

METHOD FOR ESTIMATING A VEHICLES LOW SPEED TURNING PERFORMANCE AND SWEEP PATH

Approved by the NZ Transport Agency under clauses 3.5(2)(a), 6.9(2)(a), 6.28(2)(a), 6.33(4)(a) and 6.34(5)(a) of the Land Transport: Vehicle Dimensions and Mass Rule 2016. This methodology meets the requirements of clauses 3.5(1), 6.9(1), 6.28(1), 6.33(3) and 6.34(4) respectively of the Rule.

Low Speed Turning Performance

The primary low speed turning test manoeuvre is the same one that is used in the Australian PBS system (National Transport Commission 2007). The specified path consists of straight tangent approaches to a 90° circular arc of 12.5m radius. The approaches to the turn must be of sufficient length to ensure that the vehicle is straight at the point when the turn commences and, at the conclusion of the turn, the vehicle must travel far enough so that the maximum swept width has been achieved. The vehicle must traverse the path at a speed no greater than 5km/h with the outermost point of the forward most outside steered wheel following the specified path to within $\pm 50\text{mm}$. This test should be undertaken with the vehicle laden and unladen. It may be done by either computer simulation or by field-testing.

Swept Width

During this manoeuvre the paths of innermost and outermost points of the vehicle are traced. The distance between these two paths is the swept width and the maximum value of the swept width is the performance measure. This is illustrated in Figure 1 below.

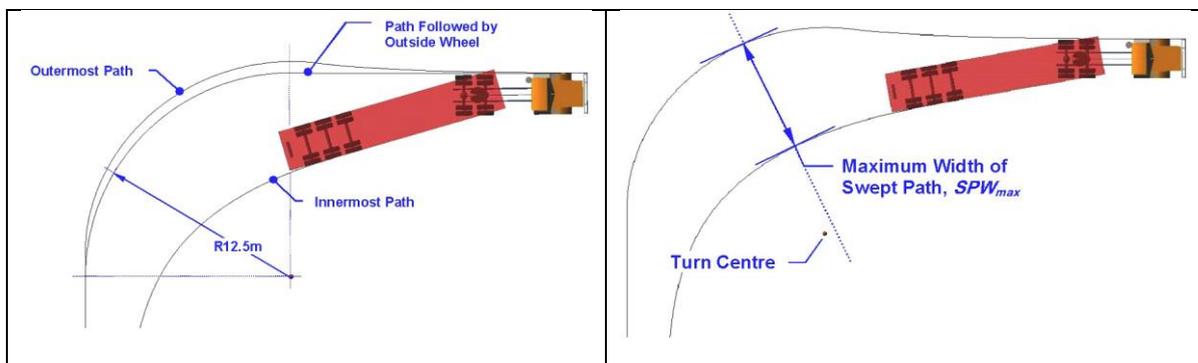


Figure 1. Illustration of the swept width performance measure reproduced from (National Transport Commission 2007)

The low speed swept width standard is:

Maximum width of swept path $\leq 7.0\text{m}$

Tail Swing

If the vehicle has significant rear overhang, then at the start of the turn the outer rearmost corner can swing outboard of the original vehicle path. With a conventional vehicles this outswing will only occur at the start of the turn but when trailers have steerable axles it can also occur at the end of the turn. Both need to be checked. This measure is identical to that used in the Australian PBS system as illustrated in Figure 2.

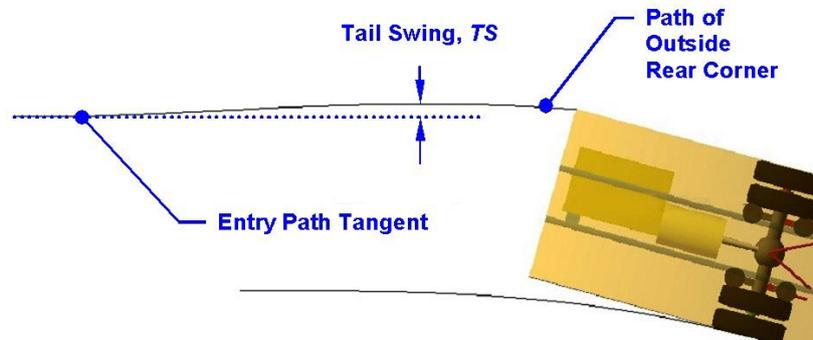


Figure 2. Tail swing as prescribed in the Australian PBS system

The tail swing is defined as the maximum excursion of the rear outermost corner of the vehicle outside the entry and exit path tangent. The performance standard is:

Maximum tail swing $\leq 0.30\text{m}$
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Frontal Swing

The frontal swing behaviour is analogous to tail swing and is the result of front overhangs. It occurs at the end of the turn. Both the towing vehicle and the trailer(s) can exhibit frontal swing. This is illustrated in Figure 3. The frontal swing is the maximum excursion of the front outermost corners of the vehicle outside the exit path tangent. The performance standard for frontal swing is:

Maximum frontal swing $\leq 0.75\text{m}$	for trucks and trailers
Maximum frontal swing $\leq 1.50\text{m}$	for buses

