DESIGN TRAFFIC DATA FOR THE NEW ZEALAND SUPPLEMENT TO THE AUSTROADS PAVEMENT DESIGN GUIDE

Transfund New Zealand Research Report No. 76

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EXECUTIVE SUMMARY

As a recently inducted member of AUSTROADS, Transit New Zealand has been adopting the AUSTROADS procedures and documentation where applicable to achieve a consistency of approach to pavement engineering in the Australasian region. An example of this has been the adoption of the AUSTROADS procedures for pavement design in July 1995.

The change in design practices has necessitated the production of a New Zealand supplement to the AUSTROADS pavement design documentation to allow for aspects of the local roading environment that are unique to New Zealand. One example of a unique aspect of pavement design is the determination of design traffic loading.

In the absence of site-specific axle loading data, the AUSTROADS procedures specify mean values of equivalent standard axles for various axle configurations and typical commercial vehicles. The data is presented with respect to the road functional class for each state of Australia. The objective of this project was to recommend the corresponding data for New Zealand.

The methodology adopted for this project had two main components. In the first, practitioners in Transit New Zealand regional offices, major local authorities and the Logging Industry Research Organisation were asked to provide an outline of their current practices in the assessment of traffic loading values. The second, described as the data analysis component of the project, involved the manipulation of raw axle count and loading information, to produce appropriate data in the required form.

The major conclusions of the research project were:

- The adoption of the AUSTROADS pavement design procedures results in a change in the definition of the damaging effect of axles. The change is shown to be relatively minor and a series of elastic analyses indicates that the influence of the design traffic parameter on the design of unbound pavements is only moderate.

- The average percentage of heavy commercial vehicles in the traffic stream varies across the Transit New Zealand regions from about 3% to 7% for urban sites and 8% to 14% for rural sites.

- Analysis of the New Zealand traffic monitoring data indicates that the mean damaging effect of the New Zealand traffic spectrum is generally lower than that found in Australia. The percentage of heavy commercial vehicles is shown to lie generally in the range 6% to 12% depending on the location, and the average load factor per heavy commercial vehicle is approximately 1.0.

- The *grey area* for identifying heavy commercial vehicles in the 5.5 - 11 m vehicle length category of classified counts has been examined. A sensitivity analysis into the proportion of heavy commercial vehicles occurring in this category indicates that a median value of 50% represents a reasonable estimate in the absence of further data.

- The weigh-in-motion data analysed in this project has yielded mean equivalent standard axle values for the four main axle group types and for typical heavy commercial vehicles for four of the seven Transit New Zealand regions. The numerical values are generally lower than the corresponding Australian values, with the states of Queensland and Tasmania providing the most comparable data. The current data suggests that an average load factor of 1 equivalent standard axle per heavy commercial vehicle is appropriate for New Zealand conditions.

- Axle group type distributions obtained from the weigh-in-motion data gives relatively consistent results across the various sites, with the exception of the data from Sulphur Beach. While the Sulphur Beach axle type distribution matches the Australian distribution reasonably well, the other sites all show a lower proportion of single axle types and a higher proportion of tandem axle types when compared with the Australian data.

- The report recommends that further axle weight surveys be carried out, particularly at the locations where there are gaps in the current data, i.e. in the Hamilton, Napier and Dunedin Transit New Zealand regions. Future investigations should also address issues that are outside the scope of the current project, e.g. the significance of the axle type distribution on the appropriate values of the *power law factors*, the influence of wide base single tyres and small diameter tyres, the significance of dynamic loading and the effect of tyre type and inflation pressure.

ABSTRACT

The report presents a background to the design traffic data included in the New Zealand Supplement to the AUSTROADS Guide. Data collected by Transit New Zealand's Weigh-in-motion Stations has been analysed and manipulated to provide New Zealand-based data suitable for inclusion alongside the Australian equivalent provided in Tables E4 and E5 of the Guide.

1. INTRODUCTION

1.1 General

One of the most difficult aspects of highway pavement design using the current mechanistic approach is determining the appropriate design traffic value. Prior to July 1995, engineers involved in pavement design and rehabilitation of state highways in New Zealand followed the procedures described in the Transit New Zealand design document *State Highway Pavement Design and Rehabilitation Manual* (Transit New Zealand 1989), herein after referred to as the TNZ Design Manual. Since that date, Transit New Zealand has adopted the Australian pavement design procedures as described in the document *Pavement Design A Guide to the Structural Design of Road Pavements* (AUSTROADS 1992), herein after referred to as the AUSTROADS Guide.

This change in approach was prompted by the need to develop consistency between the practices in New Zealand and Australia. And to facilitate the adoption of the AUSTROADS Guide in New Zealand, Transit New Zealand produced a supplement (Transit New Zealand 1995) which addresses issues which are unique to New Zealand conditions, e.g. material characterisation, traffic loading and climate. Transit New Zealand launched a project to determine appropriate design traffic data for inclusion in future editions of the New Zealand supplement, and this report presents the results of that project.

1.2 Objectives

The primary objective of this project was to recommend appropriate design traffic data to be included in the New Zealand supplement to the AUSTROADS Guide. In particular, data of the form contained in Tables E4 and E5 of the AUSTROADS Guide has been sought. Table E4 contains values of equivalent standard axles (ESA) per axle group type for each road functional class in each state of Australia. Table E5 contains values of ESA per commercial vehicle, again for each road functional class in each state of Australia. Tables E4 and E5 from the AUSTROADS Guide have been reproduced as Tables 1 and 2. This data was used to determine design traffic values when site specific traffic data was not available.

The parameters for the data presented in Tables E4 and E5 of the AUSTROADS Guide and the data analysed in the current project are slightly different, viz. Transit New Zealand does not specify multiple road classes and the data has been analysed geographically according to each Transit New Zealand region, i.e:

- Auckland
- Hamilton
- Napier

- Wanganui
- Wellington
- Christchurch
- Dunedin

The second objective of this project was to recommend procedures required to extend the quantity of data presently available and to maintain the accuracy of the data in the future.

Table 1 Number of ESAs per axle group type according to state and road functional class (Table E4 from AUSTROADS 1992).

Road Functional Class	Axle Group Type	NSW	VIC	QLD	WA	SA	TAS	ACT	NT
1	SAST	0.6	0.6	0.4	0.5	0.7	0.4	-	0.4
	SADT	0.4	0.5	0.3	0.4	0.4	0.3	-	0.2
	TADT	0.9	0.9	0.7	0.7	0.9	0.6	-	0.7
	TRDT	0.8	0.7	0.6	0.7	0.6	0.4	-	0.6
2	SAST	0.6	0.4	0.4	0.5	0.5	0.4	-	-
	SADT	0.5	0.3	0.3	0.4	0.3	0.3	-	-
	TADT	1.0	0.7	0.7	1.0	0.9	0.9	-	-
	TRDT	0.7	0.4	0.6	0.5	0.6	0.5	-	-
3	SAST	0.6	0.4	0.4	0.5	0.5	0.4	-	0.5
	SADT	0.6	0.4	0.2	0.3	0.3	0.3	-	0.5
	TADT	1.0	0.7	0.7	0.8	0.7	1.1	-	0.8
	TRDT	0.8	0.4	0.5	0.9	0.7	0.8	-	0.6
6	SAST	0.4	0.4	0.3	0.4	0.5	0.3	0.3	-
	SADT	0.4	0.3	0.2	0.3	0.2	0.2	0.2	-
	TADT	1.0	0.6	0.7	1.2	0.8	0.7	0.8	-
	TRDT	0.8	0.4	0.6	0.8	0.6	0.5	-	-
7	SAST	0.6	0.3	0.3	0.3	0.2	0.1	-	-
	SADT	0.6	0.2	0.2	0.2	0.3	0.4	-	-
	TADT	1.6	0.7	0.6	1.2	0.3	1.2	-	-
	TRDT	-	-	-	-	-	-	-	-

Table 2 Average number of ESAs per commercial vehicle according to state and road functional class (Table E5 from AUSTROADS 1992).

Road Functional Class	NSW	VIC	QLD	WA	SA	TAS	ACT	NT
1	1.8	1.9	1.5	1.5	2.0	1.1	-	1.9
2	2.1	1.2	1.1	2.2	1.6	1.4	-	-
3	1.9	1.2	1.2	1.6	1.5	1.6	-	2.5
6	1.9	1.0	1.1	1.5	1.5	0.9	-	-
7	2.7	0.9	0.9	1.2	0.5	0.7	-	-

1.3 Methodology

The project was divided into two main components, *consultancy* and *data analysis*.

The *consultancy* component comprised collating available information on design traffic loading policies and data from the seven Transit New Zealand Regional Offices, major local authorities and the Logging Industry Research Organisation (LIRO). The researcher also attended a meeting with Messrs T. Chelliah and P. Davis of Transit New Zealand to discuss issues associated with the project.

The *data analysis* component comprised manipulation of raw axle count and loading information to produce the appropriate data in the required form. The raw information was sourced from the Traffic Monitoring Group of Transit New Zealand.

2. DESIGN TRAFFIC EVALUATION PROCEDURES AND DEFINITIONS

2.1 Design Traffic Loading

2.1.1 General

If each vehicle using a pavement had the same axle load and configuration the calculation of a design traffic value would be trivial. It would be the number of vehicles per year summed over the design life of the pavement. In reality this is not the case as there are many vehicle types with different axle configurations and loads. To contend with this complication most mechanistic pavement design procedures convert the expected traffic spectrum into a number of equivalent standard axle loads. The magnitude of the damaging effect is proportional to the weight carried on a given axle raised to an appropriate exponent called the *load equivalency exponent.* The value of the load equivalency exponent is the topic of some conjecture in the literature, however it is generally accepted as being 4, hence the so-called *fourth power law* for pavement damage.

The change from the previous Transit New Zealand pavement design method to the AUSTROADS procedure meant that there was a slight change in the way the design traffic was defined. The most obvious change was the name, *equivalent standard axles* (ESA) as opposed to the previously used *equivalent design axles* (EDA). In general the ESA definition results in a higher damaging effect than the EDA definition, except for the single axle dual tyre configuration where the ESA and EDA definitions coincide. Figures 1 to 4 show comparisons of the ESA and EDA definitions for four common axle group configurations.

2.1.2 TNZ Design Manual Procedures

The superseded TNZ Design Manual included a chapter describing the assessment of design traffic. It defines the standard axle as an *equivalent design axle* (EDA) where:

$$EDA = \left[\frac{\text{Weighed Axle Load)}}{\text{(Reference Load)}} \right]^4$$

and, Reference Load = 6.7 t for single tyre axles;
= 8.2 t for dual tyre axles;
= 1.052 times the reference load for an axle in a group of two; and,
= 1.07 times the reference load for an axle in a group of three or more.

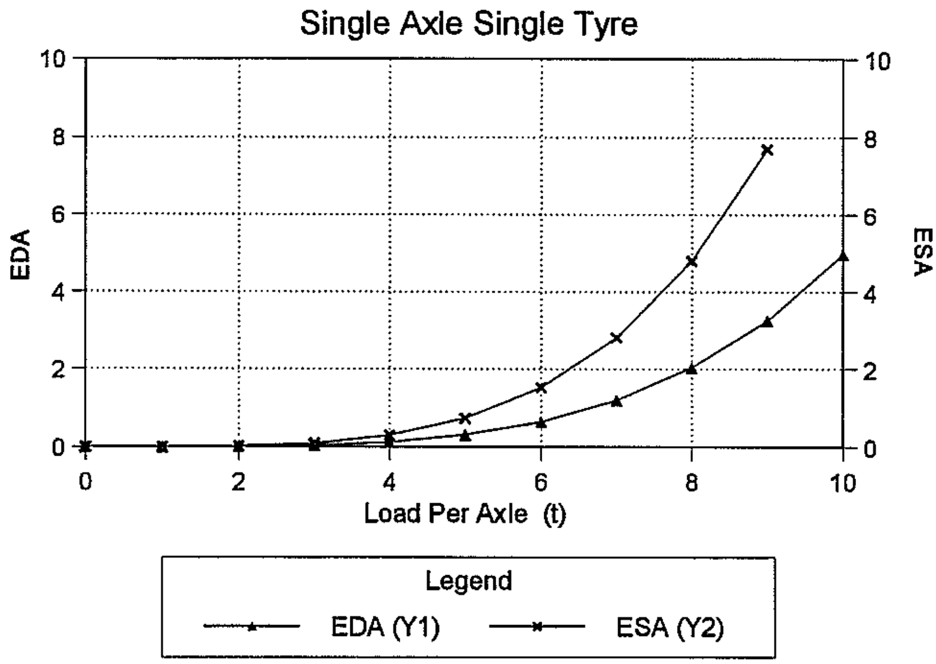

Figure 1 EDA and ESA versus axle load for single axle single tyre configuration.

