assumption noting that many owner drivers receive an effective wage below the award wage. Insufficient information was available to enable an assessment of the significance of below award wages for some owner drivers on aggregate unit road transport costs incurred by Australia's red meat industries.

[39] Sally Fletcher, Ben Buetre and Kristopher Morey 2009, 'The value of the red meat industry to Australia 2009', ABARE research report 09.13, June and Meat and livestock Australia 2009, Statistical Review, July 2008 – June 2009, p.21.

[40] Demand elasticities were obtained from :Garry Griffith, Kym I'Anson, Debbie Hill, Roland Lubett, David Vere2001, "Previous Demand Elasticity Estimates For Australian Meat Products, NSW Agriculture Economic Research Report No. 5, January.

[41] Supply elasticities were obtained from: Garry Griffith, Kym I'Anson, Debbie Hill, David Vere 2001, Previous Supply Elasticity Estimates For Australian Broadacre Agriculture NSW Agriculture Economic Research Report No. 6, August.

[42] Rural Industries Research and Development Corporation 2011, "How Price Affects the Demand for Food in Australia", RIRDC Publication No. 11/062.

The model consists of 9 equations (see Box 1) and the parameters and data used to construct the simple net trade model for Australian beef and veal are given in Table 25.

Table 25 Data used to construct the simple net trade model for Australian beef and veal

Data item	Unit	Parameter value	
		Model 1	Model 2
Per cent increase in road transport costs	%	2.3	2.3
Domestic beef supply elasticity (farm)	%	0.57	1
Elasticity beef & veal supply w.r.t. road transport prices	%	-0.05	-0.15
Domestic demand elasticity	%	-1.4	-1.4
Export demand elasticity	%	-1	-6
Processor margin	% of farm value	20	20
Farm price of a steer to at port equivalent price of a steer	Proportion	2	2
Quantity domestic demand	% of supply	35	35
Quantity domestic supply	% of supply	100	100
Quantity exports	% of supply	65	65

Box 1 Equations in the simple economic model used to assess impacts of road transport price changes

Equation (1)	Beef & veal supply	% change in Australian beef & veal supply	=	supply elasticity evaluated at port	*	% change in at port price	-	Elasticity supply wrt transport costs	*	% change transport costs at port
Equation (2)	Domestic demand beef & veal	% change domestic demand Australian beef and veal	=	domestic demand elasticity	*	% change in at port price				
Equation (3)	Export supply beef & veal	% change in export supply of Australian beef and veal	=	% change in Australian beef & veal supply	*	Share of supply in exports	-	% change domestic demand	*	Share of demand in exports
Equation (4)	Export demand beef & veal	% change export demand Australian beef & veal	=	export demand elasticity	*	% change in at port price				
Equation (5)	Total demand beef & veal	% change total demand Australian beef and veal	=	% change export demand	*	Share of export demand in total demand	+	% change domestic demand	*	Share of domestic demand in total demand
Equation (6)	Market clearing condition	% change in supply Australian beef & veal	=	% change in demand Australian beef & veal						
Equation (7)	Consumer share of transport price rise	Consumer share of transport price rise	=	% change in at port price Australian beef and veal	/	% change transport costs at port				
Equation (8)	Farmer share of transport price rise	Farmer share of transport price rise	=	1 minus consumer share of transport price rise	/	1 plus processing margin as % of farm gate price				
Equation (9)	Processor share of transport price rise	Processor share of transport price rise	=	Farmer share of transport price rise	*	Processing margin as % of farm gate price				

To examine how sensitive model results are to parameter settings two sets of parameters were specified. Model 1 parameters were set at the average of the parameter estimates provided in the NSW Agriculture research papers. In Model 2 parameters were set at levels to approximate relevant price elasticities in General Equilibrium Models i.e. relatively more price elastic export demands and relatively higher supply elasticities.

The model is specified in percentage changes and can be considered as a local approximation to the actual underling, but unknown, demand and supply relationships in the international beef and veal market. Because the model is a local approximation to the underling demand and supply technologies it should only be used to examine small changes in variables included in the model such as the small change in road transport costs under evaluation in the current study.

The 2.3 per cent change in road transport costs given in Table 25 is fed into equation 1 given in Box 1 and the initial reduction in beef and veal output caused by the rise in road transport costs is calculated. The reduction in beef and veal supply leads to an initial imbalance in world demand and supply for Australian beef and veal. The model is then solved for the percentage change in border prices for Australian beef and veal that would bring the market back into equilibrium given that road transport prices were simulated to have risen by 2.3 per cent. The results from the simulation are given in Table 26.

