Weight regulations, overweight vehicle policy and enforcement procedures in New Zealand

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New Zealand's roading system is only one hundred years old, and in the main it relies on comparatively thin unbound flexible pavements and short/medium span bridges. A thorough review of structural capacity in 1988 (Ref 1) resulted in the adoption of the 44 tonne gross weight limit. Our enforcement agency is improving its effectiveness despite funding restraints, by a combination of routine manning of permanent weigh stations, and random stopping by mobile mufti units. A study is now underway to examine the feasibility and economics of increased weight limits on the principal transport routes.

1. SETTING THE SCENE

New Zealand has 92,600 km of roads of which 10,677 km form the national state highway system. This roading network has to be supported by a population of only 3.45 million people whose resources are already stretched to provide other essential services such as health and education to a population dispersed over a land area roughly the size of the United Kingdom. However, the economy still has a large rural component which is almost entirely dependent on road transport, so the roading infrastructure has to be preserved.

Much of New Zealand's roading terrain is hilly or mountainous which requires considerable bridging, costly maintenance and construction, and can severely constrain geometric standards.

To meet its roading challenge within the funding limitations New Zealand has relied on thin flexible pavements and light bridge structures, and acceptance of geometric standards which can sometimes be less than those commonly seen in other countries. Under the present weight limits 5% of the state highway bridges are operating at well above their allowable design stresses.

To be measured against this is the fact that New Zealand depends on its rural economy, and road is now practically its sole transportation mode, so the minimisation of road transport operating costs is also a major consideration.

The above factors are overlaid by a major national commitment to improved road safety, a principal thrust of which is a policy to improve the inherent safety quality of the vehicle fleet.

Heavy vehicle regulatory policy and enforcement are therefore vital to ensure both the preservation of the nation's roading assets, and the continuing safe and efficient operation of road transport. The extraction of the maximum overall benefit from the total transportation system has required much "fine tuning" of the vehicle limits regulations over a period of many years.

We now have a highly developed and detailed weight limit regime, supported by a very lean administration and enforcement system.

It has been our experience that added levels of regulatory complexity are the inevitable result of responding to the constant demand for increased efficiency, in an environment bounded by the constraints described above.

2. OUR CURRENT WEIGHT REGULATIONS

The new regulations which came into force in 1989 in New Zealand are summarised in Appendix 1.

Chief features to note are:

- Axle, axle group and gross weight limits
- Limits on combinations of internal axle groups
- Static load sharing design requirement
- Plus or minus 10% load sharing performance requirement, built into group weight limits
- Prohibition of unacceptable suspension designs
- Suspension dynamic performance tests for non standard designs
- Verification of static load sharing by test weighing on certain vehicles
- Constraints on the number and position of axle groups allowed
- Matching of dimensional regulations and stability and safety principles with the weight limits

3. ENFORCEMENT STRATEGIES

3.1 Manpower

Heavy vehicle weight enforcement is presently carried out by the Ministry of Transport's Traffic Safety Service. The Service will be absorbed into the New Zealand Police Force from 1 July 1992, so that heavy vehicle enforcement will be under the control of district police commanders and a responsibility of the Minister of Police.

 Heavy vehicles and roads: technology, safety and policy. Thomas Telford, London, 1992.

The enforcement agency currently employs about 1100 uniformed officers whose duties include enforcement of all road traffic matters; and a smaller mufti unit of 44 men dedicated specifically to heavy vehicle fiscal, operating and safety standards enforcement.

3.2 Weighpits

Weighing by portable scales has remained the predominant method for many years. This is chiefly carried out at roadside pits known as weighpits, which involve a two-directional concrete approach surface and a narrow slot into which the scales are recessed. Each weighpit is built to a high specification of accuracy, with respect to flatness, levelness, and depth to match the scales in use. The most significant feature of this system is that the law allows a vehicle to be weighed one axle at the time using a single set of scales, and the vehicle is moved forward as each successive axle is weighed. All axle group weights and gross weights may be determined by summing the individual axle weights.

At the last check there were 140 weighpits available on the state highway network for weighing using the Swedish Tellub scales.

3.3 Roadside weighing

Random roadside weighing on a reasonably level surface is also carried out, but up till now this has required heavier scales and cumbersome dummy platforms which support the axles which are not being weighed. Transit New Zealand has therefore recently equipped the mufti unit with fifteen sets of a newer thin lightweight wheel weigher.

The dummy scales used to support other axles in the axle group being weighed will be of a plastic/plywood construction, easily carried in the rear of a motor vehicle.

This form of random weighing is expected to become more significant, since the increased portability of the equipment will permit the mufti enforcement units to respond quickly to trends in heavy vehicle movement.

