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Analysis of Changes in Log Truck Fleet Size - 2013-2016

Prepared for:

NZFOA Transportation Group

May 2017

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INTRODUCTION

On several occasions in the past, TERNZ has undertaken analyses to determine the size of the New Zealand log truck fleet and its growth. These analyses have been initiated for various reasons – mostly typically to provide exposure data so that crash statistics can be put into context. The log transport fleet has grown very substantially over the last 20 years and so simply looking at the raw crash numbers greatly underestimates the safety gains that have been achieved. However, regardless of the initial reason for the analysis, the resulting data on fleet size, composition and growth trends has provided valuable information to the industry for planning, strategy and analysis.

The two most recent studies were commissioned by the Log Transport Safety Council (LTSC) and were completed in February 2011 and July 2014. The 2011 analysis provided estimates of fleet size and annual kms travelled for each year from 1997 to 2009 inclusive while the 2014 analysis covered the period from 2008 to 2013 inclusive. Thus there was an overlap of two years in these two studies. The reason for this is that there were changes to the NZTA databases that were used and so the methodology changed between the two studies with the more recent analysis expected to be more reliable and more accurate. The overlap of analysis periods enabled us to compare the two methodologies.

This current study has been commissioned by the New Zealand Forest Owners Association (NZFOA). One of the main purposes of the study is to determine the level of uptake of High Productivity Motor Vehicles (HPMVs) and particularly 50MAX vehicles by the log transport industry. However, as noted above, the information provided by the analysis is useful as a resource to the industry for a wide range of applications.

The analysis in this report covers the period from 2013-2016 inclusive and overlaps the most recent previous study by one year. The methodology used in this study is the same as that used in this most recent study with some additional analysis to determine HPMV numbers. Repeating the analysis for 2013 provides a check on the consistency of the data extraction process.

PREVIOUS ESTIMATES OF FLEET SIZE

Methodology

The estimates of fleet size and distance in the 2011 study and the studies prior to this were primarily derived by analysing the Road User Charges (RUC) purchase data which was supplied by the New Zealand Transport Agency (NZTA) and its predecessors. Each vehicle record has an industry class associated with it and, if that industry class is commercial road transport, it also has a Road Transport Code value. One of the options for the Road Transport Code value is log haulage.

In these early studies, we quantified the log truck fleet by considering only powered vehicles of the appropriate type and weight (RUC vehicle types 6, 14 and 19 with a RUC licence weight greater than four tonnes) and then from those selecting only those vehicles with a Road Transport Code of log haulage. We then used trailer RUC data to estimate the proportions of the different configurations.

Results

The results of applying this methodology in the earlier studies are shown in Table 1. These figures show a substantial growth in vehicle numbers over the period which is in line with industry opinion. The main weakness in this approach is the use of the Road Transport Code as the identifier of log trucks. The industry class and road transport code data are input by the operator when the vehicle is first registered and again on change of ownership. However, there are no validation checks on this data and an incorrect data entry has no effect on the operator at all. If the industry class is not entered as commercial road transport, there is no need to input a road transport code value at all and a substantial proportion of the vehicle fleet has a "blank" entry for road transport code. Furthermore, there is no explicit requirement to enter changes to these data values on change of ownership and it is believed that this is often not done.

In 1997 and again in 2006 the LTSC undertook a survey of its members and estimated the number of combination vehicles in the log transport fleet. The 1997 survey indicated 650 vehicles while the 2006 survey estimated 1450 vehicles. This compares with figures of 306 vehicles and 1052 vehicles respectively determined from the RUC data analysis. Therefore it would appear that, in 1997, the methodology identified under half of the vehicles in the fleet while in 2006 it identified about 73% of the vehicles. Thus the level of under-reporting due to vehicles not being identified as log haulage vehicles appears to be reducing. Unfortunately this also means that we cannot simply scale the data because it appears that the scaling factor is changing over time.

