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REPORT FOR NATIONAL HEAVY VEHICLE REGULATOR

Final Report

HVIA 838 - Vehicle Specification Envelopes for Three Common PBS Vehicles

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About Advantia

Since its foundation in 2008, Advantia Transport Consulting has specialised in assessing the performance of high-productivity freight vehicles. Advantia now boasts over a decade of heavy vehicle performance intellectual property and has developed an international profile as experts in mechanical engineering simulation and assessment, and for supporting the expansion of freight productivity. Advantia has since gone beyond mastering the design and assessment of high-productivity freight vehicles, having made significant contributions in areas such as heavy vehicle policy development, road access facilitation and knowledge transfer. Advantia is recognised across both the heavy vehicle industry and transport-related government departments and agencies for the specialised work that it does to advance the productivity and safety of road freight transport, primarily by supporting transport policy reform and improved heavy vehicle operations. The company is known for its tenacity and a deep motivation to push boundaries when the evidence supports it. That spirit has enabled the company to make an everlasting impression on Australia's heavy vehicle industry, which is acknowledged internationally.

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Summary

The completion of this project aims to assist in reducing the barriers to entry for operators seeking to benefit from the Performance Based Standards (PBS) scheme though the development of a set of Vehicle Specification Envelopes (VSEs) for three common PBS vehicles. The three combination types selected for this process include:

- 3-axle prime mover and 3-axle semi-trailer (General freight)
- 3-axle rigid truck and 5-axle dog trailer (bin tipper)
- 3-axle rigid truck and 6-axle dog trailer (bin tipper).

These combination types have been selected due to their popularity under the PBS scheme and predictable performance across the standards. This makes these combinations ideal candidates for the development of usable and flexible VSEs.

The initial stages of the project consisted of the initial development of the draft VSEs, which formed the basis of the initial stakeholder engagement phase. The aim of this stage was to gain insight into the requirements of industry regarding what would allow for the VSEs to cover a reasonable portion of the current and future fleet. This was completed through completing a series of face-to-face or virtual meetings, email and an online form.

The initial round of consultation was successful in gaining a substantial amount of feedback regarding Version 1 of the draft VSEs. The VSEs were then updated to reflect all of the feedback received. This was used as the foundation for the next stage of the project, the conducting of a PBS assessment to determine what dimension sets would achieve the targeted PBS levels.

A set of dimensions and restrictions was determined for the prime mover and semi-trailer combination that was able to achieve the targeted Level 1 performance. Dimension restrictions were required in order for the combination to perform at the required Low speed standards. Additionally, it was not feasible to determine the average floor heights and payload heights for these combinations as they are highly dependent on the suspension configurations, and they will require the NHVR to make a decision surrounding these specifications based on the acceptable risk tolerance.

Both of the truck and dog combinations were targeting Level 2 performance. These combinations were separated into a High bin and a Low bin variant. The Low bin variant will be less dimensionally restrictive. The truck and dogs were able to achieve the required performance for the majority of the high speed and low speed standards with no additional restrictions. The specifications were also able to achieve Level 2 when considering all lift axle configurations.

For the truck and dog combinations, the critical standard was RA, and some dimensional restrictions would be required in order for the combinations to achieve the required RA performance. The low bin variants would be less dimensionally restrictive than the high bin due to the direct relationship between

RA and SRT. The suggested restriction is limiting the minimum distance between the drawbar coupling point to the centre of the trailer rear tri-axle group. A selection of suggested minimums were presented.

On the conclusion of the PBS assessments, the updated version of the VSEs was distributed to industry for additional feedback. There was minimal feedback received through this stage, with a number of stakeholders voicing the appreciation upon seeing their previous feedback being integrated into the assessment.

The exception to this was a request to increase the maximum coupling rear overhang dimension from 1,700 mm to 1,760 mm. This was investigated and it was determined that increasing this dimension decreased the combination performance. For the dynamic standards, except RA, all standards were in the required threshold.

At this stage, the dimension sets and restrictions that would pass the targeted PBS levels were determined. However, there were some specifications that were not feasible to be determined at this stage. These were the specifications relevant to SRT and RA as these will need to be decided upon by the NHVR on considering an acceptable risk tolerance.

Contents

Revision history

Document version	Changes	Approved	Date
ATC3214-03-01	Draft release	SDT	2/08/2024

1. Introduction

The Australian Performance Based Standards (PBS) scheme facilitates an increase in efficiency and safety in the heavy vehicle fleet. However, the increased demand for resources, effort administration and operational complexity required to access the scheme can be prohibitive for many operators. The National Heavy Vehicle Regulator's (NHVR) PBS 2.0 discussion paper states that the NHVR is seeking to provide alternative pathways to PBS with the intention of making it "quicker and easier to get both PBS and PBS-like vehicles onto roads, thus making the PBS scheme more attractive to new market entrants".

Through the development of a set of Vehicle Specification Envelopes (VSEs), this project aimed to provide a way for prescriptive version of three PBS combinations to be implemented on Australian roads while maintaining the safety and productivity benefits of current PBS combinations. The VSEs that have been developed to include a set of dimensions and restrictions required to achieve the required PBS performance. Three common PBS vehicles were selected for this process including:

- 3-axle prime mover and 3-axle semi-trailer (General freight)
- 3-axle rigid truck and 5-axle dog trailer (bin tipper)
- 3-axle rigid truck and 6-axle dog trailer (bin tipper).

These combination types have been selected due to their popularity under the PBS scheme and predictable performance across the standards. This makes these combinations ideal candidates for the development of usable and flexible VSEs.

The process for the development of these VSEs was based on that conducted previously during the implementation of the National Class 3 20m Long 3-axle Truck and 4-axle Dog Trailer Mass and Dimension Exemption Notice. The VSEs developed for this notice stemmed from prior work conducted by Advantia.

1.1 Project stages

The completion of this project has been separated into seven stages starting from the inception in January 2024. A summary of the stages can be found in Table 1.

Table 1 - Summary of project stages

Project stage		**Stage summary**
Stage 1	**Planning**	Develop communication and consultation strategy including identification of stakeholders, locations and timing.
Stage 2	**Draft VSEs**	Conduct and internal review of subject vehicles and prepare draft VSEs for use in stakeholder engagement.
Stage 3	**Initial Consultation**	Conduct face-to-face and virtual consultation with OEMs and operators.

Stage 4	**PBS simulation**	Based on the consultation findings, conduct a PBS assessment and update the VSEs to reflect simulation assessment results.
Stage 5	**Follow up consultation**	Seek feedback on the updated VSEs.
Stage 6	**Finalise VSEs**	Finalised the VSEs after additional feedback and prepare final report
Stage 7	**Dissemination**	Dissemination meeting with NHVR and delivery of final report. Present at up to four industry events to engage with industry on the use of the VSEs.

2. Initial stakeholder consultation

This section outlines a summary of stages 2 and 3 of the project. A more detailed overview of these stages can be found in the previous consultation findings report "ATC3214-Report-01-01". Throughout these initial stages of the project, the aim was to develop the initial draft VSEs and seek feedback regarding them. This feedback would then form the foundation of the PBS assessment to be conducted in Stage 4.

2.1 Development of initial Draft VSEs

The first stage of the project included the development of the draft VSEs that would be used to facilitate discussion during the stakeholder engagement. Through an internal review of PBS assessment conducted in the past by Advantia. This review provided an insight into the range of specifications that would be required for the VSEs.

In order to seek accurate and meaningful feedback the ranges on many dimensions were restricted so as to incite people to ask for the dimensions they needed. These drawings included limitations on minimum tare mass and tyre restrictions. Additionally, the option of a lift axle at the front tri-axle group on all trailers was included.

The draft VSEs can be seen in Figure 1 to Figure 3. The prime mover and semi-trailer draft VSEs were separated into three body types including Flat top, Van body and Drop deck. The complete set of VSEs can be seen in Appendix A.

Figure 1 – Prime mover and semi-trailer draft VSE – Version 1 (Flat top body type)

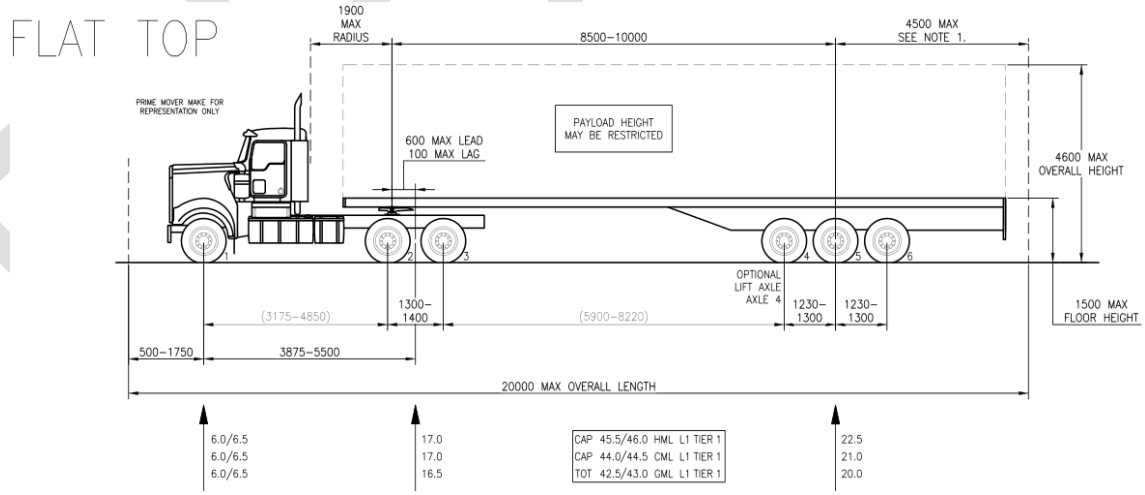


Figure 2 – Truck and 5-axle dog draft VSE – Version 1

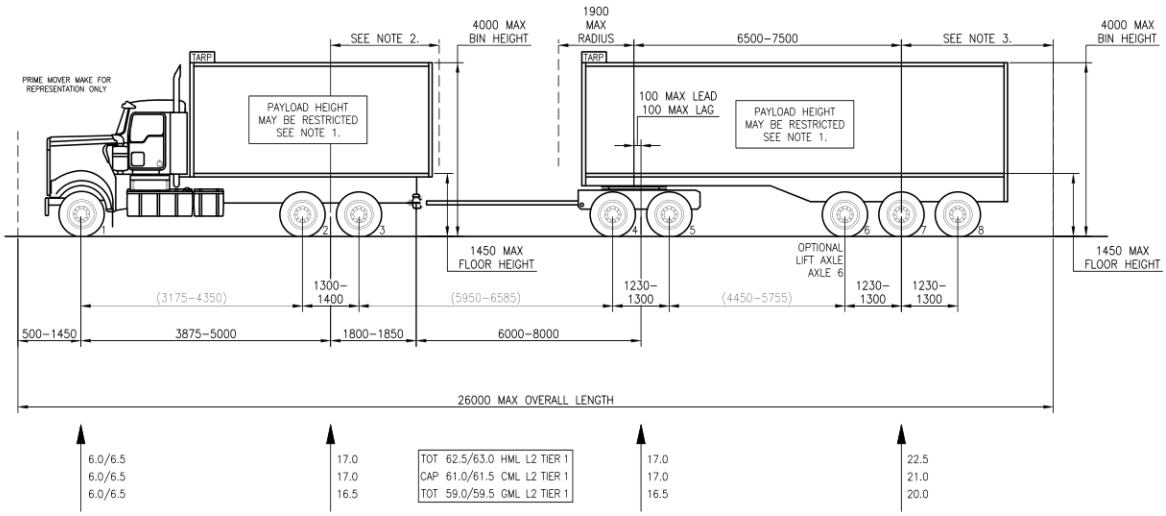
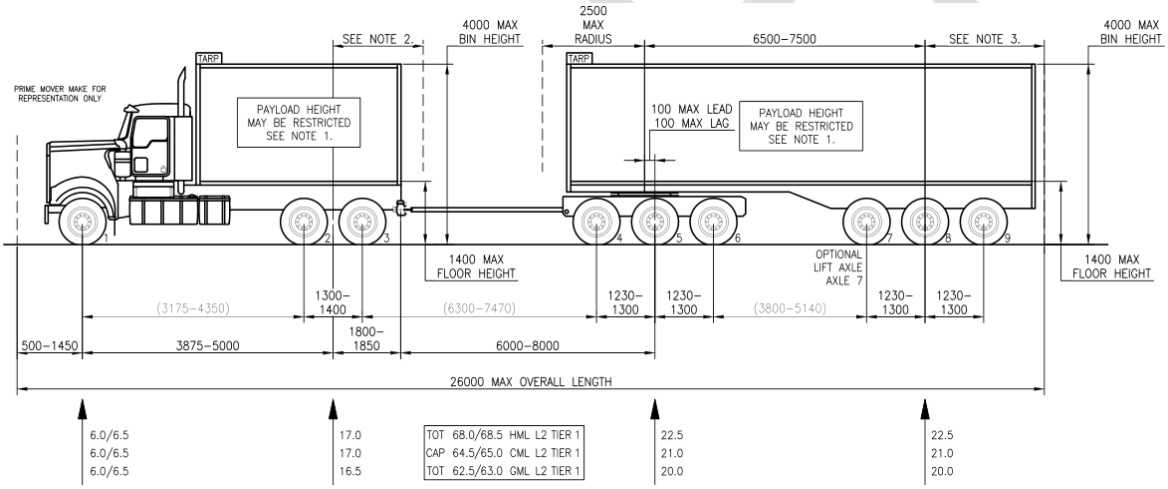


Figure 3 – Truck and 6-axle dog draft VSE – Version 1



2.2 Stakeholder consultation methodology

Throughout March 2024, Advantia engaged with a number of equipment suppliers and industry bodies in order to gain feedback regarding the initial draft VSEs. Due to the sensitive nature of these discussions, they were conducted confidentially. It was preferable that these meetings would be conducted face-to-face at the stakeholder's location of business, however any of the following methods were accepted:

- Face-to-face meetings
- Virtual meetings
- Emails
- Online feedback form

Through the stakeholder engagement process, Advantia was able to elicit feedback from the majority of stakeholders listed in the initial consultation plan. The list of stakeholders who participated at this stage are listed in Table 2.

Table 2 – List of stakeholder engagement feedback

Stakeholder	Project Relevance	Feedback Format
Vawdrey Australia	Titeliner, Iceliner and Dry Van trailer supplier	In person meeting
Fibreglass Transport Equipment	Iceliner trailer supplier	In person meeting
MaxiTRANS Australia	Truck and Dog tipper body and trailer supplier, Titeliner, Iceliner and Dry Van trailer supplier	Email feedback
Borcat Trailers	Truck and Dog tipper body and trailer supplier	Email feedback
PACCAR Australia	Prime movers and truck chassis supplier	In person meeting
Daimler Australia	Prime movers and truck chassis supplier	MS Teams meeting
Gorski Engineering	Truck and Dog tipper body and trailer supplier	In person meeting
Muscat Trailers	Truck and Dog tipper body and trailer supplier	In person meeting
Sloanebuilt Trailers	Truck and Dog tipper body and trailer supplier	In person meeting
Shephard Transport Equipment	Truck and Dog tipper body and trailer supplier	In person meeting
Volvo Group Australia	Prime movers and truck chassis supplier	In person meeting
Tefco Trailers	Truck and Dog tipper body and trailer supplier	In person meeting
Haulmark Trailers	Flat-top and drop deck trailer supplier	In person meeting
Scania Australia	Prime movers and truck chassis supplier	MS teams meeting
Mack Australia	Prime movers and truck chassis supplier	MS teams meeting
Barry Stoodley	Truck and Dog tipper body and trailer supplier	In person meeting
Southern Cross Transport Equipment	Titeliner, Iceliner and Dry Van trailers supplier	In person meeting
Krueger Transport Equipment	Titeliner, Iceliner and Dry Van trailers supplier	Email feedback
Roadwest Transport Equipment	Truck and Dog tipper body and trailer supplier	In person meeting

2.3 Summary of feedback

The following sections summarise the feedback received during the stakeholder engagement. A complete outline of the feedback received can be found in the report "ATC3214-Report-01-02".

The VSEs were updated to reflect the feedback received and can be seen in Appendix B.

General comments

The feedback regarding the VSEs was positive, with most manufacturers having some equipment that fit within the envelopes with changes to a small number of dimensions. Across the three combination types the following points were consistent across each:

- Identified critical dimensions required to change to cover the majority of the fleet.
- Reiterated the importance of ensuring the final VSEs are as generic as possible, including the body type restrictions.
- Allowing for prime mover widths up to 2.55 metres in accordance with the "Safer Freight Vehicles" package.

Additionally, many stakeholders used the engagement meetings as an opportunity to provide feedback regarding the implementation of the truck and 4-axle dog notice. Many of the stakeholders with direct contact with this notice have seen minimal or no use of it. The main reasons identified for this are as follows:

- The lack of supporting documentation for operators running under the notice
- Required improved information and documentation upon the release of the notice
- The class 3 classification resulting in reduced access for vehicles
- The required "conspicuity markings" were considered a deal breaker due to aesthetic reasons and the increased cost requirements.

