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# Design of Fencing and Walls



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# Contents

# Document Control

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# Amendments

| Revision Number | Revision Date | Description of Key Changes | Section / Page No. |
|---|---|---|---|
| 5 | 24-October-2024 | Pastoral Cattle Fence Details added.<br>Reference to Fibre Cement Fence removed.<br>Guideline Converted to PDF format. | All |
| 4C | 09-Feb-2012 | Table 1 - Fibre Cement Fence not for use for new installation All - Reference: Austroads Guide to Road Design Part 6A: Paths for Walking and Cycling updated 1.1.3 - Reference: Policy and Applications Guidelines Stock Crossing updated 1.1.11 - PTA Contacted 1.1.12 - New Section added 3 - Reference updated. | 4.1 |
| 4B | 19-Feb-2020 | Drawing 200331-0107 amended. | 1 |

# 1 FENCING

This document specifies current Main Roads practice in the design of fencing and walls within road reserves.

Fences along and within road reserves is generally used to control entry or crossing of the roadways by vehicles, pedestrians, or animals.

The fence may also be a combination of noise and screen walls along the alignment. Other design requirements should be as per typical fence details shown on the Main Roads standard drawings listed below in Table 1.

| Fence Type | Fence Use | Drawing Numbers |
|---|---|---|
| 1200 Chainwire Fence | This type of fence should generally be used for maintenance purpose or matching with existing fencing. 1400 Chainwire fence is the preferred fencing for Principal Shared Paths (PSP), Dual Use Paths (DUP) and Footpaths. | 200331-0106 - Gate and Strainer Assembly Details<br><br>200331-0109 - Strainer and Post Details |
| 1400 Chainwire Fence | This type of fence is generally recommended to control pedestrian and cyclist access. For example, this fence is normally used along Principal Shared Paths (PSPs), Dual Use Paths (DUPs) and Footpaths on the roadside of the path without affecting both the vista and visibility. | 201431-0037 - Gate and Strainer Assembly Details<br><br>200331-0109 - Strainer and Post Details |
| 1800 Chainwire Fence | This type of fence is generally recommended along Footpaths and Shared Used Paths (SUPs) on the property boundary side of the path. It is also often used along industrial properties and drainage basins with permanent water. | 200331-0107 - Assembly Details<br><br>200331-0109 - Strainer and Post Details |
| 2400 Chainwire Fence | This type is of fence recommended where the risk of crossing is high, and it is possible for pedestrians to jump over other fence types. (e.g. Along medians of high speed, high traffic volume roads adjacent to school entrances if pedestrian crossing is further away from the entrance). | 200331-0108 - Assembly Details<br><br>200331-0109 - Strainer and Post Details |
| 1200 Agriculture Fence | This type of fence is typically used in rural areas to control entry of animals into the road reserve. | 200331-0096 - Agricultural Fencing Detail<br><br>200331-0097 - Prefabricated Fencing Details<br><br>200331-0098 - Plain Fencewire Details<br><br>200331-0099 - Pastoral Cattle Fence<br><br>200331-0110 - Fauna Fencing Details |

**Table 1 Typical Type of Fence**

Apart from the specific requirements shown on the typical drawings and in the above table the following general requirements also should be considered:

- Posts are positioned on the road reserve side of fence.
- Intermediate posts to be equally spaced.
- All strainers shall be offset so the fence wires follow a straight line.
- Horizontal railing is permitted only if the fence is located outside the clear zone. (*This type of fence should be used with caution even outside of the clear zone.*)
- Requirement for fencing where PSPs or DUPs is located in close proximity to steep batters should be as specified in Austroads Guide to Road Design Part 6A: Paths for Walking and Cycling.
- An offset of 1.0m (minimum 0.5m) should be provided if used along PSPs and DUPs as per Austroads Guide to Road Design Part 6A: Paths for Walking and Cycling.

## 1.1 Fencing of Road Reserves

Fencing of urban road reserves should be considered on all freeways and control of access highways, to control entry or crossing of the roadways.

Fencing requirements for other road categories shall be determined on an individual basis considering factors such as: safety risks, social aspects, aesthetics, cost, and local circumstances.

### 1.1.1 Freeways and Control of Access Highways

All roads designated as freeways and control of access highways in urban areas should be fenced along the whole alignment to prevent access to the road reserve. Fences should be placed adjacent to, but on the road reserve side of the property line. The type of fence should be determined in accordance with local circumstances and shall be approved by Main Roads.

### 1.1.2 Fencing For Fauna Underpasses

Fauna underpasses are generally provided where a road obstructs fauna movements between large, well vegetated, areas that extend past the road reserve fence and where migration of critical fauna species is expected. Fences to control and guide fauna towards and through the underpasses and prevent crossing at other locations shall be erected. A minimum 1200mm high galvanised chainwire mesh fence, with top and bottom salvages knuckled, or agricultural fence is recommended to guide the fauna species towards the underpasses and prevent road deaths.

