

# Forest Road Design Standards: New Zealand



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# Overview



1. Forest roads in NZ
2. 'Conflict' – Forest Roads vs Log Trucks
3. Changing design demands
4. Developing appropriate road standards
  - → Benched road design



# Roads - We need to build a lot of them...

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- ❑ Increasing harvest volumes: 50% increase in last 10 years!
- ❑ 'New' harvest locations are still often first rotation forests, in steep, erodible, land
- ❑ 1600 – 2000km per year



# Large scale operations...

- Both Ground-based and Cable yarding
- each producing 250 – 500 m<sup>3</sup> / day
- 10 – 20 log trucks per day per crew



# Roads are “Fit for Purpose” -

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Road are being paid for by the value of the timber harvested...

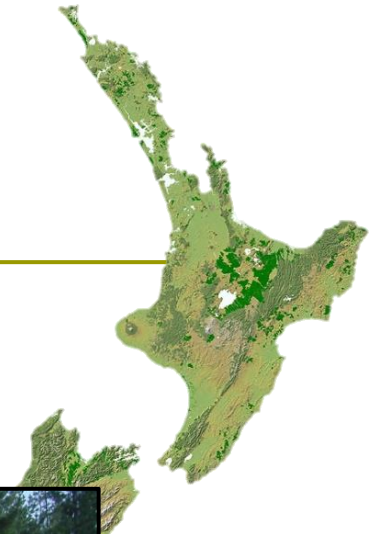
Harvesting – US \$15 - \$35 / m<sup>3</sup>

Trucking – US \$10 - \$25 / m<sup>3</sup>

Roading – US \$2 - \$10 / m<sup>3</sup>

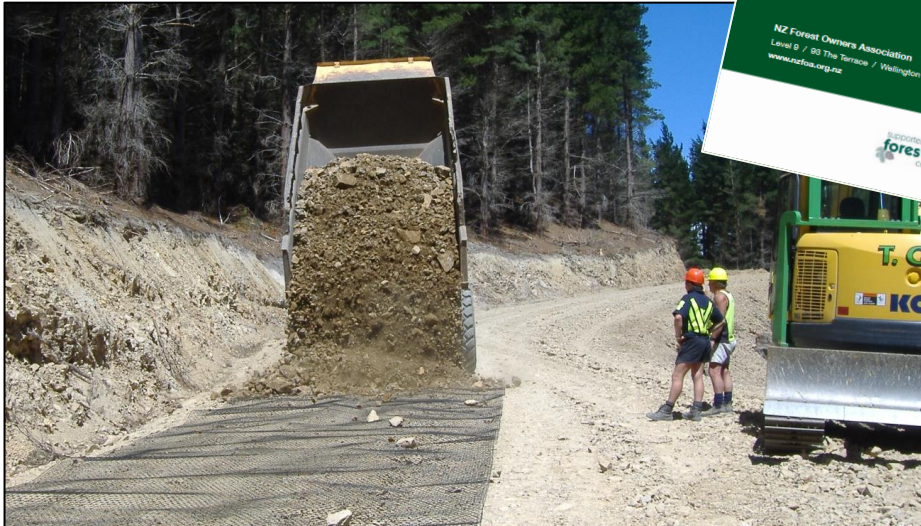


# Challenging terrain...



# We have some good guidelines / practices

- ❑ Informing *fit-for-purpose* road design and construction.
- ❑ No legal mandate - but are accepted as 'best practice'.
- ❑ Available for free download from <https://www.nzfoa.org.nz/>



- A slash bund at the bottom of the fill helps reduce sediment movement.
- The fill is contained and stable.



- Poor water control at the top of the fill has led to rill erosion.
- The fill has not been protected.