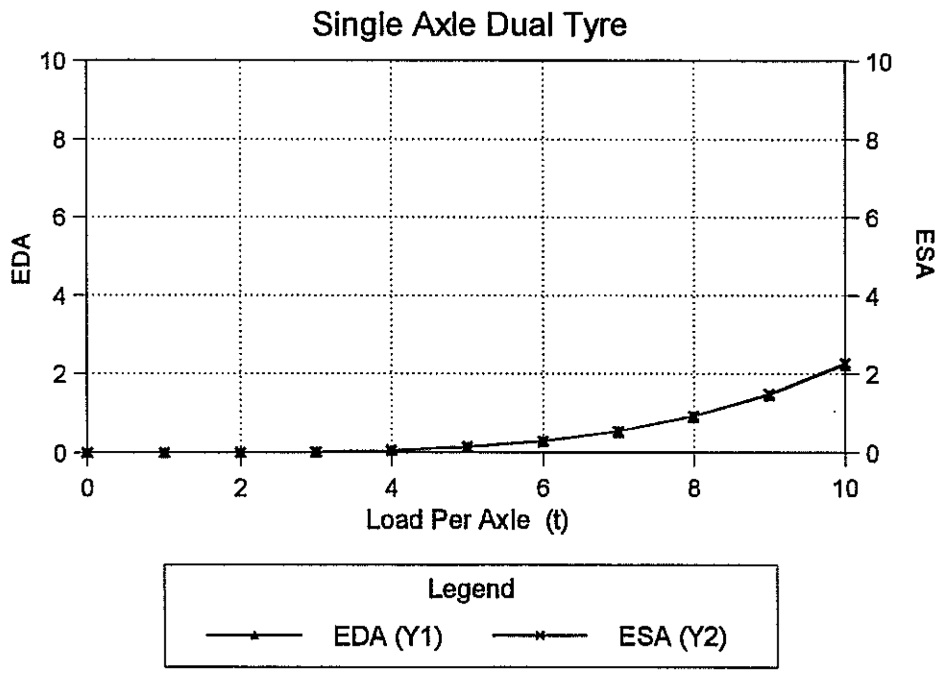

Figure 2 EDA and ESA versus axle load for single axle dual tyre configuration.

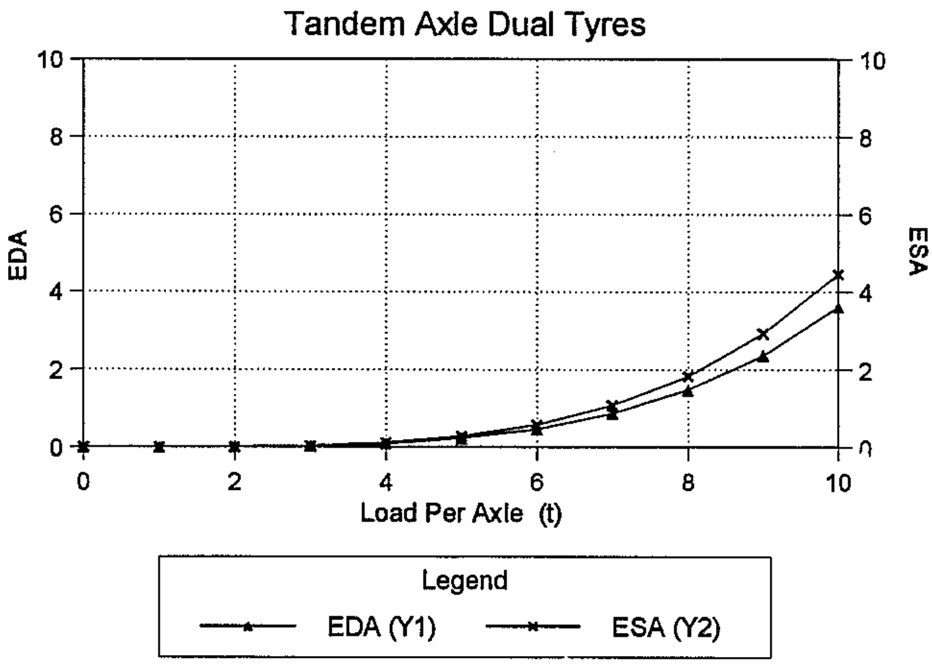

Figure 3 EDA and ESA versus axle load for tandem axle dual tyre configuration.

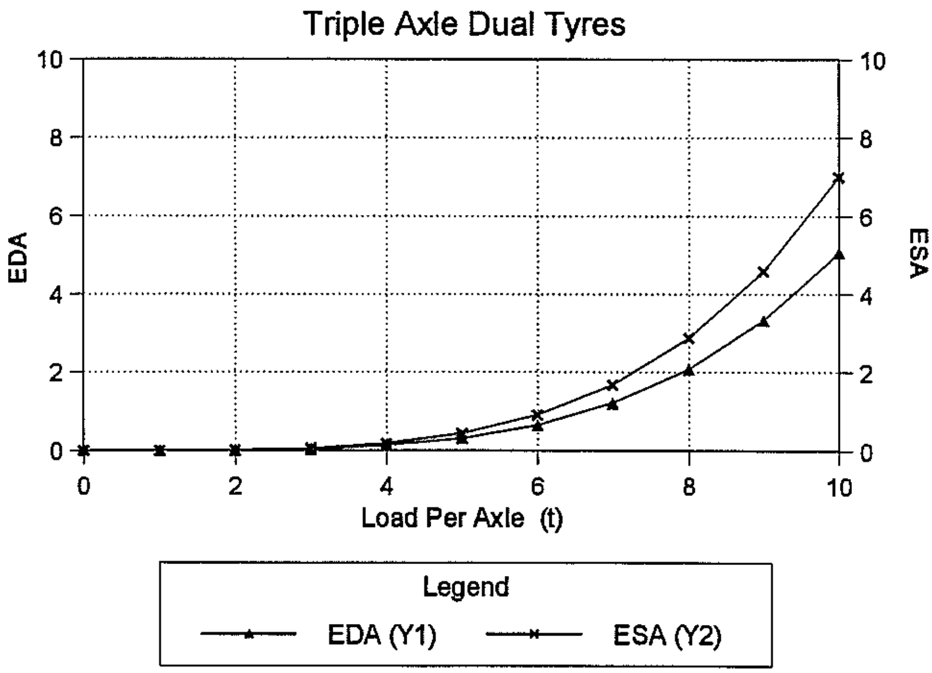

Figure 4 EDA and ESA versus axle load for triple axle dual tyre configuration.

For pavement modelling purposes the EDA was defined as an 8.2 t dual tyre axle with two circular contact areas with radius of 105 mm; constant contact pressure of 580 kPa; and distance between centres of loaded areas of 315 mm.

Two procedures, Method A and Method B were are given for determining the design traffic value. In Method A the designer estimated the total number of heavy commercial vehicles (HCV) travelling in the design lane on an average day. A load factor (EDA per HCV) based on available wheel load and commodity survey data was then applied. The total design traffic was taken as the product of the number of HCV per day multiplied by the average EDA per HCV and the number of days of pavement life required, where the effective number of working days per year is taken was 300. A geometric growth factor could be applied if required.

Method B required load factors to be established for each HCV depending on the commodity being transported. A commodity survey was then carried out and any commodity that contributed 7% or more to the HCV traffic was included in the design traffic calculation. The number of HCV per year and the load factor were multiplied together for each significant commodity. The total EDA per commodity was summed and multiplied by the number of years in the design life with an appropriate allowance made for growth. In using this method the designer had to recognise that certain commodities could be transported over varying time periods within the design life, e.g. the harvest of forest blocks.

2.1.3 AUSTROADS Guide Procedures

Chapter 7 of the AUSTROADS Guide states that the damage due to different axle groups is dependent on the axle spacing, the number of tyres per axle, the load on the group and the type of suspension. Four axle group types are considered:

- Single axle with single tyres (SAST);
- Single axle with dual tyres (SADT);
- Tandem axles with dual tyres (TADT); and,
- Triple axles with dual tyres (TRDT).

The standard axle is defined as an *equivalent standard axle* (ESA) where:

$$ESA = \left[\frac{\text{(Load on Axle Group)}}{\text{(Reference Axle Group Load)}}\right]^4$$

and Reference Axle Group Load = 53 kN for SAST;
= 80 kN for SADT;
= 135 kN for TADT; and,
= 181 kN for TRDT.

For pavement modelling purposes the ESA is defined as comprising an 8.2 t dual tyre axle with two circular contact areas of radius dependent on the contact pressure; constant contact pressure of 550 to 700 kPa; and distance between centres of load of 330 mm.

The AUSTROADS Guide describes a number of methods for calculating design traffic values depending on the type of pavement and the data available. Only Methods 2 and 3 are applicable in this project and they are used for flexible pavements when the following data is available:

- Annual average daily number of axles by type (Method 2).
- Annual average daily traffic (AADT) and percent commercial vehicles (Method 3).

Other definitions from Chapter 7 of the AUSTROADS Guide which are relevant to this project are as follows:

- Tandem axles with dual tyres on one axle and single tyres on the other are treated as tandem dual tyred axles with a 20% weight premium.
- Spread tandem axles (>2.4 m between the axles) are treated as single axles.
- Twin steer axles are considered to be equivalent to tandem axles (both with dual tyres) loaded to a 50% weight premium.

2.2 Vehicles

Both the AUSTROADS Guide and TNZ Design Manual procedures for calculating design traffic values ignore passenger cars and light commercial vehicles as having negligible damaging effect. Hence, only *commercial vehicles* are of interest to the pavement designer. The AUSTROADS Guide defines a commercial vehicle as; *a vehicle having at least one axle with dual wheels and/or having more than two axles.*

Transit New Zealand does not have a unique definition for heavy commercial vehicles, but the one that has been adopted for the analyses carried out in this project is *a vehicle with a manufacturer's gross weight exceeding 3.5 tonnes.*

This is also the legal definition of a heavy motor vehicle in New Zealand. Although the two definitions described above are worded differently, it is considered that they effectively encompass the same spectrum of vehicles. This is important since the weigh-in-motion stations monitored by Transit New Zealand only include vehicles weighing in excess of 3.5 tonnes.

A further set of definitions for heavy commercial vehicles is described in the Transit New Zealand Project Evaluation Manual (Transit New Zealand 1994) as follows:

- *Light Commercial Vehicle (LCV).* Vans, utilities and light trucks up to 3.5 tonnes gross laden weight, powered by petrol or diesel.

- *Medium Commercial Vehicle (MCV).* Two axle diesel powered heavy trucks without a trailer, over 3.5 tonnes gross laden weight.

- *Heavy Commercial Vehicle Type 1 (HCV1).* Diesel powered rigid trucks with or without trailers or articulated vehicle with three or four axles in total.

- *Heavy Commercial Vehicle Type 2 (HCV2).* Diesel powered trucks and trailers and articulated vehicles with or without trailers with five or more axles in total.

- *Buses.* Diesel powered heavy buses (excludes minibuses).

2.3 Road Functional Classes

The AUSTROADS Guide defines a total of nine road functional classes, five rural and four urban. The descriptions of the various classes are presented in Table 3.

At the current time Transit New Zealand does not officially classify its roads, hence there is only a single road class adopted for all analyses in this project. However, in some situations it has been useful to analyse the data with respect to unofficial urban and rural road classifications.

2.4 Influence of Traffic Loading on Pavement Design

It is appropriate to consider the significance of the design traffic parameter on the AUSTROADS pavement design procedures. Figure 5 shows a plot of pavement aggregate depth required versus design traffic loading (ESA) using the AUSTROADS procedures. The results are presented for subgrade elastic modulus (E_{SG}) values ranging from 30 MPa to 150 MPa and aggregate elastic modulus (E_{TOP}) values of 200 MPa, 350 MPa and 500 MPa.

Figure 5 shows that, for the circumstances depicted in the plot, increasing the design traffic by an order of magnitude results in approximately 50 mm extra granular thickness for pavements up to 300 mm deep and approximately 100 mm extra aggregate thickness for pavements greater than 300 mm deep. This observation appears, in practical terms, to be independent of the E_{TOP} value adopted.

Applying the data obtained for Figure 5 to a recent pavement design carried out by the authors gave a good perspective on the sensitivity of the design traffic parameter. In that project the client specified the design traffic parameter as 1.7×10^7 EDA, but for the purpose of this discussion we will assume it to be 1.7×10^7 ESA. Adopting E_{SG} and

Table 3 AUSTROADS definitions of road classes (Table A1 from AUSTROADS 1992).

Rural Areas	
Class 1	Those roads which form the principal avenue for communications between major regions of Australia, including direct connections between capital cities.
Class 2	Those roads not being Class 1, whose main function is to form an avenue of communication for movements: • between a capital city and adjoining states and their capital cities; or • between a capital city and key towns; or • between key towns.
Class 3	Those roads not being Class 1 or 2, whose main function is to form an avenue of communication for movements: • between important centres and the Class 1 and Class 2 roads and/or key towns; or • between important centres; or • of an arterial nature within a town in a rural area.
Class 4	Those roads not being Class 1, 2 or 3, whose main function is to provide access to abutting property (including property within a town in a rural area).
Class 5	Those roads which provide almost exclusively for one activity or function which cannot be assigned to Classes 1, 2, 3 or 4.
Urban Areas	
Class 6	Those roads whose main function is to perform the principal avenue of communication for massive traffic movements.
Class 7	Those roads, not being Class 6, whose main function is to supplement the Class 6 roads in providing for traffic movements or which distribute traffic to local street systems.
Class 8	Those roads not being Class 6 or 7, whose main function is to provide access to abutting property.
Class 9	Those roads which provide almost exclusively for one activity or function which cannot be assigned to Classes 6, 7 or 8.

E_{TOP} values of 50 MPa and 200 MPa respectively, Figure 5 indicates that the depth of aggregate required is 565 mm. If the design traffic value is doubled the depth of aggregate required increases to 610 mm. This equates to an 8% increase in pavement thickness (or cost) to achieve a 100% increase in design traffic. It would therefore be reasonable to conclude that, for unbound pavements at least, the influence of the design traffic value is relatively minor and the designer can afford to use a design traffic value that errs on the conservative side without incurring a significant cost penalty.