Table 1. Results of RUC purchase analysis using Road Transport Code.

Year	Vehicle Numbers	Vehicle-kms (000)	Refund kms (000)	On-highway vehicle-kms (000)	Average vehicle-km (000)	Average on-highway veh-kms (000)
1997	306	27964	5774	22190	91.39	72.52
1998	340	30147	6105	24042	88.67	70.71
1999	434	39847	7197	32650	91.81	75.23
2000	650	55716	9504	46212	85.72	71.10
2001	738	72381	11201	61180	98.08	82.90
2002	901	84682	13346	71336	93.99	79.17
2003	1035	91260	14219	77041	88.17	74.44
2004	1036	92004	14410	77594	88.81	74.90
2005	1040	91655	14392	77263	88.13	74.29
2006	1052	94545	15412	79133	89.87	75.22
2007	1146	95616	13705	81911	83.43	71.48
2008	1144	93007	14266	78741	81.30	68.83
2009	1097	96554	13721	82833	88.02	75.51

CURRENT ESTIMATES OF FLEET SIZE

Methodology

Since the 2011 analysis the cross-matching capabilities of the various databases maintained by the NZTA has been enhanced. This enables a different and better approach to be used for extracting the log trucks out of the RUC purchase database.

All log trucks are fitted with bolsters to secure the log loads. A bolster is a “U” shaped cradle in which the logs are placed. In 1998, a design code was developed specifying the requirements for the attachments connecting the bolsters to the vehicle chassis. All bolsters fitted since 1998 have to be certified as complying with the code by an approved certifying engineer. This certification is recorded in the Landata database. Only log trucks are certified under this requirement and thus all vehicles for which bolster attachment certification is recorded should be log trucks and nearly all log trucks will be certified. The two obvious exceptions are vehicles that were built prior to 1998 and tractor units that tow semi-trailers or B-trains. In the latter case the trailers have bolsters but the tractors do not and therefore they will not be certified. There are relatively few of these vehicle configurations operating and we can use the data to estimate how many.

There is a slight complication in this analysis in that the RUC system changed in 2012. Under the new RUC system some new RUC vehicle types were introduced. Thus in addition to RUC vehicle types 6, 14 and 19, the powered vehicles also include RUC vehicle types 308 and 408 and H81, H82, H83, H94, H95 and H96. These are actually the same vehicle configurations as previously but licenced for particular combination types and, in the case of the "H" licences, at higher weights.

Results

Applying this methodology to the 2008-13 data (extracted in 2014) gave the results shown in Table 3 which has been copied from the 2014 report. If we compare these results with those in Table 1 for the two overlapping years, 2008 and 2009, we see that this new methodology generates about 18% more vehicles and 25% more vehicle-kms than the previous methodology. This is not unexpected as the earlier methodology was known to under-report the fleet size.

Table 2. Powered vehicle numbers and distances travelled for 2008-13 based on RUC purchase data.

Year	Powered vehicle Numbers	Powered vehicle-kms (000)	Refund kms (000)	On-highway vehicle-kms (000)	Average vehicle-km (000)	Average on-highway veh-kms (000)
2008	1302	114600	14981	99619	88.02	73.51
2009	1338	123029	15645	107384	91.95	80.26
2010	1472	138130	16884	121246	93.84	82.37
2011	1665	150047	17682	132365	90.12	79.50
2012	1776	157837	18348	139489	88.87	78.54
2013	1915	172403	17822	154582	90.03	80.72

Table 3 shows the same results for the 2013-16 years based on the RUC purchase data extracted in 2017. Interestingly for the 2013 year, which appears in both Table 2 and Table 3, there are some differences between the results from the two data extractions. These are minor, being of the order of 1.5%-2%, but it is not clear what the reasons for the differences are.

Table 3. Powered vehicle numbers and distances travelled for 2013-16 based on RUC purchase data.

