



FEEDLOT DESIGN AND CONSTRUCTION

13. Access and internal road systems

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Introduction

Access to the site and the layout of internal road systems are critical to the efficient and safe functioning of the feedlot.

Access to the site includes the overall layout, infrastructure and facilities at the access point. These may include traffic access from the local road network and the proper level of access control for all personnel, visitors and traffic to the site. Design of traffic access requirements from the road network is usually governed by local government or state authority requirements.

Access control is to secure the site from unauthorised access while optimising authorised vehicular traffic flow. Each feedlot site will have its own set of challenges and security solutions.

The layout of the on site or internal road system has to take into account the mix of vehicles – semi-trailers, road trains, feed trucks, maintenance and other operational vehicles together with tractors and front end loaders – that can all be operating on the internal road network.



Slip lanes may be required on turn-ins from major roads.

Design objectives

The design objectives for feedlot access and the internal road system are to

- provide efficient, functional and safe access to the site
- provide an appropriate level of access control to the site for personnel, visitors and traffic for security and biosecurity purposes
- have an internal road system that is functional and safe in all weather conditions
- have a fit-for-purpose internal road system, with adequate road width, turning radii, drainage, good running surface and no blind corners
- provide adequate sight distance through intersections, curves and crests
- provide good traffic flow around the site with little or no need for vehicles to reverse
- restrict interference between feedlot operating vehicles and irregular delivery vehicles
- reduce the likelihood of incidents or collisions on the site.

Mandatory requirements

Compliance with:

- *National Guidelines for Beef Cattle Feedlots in Australia (MLA, 2012a).*
- *National Beef Cattle Feedlot Environmental Code of Practice (MLA, 2012b).*
- relevant Commonwealth, state and local authority codes, regulations and relevant Australian standards as applicable to the feedlot development.
- National Biosecurity manual for Beef Cattle Feedlots (Animal Health Australia, 2013).

Design choices

Intersection with local road network

Local and state governments generally have criteria by which they judge the significance of the impact of feedlot traffic on the road network. Typically these will involve a threshold increase in road traffic volumes or pavement loads.

Feedlots are sited in rural locations and most likely serviced by rural roads. As feedlots require frequent access by vehicles with high axle loads, upgrades to the local road network are often imposed on feedlot developments. Common requirements include the need for all-weather access, contribution to local authority for road maintenance/upgrades (pavement, culverts, bridges), preferred access routes to the site and upgraded intersections servicing the feedlot to a standardised design. Higher traffic volumes may trigger the need to install a slip or turning lane and/or acceleration and deceleration lanes to cater for the additional truck movements. Figure 1 illustrates typical intersection layout for a road-train configuration.