3.4 Weighbridges

Prior to 1987 Transit New Zealand's predecessor, the National Roads Board, owned only two weighbridges, both located in the central North Island and of the full length variety. It became clear from overseas practice that there was a need for a network of new weighbridges to be constructed for routine enforcement weighing. These facilities 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.

The locations of the current weighbridges are shown in Fig 3.

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

4. ECONOMICS OF HEAVY VEHICLE ENFORCEMENT

The shortage of original capital during the development of New Zealand has meant that this country possesses predominantly low strength pavements which require timely maintenance. The passage of vehicles, notably heavy axles, causes wearing of pavements which must be promptly corrected in order to preserve the asset. It has been estimated (Ref 2) that for the year ended 31 March 1989, 30% of the total expenditure on maintenance and construction of our total roading system, or \$163M, could be attributed to axle loadings. Clearly it is in our interests to contain this cost to a tolerable level by controlling the total axle loading sustained by the pavement.

New Zealand's weight monitoring programme has built up a useful picture of the heavy transport industry over the last two years. At our current level of weight enforcement, records indicate that 10-12% of all heavy vehicles (ie those exceeding 3.50 tonnes gross) are operating at above the permitted weight limits. By applying the fourth power law to weigh-in-motion data, it is possible to examine the degree of road wear (measured in Equivalent Design Axles or EDAs) which is being experienced, and make a guess at how this could be reduced by a higher level of compliance with weight limits. L R Saunders (Ref 2) has estimated that if the level of overloading were reduced to 6%, this would result in a 13% reduction in total axle loading (see Figs 1-2). This in turn is estimated to lead to a saving in the annual maintenance budget of \$21M, assuming the fourth power law is applicable.

The current cost of heavy vehicle enforcement by the Ministry of Transport is \$6.5M. Clearly from these figures there is an indication of the high pay-off available if a better level of compliance can be achieved. We are confident that our enforcement activity will become more effective with the move towards strategically located weighbridges and random roadside weighing.

Another study carried out recently by Transit New Zealand extrapolated weigh-in-motion data for a site in South Auckland into hypothetical infringement fees collected from overweight vehicles. Assuming it was possible to intercept all overloaded traffic at this site, according to the study, the revenue which would be earned at this location clearly justified a fully manned weight enforcement facility. Whilst the figures were somewhat speculative, the message about the economics of weight enforcement was clearly spelt out.

In conclusion therefore, it could be said that a more

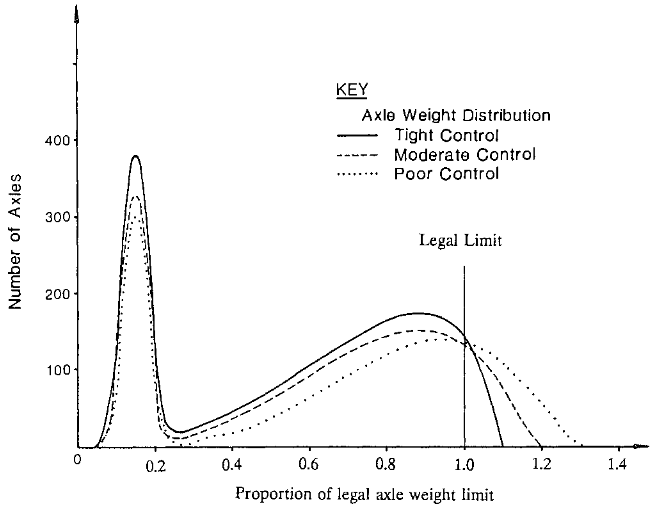

Fig 1. Axle weight distribution for varying compliance levels

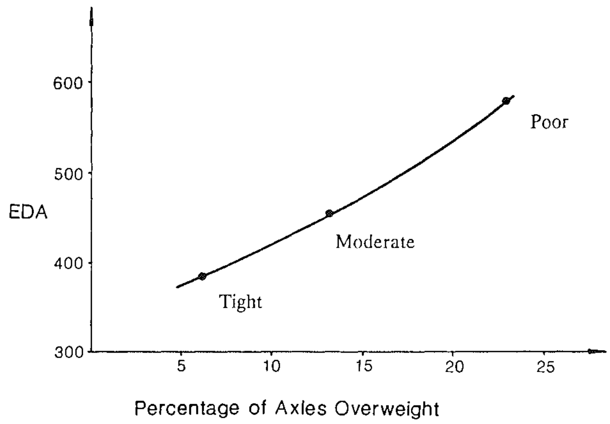

Fig 2. Damage effect of overloading

effective enforcement operation should lead to a saving in roading expenditure, and an increase in revenue available. Hopefully we can achieve both.

5. THE ROLE OF WEIGHT MONITORING

In another paper to this Symposium (Ref 3) the experiences of Transit New Zealand with installation of weight monitoring equipment is covered in detail. Of relevance here is the part that this technology can play in enforcing weight limit policies.

