Christchurch Transport Operations Centre

A partnership of Christchurch City Council, New Zealand Transport Agency and Environment Canterbury

Keeping Christchurch Moving

Traffic Management Vehicle Tracking Guideline
May 2018

1 GUIDELINE PURPOSE

1 This guideline provides an overview of when a check or analysis of vehicle tracking may be required when designing and planning Traffic Management Plans (TMPs).

2 WHEN ARE VEHICLE TRACKING CHECKS REQUIRED?

Development of Traffic Management Plans

2 Traffic Management Plans (TMPs) are required when a planned event effects the typical operating conditions of the road[1]. TMPs may include adjusting the paths of vehicles through the traffic network, e.g. by narrowing or shifting traffic lanes, reconfiguring intersections, creating temporary accesses etc.

3 Vehicle tracking may need to be checked where a TMP could involve a revision to the existing vehicle paths/movements, creation of new temporary accesses or traffic facilities (intersections, roads etc), or a change to the way certain vehicles use the transport network (e.g. detouring bus routes away from their usual route).

Example of Simple Vehicle Tracking Check

4 The images below show a simple representation of an intersection, worksite, a series of simple checks on vehicle swept paths, and an example of how the worksite could be altered to safely accommodate traffic movements.

[1] Best practice for TMPs is described by the Code of Practice Temporary Traffic Management (COPTTM) and the local area Local Operating Procedures (LOPs).

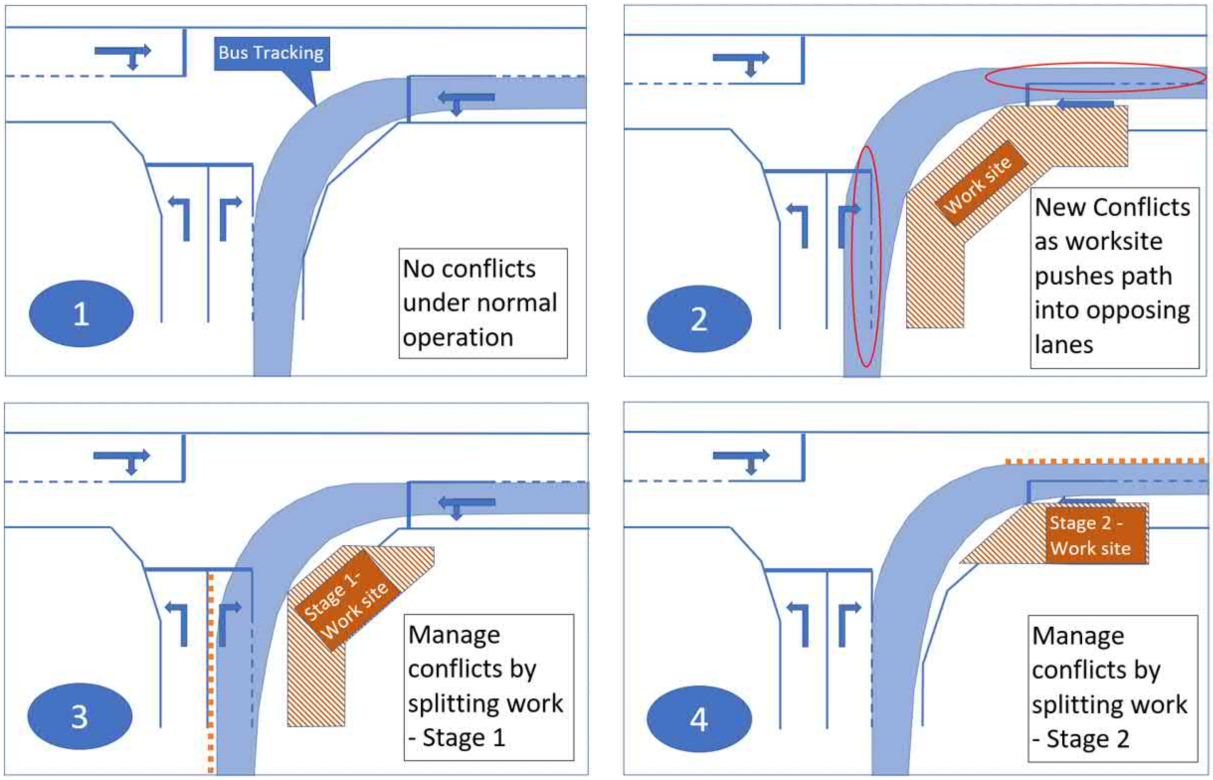


Figure 1: Example of a simple, e.g. transparency, vehicle tracking check and adjustment

Requirement to Check Vehicle Tracking

5 During TMP development vehicle tracking checks are typically not required when:

5.1 Vehicle movements remain as-is or the change to vehicle movement is minor. Examples may include minor lane narrowing, mid-block lane drops which comfortably achieve COPTTM standards and similar scenarios.

6 During TMP development vehicle tracking checks are typically required when:

6.1 Larger vehicles (heavy trucks, buses, over dimension vehicles, high productivity motor vehicles (HPMVs) etc.) need to be facilitated on roads or accesses not designed to accommodate these vehicles and/or in locations that they would not usually travel.

6.2 Traffic Management reduces the physical space available at an intersection, access, or key section of road. E.g. narrowing lanes at an intersection, working on a bend in the road or working on a corner or immediate approach at an intersection,

6.3 A worksite access is physically constrained and vehicle movement in / out of the site (e.g. heavy vehicles) could be a problem.

6.4 Vehicles are anticipated to travel over multiple lanes or opposing lanes to enter / exit a worksite, or through an intersection.

6.5 Traffic Management significantly changes the road, particularly intersection, layout e.g. changing roundabout to signals or vice versa.

6.6 Traffic Management includes the temporary construction of a new section of road, intersection, etc.

3 SELECTING THE APPROPRIATE TRACKING CHECK APPROACH

TMP Design Scenario	"Inspection" Check / On-Site Adjustment	Transparency Check	CAD Swept Path Analysis
Minimal change to existing layout and vehicle movements, minor impact to existing lane widths / available space	Likely to be useful	May be useful	Unlikely to be required
Site access with physical constraints	Likely to be useful	Likely to be useful	May be useful
Minor constraint / restriction to the movement of larger vehicles	Likely to be useful	Likely to be useful	May be useful
Significant intersection reconfiguration (e.g. converting signals to roundabout or vice versa etc)	Unlikely to be appropriate	May be useful	May be useful
Major physical constraint, detour, or change effecting movement of larger vehicles	Unlikely to be appropriate	May be useful	Likely to be useful
New temporary intersection	Unlikely to be appropriate	May be useful	Likely to be useful

Table 1 below provides a *guide* around when certain tracking checks could be appropriate. The different key methods are described in the section below.

TMP Design Scenario	"Inspection" Check / On-Site Adjustment	Transparency Check	CAD Swept Path Analysis
Minimal change to existing layout and vehicle movements, minor impact to existing lane widths / available space	Likely to be useful	May be useful	Unlikely to be required
Site access with physical constraints	Likely to be useful	Likely to be useful	May be useful
Minor constraint / restriction to the movement of larger vehicles	Likely to be useful	Likely to be useful	May be useful
Significant intersection reconfiguration (e.g. converting signals to roundabout or vice versa etc)	Unlikely to be appropriate	May be useful	May be useful
Major physical constraint, detour, or change effecting movement of larger vehicles	Unlikely to be appropriate	May be useful	Likely to be useful
New temporary intersection	Unlikely to be appropriate	May be useful	Likely to be useful

Table 1: Guideline on Selecting Vehicle Tracking Methodology

4 METHODS OF CHECKING VEHICLE TRACKING (SWEPT PATHS)

Basic Inspection of Remaining Space / Lane Widths

7 The most straightforward vehicle tracking check is a simple "inspection" of the proposed TM layout. This typically focuses on the space remaining (particularly any reductions to lane widths at intersections) and whether any vehicle movements (particularly larger vehicles) could cross into other lanes.

8 An inspection would be carried out by reviewing the proposed TM layout against the existing road layout, usually from aerial photos, Google streetview, or similar imagery.

9 If the inspection identified any more significant issues, e.g. tight turning movements, narrower lanes, potential for large vehicle paths to cross into other lanes etc., this would trigger the need to carry out a more thorough vehicle tracking check using one of the approaches below.

On-Street Tests and Adjustments

10 A straightforward inspection check of vehicle swept paths may identify that the TMP arrangement is 'tight' for certain movements, although not necessarily generating a need for a more thorough swept path analysis. This may be flagged for on-site setup, with review and adjustment to accommodate traffic movements carried out as a 'live test'.

11 If concerns were more significant, e.g. if a high frequency bus route could be affected, then a planned 'live' on-site test may be carried out. This would typically be carried out by setting up / mocking up the site as designed prior to the planned event (e.g. physical works) starting and allowing vehicles to navigate the site on-street in a controlled manner. The on-street manoeuvres would be inspected and could be videoed 'live' to check for any issues including crossing into opposing lanes and any physical constraints in the available road space. This would often be done during a 'low traffic flow' period, e.g. at night, where any issues with the site and vehicle tracking would not have a significant effect on other travellers.

12 On-street tests are an option where it is straightforward to carry out the test, the results of other tracking analysis remain unclear, uncertain, or are challenged, and/or the TMP setup is particularly unique, innovative, or new.

Transparency Swept Path Method

13 The transparency method involves printing out the TMP layout to the correct scale and overlaying on the TMP transparencies showing specific vehicle swept paths (also printed to the same correct scale). To correctly scale the TMP, this would either involve drawing the plan in AutoCAD or similar CAD software, or scaling the printed plan with aerial photograph background carefully using printer scaling and scale ruler.

14 This method can give a relatively quick result and is easy to complete however it is only indicative as the print outs are not likely to be completely accurate.

15 Tracking layouts for various movements are available for a range of vehicles such as those in the Christchurch District Plan. A list of vehicles is provided in Section 5 below and plans which can be printed to the correct scale provided in the Appendix.

Computer Based Swept Path Method

16 As indicated in Table 1, a Computer Assisted Drafting (CAD) approach is likely to be useful in scenarios where significant temporary network reconfigurations are deployed, e.g. major roading projects such as motorway constructions. CAD analysis is not anticipated as a core requirement in day-to-day urban traffic management activities.

17 Drawing the plan in AutoCAD and using AutoTURN (or similar CAD software) is the most robust form of vehicle tracking analysis as it is done using software which can produce accurate outputs. This means the plans can be drawn robustly and tracking paths checked accurately providing confidence that the planned layout would work in practice. As well as this, AutoCAD has several adjustable parameters such as speed and clearance which can be used to calibrate tracking and carry out sensitivity tests on the swept paths. This means that tracking paths of

complex turning manoeuvres can be completed with a high level of accuracy unlike the transparency swept path method.

18 The software also allows new vehicle types to be made if all the parameters relating to the vehicle (size, speed, axels etc) are known.

19 Outputs can be presented to show different aspects including a body envelop, clearance and tyre tracking. These are described below:

19.1 The body envelop would show the area that the vehicle uses to manoeuvre.

19.2 The clearance is offset from the body envelop and gives an indication of how much clear space is required on each side of a vehicle for comfortable manoeuvring. Typically clearances are set at 0.3m for light vehicles and 0.5m for heavy vehicles.

19.3 The tyre tracking would show where the tyres are going to travel over (within the body envelop). This is useful when avoiding kerbs or other such constraints.

20 An example of CAD-based vehicle tracking for over-dimension vehicles is shown below.

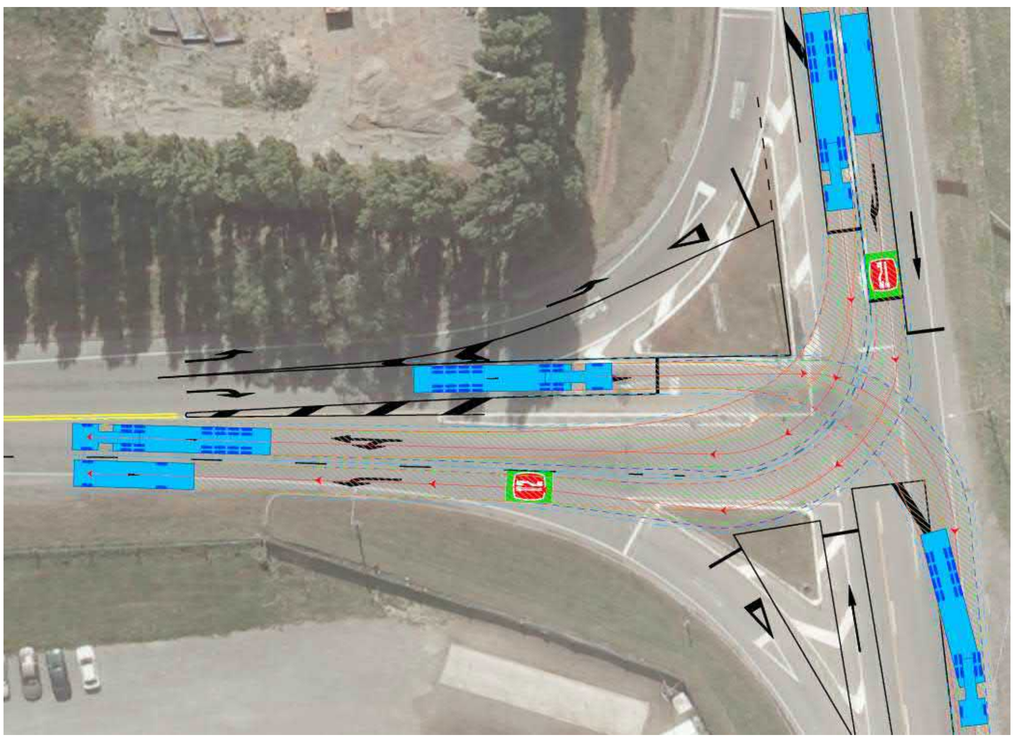


Figure 2: CAD-based vehicle tracking analysis example

21 AutoCAD will give an accurate result and a good indication of time required to complete the manoeuvre. The time to complete the manoeuvre is useful further information when checking vehicle tracking, i.e. if it's taking a long time for a vehicle to complete a manoeuvre this could indicate potential issues with the plan which could cause problems on-site.

5 VEHICLE TYPES

22 A number of design vehicles are available in the District Plan and from NZTA. The tracking curves specify the technical parameter of each vehicle so that they can be made in AutoCAD or similar software if required. These are attached in the Appendix and can be printed on

transparency to scale to carry out transparency vehicle tracking checks. The vehicle type tracking paths included are;

22.1 85 Percentile design motor car

22.2 99 Percentile design vehicle

22.3 Small Rigid Vehicle

22.4 Medium Rigid Vehicle

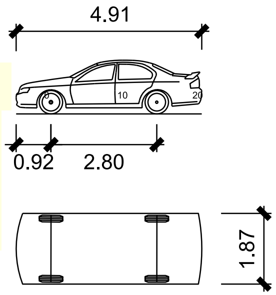
22.5 Large Rigid Vehicle

22.6 Semi-Trailer

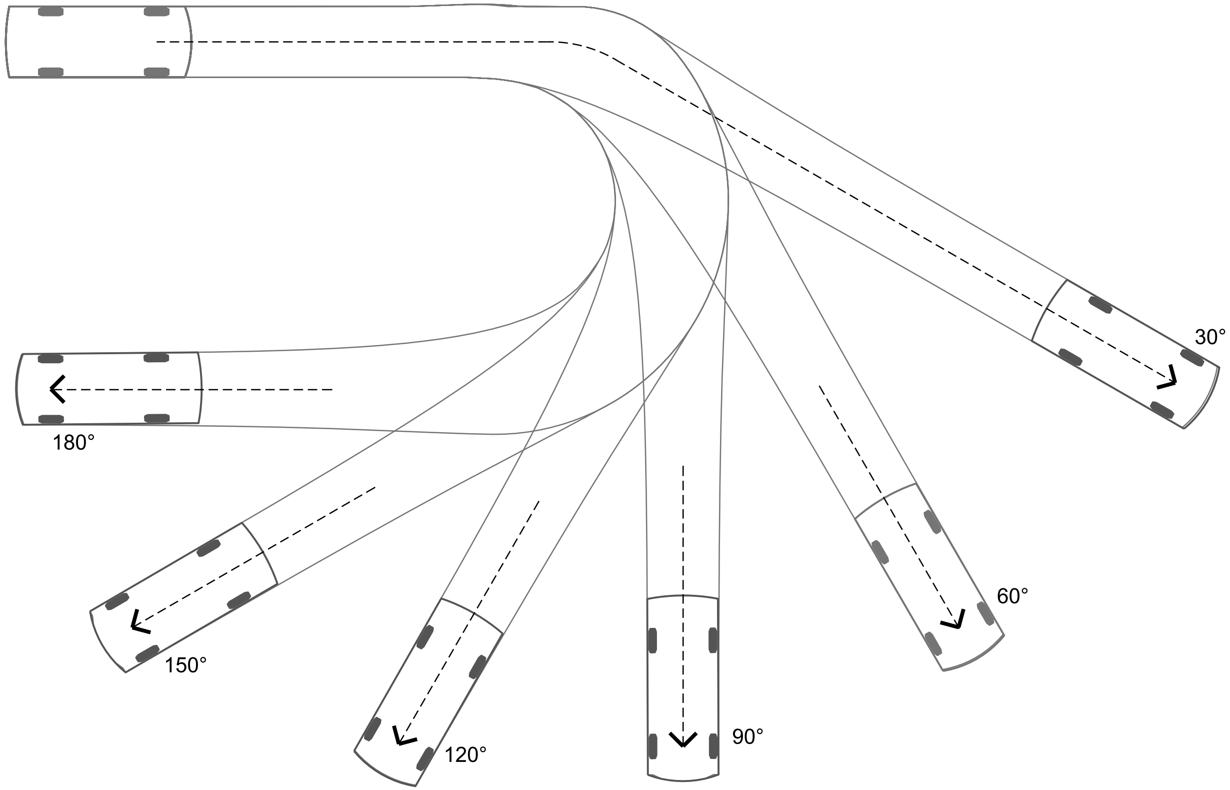
22.7 City Bus

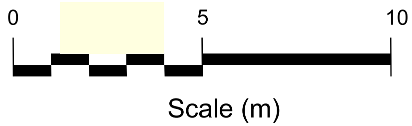
22.8 Tour Coach

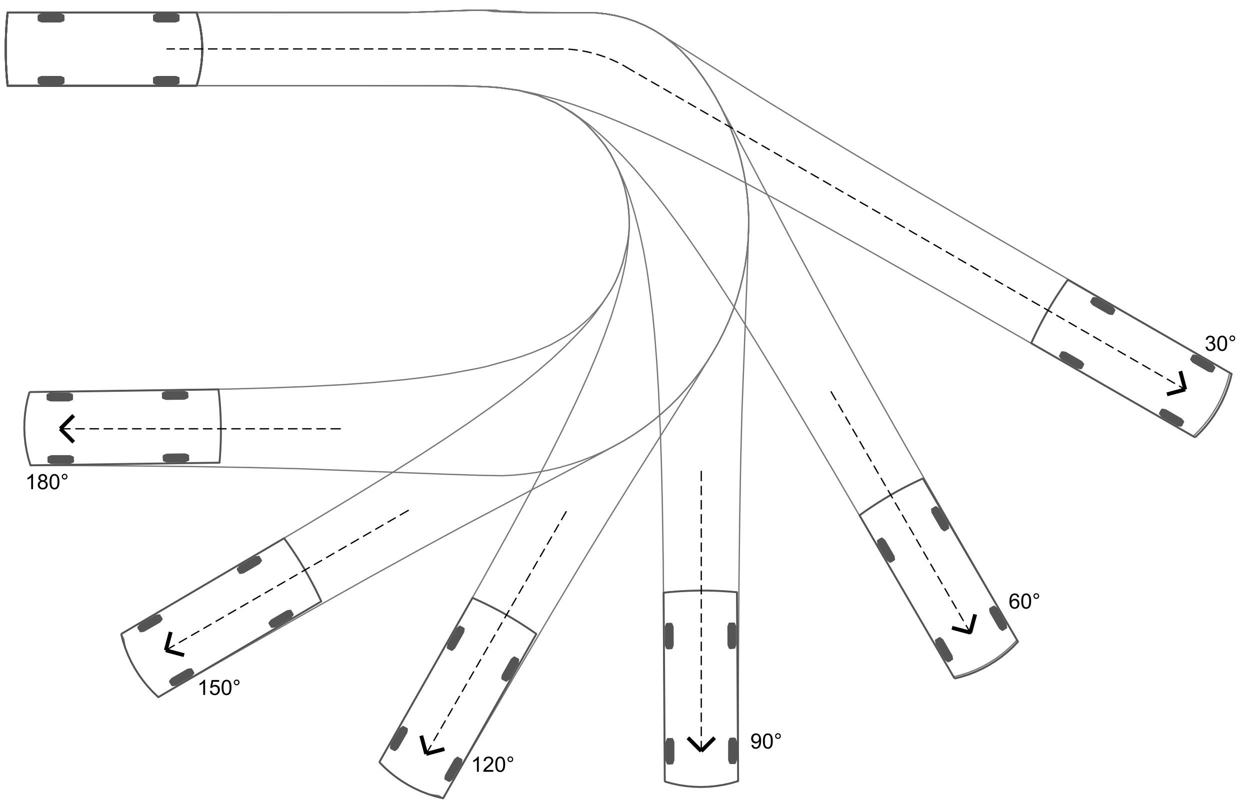
APPENEDIX

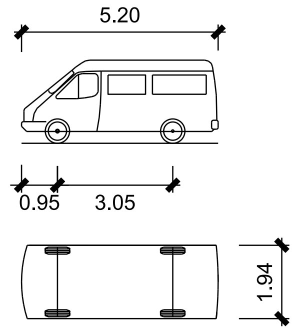


B85 Vehicle (Realistic min radius) (2004)	
Overall Length	4.910m
Overall Width	1.870m
Overall Body Height	1.421m
Min Body Ground Clearance	0.159m
Track Width	1.770m
Lock to Lock Time	4.00s
Kerb to Kerb Turning Radius	5.750m