Turn-in and turn-out onto major road

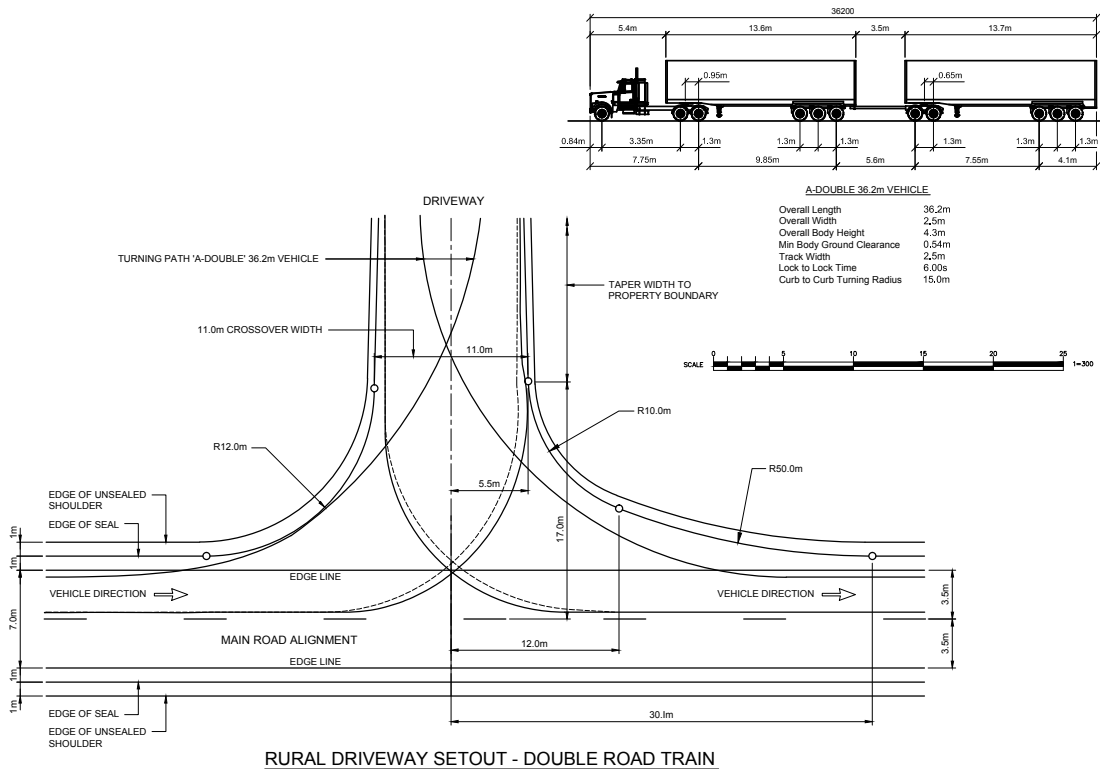


Figure 1. Typical intersection setout for road trains

Because of low ambient noise levels in rural areas (particularly at night) traffic noise may require noise-related conditions, such as curfews on traffic movements or having designated access routes.

Proponents should consult with the responsible authority early in the feedlot planning stages to identify any impacts that the development may have on the local road network and what conditions are likely to be imposed on the development.



Security gate at entrance to large feedlot



Boom gate access control and signage at feedlot entrance



Signs at a feedlot entrance advise entry requirements to the site.

Access control

The term access control generally refers to physical or behavioural measures for managing the passage of personnel and vehicles into, out of and within a feedlot complex. Access control for security and biosecurity purposes should be sufficient to protect the feedlot while still allowing effective access for onsite traffic.

Access control at feedlots typically consists of physical control processes. Passive barriers can secure a site perimeter to limit unwanted access. Access to various buildings (e.g. control rooms, chemical storage) may need to be controlled.

The following measures may be used to control access into, within, and out of a given site, area or building

- Physical barriers
 - fencing
 - boom gate
 - lockable gates and grids
 - surveillance video/still cameras.
- Signage
 - posting ‘Private Property’, ‘No Trespassing’ and ‘Authorised Access Only’ signs
 - posting sign ‘All visitors to this site must report to the office’
 - property sign and contact details e.g. office phone number, UHF channel
 - posting signs indicating biosecurity levels in effect on the site. Placing ‘Restricted entry’ notices on the access points to relevant areas.
- Require all visitors to sign a visitor log and complete a biosecurity assessment form before being escorted to approved areas of operations.
- Establish a system for determining which vehicles may enter the site, which gates or other entrances they may use and under what conditions.
- Designate a parking area for vehicles entering the site, away from traffic areas used by feed trucks, mobile plant and machinery and commodity and livestock delivery vehicles.
- Provide facilities outside the secure perimeter of the feedlot for incoming livestock vehicles to be safely unloaded and the cattle given access to water and feed should they arrive outside normal operating hours.

Further detail on these biosecurity requirements can be found in *Feedlot Biosecurity – Understanding and Implementing the NFAS Guidelines* (ALFA, 2013) and/or the *National Biosecurity Manual for Beef Cattle Feedlots* (Animal Health Australia, 2013).

Internal road system

The internal road system should be considered in the overall site layout design process (see *Section 2 – Site layout*). The objective of the road network is to have a functional grouping of roads to ensure practical, efficient, user-friendly and safe movement around the site.

The following elements should be considered when designing the internal road system.

Traffic routes

The location of feedlot processes will influence the extent and direction of internal traffic. Careful planning and consideration of site traffic routes can result in production efficiencies and a reduction in the likelihood of collisions between vehicles and/or equipment (see *Section 2 – Site layout*). Measures that can be considered to manage traffic flow around the site include

- good sight lines and separation of heavy and light vehicles.
- types of road traffic, typically commodity and livestock delivery vehicles (such as semi-trailers, B-doubles, road trains), internal vehicles (including light vehicles, feed trucks, tractors) and visitor and employee vehicles
- one-way systems reduce the likelihood of collision, reduce congestion and improve traffic movement
- ability to reverse traffic flow dependent of operational/ climatic conditions e.g. dust generation during unloading of commodities
- roundabouts may avoid traffic turning directly in front of oncoming traffic at intersections
- avoid curves and crests for locations of intersections
- minimise 4-way intersections and avoid Y intersections where possible
- provide queuing areas for incoming trucks so as not interfere with moving road traffic during any periods of high volume movement
- provide sufficient area for laydown/parking of heavy vehicles
- provide a light vehicle park area for employees and visitors to the feedlot.

