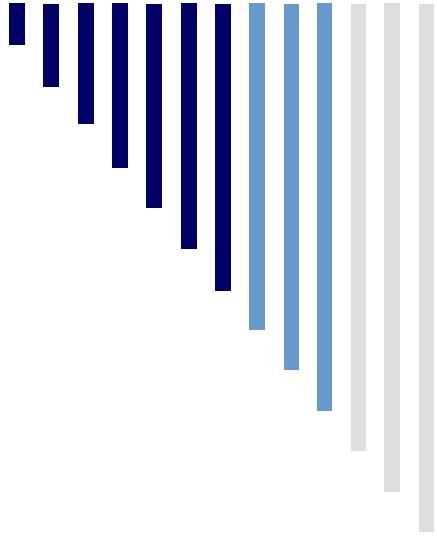

Engineering Challenges and Learning from the Introduction of HPMV

Geoff Walsh – Engineering Manager
Transport Technology Ltd
Auckland



What are these Challenges



- Increased Vehicle & Combination Lengths
 - Increased Mass
 - Stability – SRT
 - Road Space demand
 - Longer Trailers
 - Maintaining or reducing tare weight
-

Age is also a challenge



Higher gross mass and reduction in thair



HPMV - a long time coming but well worth the wait

- 25m – 62 t Scope
- Achieved in difficult political era
- Benefit single regulatory authority
- Good regulation = good vehicles
- Challenge for industry to retain value

Our Australian Friends

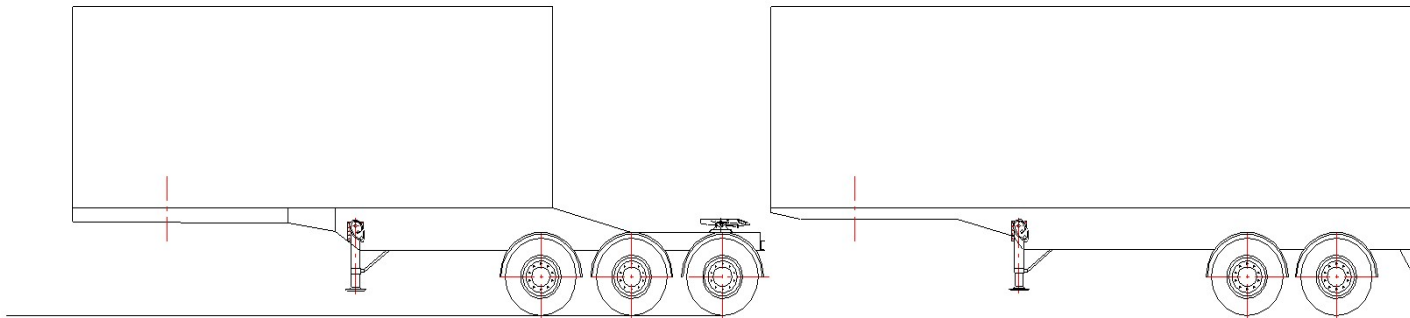


25 & 26 meter B-Doubles have been in service for many years

Nothing much new in HPMV range that has not been proven Overseas

We can learn from this and not make same mistakes
PBS vs Proformer – cost effective options - standardised

B-Train Options



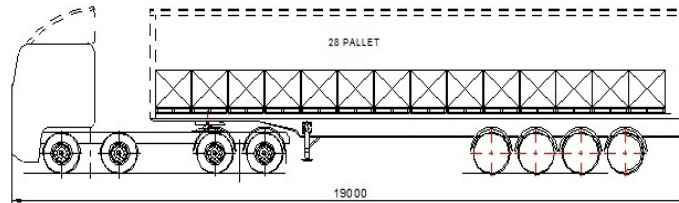
Short lead unit with longer rear unit – forward distance ratio limits

Convertor Dollys – tandem only

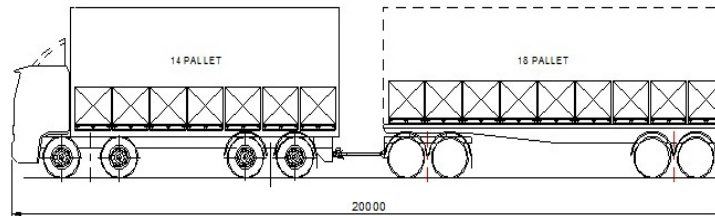


Could be used with conventional tri-axle semi to make
+ 23mtr combination – drawbeam requires vertical

