SUPER ROUTES
VEHICLE WEIGHT POLICY
ISSUES IN NEW ZEALAND

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TRANSIT NZ

NEW ZEALAND

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WEIGHT MONITORING, ENFORCEMENT STRATEGIES AND HEAVY VEHICLE POLICY DEVELOPMENT IN TRANSIT NEW ZEALAND

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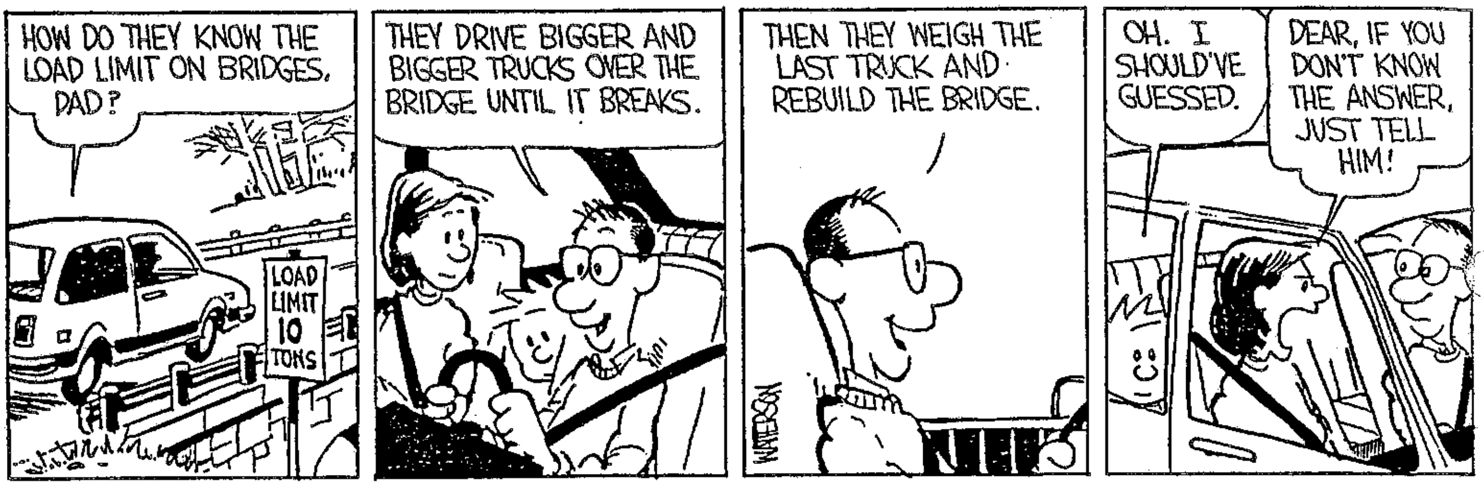
HOW DO THEY KNOW THE LOAD LIMIT ON BRIDGES, DAD?
LOAD LIMIT 10 TONS
THEY DRIVE BIGGER AND BIGGER TRUCKS OVER THE BRIDGE UNTIL IT BREAKS.
THEN THEY WEIGH THE LAST TRUCK AND REBUILD THE BRIDGE.
WATTERSON
OH. I SHOULD'VE GUESSED.
DEAR, IF YOU DON'T KNOW THE ANSWER, JUST TELL HIM!

LS:RS168

WEIGHT MONITORING, ENFORCEMENT STRATEGIES AND HEAVY VEHICLE POLICY DEVELOPMENT IN TRANSIT NEW ZEALAND

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Introduction

This paper covers three closely related topics which Transit New Zealand is currently involved with. There is a direct relationship between weight monitoring and heavy vehicle enforcement, and our predecessor the National Roads Board recognised this when it embarked in 1985 on an ambitious capital works programme to establish a network of monitoring sites and permanent weighbridges.

Weight Monitoring in Flexible Pavements

The National Roads Board's plan for weight monitoring in 1987 included building 10 weigh-in-motion (WIM) devices annually at strategic locations over a five year period. These were intended to augment the programme for traffic classifiers – devices which record numbers, speeds and axle spacings, but not weight. At that time Roading Division of Ministry of Works and Development (and later of Ministry of Transport) had already installed the first three plate-in-road systems at Pukerua Bay, Drury and Waipara.

The policy then developed into the installation of a wide range of devices manufactured in Europe and Australia, with the intention of later assessing their relative success rate in New Zealand's flexible pavements. To date six different systems have been trialled at nine sites. These include:

(a) Weighpads containing strain gauges internally wired as a bridge – the most accurate but also the most costly;

(b) Piezo-electric cables set in epoxy. Three different brands have been trialled;

(c) Capacitance strips set in epoxy; and

(d) Strain gauge transducers fixed to culverts.