# Forest Road Standards – Issue?

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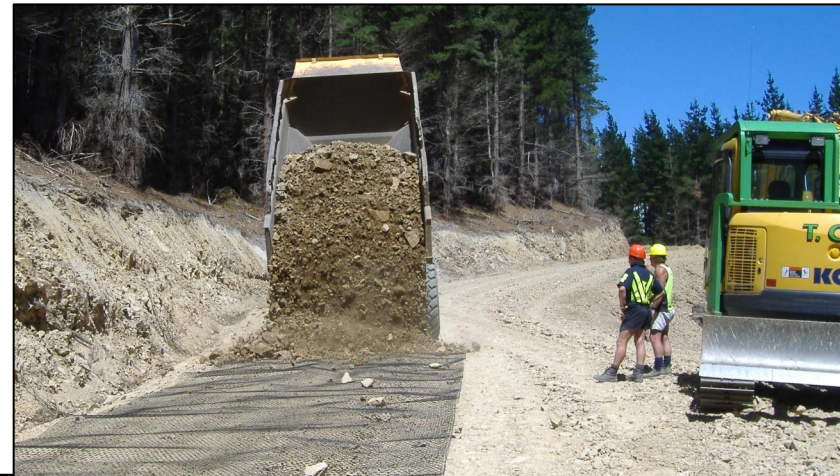
Forest Owners design and pay for the forest roads

- ❑ steeper road → shorter lengths
- ❑ higher loads → fewer trucks

VS

Truck contractors operator the fleet on a per km rate

- ❑ Poorer roads slow the trucks and increase maintenance costs
- ❑ Steep roads increase safety concern





# Road design practice?

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Single Improved Layer,  
approx. 150mm of gravel

Log trucks were typically  
44t truck/trailer with 8  
axles.

'New 50Max (4 axle Truck  
and 5 axle trailer)

'Newer' High Performance  
Motor Vehicle 'licence' can  
be purchased for higher  
loading...



# New HPMV log trucks...

- HPMV (same width & height).
- → over-length to 23.5m
- → over-weight up to 62 tonnes GVM.



- ALSO – stem length 'off-road' cartage



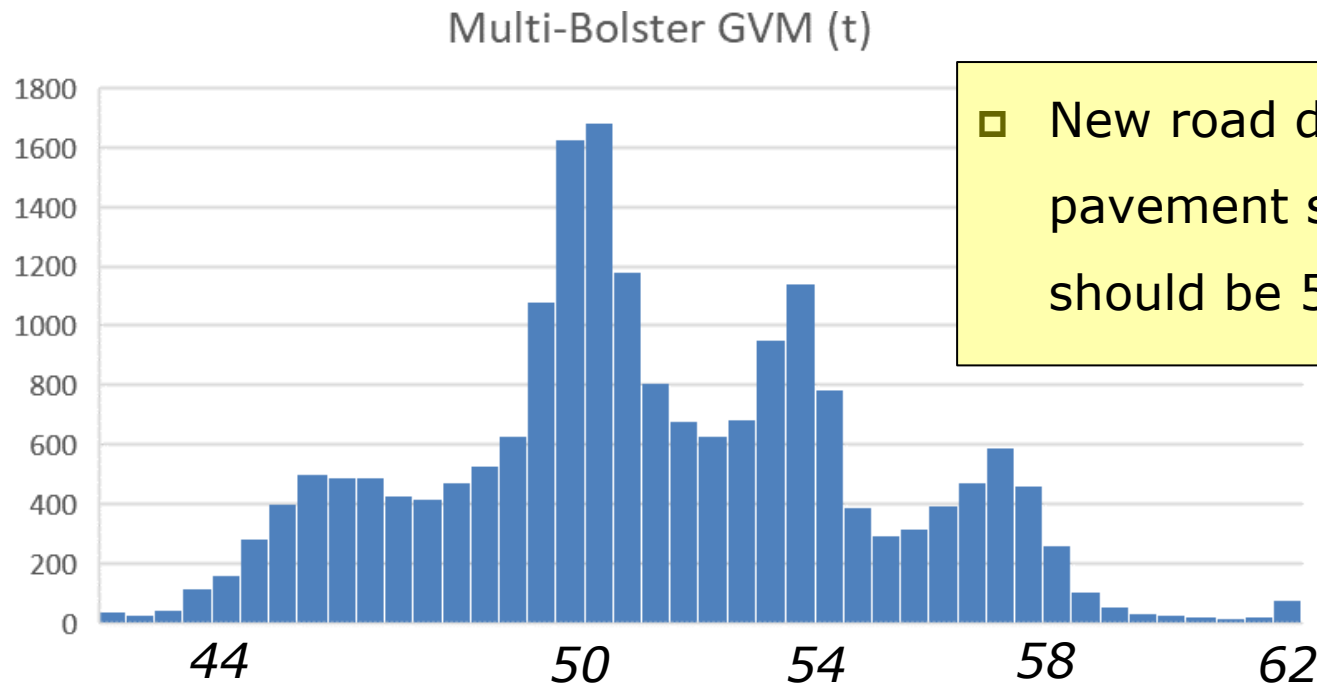
# Study 1 – actual truck loading using weighbridge data