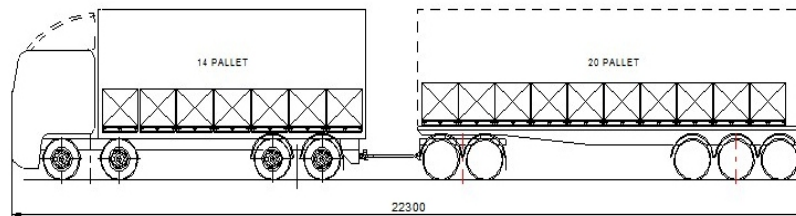
NZ HPMV Configurations



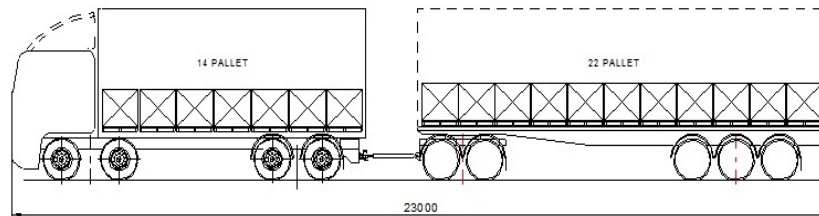
19 m Semi



20m Truck Trailer

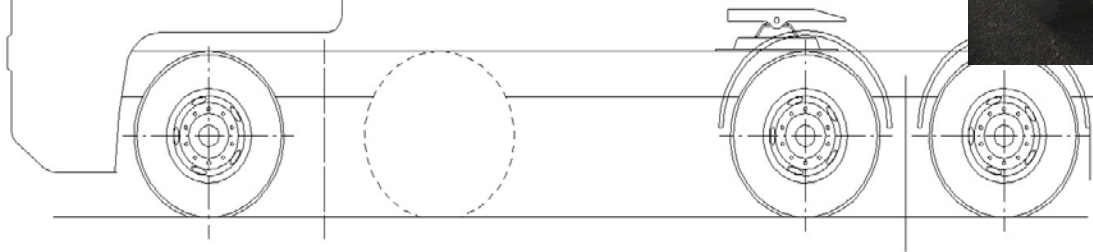


22.3m truck Trailer



23m Truck Trailer

Tri and Quad axle tractors



Frame limits of offsets trailer landing leg positions

Large Semi – type 2 quad axle

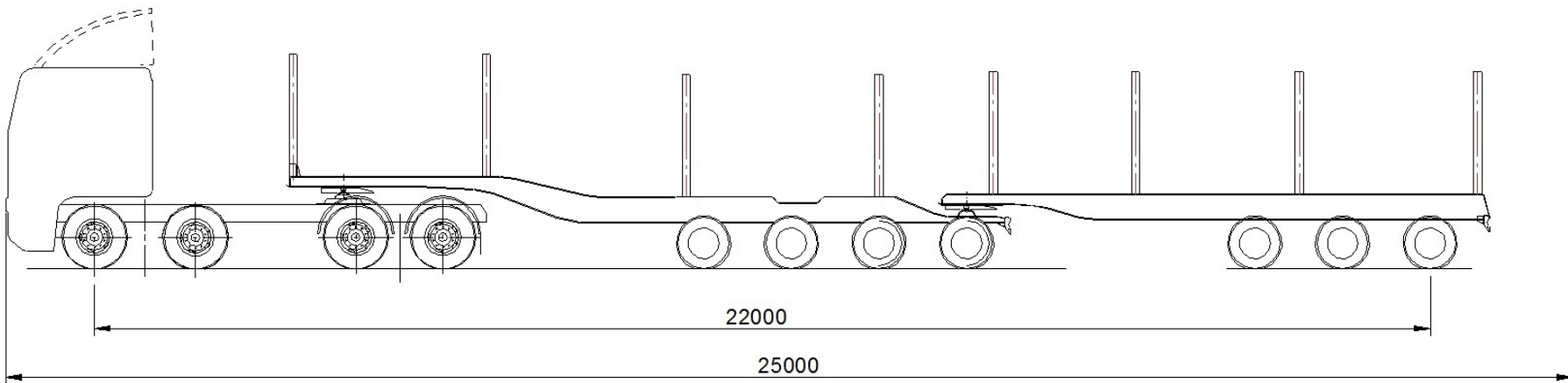


1 Steer axle - 15.1 meters long – 20t rear bogie
22t rear group HPMV on approved routes

2 and 3 axle options for 15.1 meter long

25 m 62t B- train logger

Front trailer has steer axle in quad





Design Challenges

- Extension of existing model - proformers
- New design work
 - +23 m units
 - Higher Mass
 - 44 tonne unit could now be 62 tonne
 - Durability – higher utilisation
- Component ratings
 - Certification
 - NZ Standards
 - NZS 5446 Towing Connections to 40 t MTM
 - Uprating existing – reduced life
- Maintaining or reducing tare weight



The effects of RUC's on Vehicles & Combinations

- ❑ New system GVM Based
- ❑ Based on premise operators buy vehicles larger than they need
- ❑ In a extremely competitive industry premise does not reflect reality
- ❑ Operators have invested on typical operating laden mass – not GVM
- ❑ Desirable specifications not always available in lower GVM models – GVM greater legal axle limits
- ❑ Specifications often based on overseas markets
- ❑ 7 & 9 axle combinations now being favoured over the typical 8 axle (4+4) combinations

The effects of RUC's on Vehicles & Combinations

- Other combinations making a come back – rigid / simple trailer



\$31 / 1000kms for simple trailer - 6500kg payload

Two center axle trailers in combination possible in Europe ?

Tractor unit Modifications



- Reduction in RUC
- \$126 /1000 kms
- \$11970 per year
- Regains some of loses
- Saves Vehicle Replacement



Stability – SRT

