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To: Infrastructure Australia Submissions
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Subject: FW: VARIABLE GAUGE AXLES AND THE RAILWAY GAUGE PROBLEM (4)
Attachments: Submission_Coversheet_VGA.pdf

VARIABLE GAUGE AXLES AND THE RAILWAY GAUGE PROBLEM

Australian railways have and will always have a gauge problem. However, a "new" technique called Variable Gauge Axles (VGA) is now available to help out. VGA is more compact, quicker and cleverer replacement for bogie exchange, which has been used in [Australia](#) in the past. VGA has been around since the 1960s, but conceptually it is much more complicated and intricate than bogie exchange, which is why it has taken time to develop and perhaps why it hasn't yet had the impact that it might have.

VGA would enable trains to travel across a break-of-gauge, almost as if it wasn't there. Special axles with wheels that move in and out plus a special converter track allow the train to change gauges while travelling at walking pace, say 10km/h (2.77m/s). An 1800m long train would therefore take 11 minutes to convert.

Worldwide, VGA is used in four places, between BG Spain and SG Europe; between SG Europe and BG Russia; and between BG Central Asia and SG China. Japan is also working on a SG/NG version for internal use. This seems to indicate that the basic VGA concept works. [In Australia, the potential use of VGA is conspicuous by its absence.](#)

However, there are some unknown details:

- 1) Does VGA work with locomotives as well as wagons? (The economics of a VGA adapted Oaklands Branch would suffer if the locomotives cannot operate right through). It seems to work on the power cars of electric multiple unit trains (EMU), but these are low power compared to proper locomotives. Talgo have an electric VGA locomotive under trial, [but is this a recent or a longstanding development?](#) (see below)
- 2) Does VGA work with any gauge combination? (The examples so far are between Standard Gauge, and either of two Broad Gauges. There are no examples of VGA between Standard Gauge and Narrow Gauge (NG) such would be needed in Queensland or Western Australia (except perhaps for the Japanese EMUs).
- 3) Does VGA work with heavy duty axle loads such as 40T in the Pilbara compared to just 25T on the interstate network? (The heaviest axleloads in Europe and non-Pilbara Australia are about 25T).
- 4) Would VGA on narrow gauge locomotives suffer by having smaller traction motors in the smaller space between the wheels?
- 5) Does VGA work with three gauges, where the axles of gauge in the middle do not rest against "stopblocks" and might be too weak? Australia would still benefit from two-out-of three-gauge VGA equipment, especially since standard gauge would always be the common gauge.
- 6) What devices exist to ensure that a train with mixed VGA and non-VGA wagons is not allowed through the VGA

converter until the non-VGA wagons are removed? (Radio Frequency tags applied to the wagons and bogies would solve this problem. [Such technology is already needed to detect wagons that are too tall for low bridges.](#)

7) What does VGA cost? Per wagon; per locomotive; per converter track? To operate and maintain?

8) VGA would be useful on lines fitted with concrete sleepers which cannot be regauged [easily](#).

9) VGA used on Talgo articulated trains in Spain and France do not necessarily create useful precedents since Talgo trains are unusual to begin with.

10) VGA is much faster than Bogie Exchange especially as the VGA train moves through the gauge-change non stop, whereas bogie exchange is stop-start.

11) Fiddling with the wheels and axles sounds like something full of risk, though so far no serious problems have been reported with existing [VGA](#) installations.

12) The VGA converter track is a short length of special track that needs no special building, [or storage area for bogies](#).

13) How much heavier does a VGA bogie weigh compared to a normal bogie?

14) [Can existing bogies be converted to VGA? Some sources suggest this!](#)

15) Since VGA doesn't disconnect then reconnect the air brakes hoses, how much time is spent on brake tests compared to bogie exchange which does disconnect the brake hoses?

16) [Variable Gauge Axles are also known by other names including, which makes internet searching incomplete:](#)

* Gauge Change Train

* Gauge Change Trucks (i.e. bogies)

* Adjustable Gauge Axles.

COMPATIVE ADVANTAGE OF VGA VERSUS REGAUGING

VGA would be advantageous on a lengthy orphaned branchline with wheat light traffic such as the Oaklands Branch and where the VGA portion of the whole journey is high. Should heavy coal traffic from Oaklands eventuate, then the balance tips in favour of regauging.

Regauging would be more advantageous on a short orphaned branchline with heavy traffic and where the VGA portion of the whole journey is low.

VGA would be [very useful](#) where regauging or dual gauging is difficult such as between say Dynon and Dandenong via the Melbourne CBD should freight access to the east be required.

CONCLUSIONS

A trial of the VGA system looks to be worth a try. As a minimum, some official enquiries to the respective manufacturers might elicit answers to the above unanswered questions. A couple of locomotives and some container and wheat wagons would do for starters. Ideally, the VGA bogies would be imported rather than the whole vehicles. Plus converter tracks.

If the experiment fails, then the variable axles can be fixed at one or other gauge so that the wagons become single gauge ones. There appear to be several VGA systems, in Spain, Germany and Japan which are no doubt incompatible with each other.

SELECTED SOURCES

A) See http://findarticles.com/p/articles/mi_m0BQQ/is_7_39/ai_58678001 for the DBAG/Rafil example.

B) See <http://www.crashbuffer.com/p14e.htm> Example of High Speed Bo-Bo Electric Locomotive with VGA by Talgo in Spain.

C) See http://en.wikipedia.org/wiki/Variable_gauge_axles for a compilation of relevant material.

D) See http://www.kenjasper.net.au/home/index.php?option=com_content&task=view&id=269&Itemid=9 where the local MP Ken Jasper MLA offers some facts and figures about the Oaklands rail line (\$13m to gauge convert 126km of country line (\$100k per km))

E) See http://www.caf.net/ingles/productos/sistemas_brava.php CAF BRAVA VGA - adapt to any gauge in just 3 seconds; up to 275km/h

AFTERTHOUGHT

It is noted that Africa, Latin America, and Asia have gauge muddles as bad as in Australia, so if you get some answers to the VGA question for our own use, you might share them with these other places, and in the process earn yourself some foreign travel on some study tours!

(END)