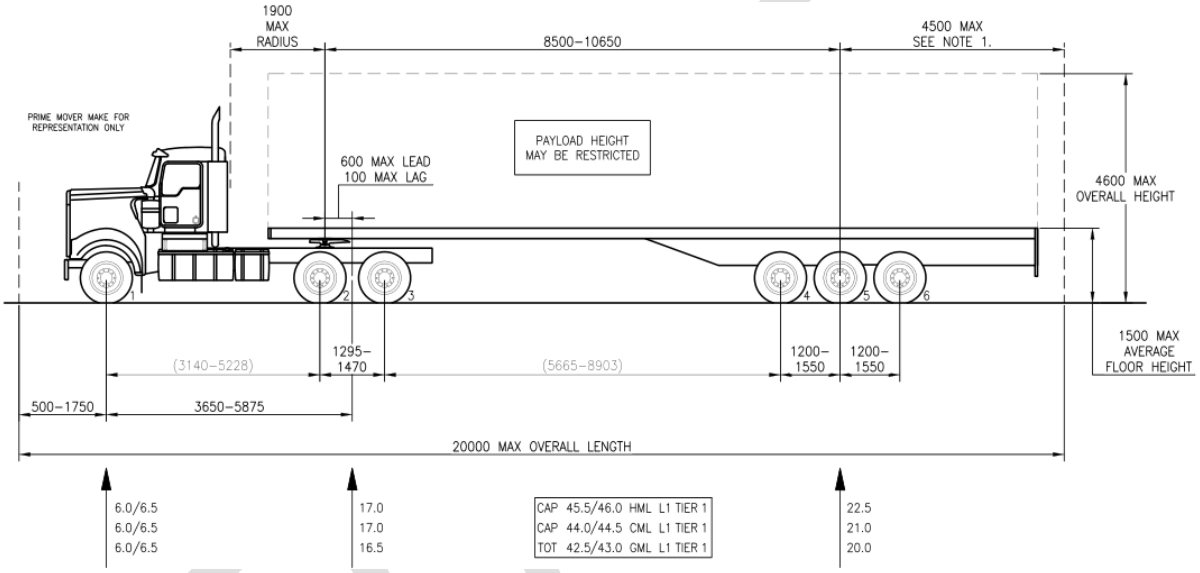
Prime mover and Semi-trailer

The main feedback regarding the semi-trailer VSEs included the dimensional requirements listed in Table 3. In addition to this it was noted that it would be beneficial to allow for all body types to allow for various drop deck configurations. Additionally, feedback indicated that the utilisation of lift axles is rare on tri-axle groups. Therefore, the option was removed from the VSE. Version 2 of the VSE can be seen in Figure 4.

Table 3 - Prime mover and semi-trailer dimensional changes

Dimension	Version 1	Version 2
Prime mover wheelbase	3,875 – 5,500 mm	3,650 – 5,875 mm
Drive axle spacings	1,300 – 1,400 mm	1,295 – 1,470 mm
Trailer S-dimension	8,500 – 10,000 mm	8,500 – 10,650 mm
Trailer axle spacings	1,230 – 1,300 mm	1,200 – 1,550 mm

Figure 4 - Prime mover and semi-trailer draft VSE – Version 2



Truck and dog combinations

The feedback regarding both truck and dog combinations was similar. A summary of the dimensional changes requested can be found in Table 4 and Table 5. It was identified that for these combinations that the critical dimension would be the coupling rear overhang distance. This saw the most significant change from Version 1 of the VSEs. Version 2 of the draft VSEs can be seen in Figure 5 and Figure 6.

Table 4 – Truck and 5-axle dog trailer dimensional changes.

Dimension	Original VSE	Draft VSE
Truck Front overhang	500-1450 mm	500 – 1750 mm
Truck wheelbase	3875 – 5000 mm	3875 – 5,875 mm
Drive axle spacing	1,300 – 1,400 mm	1,295 – 1,470 mm
Coupling rear overhang	1,800 – 1,850 mm	1,550 – 1,700 mm
Drawbar length	6,000 – 8,000 mm	5,200 – 7,000 mm
Dolly/Trailer axle spacings	1,230 – 1,300 mm	1,200 – 1,500 mm
Trailer S-dimension	6,500 – 7,500 mm	6,000 – 8300 mm

Figure 5 - Truck and 5-axle dog trailer draft VSE – Version 2

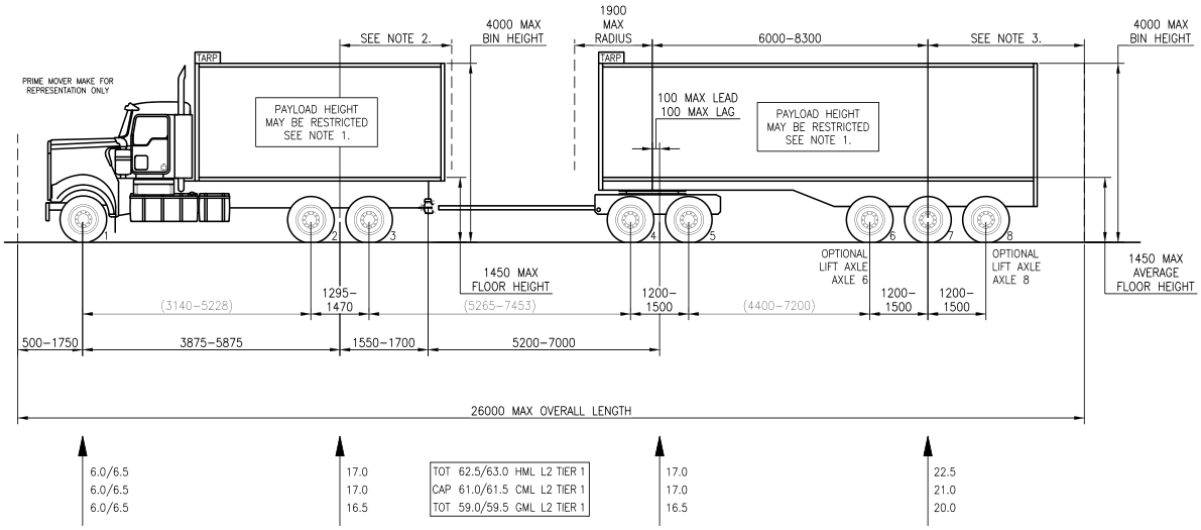
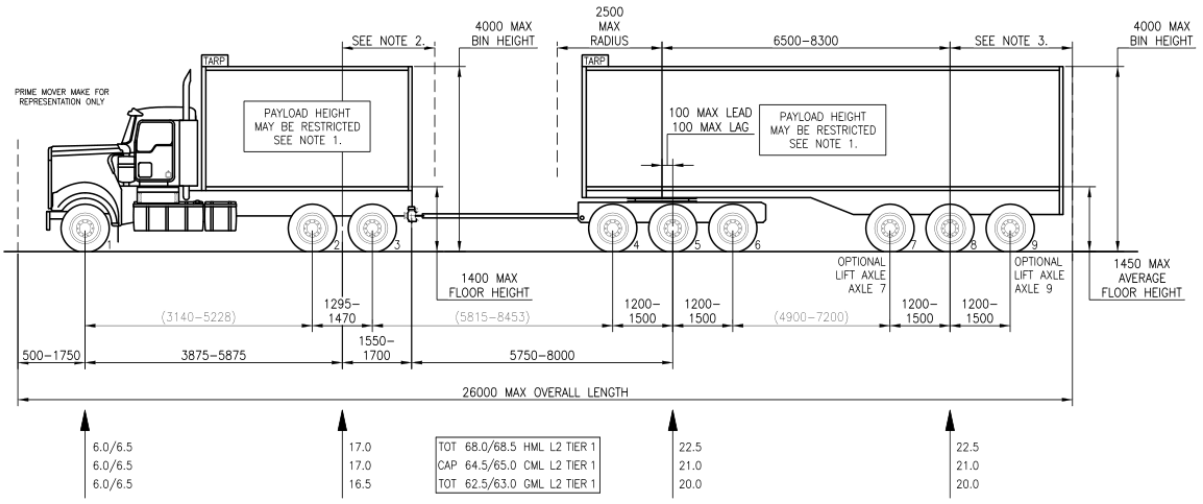


Table 5 - Truck and 6-axle dog trailer dimensional changes.

Dimension	**Original VSE**	**Draft VSE**
Truck Front overhang	500 -1450 mm	500 – 1750 mm
Truck wheelbase	3875 – 5000 mm	3875 – 5,875 mm
Drive axle spacing	1,300 – 1,400 mm	1,295 – 1,470 mm
Coupling rear overhang	1,800 – 1,850 mm	1,550 – 1,700 mm
Drawbar length	6,000 – 8,000 mm	5,750 – 8,000 mm
Dolly/Trailer axle spacings	1,230 – 1,300 mm	1,200 – 1,500 mm
Trailer S-dimension	6,500 – 7,500 mm	6,500 – 8300 mm

Figure 6 - Truck and 6-axle dog trailer draft VSE – Version 2



3. Assessment considerations and methodology

Stage 4 of the project consisted of conducting an assessment for the three combinations to determine their performance under the PBS scheme. The three combinations and targeted levels are:

- 3-axle prime mover and 3-axle semi-trailer – PBS Level 1
- 3-axle rigid truck and 5-axle dog trailer – PBS Level 2
- 3-axle rigid truck and 6-axle dog trailer – PBS Level 2.

3.1 Assessment methodology

The assessment was conducted to determine the PBS performance of the Vehicle Specification Enveloped (VSEs) for the 3 combinations across the following PBS standards:

- High Speed Transient Offtracking (HSTO)
- Reward Amplification (RA)
- Static Rollover Threshold (SRT)
- Tracking Ability on a Straight Path (TASP)
- Yaw Damping Co-efficient (YDC)
- Low-speed Swept Path (LSSP)
- Frontal Swing (FSA, FSB and FSC)
- Tail Swing (TS)
- Steer Tyre Friction Demand (STFD).

Each of the standards was assessed as per the PBS assessment rules[1] and Advantia's standard PBS assessment processes.

3.2 Simulation environment

The subject vehicle models were generated using 'TruckSim' heavy vehicle simulation software. The vehicles were made to perform the manoeuvres prescribed in the PBS scheme assessment rules[1]. Further background information on TruckSim, the use of computer simulation in Australia, its application in the PBS heavy vehicle regulatory scheme and defined performance levels are outlined in Appendix C.

[1] https://www.nhvr.gov.au/files/media/document/123/202211-0020-pbs-standards-and-vehicle-assessment-rules.pdf

3.3 Design Considerations

Generally, during the completion of a standard PBS assessment, the performance is based on the specific components fitted to a combination. This presented a challenge during the completion of this assessment as the main requirement is that specifications remain as generic as possible in order to account for as much of the fleet as possible. Therefore, the specification used in the assessment were critical, of note are the following:

- Dimensions
- Tyres
- Suspension
- Tare weights.

Dimensions

The dimensions for the combinations are critical for what will be able to operate under the VSEs. The initial dimensions have been determined through the stakeholder engagement. These dimensions are the stretch goal/largest ranges that are being aimed for regarding the dimension ranges.

In order to achieve the desired PBS performance for each combination it is expected that many of these dimension ranges will need to be reduced. When it comes to reducing these dimensions, the decision on which dimension to reduce and how much to reduce them will be influenced on the feedback from the stakeholder consultation.

Additionally, there may be the opportunity to maintain larger dimension ranges and add in maximum or minimum dimensional restrictions. If required, the aim of implementing these restrictions will be to keep them as simple and easy to follow as possible.

Tyres

The tyres used in the assessment are in-line with the generic tyres required for PBS assessment. During the stakeholder engagement, it was determined what the minimum generic tyre ratings that would be utilised on each specific combination type.

The other specification that will be considered for the tyres is the minimum allowable tyre size. Generally, the smaller tyres have negative implication for the dynamic performance of a combination.

The generic tyres used in the assessment are intended to be fixed, as increasing the Generic tyre dataset would exclude a significant proportion of the fleet. This is similar for the tyre sizes as limiting them would exclude a portion of the fleet. However, the smallest tyre sizes are less common and there is some room for increasing the minimum tyre size to improve performance.

A summary of the targeted tyre specifications can be seen in Table 6.

Table 6 - Targeted tyre specifications

<table>
<tr><th rowspan="2">Combination</th><th colspan="2">Steer</th><th colspan="2">Drive</th><th colspan="2">Trailers</th></tr>
<tr><th>Minimum load rating</th><th>Minimum tyre size</th><th>Minimum load rating</th><th>Minimum tyre size</th><th>Minimum load rating</th><th>Minimum tyre size</th></tr>
<tr><td>Prime mover and semi-trailer</td><td rowspan="3">144</td><td rowspan="3">11R22.5</td><td rowspan="3">140</td><td rowspan="3">275/70R22.5</td><td>136</td><td>265/70R19.5</td></tr>
<tr><td>Truck and 5-axle dog</td><td rowspan="2">140</td><td rowspan="2">255/70R22.5</td></tr>
<tr><td>Truck and 6-axle dog</td></tr>
</table>

Tare masses

The minimum tare masses of a combination can have a significant impact on the performance across some PBS standards, of particular importance is SRT performance. The tare masses used during the assessment were determined during the stakeholder consultation. These are listed for each of the combinations throughout Section 4 – Assessment results.

Suspension tiers

Accounting for a generic suspension was the main challenge of the assessment stage. When comparing the performance of the suspensions, the performance of one suspension is not consistent across all standards. A suspension that could be the highest performing in one standard could be the lowest in another.

In order to cover all ranges of suspension performance the most common suspensions were used for each combination based on information gained from the stakeholder engagements and internal review of assessments completed, were ranked in order to determine performance in all high-speed standards. From these rankings four virtual suspensions were developed, based on existing suspensions, which corresponded with the following, and were used for the assessment of various standards.

- **Best** – highest performing suspensions
- **Mid** – suspensions with average performance
- **Low** – suspensions with the lowest performance
- **Low 80%** - suspensions with 80% of the specifications of the lowest performing suspension.

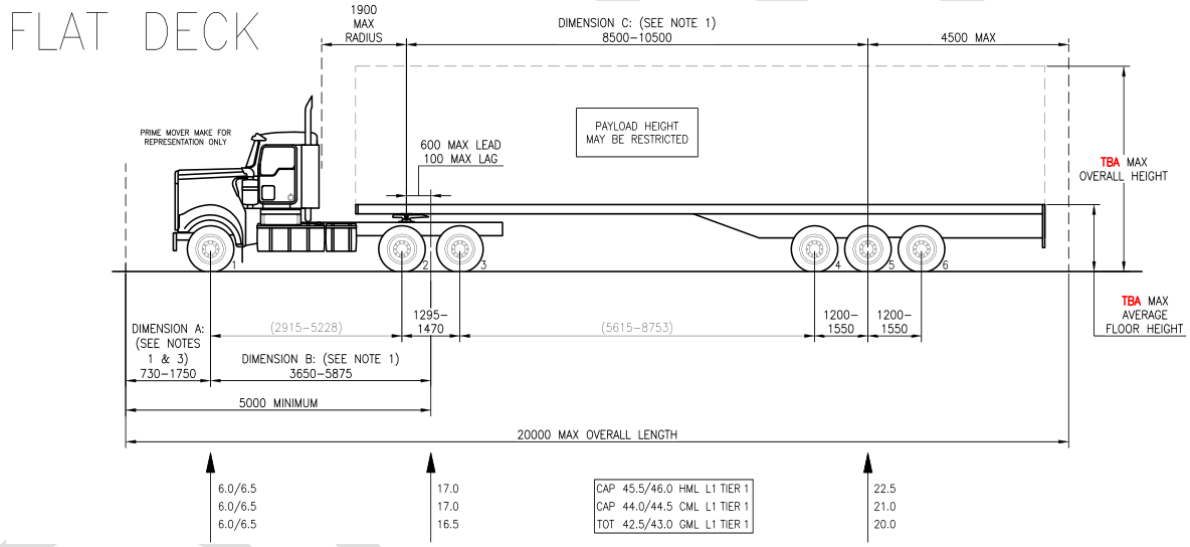
4. Assessment results

Upon the conclusion of the assessment the VSEs were updated to reflect the dimensional changes and restrictions required to meet the targeted PBS levels. These updated VSEs can be seen in Appendix D.

4.1 Prime mover and Semi-trailer results

The prime mover and semi-trailer was assessed against the Level 1 PBS standards. The updated set of dimensions with restrictions required to perform to the required standard can be seen in Figure 7. The restrictions required to meet the majority of the standard were able to be determined. The only exception to this is for SRT where the allowable dimension will be dependent on the NHVR risk tolerance.

Figure 7 - Prime mover and semi-trailer draft VSE - Version 3



Combination specifications

The specifications assessed for the prime mover and semi-trailer remained similar to those from previous versions of the Vehicle Specification Envelopes project. The only difference was an increase in the minimum tare mass for the Curtainsider and Van combinations based on the project's consultation phase.

Table 7 and Table 8 outline the minimum tare masses used and the tyre size and load index for this combination.