Year	Powered vehicle Numbers	Powered vehicle-kms (000)	Refund kms (000)	On-highway vehicle-kms (000)	Average vehicle-km (000)	Average on-highway veh-kms (000)
2013	1944	175,963	18,883	157,080	90.52	80.80
2014	2098	173,589	18,574	155,015	82.70	73.89
2015	2125	167,419	17,006	150,413	78.79	70.78
2016	2170	177,578	14,791	162,788	81.83	75.02

In the 2014 study a cross-check on the validity of the methodology of using the log bolster attachment certification to identify logging trucks was undertaken by looking at the Road_Transport_Code data entries for these vehicles. This has been repeated and the results for the powered vehicles are shown in Table 4. About 59% of the vehicles have a Road Transport Code of "Log Haulage" and a further 26% are "blank". The two "General Goods" categories account for a little under 10% of the fleet with small numbers of vehicles in a range of other categories that are clearly not log transport. These proportions vary a little from year to year and are approximately the same as they were in the 2014 study.

These data reliability issues were discussed in the 2014 report and we will not repeat that discussion here. The view of the NZTA statistical analysis staff was that the log bolster certification data is more reliable than the Road_Transport_Code data. Errors can be introduced into the data for this latter field and these errors would not necessarily ever be fixed.

Table 4. Number of powered vehicles with log bolster attachment certification by Road Transport Code.

ROAD TRANSPORT CODE	2013	2014	2015	2016		2013
BULK CARTAGE - LIQUIDS	6	7	8	9		4
BULK CARTAGE - SOLIDS	48	56	57	57		38
BUS SERVICE	1	1	1	2		1
COURIER - RURAL & INTER URBAN	2	3	3	3		1
COURIER - URBAN	7	10	10	11		3
FURNITURE REMOVALS	0	1	1	1		1
GENERAL GOODS - LINE HAULAGE	84	87	93	92		91
GENERAL GOODS - LOCAL	104	106	107	104		91
HEAVY HAULAGE	28	28	27	28		15
LOG HAULAGE	1074	1202	1268	1334		1249
REFRIG. HAULAGE	2	2	2	2		3
STOCK CARTAGE	15	15	14	13		13
VEHICLE RECOVERY	2	3	2	3		1
(blank)	571	577	532	511		404
Total	**1944**	**2098**	**2125**	**2170**		**1915**

By analysing the RUC purchase data for trailers with bolster attachment certification we can gain some further insights. The powered vehicles fitted with bolsters shown in Table 3 are all rigid trucks and when logging almost all of them are towing full trailers. Full trailers are RUC vehicle type 37 (3-axle trailers), RUC vehicle type 43 (4-axle full trailers) and RUC vehicle type 951 (5-axle full trailers. RUC type 43 also includes quad-axle semi-trailers. However, there are very few of these in the log transport fleet.

Table 5 shows the RUC purchase data for these full trailer RUC vehicle types. In theory we would expect the trailer numbers to match the truck numbers shown in Table 3 because every truck tows a trailer. In fact there are approximately 150- 200 fewer trailers than trucks shown in the data. A possible explanation for this comes from the methodology. To select the vehicles that are log trucks we chose all vehicles with bolster attachment certification. Vehicles that had bolsters fitted prior to 1998 do not require certification unless they are also fitted with load cells. Log trucks have a significantly shorter working life than log trailers and so there are likely to be significantly more pre-1998 trailers than pre-1998 trucks. Because of the way that the vehicles were selected these older trailers are not included in the database. In the most recent year this represents about 7.5% of the trailer fleet by vehicle numbers although it is likely that these older vehicles are less heavily utilised and so they would represent even less by vehicle-kms.

Table 5. Full trailer numbers and distances travelled based on RUC purchase data.