In our view the low cost WIM equipment has an accuracy level well outside what is required for this purpose. If we are trying to make conclusions from data which has a standard deviation of more than 10%, then we are wasting our time. We have therefore confined our studies on road wear and compliance levels to the data from the older, more robust sites where we are more confident of accuracy of weight records. This data has assisted us, as referred to in Section 4 above.

Also of note from this information gained so far has been the high level of offending from the triaxle and tandem groups, and the weight variation on axles within those groups. The bridge decks on many of our structures are sensitive to high axle group loads and poor group load sharing. The weight monitors are therefore a helpful indicator of the effectiveness of the current transport fleet. They are also able to support our reasons for maintaining a relatively low weight limit for axles and axle groups.

In summary, it seems that weight monitoring is a useful indicator of compliance, but is presently not of sufficient accuracy for enforcement purposes.

6. HEAVY TRANSPORT ROUTES

As we mentioned earlier, our national economy relies strongly on the roading network. Our current weight limits are acknowledged as being somewhat lower than in many countries. This produces the following problems:

- Restriction on movement of containers built to international standards
- Import of heavy vehicles manufactured to accepted codes
- Restriction on competitiveness of road transport industry
- Limit on industrial development eg recent boom in forestry

It is therefore proposed to carry out a study to determine the costs and benefits of upgrading the present roading network to address these problems.

This would lead to a list of new projects proposed to achieve a network of transport routes able to sustain higher loadings.

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DISCLAIMER

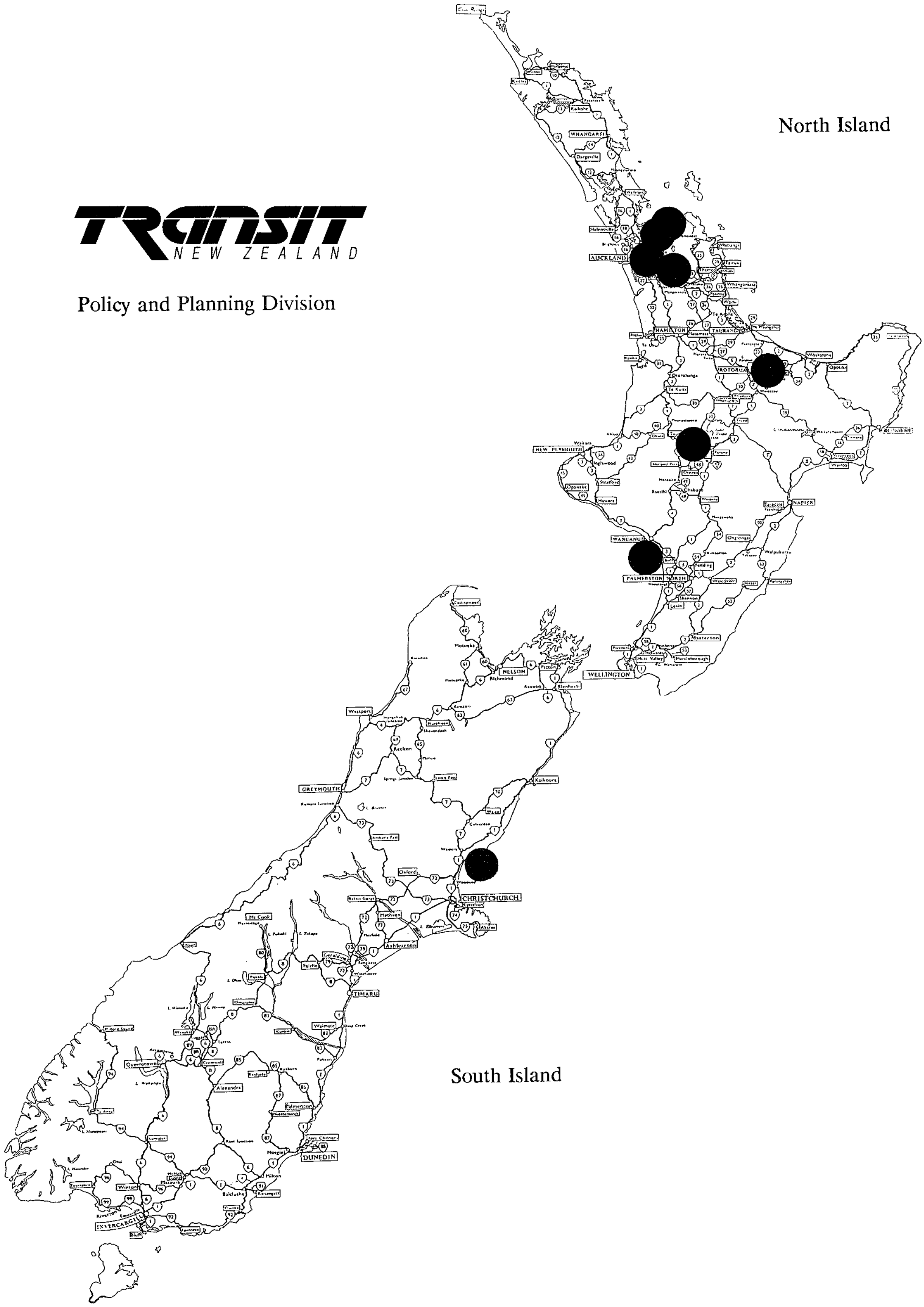
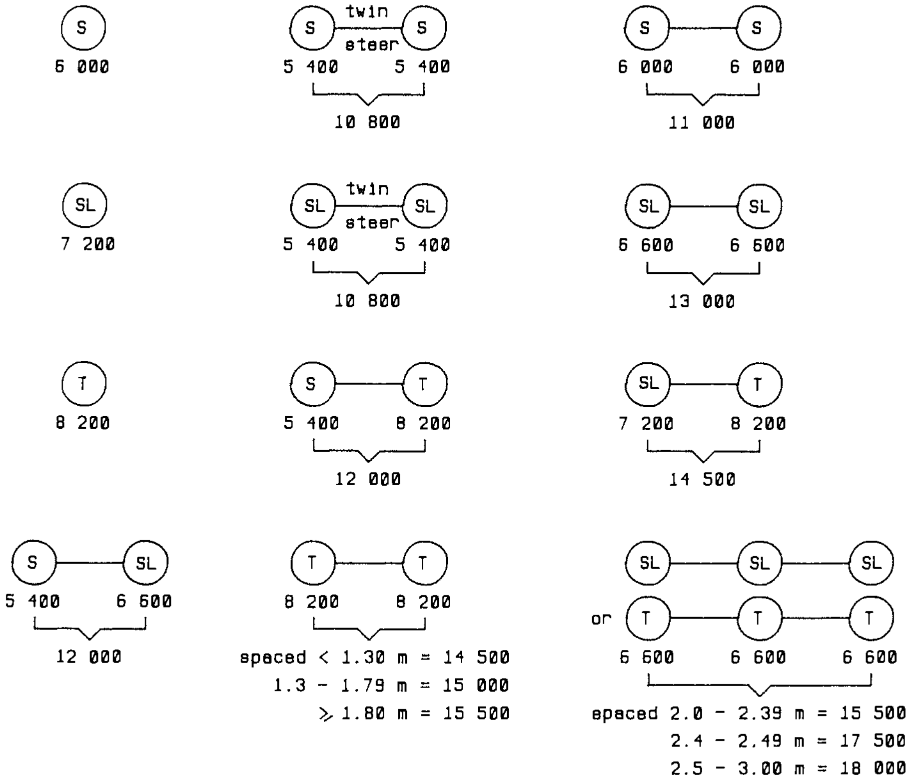


