

Subject: Design Vehicles – Over-Length Configurations	
Date: September 30, 2015	Author: Darwin Tyacke, ASCT
Bulletin Number: DS15001 Bulletin Type: Informational	Action Required: Immediate Effective Date: September 30, 2015
Contacts	Standards Affected
Jemay Zheng, P.Eng. Senior Geometric Standards Engineer Engineering Branch, Victoria (250) 387-7761 Darwin Tyacke, ASCT Senior Geometric Standards Technologist Engineering Branch, Victoria (250) 356-7928	Insert behind Section 720 of the BC Supplement to TAC Geometric Design Guide.

1. Background:

The TAC WB-20 tractor-semitrailer is the typical design vehicle for ministry roadways. The trailer wheelbase for the WB-20 is 12.4 m; however, under the *Commercial Transport Policy*, the maximum allowable wheelbase from the king-pin to last trailer axle is 18.3 m. This longer vehicle configuration is allowed to operate under permit from CVSE on almost all roads in the province. One of the typical configurations with this 18.3 m wheelbase is for hauling a “fixed equipment” load. Fixed equipment with a conveyor is one common type of load for gravel, asphalt and redi-mix concrete plants. These trailers can also have a long rear overhang. When turning, this substantially longer wheelbase will result in a wider swept path for the inside rear trailer tires. The rear overhang will also swing significantly outside of the trailer wheel path.

The BC Trucking Association provided a schematic showing the dimensions for a 9-axle Expando vehicle configuration (see Appendix, Figure A) which may need to be accommodated at some intersections. Actual configurations may have fewer axles and different dimensions than shown in Figure A. The dimensions shown in Figure B have been simplified to represent the worst case for ministry design checking purposes. This configuration has been designated as “WB-24” and is representative of the maximum allowable wheelbase and rear overhang for path tracking analysis.

Generally, the WB-24 vehicle is expected to be able to travel on its own side of the road (i.e. no counterflow movements). Many heavy haul configurations larger than this typically have steerable trailer axles that may be maneuverable enough to track within the WB-24’s swept path; however, some may have to travel counterflow.

Configurations ≥ 27.5 m long usually require one or more pilot vehicles. They also require traffic control if they need to travel in the opposing traffic lanes. There are some exceptions for using pilot cars with over-length configurations such as Long Combination Vehicles (LCV's). LCV's are not allowed to travel in the opposing lanes. Currently, routes that are approved for LCV's are located in the Kamloops/Lower Mainland corridor and on Vancouver Island [Rocky Mountain Doubles (max. 32 m overall length) and Turnpike Doubles (max. 41 m overall length)] and in the Peace River Area [Rocky Mountain Doubles only (max. 31 m overall length)]. A list of the approved routes for these vehicles is provided on form CVSE1014 available at www.th.gov.bc.ca/forms/getForm.aspx?formId=1260.

2. Problem:

Most of the ministry's recent intersections were designed using a WB-20 design vehicle; however, this may not be sufficient at some locations. There have been instances where the commonly 'permitted' 18.3 m wheelbase vehicle had problems negotiating some of our intersections. At one protected-T intersection where a vehicle was turning left onto the highway, the tractor had to swing wide and drive over the right side raised median to avoid mounting the left side raised median with the trailer and striking the keep right/hazard marker signs.

Another situation to be aware of is at single lane roundabouts. The entry and exit lanes, and central truck apron should be wide enough to accommodate this vehicle on its own side of the road.

3. Practice:

Vehicles larger than the typical design vehicle (WB-20) may need to be checked for their ability to negotiate some intersections. This could include, but not be limited to, the following design vehicles: WB-24, Tractor & Mobile Home, Rocky Mountain Double, and Turnpike Double. There are over-size/over-weight configurations that can be even larger. This can have significant implications for designing roundabouts in order to accommodate these extraordinary loads. Designers should consult with their local CVSE office, HQ engineering staff, and the BC Trucking Association to identify the worst case configuration for path tracking analysis. Designers should also check whether there are stakeholders (e.g. manufacturing plants or other industrial facilities) within the area that would haul oversize loads through any intersection being considered for reconstruction.