Table 26 **Results obtained from simulating a 2.3 per cent increase in road transport costs for Australian beef and veal**

Equation	Endogenous variable	Value of endogenous variables in the model	
		Model 1	Model 2
Equation 1	Supply (% change)	-0.057	-0.236
Equation 2	Domestic demand (% change)	-0.070	-0.075
Equation 3	Export supply (% change)	-0.050	-0.323
Equation 4	Export demand (% change)	-0.050	-0.323
Equation 5	Total demand (% change)	-0.057	-0.236
Equation 6	Price Australian beef & veal (% change)	0.050	0.054
Equation 7	Consumer share (%)	21	23
Equation 8	Farmer share (%)	66	64
Equation 9	Processor share (%)	13	13

The results from Model 1 indicate that the increase in road transport costs would result in a small reduction of 0.057 per cent in the production of beef and veal in Australia and a reduction in exports of 0.050 per cent. The small reduction in output of beef and veal reflects the fact that the simulated rise in road transport costs was relatively small at 2.3 per cent and this small change in road transport costs resulted in a relatively small initial reduction in beef and veal supply in the model. Consequently only small changes in supply and demand were required to bring the market back into equilibrium

The results obtained from Model 2 are larger, in absolute values, than are the results generated by Model 1. This reflects the fact that the supply elasticity is higher under Model 2 parameter settings. Consequently, the elasticity of supply with respect to transport costs is assumed to be higher. This results in a bigger initial reduction in supply and bigger supply

and demand adjustments are required too bring the model back into equilibrium. Thus a larger price increase is observed under Model 2 even though supply and export demand elasticities are higher in absolute values in Model 2.

These results are broadly supported by previous research.[43] For example, results from a previous study imply that activity in meat processing industries declines by 0.1 per cent for every 1 per cent increase in per unit inbound road transport costs faced by meat processors. This result implies that a 2.3 per cent increase in road transport costs would reduce beef and veal output by approximately 0.23 per cent which is of the same broad order of magnitude to the decline in beef and veal output obtained in Model 2 (see Table 26).

Equations 6 through to 9 in the model allow the rise in road transport costs to be allocated across farmers, processors and consumers (see Box 1). The forecast rise in beef and veal prices is that part of the rise in transport costs that is borne by consumers. The remainder of the road transport price rise is borne by farmers and processors. According to the model results approximately 65 per cent of the road transport price rise is borne by farmers under Model 1 parameters settings. Consumers bear approximately 20 per cent of the road transport price rise and processors bear approximately 15 per cent the of the road transport price rise under Model 1 parameter settings (see Table 27).

As the comparison between Model 1 and Model 2 results demonstrates, the model results are sensitive to the selection of the elasticities used in the model. The lower the absolute value of the demand and supply elasticities built into the model the higher is the share of the increase in road transport costs born by consumers and hence the lower the share of the increase in road transport costs born by farmers and processors. Similarly, the higher the absolute value of the elasticity of beef and veal supply with respect to road transport costs, the higher is the share of the road price rise born by consumers.

The conclusion that farmers bear a large proportion of the rise in road transport costs is in accord with results from a recent study that examined the impact of a carbon pollution reduction scheme on sectors of Australian red meat industries. The study reported results indicating that between 13 to 38 per cent of cost increases generated by such a scheme would be borne by consumers and that processors could pass around 80 per cent of the remaining cost increase back to farmers. Thus it can be calculated that farmers bear between 70 per cent of the cost increase generated by a carbon pollution reduction scheme [calculated as :(1 - 0.13) * 0.8 = 0.696] to approximately 50 per cent of cost increase generated by such a scheme [44] [calculated as: (1- 0.38) * 0.8 = 0.496].

The results from the simple net trade model can be used to calculate the direct dollar impact of the rise in road transport costs on farmers, processors and consumers. For example, a 2.3 per cent increase in the road transport costs of grain fed steers would represent a direct increase in the at port cost of approximately $2.48 per steer.[45] Of this increase the farm