Table 7 – Prime mover and semi-trailer tare masses for different body types

Unit	Tare minimum (tonnes)		
	Flat deck trailer	Curtainsider	Van
Prime mover	8.5		
Trailer	5.5	6.5	8.0

Table 8 – Prime mover and semi-trailer tyre sizes and load index

Axle group	Minimum load rating	Smallest tyre size
Steer	144	11R22.5
Drive	140	275/70R22.5
Trailer	136	265/70R19.5

High-speed standards (HSTO, RA, TASP YDC)

The prime mover and semi-trailer achieved Level 1 or better performance for all dynamic standards (HSTO, RA, SRT, TASP and YDC). The results are outlined in Table 9. The results listed utilised the worst-case dimensions and were obtained using 80% of the lowest performing suspension configuration.

It can be seen that there is little difference in the results when comparing the results for 2.5 metre-wide and 2.55-metre-wide combinations. The only exception to this is TASP, however the result remains within the Level 1 requirement.

The RA value presented is below what would be required to pass the standard with the required SRT value of 0.35 g.

Table 9 – Prime mover and semi-trailer dynamic results

	HSTO (m)	RA	SRT (g)	TASP (m)	YDC
2.5 m wide	0.38	1.36	0.29	2.78	0.47
2.55 m wide	0.38	1.36	0.29	2.81	0.47
	L1		**Fail***	**L1**	**PASS**

***See Section 0 for detailed SRT results**

SRT and payload heights

SRT is one of the critical parameters for the prime mover and semi-trailer. The SRT performance was assessed across the three body types due to their different tare masses and properties:

- Flat Deck
- Curtainsider
- Van.

For the current (and all previous) versions of the VSE, these body types have been presented on separate versions. However, depending on the payload height and risk tolerance of the NHVR it may be beneficial to combine these onto one version for simplicity.

As was brought up during the consultation phase of the project, all body types have been adjusted to be limited by a maximum average floor height to allow for multiple drop deck, slope deck or other deck height configurations. The baseline for this has been set at 1.3 metres above ground.

The VSEs currently allow for up to 4.6-metre body heights. Increasing the body heights has minimal impact on the SRT result when comparted to a 4.3-metre combination with the same average floor height and loading height. However, it was not found that any of the combinations could achieve such a payload height while meeting the 0.35 g SRT limit when using uniform density payloads and the 1.3 metre average floor height.

When examining the effect of suspension performance, a series of tests were done to evaluate the SRT result with varying suspension performance and payload heights, these are shown in Table 10.

Table 10 – SRT achieved by different suspension configurations

Suspension tier	Uniform density payload height (from ground) Based on Curtainsider body type			0.35 g SRT payload height (mm)
	3300 mm	3500 mm	3800 mm	
Best	0.386	0.362	0.331	3,600
Mid	0.329	0.313	0.290	3,080
Low	0.312	0.299	0.276	2,870
Low 80%	0.296	0.281	0.262	2,670

In order to improve the allowable payload heights for each combination it may be beneficial to provide payload heights for each body type or to reduce the maximum average floor heights. The effect of these parameters can be seen in Table 11 and

Table 12. Other options may include different payload heights for different floor heights.

Table 11 – Effect of body type on SRT result

Body type	SRT (g)*
Curtain sider	0.359
Flat deck	0.371
Refrigerated Van	0.360
*Based on 1,300 mm floor height and 3,300 mm payload height	

Table 12 – Effect of average floor height on SRT result

Floor height (mm) above ground	SRT (g)
1,200	0.373
1,300	0.360
1,400	0.349
1,500	0.339

Low-speed standards (LSSP, FSA, FSB, FSC, TS, STFD)

In order to pass PBS Level 1 low-speed standards some dimensional restrictions were required. These dimensional restrictions are summarised in Table 13.

The method that was determined to provide the most dimensional flexibility and simplicity involved limiting the maximum and minimum values of the prime mover Front Overhang (FOH), prime mover wheelbase (WB) and trailer S-dimension (SD). The standard that dictated the restriction is included in the table.

It was determined that while increasing the allowable prime mover width to 2.55 metres wide does have an impact on the low-speed standards, this was able to be mitigated by imposing an additional restriction limiting the front overhang of the combination to a maximum of 1,700 mm.

After the restrictions noted in Table 13, the worst-case LSSP results are as seen in Table 14.

Table 13 – Summary of dimensional restrictions for prime mover and semi-trailer

Standard	**Restriction**
LSSP	FOH + WB + SD ≤ 15,725 mm
FSA (2.55W only)	FOH ≤ 1,700 mm
FSB and FSC	FOH ≥ 730 mm and FOH + WB ≥ 5,000 mm

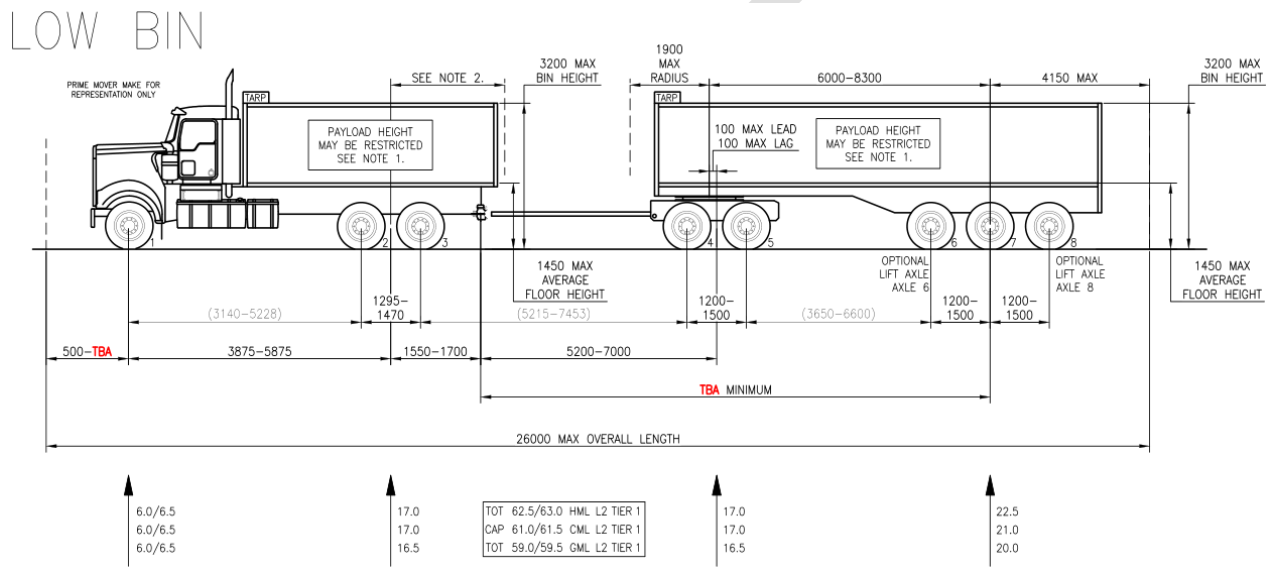
Table 14 – Prime mover and semi-trailer worst case LSSP result

LSSP (m)	**FSA (m)**	**FSB (m)**	**FSC (m)**	**TS (m)**	**STFD (%)**
7.370	0.850	0.390	0.200	0.280	44
L1	**Pass**	**Pass**	**Pass**	**L1**	**Pass**

4.2 Truck and 5-axle Dog-trailer Results

The truck and 5-axle dog trailer was assessed against the Level 2 PBS standards. The dimension sets for this VSE were separated into two Variants, high bin and low bin. The dimensions for these two variants are the same except for the bin heights, with a 3,200 mm bin height for the low bin height Variant and a 3,500 mm bin height for the high bin Variant. The low bin Variant can be seen in Figure 8. The restrictions required to meet the majority of the standard was able to be determined. The only exception to this is for SRT and RA where the allowable dimension will be dependent on the NHVR risk tolerance.

Figure 8 - Truck and 5-axle dog draft VSE (Low bin Variant) - Version 3



Combination specifications

The specifications assessed for the truck and 5-axle dog combination remained similar to those from previous versions of the VSEs generated in earlier stages of the project. The only difference was a change in the minimum tyre size of the trailing units to 275/70R22.5. These are summarised in Table 15 and Table 16.

Table 15 - Truck and 5-axle dog tare masses

Unit	Tare minimum (tonnes)
Truck	9.0
Dog trailer	8.0

Table 16 - Truck and 5-axle dog tyres

Axle group	Minimum load rating	Smallest tyre size
Steer	144	11R22.5
Drive	140	275/70R22.5
Trailer	140	275/70R22.5

High-speed standards (HSTO, RA, TASP, YDC)

The HSTO, TASP and YDC results all achieved Level 2 or better. The results listed in Table 17 were assessed with the worst-case dimensions. The suspension used to obtain these results was 80% of the lowest performing configuration. The combinations presented only minor differences between the 2.5-metre wide and 2.55-metre-wide combinations, with a slightly larger difference for TASP.

Table 17 - Truck and 5-axle dog dynamic standards results

	2.5m Wide			2.55m Wide		
	HSTO (m)	**TASP (m)**	**YDC**	**HSTO (m)**	**TASP (m)**	**YDC**
3500 mm bin height	0.680	2.834	0.185	0.680	2.843	0.191
3200 mm bin height	0.707	2.817	0.191	0.706	2.842	0.185
	L2	**L1**	**PASS**	**L2**	**L1**	**PASS**

The critical standard for the truck and dog combinations is RA. In order for the 5-axle dog combination to pass this standard a dimensional restriction was required. The most appropriate limitation involves imposing a minimum length between the coupling point between the truck and dolly and the centre of the trailer tri-axle group (axle 7). In the current VSE, the minimum length of this dimension is 11.1 metres. The distance between these points was increased iteratively to determine the minimum length required for each suspension tier to pass the standard.

Depending on the performance requirements the RA Ratios for the different tiers of suspension performance are listed in Table 18 and Table 19. Results are presented as a function of SRT and RA as a ratio, combinations achieving a ratio percentage above 100% are deemed to have failed the standard.

Table 18 - RA Ratios at 3.2-metre bin height

	3.2-metre Bin Height		
	Coupling to Axle 7 distance		
	12.20 m	**11.80 m**	**11.10 m**
Best	89.7%	91.1%	94.0%
Mid	93.2%	95.0%	98.5%
Low	98.0%	99.9%	111.3%
Low 80%	99.9%	102.7%	113.7%

Table 19 - RA Ratios at 3.5-metre bin heights

	3.5-metre Bin Height			
	Coupling to Axle 7 distance			
	13.70 m	**12.80 m**	**12.60 m**	**11.10 m**
Best	87.5%	91.1%	91.9%	106.2%
Mid	96.3%	99.0%	102.8%	109.4%
Low	99.2%	109.1%	107.8%	127.7%
Low 80%	99.6%	108.9%	104.4%	124.6%

SRT and payload height

The SRT performance of the combination directly depends on the suspension fitted throughout the vehicle. The results in Table 20 show the SRT performance of the combination for different tiers of suspension at different bin heights and the payload heights required for a 0.35 g SRT result.

Table 20 - Truck and 5-axle dog SRT results

	SRT (g) at 3,500mm bin height		SRT (g) at 3,200mm bin height		0.35 g SRT payload height (mm)[2]	
	Front	**Rear**	**Front**	**Rear**	**Front**	**Rear**
Best	0.367	0.378	0.394	0.404	3690	3800
Mid	0.341	0.367	0.364	0.394	3360	3700
Low	0.302	0.355	0.327	0.381	2930	3530
Low 80%	0.288	0.348	0.314	0.375	2810	3450

Low-speed standards (LSSP, FSA, FSB, FSC, TS, STFD)

It was determined that the truck and 5-axle dog performed at Level 2 or better for all low-speed standards. This assessment accounted for the worst-case dimension sets from Version 2 of the VSEs. Additionally, the low-speed assessment accounted for all possible configurations of lift axles, including fitted to either Axle 6, Axle 8 or both Axles 6 and 8.

In order for the VSE to account for trucks at up to 2.55-metre wide, the only additional restriction that was required was to limit to the truck front overhang to 1,600 mm, instead of 1,650 mm for 2.5-metre wide combinations.

The worst-case low-speed standards results can be seen in Table 21.

Table 21 - Truck and 5-axle dog low-speed results

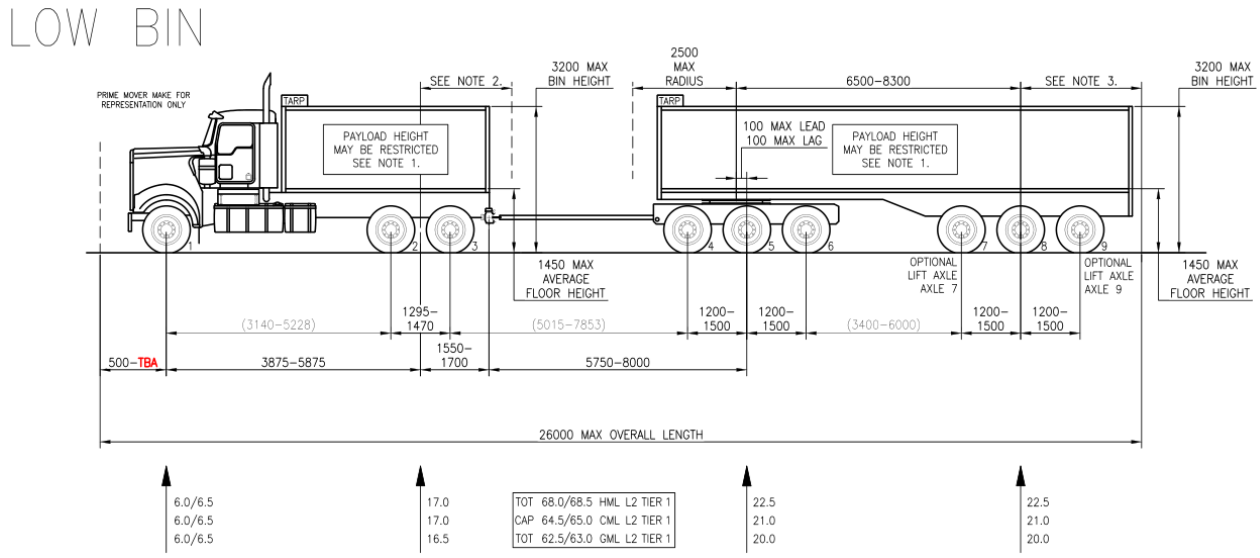
Truck width (m)	Min FOH (mm)	Max FOH (mm)	LSSP (m)	FSA (m)	FSB (m)	FSC (m)	TS (m)	STFD (%)
2.55	500	1600	8.648	0.845	0.024	0.000	0.231	26
2.5	500	1650	8.651	0.847	0.049	-0.106	0.239	26
			L2	**Pass**	**Pass**	**Pass**	**L1**	**Pass**

[2] For payload heights which achieve exactly 0.35 g, the bin height was relaxed up to 3.8 metres.

4.3 Truck and 6-axle Dog-trailer Results

The outcomes for the truck and 6-axle dog where similar to that of the 5-axle dog. With the combinations being separated into a high bin variant (3,500 mm bin height) and low bin variant (3,200 mm bin height). The low bin Variant can be seen in Figure 9. The restrictions required to meet the majority of the standard was able to be determined. The only exception to this is for SRT and RA where the allowable dimension will be dependent on the NHVR risk tolerance.

Figure 9 - Truck and 6-axle dog draft VSE (Low bin Variant) - Version 3



Combination specifications

The specifications assessed for the truck and 6-axle dog combination remained similar to those from previous versions of the VSEs. The only differences were an increase in the minimum tyre size of the trailing units to 275/70R22.5 and an increase in the dog trailer minimum tare mass to 9.0 tonnes. These are summarised in Table 22 and Table 23.

Table 22 - Truck and 6-axle dog tare masses

Unit	Tare minimum (tonnes)
Truck	9.0
Dog trailer	9.0

Table 23 - Truck and 6-axle dog tyre size and load index

Axle group	Minimum load rating	Smallest tyre size
Steer	144	11R22.5
Drive	140	275/70R22.5
Trailer	140	275/70R22.5

High-speed standards (HSTO, RA, TASP, YDC)

The HSTO, TASP and YDC results all achieved Level 2 or better. The results listed in Table 24 were assessed with the worst-case dimensions. The suspension used to obtain these results was 80% of the lowest performing configuration. The combinations presented only minor differences between the 2.5-metre-wide and 2.55-metre-wide combinations, with a slightly larger difference for TASP.

Table 24 – Truck and 6-axle dog dynamic results

	2.5m Wide			2.55m Wide		
	HSTO (m)	**TASP (m)**	**YDC**	**HSTO (m)**	**TASP (m)**	**YDC**
3500 mm bin height	0.663	2.852	0.236	0.663	2.873	0.253
3200 mm bin height	0.626	2.834	0.245	0.626	2.858	0.245
	L2	**L1**	**PASS**	**L2**	**L1**	**PASS**

Similar to the truck and 5-axle dog, the critical standard for the 6-axle combination is RA. As seen in the results in Table 25, at a 3.2-metre bin height the combination passes RA at 80% of the lowest suspension configuration. In order for the combination to pass at a 3.5-metre bin height a dimensional restriction was required, which was a limit on the minimum distance from the tow-eye coupling to the centre of the rear axle group on the trailer.