The construction details of animal underpasses and warrants for construction are presented in Guide to the Design of Fauna Underpasses.
Typical fence details are described in Section 1.1.3 and are shown on Main Roads Drawing No's 200331-0097, 200331-0098, and 200331-0110.

### 1.1.3 Wildlife Fences

Wildlife fences, to keep animals off the road, are usually considered on urban and rural roads to improve the safety of the traffic movements. If however the continuous fence may create undesirable effects on animal life appropriate underpasses should be considered in accordance with the Policy and Applications Guidelines Stock Crossings.

The wildlife fence must tie into fauna underpass wing-walls, bridge abutments or ends of noise walls where applicable. Cost and effectiveness of fencing should be always weighted against the alternative of erection of warning signs.

Wildlife fences must be designed in accordance with Drawing No 200331-0110 -"Fauna Fencing Details".

The location and type of fence required will be determined in accordance with the recommendations of the Environmental Management Plan for the project. The standard fencing should be modified for a particular type of fauna such as:

- Kangaroo Fence - The fence shall be 1800mm high and buried into ground to at least 500mm deep at an angle.
- Rabbit Proof Fence - 50mm wire apertures are recommended and buried into ground to at least 350mm.
- Snake Proof Fence - Wire apertures to be determined in consultation with the Department of Biodiversity, Conservation and Attractions (DBCA).

Advice from the DBCA must be obtained prior the design of wildlife fences.

### 1.1.4 Drainage Basin Fences

In built-up areas, all drainage basins should be fenced where readily accessible to pedestrians (eg adjacent to a path- or cycleway). The fence should be fitted with a locked gate suitable for access by maintenance crews, plant, and equipment.

The type of fence to be used is site specific and depends on the level of protection required but should generally be 1200, 1400 or 1800mm Chainwire fence. If a drainage basin is located outside road reserve on local government land, then local government requirements should be met.
If a drainage basin is located within the clear zone and steep slopes are a hazard to motorists, a safety barrier may be required. For details refer to Main Roads Supplement to Austroads Guide to Road Design - Part 6 Roadside Design – Safety and Barriers.

### 1.1.5 Work Construction Site Fences

Where any person is at risk because of construction work, suitable fencing shall be erected in accordance with Occupational Health and Welfare Regulations 1996.

If a Nuclear Density Meter (NDM) is to be used on a construction site and stored in a shed, it shall have a 2050mm high, galvanised chainwire mesh fence with lockable gate, around the shed. The fence shall be in accordance with Specification 100 General Management Requirement, Section 103.06 and Drawing No. 9034-2071.

Rubbish tips on work sites shall be surrounded by a 2050mm high chainwire mesh fence as per Drawing No. 9034-2071.

### 1.1.6 Protected Sites Fences

During construction all protected sites identified and nominated in the Environmental Management Plan, including rare flora and fauna habitats and heritage sites, in the vicinity of

construction works shall be fenced to minimise the risk of site degradation during construction. The recommended fence type is 1200mm high chainwire fence.

### 1.1.7 Fencing of Bus Stations

Chainwire fence 1400mm high (Drawing No. 201431-0037) should be provided along full length of boundary with the main road for safety and pedestrian control. Exceptions should be guided by engineering judgement particularly in areas with natural barriers such as precipitous slopes or other natural barriers. The detailed design should be produced in consultation with relevant authority (e.g. PTA).

### 1.1.8 Fencing Adjacent to High-Risk Areas

If persistent trespassing is expected at some high-risk locations such as school sites, a 2400mm chainwire fence should be installed as per Drawing No. 200331-0108 to discourage crossing. If sufficient clearance to the fence cannot be provided the fence should be frangible not to spear a vehicle.

Generally, school sites are not fenced. However, if the school site is located adjacent to a main road or highway and the risk for collision is high, a 1400mm chainwire fence is recommended.

For fencing requirements for pedestrian and cyclist facilities refer to Main Roads WA Supplement to Austroads Guide to Road Design Part 6A: Paths for Walking and Cycling.

### 1.1.9 Fencing Adjacent to High Voltage Powerlines

Sections of fence or metallic pipe constructed in parallel to high voltage distribution and transmission lines are potentially at risk of induction (transfer of voltage from one circuit to another without a direct connection). The minimum offset of fencing running parallel to the high voltage power line depends on number of factors such as:

- Horizontal distance to the fence line,
- Vertical height of the fence,
- Length of fence running parallel to the conductor/power line,
- Post, strainer and fence material,
- Conductor type and electrical parameters of the power line.