Fig 3. Weighbridges in New Zealand (as at 1 April 1992)

MAXIMUM VEHICLE AND AXLE WEIGHTS (Kilograms)

FEBRUARY 1989

AXLE SETS



WHEELS 1/2 axle limit plus 500 kg.

S .... Single standard tyred axle.

SL .... Single large tyred axle (tyres at least 330 mm (13 inch) width by 24 inch diameter or 355 mm (14 inch) width by 19.5 inch diameter)

T .... Twin tyred axle.

Note: For weights on oscillating axles and other axle combinations not shown above, refer to the Heavy Motor Vehicle Regulations 1974, Amendment No.5.

Distance from 1st to last axle of any vehicle or combination.

2.5 m or more	17 500 kg	
3.0 m or more	19 000 kg	
3.3 m or more	20 000 kg	
3.6 m or more	21 000 kg	
4.0 m or more	22 000 kg	
4.4 m or more	23 000 kg	
4.7 m or more	24 000 kg	
5.1 m or more	25 000 kg	
5.4 m or more	26 000 kg	
5.8 m or more	27 000 kg	
6.4 m or more	28 000 kg	
7.0 m or more	29 000 kg	
7.6 m or more	30 000 kg	
8.2 m or more	31 000 kg	
8.8 m or more	32 000 kg	
9.4 m or more	33 000 kg	
10.0 m or more	34 000 kg	
10.8 m or more	35 000 kg	
11.6 m or more	36 000 kg	
12.4 m or more	37 000 kg	
13.2 m or more	38 000 kg	
13.5 m or more	39 000 kg	
14.4 m or more	40 000 kg	Vehicles exceeding
14.8 m or more	41 000 kg	39 000 kg are subject
15.2 m or more	42 000 kg	to preconditions
15.6 m or more	43 000 kg	determined by the
16.0 m or more	44 000 kg	Secretary for Transport.