- SRT – Static Roll Threshold
 - 0.35g All HEAVY VEHICLES
 - 0.4g HPMV TRAILERS WITHOUT EBS
 - 0.45g DANGEROUS GOODS VEHICLES

- EBS WITH ROLL STABILITY FUNCTION
- 4 AXLE TRAILERS < 0.4 SRT CAPABILITY
- Suspensions being spec on performance



Braking – Electronic

- Comply HV Brake Rule –all vehicles
- EBS on trailers
- Longer trailers – less compliance issues
- LSV allowed but difficult to comply
- Retrospective cost of fitting deterrent

50MAX Combinations

- Limited to 23 meter Combinations
- Min 9 axles in combination
 - Truck & trailer - 4+5 or 5+4
 - B-train - 3+3+3 or 4+3+2
- Min 20 mtr first to last axle spread to gross 50 t





50MAX (former lower bound)

Axle spread up to (mtrs)	VDAM tonnes	HPMV tonnes (a)	50MAX tonnes (b)	
16	44	50	44	
17	-	52	45.5	
18	-	54	47	
19	-	56	48.5	
20	-	58	50	

- a) Table 6 – route approvals reqd for mass permit
b) 9 axle combination – (interpretation of proposal)

Current Primary 4 axle Truck and 4 axle Trailer Combination

- Truck = 10.8t + 15t = 25.8 t axle gross – GVM = 29.2t
- Trailer = 15t + 15 t = 30 t axle gross – GVM = 29t
- CCM = 55.8t group axle capacity but 44 t GCM limit



Livestock units 8 & 9 axles

20 mtrs / 44 tonne

Truck – 25.8 t GVM

Trailer – 29 t GVM

50max – 46.5t *

*Limited on Gross by axle spread – 17m



23 meters / 44 tonne

50max = 49t GCM *

Truck – 26.8 t GVM

Trailer – 35 t GVM

*GCM limited by axle spread – 19m

Wannabe HPMV's not all combinations can be HPMV





TRAILER MODIFICATIONS

existing vehicles

- Increase wheelbase
- Increase in overhang
- Increase Mass limits – GVM
- Towing connection ratings
 - Drawbars and Drawbeams
 - 29 tonne MTM increase to 32 or 33 tonne
 - Fifth wheel and Kingpins
 - 38 tonne MTM increase to 48 or 50 tonne
- Load anchorage capacity –
 - Must comply new LA - Std 2007
- Longer Trailers
- Maintaining or reducing tare weight