Swept path for turns

When a heavy vehicle turns, the rear of the vehicle covers a wider path towards the inside of the turn than the path of the prime mover. The swept path envelope is the road area covered by the outermost and innermost points of the vehicle during the turn.

Swept path information for the range of vehicles to be operating at the feedlot is needed to provide appropriate and safe access to the various facilities around the feedlot. Semi-trailers and B-doubles are the most common vehicles. Figure 2 illustrates the swept paths for a B-double vehicle at various turning angles.

At a feedlot, sufficient room is needed for feed trucks to turn around at the end of one row of feed bunks and then straighten up before starting to feed the next row. Room may be needed for side loading or end loading of livestock vehicles. Figures 3 and 4 illustrate the turning area required for a typical feed truck at the end of a feed road to turn around and straighten to deliver feed to the bunk. Turning circles should be as large as practical with a minimum radius of about 10 m; the tighter the turning radius the greater the damage to the road surface and scrubbing of vehicle tyres.



Turn-in and turn-out from feedlot access road onto minor rural road – sufficient area is provided for vehicle turning.

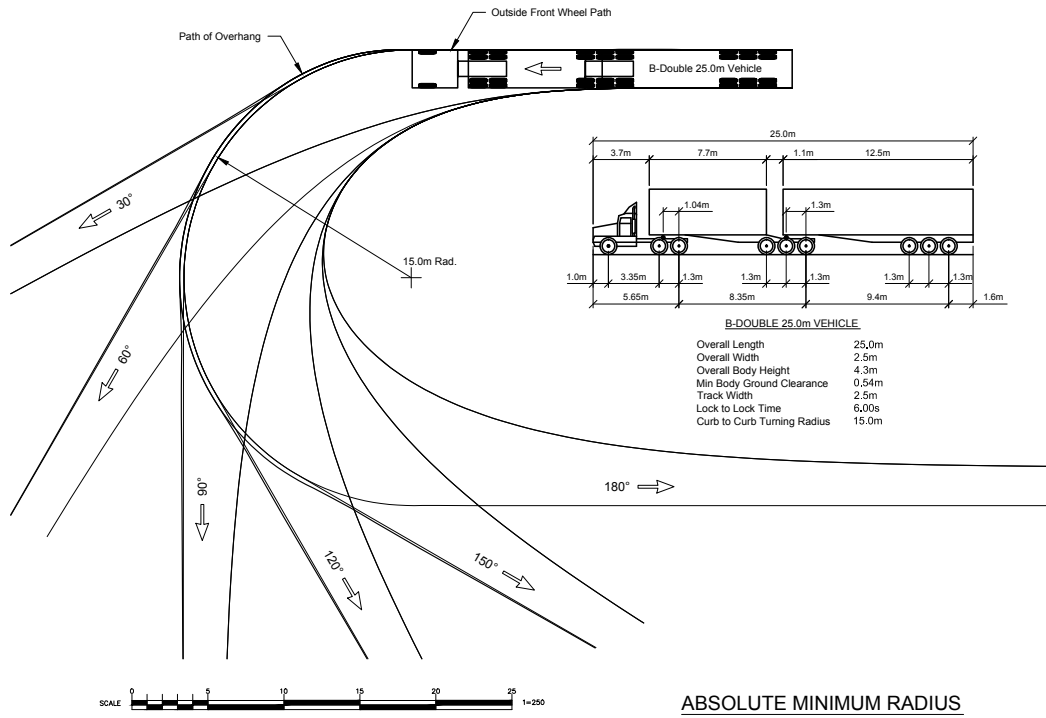
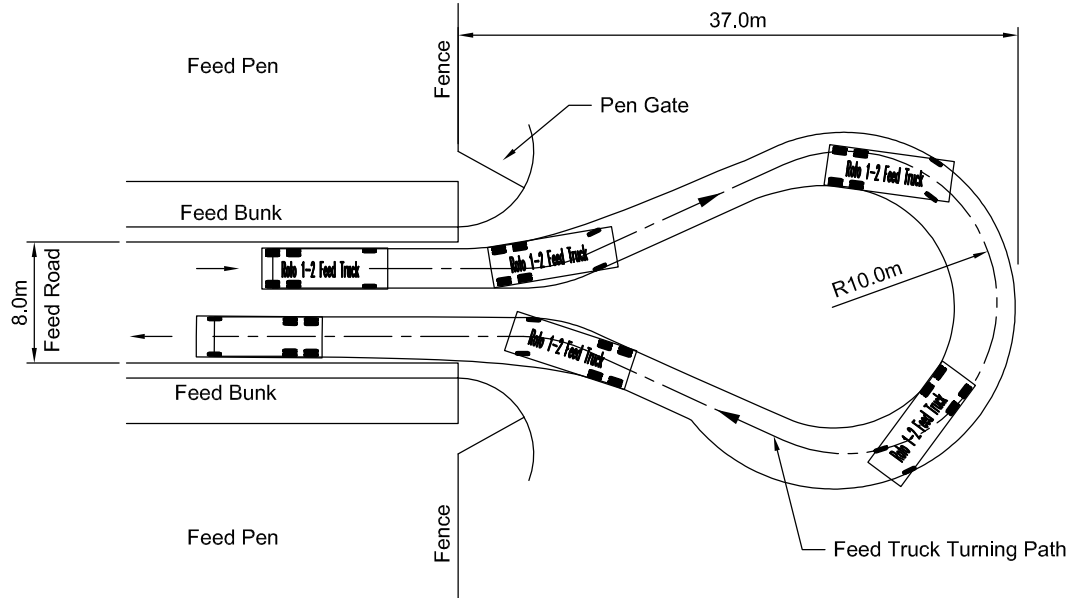


