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An International Heavy Vehicle Nomenclature System

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Abstract

With an ever-increasing diversity of heavy vehicles worldwide, there is a need to have a clear and consistent means of describing heavy vehicle configurations. A review of the existing descriptions, common terminology, vehicle classification schemes and designation notation used throughout the world was conducted, and areas of potential confusion were identified. A nomenclature system was developed that provides a shorthand means for designating and coding vehicle configurations.

The proposed system is primarily based on that used by the Society of Automotive Engineers (SAE). The major enhancements are the use of the number of axles in each axle group rather than in each vehicle unit, and precise description of the number and type of articulation points. The character "S" to denote a semi-trailer has been retained but the symbol "-" is used to pictorially represent a drawbar. As an example, a twin-steer tandem drive rigid truck towing two five-axle full trailers, would be represented as 22-2S3-2S3. Under the SAE scheme, the vehicle would be designated as 4-5-5. This designation system leads directly into a simpler shorthand coding system that uses "R" for a rigid truck, "T" for a full trailer, and "B" for B-coupled units. Numbers after a letter designate repeated units.

The proposed nomenclature system is fully described in the paper, which includes an interesting and comprehensive range of examples taken from different countries. The paper is intended to promote discussion with a view to ultimately adopting an agreed heavy vehicle nomenclature system worldwide.

1. INTRODUCTION

Current trends in the world's heavy vehicle fleets are towards the maximization of vehicle productivity through increased overall vehicle lengths and weights. Even maintaining the same overall dimensions and axle loads results in many new vehicle combinations emerging that are proving a challenge to the existing classification systems.

This paper reviews the current Australian and a number of international heavy vehicle classification terminologies and description systems, and recommends a uniform terminology to be considered. It is based on a discussion paper prepared for AUSTRROADS (the association of Australian and New Zealand road transport and traffic authorities) by Ramsay and Prem (1999).

2. BACKGROUND

2.1 Definitions

Distinction should be made at the outset between the terms Vehicle Classification, Vehicle Designation, Vehicle Code, and Common Terminology as used in this paper.

Vehicle Classification is the classification of the vehicle into one of a number of distinct groups. It is usually applied in the context of disaggregation of traffic data, for example in the analysis and reporting of Weigh-in-Motion data. There is a current AUSTRROADS Vehicle Classification System, comprising 12 classes that has served well in its current form for the past 5 years.

Vehicle Designation is the identification of the vehicle based solely on the number of vehicle units, the types of connections between them, and the number of axles in each group on each unit. Several different alphanumeric coding systems have been developed for use in different countries for this purpose. The spacings between axles or axle groups are generally not included in vehicle designation.

Vehicle Code is the identification of the vehicle type based on the number and type of units in the vehicle. A simple coding system can be used to describe the vehicle.

Common Terminology is the name that is applied to a vehicle type. Often defined by the transport industry, and more recently by the transport press, this regular name readily identifies a vehicle type, but usually not down to the detail of the axles within each group. Common terminology has been found to vary widely between different countries, and between (and sometimes within) different states or provinces.

2.2 Coupling Types

Three coupling types currently exist, described as "A", "B" and "C". "A-type" coupling connections, commonly referred to as a pintle hitch or Ringfeder®, only transmit translational forces between the connected units. These include the towing forces (fore-aft direction), lateral and vertical forces. Moments are not transmitted through A-type connections under normal operating conditions.

"B-type" couplings are typified by fifth-wheel or turntable connections, and transmit translational forces as well as roll moments. Roll moments are the overturning moments generated between two connected units (for example a prime mover and semi trailer). Under normal operating conditions B-type couplings allow rotational freedom in yaw and pitch between the connected units, but restrict roll freedom.

Innovative coupling systems, or "C-type" connections, transmit translational forces as well as some rotational motion (and moments) depending on the design of the coupling. In a typical application, a C-type coupling will cause steering of the axles of the trailing unit (for example, a dolly) in response to yaw articulation between the lead and trailing units.

3. LITERATURE REVIEW

3.1 Australia

The current AUSTROADS Vehicle Classification System (Fig. 1) was recently updated (Peters, 1993). It was found that the previous system (as published in NAASRA, 1988) had deficiencies relating to cars with wheelbases over 3 m, vehicles with wheelbases of more than 7.5 m, and vehicles with more than 11 axles but a wheelbase of less than 34 m.

The current system predated the introduction of many innovative multi-combination vehicles, such as the B-Triple and the AB-Triple. Whilst retaining the current 12 classifications, the descriptions of the vehicle types in each classification may require revising to maintain their relevance.