Looking at these systems in reverse order, the Australian CULWAY system is in place on the northbound lane of State Highway 1 at Ohakea and is producing apparently reliable data which is yet to be analysed.

A Golden River capacitance strip system is being trialled on State Highway 2 in the Lower Hutt valley.

PAT DAW 200 piezo-electric sensors have been installed on the approaches to the Auckland Harbour Bridge but have not been as reliable as hoped because of the flexibility of the pavement there and problems with vehicles changing lanes as they pass over the sensors. A GK piezo-electric sensor has been installed in the southbound lane of State Highway 1 at Ohakea and ECM piezo-electric sensors have been installed in northbound and southbound lanes on State Highway 2 at Bayview north of Napier. These last 2 units were not operational at the time of writing.

Finally we have the PAT DAW 200 weighpad systems. There are three such systems currently operating situated at:

(a) Auckland Southern Motorway at Drury covering the 2 southbound lanes;

(b) State Highway 1 at Pukerua Bay, north of Wellington, covering both northbound and southbound lanes; and

(c) State Highway 1 at Waipara, just south of the junction with State Highway 7, covering both northbound and southbound lanes.

These three systems have produced over a year's data each. Data is collected in two forms:

(a) Hourly statistics of cars and light commercial vehicles with and without trailers, and heavy vehicles in two categories based on length. Speed statistics are given for all types of vehicles and gross load and axle group load statistics are given for heavy commercial vehicles.

(b) Individual vehicle records for heavy vehicles consisting of:

date and time vehicle passed over site
site and lane numbers
vehicle code
gross weight and individual axle weights
total length and inter-axle distances
speed

Heavy vehicles in 1991 data are currently defined according to the Transport Amendment Act 1989 as "a motor vehicle . . . the gross laden weight of which exceeds 3,500 kilograms". Previously the minimum gross weight of 2,000 kilograms as defined by the Heavy Motor Vehicle Regulations was used, but this was distorting statistics as 70 percent and more of the vehicles being recorded were car/light commercial vehicles with or without trailers which were just exceeding the limit.

Heavy vehicles are given a code based on axle configuration and in some cases, eg 2 axle vehicles, wheelbase. An attempt has been made to distinguish between rigid trucks and articulated vehicles based on the distance between the front steer axle and the second axle in single steer vehicles.

Interim Conclusions from Weight Monitoring

Weight monitoring technology never stands still. There has been an enormous amount of interest in the subject from roading agencies and enforcement organisations, and this has led to rapid product development. We now have a very wide range of equipment available, ranging from the high capital cost robust plate-in-road systems favoured by Caltrans for ± 8 percent weight accuracy, through to a multitude of piezo-electric componentry which is cheap to install, around 15-20 percent accurate, and may last three years if good fortune is with you.

Problems encountered by Transit New Zealand have included site selection, temperature variation, pavement flexibility, and reporting format. We have found that piezo electric systems prefer stiff pavements (eg benkelmen beam deflections below 0.50 mm at all times), and that results generally fall well short of the purchaser's expectations. It is likely that in future we will focus on fewer key sites using high accuracy equipment, and rely on traffic classifiers to provide the overall patterns and trends. We have also found that the data capture and analysis is time consuming, and requires a dedicated staff resource.

Enforcement Strategies

Allied with the strategy established for weight monitoring developments back in 1987 was a capital works programme for upgrading weighpits and constructing new weigh stations for use by Ministry of Transport's Traffic Safety Service.

At the last check there were 140 weighpits available on the state highway network for weighing using Tellub scales. Random roadside weighing on a reasonably level surface is also possible, but this requires cumbersome dummy platforms to support the axles which are not being weighed. Transit New Zealand has therefore recently equipped the Transport Licensing Units with fifteen sets of a newer thin lightweight wheel weigher which will permit more random roadside weighing to be performed.

Prior to 1987 the National Roads Board owned only two weighbridges, both located in the central North Island and of the full length variety. It is clear from overseas practice that there is a need for a network of new weighbridges to be constructed for routine enforcement weighing. These facilitates have the advantages of higher vehicle throughput and individual axle/axle group results. Already six new weighbridges have been constructed, and three more will be completed this year. These stations will feature increasing sophistication, including computer output of results and more automation of vehicle movement. There is also the possibility further ahead of fully manned stations operating 24 hours a day, and also of making unmanned facilities available to the transport industry.

New sites for weighbridges will concentrate on targetting primary produce areas, container ports, and the principal transport routes.