Figure 2. Swept path for B-double truck

Figure 3. Swept path for typical feed truck in a back to back pen layout



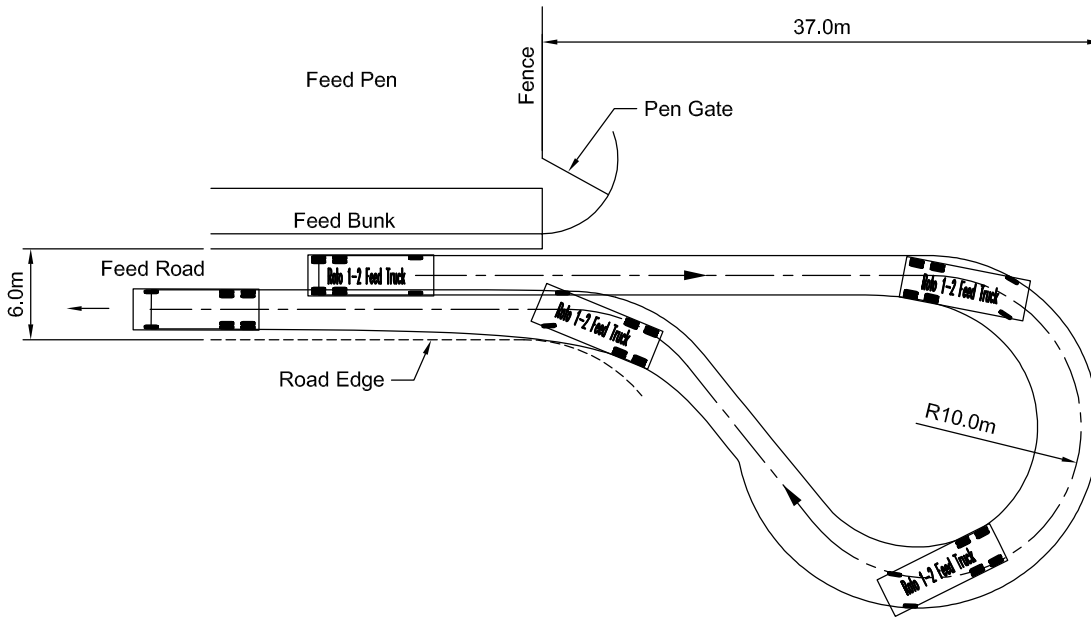


Figure 4. Swept path for typical feed truck in a sawtooth pen layout

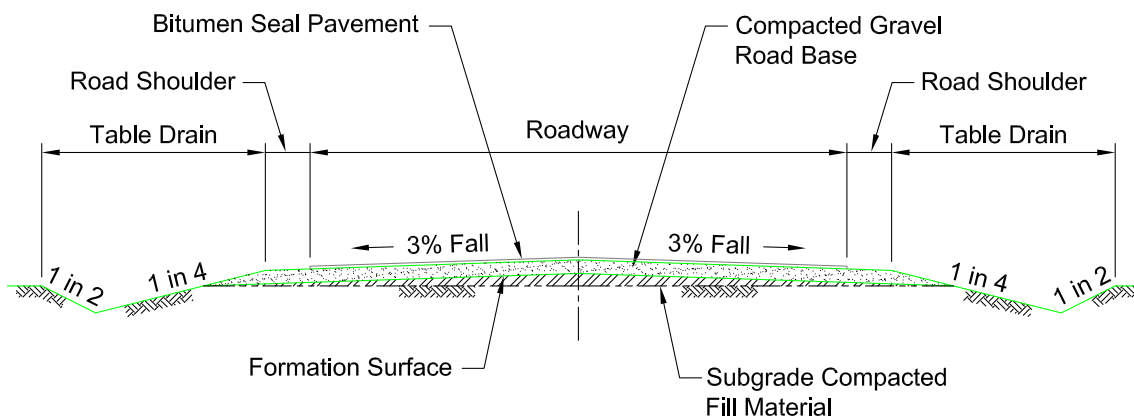
Width

Internal roads should generally be designed to be about 3.5 times the width of the largest vehicle to allow vehicles to pass safely. Hence, road widths of about eight metres are typical although a width of four metres would be appropriate for one-way roads. The typical cross sections of on site feedlot unsealed and sealed roads are illustrated in Figures 5 and 6 respectively. Note the variation in crossfall for drainage between the unsealed and sealed cross sections.



Internal roads should be wide enough to allow vehicles to pass safely.

Figure 5. Typical sealed road cross section



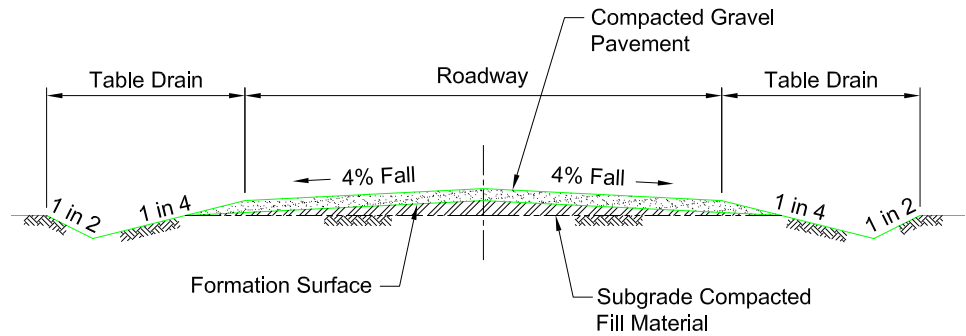


Figure 6. Typical unsealed road cross section

Vehicles using the road system

The interaction of heavy and light vehicles on the internal road system may increase the likelihood of incidents. Where possible separate roads should be provided for light vehicles.

Safety

Signage and delineation should be provided to guide drivers. Intersections should be signed in advance with warning signs and directional signs; speed limits should be set and managed in accordance with the road hierarchy and function.

Crossfall and camber

Poor crossfall or camber may result in the buildup of loose material on the outside of a road curve, creating a potential safety hazard. Good camber will assist driver comfort and safety in travelling around curves, and will minimise the buildup of loose material.

Drainage

Without good drainage, roads will start to degrade quickly. Where possible, table or V drains should be constructed to remove the run-off water from the edge of the road. See Section 17 – Pen and road surfaces.

Intersections

Traffic entering most intersections is allowed to cross, enter on to, or exit from one direction into any other, and this increases the risk of conflicts unless the design of intersections is kept simple. A simple T-intersection has half the crossing conflict points (3) when compared to a 4-way intersection (16) as shown in Figure 7. Y-intersections are not desirable as they allow for high speed movement through intersections with limited visibility. Y-intersections should be realigned into T-intersections as shown in Figure 8.