Based on the ministry's *Commercial Transport Procedures Manual* and input from our CVSE engineer, new PathTracker files (*name.veh*) have been created as follows:

Name	Description
W24	WB-24: 17.6 m trailer wheelbase, rear trailer overhang of 9.5 m (see Appendix, Figure B). This trailer wheelbase length assumes a spacing of 0.7 m from the centre of a dual axle assembly to the rear-most axle.
RMD31	Rocky Mountain Double, 31 m overall length (see Appendix, Figure C)
RMD32	Rocky Mountain Double, 32 m overall length (see Appendix, Figure D)
TPD41	Turnpike Double, 41 m overall length (see Appendix, Figure E)

For ministry staff, these files have been included in a September 2015 AutoCAD update. For consultants, custom vehicles will have to be created in your path tracking software (e.g. AutoTurn) based on the dimensions in Figures B through E.

The WB-20 will still be the primary design vehicle, but the WB-24 vehicle should be used to check that there is sufficient room at all locations with tight constraints where this vehicle could be expected (e.g. protected-T intersections and roundabouts). The overall size and layout of an intersection (typically based on accommodating a WB-20) may not necessarily have to be adjusted, provided that this larger vehicle can maneuver without driving over non-mountable raised curbing or off the paved surface. Rather than enlarging an intersection, some turning movements for the WB-24 vehicle may be accomplished by over-tracking briefly into adjacent and/or opposing lanes which is acceptable for some rural locations. Consult with your ministry Traffic Engineer regarding how much overtracking is allowable at each specific intersection.

At protected-T intersections, one option for the left side raised median island may be to construct a portion of the island with a mountable surface to accommodate the rear trailer sweep and move the signing further back.

At single lane roundabouts, entry and exit legs may need to be widened; however, to maintain positive guidance and promote slow entry speeds for smaller vehicles, the use of right side mountable truck aprons or left side mountable splitter islands may be appropriate. Vehicles larger than the WB-24 configuration may need to be accommodated with other solutions (e.g. designing to allow counterflow movements, wider truck aprons, or a gated central island pass-through).

When checking the swept path envelope for any multiple-unit vehicle not listed in TAC section 1.2.4, it is recommended that the minimum turn radius results in about 3 m of distance between the centre point of the turn and the inside rear-most trailer axle assembly. For the four new vehicles listed above, the minimum design turning radii are shown in the following table. These radii correspond to the vehicle beginning a turn from a stationary position and negotiating the turn at speeds up to 15 km/h.

Vehicle Name	Degree of Turn	Minimum Turning Radius	
		Centre of Axle	Outside Front Wheel
W24	90	13.0	14.1
	180	16.8	18.0
RMD31	90	11.9	13.0
RMD32	180	14.9	16.0
TPD41	90	13.4	14.5
	180	17.1	18.2

On routes that have LCV's, any reconstruction at intersections where these vehicles are turning should be checked using the appropriate Rocky Mountain Double or Turnpike Double design vehicle to check that there is sufficient room. Some LCV turning movements are expected to utilize adjacent lanes on their own side of the road to ensure that they do not track into opposing lanes. Rather than designing an excessively large intersection based on the LCV, designing for a WB-20 may be adequate provided there is sufficient roadway width on the approach and departure legs.

Appendix

Figure A: 9-Axle Expando Vehicle

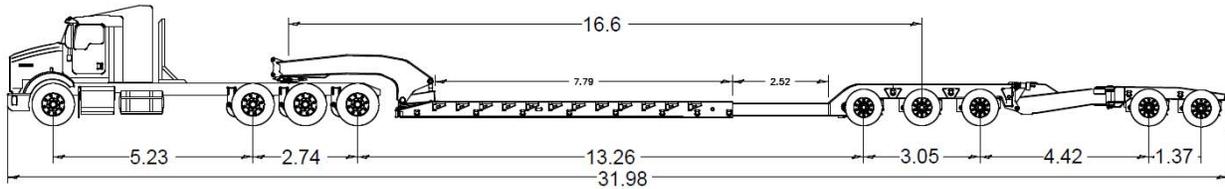
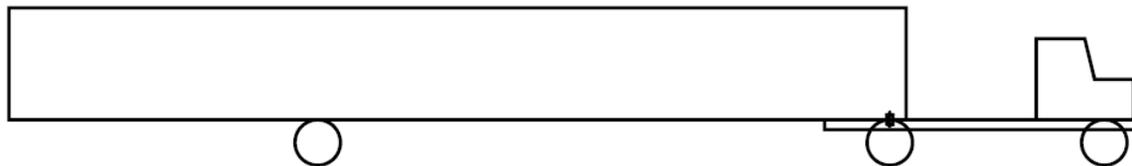