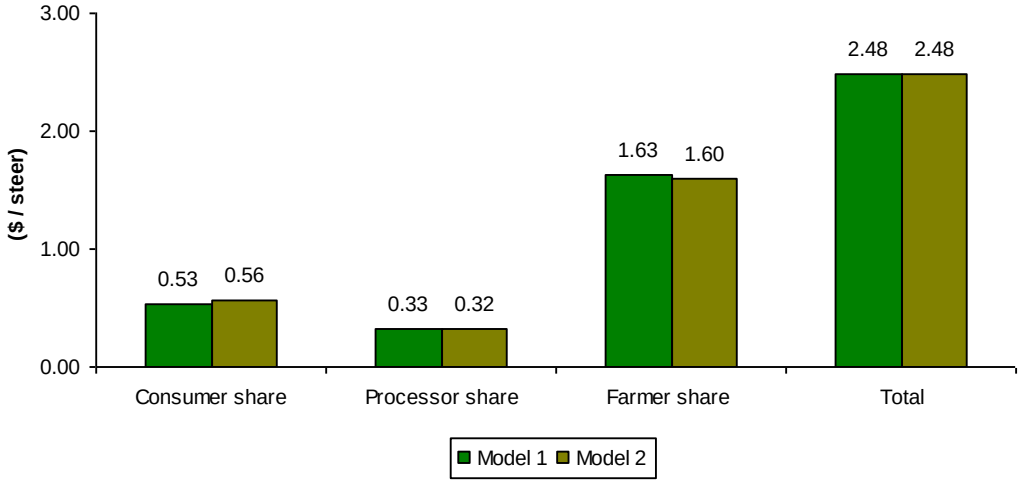
[43] New South Wales Livestock and Bulk Carriers Association 2006, "Benefits for NSW from introducing an accredited livestock loading scheme", Submission to New South Wales Government, December.

[44] The Centre for International Economics 2009, "Possible impacts of the CPRS on the Australian red meat and livestock industry", Report prepared for Meat and Livestock Australia, June, pp. 18-19.

[45] The export value of beef and by products produced from a 600 kilogram grain fed steer is of the order of $1,980 per head. This value includes the value of by products plus the value of boneless beef 80 per cent chemically lean, boneless beef 80 per cent chemically lean, shank 90 per cent chemically lean and full sets. Unit values for these products were obtained from the Co-products_V2 spreadsheet and Meat and Livestock Weekly, Friday 2 September 2011. Direct road transport costs for a steer and products produced from a steer were $108 / steer.

return from grain fed steer production was calculated to fall by between $1.60 per head to approximately $1.63 per head (Chart 42). Processors would incur a reduction in the return from processing steers of between approximately $0.32 per steer to $0.33 per steer (Chart 42).

Chart 42 **Allocation of the increase in heavy vehicle charges to supply chain sectors ($/steer, 2010-11 charges)**



Data source: Author's calculations.

The calculations provided in Chart 42 provide an estimate of the direct impact of higher road transport charges on certain sectors of Australia's red meat industries. In addition to these direct effects of higher road transport costs there would also be indirect effects as the price of other inputs used by red meat industries would also change as a result of altering heavy vehicle charges. To examine the total effect of alternate heavy vehicle charges on Australia's red meat industries a Computable General Equilibrium (CGE) analysis of the effects of altering heavy vehicle charges was undertaken. The results of the CGE analysis are presented in the following section.

9.2. COMPUTABLE GENERAL EQUILIBRIUM ANALYSIS OF ALTERNATE HEAVY VEHICLE CHARGES

The case studies undertaken for this study indicate that alternate heavy vehicle charges could lead to small but significant increases in road transport costs faced by Australia's red meat industries.

An increase in road transport costs faced by the farm and meat processing sector was simulated in Deloitte Access Economics Regional General Equilibrium Model (DAE-RGEM) of the Australian economy. In the version of DAE-RGEM used for this analysis there were two fully modelled regions including Australia and all other countries aggregated into the Rest of the World. In each region production of goods and services was represented by 27 industries including an "Agricultural meat animals" industry and "Meat Processing" industry.

Drawing on the average results of all the case studies presented in Table 24 for mass distance location and mass distance pricing, a 2.1 per cent increase in road user charges incurred by livestock and meat processing industries in Australia was simulated. The main assumptions built into the modelling include:

- expenditure on the maintenance of roads is maintained at business as usual rates;
- capital stocks adjust in each country to maintain rates of return in a country relative to the average rate of return across all countries;
- industry capital stocks also adjust to achieve country rates of return;
- real wages adjust to ensure the demand for labour equals the supply of labour; and
- tax rates are exogenous and the public sector borrowing requirement is allowed to vary in response to changes in economic activity.