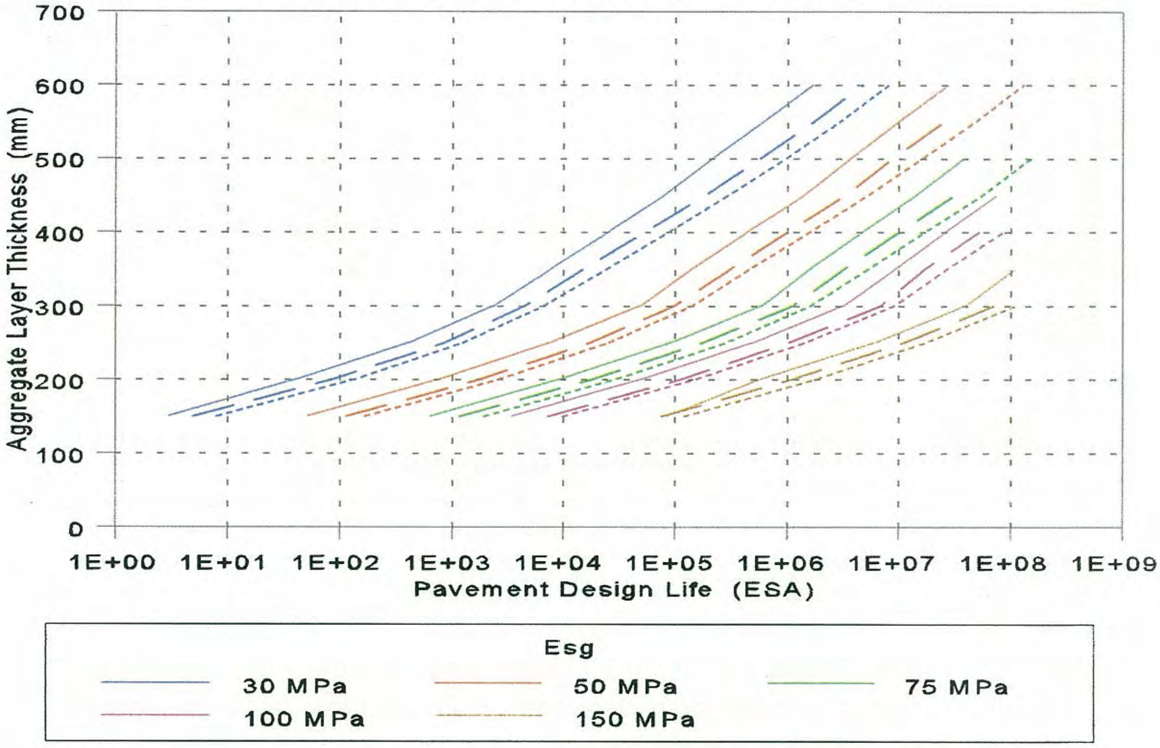

Figure 5 Plot of aggregate layer thickness versus pavement design life with E_{TOP} values of 200 MPa (solid lines), 350 MPa (dashed lines) and 500 MPa (dotted lines).

The data presented in Figure 6 is similar to that shown in Figure 5 except that a 40 mm thick asphaltic concrete surface layer has been added to the pavement structure. The data presented in Figure 6 is based on aggregate with a E_{TOP} value of 350 MPa and asphaltic concrete with an elastic modulus of 1700 MPa. The solid lines on the plot show the performance of the subgrade while the dashed lines show the performance of the asphaltic concrete layer. It is clear that the subgrade performance is similar to that shown in Figure 5, which is to be expected, however, the performance of the asphaltic concrete layer is practically independent of the thickness of the aggregate layer. The asphaltic concrete displays a service life of approximately 10^7 ESA over the full range of aggregate layer thicknesses analysed.

The implication of the data shown in Figure 6 is that if the owner of the road stipulates a set thickness of asphaltic concrete surfacing, they should be aware that depending on the circumstances, the layer will have a unique service life. Therefore, the design traffic parameter should be known with sufficient accuracy to ensure that the service life of the surfacing is not exceeded in practice.

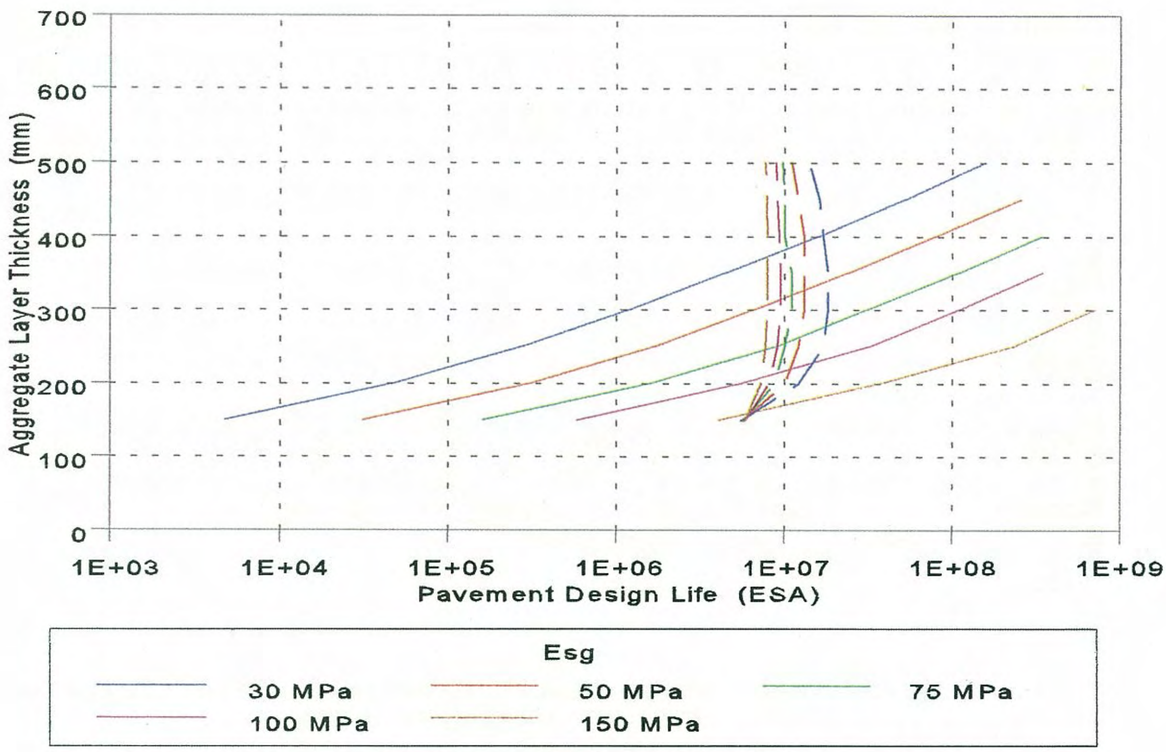

Figure 6 Plot of aggregate layer thickness versus pavement design life with respect to subgrade performance (solid line) and asphaltic concrete performance (dashed line).

3. CONSULTATIONS

One component of the research brief was to consult with the regional offices of Transit New Zealand, major local authorities and the Logging Industry Research Organisation regarding their current practices for determining design traffic values. Letters to this effect were distributed, however responses were only received from Auckland City, Christchurch City Council and Transit New Zealand's Auckland and Napier offices.

3.1 Auckland City

Auckland City generally uses a similar approach to Method 3 of the AUSTROADS Guide for calculating design traffic values, i.e. they assume a certain percentage of commercial vehicles and apply an average ESA for various commodities.

The City's roads are classified as follows:

- Arterial Servicing The Port - 20% To 25% HCV;
- Arterial - 15% HCV;
- Collector - 12% HCV; and
- Local - 6% HCV.

The load factors for various commodities are generally taken as those values presented in the TNZ Design Manual, viz.

- Sheep - 1.26 EDA/HCV;
- Logs - 1.34 EDA/HCV;
- Liquid fuels - 0.64 EDA/HCV;
- Frozen foods - 0.78 EDA/HCV;
- Buses - 0.23 EDA/HCV; and,
- Others - 0.18 EDA/HCV.

3.2 Christchurch City Council

The current Christchurch City Council practice is to use the TNZ Design Manual procedures for determining the design traffic but then to *factorise* the design to allow for instances where poor drainage conditions prevail. This provides good results in terms of pavement performance and construction and maintenance costs. It is noted that the

AUSTROADS Guide allows for the design traffic value to be multiplied by an appropriate factor (generally up to 4.0) to allow for uncertainties in the design traffic data.

3.3 Transit New Zealand Auckland Regional Office

The response from Transit New Zealand's Auckland office came from Duffill Watts and King Ltd (Whangarei) who have acted as consulting engineers on Transit New Zealand's behalf on a number of pavement construction and rehabilitation projects. The methodology comes from a paper by Wanty (1991) who reported that the annual average load factor for three and four axle vehicles was 0.3 and for vehicles with five or more axles the value was 2.8. The data was taken from three sites: Drury, Pukerua Bay and Waipara.

The two definitions of "heavy commercial vehicle" used by Duffill Watts and King Ltd correspond to the classifications HCV1 and HCV2 in the Transit New Zealand Project Evaluation Manual. The distribution of HCV1 and HCV2 vehicles is taken as 4% and 5% respectively.

3.4 Transit New Zealand Napier Regional Office

Transit New Zealand Napier use weigh-in-motion results from the Drury, Pukerua Bay and Waipara sites to obtain EDA data by vehicle classification. They also use portable traffic counting devices to carry out both classified and unclassified monitoring for AADT data.

The load factors adopted in the Napier region are as follows:

- 2 axle heavy vehicles - 0.3 EDA/HCV;
- 3 or 4 axle heavy vehicles - 0.5 EDA/HCV;
- 5 or 6 axle heavy vehicles - 1.1 EDA/HCV; and,
- 7 or more axle heavy vehicles - 1.4 EDA/HCV.

The response from Transit New Zealand Napier acknowledged the significant potential for inaccuracies to occur in the data due to the small number of permanent weigh-in-motion sites in New Zealand. These inaccuracies are compounded by inconsistent data from the weigh-in-motion sites currently in use. This is demonstrated by the differences in the data obtained from Transit New Zealand's Napier and Auckland offices.

4. DATA ACQUISITION AND ANALYSIS

4.1 Monitoring Sites and Equipment

The Transit New Zealand Traffic Monitoring Group administered a number of traffic monitoring sites located throughout the state highway network. The sites included five permanent weigh-in-motion facilities and over sixty classified count stations. All had telemetry links to the Transit New Zealand head office in Wellington.

A large number of other sites were monitored for AADT data on a rostered basis but they did not incorporate telemetry links and they were not been used to provide data for this project.

The locations of the sixty six traffic monitoring sites used in this project are detailed in Appendix A (Table A1). Of particular interest were the five weigh-in-motions sites at Sulphur Beach (Auckland Harbour Bridge); Drury; Ohakea; Pukerua Bay; and Waipara (temporarily out of commission at the time of writing).

All of the weigh-in-motion sites comprised PAT DAW200 devices except the Ohakea site which used ARRB CULWAY equipment. The accuracy of the PAT DAW200 equipment was guaranteed to be within ±8% but levels of accuracy of about ±3% had been recorded at the Drury site (Clouston and Wanty 1994). The CULWAY equipment used a different type of weight measuring sensor and it was accurate to about ±15%. The Transit New Zealand Traffic Monitoring Group investigated the reliability and accuracy of the Pukerua Bay site and concluded that the DAW200 equipment was functioning well, but if there were errors it tended to overweigh the two axle vehicles and underweigh many of the three axle vehicles. These errors may have been due to a small component of dynamic loading due to pavement roughness and therefore are not considered to be significant.

4.2 Analysis of Traffic Data

4.2.1 Classified Count Site Data

The classified traffic count data from sixty traffic monitoring sites has been analysed to determine the mean percentage of heavy commercial vehicles (HCV) in each of the seven Transit New Zealand regions. In addition, the monitoring sites have been classified in terms of their location being either *urban* or *rural*. The data comprises the average number of vehicles per day falling into each of four vehicle length classifications, i.e. 0 to 5.5 m, 5.5 m to 11 m, 11 m to 17 m and greater than 17 m. The data has been averaged over the 1995 year, except for four sites where the April 1996 data was used because the 1995 data was considered to be unreliable.

The data is plotted in Figure 7 and tabulated in Appendix B (Tables B1 and B2). In analysing the data it is clear that all vehicles in the 11 m to 17 m and greater than 17 m length classifications are HCV and that all vehicles in the 0 to 5.5 m classification are not HCV. However, the 5.5 m to 11 m classification is a *grey area* because it could include both rigid trucks and passenger cars or vans towing trailers or caravans. Whilst the rigid trucks would generally be classified as HCV, the cars and vans towing trailers and caravans would not. The proportion of HCV in the 5.5 m to 11 m classification is estimated to be about 40% to 60%, with 50% considered to be a reasonable approximation.

A summary of the results for the percentage of HCV for each Transit New Zealand region with 40%, 50% and 60% HCV in the 5.5 to 11 m vehicle length category is presented in Table 4.

Table 4 Summary of mean % HCV data analysed for sixty classified count sites.

TNZ Region	**% HCV**					
	With 40% HCV in 5.5-11m Category		**With 50% HCV in 5.5-11m Category**		**With 60% HCV in 5.5-11m Category**	
	Urban	Rural	Urban	Rural	Urban	Rural
Auckland	5.75	8.09	6.42	8.83	7.08	9.58
Hamilton	5.29	10.40	5.82	11.23	6.35	12.05
Napier	5.59	11.93	6.24	12.90	6.90	13.87
Wanganui	3.16	9.12	3.67	9.82	4.18	10.52
Wellington	3.11	11.61	3.55	12.56	3.98	13.51
Christchurch	4.51	10.09	5.17	10.99	5.84	11.89
Dunedin	2.75	8.27	3.14	9.13	3.53	9.99
National Mean	**4.31**	**9.93**	**4.86**	**10.78**	**5.41**	**11.63**

Data from four weigh-in-motion sites has been analysed to determine the actual % HCV (i.e. gross weight greater than 3.5 t). Comparing the data with the mean values presented in Table 4 allows an estimate of the percentage of HCV in the "grey area" to be made. The results are presented in Table 5.