Year	Full trailer numbers	Full trailer vehicle-kms (000)	Refund kms (000)	On-highway vehicle-kms (000)	Average vehicle-km (000)	Average on-highway veh-kms (000)
2013	1754	91,666	9,943	81,723	52.261	46.592
2014	1883	91,035	10,107	80,929	48.346	42.979
2015	1940	88,357	10,009	78,348	45.545	40.386
2016	2006	93,659	7,498	86,161	46.689	42.952

The average distance travelled by the trailers is approximately half that travelled by the trucks. This is in-line with normal log transport practice. Typically the vehicle travels fully laden in one direction. It is then unloaded and the trailer is loaded onto the back of the truck. Thus on the return journey the trailer does not incur any RUC distance liability. Occasionally there are opportunities for back-loading where the loaded kms would exceed the unloaded kms but these are relatively rare.

As noted above, the tractor units for B-train and semi-trailer log trucks are not fitted with bolsters and therefore are not included in Table 3. The trailers for these combinations are all semi-trailers which are RUC vehicle types 29 (2-axle) and 33 (3-axle). With the new RUC system (since 2012) it also includes RUC vehicle types 929 and 939. A RUC type 929 vehicle is a type 29 vehicle that is exclusively used as the first trailer of a B-train, while a type 939 vehicle is a type 33 that is exclusively used as the first trailer of a B-train. For convenience of presentation we have included the type 929 trailers with the type 29 trailers and the type 939 trailers with the type 33 trailers. Table 6 shows the results for the two-axle semi-trailer (type 29 and 929) and Table 7 shows the results for the three-axle semi-trailers (type 33 and 939). In both cases the second series of 2013 data is from the 2014 study and is included for comparison.

Table 6. Two-axle semitrailer numbers and distances travelled based on RUC purchase data.

Year	2-axle semi-trailer numbers	2-axle semi-trailer veh-kms (000)	Refund kms (000)	On-highway vehicle-kms (000)	Average vehicle-km (000)	Average on-highway veh-kms (000)
2013	31	981	95	886	31.65	28.58
2014	30	809	34	775	26.97	25.84
2015	22	400	41	359	18.18	16.32
2016	22	259	23	235	11.76	10.70
2013	30	941	84	857	31.37	28.57

Table 7. Three-axle semitrailer numbers and distances travelled based on RUC purchase data.

Year	3-axle semi-trailer numbers	3-axle semi-trailer veh-kms (000)	Refund kms (000)	On-highway vehicle-kms (000)	Average vehicle-km (000)	Average on-highway veh-kms (000)
2013	45	2232	343	1889	49.60	41.99
2014	44	1903	292	1611	43.25	36.61
2015	37	1251	137	1114	33.81	30.10
2016	35	1072	169	903	30.63	25.81
2013	40	2049	342	1707	51.23	42.69

As far as we are aware, two-axle semi-trailers are not used as standalone vehicles for log transport. Thus all of the two-axle semitrailers can be assumed to be part of a B-train. The 2013 and 2014 data show only one of these vehicles as a type 929 vehicle which is a type 29 vehicle being used as a B-train first trailer. The 2015 and 2016 data show none. Thus potentially we might assume that the remaining 2-axle trailers were all B-train second trailers with three-axle first trailers. However, there are also only six type 939 vehicles recorded in 2013, 2015 and 2016 (there were seven in 2014). The reason that there are not more 929 or 939 trailers is that most logging B-trains piggy-back the second trailer when the vehicle is empty and thus the first trailers are not eligible to be licenced as 929 or 939 RUC types because, for approximately half of their travel distance, they travel without having a second trailer attached.

There is not sufficient information available in the data to be able to determine the mix of B-train and semi-trailer combinations. Previous work undertaken for the NZTA in developing the 50MAX concept found that for the general fleet, based on 2012 registration data, 74% of B-train first trailers were 3-axle trailers and 26% were 2-axle trailers. There were also a very small number of 4-axle first trailers. From the Weigh-in-Motion (WIM) data, 26% of B-trains with 3-axle first trailers had 3-axle second trailers and 74% had 2-axle second trailers. If we assume that these proportions also apply to log trucks we can back-calculate estimates of the numbers of B-trains and semi-trailer combinations and the distance travelled by them.