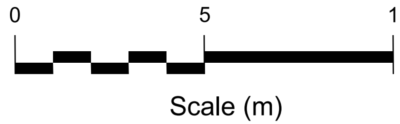


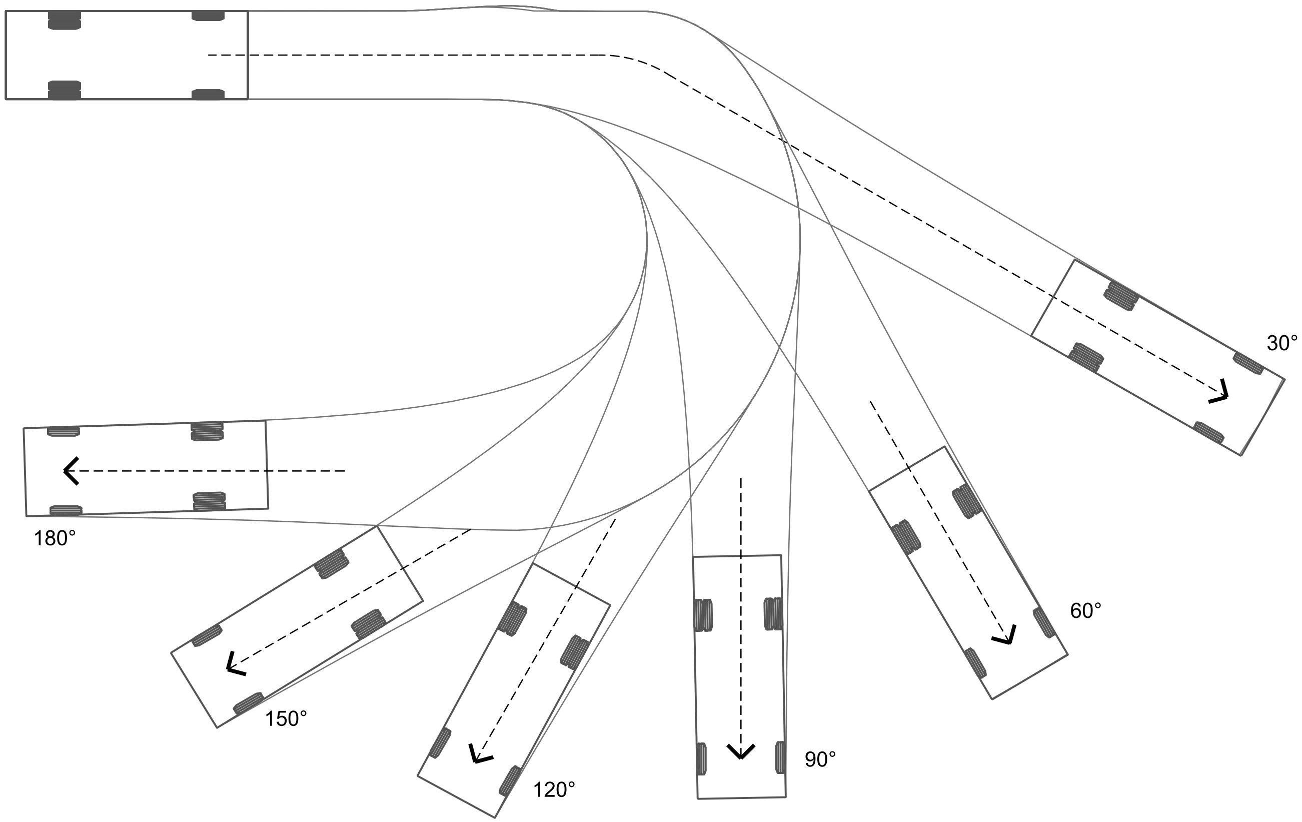


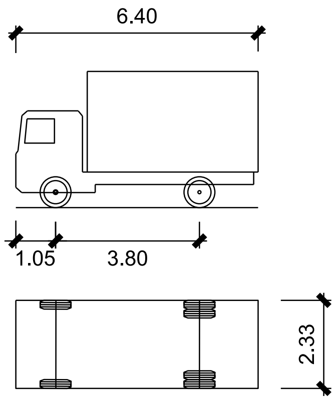


B99 Vehicle (Realistic min radius) (2004)

Overall Length	5.200m
Overall Width	1.940m
Overall Body Height	2.200m
Min Body Ground Clearance	0.312m
Track Width	1.840m
Lock to Lock Time	4.00s
Kerb to Kerb Turning Radius	6.520m

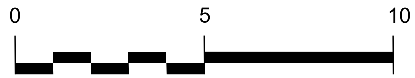




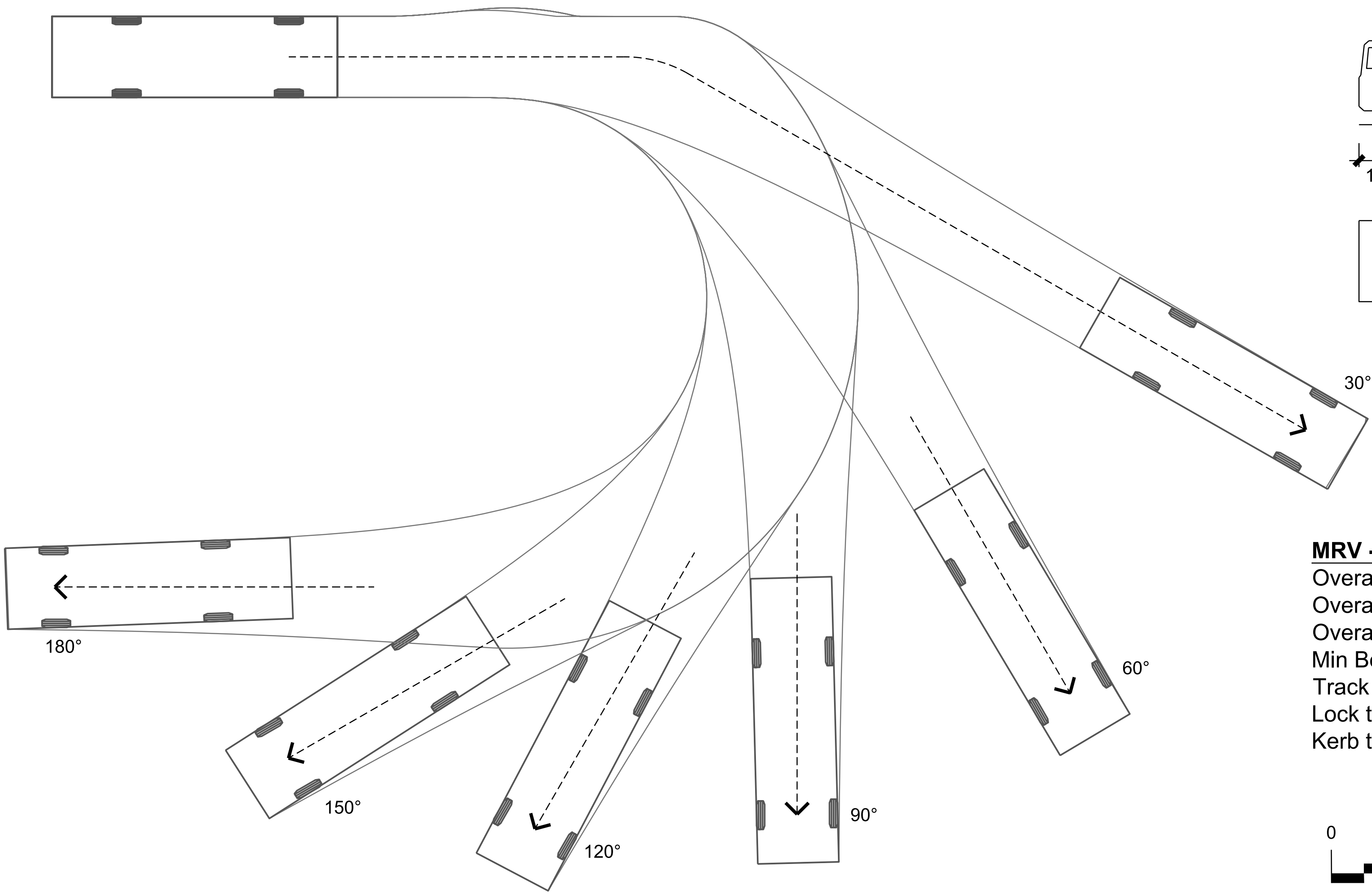


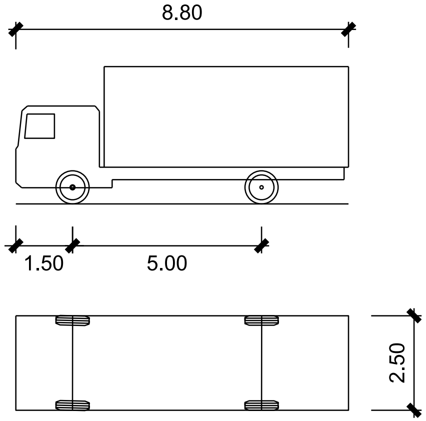
SRV - Small Rigid Vehicle

Overall Length	6.400m
Overall Width	2.330m
Overall Body Height	3.602m
Min Body Ground Clearance	0.398m
Track Width	2.330m
Lock to Lock Time	4.00s
Kerb to Kerb Turning Radius	7.100m



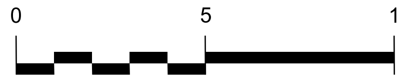
Scale (m)





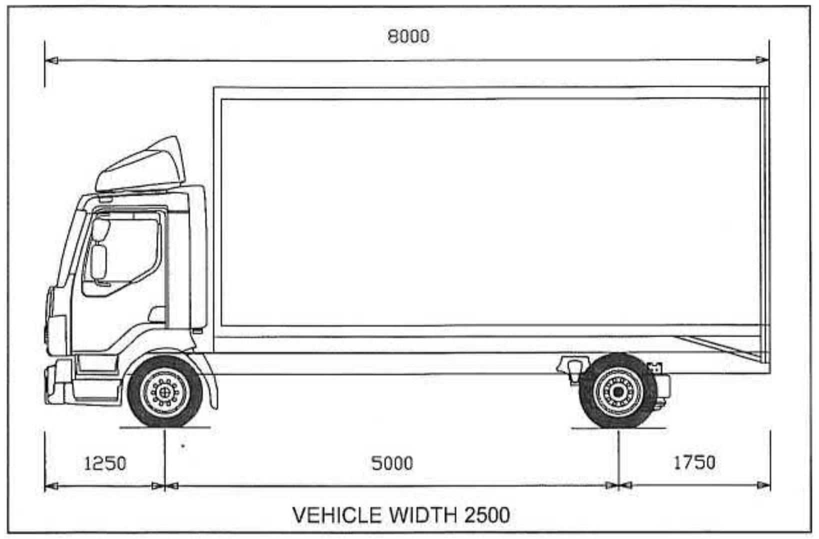
MRV - Medium Rigid Vehicle

Overall Length	8.800m
Overall Width	2.500m
Overall Body Height	3.633m
Min Body Ground Clearance	0.428m
Track Width	2.500m
Lock to Lock Time	4.00s
Kerb to Kerb Turning Radius	10.000m

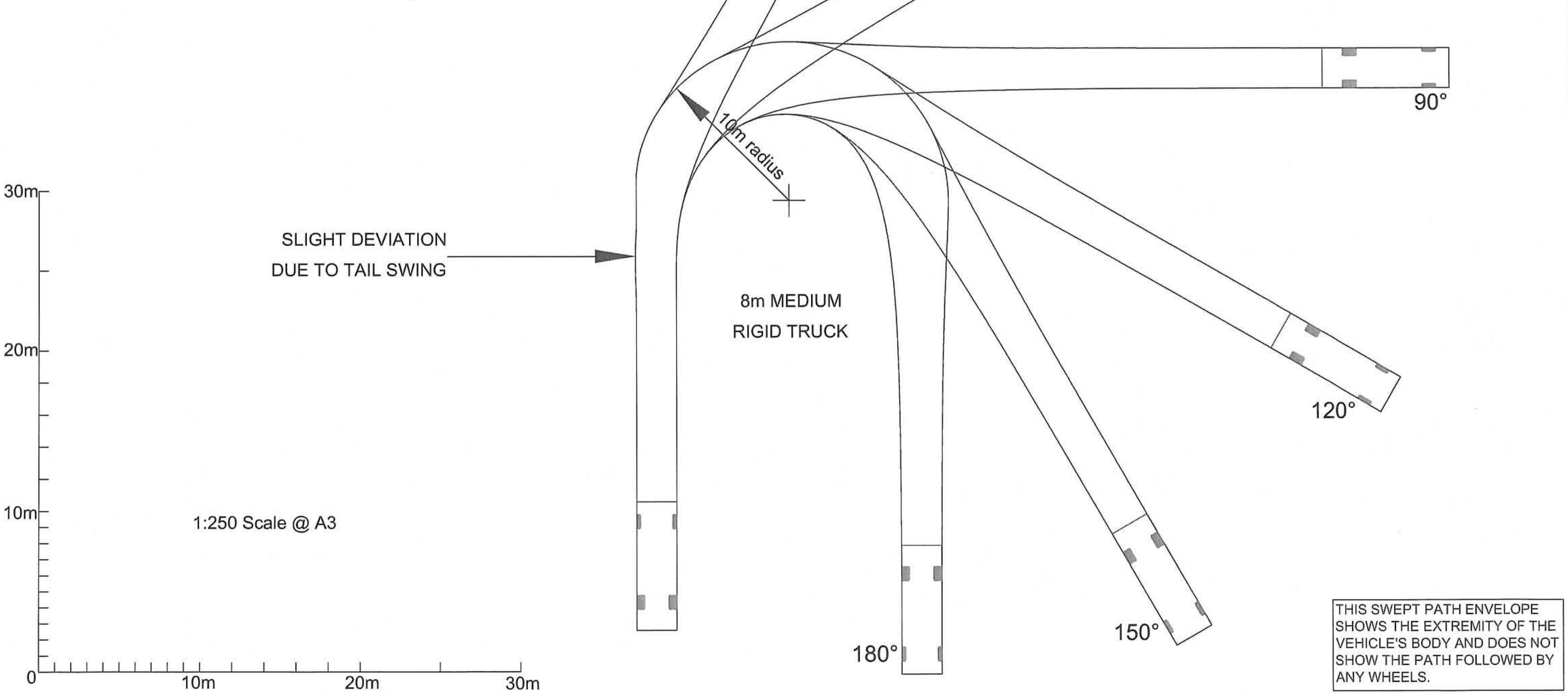


Scale (m)

1:200 @ A4



DESIGN VEHICLE DIMENSIONS (mm)



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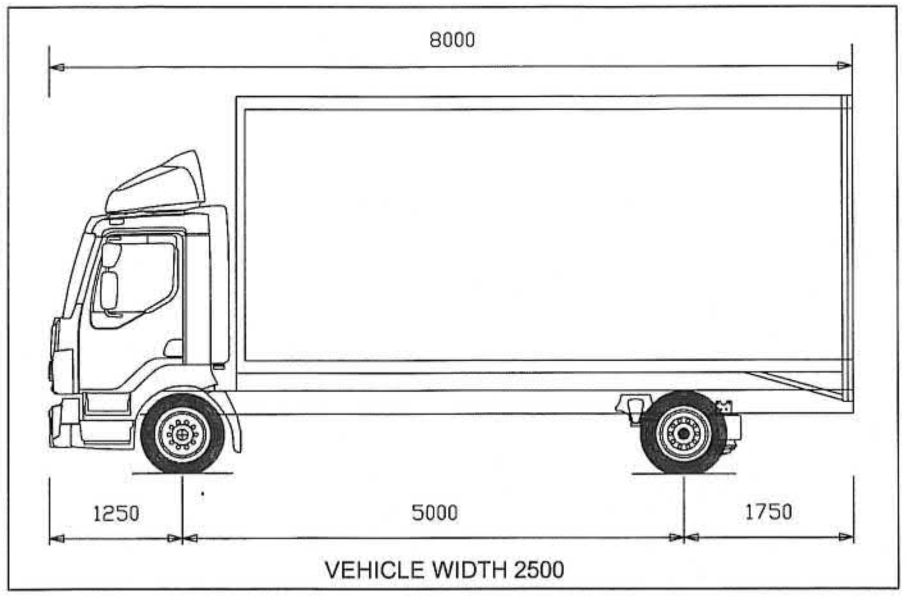
2007 ON-ROAD TRACKING CURVES
VEHICLE: 8m MEDIUM RIGID TRUCK
TURN: 10m RADIUS