Considering the data presented in Tables 4 and 5, the mean proportion of HCV in the traffic spectrum varies from approximately 6% to 12% depending on the location and on the percentage of HCV falling within the 5.5 m to 11 m length category. The analysis indicates that the proportion of HCV in the rural traffic stream is approximately double that for the urban traffic stream.

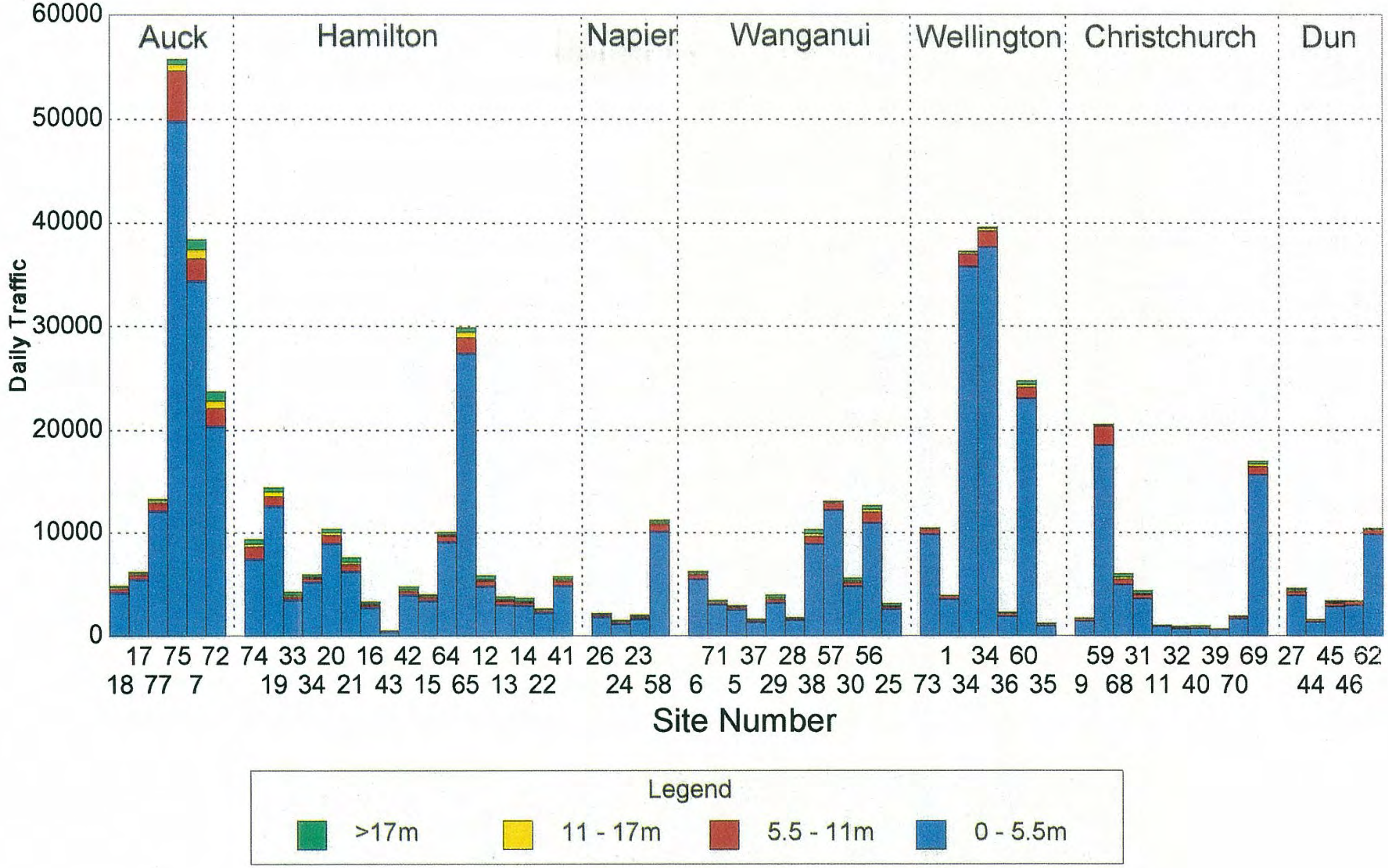

Figure 7 Daily Traffic from 60 monitoring sites, sorted by vehicle length.

Table 5 Actual % HCV data from four weigh-in-motion sites.

Weigh-In-Motion Site	% HCV	Estimated % HCV in 5.5 - 11m Length Category
Drury (SB)	8.8	> 60
Ohakea (NB)	9.2	Approx 55
Pukerua Bay	5.8	< 40
Waipara	8.5	< 40

4.2.2 Weigh-In-Motion Site Data

4.2.2.1 Analysis by Axle Configuration Type

Data from the five weigh-in-motion sites has been analysed to determine the average ESA values for each of the following axle group types:

- SAST
- SADT
- TADT
- TRDT

The following weigh-in-motion data has been used in the analysis:

- Sulphur Beach 1995 (347 days), 1996 (189 days);
- Drury SB 1994 (175 days), 1995 (364 days), 1996 (144 days);
- Ohakea 1995 (361 days), 1996 (199);
- Pukerua Bay 1994 (81 days), 1995 (255 days), 1996 (121 days); and,
- Waipara 1994 (126 days).

A summary of the results is presented in Table 6 and full tabulations of the data are included in Appendix C (Tables C1 to C11).

The mean values of ESA per axle group type with respect to Transit New Zealand region are presented in Table 7 for the complete set of records. The analysis indicates that axle loading is reasonably consistent across the regions, although Auckland generally shows a slightly higher ESA value for the TADT configuration. Note that only four regions are currently represented. Monitoring in the remaining regions will be required to complete the data set.

Table 6 Average ESA per axle group type recorded at the five weigh-in-motion sites.

Site	**TNZ Region**	**Year**	**Days of Record**	**Mean ESA Per Axle Group Type**			
				SAST	SADT	TADT	TRDT
Sulphur Beach	Auckland	1995	347	0.4	0.2	0.6	0.5
		1996	189	0.3	0.2	0.6	0.5
Drury SB	Auckland	1994	175	0.5	0.2	0.4	0.5
		1995	364	0.4	0.2	0.4	0.4
		1996	144	0.5	0.2	0.4	0.4
Ohakea	Wanganui	1995	361	0.5	0.2	0.3	0.3
		1996	199	0.5	0.2	0.3	0.4
Pukerua Bay	Wellington	1994	81	0.3	0.2	0.3	0.3
		1995	255	0.4	0.2	0.3	0.4
		1996	121	0.4	0.2	0.3	0.4
Waipara	Christchurch	1994	126	0.4	0.3	0.3	0.5

Table 7 Average ESA per axle group type with respect to Transit New Zealand region.

TNZ Region	**Mean ESA Per Axle Group Type**			
	SAST	SADT	TADT	TRDT
Auckland	0.4	0.2	0.5	0.5
Hamilton	-	-	-	-
Napier	-	-	-	-
Wanganui	0.5	0.2	0.3	0.4
Wellington	0.4	0.2	0.3	0.4
Christchurch	0.4	0.3	0.3	0.5
Dunedin	-	-	-	-

4.2.2.2 Analysis of Mean ESA Per HCV

The data described in Section 4.3.1 has been analysed in terms of all HCV recorded at the weigh-in-motion sites. The results are summarised in Table 8.

Table 8 Mean ESA per HCV recorded at the five weigh-in-motion sites.

Site	TNZ Region	Year	Days of Record	Mean ESA Per HCV
Sulphur Beach	Auckland	1995	347	0.8
		1996	189	0.8
Drury SB	Auckland	1994	175	1.2
		1995	364	1.1
		1996	144	1.1
Ohakea	Wanganui	1995	361	1.0
		1996	199	1.1
Pukerua Bay	Wellington	1994	81	0.7
		1995	255	0.9
		1996	121	0.8
Waipara	Christchurch	1994	126	1.1

The mean values of ESA per HCV with respect to Transit New Zealand region are presented in Table 9 for the complete set of records. Note that only four regions are currently represented. Further monitoring in the remaining regions will be required to complete the data set.

Table 9 Average ESA per HCV with respect to Transit New Zealand region.

TNZ Region	Mean ESA Per HCV
Auckland	1.0
Hamilton	-
Napier	-
Wanganui	1.1
Wellington	0.8
Christchurch	1.1
Dunedin	-

The data in Table 9 suggests that a mean load factor (ESA per HCV) of 1.0 is suitable on a nationwide basis. This level of accuracy is considered to be appropriate at the current time, or at least until further data can be obtained and analysed.

A comparison between the traffic loading data used by the Australian states and the corresponding data obtained in this project for New Zealand can be obtained by examining Tables 1 and 2, and Tables 7 and 9. These tabulations indicate that the proposed New Zealand traffic loading data is generally lower than the Australian data. The Australian states of Queensland and Tasmania appear to have traffic loading conditions closest to that occurring in New Zealand.

4.2.2.3 Axle Group Type Distribution

In the AUSTROADS pavement design procedures the performance criteria used to characterise the response of the subgrade, asphaltic concrete and cemented components of the pavement are raised to exponents of 7.14, 5 and 18 respectively. However, a fourth power relationship is used to characterise the damaging effect of the applied axle loads. To account for this discrepency a power law factor (F_P) is used. The values of the power law factors are:

- F_P = 1.1 (subgrade)
- F_P = 1.1 (asphaltic concrete)
- F_P = 20 (cemented materials)

The power law factor is dependent on the distribution of the various axle group types in the traffic stream. Table 10 presents the axle group distribution adopted in the AUSTROADS Guide for the calculation of the power law factors and provides a comparison with the axle group distributions determined from the weigh-in-motion sites used in the current project.

Table 10 Axle group distribution data used in the AUSTROADS Guide and corresponding data from New Zealand weigh-in-motion sites.

Site	**Distribution by Axle Group**			
	SAST	SADT	TADT	TRDT
Sulphur Beach	42%	34%	21%	3%
Drury SB	34%	21%	37%	8%
Ohakea	34%	18%	40%	8%
Pukerua Bay	35%	24%	34%	7%
Waipara	31%	22%	42%	6%
AUSTROADS Guide	43%	32%	18%	7%

Table 10 shows that the axle group distribution adopted in the AUSTROADS Guide is relatively close to that measured at the Sulphur Beach monitoring site with the exception of the TRDT axle group category. The other monitoring sites give reasonably consistent distributions within New Zealand, with the proportion of single axles being low, and the proportion of tandem axles being high, when compared with the Australian data.

The differences between the Sulphur Beach axle distribution and those found for the remainder of the New Zealand sites are considered to be due to the Sulphur Beach site being located in an urban environment whereas the others are in rural or rural/urban fringe settings. This result is expected since the urban heavy traffic distribution includes a relatively high number of delivery type vehicles, whereas the rural heavy traffic distribution comprises a high proportion of long haul, bulk cartage type vehicles.

5. RECOMMENDATIONS

It is clear from Tables 7 and 9 that the information pertaining to this project is currently incomplete. There is a requirement for axle weight data to be obtained for the Hamilton, Napier and Dunedin regions. This may be achieved by the establishment of permanent weigh-in-motion sites, however it is understood that the cost of the equipment and installation is in the order of $250,000 per site. This cost may be prohibitive given that highway pavement design is not an exact science and the accuracy of the input data should coincide with the level of uncertainty of the other parameters, especially considering that the significance of the design traffic value is only moderate (see Figure 5).

An acceptable solution may be obtained by weighing random samples of HCV using portable axle weighing equipment. This option would be significantly cheaper than establishing permanent monitoring sites and would give the flexibility to monitor traffic where and when required.

Although data has been derived for the Auckland, Wanganui, Wellington and Christchurch regions it is only based on one monitoring site in each region, except Auckland which has two sites. It would be beneficial to monitor axle weights at other locations to investigate the variability of loadings within the regions. This would also provide a better statistical basis for the data in general.

Periodic updates of the data determined in this project on, say, an annual or biannual basis would help to maintain the accuracy and completeness of the data. This would also allow any growth trends to be identified and appropriate strategies to be implemented so that the integrity of the state highway pavements and bridges can be assured. In addition, all future analyses should be carried out with reference to the Transit New Zealand National Traffic Database (Transit New Zealand 1996).

The data presented in Table 10 indicates that the rural heavy traffic in New Zealand comprises an axle group type distribution which is slightly different than that adopted in the AUSTROADS Guide. This may influence the values of the power law factors appropriate for New Zealand, however this is beyond the scope of the current investigation. A future project should be established to investigate this matter in further detail.

Future traffic monitoring projects should also investigate issues such as the use of single wide base tyres, small diameter tyres, central tyre pressure systems and dynamic loading effects.

6. CONCLUSIONS

The following conclusions have been drawn from the review of ESA/EDA issues and the analysis of classified count and weigh-in-motion data carried out in this project:

- The adoption of the AUSTROADS Guide for use in New Zealand requires that the design traffic be expressed in terms of *equivalent standard axles* (ESA) rather than the previously used *equivalent design axles* (EDA).

- Comparison of the definitions of EDA and ESA indicates that the latter predicts a slightly greater damaging effect for SAST, TADT and TRDT axle configurations, but the two definitions coincide for the SADT axle configuration.