Let us suppose that there are **X** 2-axle B-train first trailers. Then there also will be **X** 2-axle B-train second trailers that are towed by these 2-axle first trailers[1]. Based on the proportions outlined above this means that there will be 74/26 **X** 3-axle B-train first trailers and that 74% of these 3-axle first trailers will be towing 2-axle second trailers. There are no 2-axle semi-trailer combinations in logging, so adding together all the 2-axle semitrailers listed above we find that the total number of 2-axle semitrailers is 4.11**X.** From Table 6 we can determine the value of **X** for each year. The number of 3-axle semitrailer trailers used in B-trains is 74/26 **X** plus 26% which is 3.59**X**. All of the remaining 3-axle semi-trailers will be in semi-trailer combinations. The results of applying this algorithm are shown in Table 8.

A similar calculation can be done using distance travelled rather than vehicle numbers. This becomes slightly more complicated because of the trailer "piggy-backing" practice. B-train second trailers would only be expected to travel half the distance of B-train first trailers. Table 9 shows the results of applying this algorithm to the on-highway distance data. This approach implicitly assumes that each of the B-train configurations travel the same average annual distance as shown in

Table 10 which is calculated directly from Table 8 and Table 9. This assumption is not necessarily correct and, at the detail level, the results shown in Table 9 are unlikely to be correct. However, the total number

[1] It is possible to have a 2-axle first trailer towing a 3-axle second trailer but this configuration is rare. We have assumed that there are none of these in the log transport fleet.

of vehicles and total distance travelled as shown by the last column in the tables should be approximately correct. It is always possible that some of the trailers allocated to B-trains are in fact used in semi-trailer combinations (or vice versa). In this case the number of vehicles increases but the distance travelled by these vehicles does not change and so the average distance per vehicle reduces. Note that in all three tables the 2013 results in the final row are the results from the 2014 study which are included for comparison with the first row.

Table 8. Estimates of numbers of B-trains and semi-trailer combinations.

Year	VEHICLE NUMBERS						
	2-axle semi-trailers	3-axle semi-trailers	B1222 4-axle B-trains	B1232 5-axle B-trains	B1233 6-axle B-trains	A123 3-axle semi-trailers	Tractor units
2013	31	45	7.5	15.8	5.6	18.1	47.0
2014	30	44	7.3	15.4	5.4	17.8	45.9
2015	22	37	5.4	11.4	4.0	17.6	38.4
2016	22	35	5.4	11.4	4.0	15.6	36.4
2013	30	40	7.3	15.4	5.4	13.8	41.9

Table 9. Estimates of total on-highway distance travelled by B-trains and semi-trailer combinations.

Year	TOTAL ANNUAL DISTANCE TRAVELLED (000 kms)						
	2-axle semi-trailers	3-axle semi-trailers	B1222 4-axle B-trains	B1232 5-axle B-trains	B1233 6-axle B-trains	A123 3-axle semi-trailers	Tractor units
2013	886	1889	347	731	257	773	2108
2014	775	1611	304	639	225	635	1802
2015	359	1114	141	296	104	662	1203
2016	235	903	92	194	68	607	961
2013	857	1707	336	707	248	627	1918

Table 10. Estimates of average on-highway distance travelled by B-trains and semi-trailer combinations.

Year	AVERAGE ANNUAL DISTANCE TRAVELLED (000 kms)						
	2-axle semi-trailers	3-axle semi-trailers	B1222 4-axle B-trains	B1232 5-axle B-trains	B1233 6-axle B-trains	A123 3-axle semi-trailers	Tractor units
2013	28.58	41.98	45.96	45.96	45.96	43.12	44.88
2014	25.83	36.61	41.55	41.55	41.55	35.66	39.26
2015	16.32	30.11	26.24	26.24	26.24	37.21	31.32
2016	10.68	25.80	17.18	17.18	17.18	38.45	26.41
2013	28.57	42.68	45.94	45.94	45.94	45.47	45.79

It is noteworthy that the 2015 and 2016 data shows a reduction in the number of B-trains compared to the previous two years and, more significantly, a reduction in the average kms travelled by those B-trains. This suggests that the B-train configuration is becoming even less popular with operators than it already was.