Depending on the performance requirements the RA Ratios for the different tiers of suspension performance are listed in Table 26. Results are presented as a function of SRT and RA as a ratio, with combinations achieving a ratio percentage above 100% are deemed to have failed the standard.

Table 25 – Truck and 6-axle dog RA Ratios at 3.2-metre bin height

	3.2-metre Bin Height
	Minimum coupling to Axle 8 distance
	12.15 m
Best	87.3%
Mid	95.2%
Low	93.5%
Low 80%	99.6%

Table 26 – Truck and 6-axle dog RA Ratios at 3.5-metre bin height

	3.5-metre Bin Height		
	Minimum coupling to Axle 8 distance		
	14.1 m	**13.1 m**	**12.15 m**
Best	84.7%	88.7%	92.9%
Mid	96.5%	99.4%	104.6%
Low	96.4%	104.2%	102.4%
Low 80%	103.1%	110.3%	109.9%

SRT and payload height

The results in Table 27 show the SRT performance of the combination for different tiers of suspension at different bin heights and the payload heights required for a 0.35 g SRT result.

Table 27 - Truck and 6-axle dog SRT results

	SRT (g) at 3,500mm bin height		SRT (g) at 3,200mm bin height		0.35 g SRT payload height (mm)[3]	
	Front	Rear	Front	Rear	Front	Rear
Best	0.367	0.378	0.394	0.404	3690	3800
Mid	0.341	0.367	0.364	0.394	3360	3800
Low	0.302	0.355	0.327	0.381	2930	3690
Low 80%	0.288	0.348	0.314	0.375	2810	3590

Low-speed standards (LSSP, FSA, FSB, FSC, TS, STFD)

As with the 5-axle dog combination, the truck and 6-axle dog achieved PBS Level 2 across all low-speed standards when accounting for all potential lift axle configurations and the only restriction required is the front overhang on 2.55-metre-wide combinations, limited to 50 mm less than that of the 2.5-metre-wide combination.

The low-speed results can be seen in Table 28.

Table 28 - Truck and 6-axle dog low-speed results

Truck width (m)	Min FOH (mm)	Max FOH (mm)	LSSP (m)	FSA (m)	FSB (m)	FSC (m)	TS (m)	STFD (%)
2.55	500	1600	8.631	0.833	0.188	0.062	0.331	19
2.5	500	1650	8.635	0.839	0.213	0.085	0.241	19
			L2	**Pass**	**Pass**	**Pass**	**L2**	**Pass**

[3] For payload heights which achieve exactly 0.35 g, the bin height was relaxed up to 3.8 metres.

4.4 Reduced masses for Tier 1

One of the main limitations listed on the draft VSEs is that the combination must comply with the tier 1 formula as reducing the mass of a combination generally has a positive impact on the high-speed standards. The impact of this was investigated regarding the SRT and RA performance of the truck and dog combinations.

It was determined that reducing the mass across axles 4 to 8 is critical in meeting the Tier 1 mass. Reducing the payload mass in the trailer in order to meet the Tier 1 mass limit also has the benefit of improving the rear SRT performance and the RA performance. Therefore, improving the RA ratio of the combination.

As can be seen in Table 29, reducing the mass to meet the Tier 1 requirement had a significant impact on the RA result of the combinations. It can be assumed that the performance of the combinations requiring a mass reduction will be improved upon what has been reported in previous sections.

Table 29 - Truck and 5-axle dog RA performance (Full GCM versus reduced Tier 1 mass)

	Truck and 5-axle dog (High Bin Variant)			
Minimum coupling to axle 7 distance	**12.60 m**		**11.10 m**	
Mass	**62.25t**	**63.00t**	**60.05t**	**63.00t**
Best	91.4%	91.9%	93.9%	106.2%
Mid	99.5%	102.8%	105.1%	109.4%
Low	107.3%	107.8%	112.0%	127.7%
Low 80%	107.4%	104.4%	111.7%	124.6%

5. Secondary stakeholder consultation

Upon the completion of the PBS assessments, Version 3 of the Draft VSEs were distributed to the stakeholders involved in the initial round of engagement as listed previously in Section 2.2, Table 2. This round of consultation was completed via email. The stakeholders were given a set period of time to provide feedback for it to be considered.

The feedback received during this phase was limited. However, the main feedback received was positive regarding the changes made to the VSEs. Stakeholders were appreciative that the feedback provided in the initial stakeholder engagement was accounted for. At that stage, the main feedback that required consideration was a request to increase the maximum coupling rear overhang to 1,760 mm on all truck and dog combinations.

An additional piece of feedback was received after the deadline included that for the prime mover and semi-trailer VSEs the restriction including "The sum of dimensions A, B and C must not exceed 15,725 mm", may overly compromise the usability for some common prime movers.

6. Updated PBS assessments

After the second round of stakeholder engagement, the only additional assessment that was required involved investigating the potential of increasing the coupling rear overhang on both truck and dog combinations.

Increasing this dimension has a negative impact on the high-speed performance of a combination. As previously stated, the critical standard for these combinations is RA. The dynamics performance of these combinations was re-assessed with the increased coupling distance.

The HSTO, TASP and YDC results of the truck and dog combinations can be seen in Table 30 and Table 31. Similar to the smaller drawbar distance, both combinations pass all these standards.

Table 30 – Truck and 5-axle dog dynamic results (1,760 mm coupling rear-overhang)

	Truck and 5-axle dog					
	2.5m Wide			2.55m Wide		
	HSTO (m)	TASP (m)	YDC	HSTO (m)	TASP (m)	YDC
3500 mm bin height	0.754	2.836	0.236	0.663	2.844	0.242
3200 mm bin height	0.726	2.836	0.206	0.626	2.861	0.209
	L2	**L1**	**PASS**	**L2**	**L1**	**PASS**

Table 31 – Truck and 6-axle dog dynamic results (1,760 mm coupling rear-overhang)

	Truck and 6-axle dog					
	2.5m Wide			2.55m Wide		
	HSTO (m)	TASP (m)	YDC	HSTO (m)	TASP (m)	YDC
3500 mm bin height	0.760	2.855	0.276	0.761	2.893	0.273
3200 mm bin height	0.725	2.837	0.274	0.727	2.878	0.265
	L2	**L1**	**PASS**	**L2**	**L1**	**PASS**

6.1 Truck and 5-axle dog RA results

As previously outlined, RA is the critical standard for truck and dog combinations. The suggested coupling to axle 7 distances have been re-assessed with the increased coupling distance and the results can be seen in Table 32 and Table 33.

Table 32 - RA Ratios at 3.2-metre bin height

	3.2-metre Bin Height		
	Coupling to Axle 7 distance		
	12.20 m	**11.80 m**	**11.10 m**
Best	90.6%	92.1%	96.5%
Mid	93.8%	95.6%	99.8%
Low	99.1%	99.9%	111.7%
Low 80%	101.8%	103.1%	117.0%

Table 33 - RA Ratios at 3.5-metre bin heights

	3.5-metre Bin Height			
	Coupling to Axle 7 distance			
	13.70 m	**12.80 m**	**12.60 m**	**11.10 m**
Best	88.1%	91.8%	92.6%	112.2%
Mid	95.3%	99.5%	100.4%	114.5%
Low	102.2%	107.4%	108.5%	132.1%
Low 80%	102.2%	103.7%	104.6%	134.6%

6.2 Truck and 6-axle dog RA results

As with the 5-axle dog, the critical standard for the truck and 6-axle dog is RA and it suggested that the high bin variant will require a minimum distance between the coupling to axle 8. The results for the previously suggested minimum distances can be seen in Table 34 and Table 35.

Table 34 – Truck and 6-axle dog RA Ratios at 3.2-metre bin height

	3.2-metre Bin Height
	Minimum coupling to Axle 8 distance
	12.15 m
Best	88.9%
Mid	96.2%
Low	93.4%
Low 80%	99.2%

Table 35 – Truck and 6-axle dog RA Ratios at 3.5-metre bin height

	3.5-metre Bin Height		
	Minimum coupling to Axle 8 distance		
	14.1 m	**13.1 m**	**12.15 m**
Best	86.3%	90.3%	92.6%
Mid	96.6%	101.9%	105.9%
Low	98.6%	104.7%	103.5%
Low 80%	104.9%	110.7%	110.9%

7. Further work and decisions

The final list of VSEs can be seen in Table 36 for reference. For each of these VSEs there are some dimensions and specifications that have not been included as it has been determined that the implications of these restrictions constitutes a policy decision to be made by the NHVR upon determining an acceptable risk tolerance.

Table 36 - Final list of developed draft VSEs

Combination	Variants	Drawing numbers
3-axle prime mover and 3-axle Semi-Trailer	Flat deck Van body Curtainsider	ATC3214-L-01-C-01 ATC3214-L-01-C-02 ATC3214-L-01-C-03
3-axle rigid truck and 5-axle dog trailer	Low bin High bin	ATC3214-L-02-C-01 ATC3214-L-02-C-01
3-axle rigid truck and 5-axle dog trailer	Low bin High bin	ATC3214-L-03-C-01 ATC3214-L-03-C-01

Maximum prime mover/truck width

This was one of the points raised by a number of truck manufacturers during the initial consultation phase. It was presented that the VSEs should allow for prime movers to operate at up to 2.55 metre wide for vehicles that are compliant with the "Safer Freight Initiative". It was believed by industry that the inclusion of this would assist in future proofing the envelopes as well as facilitate the uptake of vehicles aiming to operate under this initiative.

The implication for increasing the prime mover width from 2.5 metres to 2.55 metres, was seen to be minimal. With only some additional front overhang restrictions for each combination.

Prime mover and semi-trailer

As the critical standard for the prime mover and semi-trailer was SRT, the remaining dimensions to be confirmed is the maximum average floor height and allowable payload heights. As the SRT performance of a combination is highly dependent on the suspension configuration, floor heights and loading height, it was not possible at this stage to determine a payload loading height that would both be usable and achieve the SRT threshold for all suspensions. Therefore, it was determined that this should be a policy decision for the NHVR based on acceptable risk tolerances.

Additionally, the prime mover and semi-trailer VSEs were assessed across the three body types. However, the only difference in results between these was SRT performance. Therefore, it may be determined that it may be simpler for implementation to combine these into one version.

Truck and dog combinations

The first requirement to be confirmed for the truck and dog combinations is the same as the prime mover and semi-trailer, being the maximum floor height and bin heights for all variants based on the SRT performance.

Additionally, for each of these variants, with the exception of the Low Bin 6-axle dog trailer, the minimum distance between the drawbar coupling point and the centre of the tri-axle group will need to be determined. This is for the purpose of controlling the RA performance of these combinations. As previously stated, the RA standard is highly dependent on the same specifications as SRT. And the decision on what this dimension should be is a policy decision for the NHVR based on acceptable risk tolerance.

Conclusions

Over the course of the project, a set of VSEs were able to be developed for the three selected combinations:

- 3-axle prime mover and 3-axle semi-trailer (General freight)
- 3-axle rigid truck and 5-axle dog trailer (bin tipper)
- 3-axle rigid truck and 6-axle dog trailer (bin tipper).

The initial phases of the project saw a successful round of stakeholder engagement conducted. Advantia was able to meet with a number of stakeholders and received an extensive amount of feedback regarding the first version of the draft VSEs. The feedback was received through in-person and virtual meetings, email and online forms. The feedback received was used to develop the second version of the VSEs. Based on the feedback an updated version of the VSEs was developed and used as the basis for the PBS assessment of the combinations.

The prime mover and semi-trailer was targeting Level 1 performance. The combination was able to pass all the high-speed dynamics standards at the worst-case dimension and suspension configurations, with the exception of SRT. In order to achieve Level 1 performance for the low-speed standards a set of dimensional restrictions was required. In order to maintain the flexibility requirements for this VSE, this mainly consisted of limiting the maximum and minimum sums of the prime mover front overhang, wheelbase and trailer s-dimensions.

The truck and dog combinations were targeting Level 2 performance. These combinations were separated into two versions consisting of the high-bin variant and low-bin variant. Both were able to pass the low-speed standards without any additional restrictions with the exception of a FOH limitation for 2.55 wide trucks. These combinations also passed HSTO, YDC and TASP standards without requiring any restrictions. For both the 5-axle and 6-axle dog combinations, the critical standards were SRT and RA.

In order to control the RA performance of the truck and dog combinations, it has been proposed that a minimum dimension be implemented between the tow-eye coupling of the drawbar and the centre of the rear tri-axle group on the trailer (Axle 7 on the 5-axle dog trailer and Axle 8 on the 6-axle dog trailer). This would not be required for the low bin variant for the 6-axle dog. However, would be required for the high bin variant of the 6-axle dog and both for the 5-axle dog. A selection of suggested minimum lengths have been presented allowing for a pass result for different suspension categories.

On the conclusion of the PBS assessment, the updated VSEs were again distributed to industry. Very little feedback was received at this stage. That which was received was positive and appreciative of the inclusion of previous feedback.

The exception to this was a request to increase the coupling point on the truck and dog combinations to 1,760 mm (from 1,700 mm). This change decreased the dynamic performance of these combinations. All dynamics standards, except RA were within the requirements of the standards. However the RA performance was worse for a number of minimum dimension ranges.