Developments in Heavy Vehicle Policy

The Axle Weights and Loadings Advisory Group was set up last year by Transit New Zealand, to provide it with advice on heavy road transport issues. Its membership includes three representatives from the commercial sector who have a background in heavy road transport. There is also representation from Ministry of Transport and territorial local authorities.

To date the Group has met twice and produced a list of activities which represent our future workload. These are as follows:

(a) Development of Heavy Transport Routes

This would involve obtaining data and identifying major transport routes, then investigating their suitability for carrying loadings in excess of present heavy motor vehicle weight limits. A review of current policy on transport by road of ISO containers which exceed 20 tonnes would be included.

(b) Overweight Permit Policy

A review of the current policy document and preparation of a 1992 edition incorporating all recent policy amendments and including a section applicable to mobile cranes is needed. This would include examining speed limits permitted within present document for road transporters operating under overweight and overdimension permits; preparing policy for bridge supervision of transporters travelling centrally; and reviewing current policy on tyre sizes, loadings, and inflation pressures.

(c) Enforcement Strategies

Preparation of a programme for completion of a strategic network of weight monitoring and enforcement facilities is needed. Completion of recommendations for the establishment of weight enforcement stations at all major container ports and preparation of guidelines for layout and operation of roadside weigh stations would be included.

(d) Vehicle Suspension Performance

The Ministry of Transport is seeking comment on their Road and Traffic Standards draft design for heavy vehicles suspension performance. Input from TNZ is appropriate and could be handled through the Advisory Group.

Heavy Transport Routes

Transit New Zealand recognises that the road transport industry is seeking higher load classification transport routes, in an effort to improve its competitiveness. The 1989 changes to load limits were a recognition of this, but the study prepared for the review indicated that we still have very real restraints imposed by the structural capacity of state highway bridge decks.

Concessions have been made to the transport industry recently, notably the current policy on movement under overweight permit of sealed 20 ft ISO containers, and the increase in operating speed for mobile cranes.

The heavy transport route study is expected to have several stages as follows:

1. Canvassing of industry groups to assess their needs, and establish what loadings and routes are required.

2. Discussion with port companies and road controlling authorities.

3. Analysis of submissions.

4. Examination of preferred routes and loadings.

5. Consideration of funding policies.

6. Preparation of proposals.

References

1. J Ihaka & D Wanty "Axle Loads on New Zealand Roads" IPENZ Conference February 1992.

2. E J Burt "Enforcement Weighing Facilities" NRB Submission 87/6/9041 June 1987.

3. J F McGuire "Heavy Motor Vehicle Weighing Strategy" TNZ Submission 90/5/135 May 1990.

4. L R Saunders "Economics of Weight Enforcement" report to TNZ Policy Division October 1990.

5. L Sleath "Weighing Programme 1991-92" Report to TNZ Policy Division October 1990.

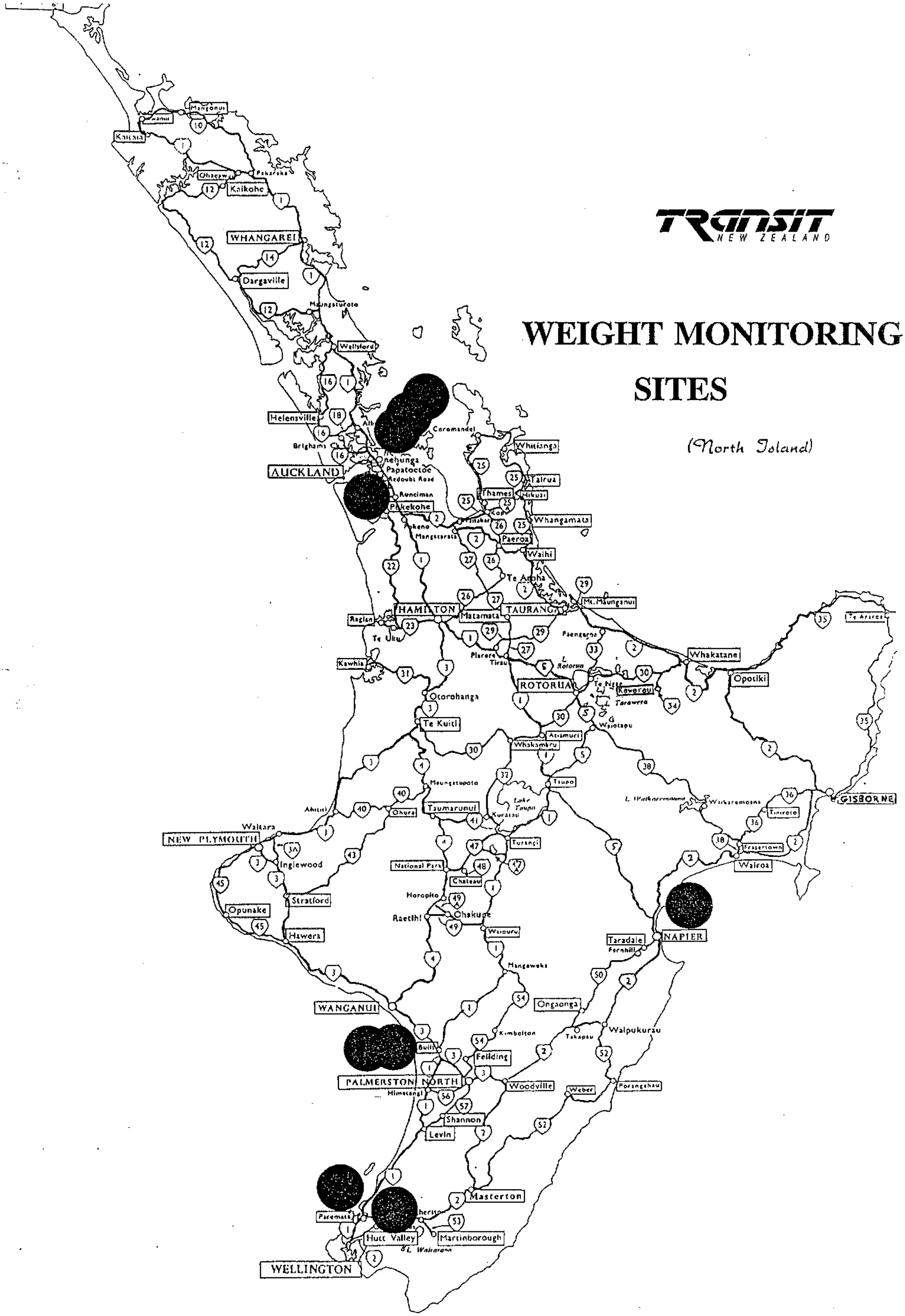
6. E J Burt "The Road & Highway Viewpoint" CIT/ICHCA Seminar, Auckland, March 1990.