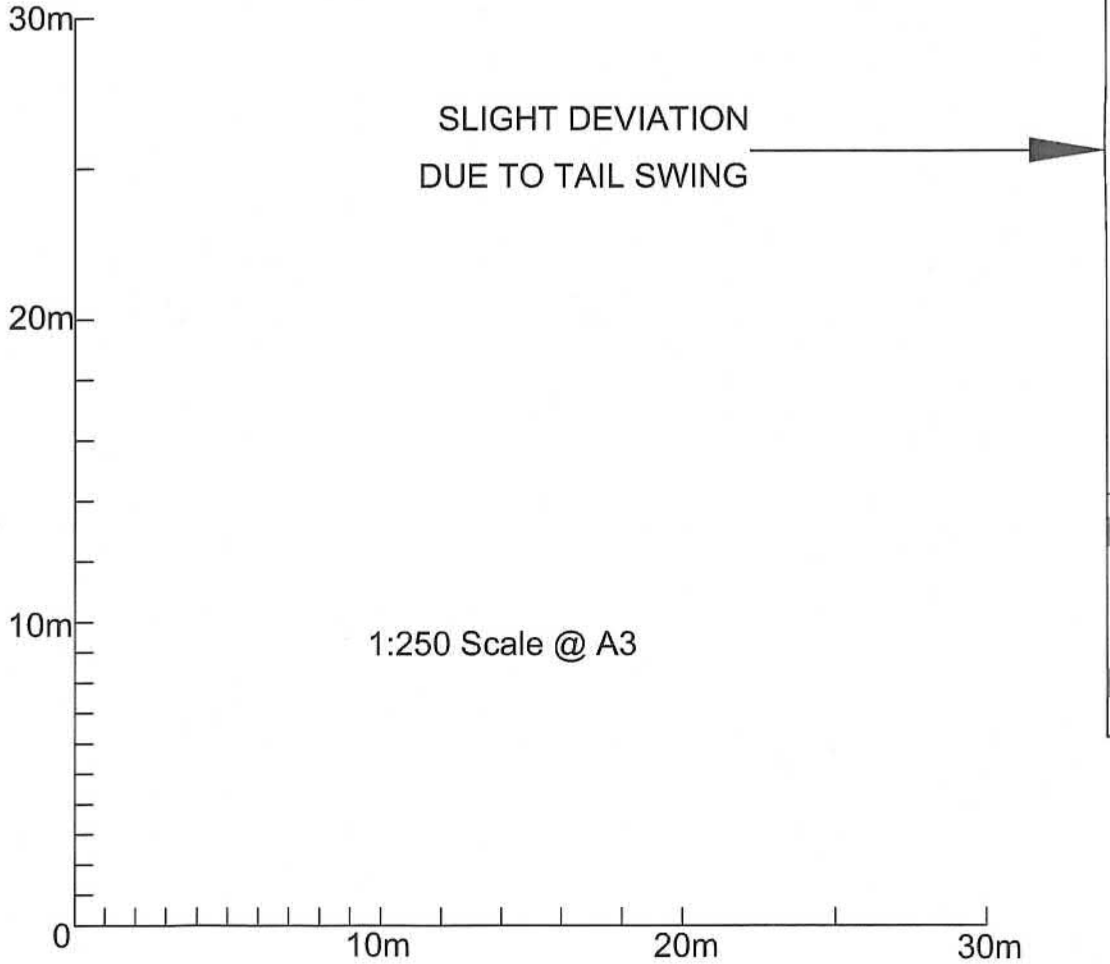
Recommended clearances (500mm) must be added to each side of the tracking curve (refer to text)

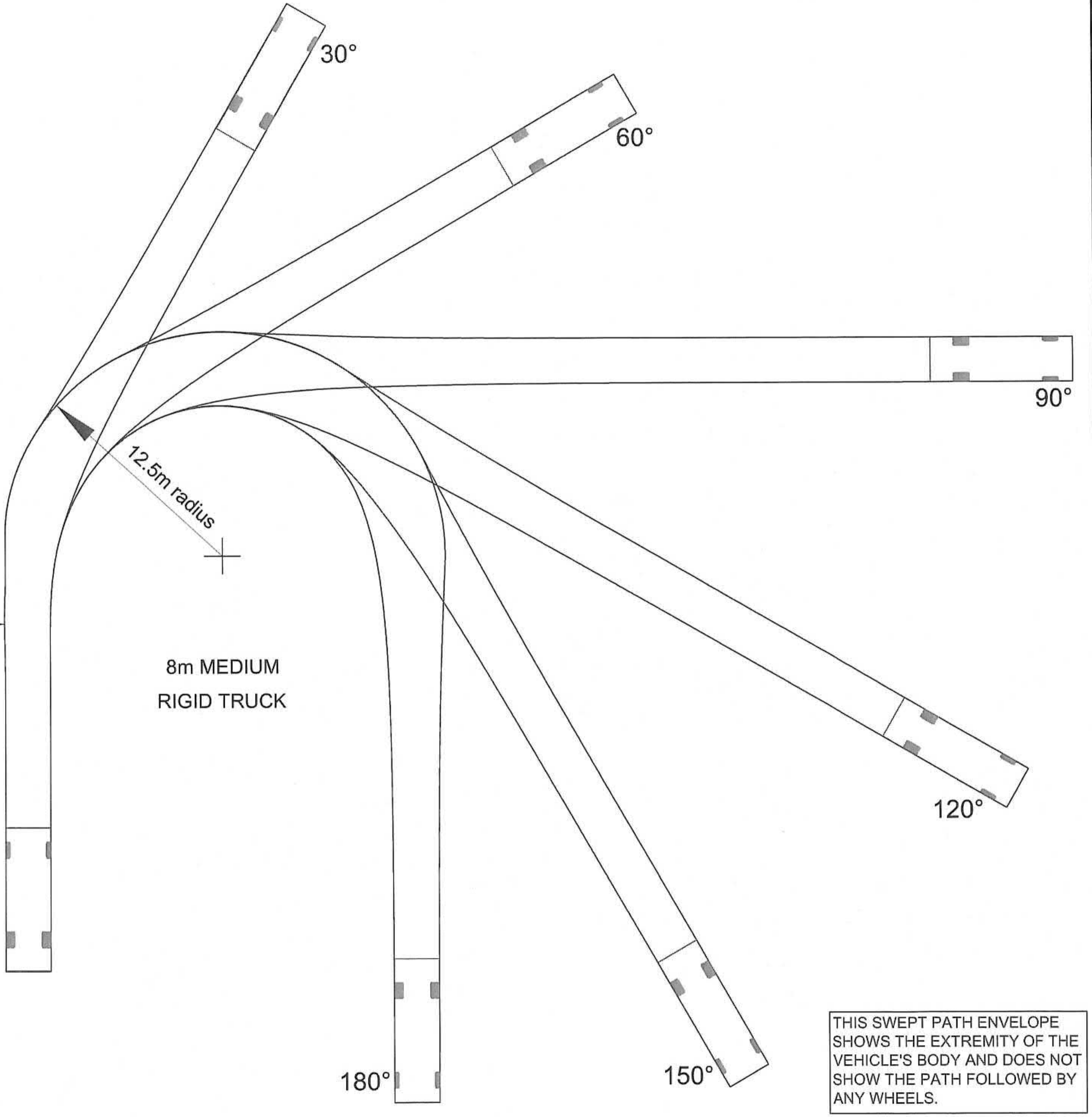
QUICK REFERENCE

- 8m Medium Rigid Truck
- 1:250
- 10m radius



DESIGN VEHICLE DIMENSIONS (mm)





THIS SWEPT PATH ENVELOPE SHOWS THE EXTREMITY OF THE VEHICLE'S BODY AND DOES NOT SHOW THE PATH FOLLOWED BY ANY WHEELS.

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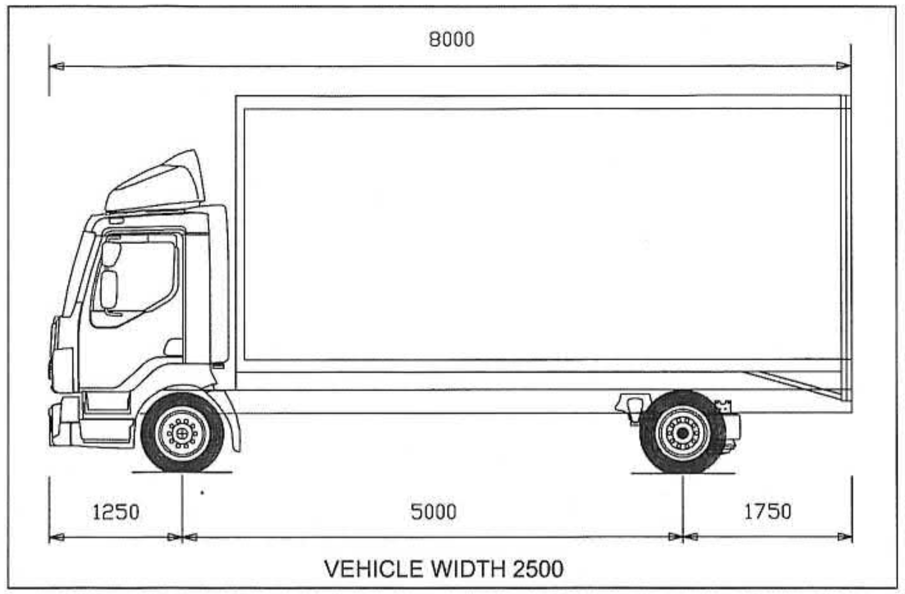
2007 ON-ROAD TRACKING CURVES
VEHICLE: 8m MEDIUM RIGID TRUCK
TURN: 12.5m RADIUS

Recommended clearances (500mm) must be added to each side of the tracking curve (refer to text)

Sheet 2 of 17

QUICK REFERENCE

- 8m Medium Rigid Truck
- 1:250
- 12.5m radius



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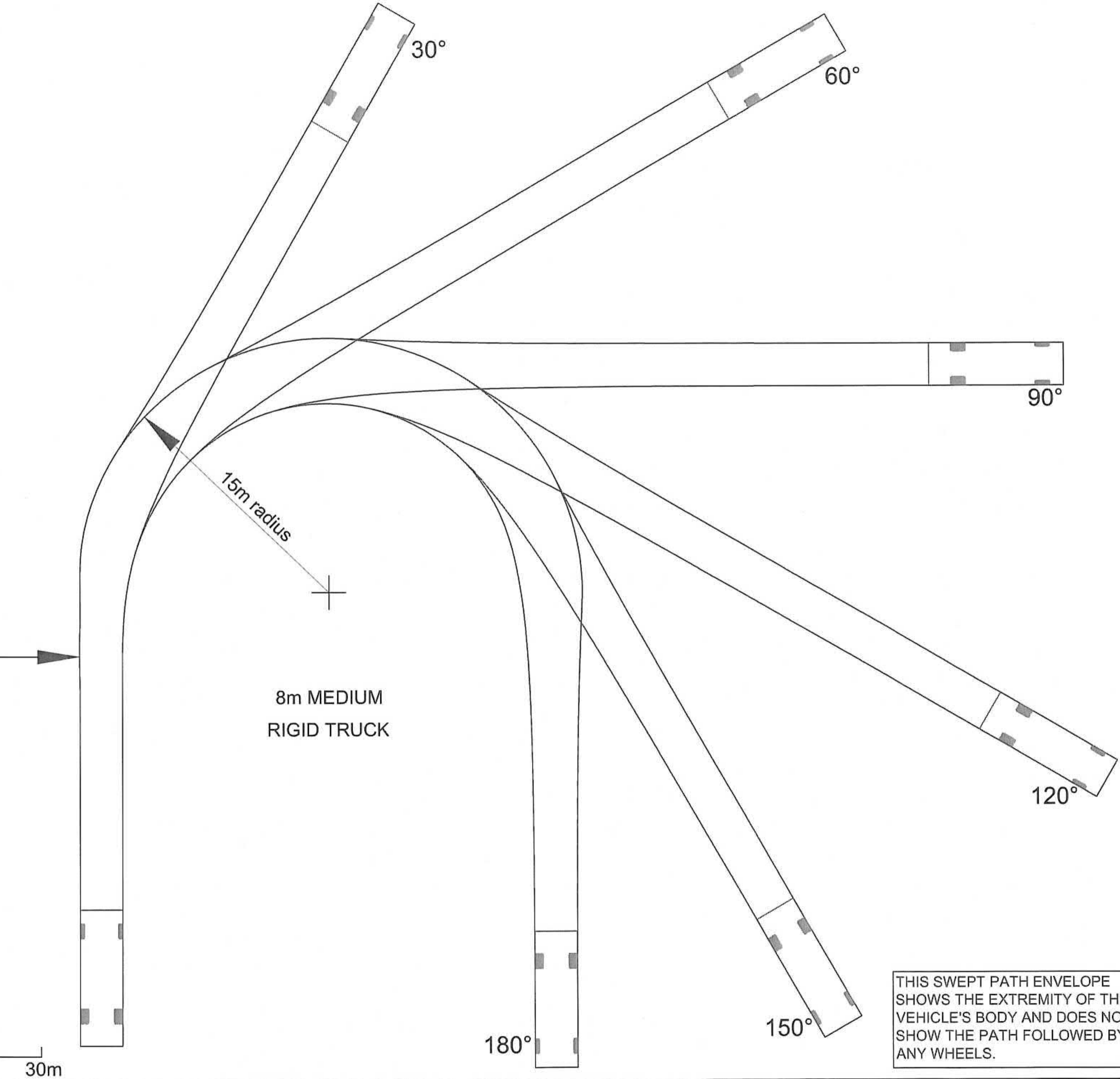

THIS SWEPT PATH ENVELOPE SHOWS THE EXTREMITY OF THE VEHICLE'S BODY AND DOES NOT SHOW THE PATH FOLLOWED BY ANY WHEELS.

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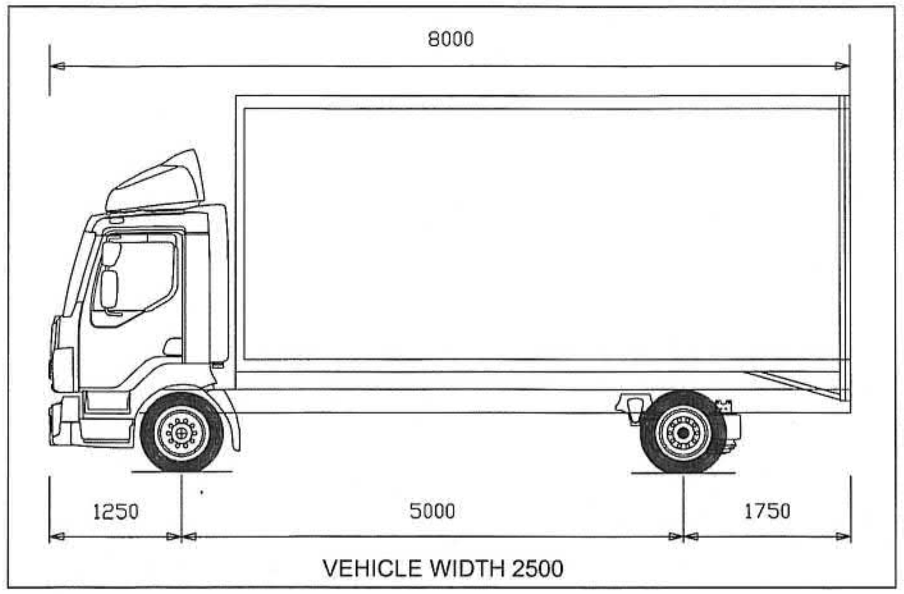
2007 ON-ROAD TRACKING CURVES
VEHICLE: 8m MEDIUM RIGID TRUCK
TURN: 15m RADIUS

Recommended clearances (500mm) must be added to each side of the tracking curve (refer to text)

QUICK REFERENCE
- 8m Medium Rigid Truck
- 1:250
- 15m radius



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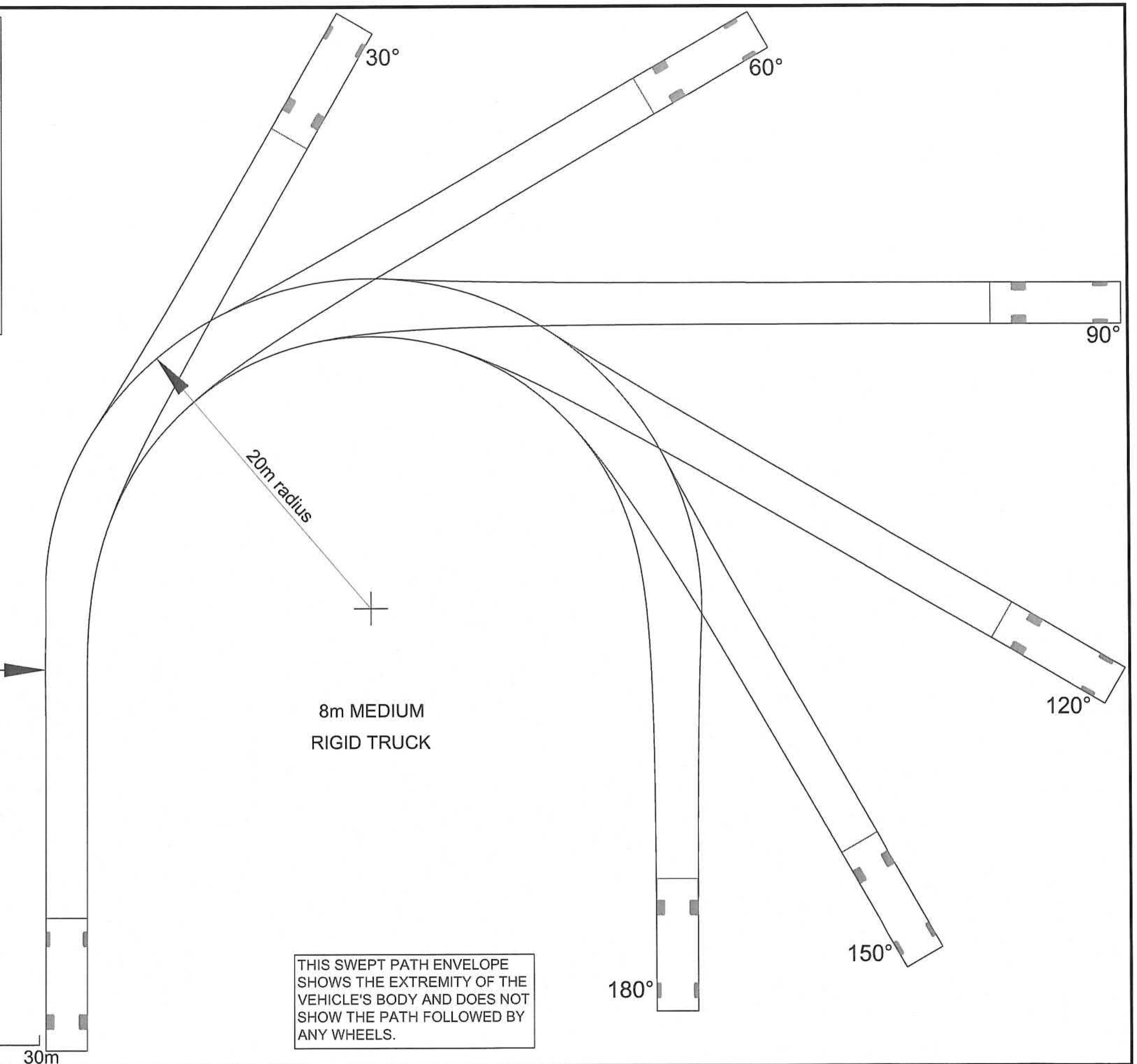