Appendix A – Draft VSE version 1

Figure 10 - Prime mover and semi-trailer draft VSE (Flat Top) - Version 1

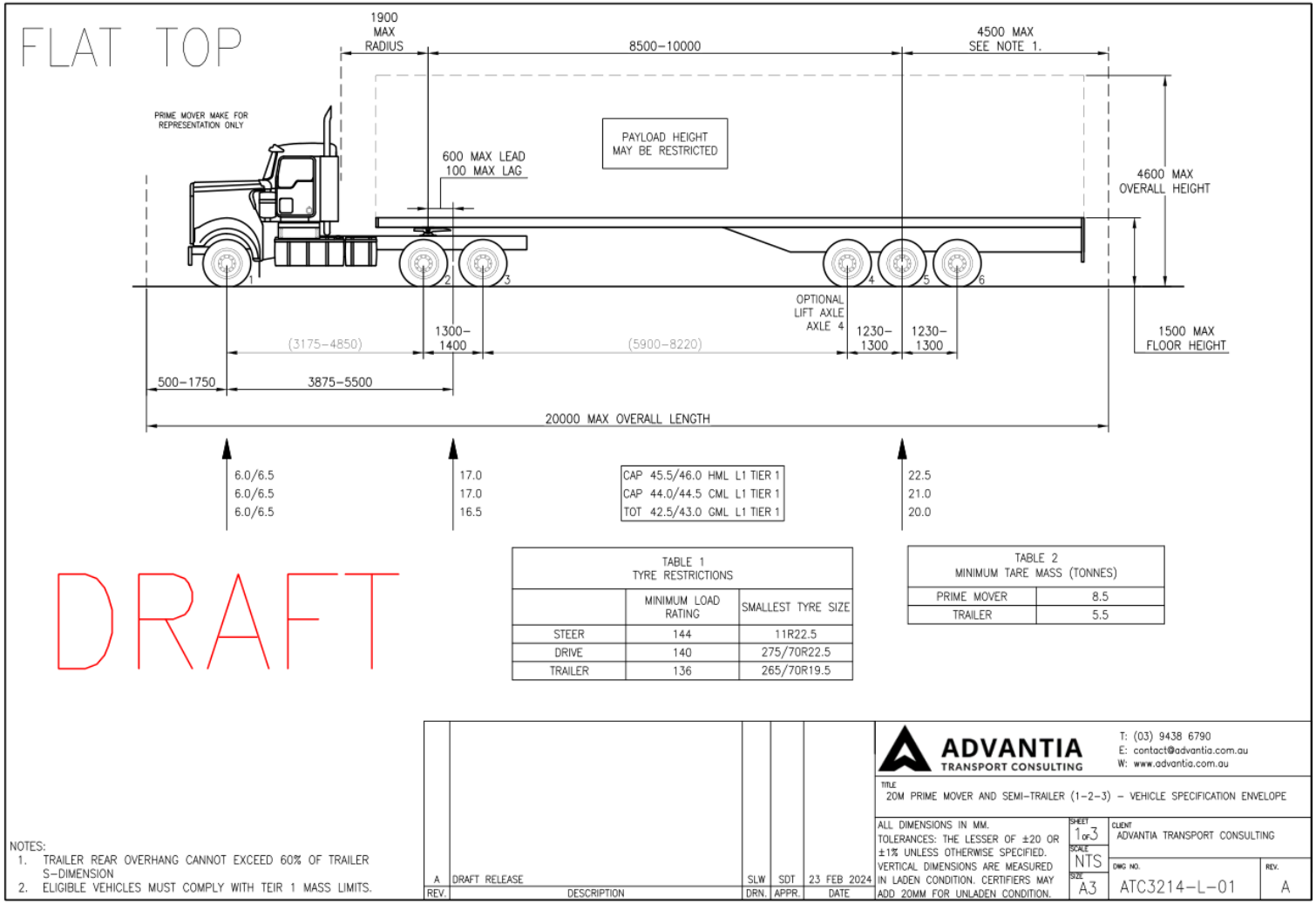


Figure 11 - Prime mover and semi-trailer draft VSE (Van Body) - Version 1

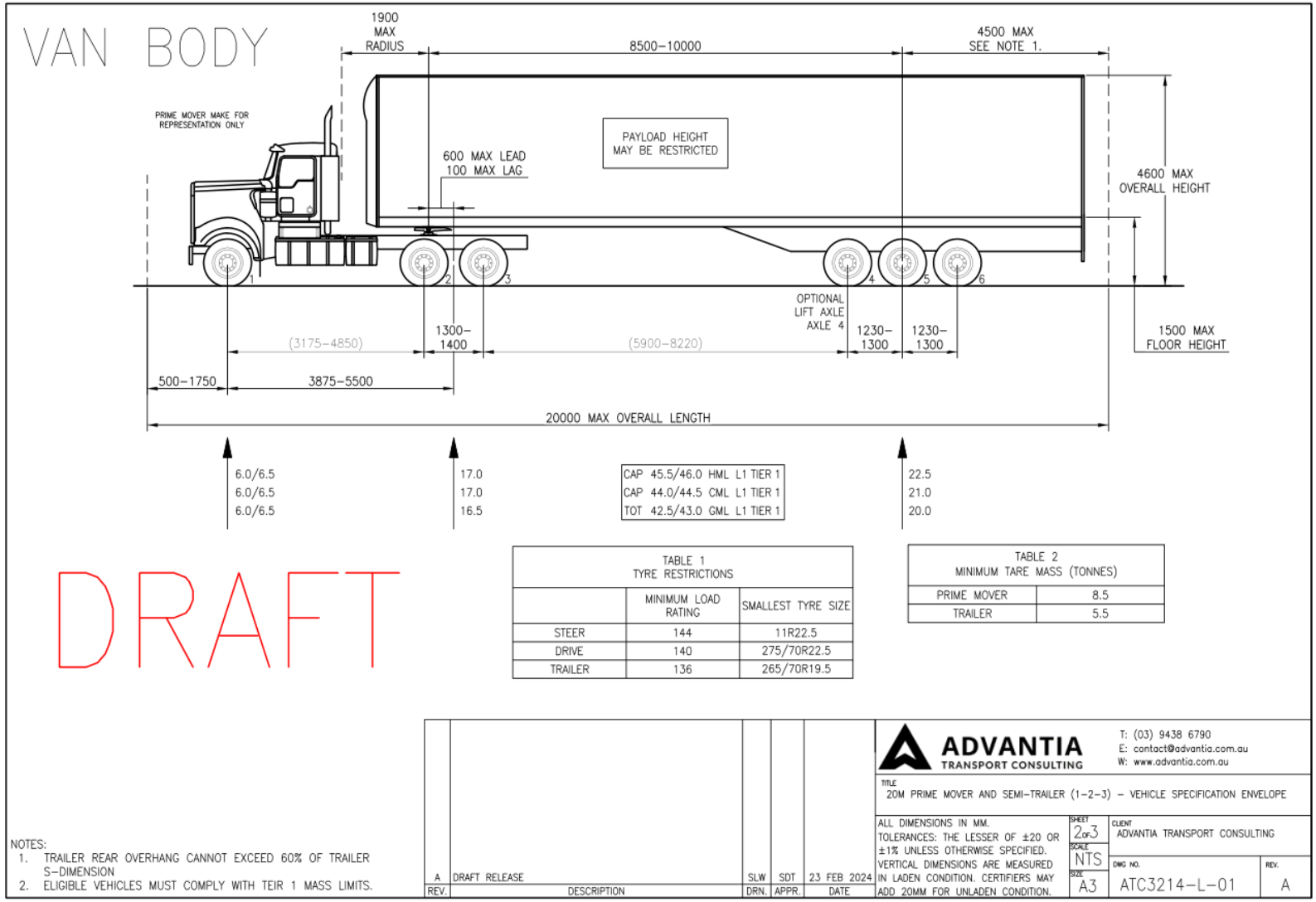


Figure 12 - Prime mover and semi-trailer draft VSE (Drop Deck) - Version 1

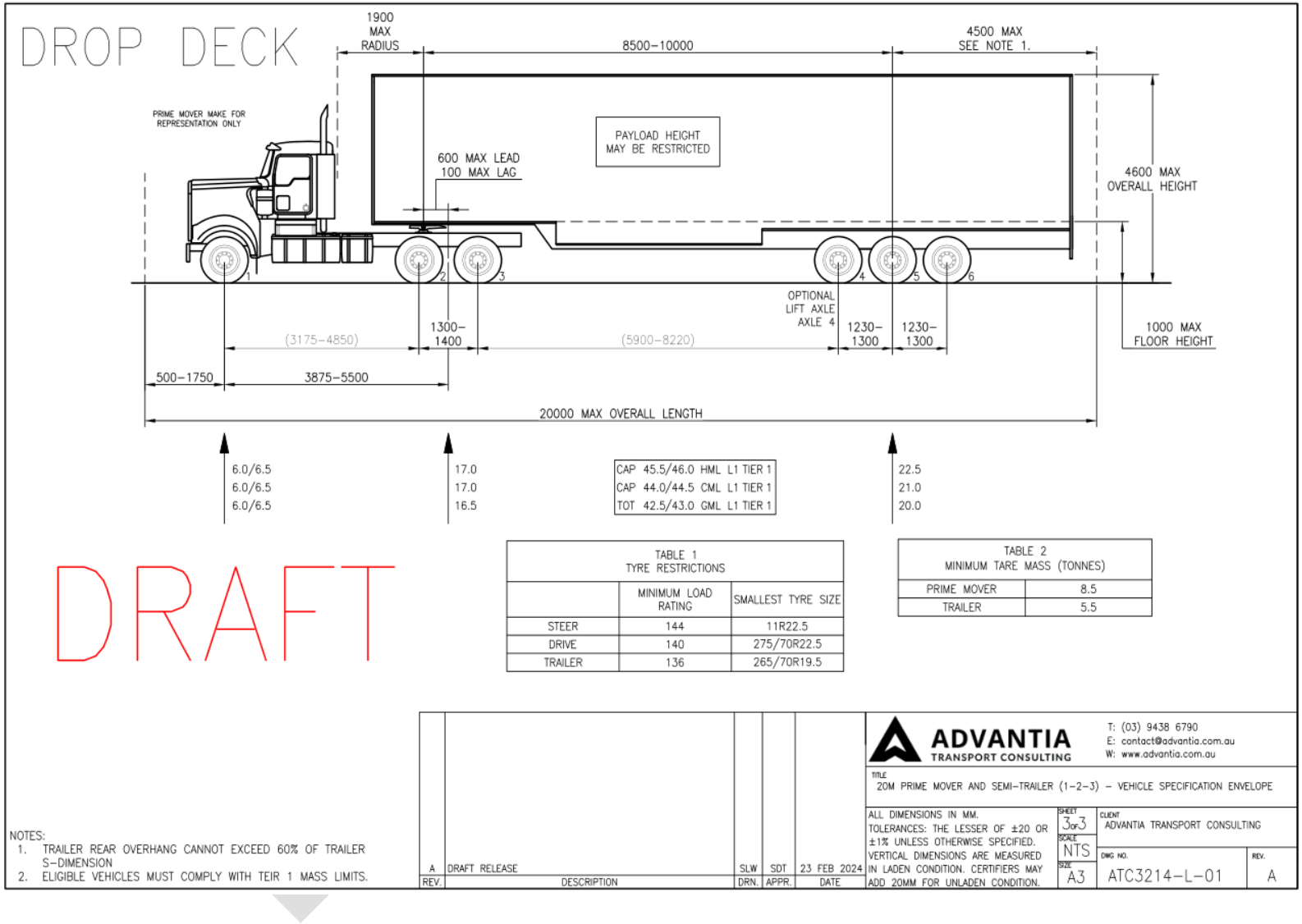


Figure 13 - Truck and 5-axle dog draft VSE - Version 1

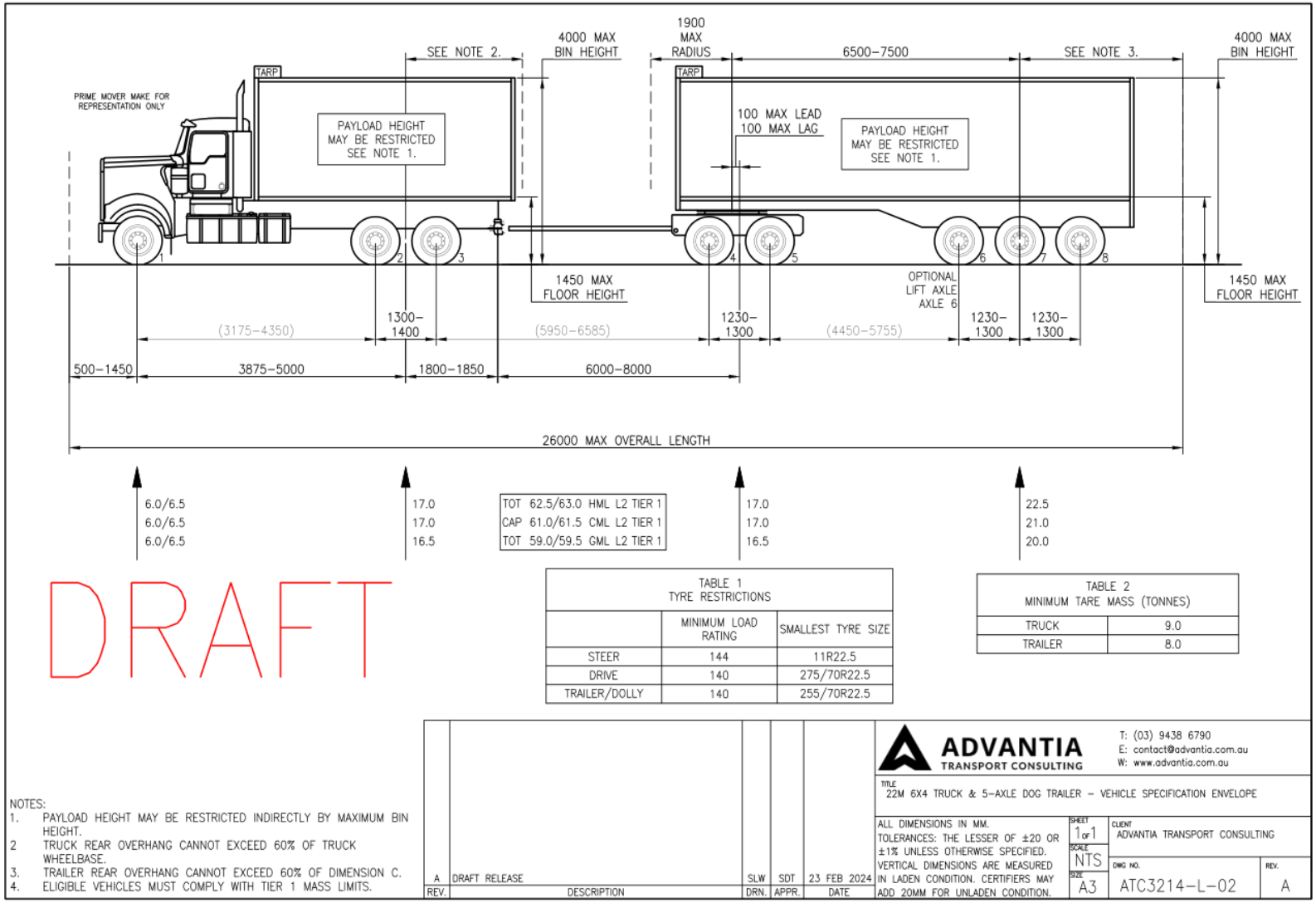


TABLE 1
TYRE RESTRICTIONS

	MINIMUM LOAD RATING	SMALLEST TYRE SIZE
STEER	144	11R22.5
DRIVE	140	275/70R22.5
TRAILER/DOLLY	140	255/70R22.5

TABLE 2
MINIMUM TARE MASS (TONNES)

TRUCK	9.0
TRAILER	8.0

NOTES:
1. PAYLOAD HEIGHT MAY BE RESTRICTED INDIRECTLY BY MAXIMUM BIN HEIGHT.
2 TRUCK REAR OVERHANG CANNOT EXCEED 60% OF TRUCK WHEELBASE.
3. TRAILER REAR OVERHANG CANNOT EXCEED 60% OF DIMENSION C.
4. ELIGIBLE VEHICLES MUST COMPLY WITH TIER 1 MASS LIMITS.

REV.	DESCRIPTION	DRN.	APPR.	DATE
A	DRAFT RELEASE	SLW	SDT	23 FEB 2024

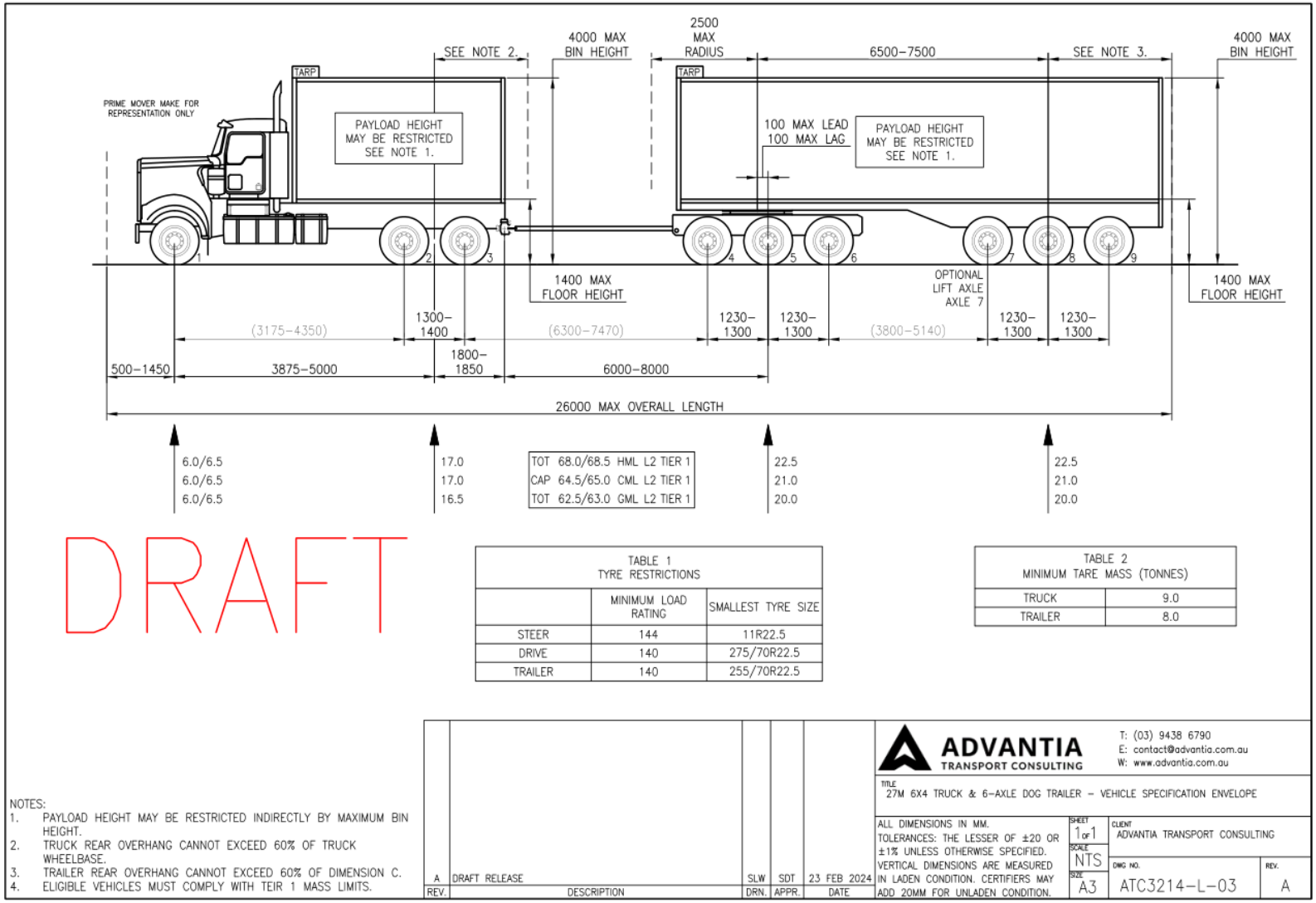
ADVANTIA TRANSPORT CONSULTING
T: (03) 9438 6790
E: contact@advantia.com.au
W: www.advantia.com.au

TITLE: 22M 6X4 TRUCK & 5-AXLE DOG TRAILER – VEHICLE SPECIFICATION ENVELOPE

ALL DIMENSIONS IN MM.
TOLERANCES: THE LESSER OF ±20 OR ±1% UNLESS OTHERWISE SPECIFIED.
VERTICAL DIMENSIONS ARE MEASURED IN LADEN CONDITION. CERTIFIERS MAY ADD 20MM FOR UNLADEN CONDITION.