REGULATIONS AND RULES DICTATE MODIFICATIONS

- HEAVY VEHICLE RULE
 - MAINTAIN OR REDUCE OEM STRESS DESIGN LEVELS
- BRAKE RULE APPLIES RETROSPECTIVELY
 - > JULY 2008
 - ABS MANDATORY – LOAD SENSING DIFFICULT
 - EBS WITH ROLL STABILITY FOR HPMV

- APPROVALS TO BE IN WRITING
- VIRM
- GOOD RECORDS
- AUDIT TRAIL
- PRS – PERFORMANCE REVIEW SYSTEM



Heavy Vehicle Rule General Safety Requirement

3.1 Chassis and body strength

- 3.1(1) The chassis and body of a vehicle must be of adequate strength for all conditions of loading and operation for which the vehicle was constructed.



Heavy Vehicle Rule General Safety Requirement

6.4 Modification affecting chassis

6.4(1) If a vehicle is modified by the addition, removal or relocation of an axle and suspension system, by the replacement of an axle or suspension system with a different type of axle or suspension system, or by the modification of its chassis:

- (a) a new chassis rating must be issued and a new certificate of loading obtained; or
- (b) the current chassis rating must be confirmed as being valid.



Heavy Vehicle Rule General Safety Requirement

6.4 Modification affecting chassis

6.4(3) A modification to the chassis of a vehicle must be designed to stress levels:

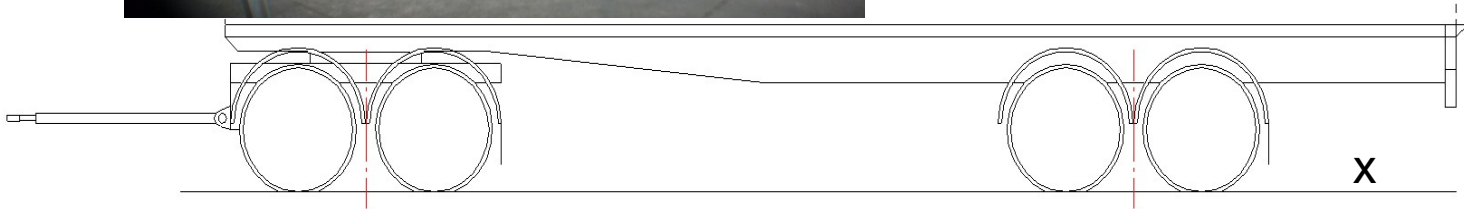
(a) as specified by the vehicle manufacturer; or

(b) in accordance with *Australian Standard — 3990 1993: Mechanical equipment — Steelwork*; or

(c) in accordance with *British Standard Code of practice for fatigue design and assessment of steel structures*; or

(d) that are not higher, when the vehicle is loaded to its proposed new gross vehicle mass, than those of the chassis of the unmodified vehicle loaded to its