A uniform notation system is commonly used throughout Australia to designate vehicles (for example, see NAASRA 1987). Letters used are **A** for an articulated vehicle, **R** for a rigid truck, and **T** for a trailer. The numbers of axles in each group are used. For example a six-axle articulated truck is designated **A1-2-3**, and a three-axle rigid truck and four-axle trailer is designated **R1-2,T2-2**.

3.2 United States

The Federal Highways Administration classifies vehicles into 13 classes according to "Scheme F" (FHWA, 1995). A further classification scheme was developed by the American Association of State Highway and Transportation Officials (AASHTO) and is

used primarily for calculating design dimensions for the geometric design of roadways, intersections and interchanges (AASHTO, 1994).

A standard vehicle type designation has been adopted by the Society of Automotive Engineers (SAE) (Fitch, 1994). The number of axles on each unit are used, with an “-S” for a semi-trailer (B-type) connection, or a “-” for a full trailer (A-type) connection. Dollies are considered part of their trailer. For example a 3-S2 is a five-axle tractor semi-trailer, and a 3-S2-S2 is a seven-axle B-Train Double.

One deficiency that has been raised concerning the SAE designation system is the inability to differentiate between twin steer and single steer vehicles, and also between articulated trailers and rigid trailers. For example, a truck trailer designated as 3-3 under the SAE system could be any of R1-2,T1-2; R2-1,T1-2; R1-2,T3 or R2-1,T3 (not to mention the rare but possible T2-1 combinations).

Several common vehicle types have specific names, for example:

Rocky Mountain Double - A combination vehicle having 7 axles consisting of a tractor, a 13.7 to 14.6 m (45 to 48 foot) semi-trailer and a shorter 8.5 metre (28-foot) semi-trailer. Using the above notation, this vehicle would be represented as 3-S2-2.

Turnpike Double - A combination vehicle having 9 axles consisting of a tractor and two trailers of 13.7 to 14.6 m (45 to 48 foot). This vehicle would be represented as 3-S2-4.

Twin Trailer - A combination vehicle having 5 axles consisting of a tractor and two short 8.5 metre (28-foot) trailers. This vehicle would be represented as 2-S1-2.

Triple Trailer - A combination vehicle having 7 axles consisting of a tractor and three short 8.5 metre (28-foot) trailers. This vehicle would be represented as 2-S1-2-2.

3.3 New Zealand

New Zealand generally uses a similar classification scheme to that used in Australia, with the obvious exclusion of Class 12 (Triple Road Trains). A few short 7-axle double road trains (similar to US Rocky Mountain Doubles) operate up to an overall length of 20.0 m. Vehicle categorization generally is the same as used in Australia, however some authors use the American notation. The term **B-Train** is generally used in place of **B-Double**.

3.4 Canada

The Transport Association of Canada developed a Uniform Vehicle Classification System (Billing, 1994), known as “Canada Scheme A”. This scheme comprises 22 classes defined by number and type of vehicle units, and the total number of axles on the vehicle.

Generally Canada follows similar naming conventions to those used in the United States. The term “B-Train Double” is used to describe what Australians refer to as a “B-Double”.

3.5 Europe

Due to the (generally) smaller size of European heavy vehicles, vehicle nomenclature used in Europe are unlikely to be directly relatable to vehicles in other countries. For example, in Britain, the term “Road Train” is often applied to a rigid truck and trailer. Hoogevelt and Huibers (1998) examined the possibility of the introduction of multi-articulated vehicles into the Netherlands. Three vehicles, all 25.25 metres long with a GCM of 60 tonne were considered –a three-axle rigid truck and five-axle trailer; a three-axle prime mover, three-axle semi-trailer and two-axle trailer; and a nine-axle B-Double.

4. PROPOSED NOMENCLATURE AND DESIGNATIONS

Historically, wide ranges of vehicle names have been developed as people attempt to describe different vehicles. In recognition of this, and for any standard nomenclature to be accepted, the names used in a scheme should be consistent and if possible based upon existing names.

4.1 Problems with existing nomenclature

In the Australian road transport industry, the current naming conventions generally are descriptive and well understood. However several areas where some clarification is required have been identified. These include the following:

Use of two terms for the most common types of road train. The terms ‘Type 1 Road Train’ and ‘Type 2 Road Train’ are used in addition to the more descriptive terms ‘Double Road Train’ and ‘Triple Road Train’.