- A limited response was obtained from major local authorities and Transit New Zealand regional offices regarding the procedures used for determining the design traffic parameter. Method 3 of the AUSTROADS Guide appears to be the generally accepted procedure.

- An investigation using multi-layer elastic modelling carried out in this project suggests that the influence of the design traffic parameter on the design of unbound pavements is only moderate. Hence, the accuracy of the design traffic value must be kept in perspective considering the level of accuracy of the other input parameters and the mechanistic procedure itself.

- The percentage of HCV in the traffic spectrum varies across the Transit New Zealand regions from approximately 3% to 7% for urban sites and 8% to 14% for rural sites.

- The significance of the *grey area* in the 5.5 - 11 m vehicle length category is relatively low assuming that the percentage of HCV in this category generally lies in the range 40% to 60%. A median value of 50% is therefore considered to be reasonable but this value should be verified on a regular basis.

- The weigh-in-motion data analysed in this project has yielded mean ESA values for the four main axle group types and for typical HCV for four of the seven Transit New Zealand regions. The numerical values are generally lower than the corresponding AUSTROADS values, with the states of Queensland and Tasmania providing the most comparable data. The analysis of the currently available data suggests that an average ESA per heavy vehicle of 1.0 is appropriate for New Zealand.

- The axle group type distributions obtained from the weigh-in-motion data gives relatively consistent results across the various sites, with the exception of the data from Sulphur Beach. The Sulphur Beach site is however located in an urban setting whereas the other sites are rural or rural/urban fringe. While the Sulphur Beach axle type distribution matches the Australian distribution reasonably well, the other sites all show a lower proportion of single axle types and a higher proportion of tandem axle types when compared with the Australian data.

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APPENDIX A

Transit New Zealand Traffic Monitoring Sites

Table A1 Transit New Zealand traffic monitoring sites.

Site No.	Highway	Route Position	Location	Analyser
1	2	931/6.010	Rimutaka	GR Mk3
3	1N	979/8.260	Ngauranga S/B	GR M660
4	1N	979/8.260	Ngauranga N/B	GR M660
5	3	352/18.000	Waitotara	GR Mk3
6	3	258/9.190	Tariki	GR Mk3
7	1N	355/11.406	Drury - Park Estate	GR Mk3
9	1S	138/6.260	Kaikoura	GR Mk3
11	73	52/12.520	Springfield	GR Mk3
12	29	24/10.390	Kaimai	GR M660
13	2	189/13.900	Ohinepanea	GR Mk3
14	33	17/12.500	Paengaroa	GR Mk3
15	5	30/4.070	Tarukenga	GR M660
16	3	84/1.900	Te Kuiti	AVC100
17	1N	237/2.977	Wellsford	GR Mk3
18	1N	96/14.636	Kawakawa	GR Mk3
19	1N	428/7.030	Taupiri	GR Mk3
20	1N	486/5.710	Karapiro	GR M660
21	1N	518/13.400	Lichfield	GR Mk3
22	30	170/17.430	Lake Rotoma	GR Mk3
23	5	220/10.170	Te Pohue	GR Mk3
24	2	626/1.270	Tangoio	GR M660
25	2	751/4.303	Norsewood	GR Mk3
26	2	416/11.640	Ormond	GR Mk3
27	1S	763/2.000	Milton	GR Mk3
28	4	223/3.630	Upokongaro	GR Mk3
29	1N	728/11.640	Hihitahi	GR Mk3
30	3	474/15.690	Manawatu Gorge	GR Mk3

31	1S	516/6.000	St Andrews	GR Mk3
32	7	98/9.630	Lewis Pass	GR Mk3
33	27	0/12.470	Kaihere	AVC100
34	2	73/17.470	Waihi	GR Mk3
35	6	225/10.940	Murchison	GR Mk3
36	6	99/1.200	Hira	GR Mk3
37	4	127/8.370	Horopito	GR Mk3
38	1N	845/3.400	Sanson	GR Mk3
39	6	388/10.240	Punakaiki	GR Mk3
40	7	239/1.070	Ahaura	GR Mk3
41	5	56/1.180	Waipa	GR M660
42	1N	639/2.500	Halletts Bay	GR Mk3
43	32	69/4.700	West Lake Taupo	GR Mk3
44	8	328/8.000	Alexandra	GR Mk3
45	1S	854/0.310	Gore	GR Mk3
46	6	1145/2.160	Winton	GR Mk3
47	1N	953/4.890	Pukerua Bay	DAW 200
48	1N	369/2.239	Drury	DAW 200
50	1N	326/3.732	Sulphur Beach	DAW 200
52	1S	-	Waipara	DAW 200
54	1N	845/2.380	Ohakea N/B	CULWAY
55	1N	326/5.870	Auckland Harbour Bridge	GR Mk3
56	1N	903/3.480	Ohau Overbridge	GR Mk3
57	56	0/3.230	Palmerston North	GR M660
58	50	3/7.300	Napier South	GR M660
59	74	0/7.800	Cranford St, Christchurch	GR M660
60	6	116/6.600	Stoke	GR M660
62	1S	920/2.270	Invercargill	GR M660
64	30	30/0.210	Te Ngae	GR Mk3

65	2	140/1.400	Te Puna	GR Mk3
68	1S	381/7.700	Dunsandel	GR M660
69	1S	501/4.310	Evans St, Timaru	GR M660
70	6	445/9.230	Chesterfield	GR M660
71	45	97/4.130	Hawera	GR M660
72	1N	369/12.796	Bombay	GR M660
73	58	0/8.780	Belmont	GR M660
74	2	0/2.470	Mangatawhiri	GR M660
75	1N	338/4.720	McNabb St, Ellerslie	GR M660
77	1N	288/2.900	Hadfields Beach	AVC100

APPENDIX B

Classified Count Data

Table B1 Classified count information - urban state highways (1995 data).

Site	H'way	Location	AADT By Vehicle Length Classification					% HCV 100% > 11m Length + x% in 5.5-11m Length Class				
			0 - 5.5m	5.5 - 11m	11 - 17m	> 17m	All	x = 0	x = 40	x = 50	x = 60	x = 100
77	1	Hatfields Beach (1)	12171	787	162	170	13290	2.50	4.87	5.46	6.05	8.42
75	1	Ellerslie (NB)	49833	4777	637	493	55740	2.03	5.46	6.31	7.17	10.60
7	1	Drury	34431	2119	879	931	38360	4.72	6.93	7.48	8.03	10.24
Auckland Region (Urban Sites)								*3.08*	*5.75*	*6.42*	*7.08*	*9.75*
64	2	Te Puna	9190	563	130	188	10071	3.16	5.39	5.95	6.51	8.75
65	30	Rotorua East	27418	1505	545	401	29869	3.17	5.18	5.69	6.19	8.21
Hamilton Region (Urban Sites)								*3.16*	*5.29*	*5.82*	*6.35*	*8.48*
58	50	Napier South	10158	738	134	198	11228	2.96	5.59	6.24	6.90	9.53
Napier Region (Urban Sites)								*2.96*	*5.59*	*6.24*	*6.90*	*9.53*
57	56	Palmerston North	12276	673	70	74	13093	1.10	3.16	3.67	4.18	6.24
Wanganui Region (Urban Sites)								*1.10*	*3.16*	*3.67*	*4.18*	*6.24*
73	58	Belmont (1)	9907	456	55	38	10456	0.89	2.63	3.07	3.51	5.25
1	2	Rimutaka	3578	241	39	44	3902	2.13	4.60	5.22	5.83	8.30
3,4	1	Ngauranga	35826	1198	165	74	37263	0.64	1.93	2.25	2.57	3.86
3,4	2	Ngauranga	37698	1515	258	98	39569	0.90	2.43	2.81	3.20	4.73
60	6	Nelson	23111	1025	238	334	24708	2.32	3.97	4.39	4.80	6.46
Wellington Region (Urban Sites)								*1.37*	*3.11*	*3.55*	*3.98*	*5.72*
59	74	Christchurch City	18564	1813	140	30	20547	0.83	4.36	5.24	6.12	9.65

69	1	Timaru	15721	764	214	271	16970	2.86	4.66	5.11	5.56	7.36
Christchurch Region (Urban Sites)								*1.84*	*4.51*	*5.17*	*5.84*	*8.51*
62	1	Invercargill	9881	410	79	43	10413	1.17	2.75	3.14	3.53	5.11
Dunedin Region (urban Sites)								*1.17*	*2.75*	*3.14*	*3.53*	*5.11*
National (Urban Sites)								*2.10*	*4.31*	*4.86*	*5.41*	*7.62*

Note (1) : April 1996 data used due to 1995 data being unreliable.

Table B2 Classified count information - rural state highways (1995 data).

Site	H'way	Location	AADT By Vehicle Length Classification					% HCV 100% > 11m Length + x% in 5.5-11m Length Class				
			0 - 5.5m	5.5 - 11m	11 - 17m	> 17m	All	x = 0	x = 40	x = 50	x = 60	x = 100
18	1	Kawakawa	4218	396	88	130	4832	4.51	7.79	8.61	9.43	12.71
17	1	Wellsford	5520	447	110	141	6218	4.04	6.91	7.63	8.35	11.23
72	1	Bombay	20457	1657	672	931	23717	6.76	9.55	10.25	10.95	13.75
Auckland Region (Rural Sites)								*5.10*	*8.09*	*8.83*	*9.58*	*12.56*
74	2	Mangatawhiri	7532	1134	258	428	9352	7.34	12.19	13.40	14.61	19.46
19	1	Taupiri	12642	920	428	403	14393	5.77	8.33	8.97	9.61	12.17
33	1	Kaihere (1)	3512	285	141	303	4241	10.47	13.16	13.83	14.50	17.19
34	2	Waihi	5240	409	108	173	5930	4.74	7.50	8.19	8.88	11.64
20	1	Karapiro	8996	770	237	381	10384	5.95	8.92	9.66	10.40	13.37
21	1	Lichfield	6317	625	207	441	7590	8.54	11.83	12.65	13.48	16.77
16	3	Te Kuiti	2748	264	94	180	3286	8.34	11.55	12.36	13.16	16.37
43	32	West Lake Taupo	435	45	4	8	492	2.44	6.10	7.01	7.93	11.59
42	1	Halletts Bay	3994	345	128	288	4755	8.75	11.65	12.38	13.10	16.00
15	5	Tarukenga	3451	298	127	114	3990	6.04	9.03	9.77	10.52	13.51
12	29	Kaimai	4855	526	125	325	5831	7.72	11.33	12.23	13.13	16.74
13	2	Ohinepanea (1)	3024	387	97	280	3788	9.95	14.04	15.06	16.08	20.17
14	33	Paengaroa	2969	320	117	238	3644	9.74	13.25	14.13	15.01	18.52
22	30	Lake Rotoma	2297	203	39	66	2605	4.03	7.15	7.93	8.71	11.82

41	5	Waipa	4882	461	155	237	5735	6.84	10.05	10.85	11.66	14.87
Hamilton Region (Rural Sites)								*7.11*	*10.40*	*11.23*	*12.05*	*15.35*
26	2	Ormond	1844	203	40	81	2168	5.58	9.33	10.26	11.20	14.94
24	2	Tangoio	1211	180	36	91	1518	8.37	13.11	14.30	15.48	20.22
23	5	Te Pohue	1665	159	73	135	2032	10.24	13.37	14.15	14.93	18.06
Napier Region (Rural Sites)								*8.06*	*11.93*	*12.90*	*13.87*	*17.74*
6	3	Tariki	5524	416	156	140	6236	4.75	7.42	8.08	8.75	11.42
71	45	Hawera	3067	173	51	163	3454	6.20	8.20	8.70	9.20	11.20
5	3	Waitotara	2553	227	85	68	2933	5.22	8.31	9.09	9.86	12.96
37	4	Horopito	1384	113	29	80	1606	6.79	9.60	10.31	11.01	13.82
29	1	Hihitahi	3253	271	131	264	3919	10.08	12.85	13.54	1423	16.99
28	4	Upokongaro	1580	137	18	41	1776	3.32	6.41	7.18	7.95	11.04
38	1	Sanson	8975	675	254	407	10311	6.41	9.03	9.68	13.34	12.96
30	3	Manawatu Gorge	4820	383	133	234	5570	6.59	9.34	10.03	10.71	13.46
56	1	Ohau	11032	993	269	359	12653	4.96	8.10	8.89	9.67	12.81
25	2	Norsewood	2598	240	110	165	3113	8.83	11.92	12.69	13.46	16.54
Wanganui Region (Rural Sites)								*6.31*	*9.12*	*9.82*	*10.52*	*13.32*
36	6	Hira	1895	208	82	97	2282	7.84	11.49	12.40	13.31	16.96
35	6	Murchison	1016	122	30	66	1234	7.78	11.73	12.72	13.71	17.67
Wellington Region (Rural Sites)								*7.81*	*11.61*	*12.56*	*13.51*	*17.31*
9	1	Kaikoura	1470	154	57	64	1745	6.93	10.46	11.35	12.23	15.76
68	1	Dunsandel	4972	508	209	297	5986	8.45	11.85	12.70	13.54	16.94

31	1	St Andrews	3634	351	97	235	4317	7.69	10.94	11.76	12.57	15.82
11	73	Springfield	926	84	16	10	1036	2.51	5.75	6.56	7.37	10.62
32	7	Lewis Pass	722	92	22	67	903	9.86	13.93	14.95	15.97	20.04
40	7	Ahaura	767	100	19	56	942	7.96	12.21	13.27	14.33	18.58
39	6	Punakaiki	594	57	12	14	677	3.84	7.21	8.05	8.89	12.26
70	6	Chesterfield	1667	182	29	60	1938	4.59	8.35	9.29	10.23	13.98
Christchurch Region (Rural Sites)								*6.48*	*10.09*	*10.99*	*11.89*	*15.50*
27	1	Milton	3928	376	122	155	4581	6.05	9.33	10.15	10.97	14.25
44	8	Alexandra	1380	151	29	32	1592	3.83	7.63	8.57	9.52	13.32
45	1	Gore	2901	292	75	109	3377	5.45	8.91	9.77	10.64	14.10
46	6	Winton	2982	276	50	84	3392	3.95	7.21	8.02	8.83	12.09
Dunedin Region (Rural Sites)								*4.82*	*8.27*	*9.13*	*9.99*	*13.44*
National (Rural Sites)								*6.53*	*9.93*	*10.78*	*11.63*	*15.03*

Note (1) : April 1996 data used due to 1995 data being unreliable.