- Survey of logging trucks on road
  - 56% were 4-axle trucks & 5-axle trailer

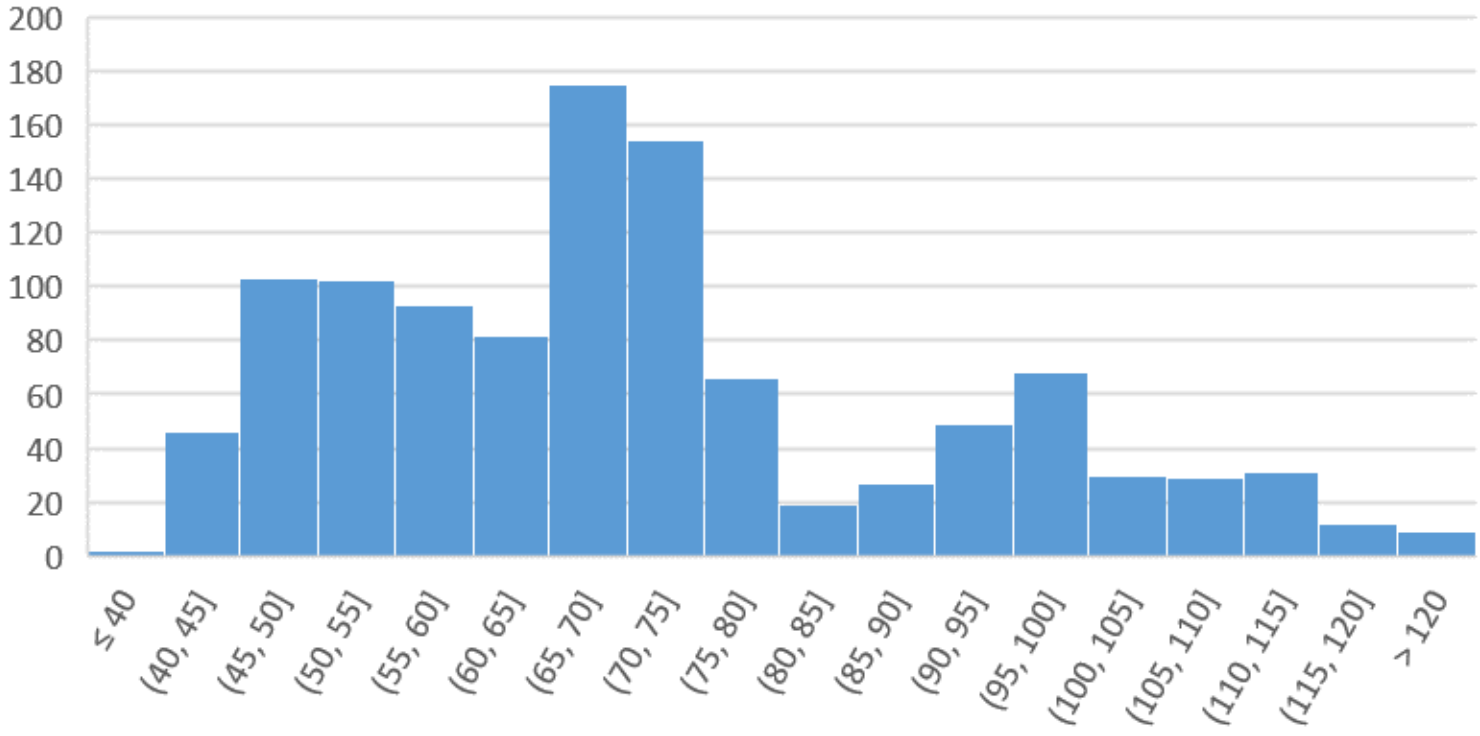
Using data on 30,000 delivered loads from on-road trucks...

- Tare weight between 17.5 and 18.5 tonne



New road design pavement standard should be 54t?