The simulation results are presented in Table 27 where it can be seen that the simulated rise in road transport costs led to a significant fall in output of meat products and farm production of meat animals. The decline in meat production of approximately 0.9 per cent is sustained throughout the simulation period of 2012 to 2020 and the magnitude of the decline is significantly greater than the decline in beef and veal production derived from the partial equilibrium model. This reflects the strong impact the rise in road transport costs had on the competitiveness of Australia's red meat industries in the simulations. The decline in competitiveness reduced rates of return in red meat industries in Australia which caused a significant shift of capital out of red meat production in Australia. These effects were additional to those picked up in the partial equilibrium model and consequently a greater reduction in production in red meat industries is observed in the CGE simulations.

The decline in the competitiveness of Australia's red meat industries caused by higher road transport costs would be expected to induce a shift of capital out of these industries over the longer term as the reduction in competitiveness would result in a reduction in rates of return on capital invested in these industries. As these sorts of effects are likely to be less strong in the short run, the results for years 2015 and 2020 provided in Table 27 are likely to provide more reliable indications of the effects of higher heavy vehicle charges than are the results for the 2012 year.

Industries other than red meat industries may also incur changes in road transport costs under alternate heavy vehicle charges. To provide an indication of how such changes could affect Australia's red meat industries a second simulation was undertaken in which all industries in the DAE-RGEM model were assumed to face changes in road transport costs.

In the absence of case studies for other industries generic estimates of the effects of alternate heavy vehicle charges on other Australian industries were calculated. As detailed in Appendix A , Australia's heavy vehicle fleet contains a significant proportion of heavy vehicles which the ABS describes as "Non-freight carrying trucks". These vehicles travel less distances and carry lighter loads than do freight carrying vehicles.[46] Thus, heavy vehicle

[46] Australian Bureau of Statistics 2008, "Survey of Motor Vehicle use , 12 months ending 31 October 2007", Publication Number 9208, p.18, 28 August.

charges were calculated using data evaluated at the fleet average would underestimate heavy vehicle charges for freight carrying vehicles.

Table 27 **Impact on the Australian economy of a 2.1 per cent increase in road transport costs for Australia's red meat industries (per cent change compared to baseline forecast)**

Variable	2012	2015	2020
Macro economic variable			
GDP	-0.006	-0.005	-0.004
GNP	-0.005	-0.004	-0.003
Employment	-0.011	-0.008	-0.007
Exports	-0.042	-0.036	-0.035
Imports	-0.030	-0.031	-0.031
Wages	-0.004	-0.009	-0.011
Consumer Price Index	-0.017	-0.018	-0.019
Industry real value added			
Grains	0.055	0.055	0.053
Meat animals	**-0.894**	**-0.903**	**-0.922**
Other agriculture	0.038	0.037	0.031
Coal	0.025	0.025	0.025
Oil	0.012	0.012	0.011
Gas	0.014	0.014	0.015
Other minerals	0.026	0.027	0.028
Meat processing	**-0.845**	**-0.835**	**-0.824**
Dairy	0.058	0.057	0.052
Processed Foods other	-0.001	0.000	0.000
Forestry and fishing	-0.001	0.000	0.001
Beverage and Tobacco	0.009	0.009	0.009
Light manufacturing	0.019	0.022	0.023
Petroleum and Coal	-0.005	-0.005	-0.005
Chemicals Rubber Plastics	0.027	0.030	0.030
Non-metallic minerals	0.010	0.012	0.013
Iron and Steel	0.043	0.048	0.049
Non-ferrous metals	0.078	0.081	0.083
Manufacturing other	0.036	0.041	0.043
Electricity	0.015	0.016	0.017
Water	-0.000	-0.000	-0.000
Construction	-0.005	-0.004	-0.004
Air transport	0.016	0.018	0.018
Water transport	0.010	0.011	0.011
Road transport and other transport	-0.024	-0.022	-0.021
Communications	-0.005	-0.003	-0.003
Services	-0.002	-0.001	-0.000

Data source: Results from the DAE-RGEM model.

Thus in this exercise generic estimates of heavy vehicle charges for freight carrying vehicles for industries other than red meat industries were calculated by arbitrarily assuming typical

loads and distances travelled for each type of freight carrying truck would be 15 per cent above average levels achieved by all trucks of a particular type. As detailed in Appendix A this assumption yields mass distance charges for freight carrying vehicles that result in the costs to own and operate a heavy vehicle that are approximately 1 per cent higher than costs based on PAYGO charges.

The results for the second simulation are presented in Table 28 where it can be seen that when all industries face increases in transport costs the competitiveness of Australia's red meat industries deteriorates by less than when road transport costs are increased for Australia's red meat industries in isolation. Thus in Table 28 output of meat products declines by about 0.87 per cent in year 2020 compared to a decline in meat products recorded in Table 27 of approximately 0.92 per cent.