The term ‘AB-Triple’ has been applied to several vehicle combinations, ranging from a 36.5 metre road train with three trailers through to a 53.5 metre road train with four trailers. Appropriate and distinct names are required for all of these vehicle types.

Although the term ‘Prime Mover and Semi-Trailer’ is very descriptive for the most common vehicle on interstate freight routes, a more concise term would be desirable.

4.2 Proposed Terminology

Following an appreciation of the various naming conventions and designations in use currently and historically throughout Australia and elsewhere, the following is offered to address some of the deficiencies and conflicts in the current nomenclature.

- The terms 'Type 1' and 'Type 2' should be used only to refer to the two classes of road trains, that is those under 36.5 metres and those over 36.5 metres but less than 53.5 metres, respectively. These terms would be used primarily for route specification applications.
- The terms 'A-Double' and 'A-Triple' be used to refer to double and triple road trains respectively. This will maintain consistency with the terms B-Double and B-Triple.
- The term 'AB-Triple' should be used to refer to a road train consisting of three trailers, the rear two of which are B-connected. The word 'Triple' immediately has a connotation of having three trailers. This vehicle would typically be able to operate on Type 1 Road Train routes, if its length is below 36.5 metres.
- The term 'AB-Quad' could be adopted for naming the four-trailer Type 2 road train, where at least one B-type trailer is in the combination. The word 'Quad' has the connotation of having four trailers. A further descriptive scheme would be required to differentiate between the different vehicle types in this sub-class (see below).
- A standard Combination Vehicle Code should be adopted to enable a vehicle combination to be readily identified. A proposed Combination Vehicle Code is outlined below.
- In addition to the above-mentioned Combination Vehicle Code, a Vehicle Designation Scheme is still required to uniquely identify a vehicle according to its 'footprint', or axle and axle-group configuration within each vehicle unit. A simplified Vehicle Designation Scheme is outlined below.

4.3 Proposed Vehicle Designation Scheme

Two vehicle designation schemes have been mentioned earlier in this report – the NAASRA (1987) scheme and the SAE (Fitch 1994) scheme. Having investigated the deficiencies and complexities of both systems, a hybrid scheme was established.

The proposed scheme is based primarily on the SAE scheme, but addresses two of its deficiencies, namely being unable to differentiate between twin- and single-steer axle groups; and between articulated and rigid trailers.

By using the number of axles in each group rather than the number of axles on each unit, this distinction can be made. All B-type connections are shown, even those between dollies and trailers. A further simplification is achieved through replacing the "-S" in a semi-trailer connection with "S".

For example, a three-axle prime mover and three-axle trailer would have been represented as 3-S3 under the SAE notation. NAASRA (1987) would represent this by A1-2-3. Under the new notation, it would be represented by 12S3. A single-steer tandem drive rigid truck

towing a five-axle trailer would have been represented by SAE as 3-5. NAASRA (1987) would represented this vehicle as **R1-2,T2-3**. Under the new notation, it would be represented as **12-2S3**. Note the “-” only occurs where there is a dolly and drawbar present; the “-” pictorially representing the drawbar. As a final example, a 12-axle B-Triple would be represented as **3-S3-S3-S3** under SAE, as **A1-2-3-3-3** under NAASRA (1987), and as **12S3S3S3** under the proposed scheme.

A further simplification, when there are repeated constructs as in the previous example, is by specifying a multiplier after the repeated construct. The B-Triple above is then designated as **12(S3)3**, where the 3 multiplier in this example signifies a triple.

An extensive list of combination vehicle types and their common names is presented at the end of this paper, together with their proposed designations.

4.4 Proposed Combination Vehicle Code

With the increasing diversity of multi-combination vehicles, a level of detail is required to objectively describe a vehicle without having to go to the detail of a vehicle designation system as outlined above.

This proposed code uses the following basic vehicle components:

R	<u>R</u> igid truck
T	<u>T</u> railer
A	single <u>A</u> rticulated vehicle
B	series of <u>B</u> -connected vehicle components

Numbers are used after the above letters to show more than one of a particular unit. For example a **B2** is a B-Double, a **B3** is a B-Triple, an **A2** is an A-Double, and an **RT3** is a rigid (body) truck and three trailers. For the longer vehicles, a number may also be used before a letter and number pair. For example, UTO's 3B vehicle (comprising three B-Doubles connected with dollies) would be coded as **3B2**, and McIver's 2B3 (comprising two B-Triples connected with a dolly), not surprisingly, would be referred to as a **2B3**.