# Off-Highway Truck GVM (tonnes)



# Road Design

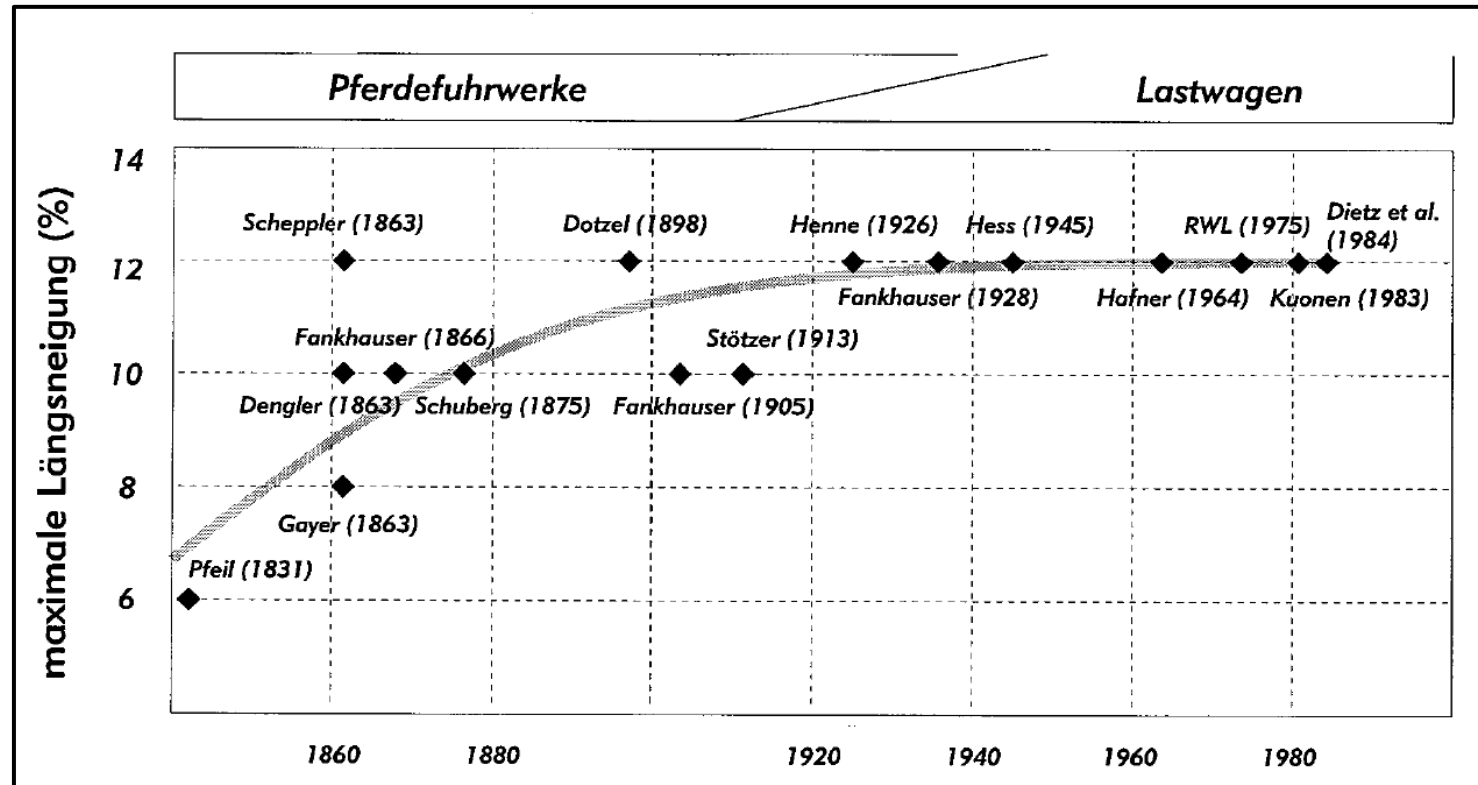
- ❑ ESA axle design theory is  
→  $(\text{axle load}/\text{standard axle})^6$
- ❑ While 54 tonne is only 23% heavier than 44t  
→ It does  $1.2^6 = 3.4$  times the damage!!
- ❑ For 9-axle about 1.5 x damage!

Companies need to build better roads so trucks get same quality experience?