SHEET: 1 of 1
SCALE: NTS
SIZE: A3
CLIENT: ADVANTIA TRANSPORT CONSULTING
DWG NO.: ATC3214–L–02
REV.: A

Figure 14 - Truck and 6-axle dog draft VSE - Version 1



Appendix B – Draft VSE version 2

Figure 15 - Prime mover and semi-trailer draft VSE (Flat Top) - Version 2

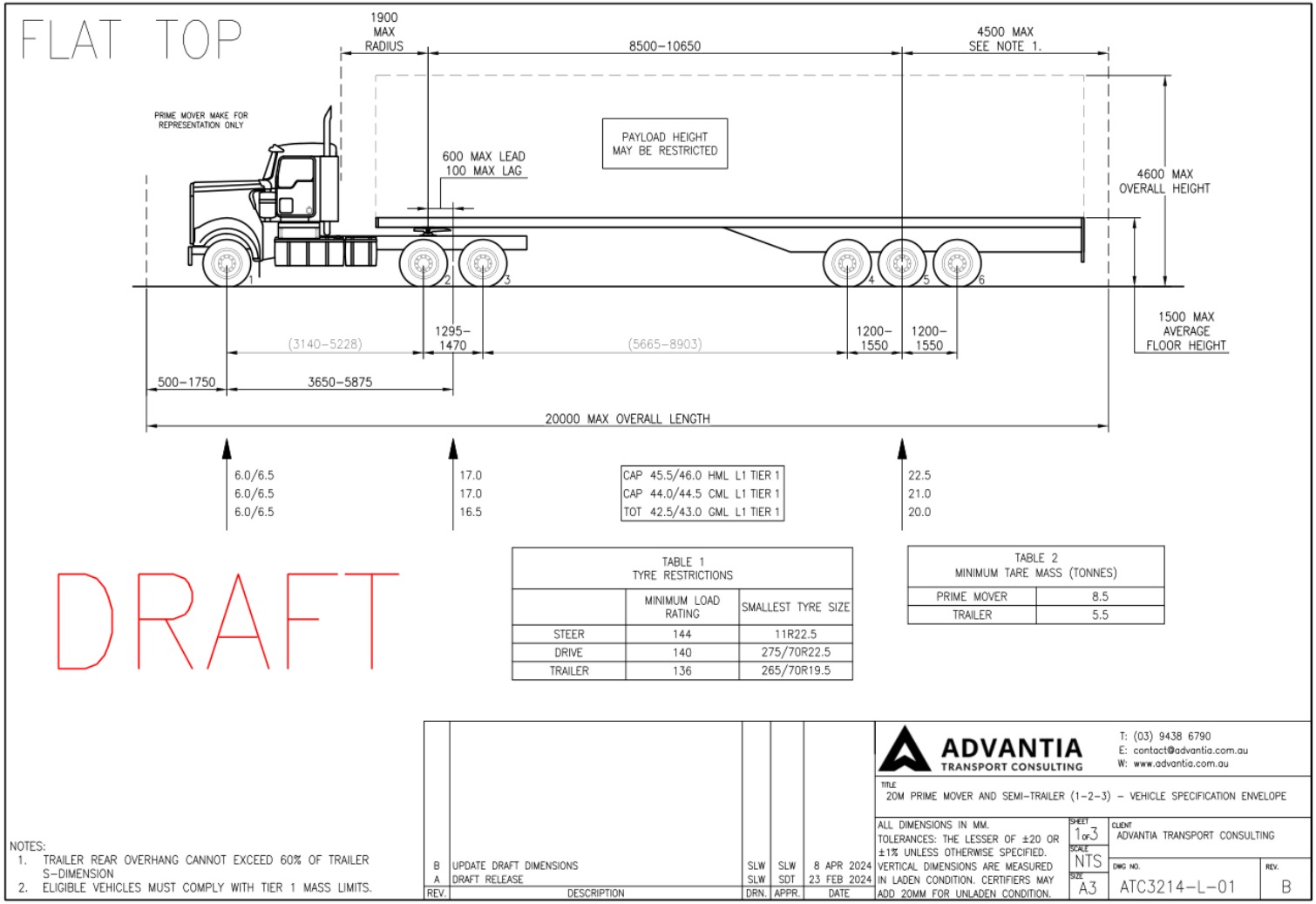


TABLE 1 TYRE RESTRICTIONS		
	MINIMUM LOAD RATING	SMALLEST TYRE SIZE
STEER	144	11R22.5
DRIVE	140	275/70R22.5
TRAILER	136	265/70R19.5

TABLE 2 MINIMUM TARE MASS (TONNES)	
PRIME MOVER	8.5
TRAILER	5.5

NOTES:
1. TRAILER REAR OVERHANG CANNOT EXCEED 60% OF TRAILER S–DIMENSION
2. ELIGIBLE VEHICLES MUST COMPLY WITH TIER 1 MASS LIMITS.

REV.	DESCRIPTION	DRN.	APPR.	DATE
B	UPDATE DRAFT DIMENSIONS	SLW	SLW	8 APR 2024
A	DRAFT RELEASE	SLW	SDT	23 FEB 2024

ADVANTIA TRANSPORT CONSULTING
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TITLE: 20M PRIME MOVER AND SEMI–TRAILER (1–2–3) – VEHICLE SPECIFICATION ENVELOPE

ALL DIMENSIONS IN MM.
TOLERANCES: THE LESSER OF ±20 OR ±1% UNLESS OTHERWISE SPECIFIED.
VERTICAL DIMENSIONS ARE MEASURED IN LADEN CONDITION. CERTIFIERS MAY ADD 20MM FOR UNLADEN CONDITION.