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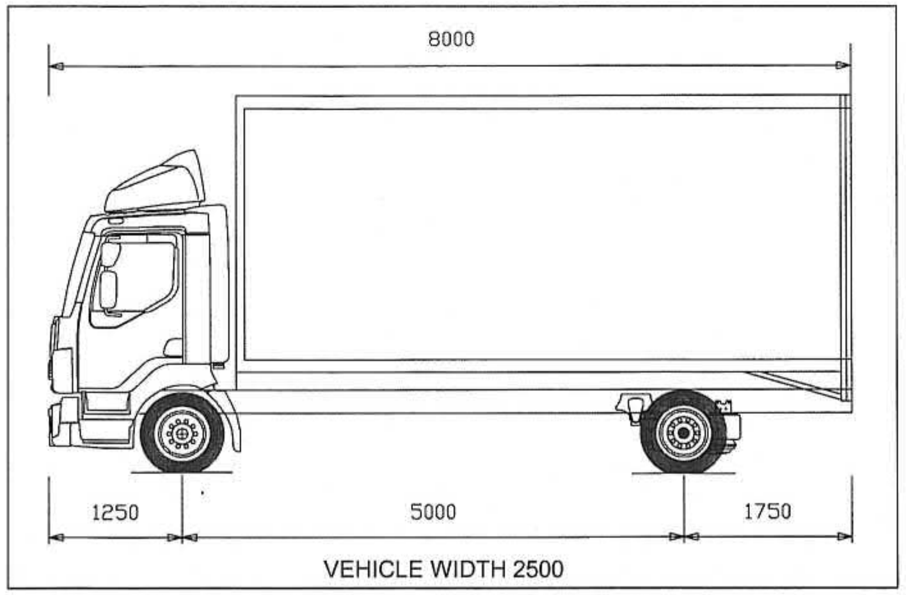
2007 ON-ROAD TRACKING CURVES
VEHICLE: 8m MEDIUM RIGID TRUCK
TURN: 20m RADIUS

Recommended clearances (500mm) must be added to each side of the tracking curve (refer to text)

QUICK REFERENCE

- 8m Medium Rigid Truck
- 1:250
- 20m radius



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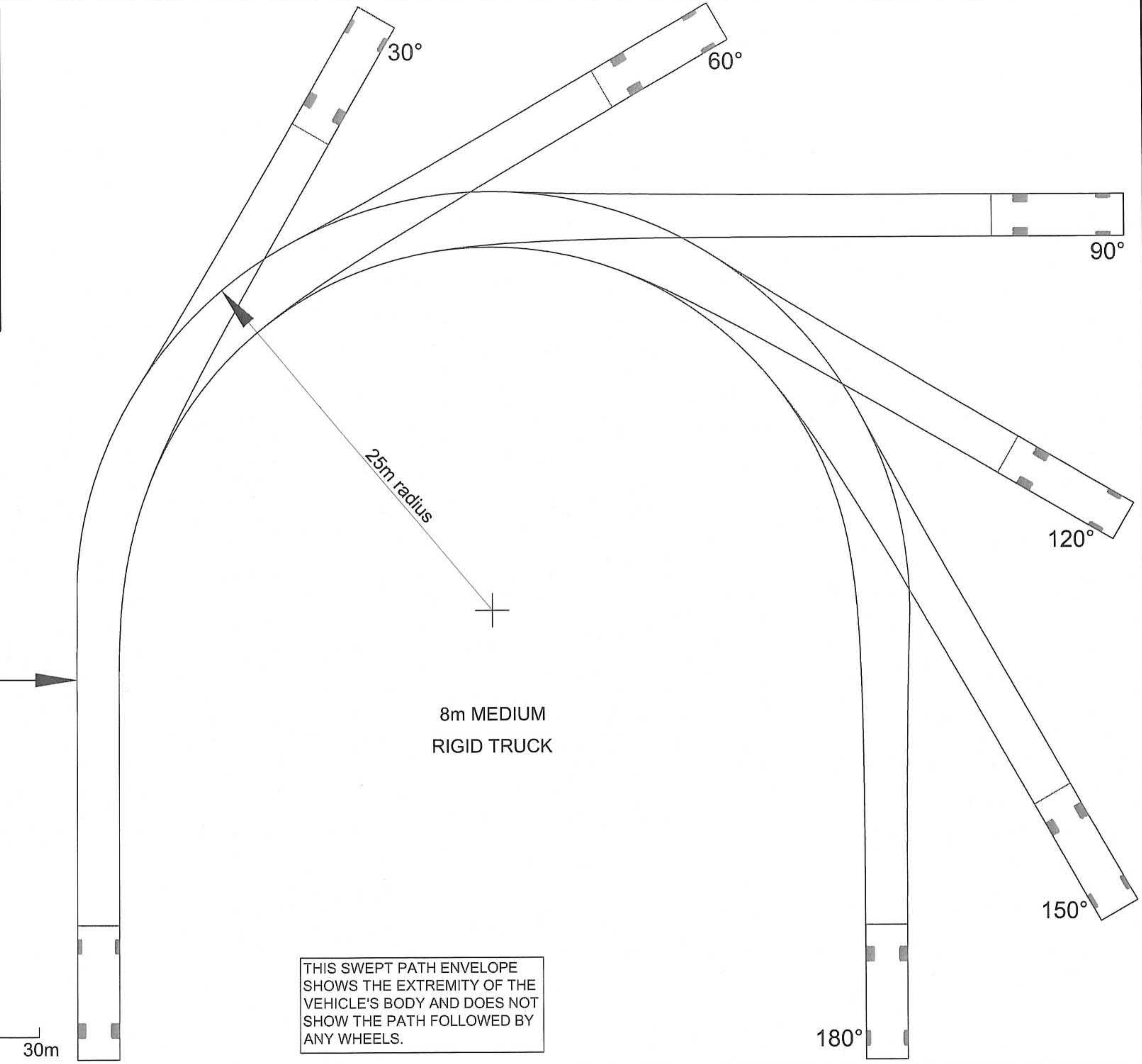

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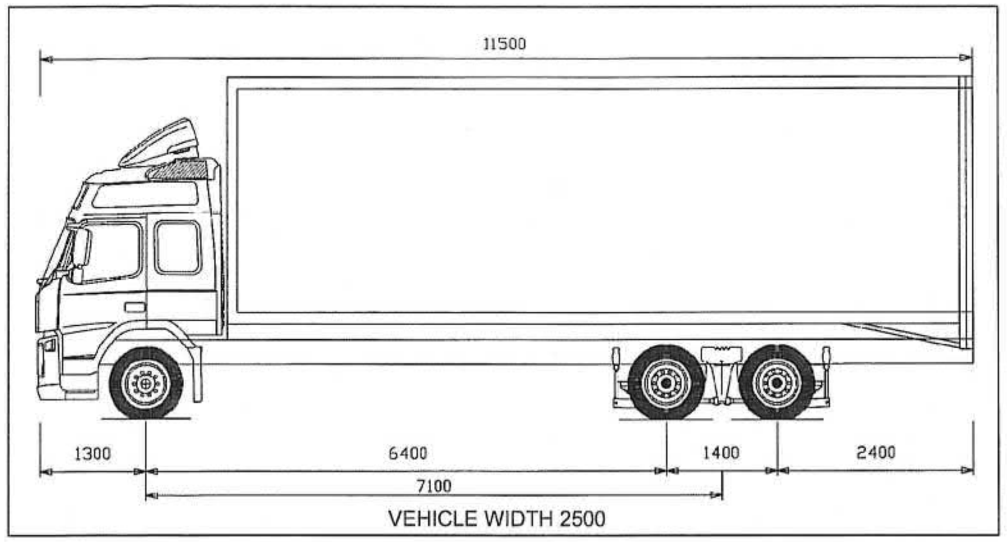
2007 ON-ROAD TRACKING CURVES
VEHICLE: 8m MEDIUM RIGID TRUCK
TURN: 25m RADIUS

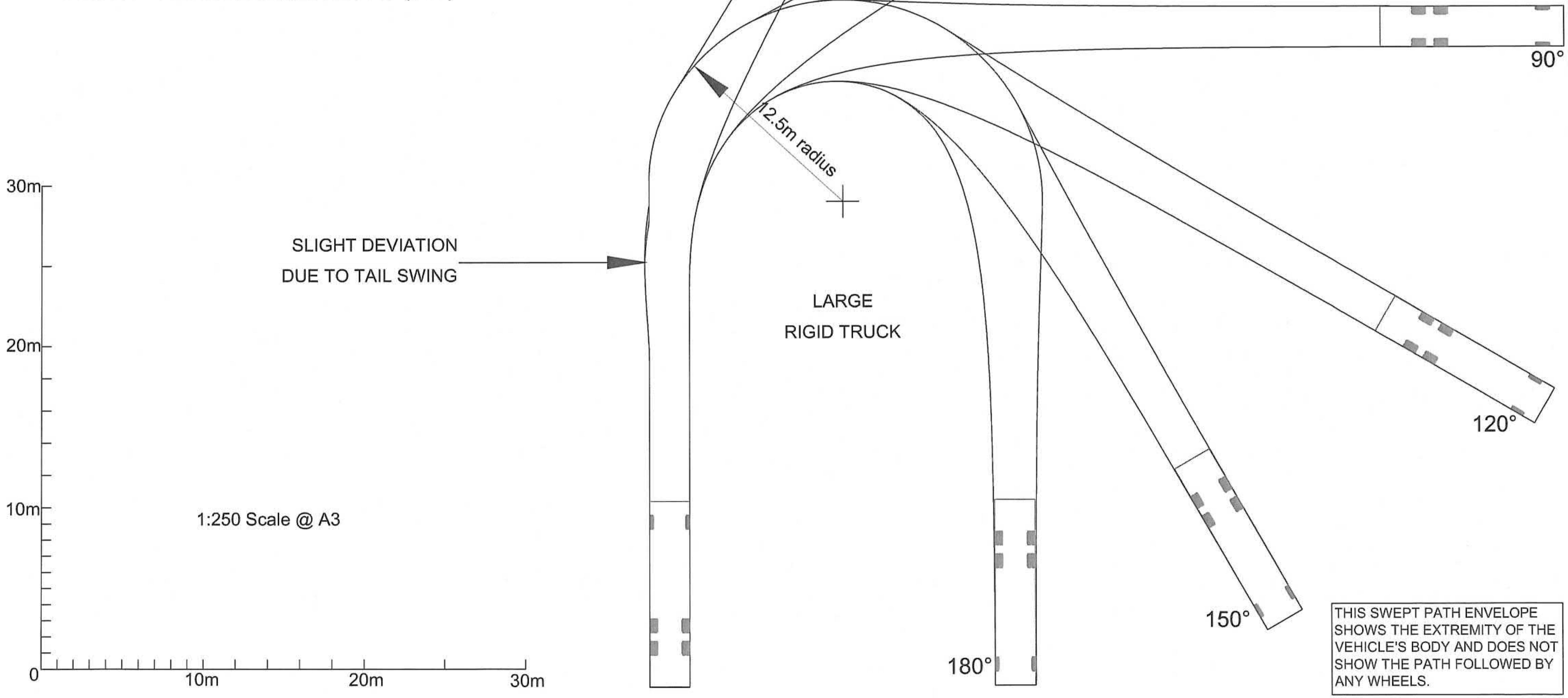
Recommended clearances (500mm) must be added to each side of the tracking curve (refer to text)

QUICK REFERENCE

- 8m Medium Rigid Truck
- 1:250
- 25m radius



DESIGN VEHICLE DIMENSIONS (mm)



THIS SWEPT PATH ENVELOPE SHOWS THE EXTREMITY OF THE VEHICLE'S BODY AND DOES NOT SHOW THE PATH FOLLOWED BY ANY WHEELS.

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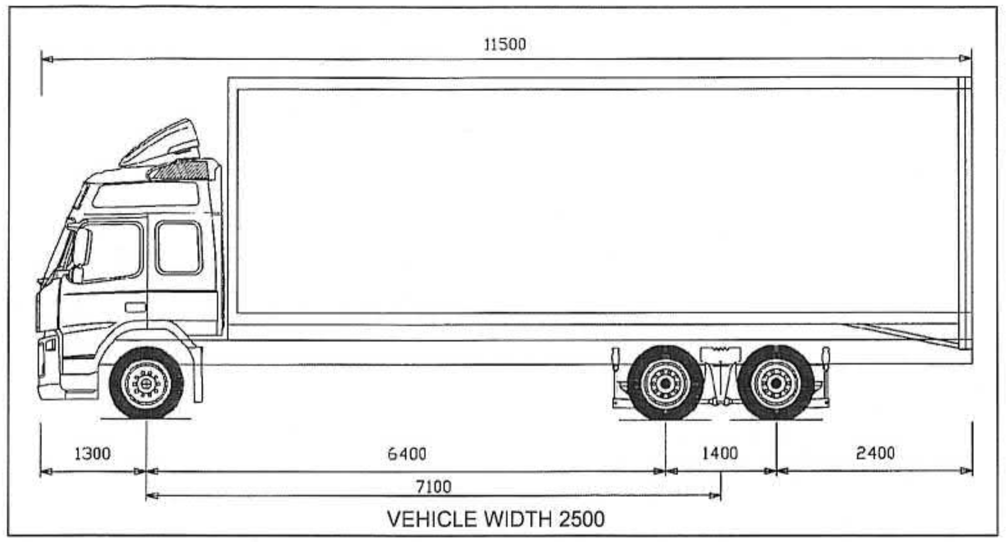
2007 ON-ROAD TRACKING CURVES
VEHICLE: LARGE RIGID TRUCK
TURN: 12.5m RADIUS

Recommended clearances (500mm) must be added to each side of the tracking curve (refer to text)

QUICK REFERENCE

- Large Rigid Truck
- 1:250
- 12.5m radius



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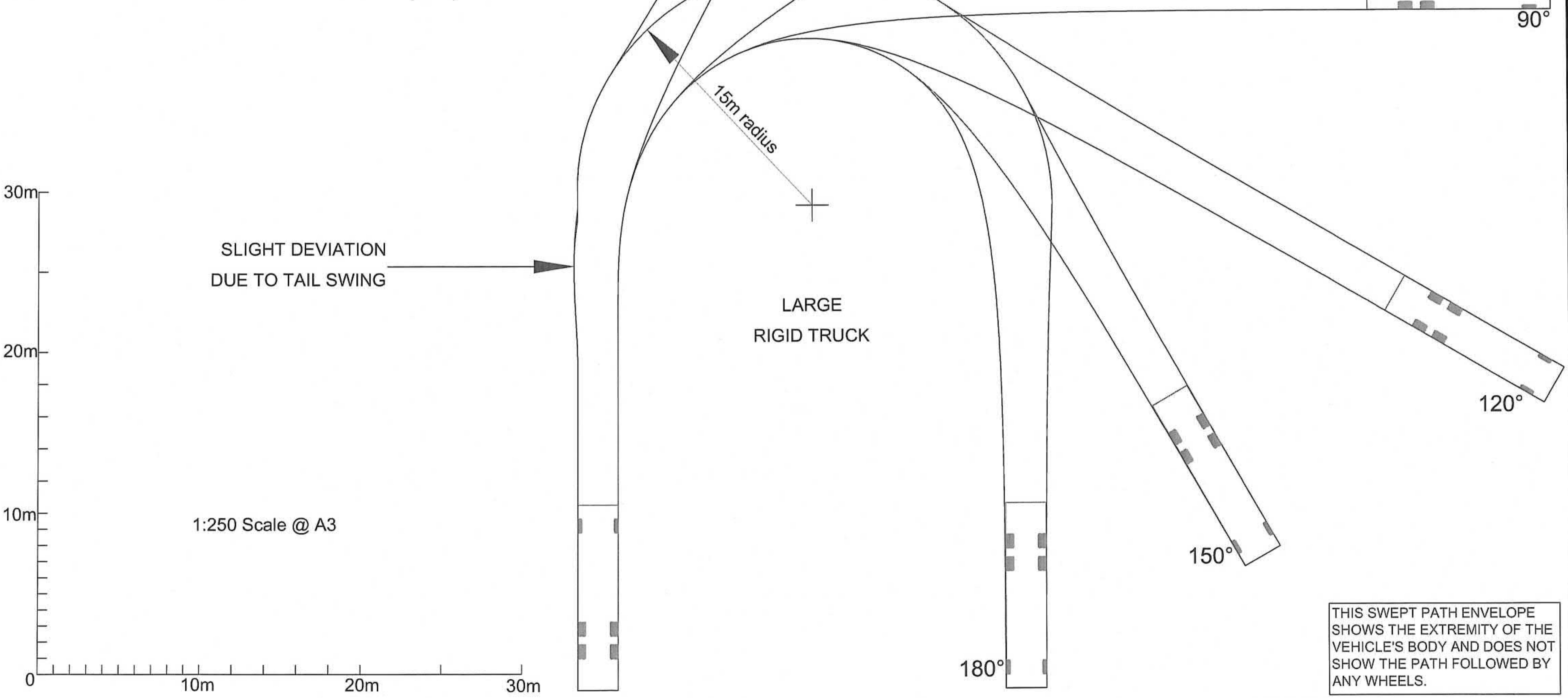

THIS SWEPT PATH ENVELOPE SHOWS THE EXTREMITY OF THE VEHICLE'S BODY AND DOES NOT SHOW THE PATH FOLLOWED BY ANY WHEELS.

