

# The Damaging Effect of Overweight Vehicles on Southland Roads

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# High Productivity Motor Vehicles



Photo Courtesy of CCANZ.



## High Productivity Motor Vehicles

For trucks on NZ public roads, maximum gross weight:

- Maximum without a permit                      44 tonnes
- High Productivity Motor Vehicles            may be > 60 tonnes  
  (HPMV) require permit
- 50MAX a subset of HPMV                      up to 50 tonnes



## High Productivity Motor Vehicles

HPMV:

- Higher gross weight than 44 tonnes.
- Higher axle loads allowed than traditional (non-permitted) trucks.

Axle and Tyre Configuration	Maximum for HPMV Tonnes	Maximum for Traditional Trucks Tonnes
Single axle dual tyred	8.8	8.2
Tandem axle dual tyred, spaced $\geq$ 1.8m	16.0	15.5
Tri-axle dual tyred, spaced $\geq$ 2.5m	19.0	18.0
Tri-axle super singles, spaced $\geq$ 2.5m	19.0	18.0
Quad-axle dual tyred	22.0	20.0
Quad-axle super singles	22.0	20.0

- But limits on gross weight may control.



## High Productivity Motor Vehicles

HPMV:

- Greater proportion of gross weight is goods.
- Fewer trips to carry same tonnage of goods.

50MAX approx. 35 tonnes of goods.

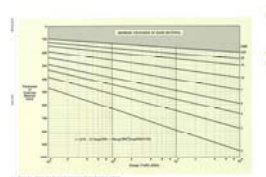


## Austrroads Pavement Design

Austrroads 2004 and 2012 provides two types of design:

- Empirical
- Mechanistic

Figure 5.8



As HPMV higher than standard axle loadings it seems appropriate to use mechanistic.



## Austrroads Pavement Design

- Equivalent standard axles, ESA, single axle, dual tyres, 80 kN.
- For different axle loads and different axle configurations pavement damage.

$$= \left[ \frac{\text{actual load on axle group}}{\text{reference axle load}} \right]^n$$

Design Method	Damage Type	Damage Exponent, <i>n</i>
Empirical	Overall pavement damage	4
Mechanistic	Fatigue of asphalt	5
	Rutting and shape loss	7
	Fatigue of cemented	12



## New Zealand Research

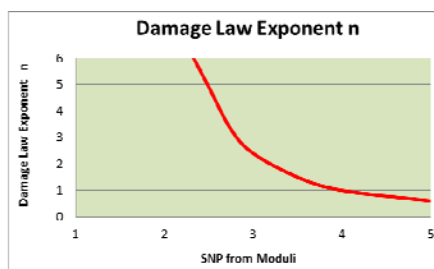
CAPTIF accelerated testing on effect of different axle loads on pavements.



## New Zealand Research

From CAPTIF

- Strong pavements higher axle loads little effect.
- Weak pavements higher axle loads major effect.
- Southland has some weak pavements, damage exponent for rut may be up to 10.



## TERNZ Report

- TERNZ Transport Research: Independent.
- Examined Weigh-in-Motion data.
- Derived typical axle load distributions 7, 8 and 9 axle truck and trailers and B trains. Derived:
  - Representative 44<sup>T</sup> truck and trailer
  - Representative 44<sup>T</sup> B train



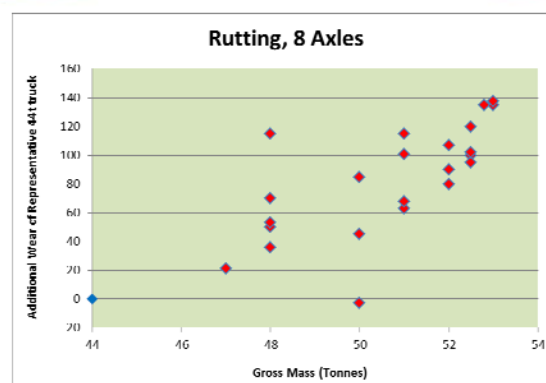
## Southland District

### HPMV:

- Each HPMV needs a permit.
- Permit gives gross weight, axle loads, axle and tyre configuration.
- Can calculate pavement wear to 4<sup>th</sup>, 5<sup>th</sup>, 7<sup>th</sup> and 12<sup>th</sup> power law.



## Southland: 8 Axle Truck and Trailer : Rutting

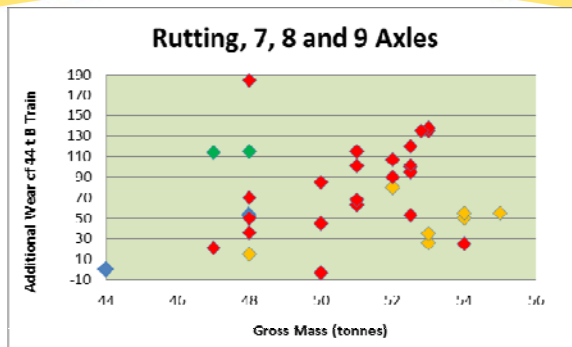


Blue is 44t representative, Red, 8 Axle T and T

- HPMV – Most cause more wear than representative 44<sup>T</sup>. One causes less wear.
- Scatter even for same gross mass.



## Southland: 7, 8 and 9 Axle Truck and Trailer Rutting



Green 7 Axle T and T  
 Red 8 Axle T and T  
 Yellow 9 Axle T and T

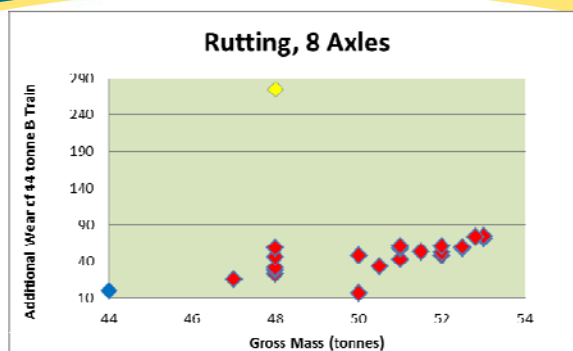
HPMV – Generally more axles cause less pavement wear for same gross mass.



## Super Singles



## Southland: 8 Axle Truck and Trailer : Rutting



Yellow 8 Axle SS  
Red 8 Axle Duals

Super Singles – For same gross mass super singles cause more pavement wear than dual tyres.



## Policy Considerations

### HPMV

- Permitting of trucks with super singles seems inappropriate for HPMV.
- Permitting of trucks with  $\leq 7$  axles seems inappropriate for HPMV.





## Conclusions

### HPMV

- HPMV can cause significantly more wear on weak pavements.
- Most HPMV cause more pavement wear than representative 44<sup>T</sup>.
- Scope to have "low wear" HPMV.