In most cases the Combination Vehicle Code can be interpreted from the Vehicle Designation System. For example, the B-Triple is designated as 12(S3)3 and coded as B3, and a rigid (body) truck and three trailers is designated as 12(-2S3)3, and coded as RT3.

5. CONCLUSIONS

This standard nomenclature and designation system should hopefully lead to a more uniform, easy to understand and consistent means of describing all heavy vehicles. It is presented as a paper to promote discussion and review within the international heavy vehicle community prior to possible adoption as a Heavy Vehicle Nomenclature System.

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REFERENCES

- AASHTO. A Policy on Geometric Design of Highways and Streets. Washington, DC, United States: American Association of State Highway and Transportation Officials, 1994.
- BILLING, J.R. An Algorithm for the Uniform Vehicle Classification System for Canada – “Canada Scheme A”. *Proc. 1994 Int. Road Federation Conf., Calgary, Alberta, Canada*, Volume 4., pp D19-41. Ottawa, Canada: Transport Association of Canada, 1994.
- FITCH, J.W. Motor Truck Engineering Handbook. *Fourth Edition*. Warrendale, Pennsylvania, United States: Society of Automotive Engineers, 1994.
- HOOGEVELT, R.B.J. and HUIBERS, J.J.W. Articulated Vehicles of 25 Meter and 60 Ton in The Netherlands - The Start of a Pilot Project. *Proc 5th Heavy Vehicle Weights and Dimensions Symp.* Vermont South, Victoria, Australia: ARRB Transport Research, 1998
- NAASRA. Guidelines for Weighing of Vehicles. Sydney, New South Wales, Australia : National Association of Australian State Road Authorities, 1987
- NAASRA. Guide to Traffic Engineering Practice, Part 3 – Traffic Studies. (National Association of Australian State Road Authorities: Sydney, NSW, Australia), 1988
- PETERS, R.J. Review of AUSTROADS Vehicle Classification System. Project RUM.3.D.8. Working Paper. (AUSTROADS: Sydney, New South Wales, Australia) 1993
- RAMSAY, E.D. and PREM, H. Development of an AUSTROADS Heavy Vehicle Nomenclature System. Discussion Paper RC7096N. (ARRB Transport Research Ltd: Vermont South, Victoria) 1999
- RTAC. Vehicle Weights and Dimensions Study Technical Steering Committee Report. (Road Transport Association of Canada: Ottawa, Ontario, Canada), 1986













Level 1	Level 2		Level 3	AUSTROADS Classification		
Length	Axles and Groups		Vehicle Type			
Type	Axles	Groups	Description	Class	Parameters	Dominant Vehicle
Short Up to 5.5m	LIGHT VEHICLES					
		1 or 2	Short Sedan, Wagon, 4WD, Utility, Light Van, Bicycle, Motorcycle, etc.	1	d(1) <= 3.2m and axles = 2	
Medium 5.5 to 14.5 m	3, 4 or 5	3	Short – Towing Trailer, Caravan, Boat, etc.	2	groups = 3, d(1) >= 2.1m, d(1) <= 3.2 m, d(2) >= 2.1m and axles = 3, 4 or 5	
	HEAVY VEHICLES					
	2	2	Two Axle Truck or Bus	3	d(1) > 3.2m and axles = 2	
	3	2	Three Axle Truck or Bus	4	axles = 3 and groups = 2	
	>3	2	Four Axle Truck	5	axles > 3 and groups = 2	
Long 11.5m to 19.0m	3	3	Three Axle Articulated Three axle articulated vehicle, or Rigid vehicle and trailer	6	d(1) > 3.2m, axles = 3 and groups = 3	
	4	>2	Four Axle Articulated Four axle articulated vehicle, or Rigid vehicle and trailer	7	d(2) < 2.1m or d(1) < 2.1m or d(1) > 3.2 m, axles = 4 and groups > 2	
	5	>2	Five Axle Articulated Five axle articulated vehicle, or Rigid vehicle and trailer	8	d(2) < 2.1m or d(1) < 2.1m or d(1) > 3.2 m, axles = 5 and groups > 2	
	>=6	>2	Six Axle Articulated Six (or more) axle articulated vehicle, or Rigid vehicle and trailer	9	axles = 6 and groups > 2 or axles > 6 and groups = 3	
	>6	4	B-Double B-Double, or Heavy truck and trailer	10	groups = 4 and axles > 6	
Medium Combination 17.5m to 36.5m	>6	5 or 6	Double Road Train Double Road Train, or Heavy truck and two trailers	11	groups = 5 or 6 and axles > 6	
Long Combination Over 33.0m			Triple Road Train Triple Road Train, or Heavy truck and three trailers	12	groups > 6 and axles > 6	