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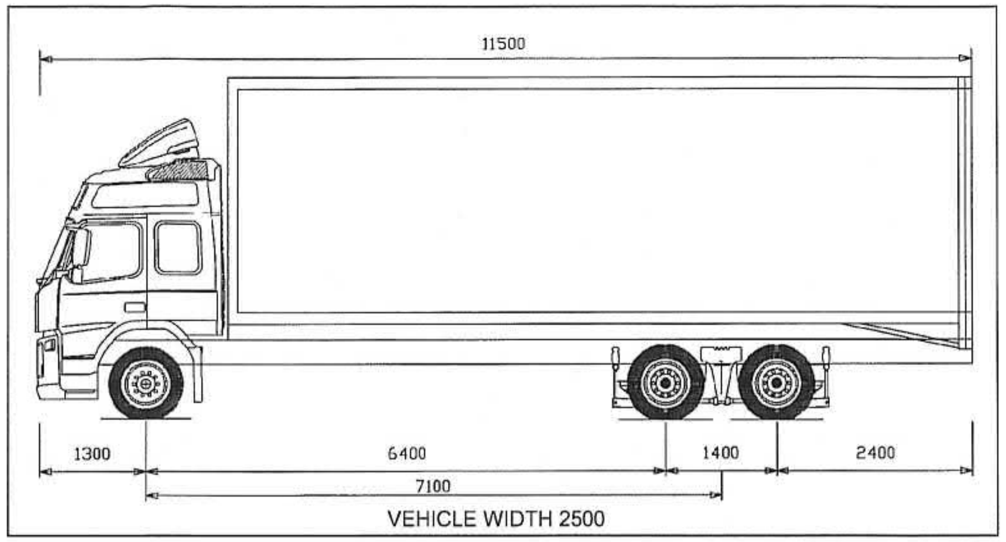
2007 ON-ROAD TRACKING CURVES
VEHICLE: LARGE RIGID TRUCK
TURN: 15m RADIUS

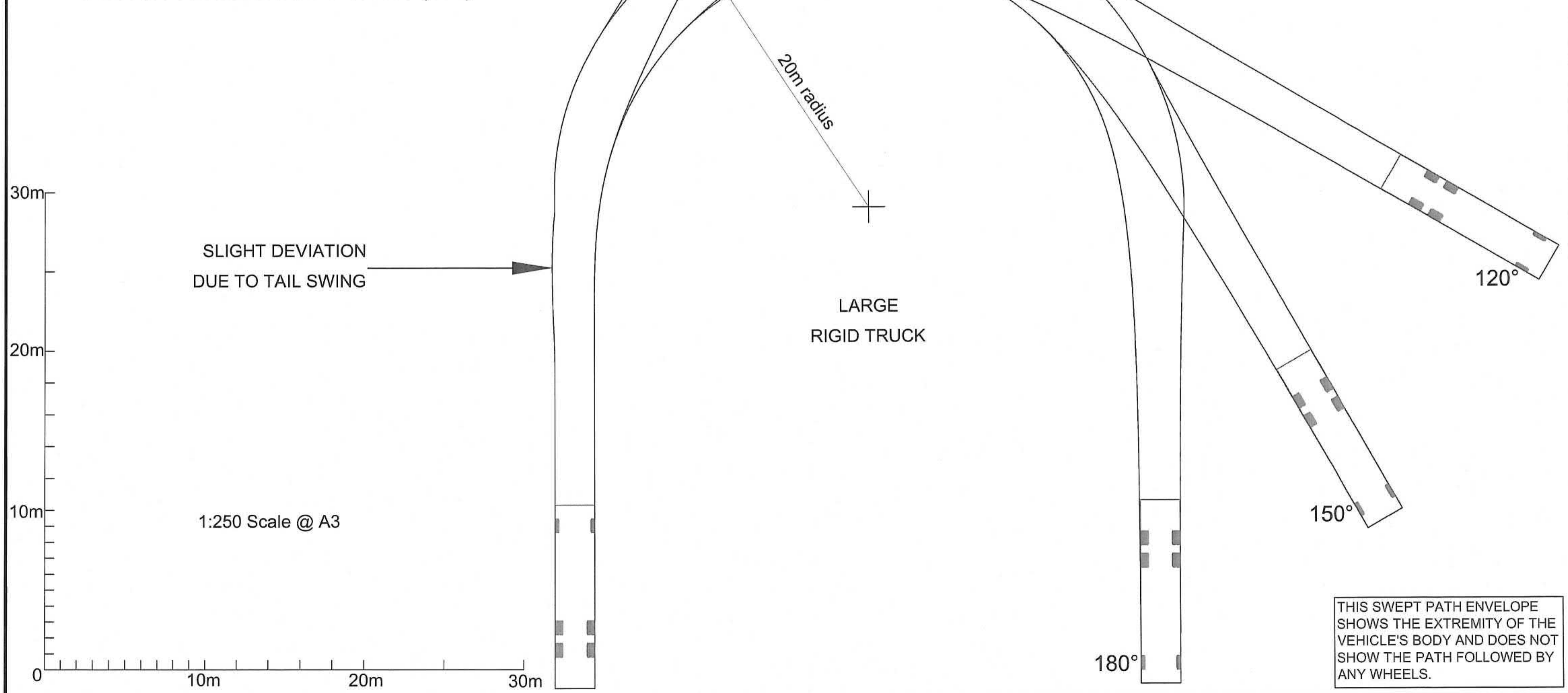
Recommended clearances (500mm) must be added to each side of the tracking curve (refer to text)

QUICK REFERENCE

- Large Rigid Truck
- 1:250
- 15m radius



DESIGN VEHICLE DIMENSIONS (mm)



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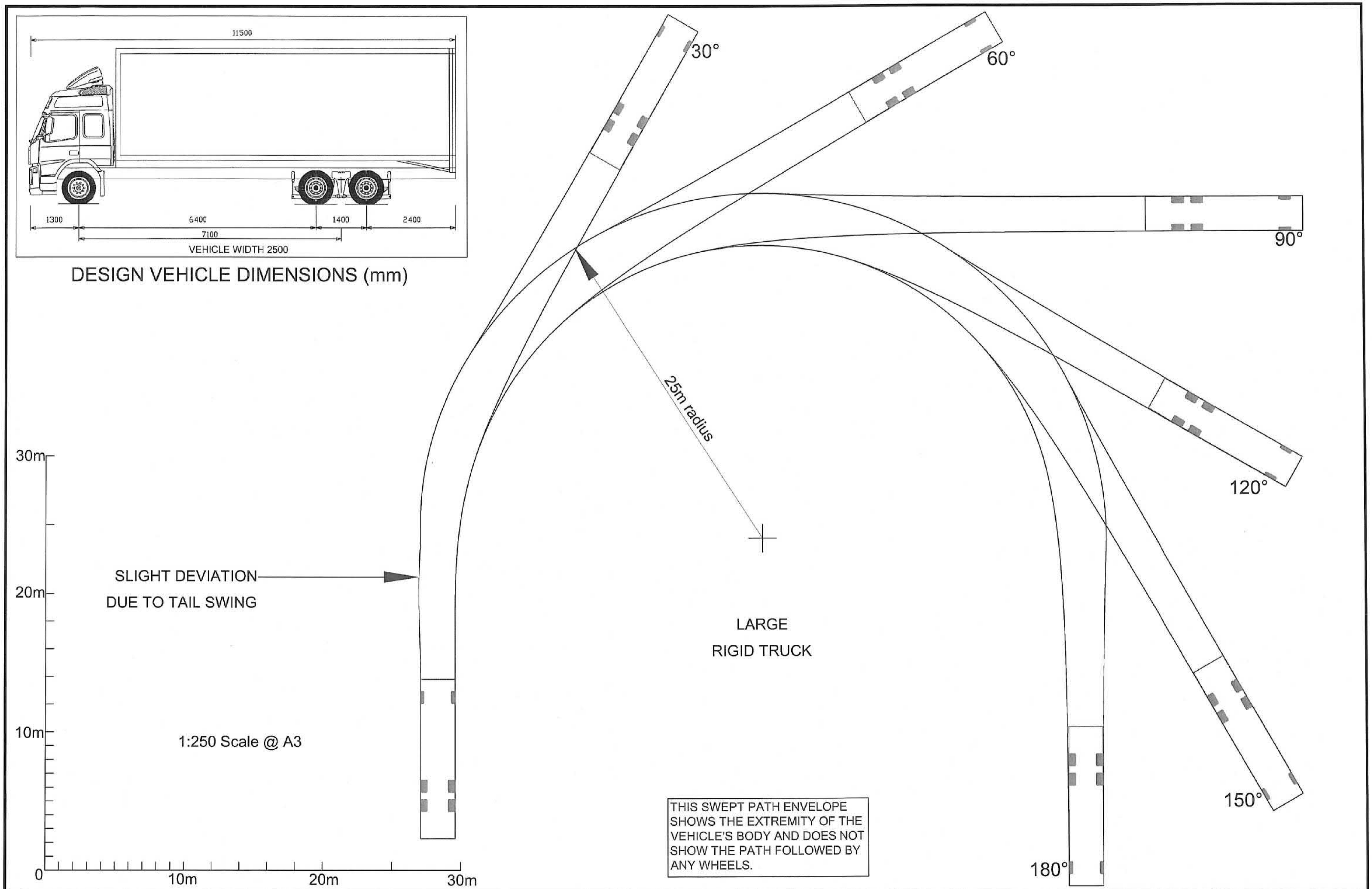
2007 ON-ROAD TRACKING CURVES
VEHICLE: LARGE RIGID TRUCK
TURN: 20m RADIUS

Recommended clearances (500mm) must be added to each side of the tracking curve (refer to text)

QUICK REFERENCE

- Large Rigid Truck
- 1:250
- 20m radius



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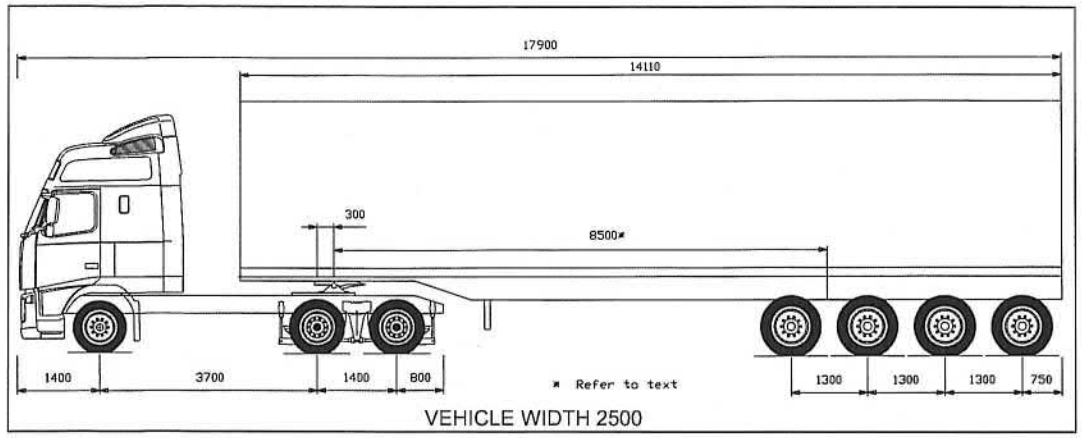
2007 ON-ROAD TRACKING CURVES
VEHICLE: LARGE RIGID TRUCK
TURN: 25m RADIUS

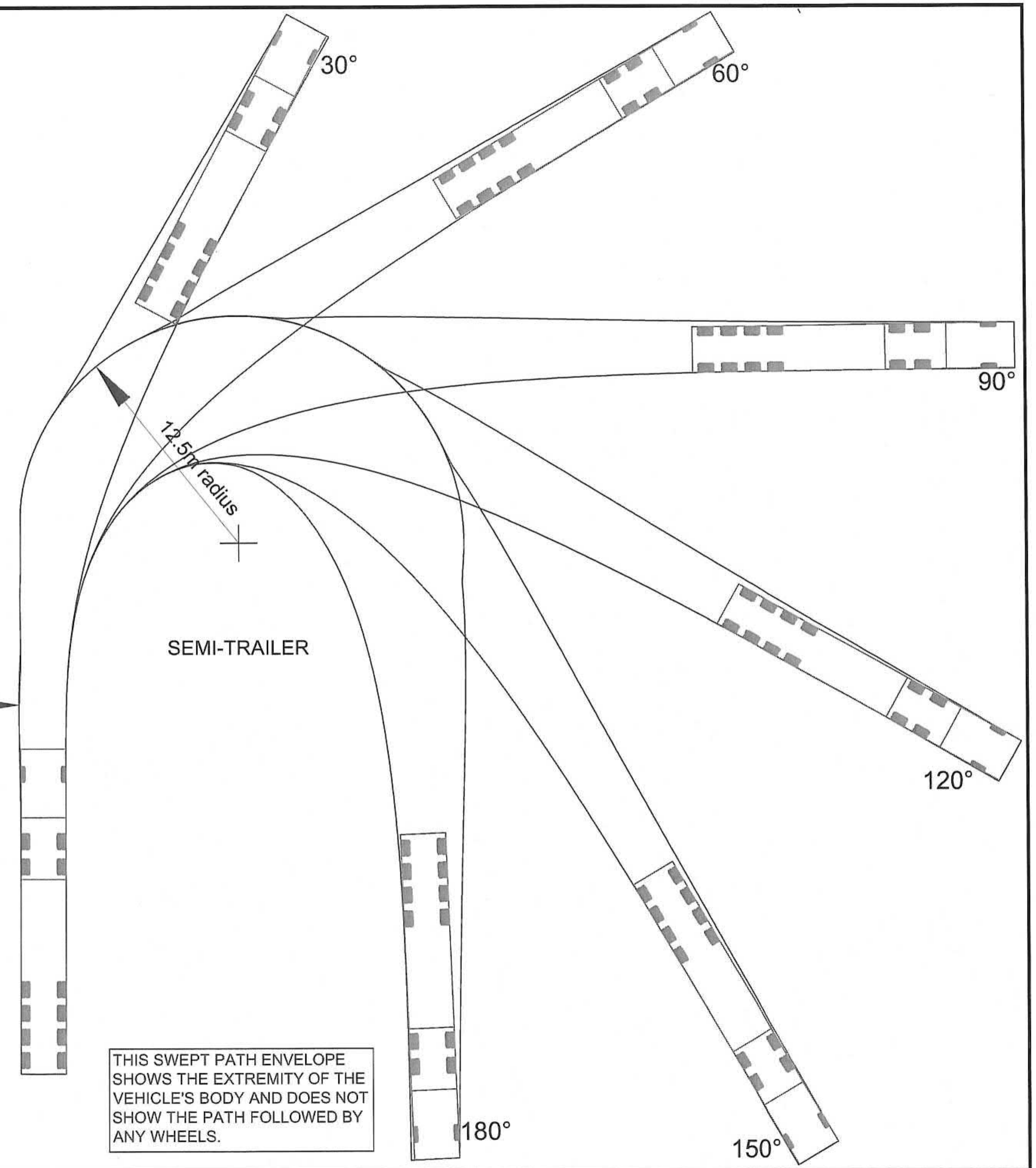
Recommended clearances (500mm) must be added to each side of the tracking curve (refer to text)

QUICK REFERENCE

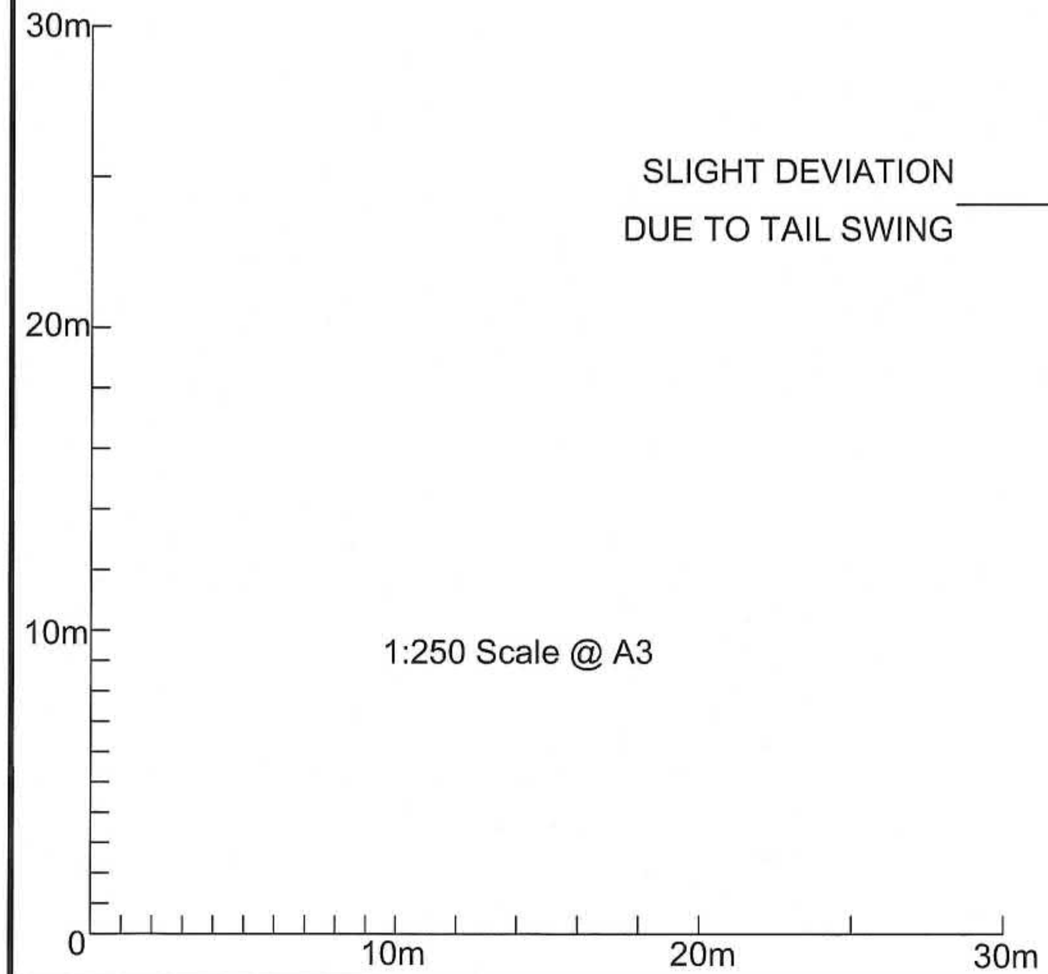
- Large Rigid Truck
- 1:250
- 25m radius



DESIGN VEHICLE DIMENSIONS (mm)



SLIGHT DEVIATION
DUE TO TAIL SWING



1:250 Scale @ A3

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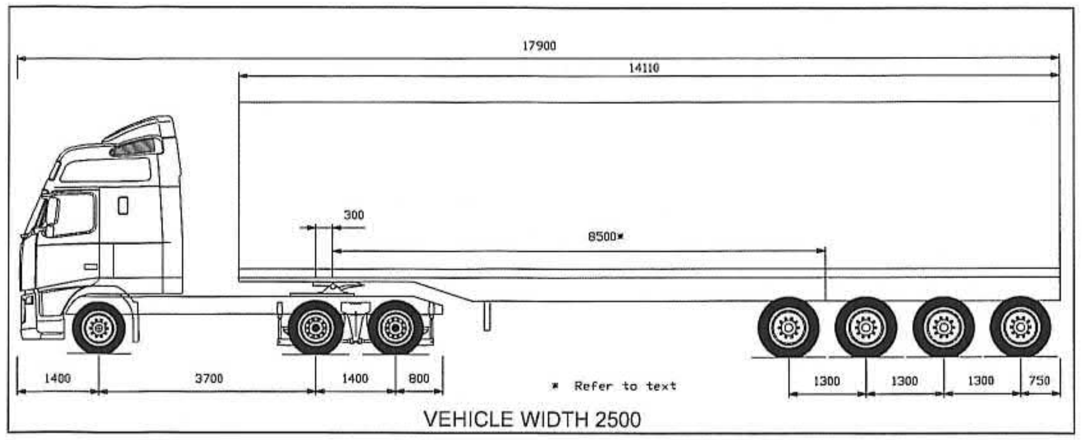
2007 ON-ROAD TRACKING CURVES
VEHICLE: SEMI-TRAILER
TURN: 12.5m RADIUS

Recommended clearances (500mm) must be added to each side of the tracking curve (refer to text)