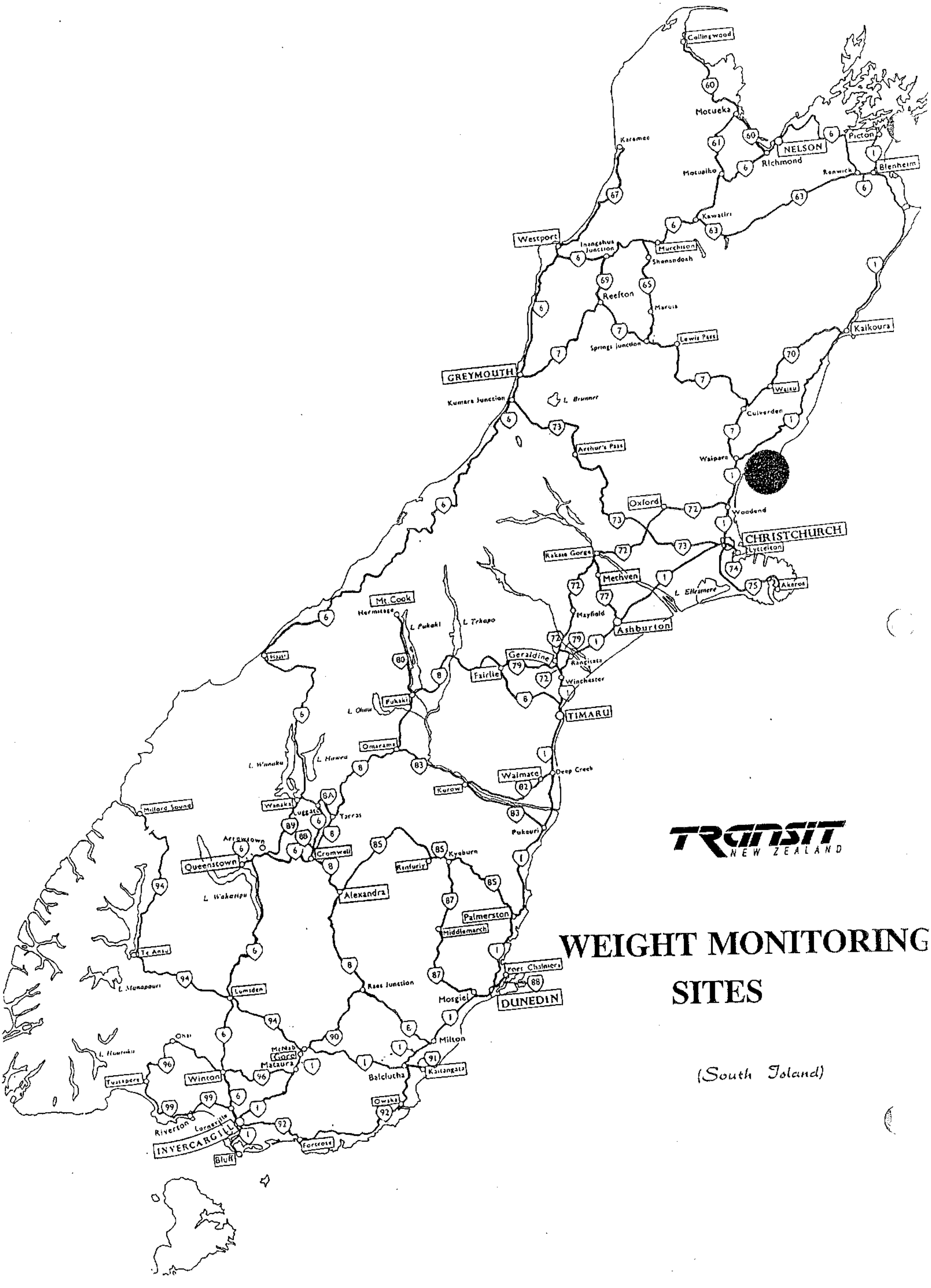
Disclaimer

The views expressed in this paper are those of the author, and do not necessarily represent the policy of Transit New Zealand.

WEIGHT MONITORING SITES

(North Island)