The distance travelled values are for on-highway travel and so this could indicate increased off-highway use of these vehicles or it could indicate that the vehicles are mainly used when demand is high.

There are a number of assumptions made in estimating these B-train and semi-trailer numbers and so the data is not very robust. However, when we compare the figures shown in Table 8, Table 9 and Table 10 with the results for truck and trailer combinations shown in Table 3 we see that the number of B-train and semi-trailer combinations is between 1.7% and 2.4% of the number of the truck-trailer combinations and the annual on-highway distance travelled by these combinations is between 0.6% and 1.3% of that travelled by truck-trailers. These proportions are decreasing over time with the lowest values recorded in 2016. Thus the accuracy of the estimates of the numbers of and distance travelled by B-train and semi-trailer combinations has only a minimal effect on the overall picture of the fleet.

One of the aims of this analysis is to determine the uptake of HPMV vehicles in log transport operations. Vehicles operating above the standard 44 tonne gross combination weight limit are classified as different RUC vehicle types and thus can be readily identified. However, this change of RUC vehicle type applies only to the powered vehicles. The trailer RUCs are unchanged. For this aspect of the analysis of log transport vehicles, this poses a problem for the B-train and semi-trailer combinations because we are not able to extract the RUC data for the powered vehicles in these combinations. As has already been noted, we identify log transport vehicles by the fact that they have been certified for their bolster attachments and this information is recorded in the vehicle registration database. For B-trains and semitrailers, the powered vehicle is a tractor unit which is not fitted with bolsters and hence cannot be identified this way. Thus, although we can determine the overall numbers of B-trains and semi-trailers by using the trailer RUC data, we are unable to distinguish between standard weight vehicles and HPMVs for these combinations because we have no specific information on the tractor units. However, as we have shown above, B-trains and semi-trailers represent only a very small proportion of the total log transport fleet and so not being able to identify the level of HPMV uptake for these particular combinations does not have a significant impact on the overall picture.

For truck and trailer combinations the process is much more straightforward. HPMVs operating at weights above the standard 44 tonne limit are required to purchase the appropriate RUC licence for the truck. These HPMV RUC vehicle types are coded on the basis of both the weight band and the vehicle configuration. The numbers of vehicles purchasing HPMV RUCs are shown in Table 11. Table 12 shows the total on-highway RUC distance purchased by these vehicles and Table 13 shows the average on highway RUC distance per vehicle. From Table 11 we can see that the number of HPMV vehicles has increased very substantially over the four years covered by this analysis with eight times as many vehicles in 2016 as there were in 2013. The growth in vehicle-kms has been similar while the average kms per vehicle has been reasonably constant. There was a dip in 2014 from a high point in 2013 but the 2015 and 2016 figures are similar. Compared to the average for all truck and trailer combinations (Table 3) we can see that the HPMVs' annual travel distances are substantially greater than the average for all vehicles.

Table 11. Number of log transport vehicles purchasing HPMV RUCs.

Year	3-axle truck and 4-axle trailer	4-axle truck and 4-axle trailer			4-axle truck and 5-axle trailer			Total Number of Vehicles
	44t – 48t	44t – 48t	48t – 53t	53t – 58t	44t – 50t	50t – 54t	54t – 58t	
2013		48	24	1	4	8	3	**88**
2014	1	194	36		99	18	5	**353**
2015	1	226	33		224	35	20	**539**
2016	2	236	32		295	112	26	**703**
2013		48	24	1	4	5	3	**85**

Table 12. Annual RUC distance (000s kms) purchased by HPMV log trucks.