QUICK REFERENCE

- Semi-trailer
- 1:250
- 12.5m radius



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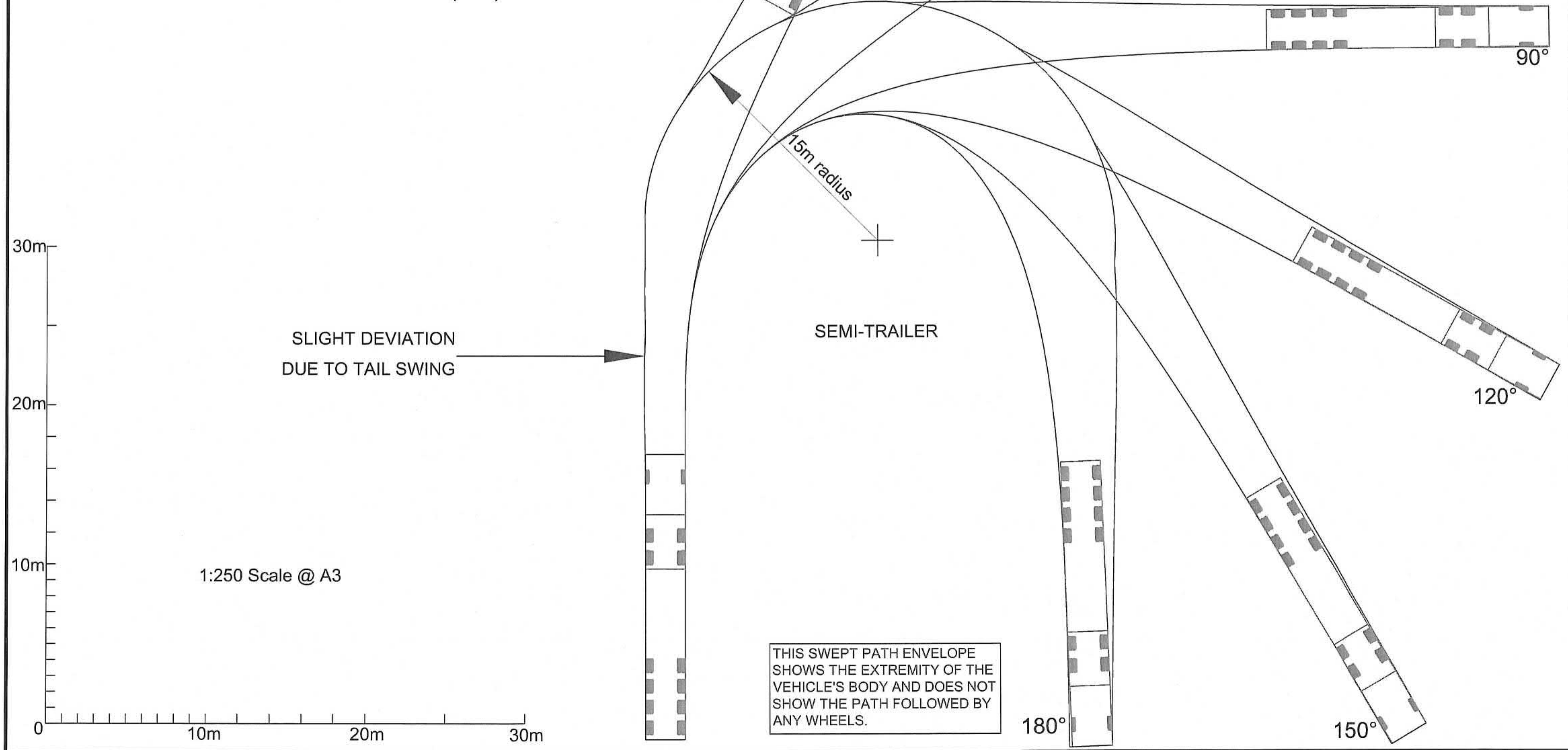

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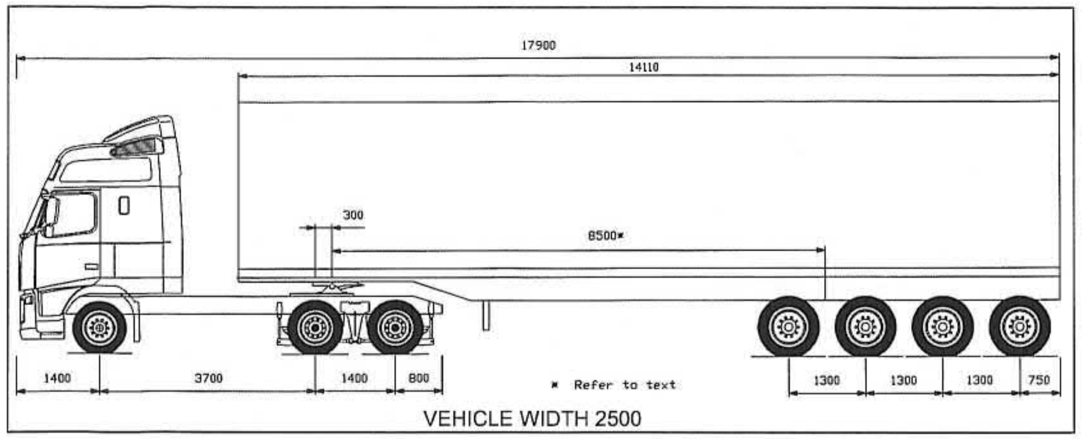
2007 ON-ROAD TRACKING CURVES
VEHICLE: SEMI-TRAILER
TURN: 15m RADIUS

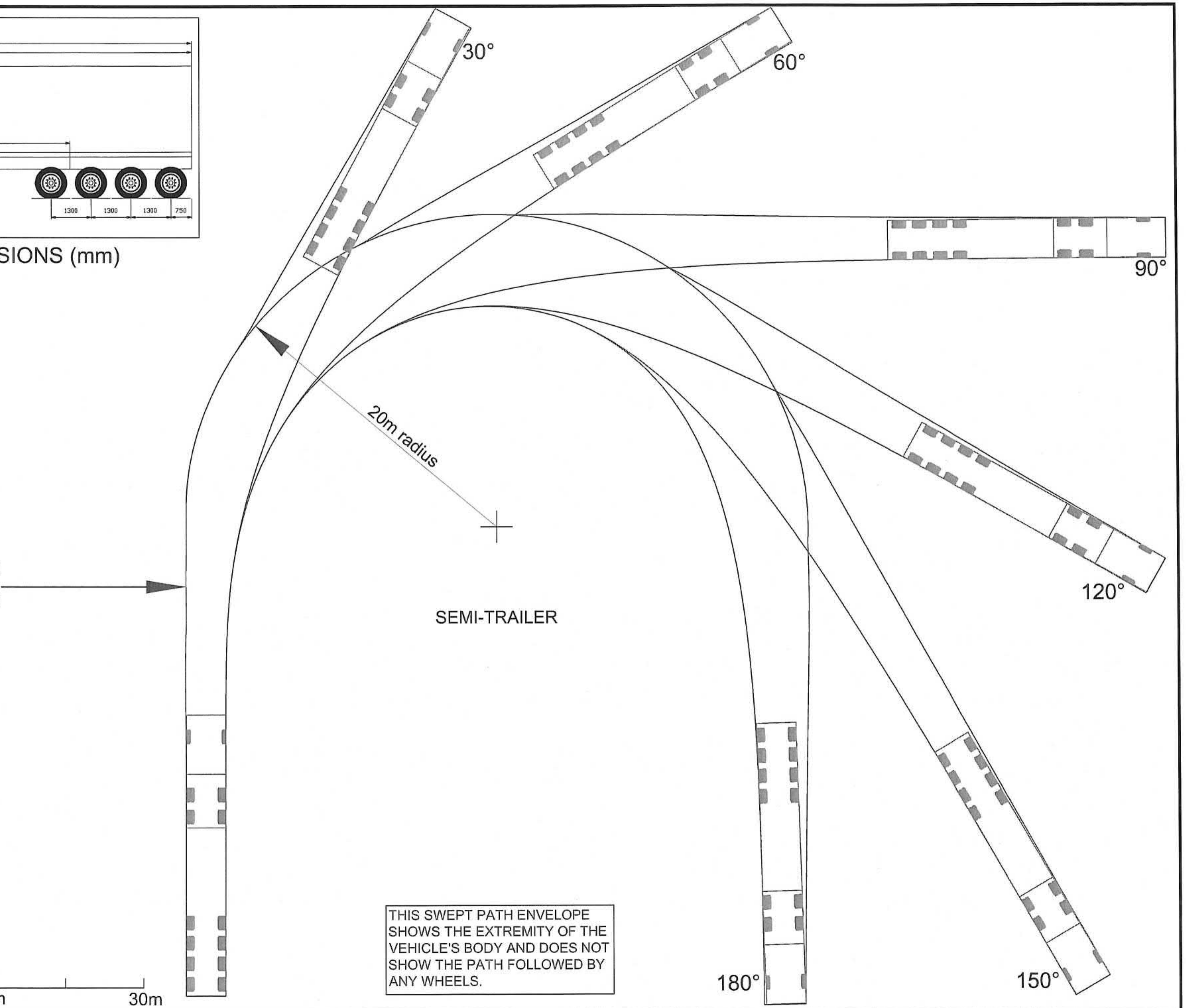
Recommended clearances (500mm) must be added to each side of the tracking curve (refer to text)

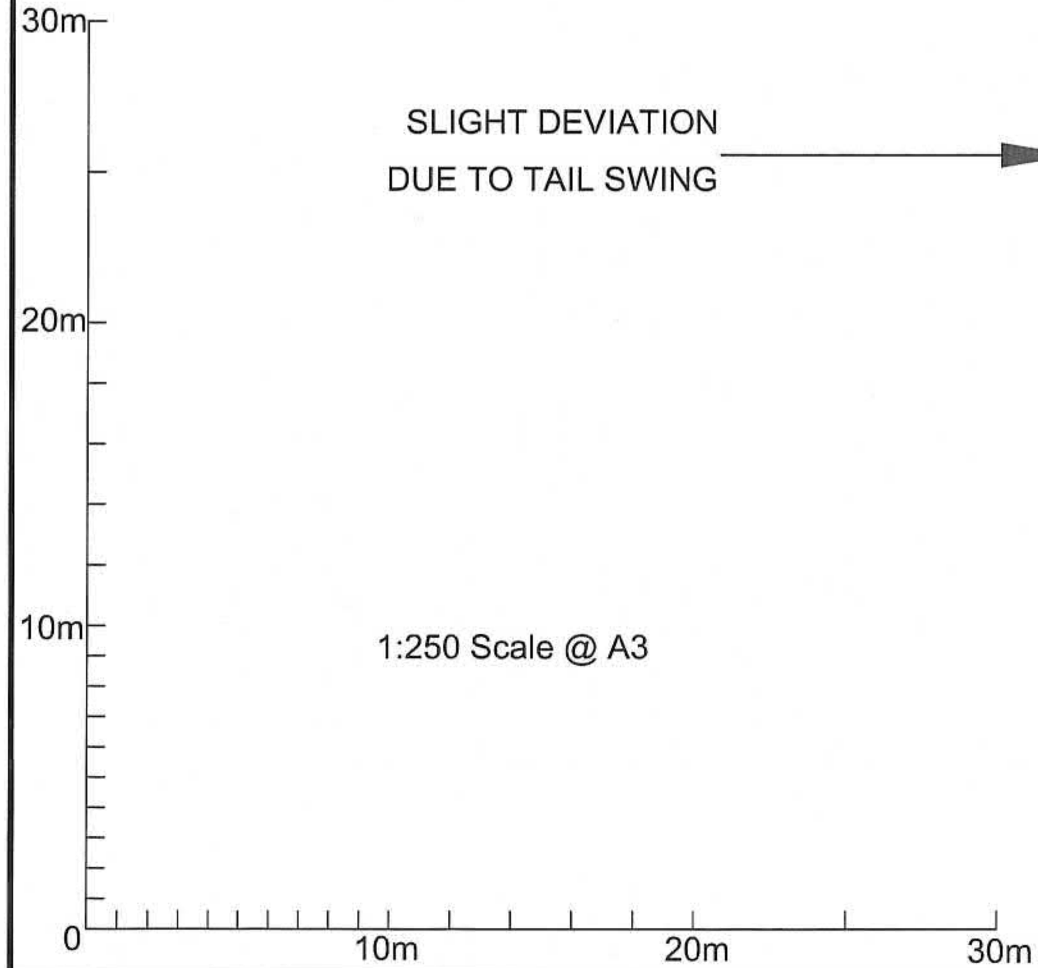
QUICK REFERENCE

- Semi-trailer
- 1:250
- 15m radius



DESIGN VEHICLE DIMENSIONS (mm)





THIS SWEPT PATH ENVELOPE SHOWS THE EXTREMITY OF THE VEHICLE'S BODY AND DOES NOT SHOW THE PATH FOLLOWED BY ANY WHEELS.

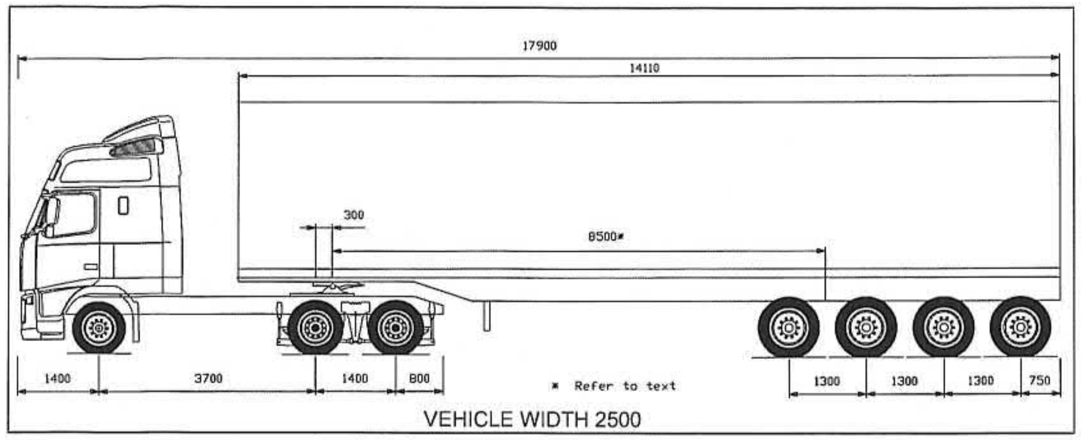
Land Transport NZ
Ikiiki Whenua Aotearoa

2007 ON-ROAD TRACKING CURVES
VEHICLE: SEMI-TRAILER
TURN: 20m RADIUS

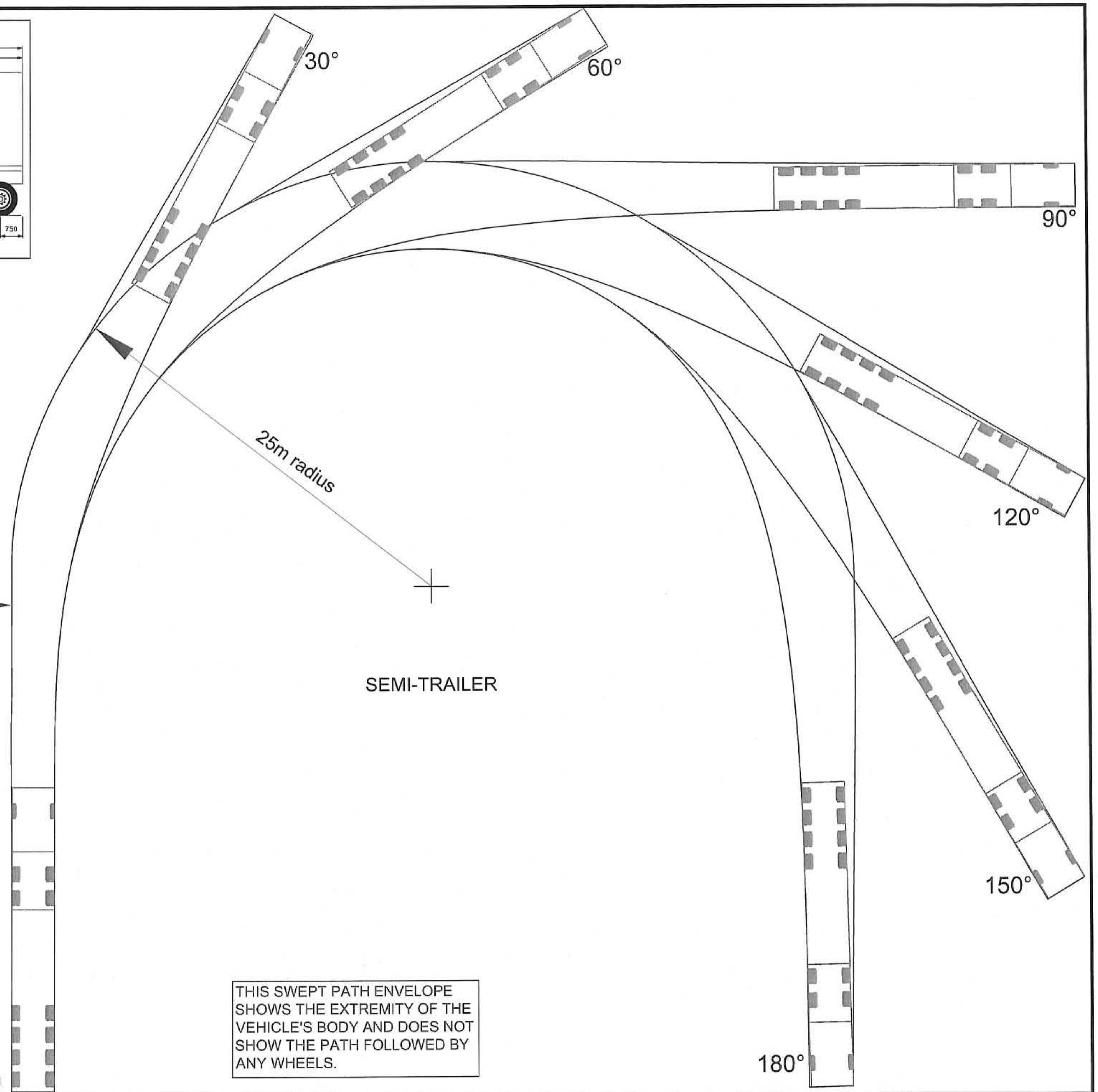
Recommended clearances (500mm) must be added to each side of the tracking curve (refer to text)

QUICK REFERENCE

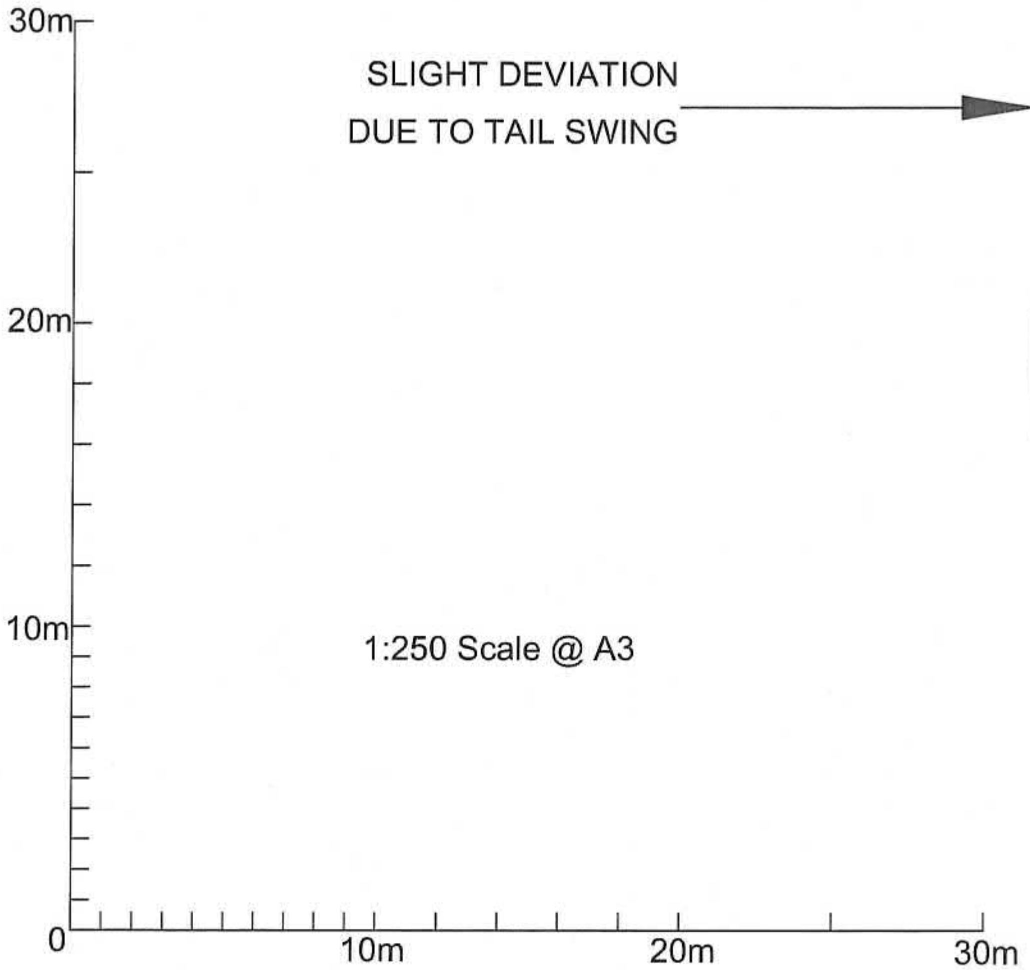
- Semi-trailer
- 1:250
- 20m radius



DESIGN VEHICLE DIMENSIONS (mm)



SLIGHT DEVIATION
DUE TO TAIL SWING



1:250 Scale @ A3

THIS SWEPT PATH ENVELOPE SHOWS THE EXTREMITY OF THE VEHICLE'S BODY AND DOES NOT SHOW THE PATH FOLLOWED BY ANY WHEELS.