This result reflects the effects of two opposing forces that higher road transport costs for non red meat industries have on red meat industries. First, red meat industries are disadvantaged as higher road transport costs for non red meat industries directly and indirectly raise costs of production for inputs used by red meat industries. However, in the simulation this effect is more than offset by a higher road transport cots induced decline in competitiveness for non red meat industries. The decline in competitiveness for non red meat industries leads to a contraction in the output in these industries which releases resources some of which relocate in red meat industries thereby reducing the effect on red meat industries of higher road transport costs to both red meat and non red meat industries.

These simulations highlight the fact that the competitiveness of Australia's red meat industries is significantly affected by how road transport costs change for non red meat industries as well as for red meat industries. However, the results presented in Table 28 should be treated with caution as they are based on simulated road transport price increases for non red meat industries that were calculated without the benefit of detailed case studies for these industries. In particular, it is possible that some non red meat industries may face lower heavy vehicle charges under heavy vehicle pricing options such as mass distance location pricing. These would be industries that have relatively low road transport requirements per unit of output and also undertake a significant proportion of the transport on major arterial roads. Without the results of detailed case studies these industry specific road transport requirements could not be built into the simulations reported in Table 28. Consequently, the estimated impacts of alternate heavy vehicle charges on red meat industries detailed in Table 28 are likely to underestimate the likely impact on red meat industries of alternate heavy vehicle charges.

Thus overall it can be concluded that the simulation results support the proposition that Australia's red meat industries would be likely to be the most adversely affected of all Australian industries if heavy vehicle charges were introduced based on the mass, distance and location of travel of heavy vehicles.

Table 28 **Impact on the Australian economy of a 2.1 per cent increase in road transport costs for Australia's red meat industries and a 1 per cent increase in road transport costs for other industries (per cent change compared to baseline forecast)**

Variable	2012	2015	2020
Macro economic variable			
GDP	-0.027	-0.021	-0.021
GNP	-0.022	-0.017	-0.017
Employment	-0.037	-0.025	-0.021
Exports	-0.158	-0.140	-0.138
Imports	-0.089	-0.095	-0.097
Wages	-0.015	-0.036	-0.047
Consumer Price Index	-0.025	-0.033	-0.035
Industry real value added			
Grains	-0.042	-0.038	-0.043
Meat animals	**-0.851**	**-0.850**	**-0.869**
Other agriculture	-0.055	-0.052	-0.060
Coal	-0.141	-0.145	-0.149
Oil	-0.071	-0.072	-0.073
Gas	0.028	0.028	0.025
Other minerals	-0.047	-0.045	-0.046
Meat processing	**-0.761**	**-0.738**	**-0.725**
Dairy	-0.243	-0.235	-0.230
Processed Foods other	-0.174	-0.168	-0.168
Forestry and fishing	-0.107	-0.100	-0.097
Beverage and Tobacco	-0.072	-0.075	-0.079
Light manufacturing	-0.008	0.005	0.008
Petroleum and Coal	-0.084	-0.085	-0.089
Chemicals Rubber Plastics	-0.079	-0.066	-0.064
Non-metallic minerals	-0.040	-0.034	-0.033
Iron and Steel	-0.045	-0.027	-0.021
Non-ferrous metals	-0.066	-0.057	-0.059
Manufacturing other	-0.013	0.006	0.010
Electricity	-0.027	-0.027	-0.030
Water	0.015	0.012	0.009
Construction	-0.027	-0.024	-0.024
Air transport	0.054	0.061	0.060
Water transport	0.030	0.034	0.032
Road transport and other transport	-0.030	-0.022	-0.022
Communications	0.000	0.004	0.002
Services	-0.003	0.002	0.002

Data source: Results from the DAE-RGEM model.

10. CONCLUSIONS

The case study evidence presented in this report indicates that heavy vehicle charges being considered by CRRP that are based on the mass of trucks, distance travelled and location of travel have the potential to directly raise road transport costs paid by Australia's red meat industries. The rise in road transport costs could be significant and over all case studies an average 2.1 per cent increase in road transport costs was observed. In case studies involving the transport of cattle an average 2.3 per cent increase in road transport costs was observed.

Such an increase in road transport costs was calculated to directly reduce output of red meat industries in Australia by up to approximately 0.2 per cent although the estimated impact is sensitive to the choice of key model parameters used to approximate supply and demand conditions in the domestic and international market for Australian beef and veal. More significant impacts of the effects of higher road transport costs were observed in results from simulations with the DAE-RGEM CGE model indicating that indirect effects of higher road transport costs play a significant role in determining the total impact on Australia's red meat industries of higher road transport costs.