SHEET 1 of 3 | SCALE NTS | SIZE A3 | CLIENT ADVANTIA TRANSPORT CONSULTING | DWG NO. ATC3214–L–01 | REV. B

Figure 16 - Prime mover and semi-trailer draft VSE (Van Body) - Version 2

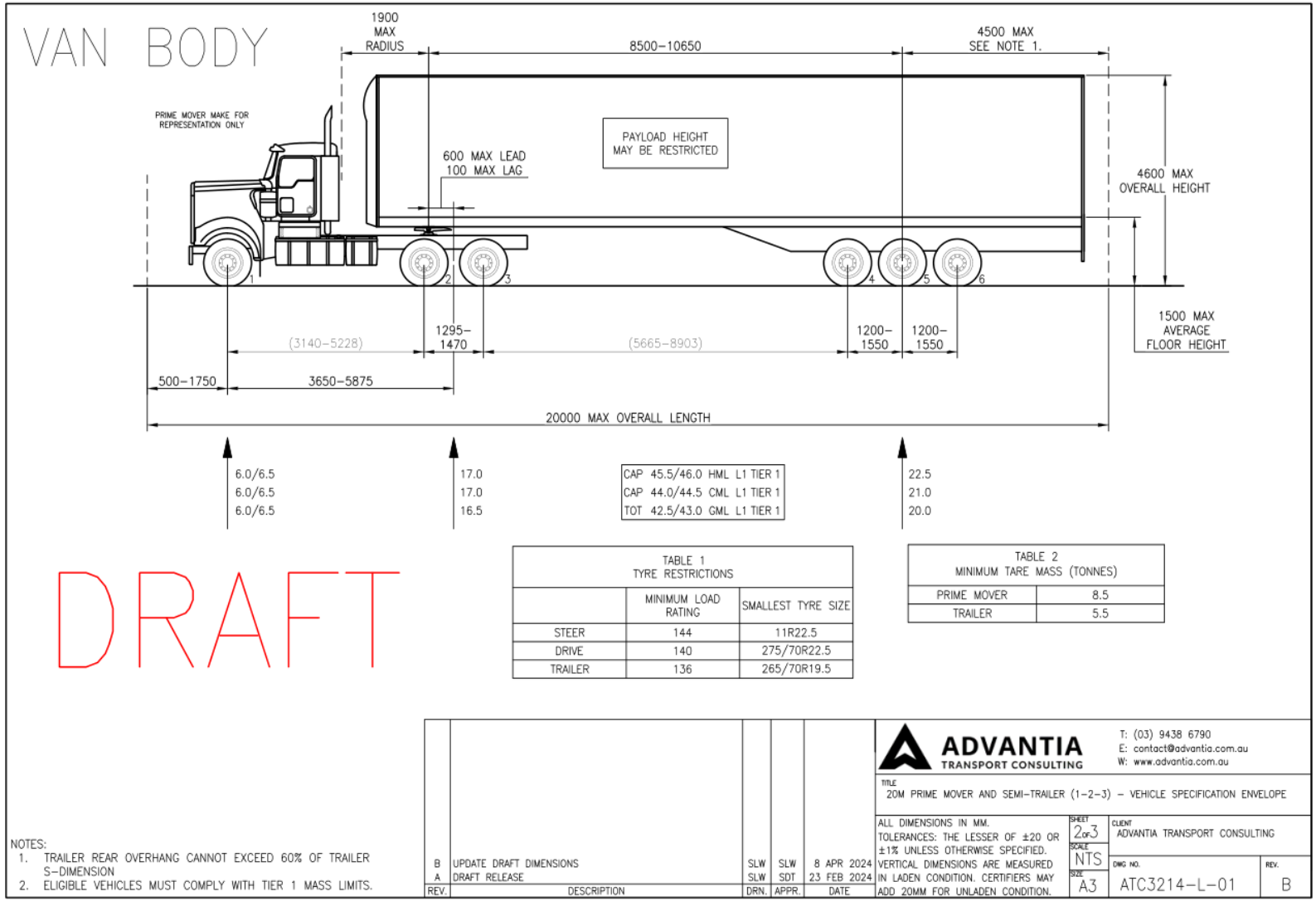

Figure 17 - Prime mover and semi-trailer draft VSE (Drop Deck) - Version 2

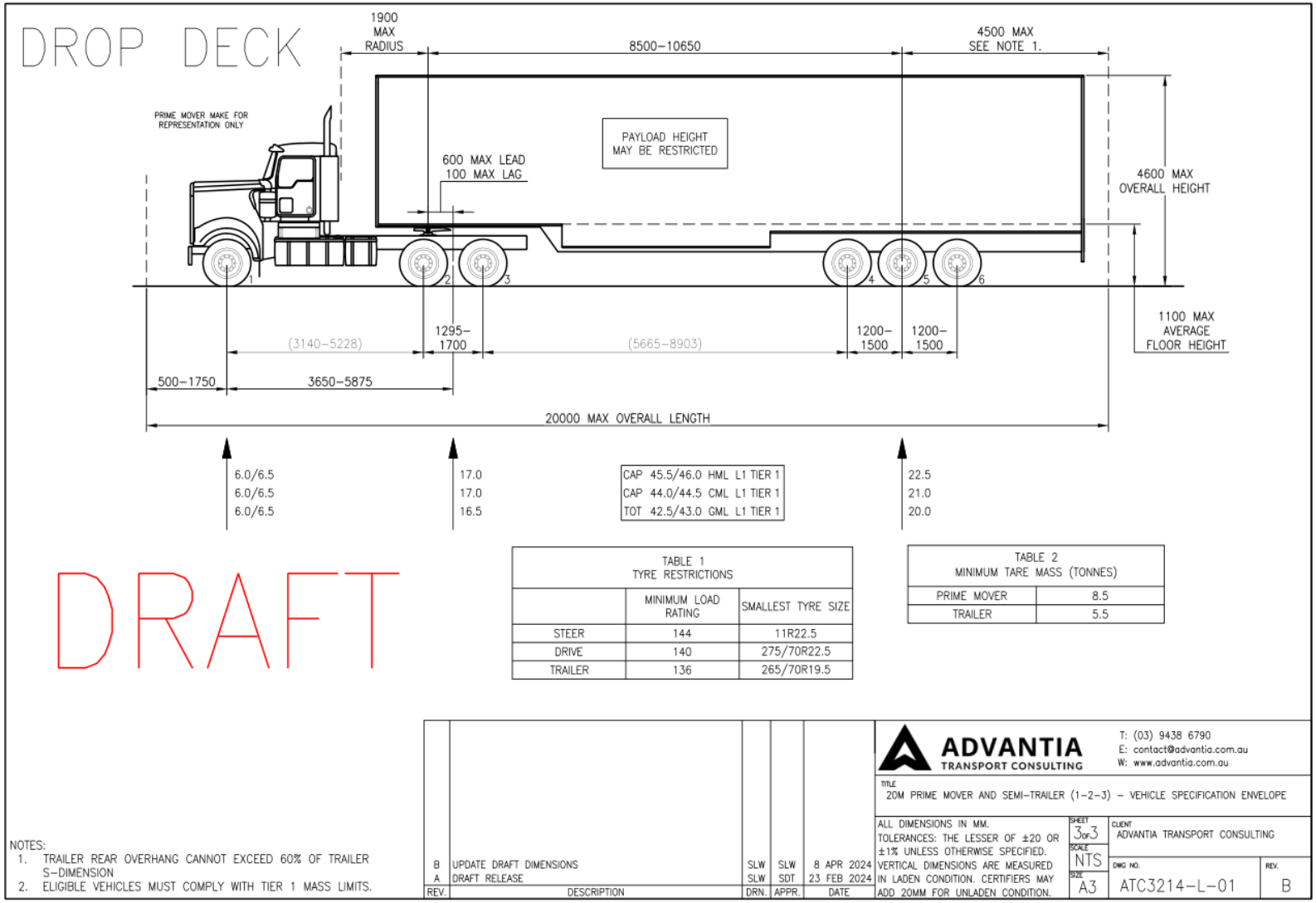

Figure 18 - Truck and 5-axle dog draft VSE - Version 2

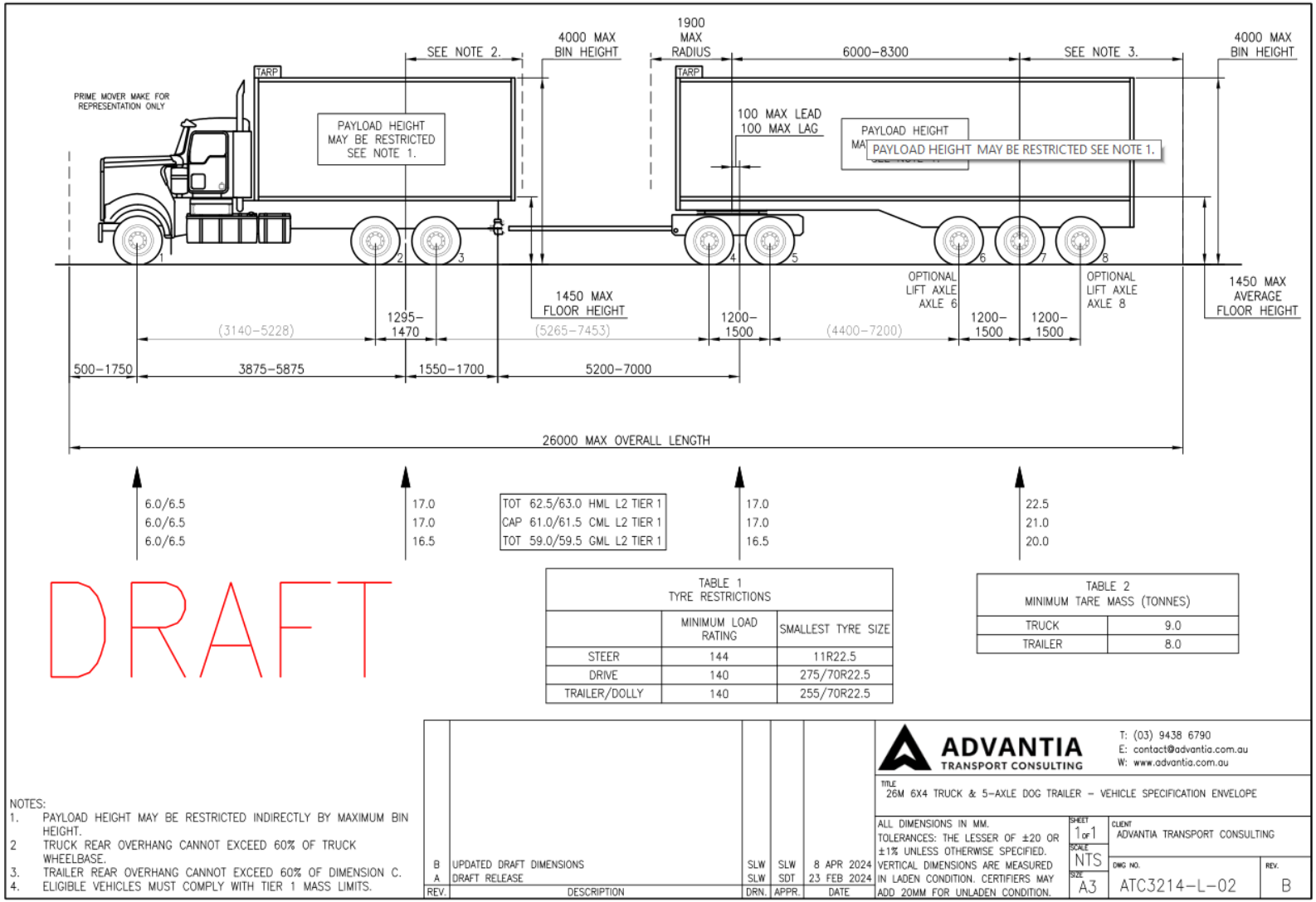

Figure 19 - Truck and 6-axle dog draft VSE - Version 2

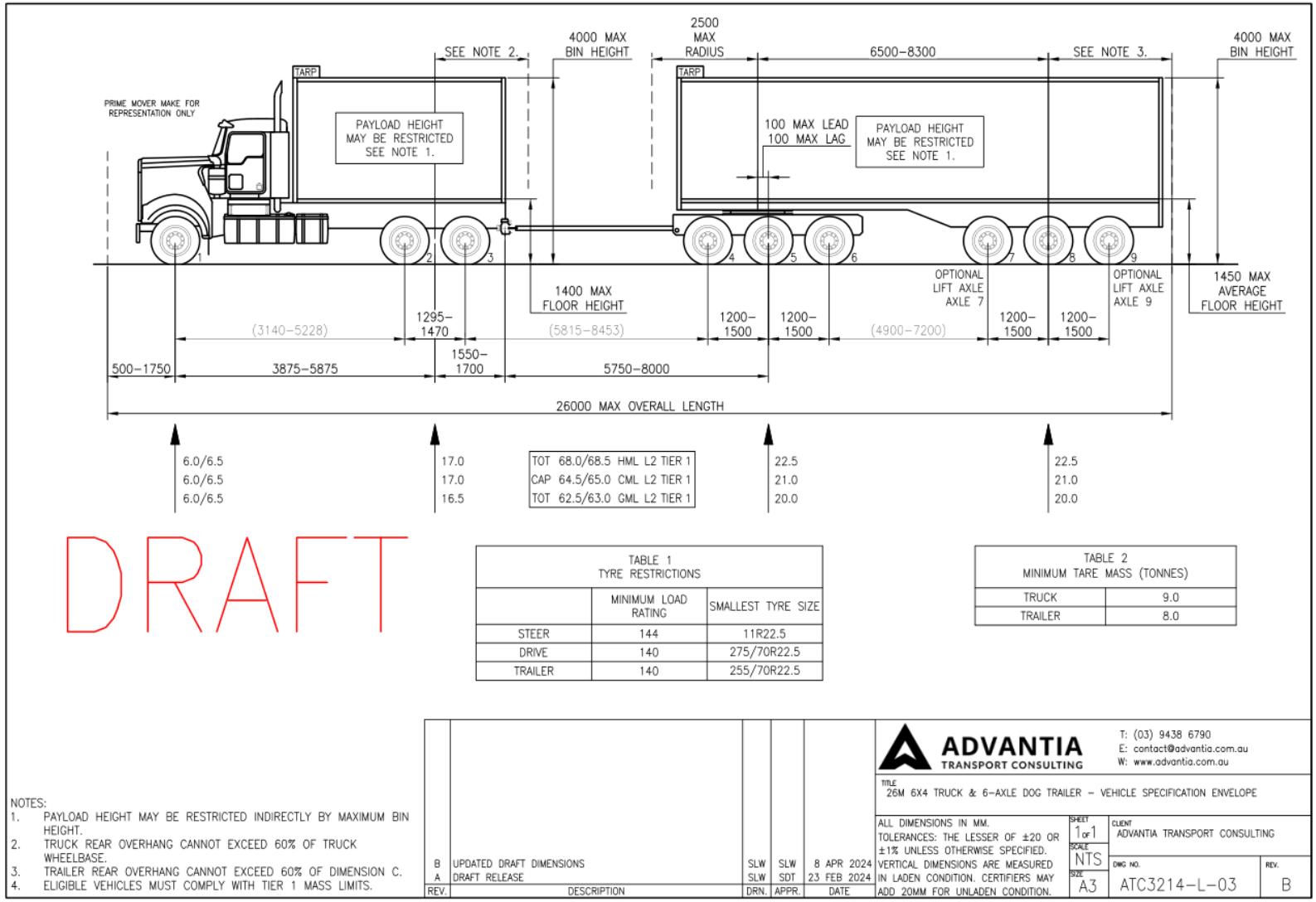

TABLE 1 TYRE RESTRICTIONS		
	MINIMUM LOAD RATING	SMALLEST TYRE SIZE
STEER	144	11R22.5
DRIVE	140	275/70R22.5
TRAILER	140	255/70R22.5

TABLE 2 MINIMUM TARE MASS (TONNES)	
TRUCK	9.0
TRAILER	8.0

NOTES:
1. PAYLOAD HEIGHT MAY BE RESTRICTED INDIRECTLY BY MAXIMUM BIN HEIGHT.
2. TRUCK REAR OVERHANG CANNOT EXCEED 60% OF TRUCK WHEELBASE.
3. TRAILER REAR OVERHANG CANNOT EXCEED 60% OF DIMENSION C.
4. ELIGIBLE VEHICLES MUST COMPLY WITH TIER 1 MASS LIMITS.

REV.	DESCRIPTION	DRN.	APPR.	DATE
B	UPDATED DRAFT DIMENSIONS	SLW	SLW	8 APR 2024
A	DRAFT RELEASE	SLW	SDT	23 FEB 2024

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TITLE: 26M 6X4 TRUCK & 6-AXLE DOG TRAILER – VEHICLE SPECIFICATION ENVELOPE

ALL DIMENSIONS IN MM.
TOLERANCES: THE LESSER OF ±20 OR ±1% UNLESS OTHERWISE SPECIFIED.
VERTICAL DIMENSIONS ARE MEASURED IN LADEN CONDITION. CERTIFIERS MAY ADD 20MM FOR UNLADEN CONDITION.

SHEET: 1 of 1
SCALE: NTS
SIZE: A3
CLIENT: ADVANTIA TRANSPORT CONSULTING
DWG NO.: ATC3214–L–03
REV.: B

Appendix C - Background

TruckSim

Computer simulation has been used to evaluate the dynamics of heavy vehicles since the 1980s. The University of Michigan Transportation Research Institute (UMTRI) initially developed simplified numerical models for researching some of the key aspects of truck stability, such as rollover threshold. The UMTRI researchers ultimately founded a software company and developed a full-featured commercial soft-ware package known as TruckSim. TruckSim has been on the market since the 1990s and is now recog-nised as the world's most advanced dedicated heavy vehicle simulation software package.

Computer simulation in Australia

In Australia, computer simulation has been used since the 1990s to demonstrate the safety and produc-tivity benefits of longer and heavier vehicle configurations. Multi-trailer road trains with up to six trailers were the focus of early work, where computer simulation compared their on-road performance with that of existing three-trailer road trains.

In the 2000s the focus shifted to smaller combinations such as semi-trailers, truck and dogs and B-doubles. Now there is a national Performance Based Standards (PBS) Scheme in place to manage these computer-based assessments.

Performance Based Standards (PBS)

The PBS Scheme was introduced in 2007. Its purpose is to enable road access approval for innovative heavy vehicle configurations that are more productive than regulation vehicles because they exceed certain conventional mass and dimension limits. A vehicle safety assessment demonstrates that the vehicle meets a set of safety-related performance standards. Service providers are accredited to per-form these assessments by computer simulation.

Further information about the PBS scheme in Australia can be found at:

https://www.nhvr.gov.au/road-access/performance-based-standards/guidelines-and-rules