Fig. 1 – AUSTROADS '94 Vehicle Classification System

General Access Vehicles ($L \leq 19.0$ m)










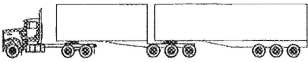

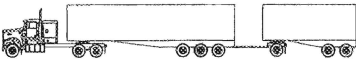
Picture	Common Name(s)	AUSTROADS ¹ Classification	NAASRA ² Designation	Proposed Designation	Proposed Code
	3-axle Rigid Truck	4	R1-2	12	R
	3-axle Rigid Truck and 2-axle "Pig" Trailer	8	R1-2,T2	12-2	RT
	3-axle Rigid Truck and 3-axle "Pig" Trailer	9	R1-2,T3	12-3	RT
	3-axle Rigid Truck and 2-axle "Dog" Trailer	8	R1-2,T1-1	12-1S1	RT
	3-axle Rigid Truck and 3-axle "Dog" Trailer	9	R1-2,T1-2	12-1S2	RT
	3-axle Rigid Truck and 4-axle "Dog" Trailer	10	R1-2,T-2-2	12-2S2	RT
	Articulated Truck Prime Mover and Semi- Trailer	9	A1-2-3	12S3	A
	19 metre B-Double / General Access B-Double / Tandem / Tandem B-Double	10	A1-2-2-2	12S2S2	B2

Fig. 2 – Proposed AUSTROADS Vehicle Nomenclature System

¹ AUSTROADS (1994) Classification² NAASRA (1987) Designation

Medium Combination Vehicles ($L \leq 25.0$ m)

Picture	Common Name(s)	AUSTROADS ¹ Classification	NAASRA ² Designation	Proposed Designation	Proposed Code
	23 metre B-Double / Tri-Tandem B-Double	10	A1-2-3-2	12S3S2	B2
	25 metre B-Double / Tri-Tri B-Double	10	A1-2-3-3	12(S3)2	B2
	Rigid Truck and 5-axle Trailer	10	R1-2,T2-3	12-2S3	RT
	Articulated Truck and Trailer / Multi-Articulated Dog / Rocky Mountain Double (US)	11	A1-2-3,T1- 2	12S3-1S2	AT

Type 1 Road Trains ($L \leq 36.5$ m)


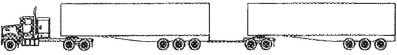

	B-Triple	11	A1-2-3-3-3	12(S3)3	B3
	A-Double / Double Road Train / Turnpike Double (US)	11	A1-2-3,T2- 3	12S3-2S3	A2
	AB-Triple / AB-Double (?)	11	A1-2-3, T2-3-3	12S3- 2(S3)2	AB2

Fig. 2 – Proposed AUSTROADS Vehicle Nomenclature System (continued)

¹ AUSTROADS (1994) Classification² NAASRA (1987) Designation

Type 2 Road Trains (L ≤ 53.5 m) and “Innovative” Vehicles





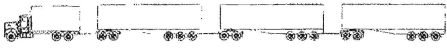


Picture	Common Name(s)	AUSTROADS Classification	NAASRA Designation	Proposed Designation	Proposed Code
	Rigid Plus 2 / Body Truck and Two Trailers	11	R1-2,T2- 3,T2-3	12(-2S3)2	RT2
	A-Triple / Triple Road Train	12	A1-2-3,T2- 3,T2-3	12S3(- 2S3)2	A3
	Double-B-Double / BB-Quad	12	A1-2-3- 3,T2-3-3	12(S3)2- 2(S3)2	2B2
	2AB / A+A+B / AB-Quad	12	A1-2-3, T2-3, T2-3-3	12S3-2S3- 2(S3)2	A2B2
	Rigid Plus 3 / Body Truck and Three Trailers	12	R1-2,T2-3, T2-3,T2-3	12(-2S3)3	RT3
	UTO's 3B	12	A1-3-3-3, T3-3-3, T3-3-3	13(S3)2- 3(S3)2 -3(S3)2	3B2
	McIver's 2B3 / “ICON”	12	A1-3-3-3- 3, T3-3-3-3	13(S3)3- 3(S3)3	2B3

Fig. 2 – Proposed AUSTROADS Vehicle Nomenclature System (continued)