Axle Type	Standard Load, T
<b>SAST</b>	<b>5.4</b>
<b>SADT</b>	<b>8.2</b>
<b>TAST</b>	<b>9.2</b>
<b>TADT</b>	<b>13.7</b>
<b>TRDT</b>	<b>18.5</b>

# Road grade for larger log trucks?



NZ guideline?

- Spur road 14% Adverse, 16% favourable
- 50Max should be 12.%

# Road grade for larger log trucks?

From international literature it depends on...

□ Adverse / favourable

□ De

□ Ro

□ St

□ Vo

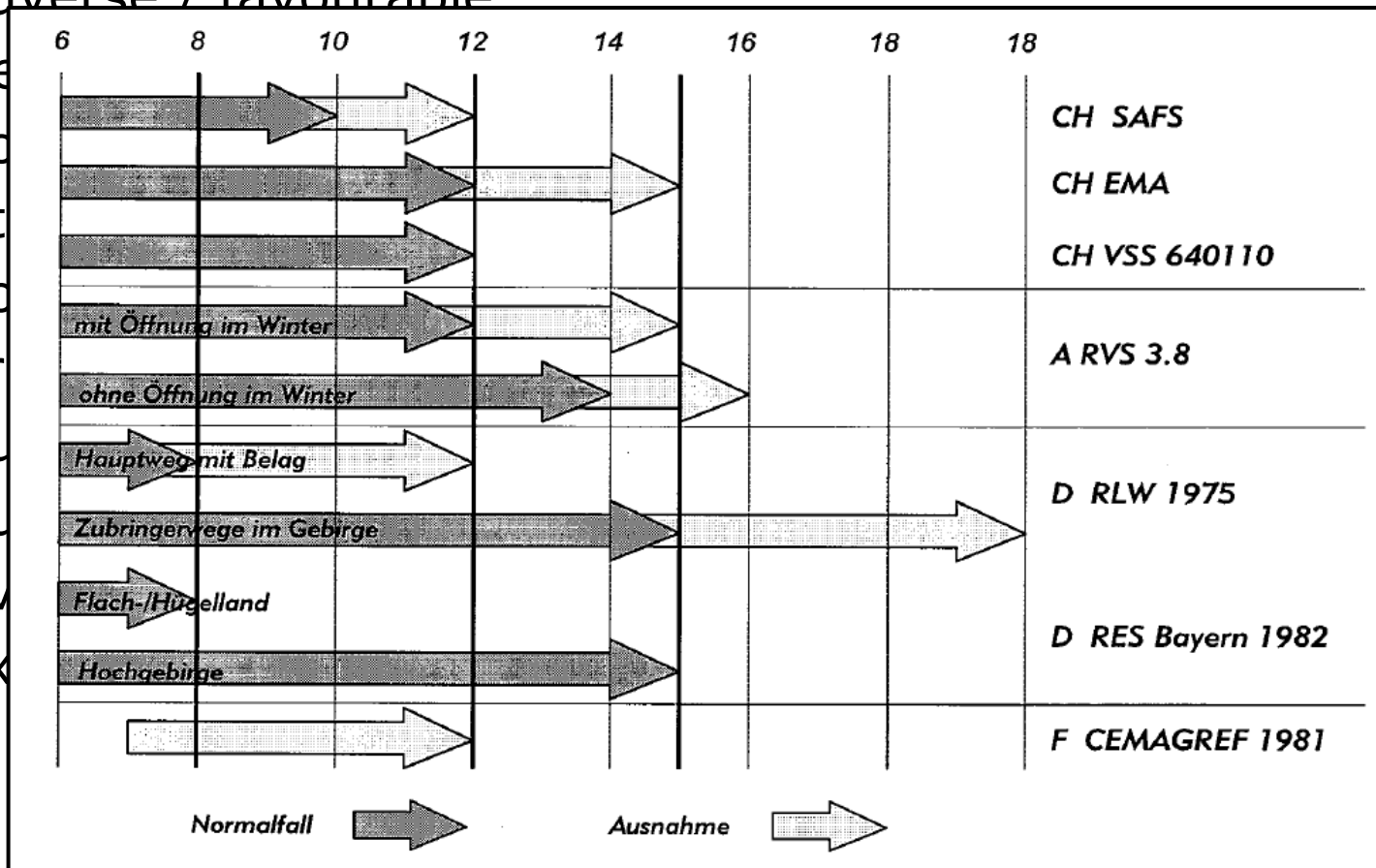
□ Tr

□ Su

□ Cu

□ Av

□ Ex



# Road grade by truck type...



Truck Type	Road Grade Straight (%)		
5-axle longs trailer	10	6	16
5-axle multi-trailer	12	8	15
4-axle multi-trailer	13	9	13.5
3-axle multi trailer	14	12	
6x8 Tractor new 3 axle multi trailer	20	17	