Appendix D – Draft VSE version 3

Figure 20 – Prime mover and semi-trailer draft VSE (Drop Deck) - Version 3

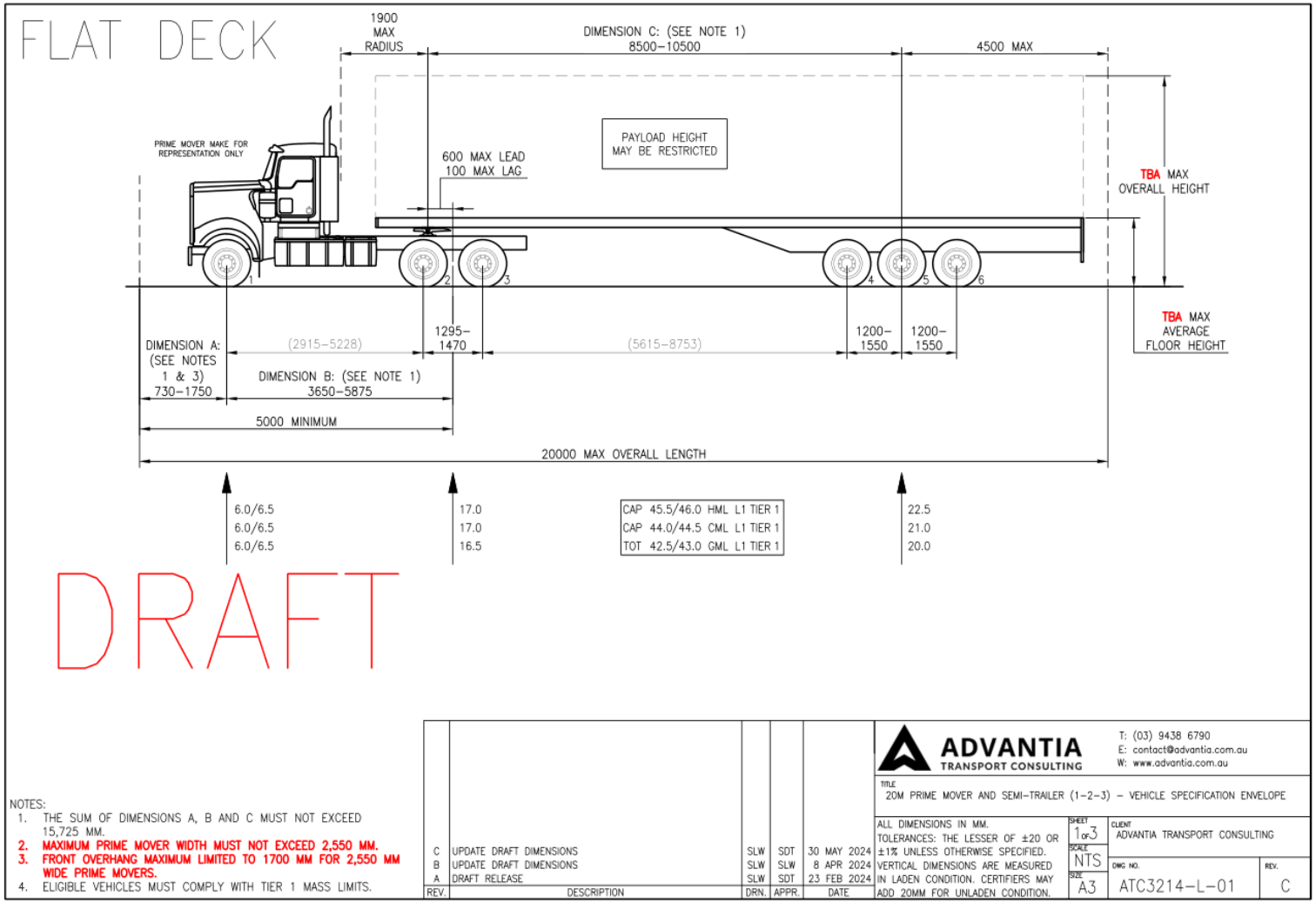


Figure 21 – Prime mover and semi-trailer draft VSE (Van Body) - Version 3

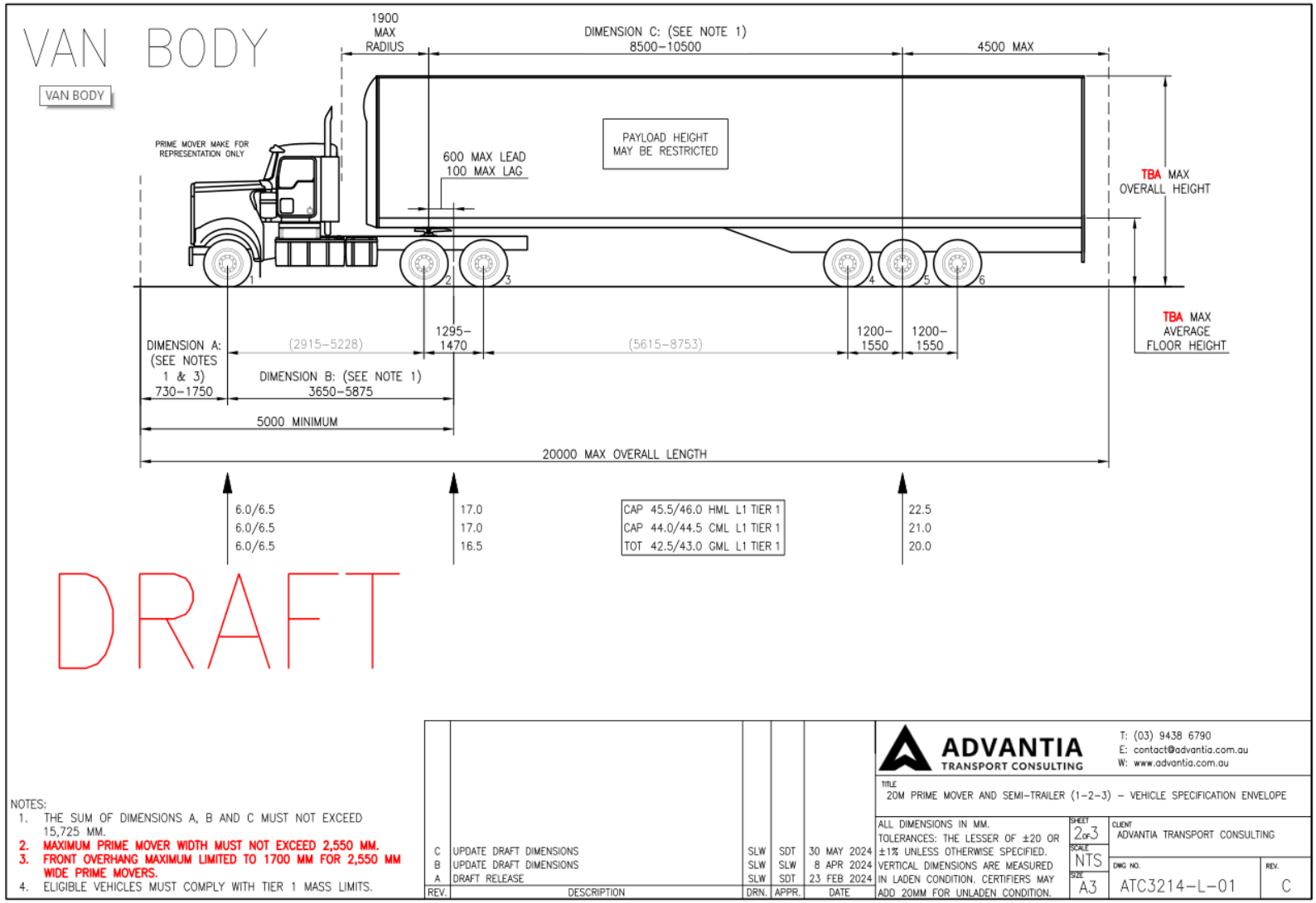


Figure 22 – Prime mover and semi-trailer draft VSE (Curtainsider) - Version 3

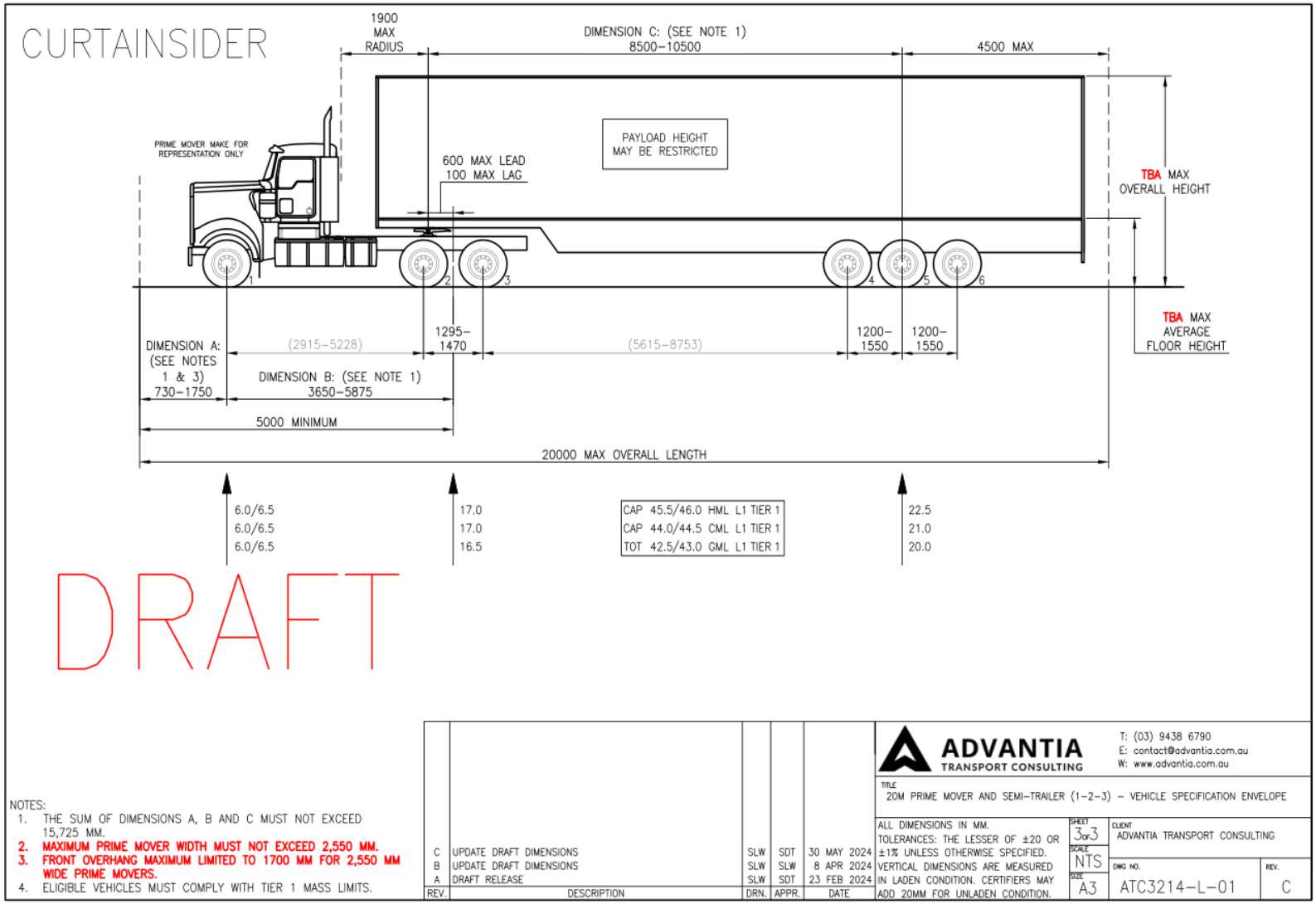


Figure 23 - Truck and 5-axle dog draft VSE (Low bin) - Version 3

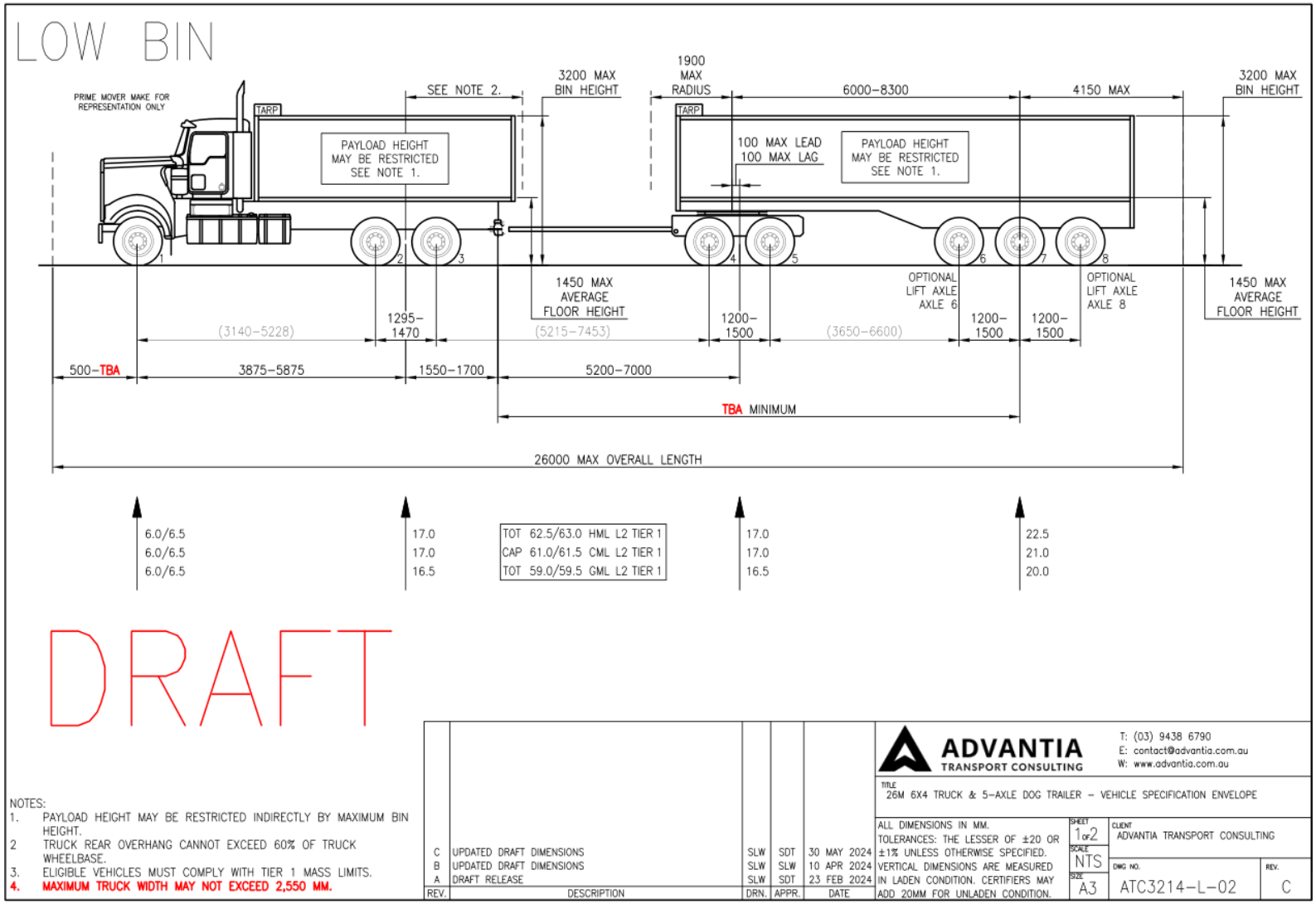


Figure 24 - Truck and 5-axle dog draft VSE (High bin) - Version 3

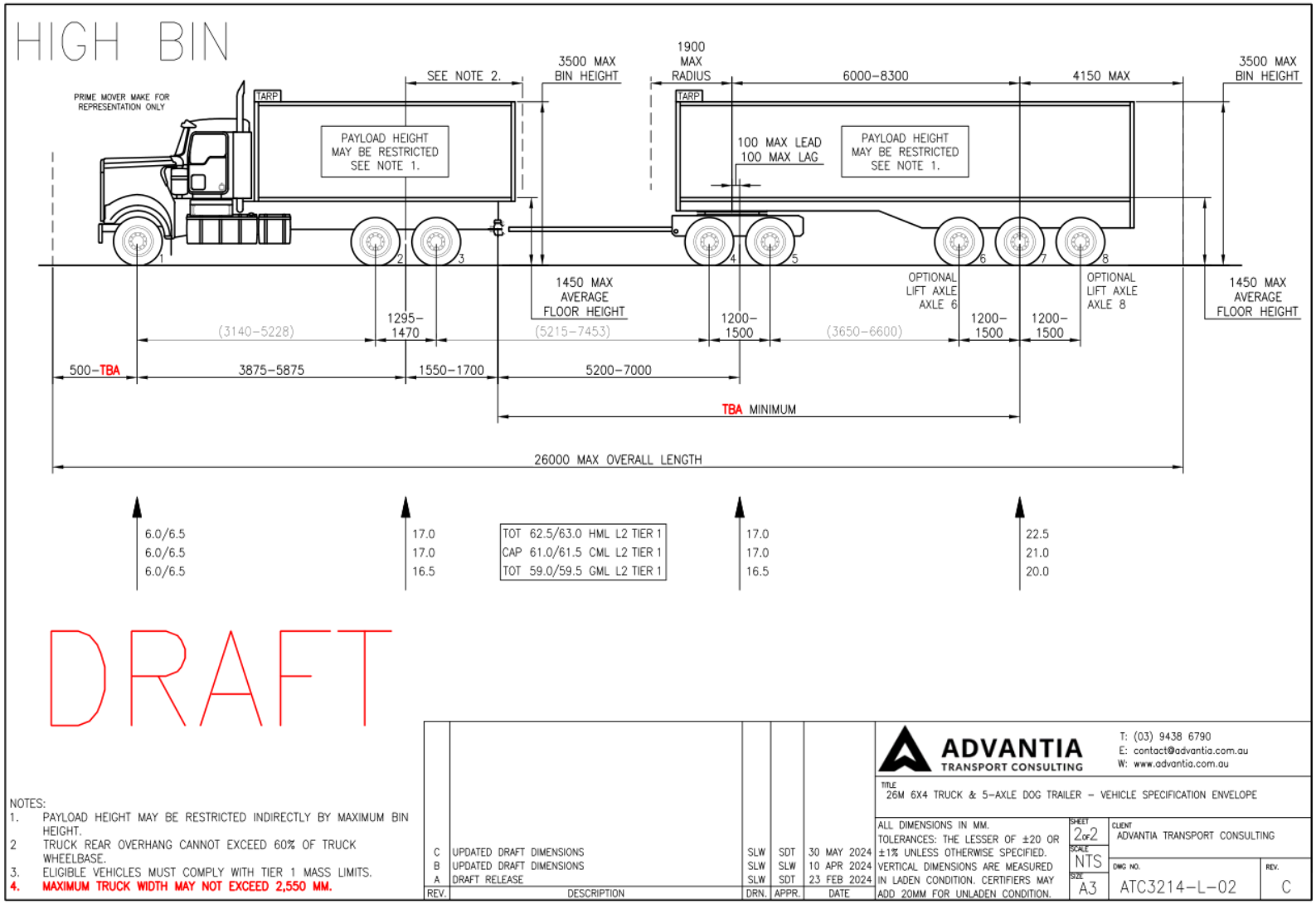


Figure 25 - Truck and 6-axle dog draft VSE (Low bin) - Version 3

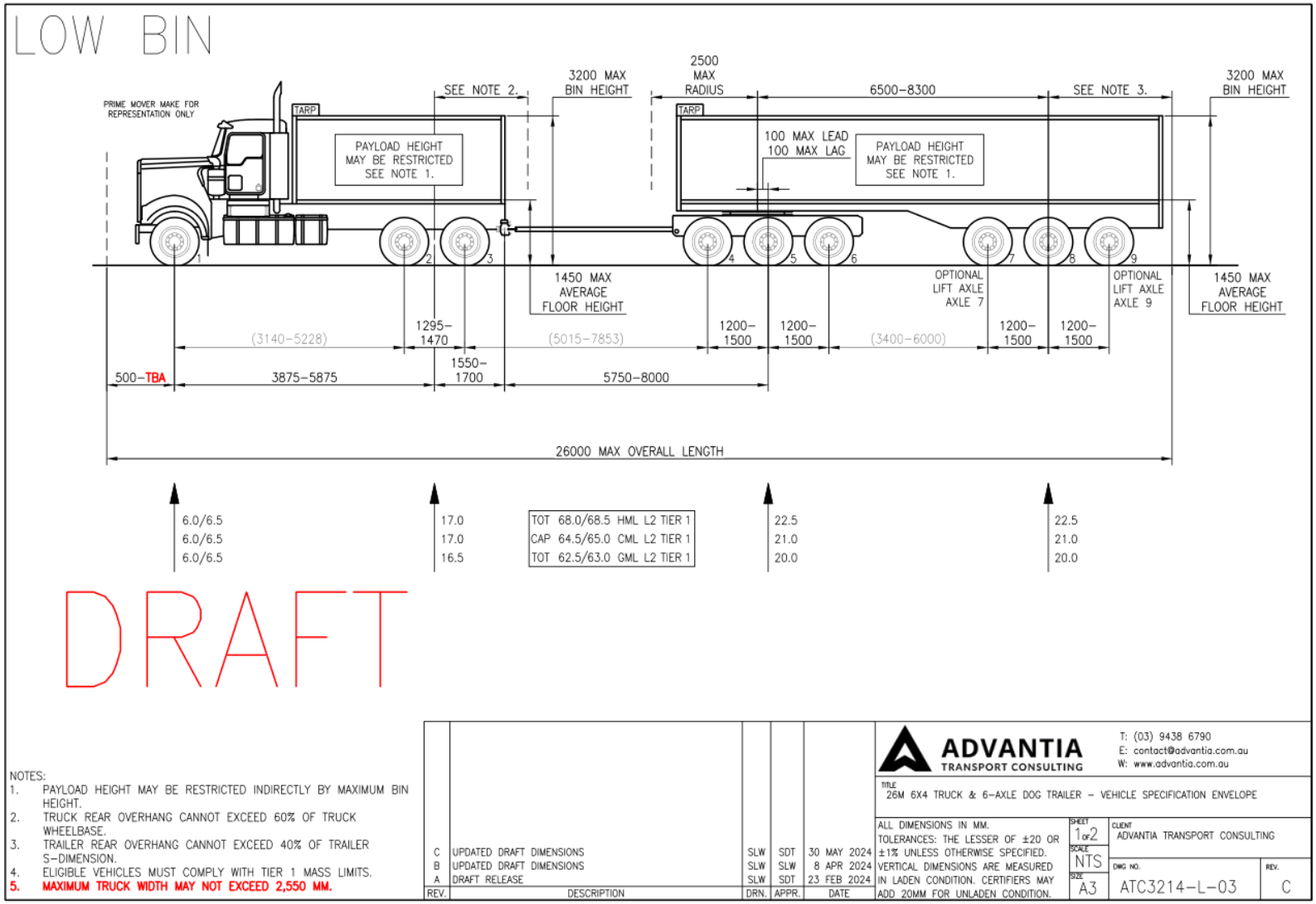
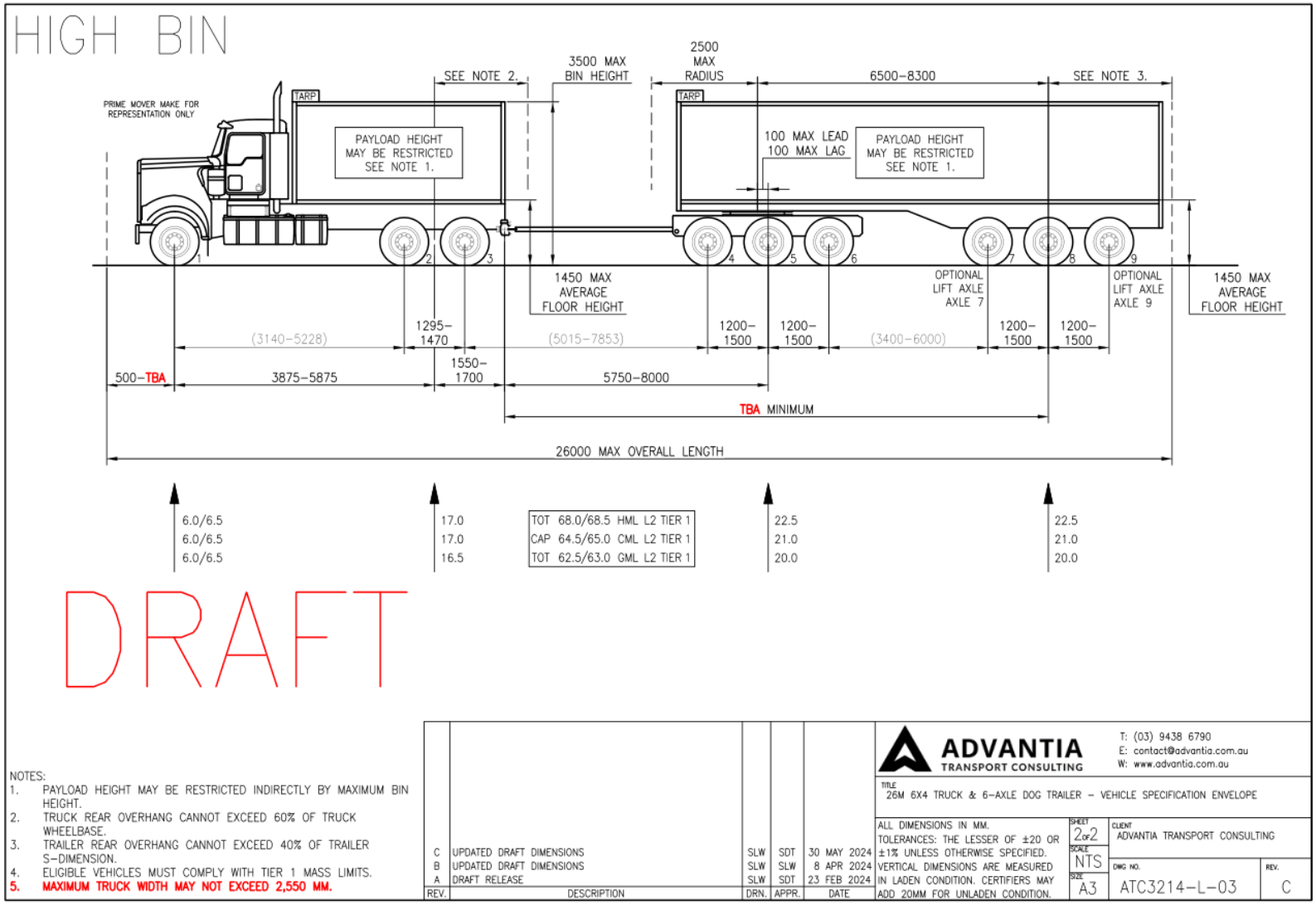


Figure 26 - Truck and 6-axle dog draft VSE (High bin) - Version 3



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