As a general guide for sections of fence up to 200m, a risk of induction is minimal. However, it is recommended to conduct a study of fault current levels for each specific case and to consult with Western Power's Environmental and Land Manager.

For sections greater than 200m in length where wooden posts are used, the following safety measures should be implemented:

- Separate sections in smaller sections up to 200m and isolate each section from another,
- A galvanised steel earth stake 1800mm long is required for each end and in the middle of each section fully driven into the ground and connected to the fence using galvanised wire and bolts to reduce the risk of corrosion.

### 1.1.10 Fencing Adjacent to Electrified Rail Reserves

Sections of fencing constructed adjacent to an electrified rail reserve are potentially at risk of induction (transfer of voltage from one circuit to another without a direct connection) and require certain offsets from mast structures to prevent trespassers from intruding into the electrified area or gaining access to live equipment.

The Public Transport Authority (PTA) has separate specifications and standards for the design and installation of fencing adjacent to electrified rail reserves, which shall be met.
These are: -

- Document No. 8110-800-047 - Procedure for Boundary Fences in the Electrified Area; and
- Document No. 8880-400-001 - Specification for Fencing of the Urban Railway Reserve.

All proposed new fencing installations or replacements in the electrified area shall be subject to review and sign off by PTA.

### 1.1.11 Fencing Adjacent to Bridges

Bridge sites could attract road users to stop and rest especially the bridges with significant historical and heritage values and scenic views. It is important that the bridge surroundings are designed to be safe to be used by all user groups especially children, youths, seniors, and people with disability.

A risk assessment should be undertaken and the identified hazards to be eliminated or protected by appropriate barrier or fence. For fencing requirements for pedestrian and cyclist facilities refer to Main Roads WA Supplement to Austroads Guide to Road Design Part 6A: Paths for Walking and Cycling.
Additional factors to be considered but not limited to are listed below.

- Fence as a barrier in preventing accessing hazardous areas to carry leisure activities such as fishing, kayaking, surfboarding etc.
- Fence as a barrier in preventing the high risk of drowning.
- Fence as a barrier in preventing accessing steep abutments and embankments which may cause trip hazards.
- Fence as a barrier in preventing graffiti and vandalism.

### 1.1.12 Other Types of Fences

For specific projects where visual harmony with the background is essential or if minimal disruption of view to motorists is required, PVC coated fence, timber fence or a colour-bonding may be specified.

If a road alignment is in the vicinity of a golf course a fence should be considered. The height and type of fence should be based on a quantitative risk assessment for the specific project, to reduce the risk of injury or damage to vehicles to a level acceptable to the community.

## 1.2 Fencing Road Reserves on Highways and Main Roads in Pastoral Areas

In many pastoral areas it has been found more practical and economical to fence the road reserve instead of providing stock grids. In these situations, main roads and highway reserves may be fenced, provided the pastoralist agrees to accept responsibility for the maintenance and future replacement of the fence. Where the cost of fencing exceeds the cost of providing grids, fencing may be carried out under a cost sharing arrangement between Main Roads and the pastoral leaseholder. Where the cost of fencing is less than the cost of providing grids, Main Roads will normally fund the full cost of fencing.

The advantages of fencing road reserves from adjoining pastoral leases are:

- Improved safety for the road user by preventing livestock from wandering onto the carriageway.
- Roadside vegetation is conserved as it is protected from grazing stock.
- Indiscriminate use and/or trespass of adjoining pastoral land is discouraged.
- The fenced road reserve provides defined access points to the adjoining lands. In some instances, fencing may be warranted in agricultural areas as well if land is used for pasture.

For more information on funding arrangements refer to Operational Guideline No 81 - "Fencing Road Reserves on Highways & Main Roads in Pastoral Areas". A copy of this document may be obtained by reference to the Online Documents contained in iRoads.

### 1.2.1 The Standard Fence

The concept of a "The Standard Fence" has been adopted for different pastoral areas of the State. The typical standard fences are shown on the following drawings: -

- 200331-0097 1200mm Agricultural Fencing Details Prefabricated Fencewire Details
- 200331-0098 1200mm Agricultural Fencing Details Plain Fencewire Details
- 200131-0099 Pastoral Cattle Fence
- 200331-0101 Timber Strainer and Post Details
- 200331-0102 Steel Pipe Strainer and Post Details
- 200331-0103 Steel Angle Strainer and Post Details

The Regional Director may approve a variation to the standard fence. For more details refer to Operational Guideline 81.

The installation of electric and solar devices for animal control as part of a fence, may be considered, providing the fence complies with the AS 3014-2003 - "Electrical Installations - Electric Fences" and Local Government By-Laws and Western Power Requirements.