TRANSIT NEW ZEALAND

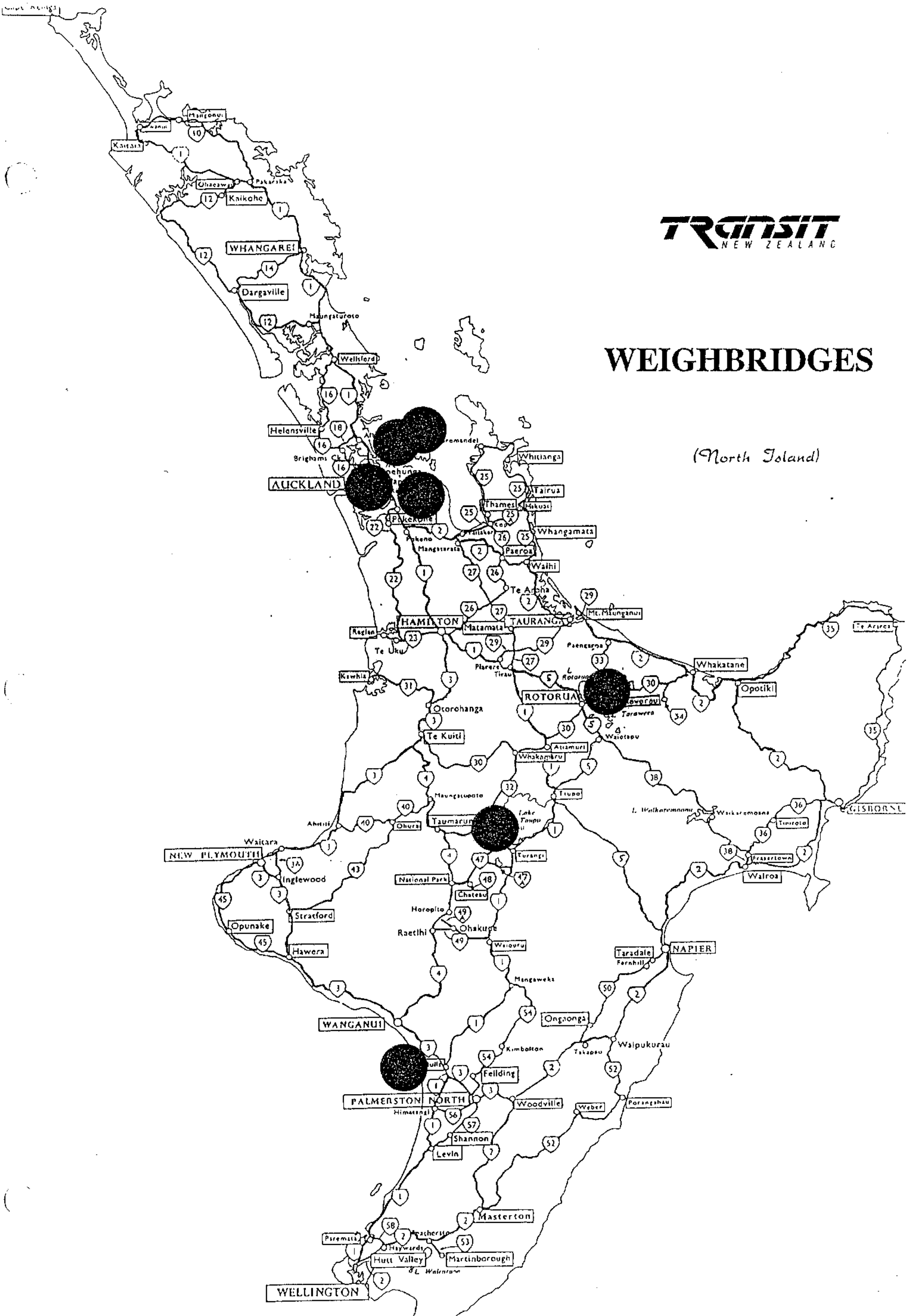
WEIGHT MONITORING SITES

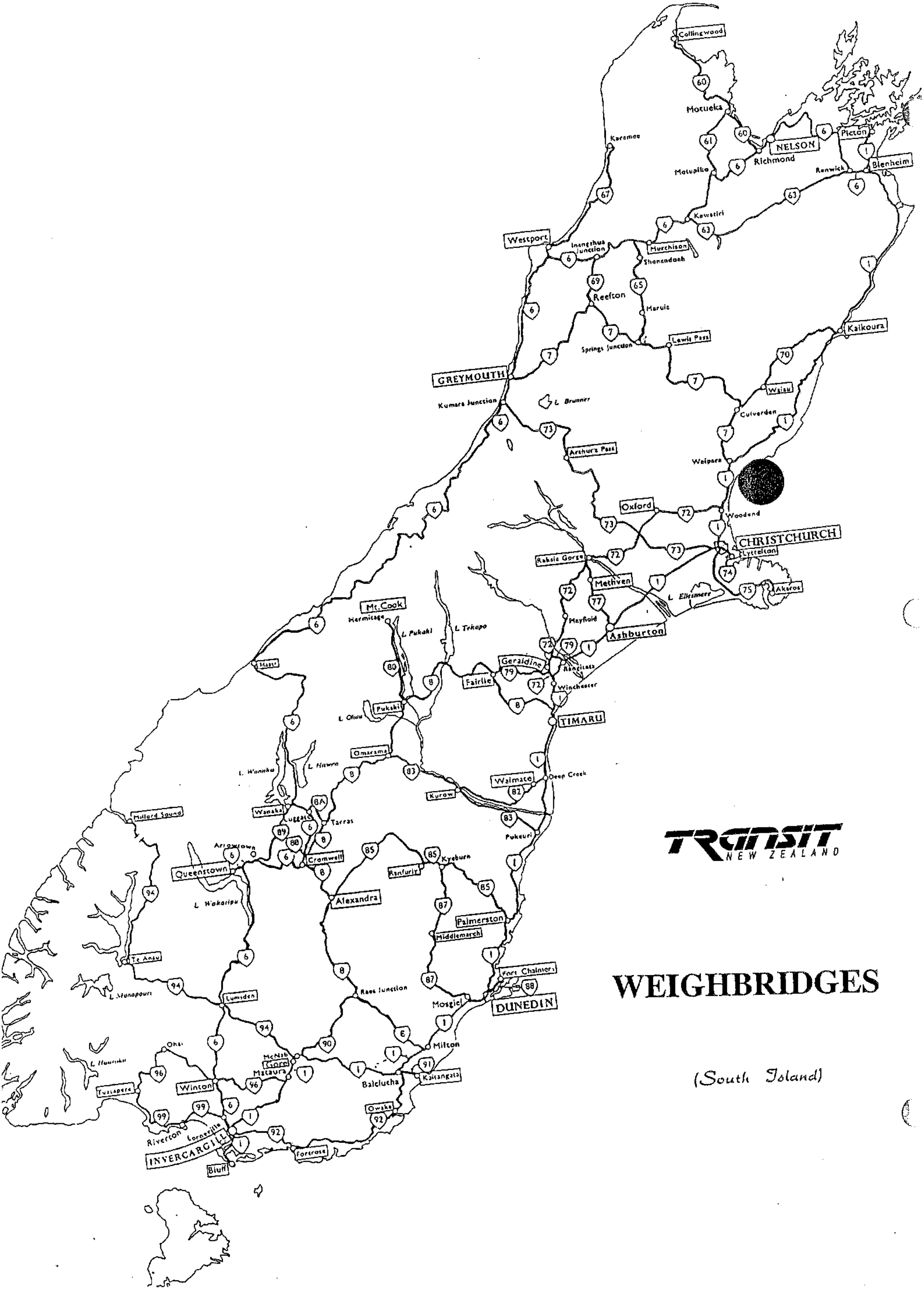
(South Island)