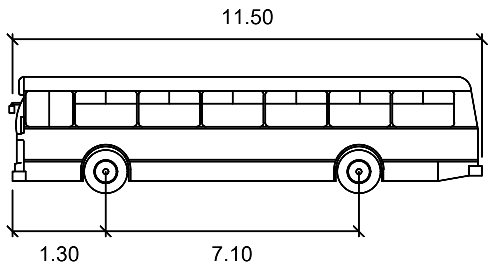
Land Transport NZ
Ikiiki Whenua Aotearoa

2007 ON-ROAD TRACKING CURVES
VEHICLE: SEMI-TRAILER
TURN: 25m RADIUS

Recommended clearances (500mm) must be added to each side of the tracking curve (refer to text)

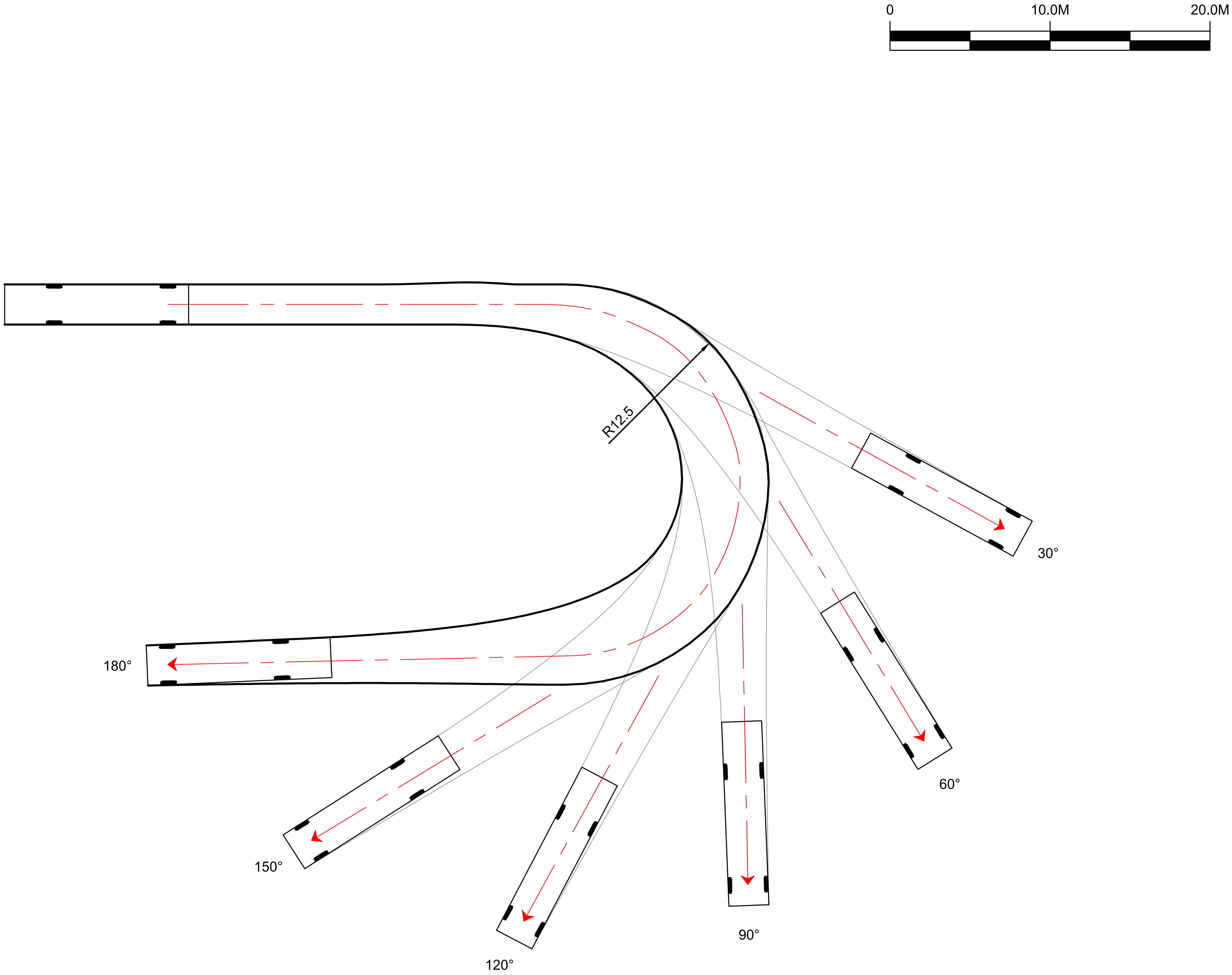
QUICK REFERENCE

- Semi-trailer
- 1:250
- 25m radius



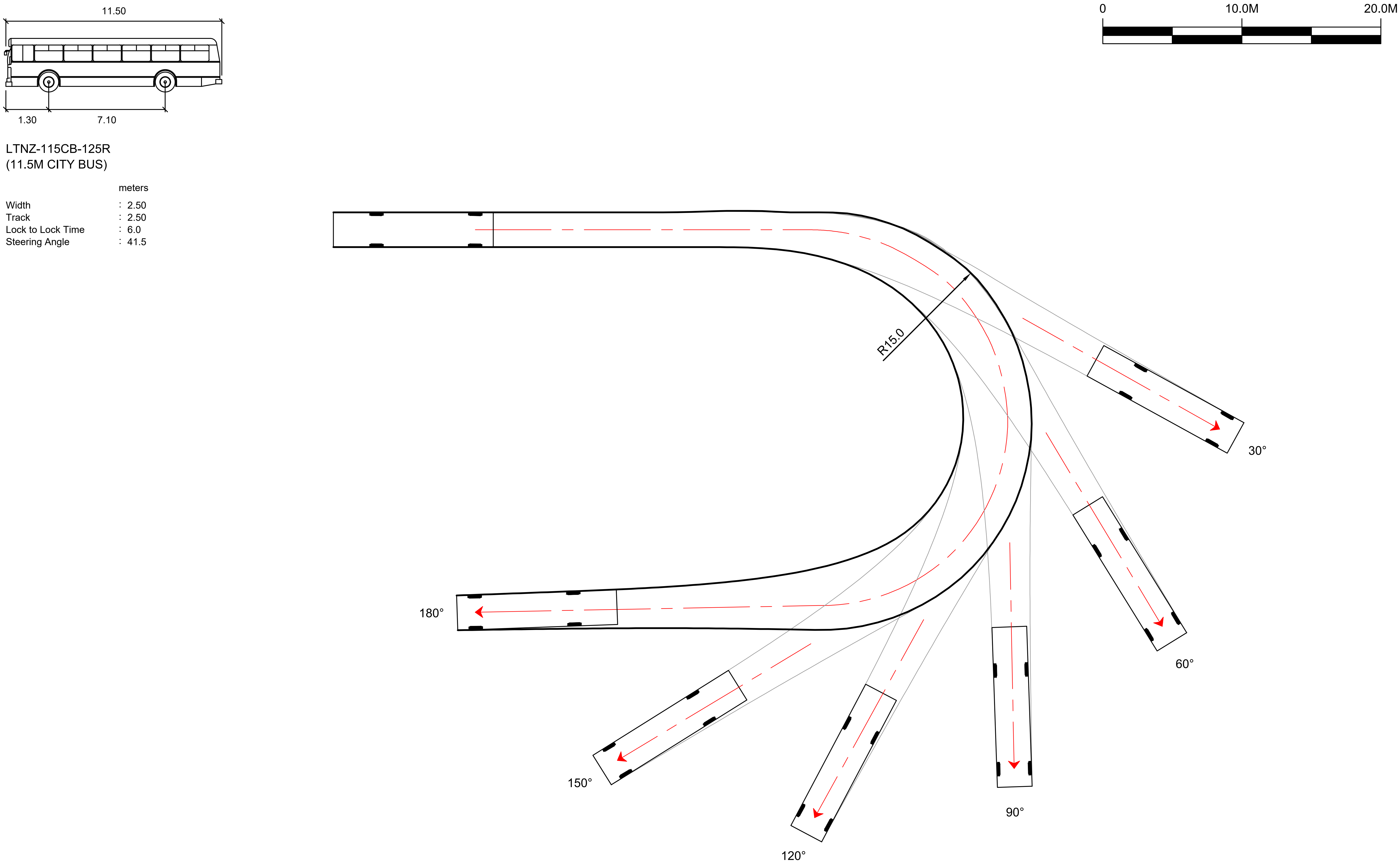
LTNZ-115CB-125R
(11.5M CITY BUS)

		meters
Width	:	2.50
Track	:	2.50
Lock to Lock Time	:	6.0
Steering Angle	:	41.5



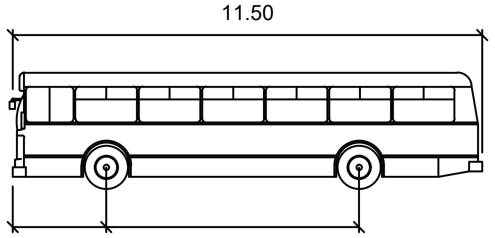
NOTE:
VEHICLE TRACKED AT 15 km/hr

SCALE 1:250 @ A3



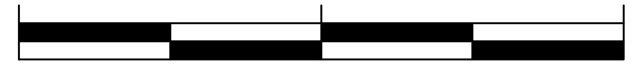
NOTE:
VEHICLE TRACKED AT 15 km/hr

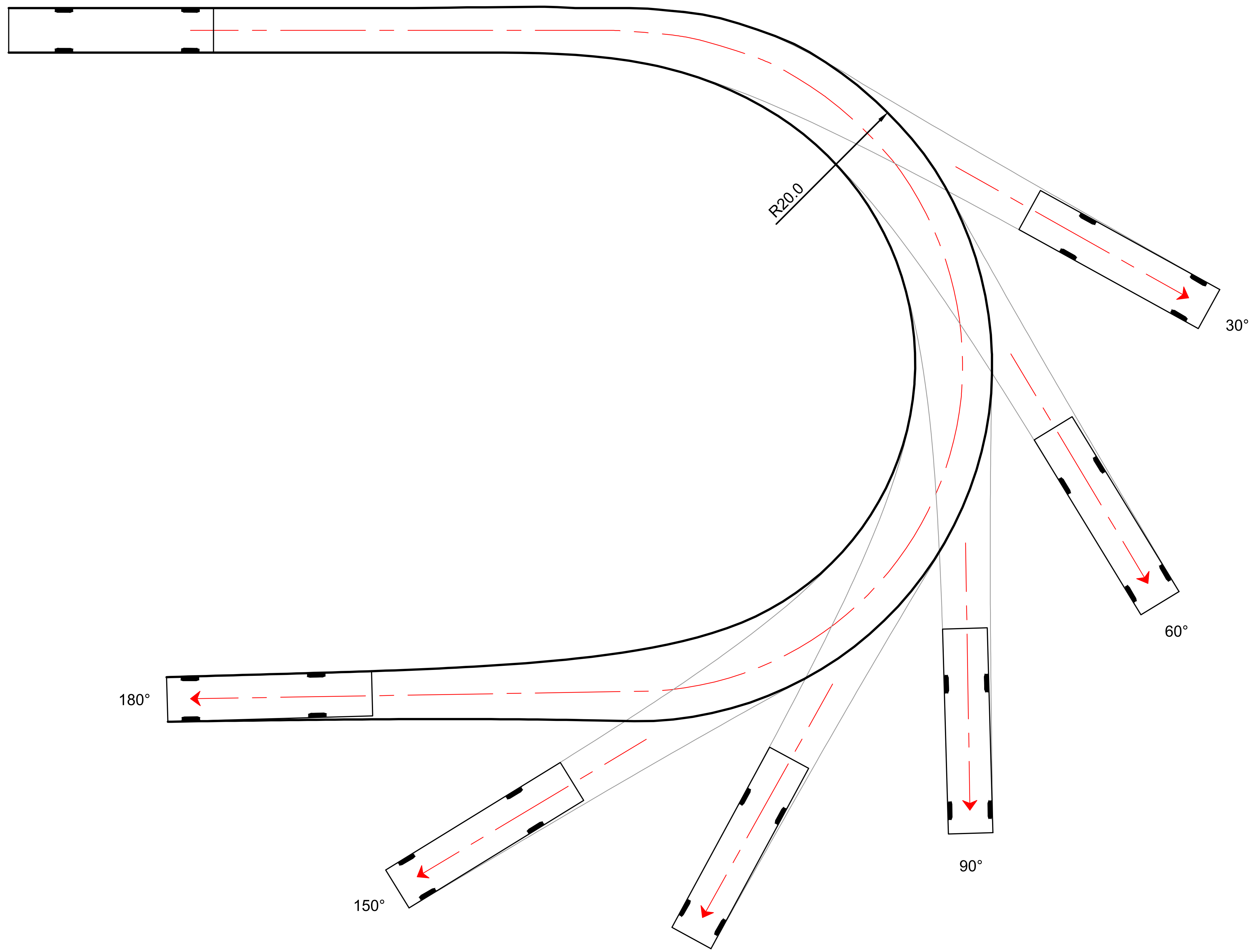
SCALE 1:250 @ A3



LTNZ-115CB-125R
(11.5M CITY BUS)

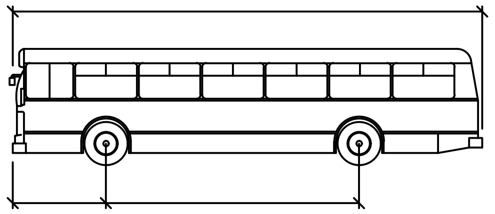
	meters
Width	: 2.50
Track	: 2.50
Lock to Lock Time	: 6.0
Steering Angle	: 41.5





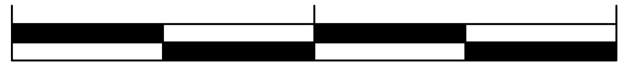
NOTE:
VEHICLE TRACKED AT 15 km/hr

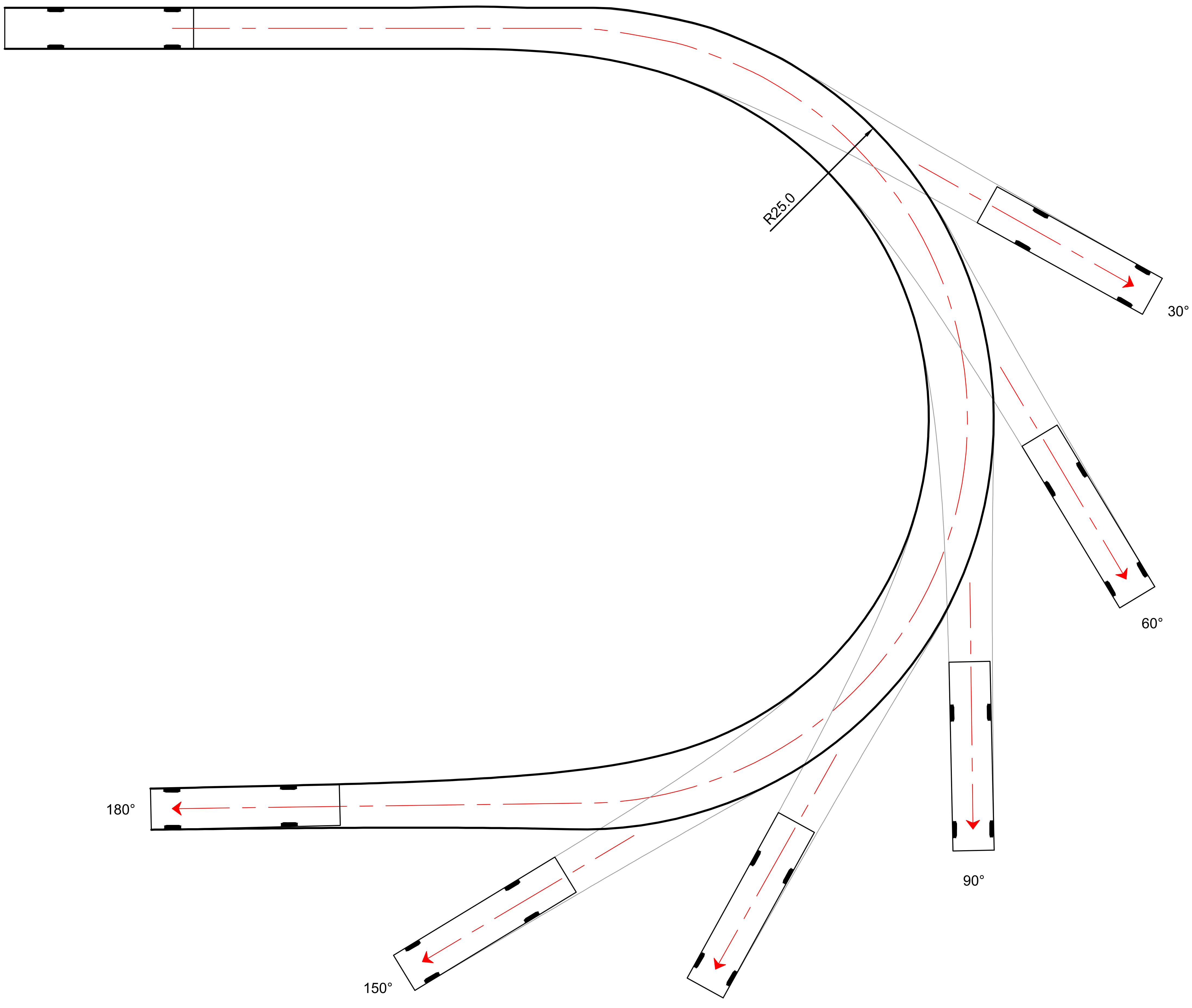
SCALE 1:250 @ A3



LTNZ-115CB-125R
(11.5M CITY BUS)