APPENDIX C

Weigh-In-Motion Data

Table C1 1995 data from SH1 Sulphur Beach NB weigh-in-motion site.

Month	Days	Data	Axle Groups				Vehicles							
			SAST	SADT	TADT	TRDT	2 Axle	3 Axle	4 Axle	5 Axle	6 Axle	7 Axle	8 Axle	All
Jan	31	Frequency	56200	45491	26917	3606	35080	8171	2806	1964	5349	1995	835	56200
		Mean ESA	0.36	0.19	0.67	0.57	0.38	1.19	0.67	2.00	2.51	2.88	1.25	0.87
		Std Dev	0.84	0.41	0.84	0.82	1.01	1.63	1.19	1.89	2.17	1.96	1.59	1.56
Feb	28	Frequency	62400	50931	30694	3962	38242	9549	2989	2230	6103	2249	1038	62400
		Mean ESA	0.39	0.19	0.71	0.56	0.39	1.31	0.74	2.07	2.62	2.90	1.27	0.93
		Std Dev	0.96	0.40	0.84	0.70	1.11	1.68	1.25	2.10	2.21	2.05	1.15	1.66
Mar	31	Frequency	73110	58680	37067	4653	44163	11432	3660	2793	7058	2763	1241	73110
		Mean ESA	0.37	0.18	0.70	0.59	0.37	1.28	0.75	2.07	2.50	2.73	1.28	0.91
		Std Dev	0.84	0.38	0.85	0.69	0.98	1.69	1.43	1.84	2.05	1.89	1.15	1.56
Apr	30	Frequency	60075	47177	30758	3953	35882	10166	2824	2088	5811	2312	992	60075
		Mean ESA	0.38	0.17	0.68	0.63	0.37	1.35	0.71	1.77	2.46	2.59	1.38	0.91
		Std Dev	1.03	0.37	0.85	0.75	1.16	1.74	1.31	2.61	2.27	1.75	1.63	1.69
May	31	Frequency	70318	54967	36417	4541	42180	11415	3519	2424	6789	2752	1239	70318
		Mean ESA	0.35	0.17	0.61	0.51	0.35	1.19	0.73	1.62	2.26	2.47	1.17	0.83
		Std Dev	0.90	0.37	0.76	0.66	1.09	1.47	1.16	1.72	1.99	1.64	1.16	1.49
Jun	30	Frequency	63674	49186	33265	4242	37784	10734	3248	2398	5799	2512	1199	63674
		Mean ESA	0.33	0.15	0.59	0.48	0.33	1.22	0.69	1.67	1.96	2.34	1.14	0.79
		Std Dev	0.78	0.33	0.72	0.64	0.88	1.47	1.32	1.41	1.82	1.73	1.02	1.35
Jul	31	Frequency	62220	48244	30315	4139	37945	10427	3152	2091	5593	2032	980	62220
		Mean ESA	0.31	0.15	0.56	0.48	0.32	1.12	0.66	1.54	1.87	2.34	0.94	0.73
		Std Dev	0.73	0.30	0.70	0.61	0.89	1.38	1.15	1.34	1.53	1.53	1.05	1.26
Aug	31	Frequency	68754	53807	33809	4642	41809	11330	3483	2178	6500	2337	1117	68754
		Mean ESA	0.32	0.15	0.57	0.50	0.33	1.11	0.67	1.51	1.99	2.43	1.14	0.75
		Std Dev	0.80	0.33	0.72	0.61	1.01	1.33	1.06	1.41	1.73	1.60	1.22	1.35
Sep	29	Frequency	62646	49593	30727	3944	38240	10293	3200	2027	5751	2161	974	62646

		Mean ESA	0.35	0.16	0.62	0.51	0.35	1.19	0.69	1.95	2.11	2.57	1.15	0.81
		Std Dev	0.93	0.36	0.81	0.64	1.17	1.59	1.16	2.12	1.83	1.65	1.15	1.53
Oct	31	Frequency	63349	50349	33161	4024	37412	10546	3516	2059	5990	2698	1128	63349
		Mean ESA	0.35	0.16	0.59	0.56	0.35	1.16	0.61	1.79	2.19	2.41	1.11	0.82
		Std Dev	0.88	0.36	0.75	0.67	1.02	1.50	1.82	1.95	1.84	1.73	1.10	1.49
Nov	27	Frequency	50061	39412	28287	3327	28472	8413	2907	1632	5119	2506	1012	60061
		Mean ESA	0.37	0.17	0.64	0.56	0.35	1.21	0.63	1.67	2.41	2.63	1.17	0.90
		Std Dev	0.85	0.37	0.74	0.66	1.06	1.53	1.04	1.55	1.83	1.82	1.75	1.53
Dec	17	Frequency	29545	23481	16808	2095	16680	4868	1701	989	3175	1491	641	29545
		Mean ESA	0.45	0.19	0.68	0.64	0.47	1.27	0.70	1.58	2.63	2.96	1.29	1.03
		Std Dev	1.64	0.49	0.79	0.75	2.20	2.14	2.51	2.34	1.92	2.04	1.43	2.32
YEAR	347	Frequency	722352	571318	368225	47128	433889	117344	37005	24873	69037	27808	12396	722352
		Mean ESA	0.36	0.17	0.63	0.54	0.36	1.21	0.69	1.78	2.28	2.59	1.19	0.85
		Std Dev	0.91	0.37	0.78	0.68	1.11	1.58	1.37	1.88	1.96	1.79	1.29	1.55

Table C2 1996 data from SH1 Sulphur Beach NB weigh-in-motion site.

Month	Days	Data	Axle Groups				Vehicles							
			SAST	SADT	TADT	TRDT	2 Axle	3 Axle	4 Axle	5 Axle	6 Axle	7 Axle	8 Axle	All
Jan	14	Frequency	18826	15512	9557	1295	11263	2842	1097	596	1906	812	310	18826
		Mean ESA	0.43	0.20	0.63	0.70	0.48	1.12	0.67	1.79	2.71	2.89	1.21	0.97
		Std Dev	1.52	0.47	0.82	0.83	2.17	1.41	1.51	1.85	2.30	1.94	1.21	2.17
Feb	25	Frequency	55341	46140	27598	3413	33600	8585	2836	1643	5336	2431	910	55341
		Mean ESA	0.37	0.18	0.66	0.55	0.36	1.18	0.64	1.89	2.52	3.01	1.38	0.89
		Std Dev	0.94	0.38	0.81	0.71	1.03	1.65	1.15	2.17	2.19	2.01	1.39	1.62
Mar	30	Frequency	48985	41308	21845	2801	30951	7351	2709	1451	4371	1513	639	48985
		Mean ESA	0.33	0.17	0.63	0.52	0.34	1.16	0.57	1.81	2.44	2.63	1.28	0.79
		Std Dev	0.85	0.36	0.86	0.77	0.99	1.58	1.11	1.77	2.21	2.04	1.22	1.51
Apr	30	Frequency	63733	52040	33448	4167	37575	10204	3470	1906	6785	2730	1063	63733
		Mean ESA	0.35	0.18	0.66	0.55	0.32	1.16	0.68	1.79	2.55	2.81	1.26	0.88
		Std Dev	0.72	0.36	0.81	0.69	0.92	1.35	1.11	1.96	1.99	1.63	1.12	1.49
May	31	Frequency	76195	61481	41994	5273	44026	12309	3897	2417	8442	3676	1428	76195
		Mean ESA	0.35	0.17	0.65	0.51	0.31	1.16	0.63	1.85	2.41	2.74	1.25	0.88
		Std Dev	0.71	0.33	0.76	0.69	0.84	1.25	1.36	1.71	1.98	1.71	1.05	1.45
Jun	30	Frequency	63900	50884	34065	4185	37330	10741	3337	2349	6249	2560	1334	63900
		Mean ESA	0.33	0.15	0.61	0.51	0.30	1.19	0.66	1.71	2.18	2.57	0.97	0.81
		Std Dev	0.67	0.30	0.77	0.66	0.80	1.27	1.10	1.62	1.82	1.76	1.06	1.34
Jul	30	Frequency	64628	51915	33057	4071	38497	10426	3544	2478	6209	2446	1028	64628
		Mean ESA	0.31	0.15	0.56	0.45	0.29	1.09	0.71	1.50	1.95	2.46	1.05	0.74
		Std Dev	0.64	0.31	0.73	0.63	0.82	1.18	1.16	1.42	1.70	1.71	1.26	1.27
Aug	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev												
Sep	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-

		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev												
Oct	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev												
Nov	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev												
Dec	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev												
YEAR	189	Frequency	391608	319280	201564	25205	233242	62458	20890	12840	39298	16168	6712	391608
		Mean ESA	0.34	0.17	0.63	0.52	0.33	1.16	0.65	1.75	2.36	2.72	1.18	0.84
		Std Dev	0.81	0.35	0.78	0.70	1.00	1.37	1.20	1.77	2.00	1.80	1.18	1.49

Table C3 1994 data from SH1 Drury SB weigh-in-motion site.

Month	Days	Data	Axle Groups				Vehicles							
			SAST	SADT	TADT	TRDT	2 Axle	3 Axle	4 Axle	5 Axle	6 Axle	7 Axle	8 Axle	All
Jan	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Feb	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Mar	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Apr	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
May	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Jun	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Jul	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Aug	30	Frequency	9265	6523	9648	1855	2935	1144	860	477	1716	1085	1048	9265
		Mean ESA	0.41	0.16	0.39	0.43	0.28	0.96	0.42	1.13	1.88	1.70	1.46	1.02
		Std Dev	0.55	0.35	0.66	0.53	0.58	1.00	0.69	0.94	1.85	0.72	1.17	1.37
Sep	30	Frequency	33174	23472	35870	6988	9985	3748	3034	1795	6555	4054	4003	33174

		Mean ESA	0.44	0.17	0.40	0.44	0.28	0.98	0.48	1.29	1.90	1.81	1.54	1.09
		Std Dev	0.67	0.37	0.64	0.55	0.66	1.30	0.72	1.11	1.73	1.90	1.18	1.45
Oct	28	Frequency	29424	19870	32501	6672	8653	3683	1940	1595	6000	3648	3905	29424
		Mean ESA	0.48	0.21	0.45	0.49	0.34	1.07	0.67	1.28	2.03	1.99	1.63	1.23
		Std Dev	0.58	0.40	0.69	0.58	0.63	1.24	0.79	1.13	1.79	1.95	1.22	1.49
Nov	30	Frequency	36534	24120	41034	8198	10461	4816	2424	1951	7333	4593	4956	36534
		Mean ESA	0.50	0.21	0.48	0.50	0.36	1.22	0.74	1.41	2.08	2.04	1.70	1.29
		Std Dev	0.69	0.43	0.73	0.61	0.73	1.49	0.92	1.35	1.85	1.93	1.49	1.60
Dec	27	Frequency	34368	23151	38899	7710	9794	4176	2305	1844	7338	4325	4586	34368
		Mean ESA	0.47	0.22	0.47	0.51	0.35	1.01	0.67	1.40	2.11	2.03	1.66	1.27
		Std Dev	0.58	0.45	0.72	0.63	0.80	1.14	0.89	1.35	1.91	1.88	1.28	1.57
YEAR	175	Frequency	142765	97136	157952	31423	41828	17567	10563	7662	28942	17705	18498	142765
		Mean ESA	0.47	0.20	0.45	0.48	0.33	1.07	0.61	1.34	2.03	1.95	1.63	1.21
		Std Dev	0.63	0.41	0.69	0.59	0.71	1.29	0.83	1.23	1.83	1.91	1.30	1.52

Table C4 1995 data from SH1 Drury SB weigh-in-motion site.