TRANSIT NEW ZEALAND

WEIGHBRIDGES

(North Island)





TRANSIT NEW ZEALAND

WEIGHBRIDGES

(South Island)

INDIVIDUAL VEHICLE RECORDS FOR HEAVY VEHICLES
AT A PAT DAW 200 WEIGHPAD SITE

Site number : 1
Lane number : 2
Date : 18/ 2/92 Time : 3:11:52

Vehicle type : 62
Total weight : 37930 (kgs)
Total length : 1927 (cms)
Speed : 73 (km/h)

Axle No.	Axle Weight (kgs)	Inter axle distance (cms)
1	3620	
		327
2	6020	
		390
3	6140	
		132
4	6390	
		364
5	8480	
		434
6	7280	

Site number : 1
Lane number : 2
Date : 18/ 2/92 Time : 3:11:53

Vehicle type : 69
Total weight : 30490 (kgs)
Total length : 1422 (cms)
Speed : 71 (km/h)

Axle No.	Axle Weight (kgs)	Inter axle distance (cms)
1	4330	
		355
2	5780	
		134
3	4870	
		484
4	5250	
		128
5	5210	
		128
6	5050	

PAT WEIGH-IN-MOTION SYSTEMS

MONTHLY DATA REPORTS

NOVEMBER 1991

PAT DAW 200 - MONTHLY REPORTS
NOVEMBER 1991

INTRODUCTION

To present the weigh-in-motion data from the PAT DAW 200 sites in a more user friendly manner a complete reappraisal of reporting procedures has been undertaken over the past few months.

The current format presents a summary of the data giving basically the same information as before but limiting it to three pages per month.

One full weeks data from each month is reported. The November reports in the format sent to the Regional Offices for the 3 PAT DAW 200 plate sites on State Highway 1 at Drury, Pukerua Bay and Waipara are contained in Appendix 3.

VEHICLE TYPES

The vehicle types used are based on a classification system which groups vehicles according to wheel base and the number of axles. This system was devised by Dave Wanty of the Transit New Zealand Traffic Monitoring Group. Appendix 1 tabulates the classification system.

Abbreviations used to describe vehicle types are explained in Appendix 2.

GROSS VEHICLE WEIGHT LIMIT

The following factors are now being taken into account when calculating the legal load limit for gross vehicle weight based on the Heavy Motor Vehicle Regulations.

1. The sum of the legal limits for each axle group.

2. Limits imposed by table 5 of the regulations for wheel base.

3. Limits imposed by table 5 of the regulations based on the distance between the second and the last axle.

4. Limits imposed by table 5 of the regulations based on the distance between the first and the second to last axle.

5. For a three axle bus it was assumed that the rear tandem axle set consisted of one single tyred and one double tyred axle.

John IHAKA
Traffic Monitoring Group
5 December 1991

Appendix 1

TRANSIT NEW ZEALAND VEHICLE CLASSIFICATION SCHEME						
Cat.	Bin	Description	Axles	Wheelbase	AS1	AS2
Short	1	light vehicles	2	≤3.1		
Medium	2	light veh + trailer	3-5	≤8.5	> 2.0 ≤ 4.0	> 2.0 ≤ 5.0
	3	van	2	≤4.0		
	4	truck	2	>4.0 ≤5.4		
	5	truck/tractor	3	≤ 6.7		
		artic	3	≤ 8.5	> 2.0	> 5.0
	6	truck/artic	4,5	≤ 8.5		
	7	bus	2	>5.4 ≤8.5		
		bus/coach	3	>6.7 ≤8.5		
Long	8	artic	3,4	>8.5 ≤15.5		
	9	or	5	>8.5 ≤15.5		
	10	truck + trailer	6,7	>8.5 ≤15.5		
V long	11	T&T	4-6	>15.5 ≤21		
		A&T, T&T B-train	7	>15.5 ≤34		
	12	A&T, T&T B-train transporter	8,9	>15.5 ≤34		
Other	13	unknown	1+			

Notes:
1. No axle spacing can be < 0.9 m or > 10.0 m
2. A vehicle is checked for a fit to the above starting at bin 1.
   As soon as a fit is made no further checking is done.