Signage illustrating the site layout and traffic flow and other site entry requirements helps new drivers.



Staggered T-intersections have fewer conflict points than 4-way intersections.

Intersection location

Road intersections on curves and crests should be avoided as these can restrict visibility for drivers entering the through road as shown in Figure 9. Vegetation e.g. shrubbery should not be planted at an intersection or should be lowered to avoid masking of light vehicles. A separation island in the side road avoids the cutting of the corners through the intersection.

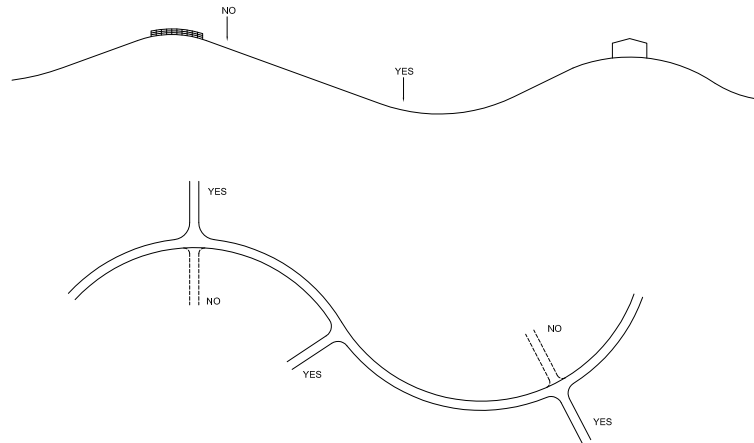


Figure 9. Location of intersection on crests and curves

Number of intersections

As a feedlot expands, new roads may need to be built to gain access to various locations on the site; this may increase the number of intersections, increasing the risk of incidents. Consider closing off roads with clearly visible earth bunds if they are not required operationally.

Other factors

Factors such as the road width, swept path, pitch, gradient and camber of roads affect vehicle stability, road damage and traffic flow. Other factors include fitting the road to the natural contours of the land, number of lanes, sight distance, livestock and feed truck turnarounds and the practicalities of feedlot access and safety.

Sight distance is important at critical locations such as at tight curves and intersections. Sight distance is influenced by road geometry and obstructions on the roadside e.g. vegetation, fences, buildings. Safe stopping sight distances for unsealed roads are longer than those for sealed roads.

Speed limits

Speed limits are necessary for safety near buildings and high foot traffic areas and to minimise dust generation, but they should be realistic and consistent without too many variations. As a guide, usually two or three different speed limits are sufficient. Limits could be 20 km/h for pedestrian areas and narrow roads, but higher where dust is not a problem and where there are few vehicles going in different directions.



Signage at the feedlot entrance to advise of the security and entry requirements and vehicle speed limit on the site.

Signage

Road signs are low cost items and should be used appropriately to warn motorists of potential hazards. All signage on site should conform to the relevant Australian Standard (AS1742) to create a consistent road environment that informs the driver. Signs should be the correct size and reflective without having multiple signs that convey the same message. Intersection signage should be consistent in its application, 'Stop' or 'Give way' signs installed at all intersections, 'Keep left' signs installed on earth berms, information signs installed where required, and warning signs installed at the correct locations.

Delineation

Delineators in the form of guideposts may be installed on roads. Guideposts should be spaced consistently with red reflectors on the left hand side and white reflectors on the right hand side.

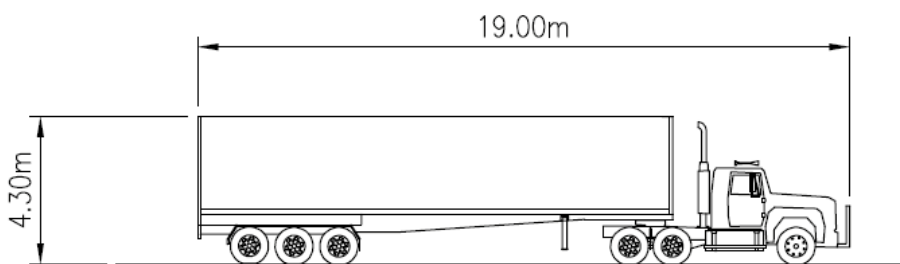
Road surfacing

The design and construction of road surfaces are important for their long-term performance. One of the fundamental ingredients for a successful road surface is a strong and stable underlying subgrade. Any surface will have reduced life if the subgrade or the surface sub-layers are weak through inadequate design, poor quality materials, poor construction techniques or poor maintenance practices.