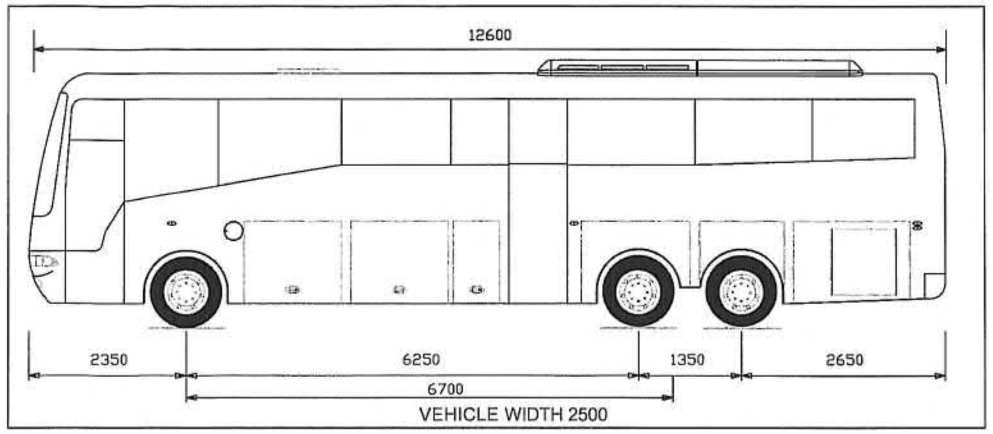
		meters
Width	:	2.50
Track	:	2.50
Lock to Lock Time	:	6.0
Steering Angle	:	41.5



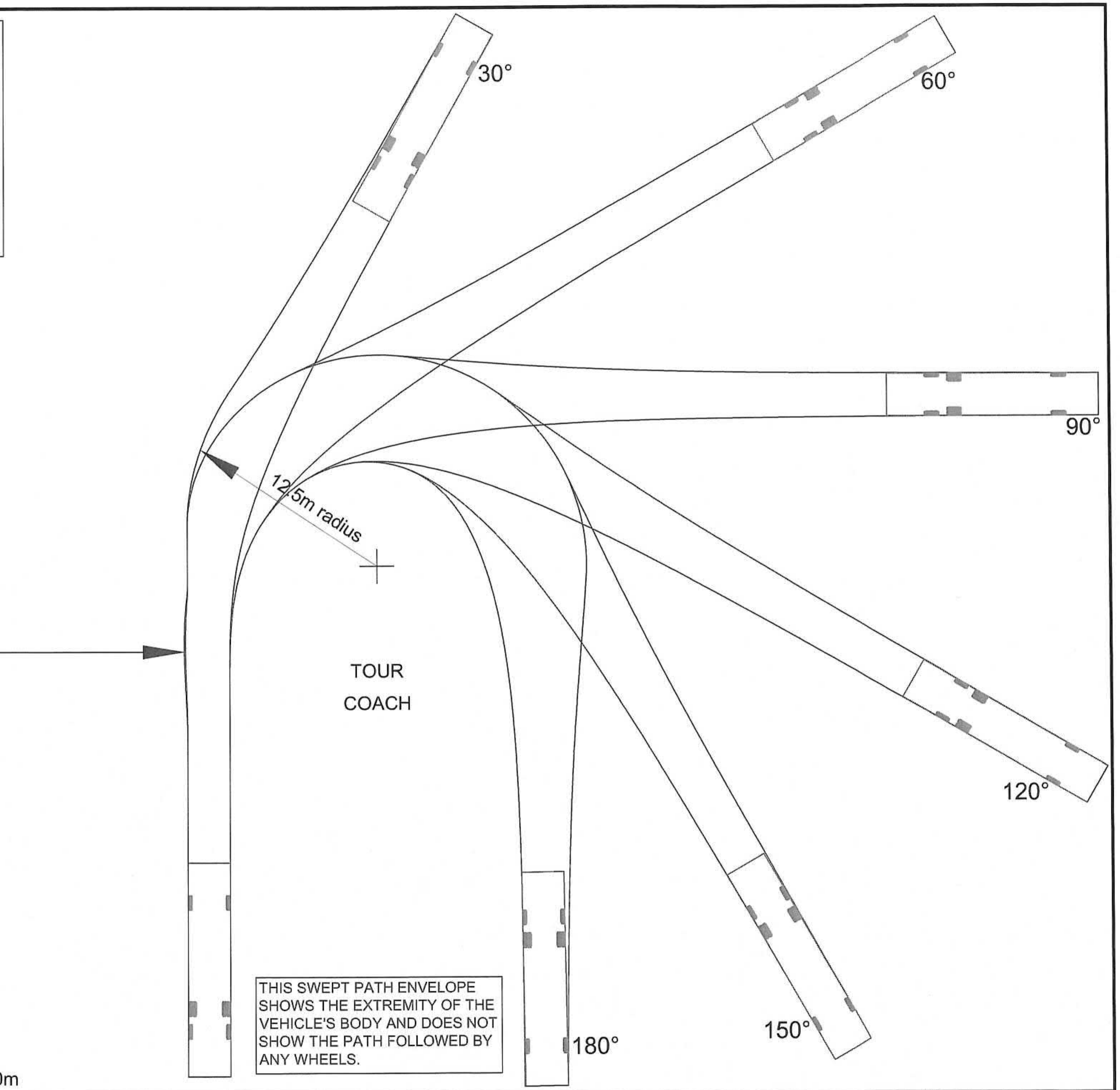


NOTE:
VEHICLE TRACKED AT 15 km/hr

SCALE 1:250 @ A3



DESIGN VEHICLE DIMENSIONS (mm)



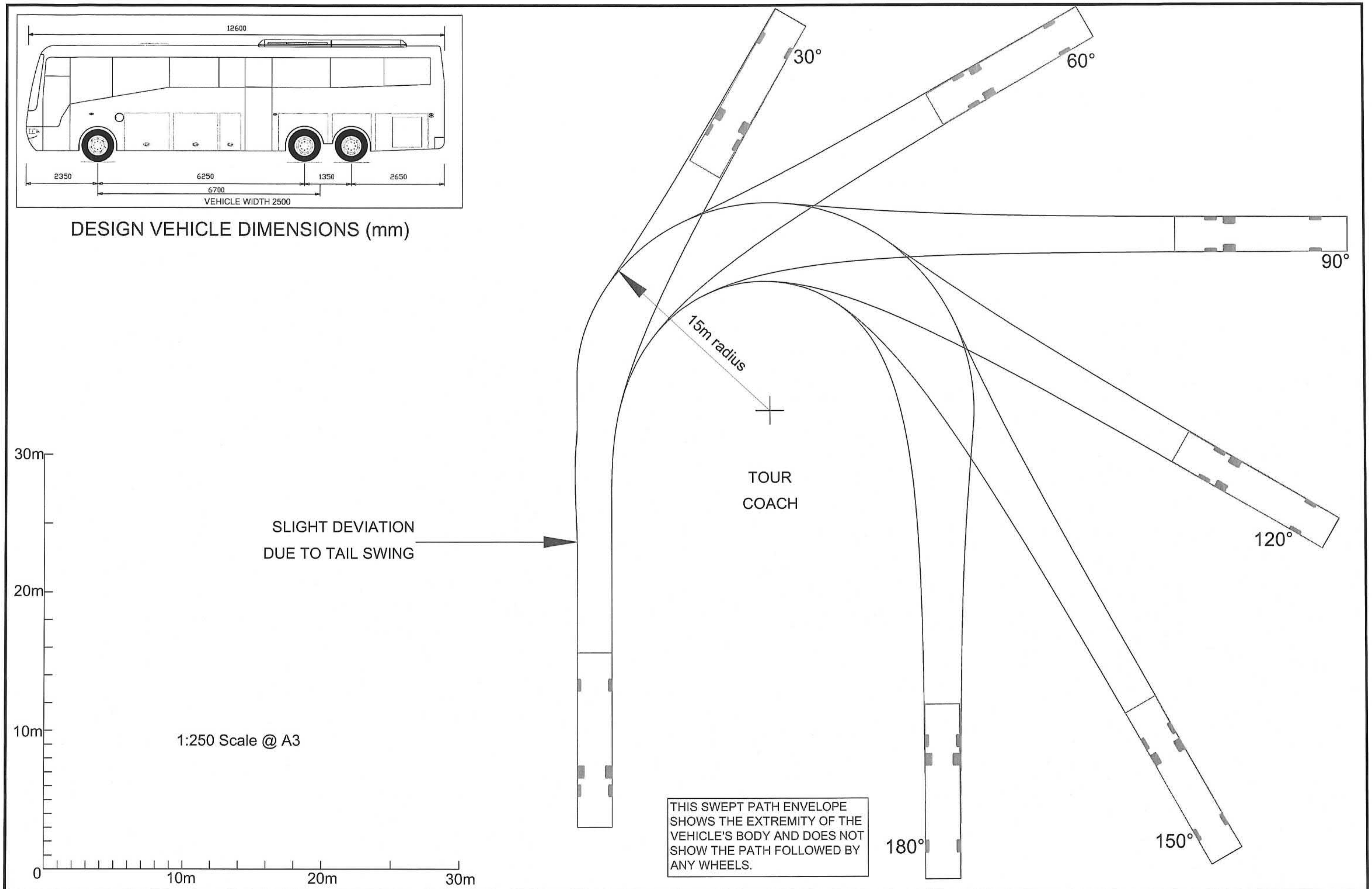
Land Transport NZ
Ikiiki Whenua Aotearoa

2007 ON-ROAD TRACKING CURVES
VEHICLE: TOUR COACH
TURN: 12.5m RADIUS

Recommended clearances (500mm) must be added to each side of the tracking curve (refer to text)

QUICK REFERENCE

- Tour Coach
- 1:250
- 12.5m radius



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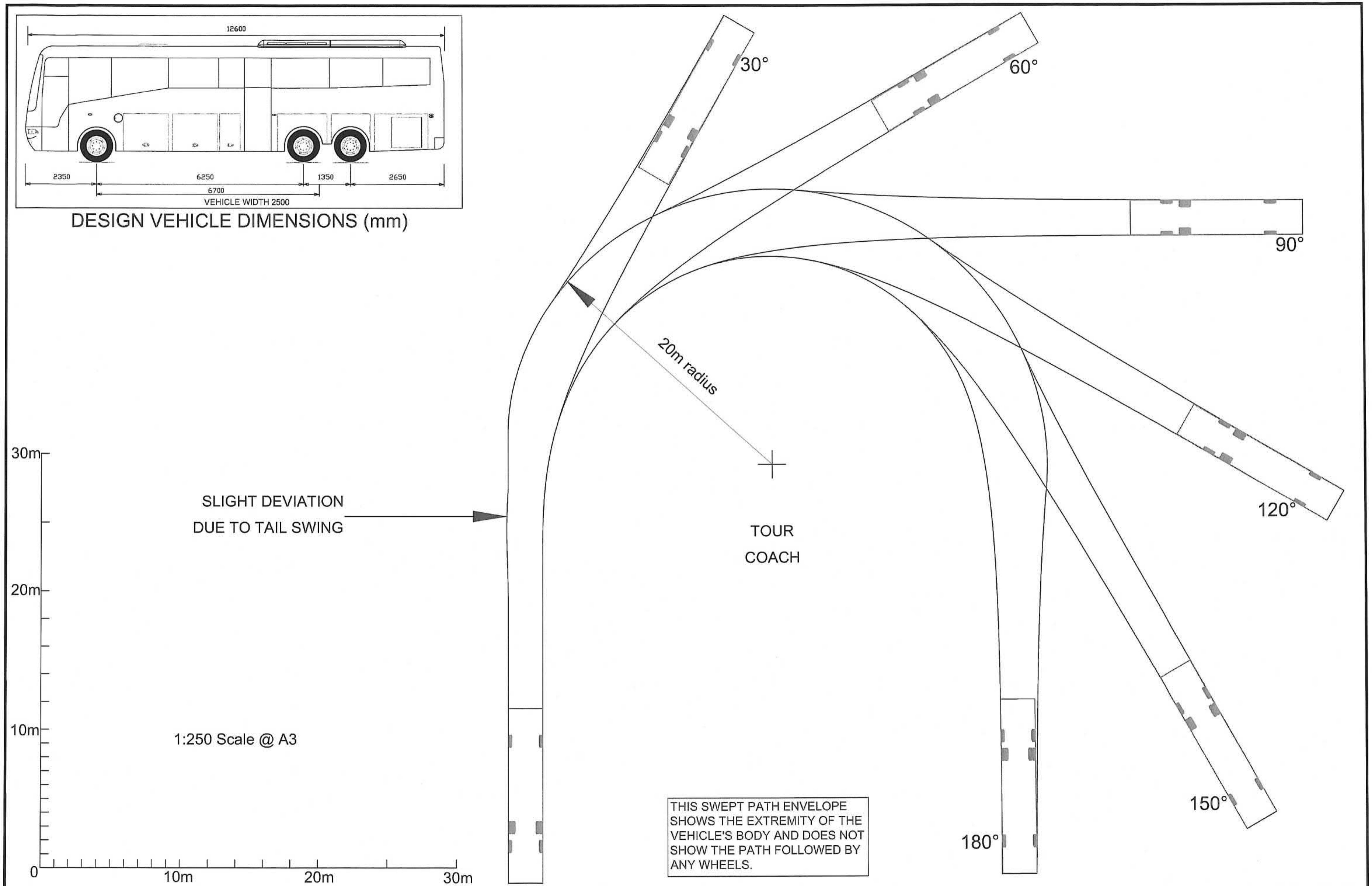
2007 ON-ROAD TRACKING CURVES
VEHICLE: TOUR COACH
TURN: 15m RADIUS

Recommended clearances (500mm) must be added to each side of the tracking curve (refer to text)

QUICK REFERENCE

- Tour Coach
- 1:250
- 15m radius



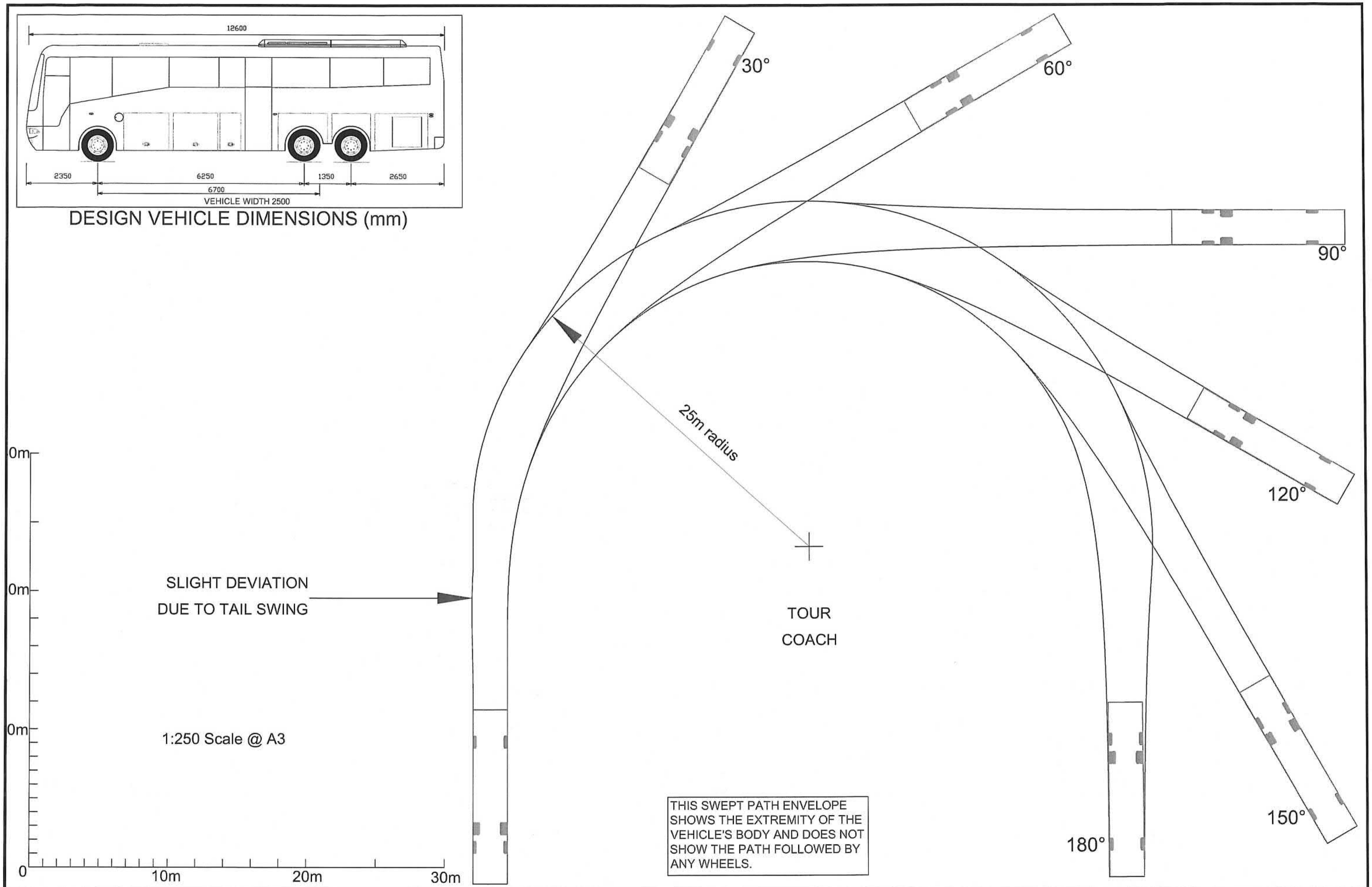
Land Transport NZ
Ikiiki Whenua Aotearoa

2007 ON-ROAD TRACKING CURVES
VEHICLE: TOUR COACH
TURN: 20m RADIUS

Recommended clearances (500mm) must be added to each side of the tracking curve (refer to text)

QUICK REFERENCE

- Tour Coach
- 1:250
- 20m radius



Land Transport NZ
Ikiiki Whenua Aotearoa

2007 ON-ROAD TRACKING CURVES
VEHICLE: TOUR COACH
TURN: 25m RADIUS

Recommended clearances (500mm) must be added to each side of the tracking curve (refer to text)

QUICK REFERENCE

- Tour Coach
- 1:250
- 25m radius