Year	3-axle truck and 4-axle trailer	4-axle truck and 4-axle trailer			4-axle truck and 5-axle trailer			Total for all Vehicles
	44t – 48t	44t – 48t	48t – 53t	53t – 58t	44t – 50t	50t – 54t	54t – 58t	
2013		4934.8	2082.9	69.1	136.0	1053.9	158.4	**8435.1**
2014	72.9	17556.6	3284.4		8055.3	2119.9	515.0	**31604.3**
2015	79.0	20180.3	3089.8		20900.1	3700.7	1698.9	**49648.7**
2016	85.9	20771.6	2664.7		28142.1	10889.9	2311.5	**64865.6**
2013		4981.7	2083.2	69.1	144.7	539.3	158.4	**7976.5**

Table 13. Average annual RUC distance (kms) purchased by HPMV log trucks.

Year	3-axle truck and 4-axle trailer	4-axle truck and 4-axle trailer			4-axle truck and 5-axle trailer			Average for all Vehicles
	44t – 48t	44t – 48t	48t – 53t	53t – 58t	44t – 50t	50t – 54t	54t – 58t	
2013		102807	86788	69140	34000	131742	52796	**95854**
2014	72938	90498	91234		81367	117773	103007	**89531**
2015	79003	89293	93631		93304	105733	84945	**92113**
2016	42938	88015	83271		95397	97231	88902	**92270**
2013		103785	86802	69140	36177	107868	52796	**93841**

From the 2016 figures we can see that, in terms of vehicle numbers, HPMVs now represent 32% of the log transport fleet. In terms of annual on-highway distance travelled they represent 40% of the fleet. As the HPMVs carry more payload than the standard vehicles, the proportion of tonne-kms of logs moved by HPMVs is higher still.

The single largest category of HPMVs is the 4-axle truck and 5-axle trailer combination operating at 50 tonnes. This is the 50MAX vehicle. There are also a large number of 4-axle truck and 4-axle trailer combinations operating at 48 tonnes. Both of these configurations also operate at higher weights in smaller numbers. These are likely to be operating on route-specific permits in areas where the relevant Road Controlling Authorities have determined that their infrastructure can cope with HPMV weights.

SUMMARY

The new methodology of using the bolster attachment certification records to identify logging trucks, which has now been used in the last two studies, is more robust than the method previously used.

Combining the analysis of the truck and trailer data with the estimates for B-trains and semi-trailers we get the results for the whole fleet shown in Table 14. To illustrate the growth trends we have plotted this data in Figure 1.

Table 14. Summary of the growth in vehicles numbers and distance travelled.

Year	Number of combination vehicles	Annual on-highway distance (000 kms)	Average on-highway distance per vehicle (000 kms)
2013	1991	159,188	79.96
2014	2144	156,817	73.15
2015	2163	151,616	70.08
2016	2206	163,749	74.22
2013	1957	156500	79.97