Typically, road surfaces are unbound natural material such as gravel with or without surface sealing. *Section 17 – Pen and road surfaces* provides information on road surfacing.

Typical truck dimensions

Typical dimensions of semi-trailer, B-double and road train are shown in Figures 10, 11 and 12 respectively.



Single Articulated	19.0m
Overall Length	19.00m
Overall Width	2.50m
Overall Body Height	4.30m
Min Body Ground Clearance	0.54m
Track Width	2.50m
Curb to Curb Turning Radius	12.50m

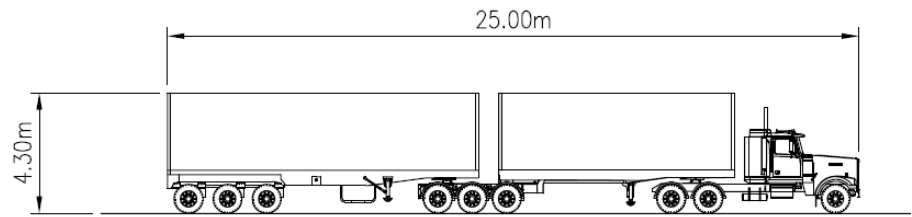
Figure 10. Dimensions of 19 m semi-trailer



Concrete pavement on feedlot access road to prevent road damage caused by heavy vehicle traffic at turn-in and turn-out

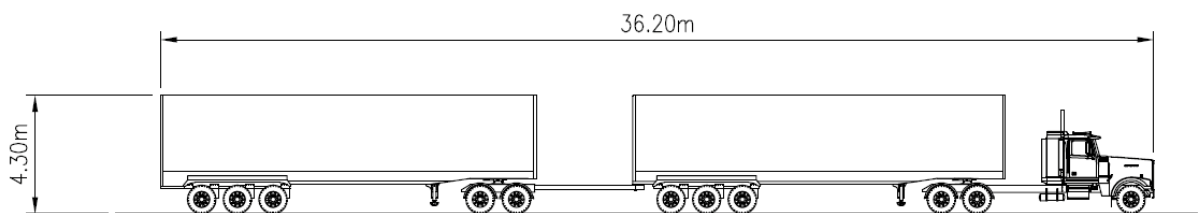


Unsealed road with a well-maintained and shaped crown, shoulder and v-drains



B-Double 25.0m	
Overall Length	25.00m
Overall Width	2.50m
Overall Body Height	4.30m
Min Body Ground Clearance	0.54m
Track Width	2.50m
Curb to Curb Turning Radius	15.00m

Figure 11. Dimensions of 25 m B-double



A-Double 36.2m	
Overall Length	36.20m
Overall Width	2.50m
Overall Body Height	4.30m
Min Body Ground Clearance	0.54m
Track Width	2.50m
Curb to Curb Turning Radius	15.00m

Figure 12. Dimensions of 36 m A-double (Road train)

Quick tips

- Consult with the responsible authority early in the feedlot planning stages to identify any impacts that the development may have on the local road network.
- Access control is critical for security and biosecurity purposes. Establish a system that determines which vehicles may enter the site, which entrances they may use and under what conditions.
- Consider the internal road system and traffic flow in the overall site layout during the design process.
- Vehicles of various sizes and configurations enter feedlots. This may include heavy vehicles such as semi-trailers, B-doubles and road trains, medium rigid vehicles such as feed trucks, tractors and light vehicles.
- Minimise the number of 4-way intersections and avoid Y-intersections to reduce the likelihood of collisions.
- The on site road network should have adequate road width, turning radii and good running surfaces for the vehicles expected.
- Avoid road intersections on curves and crests as these restrict visibility for drivers.
- Avoid planting trees or shrubbery at an intersection as these can mask light vehicles.

Further reading

- ALFA, 2013, Feedlot Biosecurity – Understanding and Implementing the NFAS Guidelines, ALFA, Sydney.
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- Standards Australia, AS1742.3-2009 - Manual of uniform traffic control devices - Traffic control devices for works on roads.
- Standards Australia, AS1742.14-1996 - Manual of uniform traffic control devices - Traffic signals.