### 1.2.2 Maintenance

Maintenance of the fence and future replacement of the fence shall be the responsibility of the lessee / pastoralist.

### 1.2.3 Water Severance Caused by Fencing

Water Severance occurs, as described in Operational Guidelines No 81, where a single water point in the paddock is located on one side of the road and stock must cross the road to reach it. When

the road reserve is fenced, stock on the opposite side of the road will no longer have access to the water point and alternative arrangements will need to be made. This could include piping across the road with a new trough, or the installation of a new water bore and the necessary equipment.

The Regional Director will negotiate with the leaseholder and any contributions from Main Roads will depend upon several factors including:

- Who initiated the proposal to fence the road reserve?
- Distance of the water point from the road (greater distance warrants less contribution),
- Traffic safety.

### 1.2.4 Fencing For Stock Underpasses

Where stock underpasses are proposed a fence to guide and control stock towards the underpasses, as described in 1.1.2 or similar, should be provided. The type of fence should be appropriate for the stock using the underpass. Refer to - Guide to the Design of Stock Crossings and Stock Grids.

# 2 WALLS AND BARRIERS

Generally, walls and barriers shall be designed to withstand loads specified in AS 5100 - Bridge Design. A minimum 50 year design life is recommended for all structures or to match the design life of adjoining structural elements if more than a 50 year design life applies.

## 2.1 Noise Barriers

The need to incorporate traffic noise barriers in a road project will have been identified in a noise study, usually as part of a wider environmental impact assessment. A typical noise study report will indicate noise level objectives and any noise barriers required to achieve them, in terms of their location, extent and height.

The design process and community consultation usually involve consideration of options and review to ensure a suitable final design.

A noise barrier may take the form of a bund (earth mound), a wall or solid fencing, or a combination of these. For design details on earth bunds refer to Austroads Guide to Road Design Part 3, 4.5.3.

**Acoustic Requirements:**

a. Minimum superficial mass of 15 kg/sq m.
b. Free of cracks and gaps, at time of construction and after weathering.
c. Position, height, and length adequate to achieve noise level objectives as determined in the noise study.

**Other Requirements:**

a. Acceptable to the local community and local government authority, in terms of appearance, location and maximum height, and security matters.

b. Meets all safety considerations.
c. Graffiti resistance and removal (refer to Specifications 908 - Graffiti).
d. Durability.
e. Minimal maintenance.
f. Acceptable materials include brick, concrete and stone, and can include plastics where considered appropriate for a specific site. Timber is not generally suitable because of durability issues (e.g. warping/cracking may particularly affect acoustic performance) and fire risk but may be used if suitably treated.
g. Colour must be consistent.
h. The footings of any noise wall located on the boundary must be located completely outside the abutting property. Such footings must be designed and located such that the face of the wall is as close as practicable and parallel to the boundary.
i. Barriers should have a logical termination point satisfying noise objectives as well as fitting with the road design.
j. Barriers must be structurally sound and accessible for maintenance.

### 2.2 Visual Screen Walls and Fences

Visual screening must be considered adjacent to roads and paths at those locations where a potential for visual intrusion exists. The requirement for visual screen walls is determined during the project investigations and design process.

Screen walls and associated footings must be located completely within the road reserve, with effective placement dependent on the project site conditions. The height of screen walls will vary according to the location to provide an effective level of screening. Screen walls, are located on the boundary of a private property, should be approved by the property owner. Screen walls must be designed to meet all safety and maintenance considerations.

Feature walls, fences or sculptural built elements may be placed within the road reserve as aesthetic elements (e.g. entry statements, public art), as part the roadside landscaping.

Noise walls are often designed to serve as visual feature walls as well as visual screening to adjoining areas and a noise barrier. In some instances, a visual screen may form part of a bridge or footbridge.

## 3 REFERENCES

1. Austroads Guide to Road Design Part 6A: Pedestrian and Cyclist Paths
2. MRWA Supplement to Austroads Guide to Road Design - Part 6: Roadside Design – Safety and Barriers
3. Operational Guideline No 81 - Fencing Road Reserves on Highways & Main Roads in Pastoral Areas - MRWA 2004
4. Work Health and Safety Act 2020
5. AS 3014 - Electrical Installations - Electric Fences
6. AS 5100 - Bridge Design
7. Selection of Rural Road Reserve Widths
8. Fencing Road Reserves on Highways & Main Roads in Pastoral Areas
9. Factsheet - Pastoral Fencing - Roles, Responsibilities and Liabilities

10. Environmental Factsheet Fencing Requirements within the Main Roads Road Reserve Guideline
11. Policy on the Management of Obstructive Fencing at Bridge Sites
12. Maintenance Responsibility within Town Sites