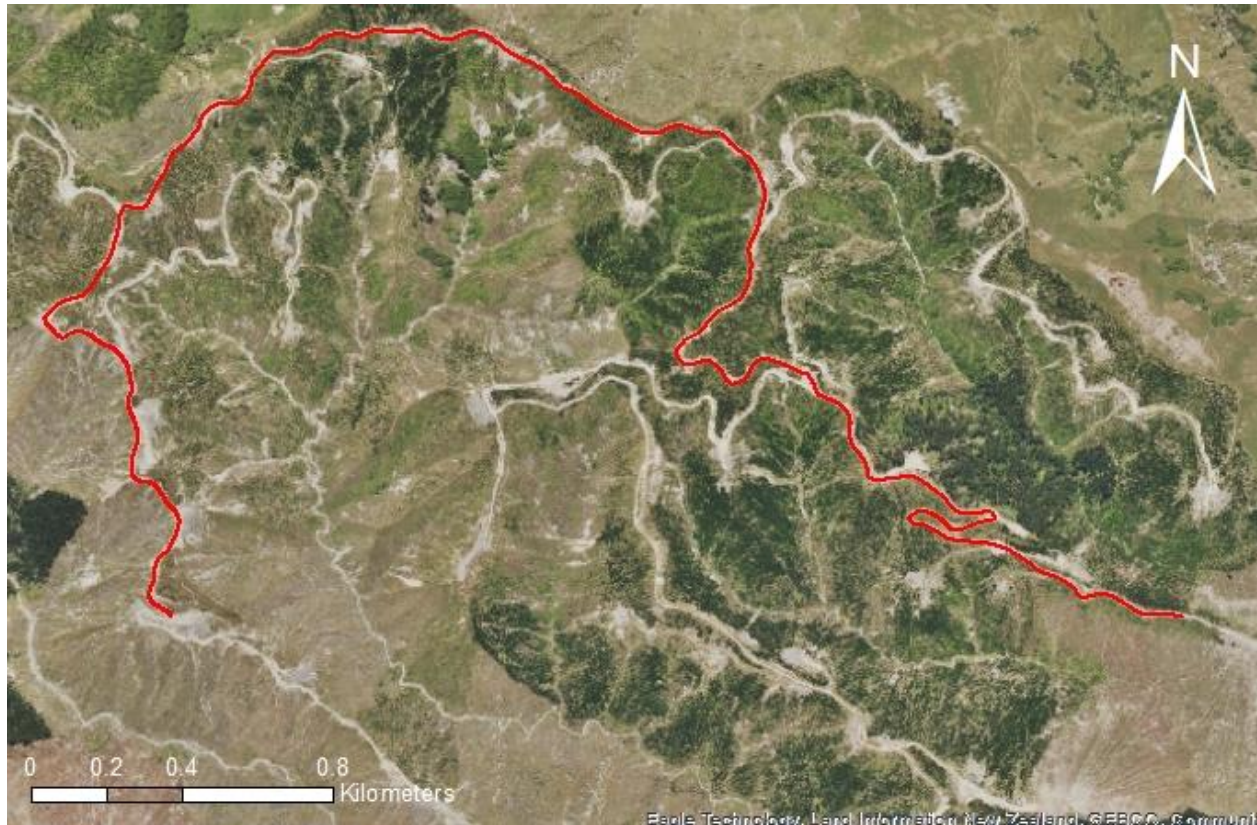




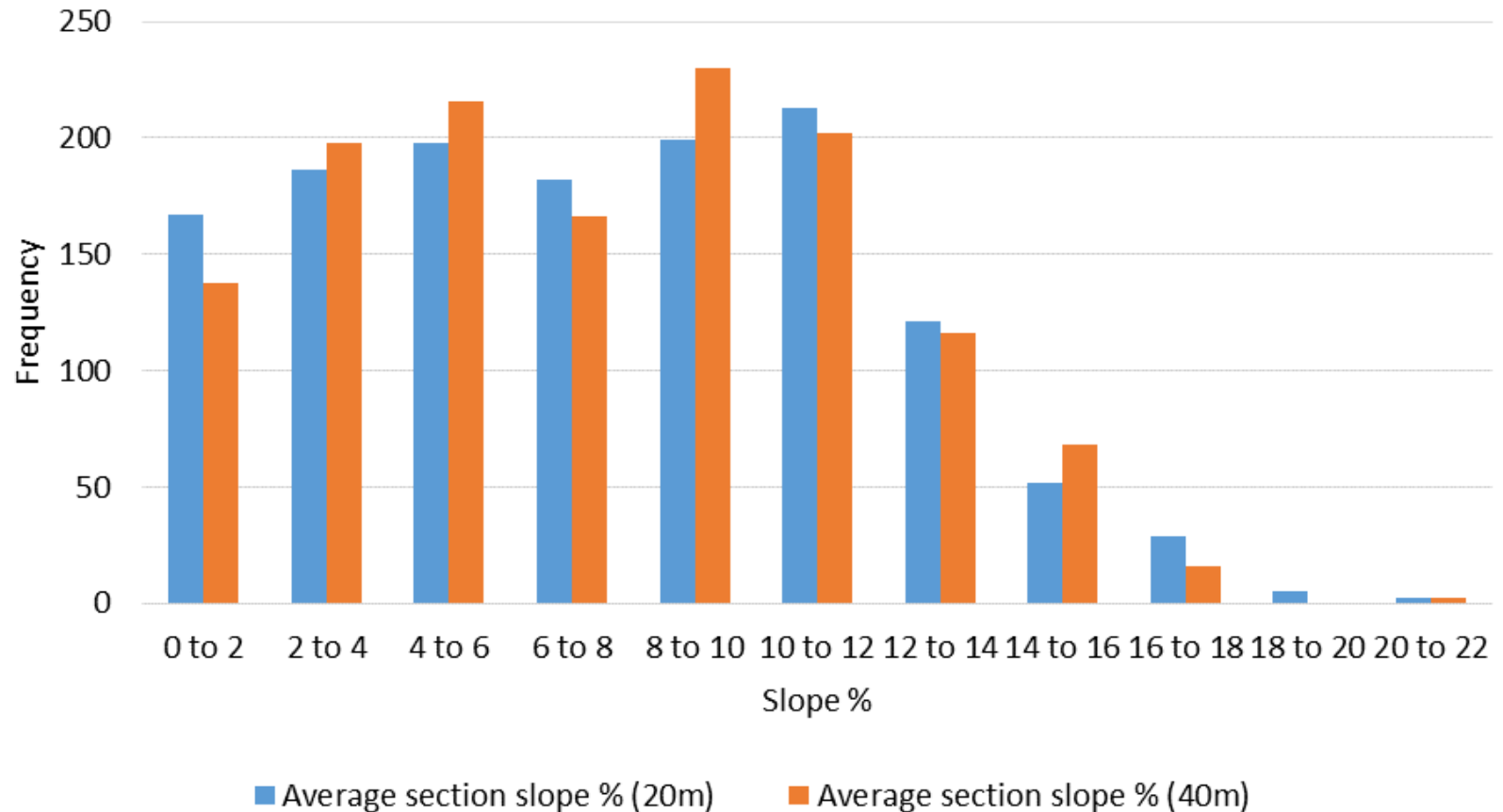
# Case study of actual road slope?

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- Ask 5 companies for steep(est) secondary roads
- Get the LiDAR layer and measure road slope in 20m & 40m segments