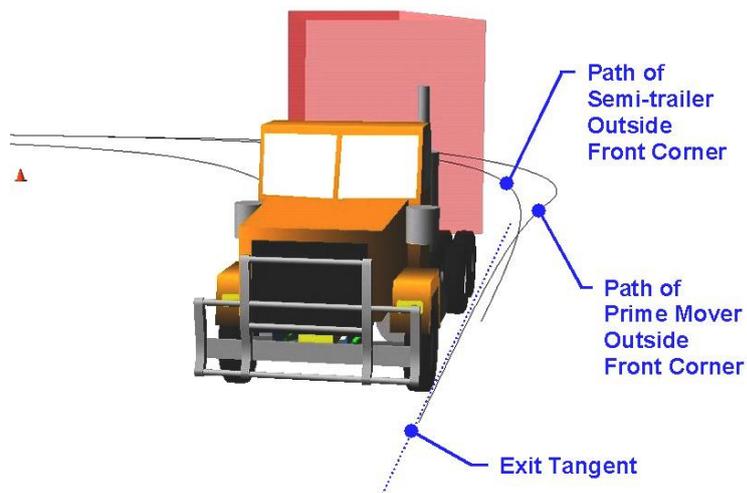


Figure 3. Frontal swing behaviour of a tractor semitrailer combination

Steady State Low Speed Swept Width

The low speed swept width measure evaluated on the 90° turn does not represent the maximum low speed swept width for long combination vehicles because, with a 12.5m radius, these vehicles require more than 90° of turn angle to achieve maximum off-tracking. For normal intersection turns, the 90° turn is sufficiently representative to control this aspect of performance but for longer lower speed highway curves such as those marked with 25km/h or 35km/h advisory speed signs, the vehicles can achieve steady state off-tracking and thus it is important to also control this aspect of performance.

The test manoeuvre for this performance standard is a 25m radius wall-to-wall turn as described in (EC 1992). The turn should be sufficiently long that steady state off-tracking is achieved. The performance measure is swept width which is measured in exactly the same way as the swept width for the 90° turn above.

The steady state low speed swept width performance standard is:

Maximum width of swept path \leq 5.25m

References

EC (1992). Directive 92/62/EEC adapting to technical progress Council Directive 70/311/EEC relating to steering equipment for motor vehicles and their trailers. [92/62/EEC](#). E. Parliament.

National Transport Commission (2007). "Performance Based Standards Scheme—The Standards and Vehicle Assessment Rules." [Prepared by National Transport Commission: Melbourne, Vic.](#)

Swept path performance measure for maximum Category 1 overdimension vehicle

The maximum swept path for a category 1 overdimension vehicle has been derived from the following tractor semi-trailer combination:

Tractor: 4.35m wheelbase, 5.5m forward distance.

Semi-trailer: tri-axle, 2.55m wide, 11.4m forward distance.

The vehicle is driven through a 90-degree turn inside a 50m radius wall at no more than 5km/h. The inside of the path is measured at the inner edge of the rear axis of the trailer. The maximum width of this path must not exceed 4.7m; that is, the inner edge of the vehicle must not cross a concentric path of radius 45.3m. This is illustrated in **Figure 4**.

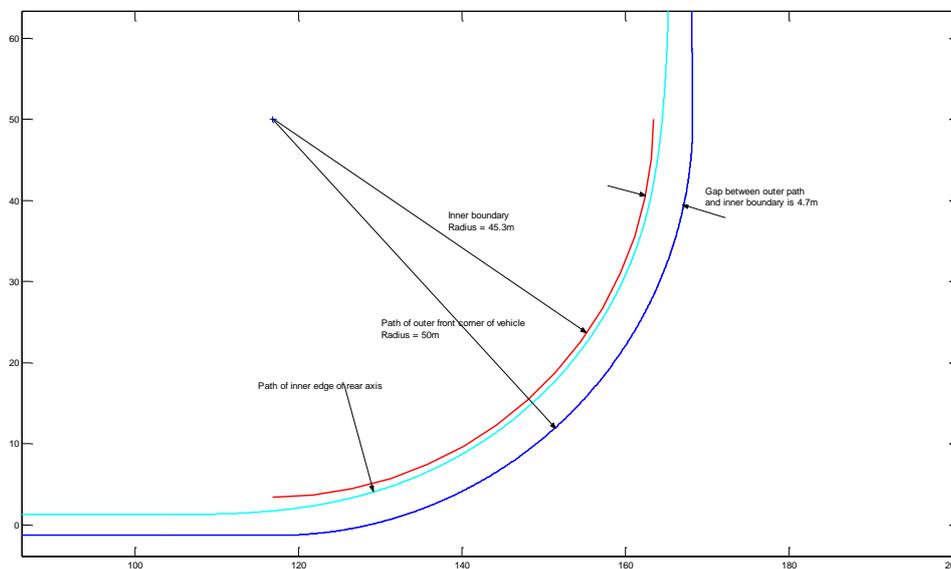


Figure 4. Swept path requirements for a maximum category 1 overdimension vehicle