Month	Days	Data	Axle Groups				Vehicles							
			SAST	SADT	TADT	TRDT	2 Axle	3 Axle	4 Axle	5 Axle	6 Axle	7 Axle	8 Axle	All
Jan	31	Frequency	33539	22246	36838	7412	9875	4528	2154	1685	7066	4053	4178	33539
		Mean ESA	0.48	0.21	0.44	0.47	0.35	1.00	0.70	1.44	1.97	1.99	1.61	1.21
		Std Dev	0.59	0.43	0.70	0.61	0.74	0.74	0.95	1.59	1.83	1.99	1.29	1.52
Feb	28	Frequency	35802	23208	40538	8257	10357	4426	2253	1794	7531	4523	4918	35802
		Mean ESA	0.49	0.22	0.44	0.45	0.35	1.02	0.68	1.48	1.99	1.99	1.59	1.23
		Std Dev	0.61	0.43	0.69	0.59	0.68	1.03	1.14	1.44	1.91	1.95	1.27	1.54
Mar	31	Frequency	41490	26614	47803	9511	11615	5271	2616	2218	8623	5251	5896	41490
		Mean ESA	0.47	0.21	0.41	0.40	0.34	0.96	0.68	1.32	1.85	2.00	1.42	1.17
		Std Dev	0.62	0.42	0.67	0.57	0.64	1.02	0.91	2.04	1.83	2.03	1.25	1.54
Apr	30	Frequency	33558	21816	37860	7308	9839	4223	2233	1823	6735	4157	4548	33558
		Mean ESA	0.46	0.21	0.42	0.44	0.35	0.95	0.63	1.34	1.90	1.98	1.49	1.16
		Std Dev	0.56	0.44	0.67	0.58	0.64	1.02	0.95	1.55	1.84	1.93	1.27	1.49
May	30	Frequency	36946	21355	44580	8869	9593	4768	2551	1963	7667	4639	5765	36946
		Mean ESA	0.34	0.16	0.29	0.29	0.27	0.67	0.44	1.02	1.31	1.44	0.96	0.85
		Std Dev	0.47	0.32	0.47	0.39	0.64	0.75	0.61	1.03	1.26	1.48	0.91	1.09
Jun	30	Frequency	32349	18763	37841	7781	8917	4009	2395	1695	6551	3804	4978	32349
		Mean ESA	0.38	0.17	0.33	0.35	0.27	0.76	0.47	1.14	1.57	1.61	1.14	0.95
		Std Dev	0.49	0.35	0.55	0.48	0.51	0.99	0.67	1.42	1.46	1.62	0.97	1.23
Jul	31	Frequency	32601	18831	37001	7776	9402	4295	2288	1658	6426	3686	4846	32601
		Mean ESA	0.42	0.19	0.38	0.39	0.31	0.87	0.55	1.26	1.76	1.78	1.28	1.05
		Std Dev	0.53	0.41	0.59	0.50	0.62	0.90	1.01	1.11	1.60	1.67	1.05	1.30
Aug	31	Frequency	35670	20817	41448	8461	9912	4600	2475	1902	7190	4260	5331	35670
		Mean ESA	0.42	0.19	0.39	0.41	0.31	0.87	0.56	1.26	1.84	1.84	1.30	1.09
		Std Dev	0.56	0.41	0.63	0.54	0.65	0.94	0.76	1.14	1.80	1.76	1.06	1.39
Sep	30	Frequency	34623	21004	39388	7900	9918	4455	2627	1774	6801	3945	5103	34623

		Mean ESA	0.44	0.20	0.41	0.43	0.32	0.95	0.56	1.41	1.86	1.98	1.42	1.13
		Std Dev	0.61	0.43	0.65	0.54	0.76	1.06	0.81	1.62	1.64	2.02	1.12	1.45
Oct	31	Frequency	35681	21324	40312	8152	10651	4488	2765	1715	6841	3971	5340	35681
		Mean ESA	0.45	0.20	0.43	0.44	0.32	1.05	0.58	1.34	1.89	2.07	1.51	1.16
		Std Dev	0.72	0.41	0.66	0.56	0.80	1.05	1.02	1.33	1.77	2.13	1.20	1.50
Nov	30	Frequency	38446	23153	43472	8791	11442	4718	2898	1948	7275	4299	5866	38446
		Mean ESA	0.45	0.21	0.42	0.45	0.33	1.00	0.57	1.35	1.90	2.00	1.56	1.15
		Std Dev	0.56	0.43	0.65	0.56	0.65	1.15	0.87	1.19	1.73	1.94	1.18	1.44
Dec	31	Frequency	35535	22377	38676	7761	10795	4703	2976	1675	6615	3735	5036	35535
		Mean ESA	0.46	0.21	0.44	0.47	0.33	1.04	0.55	1.37	2.01	2.08	1.66	1.18
		Std Dev	0.60	0.45	0.68	0.60	0.76	1.11	0.87	1.16	1.81	2.08	1.28	1.51
YEAR	364	Frequency	426420	261508	485757	97979	122226	54484	30231	21850	85321	50323	61805	426240
		Mean ESA	0.44	0.20	0.40	0.41	0.32	0.93	0.58	1.31	1.82	1.90	1.41	1.11
		Std Dev	0.58	0.41	0.64	0.55	0.68	1.01	0.89	1.43	1.73	1.90	1.17	1.43

Table C5 1996 data from SH1 Drury SB weigh-in-motion site.

Month	Days	Data	Axle Groups				Vehicles							
			SAST	SADT	TADT	TRDT	2 Axle	3 Axle	4 Axle	5 Axle	6 Axle	7 Axle	8 Axle	All
Jan	31	Frequency	33485	20601	36001	7417	10108	4704	2864	1521	6232	3462	4594	33485
		Mean ESA	0.48	0.21	0.44	0.44	0.34	1.04	0.54	1.44	1.99	2.18	1.61	1.18
		Std Dev	0.67	0.47	0.69	0.57	0.95	1.09	0.88	1.28	1.84	2.11	1.29	1.55
Feb	29	Frequency	36166	21988	40254	8222	10750	4668	2902	1648	6788	4109	5301	36166
		Mean ESA	0.48	0.20	0.44	0.43	0.32	1.05	0.60	1.38	1.92	2.13	1.59	1.18
		Std Dev	0.74	0.43	0.69	0.57	0.62	1.26	1.27	1.20	1.90	2.12	1.50	1.58
Mar	31	Frequency	38638	22919	43148	8930	11413	4972	3117	1764	7485	4247	5640	38638
		Mean ESA	0.46	0.21	0.42	0.40	0.33	1.01	0.56	1.40	1.88	2.09	1.50	1.15
		Std Dev	0.58	0.43	0.66	0.56	0.75	1.00	0.84	1.30	1.79	2.11	1.25	1.49
Apr	22	Frequency	21346	12916	23558	4724	6399	2792	1800	976	4030	2338	3011	21346
		MeanESA	0.45	0.19	0.41	0.43	0.31	1.00	0.60	1.36	1.84	1.96	1.51	1.11
		Std Dev	0.79	0.39	0.66	0.58	0.71	1.06	1.48	1.75	1.74	2.25	1.28	1.55
May	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Jun	2	Frequency	2302	1424	1816	443	1001	412	115	94	327	102	251	2302
		Mean ESA	0.38	0.18	0.34	0.30	0.35	0.87	0.45	1.07	1.60	1.49	1.40	0.82
		Std Dev	0.47	0.33	0.52	0.41	0.61	0.75	0.57	0.96	1.38	1.64	0.91	1.02
Jul	29	Frequency	72944	38147	81216	18074	22766	9389	4771	2928	14127	7187	11776	72944
		Mean ESA	0.43	0.18	0.39	0.36	0.32	0.95	0.60	1.08	1.76	1.86	1.35	1.05
		Std Dev	0.66	0.35	0.54	0.47	0.95	0.96	1.09	0.90	1.53	1.55	0.99	1.31
Aug	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Sep	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-

		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Oct	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Nov	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Dec	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
YEAR	144	Frequency	204881	117995	225993	47810	62437	26937	15569	8931	38989	21445	30573	204881
		Mean ESA	0.45	0.20	0.41	0.40	0.33	1.00	0.58	1.29	1.86	2.02	1.47	1.12
		Std Dev	0.67	0.41	0.63	0.53	0.84	1.05	1.10	1.23	1.72	1.96	1.22	1.46

Table C6 1995 data from SH1 Ohakea NB weigh-in-motion site.

Month	Days	Data	Axle Groups				Vehicles							
			SAST	SADT	TADT	TRDT	2 Axle	3 Axle	4 Axle	5 Axle	6 Axle	7 Axle	8 Axle	All
Jan	28	Frequency	11985	6809	13651	2588	3444	1754	1079	604	1902	1169	2033	11985
		Mean ESA	0.43	0.16	0.28	0.34	0.33	0.79	0.55	1.09	1.51	1.76	1.12	0.92
		Std Dev	0.49	0.31	0.37	0.41	0.49	0.80	0.65	0.87	1.15	1.34	0.80	0.99
Feb	27	Frequency	11974	6649	13421	2665	3572	1784	1018	518	1907	1095	2080	11974
		Mean ESA	0.42	0.17	0.27	0.33	0.33	0.77	0.53	1.11	1.47	1.61	1.17	0.89
		Std Dev	0.48	0.31	0.37	0.42	0.49	0.69	0.66	0.95	1.20	1.28	0.91	0.98
Mar	31	Frequency	15801	8868	17864	3620	4655	2245	1354	647	2604	1437	2859	15801
		Mean ESA	0.52	0.19	0.35	0.43	0.39	0.99	0.65	1.33	1.86	2.04	1.44	1.12
		Std Dev	0.54	0.32	0.43	0.57	0.54	0.79	0.77	0.95	1.29	1.55	0.92	1.13
Apr	30	Frequency	13678	7838	15410	3080	3962	1949	1304	516	2256	1300	2391	13678
		Mean ESA	0.49	0.18	0.33	0.39	0.38	0.93	0.58	1.27	1.76	1.95	1.33	1.05
		Std Dev	0.53	0.32	0.42	0.50	0.56	0.72	0.72	0.99	1.28	1.43	0.92	1.09
May	31	Frequency	16071	8296	19147	3913	4468	2093	1393	595	2862	1483	3177	16071
		Mean ESA	0.46	0.18	0.30	0.35	0.35	0.94	0.55	1.20	1.58	1.75	1.18	0.99
		Std Dev	0.48	0.31	0.37	0.41	0.48	0.77	0.63	0.86	1.08	1.31	0.77	0.97
Jun	30	Frequency	14577	7518	17169	3637	4110	1902	1190	600	2626	1254	2895	14577
		Mean ESA	0.43	0.18	0.28	0.31	0.35	0.84	0.58	1.15	1.47	1.68	1.11	0.93
		Std Dev	0.45	0.32	0.35	0.36	0.51	0.68	0.64	0.80	0.98	1.22	0.72	0.90
Jul	31	Frequency	14399	7382	16642	3666	4147	1883	1124	593	2676	1290	2686	14399
		Mean ESA	0.41	0.18	0.28	0.30	0.32	0.78	0.54	1.05	1.42	1.69	1.08	0.90
		Std Dev	0.41	0.29	0.34	0.43	0.45	0.63	0.57	0.70	0.97	1.20	0.76	0.89
Aug	31	Frequency	14718	7676	16719	3871	4193	1976	1196	686	2692	1232	2743	14718
		Mean ESA	0.41	0.17	0.27	0.30	0.33	0.81	0.54	1.15	1.41	1.56	1.05	0.89
		Std Dev	0.43	0.32	0.34	0.36	0.55	0.64	0.56	0.78	0.95	1.14	0.66	0.86
Sep	30	Frequency	13917	6960	15967	3662	3916	1895	1190	634	2496	1185	2601	13917

		Mean ESA	0.43	0.18	0.27	0.31	0.34	0.86	0.55	1.25	1.42	1.61	1.10	0.91
		Std Dev	0.43	0.32	0.35	0.39	0.51	0.65	0.60	0.92	0.96	1.15	0.72	0.88
Oct	31	Frequency	14229	7301	16554	3462	4037	1995	1244	630	2305	1288	2730	14229
		Mean ESA	0.43	0.17	0.28	0.30	0.33	0.87	0.53	1.19	1.41	1.63	1.13	0.91
		Std Dev	0.46	0.30	0.34	0.36	0.52	0.73	0.60	0.85	1.00	1.19	0.72	0.90
Nov	30	Frequency	15322	7889	18182	3758	4314	2059	1213	692	2584	1414	3046	15322
		Mean ESA	0.46	0.18	0.30	0.33	0.36	0.94	0.59	1.17	1.54	1.75	1.18	0.98
		Std Dev	0.49	0.33	0.37	0.38	0.50	0.80	0.69	0.82	1.10	1.34	0.76	0.97
Dec	31	Frequency	14136	7606	16531	3428	3968	1962	1184	608	2318	1326	2770	14136
		Mean ESA	0.47	0.18	0.32	0.38	0.35	0.94	0.63	1.24	1.68	1.87	1.26	1.03
		Std Dev	0.51	0.32	0.40	0.43	0.50	0.80	0.74	0.97	1.20	1.41	0.83	1.05
YEAR	361	Frequency	170807	90792	197257	41350	48786	23497	14489	7323	29228	15473	32011	170807
		Mean ESA	0.45	0.18	0.29	0.34	0.35	0.87	0.57	1.18	1.54	1.75	1.18	0.96
		Std Dev	0.48	0.32	0.37	0.42	0.51	0.73	0.66	0.87	1.11	1.32	0.80	0.97

Table C7 1996 data from SH1 Ohakea NB weigh-in-motion site.