Figure B: W24 PathTracker Design Vehicle Schematic

(Overall Length 34.7 m)

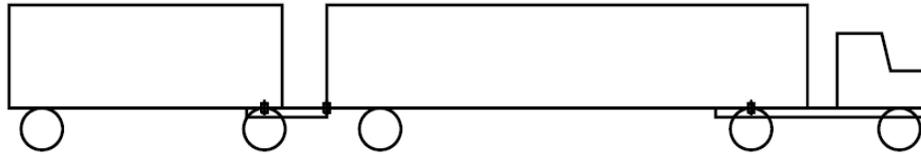


	<u>Wheelbase</u>	<u>Front Overhang</u>	<u>Rear Overhang</u>	<u>Pin Offset</u>
Tractor	6.60 m	1.00 m	2.00 m	0.00 m
Trailer	17.60 m	0.50 m	9.50 m	

Tractor Width = 2.60 m

Trailer Width = 2.60 m

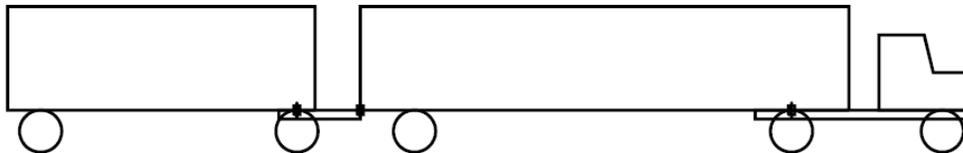
Figure C: RMD31 PathTracker Design Vehicle Schematic



	<u>Wheelbase</u>	<u>Front Overhang</u>	<u>Rear Overhang</u>	<u>Pin Offset</u>
Tractor	5.00 m	1.00 m	1.20 m	0.00 m
Trailer 1	12.50 m	1.90 m	1.80 m	-1.80 m
Dolly	2.10 m	0.00 m	0.60 m	0.00 m
Trailer 2	7.50 m	0.60 m	1.10 m	

Tractor Width = 2.60 m
Trailer Width = 2.60 m

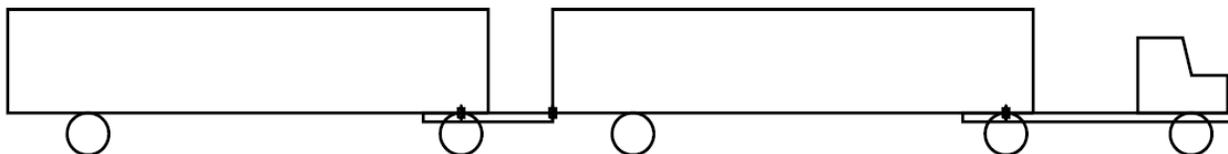
Figure D: RMD32 PathTracker Design Vehicle Schematic



	<u>Wheelbase</u>	<u>Front Overhang</u>	<u>Rear Overhang</u>	<u>Pin Offset</u>
Tractor	5.00 m	1.00 m	1.20 m	0.00 m
Trailer 1	12.50 m	1.90 m	1.80 m	-1.80 m
Dolly	2.10 m	0.00 m	0.60 m	0.00 m
Trailer 2	8.50 m	0.60 m	1.10 m	

Tractor Width = 2.60 m
Trailer Width = 2.60 m

Figure E: TPD41 PathTracker Design Vehicle Schematic



	<u>Wheelbase</u>	<u>Front Overhang</u>	<u>Rear Overhang</u>	<u>Pin Offset</u>
Tractor	6.20 m	1.32 m	1.45 m	0.00 m
Trailer 1	12.50 m	0.91 m	2.69 m	-2.69 m
Dolly	3.07 m	0.00 m	1.26 m	0.00 m
Trailer 2	12.50 m	0.91 m	2.69 m	

Tractor Width = 2.60 m
Trailer Width = 2.60 m