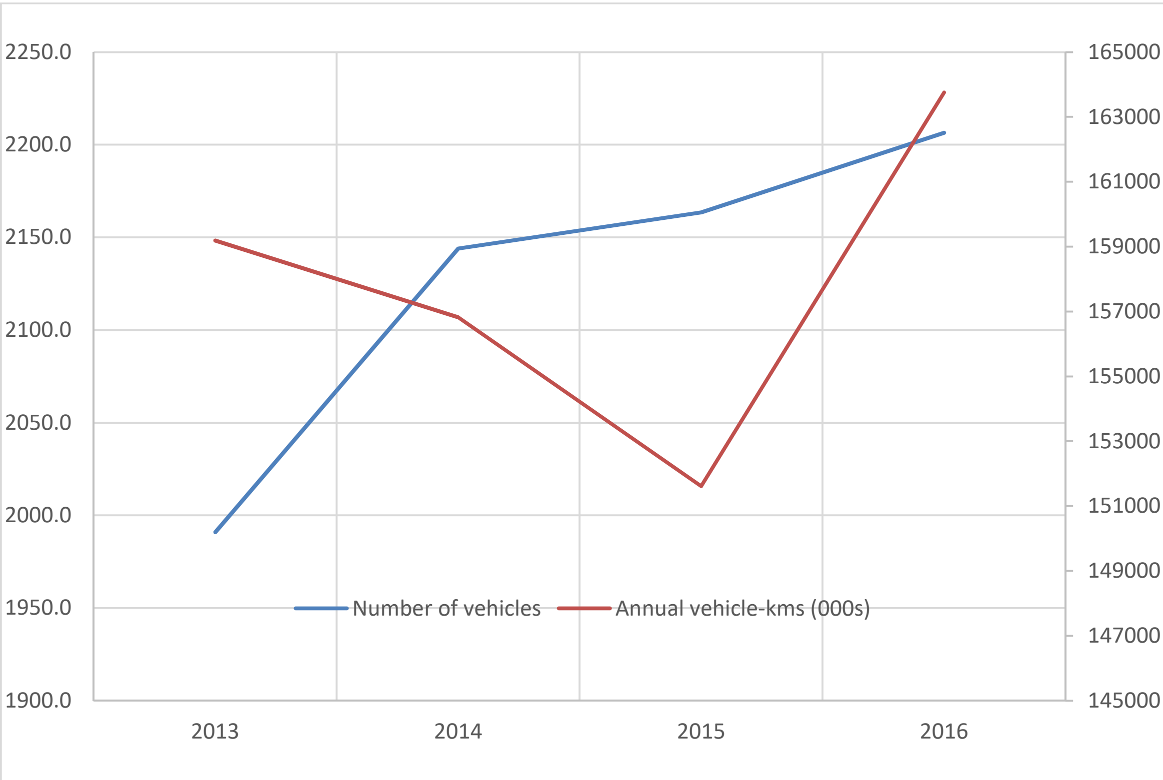

Figure 1. Growth in vehicle numbers and annual distance travelled.

These results are quite interesting. Over the four years covered by the analysis the size of the fleet has grown by 10.7% but the vehicle-kms travelled has only increased by 2.9% so the average kms per vehicle has reduced. In 2015 there was clearly a downturn in the industry with vehicle numbers staying approximately constant and vehicle-kms declining. In 2016, this situation has recovered somewhat with a small increase in vehicle numbers and a significant increase in vehicle-kms, although the average kms per vehicle has not yet returned to 2013 levels.

It is not clear whether this reduction in average kms per vehicle reflects a downturn in the industry or changes in the log transport task or a bit of both. Identifying the causes of this effect would require further and more in depth analysis. For example, if average transport lead distances have been reduced then the vehicles will have spent proportionately more time loading and unloading and less time travelling. This situation would reduce the average kms per vehicle but would result in a greater volume of wood per vehicle being moved. Alternatively, if traffic congestion and congestion at the loading and unloading facilities has increased, then the vehicles would travel less distance but the volumes of wood per vehicle being moved would also decrease. A third possibility is simply that there has been an economic downturn with less demand for log transport resulting in the vehicles operating for fewer hours per week on average.

One of the purposes of this study was to determine the uptake of HPMVs by the log transport industry. The analysis shows a very rapid uptake of these vehicles by the industry. In 2013 only 4.5% of truck and trailer combinations were HPMVs. By 2016 this had risen to 32%. In terms of annual on-highway distance travelled, in 2013 HPMVs represented 5.4% of the truck and trailer total while in 2016 this had risen to 40%. It is also notable that the average annual distance travelled by HPMVs is significantly higher than the average for all vehicles and did not experience the large dip in 2015.

We also should note that although the estimates for the B-trains and semi-trailer combinations have greater uncertainty, these vehicles represent only a very small proportion of the fleet and this proportion is decreasing. Thus the uncertainty in B-train and semitrailer numbers has very little effect on the overall picture of the log transport fleet.