The impact of higher road transport costs would also depend critically on how such increases affect the competitiveness of non red meat industries in Australia. However, the CGE results of the effects of higher road transport costs for non red meat industries built into the CGE results presented in Table 28 should be treated with caution as they are based on simulated road transport price increases for non red meat industries that were calculated without the benefit of detailed case study results for these industries.

Finally, on the basis of the analysis presented in Section 9 of this report, it is concluded that any increase in heavy vehicle charges would be borne mainly by farmers in terms of a reduction in the net return received from the production of red meat animals.

APPENDIX A DERIVATION OF ROAD TRANSPORT COSTS BY VEHICLE TYPE

In the absence of case study data for other industries a synthetic set of data was developed to enable road transport costs for non red meat industries to be approximated. Charges were calculated for 16 truck types using the methodology detailed by the NTC[47] and using heavy vehicles charges data provided to the Australian Livestock and Rural Transporters Association.

The analysis was conducted based on data evaluated at the average for the respective variable for each truck type. However, the average fleet values are derived from a fleet that contains a significant number of non freight carrying vehicles. Consequently, charges based on fleet averages would underestimate registration and road use fees likely to be paid by industries that use freight vehicles. For this reason, heavy vehicle charges were recalculated assuming vehicles had a gross vehicle mass 15 per cent above the respective fleet average for the vehicle under consideration. Vehicles were also assumed to achieve travel distances 15 per cent above the respective fleet average.

The data used in the analysis and the calculated charges for the 16 vehicle types are given in Table 29.

[47] COAG Road Reform Plan 2011, "Evaluation of Options – Draft", pages 21 and 22, 26 July.

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Table 29 Data used to calculate heavy vehicle charges and calculated heavy vehicle charges by 16 vehicle types ($ 2010/11 charges)

Truck type	Average ESA's per truck	Average fuel consumption (ltrs/ 100 Kms)	Average total distance travelled per truck (kms/year)	Average distance travelled on freeways (kms)	Average distance travelled on urban arterials (kms)	Average distance travelled on rural arterials (kms)	Average distance travelled on local roads (kms)	PAYGO (2010/11, $/vehicle)	Fuel (flat charge) (2010/11, $/vehicle)	Distance charge (axle group) (2010/11, $/vehicle)	Distance Location charge (2010/11, $/vehicle)	Distance Mass charge (2010/11, $/vehicle)	Mass Distance Location charge (2010/11, $/vehicle)
B1233 – 9 axle B double	6.0	68.7	208,531	127,964	44,319	32,619	3,628	47,717	48,584	46,634	31,439	57,293	36,911
B1232 – 8 axle b double	6.1	65.3	173,398	127,058	23,652	18,675	4,013	38,598	38,502	41,854	27,328	48,349	31,369
B Triple	0.0	25.7	12,943	8,151	2,648	1,934	211	22,464	1,565	4,519	2,734	2,066	2,066
A123T23 – Double road train 11 axle	7.8	79.6	128,167	62,225	31,458	31,489	2,995	34,216	34,711	38,499	24,968	44,532	29,693
A123T23T23 – Triple Road train 16 axle.	10.9	103.6	200,532	82,077	50,745	50,761	16,950	60,345	70,284	85,950	67,005	94,505	83,666
A124 – 7 axle articulated truck	3.9	56.6	97,872	41,024	32,588	22,027	2,233	18,583	19,045	16,619	12,650	19,650	14,052
A123 – 6 axle articulated truck	4.4	54.6	95,764	40,430	31,174	19,222	4,938	17,435	18,025	15,986	13,527	20,577	16,261
A122 – 5 axle articulated truck	3.5	49.7	60,314	22,078	21,004	12,982	4,250	11,823	10,529	11,485	9,866	11,640	10,145
A112 – Articulated truck 4 axle	1.8	42.0	50,049	18,036	17,706	10,812	3,495	6,637	7,504	7,725	7,475	7,283	6,652
R11 – Rigid Truck 2 axle	0.7	32.9	24,002	10,608	6,059	4,397	2,937	2,193	3,101	2,059	2,907	2,557	2,569
R12 – Rigid Truck 3 axle	3.0	40.5	34,057	13,689	8,948	7,427	3,994	3,818	5,082	4,057	4,634	5,615	5,627
R22 – Rigid truck 4 axle	8.0	44.6	38,511	12,065	10,122	8,685	7,640	4,806	6,221	6,001	7,366	11,715	15,774
R11T2 – 2 axle rigid truck with 2 axle trailer	1.8	41.4	30,523	10,875	10,406	6,113	3,129	4,371	4,691	5,030	5,596	5,256	5,142
R12T2 – 3 axle rigid truck with 2 axle trailer	2.2	46.8	35,464	6,931	14,975	10,726	2,832	5,459	6,026	7,070	6,827	6,411	6,040
R12T12 – 3 axle rigid truck with 3 axle trailer	4.0	54.2	35,464	23,351	4,991	4,602	2,520	6,494	6,911	8,417	6,917	8,169	6,996
R22T22 – 4 axle rigid truck with 4 axle trailer	6.5	67.3	27,587	10,367	6,835	6,228	4,157	12,686	6,688	8,813	8,370	8,393	9,371