Month	Days	Data	Axle Groups				Vehicles							
			SAST	SADT	TADT	TRDT	2 Axle	3 Axle	4 Axle	5 Axle	6 Axle	7 Axle	8 Axle	All
Jan	31	Frequency	12948	6843	14982	3093	3585	1887	1180	543	2202	1087	2464	12948
		Mean ESA	0.52	0.19	0.34	0.39	0.38	1.00	0.61	1.23	1.78	2.09	1.42	1.10
		Std Dev	0.56	0.35	0.43	0.46	0.56	0.81	0.75	0.84	1.20	1.50	0.98	1.11
Feb	29	Frequency	12243	6360	14255	3127	3401	1655	987	599	2216	1015	2370	12243
		Mean ESA	0.52	0.21	0.34	0.42	0.41	1.03	0.67	1.32	1.79	2.11	1.37	1.14
		Std Dev	0.55	0.40	0.43	0.47	0.58	0.85	0.78	0.96	1.32	1.59	0.92	1.14
Mar	31	Frequency	16281	8759	18844	3812	4515	2396	1366	777	2762	1389	3076	16281
		Mean ESA	0.53	0.19	0.35	0.43	0.39	1.03	0.65	1.28	1.84	2.11	1.41	1.13
		Std Dev	0.58	0.33	0.45	0.49	0.56	0.89	0.83	0.95	1.30	1.59	0.97	1.14
Apr	30	Frequency	14206	7558	16274	3484	3922	2023	1299	671	2479	1041	2771	14206
		Mean ESA	0.51	0.19	0.33	0.41	0.38	1.05	0.60	1.39	1.79	1.97	1.33	1.09
		Std Dev	0.54	0.33	0.41	0.45	0.53	0.91	0.71	1.03	1.18	1.42	0.91	1.08
May	31	Frequency	16297	7724	20073	4288	4227	2091	1333	720	3043	1385	3498	16297
		Mean ESA	0.47	0.19	0.30	0.36	0.34	0.92	0.58	1.27	1.60	1.87	1.21	1.03
		Std Dev	0.51	0.39	0.37	0.41	0.58	0.71	0.69	0.91	1.07	1.35	0.97	1.03
Jun	30	Frequency	13860	6454	16588	3819	3656	1842	1187	532	2664	1033	2946	13860
		Mean ESA	0.43	0.17	0.27	0.31	0.31	0.87	0.52	1.01	1.43	1.67	1.10	0.92
		Std Dev	0.44	0.28	0.32	0.37	0.43	0.66	0.59	0.71	0.91	1.17	0.69	0.85
Jul	17	Frequency	7858	3607	9267	2246	2081	1025	692	323	1564	516	1657	7858
		Mean ESA	0.43	0.17	0.27	0.30	0.31	0.89	0.53	1.12	1.43	1.61	1.07	0.91
		Std Dev	0.43	0.30	0.32	0.34	0.49	0.69	0.58	0.74	0.91	1.11	0.67	0.85
Aug	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Sep	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-

		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Oct	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Nov	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Dec	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
YEAR	199	Frequency	93693	47305	110283	23869	25387	12919	8044	4165	16930	7466	18782	93693
		Mean ESA	0.49	0.19	0.32	0.38	0.36	0.98	0.60	1.25	1.67	1.95	1.28	1.05
		Std Dev	0.52	0.35	0.40	0.44	0.54	0.81	0.72	0.91	1.15	1.44	0.90	1.05

Table C8 1994 data from SH1 Pukerua Bay weigh-in-motion site.

Month	Days	Data	Axle Groups				Vehicles							
			SAST	SADT	TADT	TRDT	2 Axle	3 Axle	4 Axle	5 Axle	6 Axle	7 Axle	8 Axle	All
Jan	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Feb	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Mar	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Apr	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
May	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Jun	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		StdDev	-	-	-	-	-	-	-	-	-	-	-	-
Jul	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Aug	22	Frequency	14913	10434	12875	2590	6065	1922	1528	699	2050	1058	1600	14913
		Mean ESA	0.31	0.17	0.26	0.35	0.36	0.64	0.40	0.80	1.29	1.59	1.12	0.72
		Std Dev	0.94	0.41	0.41	0.50	1.43	1.21	0.72	0.70	1.14	1.34	1.01	1.30
Sep	28	Frequency	27794	19567	24809	5052	10923	3445	2871	1278	3887	2262	3128	27794

		Mean ESA	0.31	0.18	0.28	0.34	0.33	0.64	0.44	0.86	1.32	1.74	1.21	0.76
		Std Dev	0.80	0.40	0.44	0.51	1.14	1.30	0.70	0.94	1.23	1.49	1.01	1.25
Oct	9	Frequency	9387	7297	7557	1528	3653	1694	920	356	1099	674	991	9387
		Mean ESA	0.31	0.16	0.31	0.36	0.35	0.47	0.41	0.91	1.41	1.90	1.34	0.74
		Std Dev	0.90	0.41	0.46	0.52	1.34	0.84	0.68	1.14	0.45	1.44	1.42	1.34
Nov	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Dec	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
YEAR	81	Frequency	52094	37298	45241	9170	20632	7061	5319	2333	7036	3994	5719	52094
		Mean ESA	0.31	0.18	0.28	0.35	0.34	0.60	0.42	0.85	1.33	1.73	1.21	0.74
		Std Dev	0.86	0.40	0.44	0.51	1.27	1.18	0.70	0.91	1.24	1.44	1.10	1.28

Table C9 1995 data from SH1 Pukerua Bay weigh-in-motion site.

Month	Days	Data	Axle Groups				Vehicles							
			SAST	SADT	TADT	TRDT	2 Axle	3 Axle	4 Axle	5 Axle	6 Axle	7 Axle	8 Axle	All
Jan	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Feb	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Mar	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Apr	28	Frequency	7926	4993	7683	1616	2702	1331	698	332	1150	622	1091	7926
		Mean ESA	0.55	0.20	0.52	0.94	0.53	0.93	0.34	0.87	2.61	3.31	2.38	1.37
		Std Dev	1.08	0.47	0.69	1.02	1.83	1.16	0.72	1.15	1.92	0.75	1.35	1.88
May	28	Frequency	30679	18939	32255	6736	10269	3901	2712	1114	4864	2752	5067	30679
		Mean ESA	0.43	0.19	0.34	0.45	0.38	0.83	0.54	1.14	1.67	2.01	1.40	1.00
		Std Dev	0.69	0.38	0.49	0.64	1.14	0.88	0.67	1.10	1.44	1.59	1.05	1.30
Jun	30	Frequency	30265	18236	31823	7226	9905	3897	2599	1040	5101	2495	5228	30265
		Mean ESA	0.41	0.17	0.33	0.35	0.35	0.78	0.56	1.06	1.57	1.96	1.37	0.96
		Std Dev	0.63	0.35	0.49	1.03	1.03	0.82	0.64	0.91	1.40	1.54	1.03	1.23
Jul	26	Frequency	25855	15653	27328	5920	8248	3448	2369	1002	4227	2381	4180	25855
		Mean ESA	0.41	0.17	0.32	0.40	0.37	0.76	0.51	0.99	1.50	1.96	1.30	0.94
		Std Dev	0.82	0.37	0.48	0.59	1.49	0.81	0.62	0.90	1.37	1.58	1.01	1.36
Aug	21	Frequency	20380	12562	20167	4912	6763	2974	1684	832	3484	1546	3097	20380
		Mean ESA	0.38	0.16	0.29	0.38	0.34	0.69	0.54	1.00	1.41	1.62	1.25	0.85
		Std Dev	0.54	0.35	0.43	0.56	0.91	0.70	0.75	0.82	1.26	1.34	0.91	1.08
Sep	30	Frequency	32980	22565	29868	7101	11951	5183	2704	1212	5001	2309	4620	32980

		Mean ESA	0.34	0.14	0.28	0.39	0.27	0.55	0.51	1.02	1.41	1.69	1.26	0.77
		Std Dev	0.55	0.33	0.43	0.54	0.79	0.72	0.65	0.84	1.27	1.64	1.00	1.09
Oct	31	Frequency	34994	24638	31033	7068	12940	5661	2895	1368	5089	2319	4722	34994
		Mean ESA	0.38	0.16	0.31	0.41	0.34	0.62	0.56	1.10	1.57	1.86	1.37	0.85
		Std Dev	0.72	0.37	0.48	0.60	1.06	0.99	0.92	0.88	1.44	1.83	0.96	1.27
Nov	30	Frequency	34514	21645	34295	7733	11943	4591	3079	1465	5439	2651	5346	34514
		Mean ESA	0.44	0.20	0.32	0.45	0.43	0.83	0.57	1.08	1.59	1.98	1.43	0.98
		Std Dev	0.79	0.41	0.49	0.67	1.31	0.86	1.05	0.95	1.46	1.59	1.04	1.35
Dec	31	Frequency	32097	20954	30583	7116	11485	4257	2940	1362	5021	2218	4814	32097
		Mean ESA	0.43	0.19	0.33	0.50	0.42	0.82	0.54	1.07	1.67	2.03	1.49	0.98
		Std Dev	0.76	0.41	0.51	0.76	1.22	0.94	0.79	0.91	1.56	1.77	1.17	1.37
YEAR	255	Frequency	249690	160185	245035	55431	86206	35243	21680	9727	39376	19293	38165	249690
		Mean ESA	0.41	0.17	0.32	0.44	0.37	0.73	0.54	1.06	1.59	1.95	1.39	0.93
		Std Dev	0.72	0.38	0.49	0.65	1.16	0.87	0.78	0.92	1.44	1.65	1.05	1.30

Table C10 1996 data from SH1 Pukerua Bay weigh-in-motion site.

Month	Days	Data	Axle Groups				Vehicles							
			SAST	SADT	TADT	TRDT	2 Axle	3 Axle	4 Axle	5 Axle	6 Axle	7 Axle	8 Axle	All
Jan	31	Frequency	30824	21185	28697	6231	10895	4345	3132	1401	4769	2159	4123	30824
		Mean ESA	0.40	0.19	0.32	0.45	0.42	0.76	0.45	1.07	1.56	2.06	1.43	0.93
		Std Dev	0.80	0.44	0.52	0.74	1.31	0.96	0.68	1.31	1.49	1.83	1.26	1.40
Feb	29	Frequency	33387	22147	31997	6939	11717	4514	3295	1508	5158	2430	4765	33387
		Mean ESA	0.39	0.19	0.32	0.49	0.41	0.74	0.48	0.94	1.54	2.11	1.39	0.92
		Std Dev	0.77	0.43	0.52	0.75	1.28	0.81	0.75	0.91	1.48	1.91	1.16	1.36
Mar	31	Frequency	33371	22434	32201	7010	11501	4335	3342	1708	5266	2402	4817	33371
		Mean ESA	0.36	0.16	0.26	0.43	0.39	0.63	0.48	0.79	1.33	1.69	1.22	0.81
		Std Dev	0.86	0.36	0.45	0.75	1.35	0.77	1.25	0.77	1.35	1.60	1.07	1.32
Apr	30	Frequency	27946	19133	26593	5765	9119	4124	2860	1723	4462	2023	3635	27946
		Mean ESA	0.30	0.13	0.23	0.38	0.34	0.53	0.38	0.56	1.05	1.44	1.11	0.68
		Std Dev	0.78	0.34	0.42	0.67	1.18	1.00	0.70	0.65	1.32	1.93	1.06	1.23
May	13	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Jun	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Jul	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Aug	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Sep	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-

		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Oct	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Nov	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Dec	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
YEAR	121	Frequency	125528	84899	119488	25945	43232	17318	12629	6340	19655	9014	17340	125528
		Mean ESA	0.36	0.17	0.28	0.44	0.39	0.67	0.45	0.83	1.38	1.83	1.29	0.84
		Std Dev	0.80	0.40	0.48	0.73	1.28	0.89	0.89	0.94	0.43	1.84	1.15	1.33

Table C11 1994 data from SH1 Waipara weigh-in-motion site.

Month	Days	Data	Axle Groups				Vehicles							
			SAST	SADT	TADT	TRDT	2 Axle	3 Axle	4 Axle	5 Axle	6 Axle	7 Axle	8 Axle	All
Jan	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Feb	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Mar	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Apr	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
May	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Jun	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Jul	0	Frequency	-	-	-	-	-	-	-	-	-	-	-	-
		Mean ESA	-	-	-	-	-	-	-	-	-	-	-	-
		Std Dev	-	-	-	-	-	-	-	-	-	-	-	-
Aug	6	Frequency	2014	1514	2398	331	482	267	300	113	251	264	337	2014
		Mean ESA	0.25	0.15	0.22	0.35	0.24	0.39	0.14	0.55	1.37	1.40	0.99	0.68
		Std Dev	0.35	0.34	0.37	0.55	0.42	0.51	0.37	0.60	1.40	1.32	0.75	0.97
Sep	30	Frequency	10669	7801	12902	1787	2630	1533	1214	594	1345	1487	1866	10669

		Mean ESA	0.28	0.18	0.25	0.34	0.24	0.48	0.21	0.76	1.45	1.54	1.03	0.77
		Std Dev	0.48	0.40	0.41	0.51	0.46	1.07	0.48	1.04	1.50	1.40	0.79	1.11
Oct	31	Frequency	11498	8650	13688	1844	3105	1664	960	717	1389	1639	2024	11498
		Mean ESA	0.31	0.21	0.28	0.38	0.24	0.46	0.27	1.24	1.68	1.77	1.09	0.88
		Std Dev	0.43	0.45	0.45	0.51	0.47	0.63	0.43	1.57	1.71	1.57	0.86	1.22
Nov	28	Frequency	8216	5286	13211	1936	357	1261	933	662	1558	1439	2006	8216
		Mean ESA	0.55	0.36	0.38	0.56	1.41	0.82	0.45	1.30	2.01	2.35	1.59	1.52
		Std Dev	0.66	0.66	0.66	0.81	0.76	0.94	0.89	1.95	2.12	2.38	1.22	1.77
Dec	31	Frequency	9299	6613	15048	1979	387	1236	1197	727	1801	1830	2121	9299
		Mean ESA	0.58	0.35	0.39	0.56	1.54	0.83	0.43	1.37	2.15	2.29	1.65	1.58
		Std Dev	0.73	0.68	0.65	0.79	0.96	0.99	1.19	1.90	2.25	2.20	1.32	1.84
YEAR	126	Frequency	41696	29864	57247	7877	6961	5961	4604	2813	6344	6659	8354	41696
		Mean ESA	0.41	0.26	0.33	0.46	0.38	0.62	0.32	1.16	1.83	1.97	1.34	1.13
		Std Dev	0.58	0.54	0.55	0.68	0.65	0.91	0.81	1.66	1.95	1.95	1.11	1.51