Appendix 2

Abbreviations:

A&T	articulated vehicle and trailer
artic	articulated vehicle
LV&T	light vehicle and trailer
t	tonnes
T&T	truck and trailer

AT 200 Y V E R T
SH 1N PUKERUA BAY FROM 18NOV91 TO 24NOV91

Vehicle - Medium wheel base (3.1m-8.5m)			EDA/vehicle		Weight (t)		Compliance with Legal Load Limit			
							Within Limit	0 - 10% Over	10 - 20% Over	> 20% Over
		Freq	Mean	Std	Mean	Std	Percent	Percent	Percent	Percent
TNZ Class	Vehicle Type									
2	3 axle LV+T	14	0.058	0.057	7.774	1.010	100	0	0	0
	4 axle LV+T	4	0.055	0.058	8.315	1.372	100	0	0	0
3	2 axle van	117	0.574	2.760	8.108	2.766	94	5	0	1
4	2 axle truck	520	0.305	0.543	8.248	1.637	97	2	1	0
5	3 axle truck	192	0.614	0.868	11.425	4.807	94	5	1	1
6	4 axle truck	20	1.429	1.620	20.185	9.137	60	15	5	20
7	2 axle bus	161	0.375	0.455	8.997	1.718	97	2	1	0
	3 axle bus	83	0.594	0.604	12.040	3.659	93	4	4	0
Total		1111	0.435	1.097	9.383	3.616	95	3	1	1

Vehicle - Large wheel base (8.5m-15.5m)			EDA/vehicle		Weight (t)		Compliance with Legal Load Limit			
							Within Limit	0 - 10% Over	10 - 20% Over	> 20% Over
		Freq	Mean	Std	Mean	Std	Percent	Percent	Percent	Percent
TNZ Class	Vehicle Type									
8	3 axle artic	32	0.114	0.160	8.756	1.629	97	3	0	0
	4 axle artic	20	0.526	0.710	17.013	9.216	55	0	0	45
	4 axle T&T	8	0.769	1.263	11.606	5.403	100	0	0	0
9	5 axle artic	42	2.715	1.517	32.622	10.307	38	12	7	43
	5 axle T&T	23	2.187	0.899	31.913	6.541	22	13	39	26
10	6 axle artic	184	1.815	0.834	34.134	6.695	66	16	7	12
	6 axle T&T	41	2.331	0.867	37.227	6.757	41	17	7	34
	7 axle	5	1.214	0.551	35.434	5.673	60	0	20	20
Total		355	1.747	1.158	30.427	11.100	60	13	8	20

?AT 200 V LE F T
SH 1N PUKERUA BAY FROM 18NOV91 TO 24NOV91

Vehicle - Very Large wheel base (15.5m-34.0m)		Freq	EDA/vehicle		Weight (t)		Compliance with Legal Load Limit			
							Within Limit	0 - 10% Over	10 - 20% Over	> 20% Over
			Mean	Std	Mean	Std	Percent	Percent	Percent	Percent
TNZ Class	Vehicle Type									
11	4 axle T&T	4	1.936	2.578	16.332	5.894	100	0	0	0
	5 axle T&T	6	1.887	1.144	30.473	7.801	33	0	0	67
	6 axle T&T	77	2.452	1.039	39.192	7.135	16	6	6	71
12	7 axle A&T	9	2.137	0.618	39.911	3.670	78	11	0	11
	7 axle T&T	109	2.812	1.026	42.516	7.170	27	23	11	39
	7 axle B-train	72	2.467	2.538	38.971	7.558	82	15	1	1
	8 axle T&T	24	2.423	0.671	44.673	5.231	33	46	17	4
	8 axle B-train	40	1.809	0.987	40.742	8.611	55	32	7	5
Total		341	2.468	1.500	40.373	7.973	42	19	7	31

Vehicle - Other		Freq	EDA/vehicle		Weight (t)		Compliance with Legal Load Limit	
							Within Limit	> 20% Over
			Mean	Std	Mean	Std	Percent	Percent
TNZ Class	Vehicle Type							
13	unknown	2	3.617	2.769	35.200	16.886	50	50

PAT 20(.E G REP
SH 1N PUKERUA BAY FROM 18NOV91 TO 24NOV91

Axle Group Type	Freq	Weight (t)		Compliance with Legal Load Limit			
				Within Limit	0 - 10% Over	10 - 20% Over	> 20% Over
		Mean	Std	Percent	Percent	Percent	Percent
Single Steer	1751	4.172	1.343	92	6	1	1
Twin Steer	99	9.345	1.769	82	14	3	1
Single Non-Steer	1194	5.456	1.940	88	5	3	4
Tandem	1377	10.918	4.124	82	13	4	2
Tri	207	16.411	4.820	44	29	17	10