Data source. Author's calculations.

The calculated charges for the 6 heavy vehicle charging mechanisms detailed in Table 29 were then used to adjust estimated costs to own and operate each of the 16 vehicle types detailed in Table 29. The cost to own and operate heavy vehicles was calculated using the heavy vehicle costing methodology developed for the Australian Livestock and Rural Transport Association. A similar model was constructed for the NTC.[48] For each of the 16 truck types given in Table 29 cost models were developed for 8 vehicle body types. The 8 body types include: flat top, dry freight pantech, refrigerated van, dry freight tautliner, tipper, tanker, cattle livestock truck, and sheep livestock truck.

The key assumptions built into the 128 heavy vehicle cost models include:

- Operator type – owner operator.
- Extent of vehicle use – fully commercial basis.
- Time period costs relate to – late December 2010.
- Annual kilometres travelled as per Table 29.
- Vehicle lease term – 5 years.
- Vehicle residual value after 5 years – 20 per cent of purchase price.
- Vehicle finance interest rate – 11 per cent per annum.
- Fuel efficiency – average value derived from Survey of Motor Vehicle use for each truck type.
- Fuel prices – average retail price derived from data published by the Institute of Petroleum as at October 2011.
- Road use fee – 22.6 cents per litre.
- Drivers wage rate – award rates based on the higher of wages calculated according to kilometres travelled or wages calculated using award average weekly wages.
- Maintenance costs – industry average rate per kilometre for each truck type.
- Tyre operating life – steer tyre 100,000 kilometres, drive and trailer tyres, 150,000 kilometres.
- Return on management and entrepreneurial activity 5 per cent.

The effect of alternate heavy vehicle charges on the cost to own and operate a heavy vehicle was then found by replacing in the cost calculations the PAYGO registration and road use fees given in Table 29 by the required road use and registration fees also given in Table 29 for the heavy vehicle charging regime being evaluated. For example, to evaluate a flat fuel fee relative to PAYGO the registration and road use fees given in column 10 of Table 29 are inserted into the cost calculations in place of the PAYGO charges given in 9 of Table 29.

[48] Verve Economics 2011, "Heavy Vehicle Operating Cost Model, List of main assumptions", report prepared for the National Transport Commission, 9 June

When these substitutions were undertaken it was found that alternate heavy vehicle charges would, in general, result in small reductions in the cost to own and operate most articulated vehicles and small increases in the cost to own and operate most rigid vehicles (Table 30).

Table 30 **Calculated increase in the cost to own and operate alternate flat top heavy vehicles under alternate heavy vehicle (% compared to charges based on PAYGO**

Truck type	PAYGO (2010/11)	Fuel (flat charge)	Distance (axle group)	Distance Location	Distance Mass	Mass Distance Location
B1233 – 9 axle B double	0.0	0.2	-0.2	-3.4	2.0	-2.2
B1232 – 8 axle b double	0.0	0.0	0.8	-2.8	2.4	-1.8
B Triple	0.0	-9.6	-8.3	-9.1	-9.4	-9.4
A123T23 – Double road train 11 axle	0.0	0.1	1.1	-2.4	2.7	-1.2
A123T23T23 – Triple Road train 16 axle.	0.0	1.6	4.1	1.1	5.4	3.7
A124 – 7 axle articulated truck	0.0	0.2	-0.8	-2.3	0.4	-1.8
A123 – 6 axle articulated truck	0.0	0.2	-0.6	-1.6	1.3	-0.5
A122 – 5 axle articulated truck	0.0	-0.7	-0.2	-1.0	-0.1	-0.9
A112 – Articulated truck 4 axle	0.0	0.5	0.6	0.5	0.4	0.0
R11 – Rigid Truck 2 axle	0.0	1.0	-0.2	0.8	0.4	0.4
R12 – Rigid Truck 3 axle	0.0	1.1	0.2	0.7	1.6	1.6
R22 – Rigid truck 4 axle	0.0	1.0	0.9	1.9	5.0	8.0
R11T2 – 2 axle rigid truck with 2 axle trailer	0.0	0.3	0.6	1.2	0.8	0.7
R12T2 – 3 axle rigid truck with 2 axle trailer	0.0	0.4	1.3	1.1	0.8	0.5
R12T12 – 3 axle rigid truck with 3 axle trailer	0.0	0.3	1.4	0.3	1.2	0.4
R22T22 – 4 axle rigid truck with 4 axle trailer	0.0	-3.5	-2.3	-2.5	-2.5	-1.9