4 to 5 axle full trailer conversions



X
X
X

Provision for additional axle at rear – cost savings at manufacture

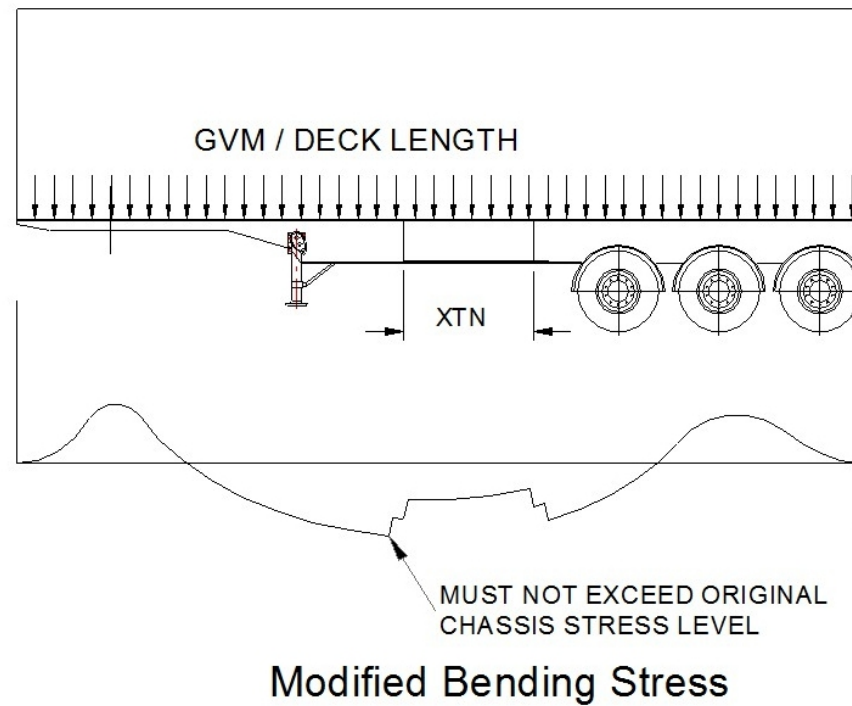
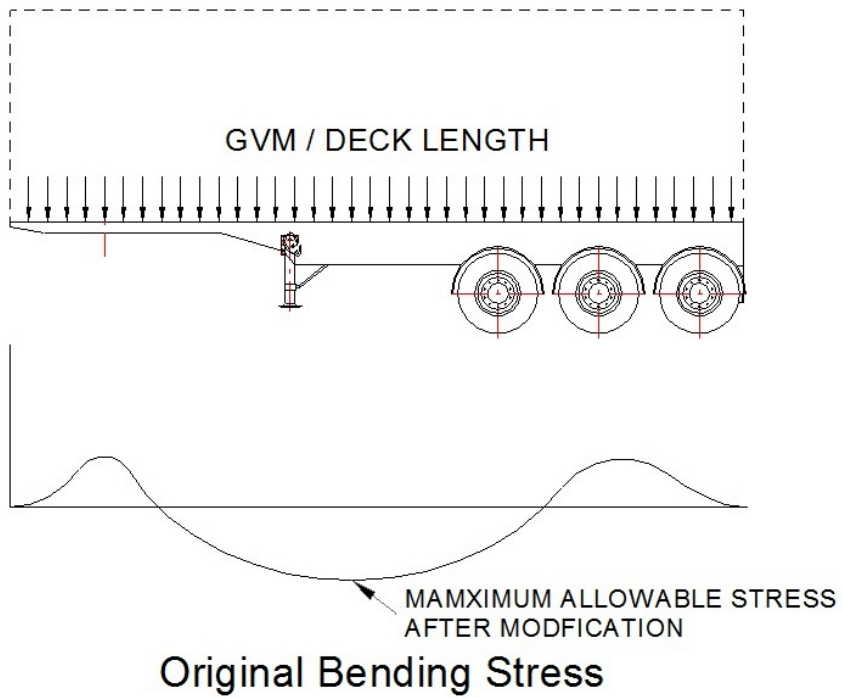
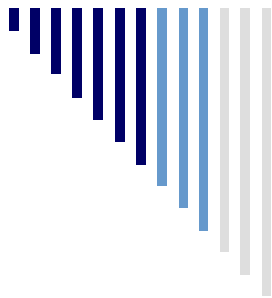


RATINGS

- SET BY COMPLIANCE RULE 2004
- GROSS VEHICLE MASS – GVM
- GROSS COMBINATION MASS – GCM
- CHASSIS RATINGS CONSIST OF :
 - AXLE - 7100kg or 10500kg
 - SUSPENSION – single or tandem
 - COMPONENT – steering box
 - Chassis frame - flatdeck vs tipper

Extension of a Semi







Additional Frame Stresses

5 axle full trailers

- Increase in tyre wear noticed on rear axle group – last tyre
- Likely from tri-axle rear bogie during spot or scrub turn – 30% increase in lateral resistance from tyre scrub due to axle group spacing



B-train extension 20 m to 23 m





Additional Frame loads

- Lift axles
 - Fully raise-able
 - Intermittent (speed sensitive)
 - Frame stress ROH (rear over hang) increased 33% during intermittent air bag dump activity
 - Function needs to be allowed for in the design of the chassis
 - If fitted retrospectively then problems may occur