# Results –actual road slope?



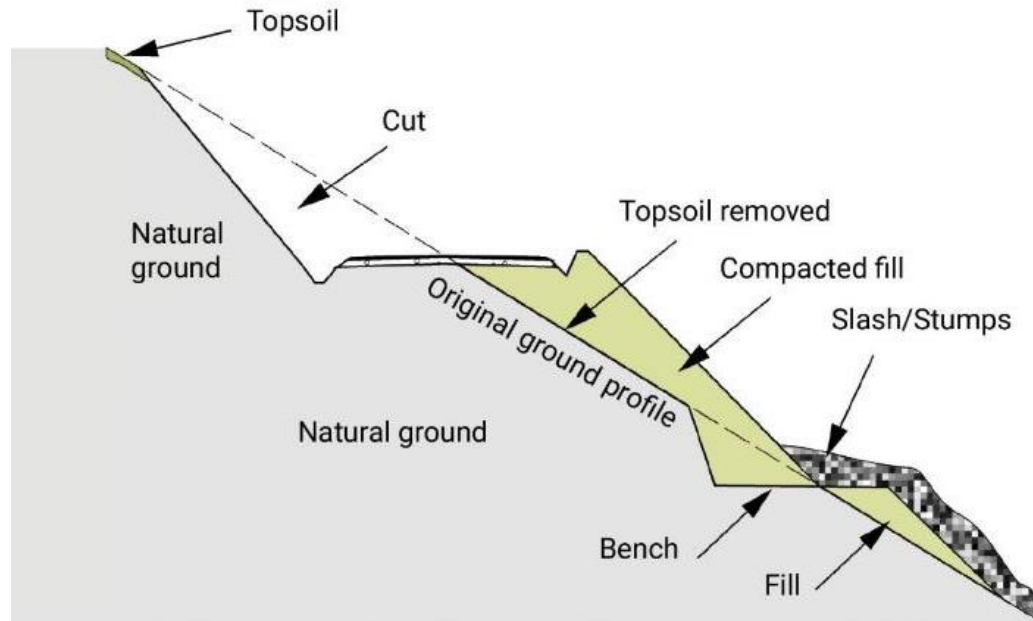
- So overall OK? – common 'upper limit is 14-16%

# New road construction rule: Benching..

## (for permitted road construction)

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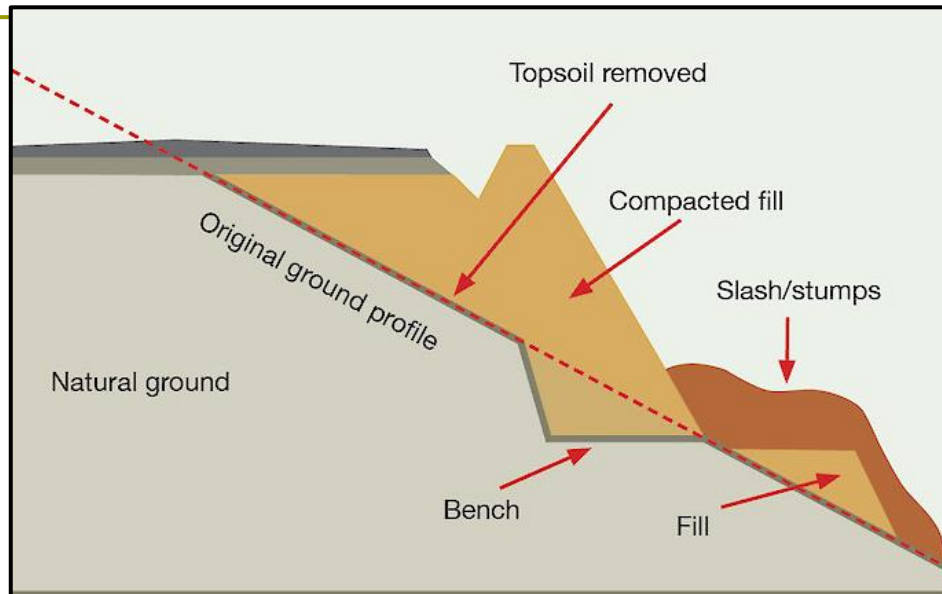
- ❑ If less than 25 degree side slope you can side-cast
- ❑ If land slope is between 25 and 35 degrees, benching must be used...



- ❑ If land slope is greater than 35 degrees, spoil material must be end-hauled to a safe containment area

# New road construction rule: Benching..

(for permitted road construction)



- More common to use bench for catching / supporting fill material, not for carriageway...

# Summary – NZ Forest Roads

- ❑ Extensive on-going road building programme in NZ forests
- ❑ Quickly changing truck fleet
- ❑ Plenty of challenges, but also good competence in building 'fit-for-purpose' road
- ❑ Real opportunity for innovative roading practices
- ❑ Plenty of work to do!