Data source: Author's calculations.

The calculations summarised in Table 30 were undertaken for each of the 8 vehicle body types. The calculated changes in costs to own and operate heavy vehicles were then used to calculate changes in the cost to transport commodities broken down into the 12 commodity groups used by the Australian Bureau of Statistics in the Survey of Motor Vehicle Use (see Table 31). This was achieved in two steps. First, the proportion of the total transport task by commodity that would be undertaken by each of the 8 vehicle body types were obtained from a previous study.[49] For each of the 16 truck types, these shares were used to weight together the changes in costs to own and operate heavy vehicles across the 8 body types. This gave the aggregate road transport proportional increase in costs by commodity.

[49] CRA International and Centre for Policy Studies, Monash University 2007, "Economic and Fiscal Analysis of Higher Mass Limits in New South Wales", report prepared for the New South Wales Roads and Traffic Authority, p. 29.

Table 31 Commodities for which data is available from the Survey of Motor Vehicle Use

Commodity	Commodity
Animal and vegetable oils, fats and waxes	Manufactured goods
Beverages and tobacco	Machinery, transport equipment
Chemicals and related products, not elsewhere specified	Miscellaneous manufactured articles
Crude materials, inedible, except fuels	Unspecified
Food and live animals	Other commodities, not elsewhere specified
Mineral fuels, lubricants, and related materials	Tools of trade

Data source: Australia Bureau of Statistics, 2008, Survey of Motor Vehicle Use, Australia publication 9208.0, August.

The second step involved aggregating the proportional increase in costs across the 16 truck types to derive the aggregate road transport proportional increase in costs by commodity. This aggregation was achieved by using shares of commodities transported by different truck types. These proportions were calculated using data derived from the Australian Bureau of Statistics Survey of Motor Vehicle Use.[50]

The calculated changes in charges are given in Table 32 where it can be seen that for trucks travelling average distances with average payloads all the alternate charges developed by the NTC would yield negligible aggregate changes in road transport costs Table 32.

Table 32 Calculated change in unit road transport costs by commodity (% compared to charges based on PAYGO)

	PAYGO (2010/11)	Fuel (flat charge)	Distance (axle group)	Distance Location	Distance Mass	Mass Distance Location
Food and live animals	0.0	0.4	-0.1	-0.5	0.9	0.0
Beverages and tobacco	0.0	0.4	0.0	-0.5	1.1	0.0
Crude materials inedible except fuels	0.0	0.4	-0.1	-0.5	0.9	0.0
Minerals fuels lubricants and related materials	0.0	0.4	-0.1	-0.4	0.9	0.0
Animal and vegetable oils fats and waxes	0.0	0.4	-0.1	-0.4	0.9	0.0
Chemical and related products NES	0.0	0.4	-0.1	-0.4	0.9	0.0
Manufactured goods	0.0	0.4	0.0	-0.5	1.0	0.0
Machinery transport equipment	0.0	0.4	-0.1	-0.5	1.0	0.0
Miscellaneous manufactured articles	0.0	0.4	-0.1	-0.5	1.0	0.0
Tools of trade	0.0	0.4	-0.1	-0.5	0.9	0.0
Other commodities NES	0.0	0.4	0.0	-0.5	1.0	0.0
Unspecified	0.0	0.4	0.0	-0.4	1.0	0.0
Total	0.0	0.4	-.10	-0.5	1.0	0.0

Data source: Author's calculations.

The increase in the cost to own and operate a heavy vehicle assuming distance mass pricing was introduced was used in the simulations reported in Section 9 .

50 See Australian Bureau of Statistics 2008, Survey of Motor Vehicle Use, Australia publication 9208.0, August.