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# SECTION 205 ROAD DESIGN AND Traffic Engineering

## 205.1 General

The responsibility for preparing a correctly documented final design which maximises the safety, efficiency and effectiveness of the road rests with the Consultant, irrespective of whether the Principal may have provided some design standards to be adopted. All aspects of the design shall be reviewed and design checks and audits shall be conducted to ensure that this primary objective is met.

The Consultant is to ensure that the design does not unnecessarily conflict with existing infrastructure such as services, drainage, lighting, pavement markings, signals, signs, trees, structures and road safety barriers (with due consideration of barrier deflections). The Consultant is also to ensure that new or relocated infrastructure can be installed as proposed in the design.

## 205.2 Horizontal and Vertical Alignment

### 205.2.1 General Standards and Application

* Design speed: 110 km/h
* Traffic lanes width: 3.5m
* Shoulder width: 2.0m fully sealed
* Minimum radius: 750m

**Pavement Crossfall**

All carriageways shall have a normal crossfall of 3%.

**Earthwork Batters**

* Fill

General 6:1, 3:1 maximum, 2:1 to 1:1 to be stabilised. Retaining walls are required for slopes steeper than 1:1.

* Cut

General 4:1, 3:1 maximum, 2:1 to 1:1 to be stabilised. Retaining walls are required for slopes steeper than 1:1.

**Kerbing**

The road shall be kerbed. Kerb profile shall be in accordance with Main Roads Standard Drawing No. 9331-0376.

<Example of typical standards - amend as required>

The alignment is to be determined such that the design standards defined in this Section are attained while minimising costs and impacts and maximising benefits. Alignments outside the existing road reserve can be considered.

*<Amend as required – alignments may not be permitted outside the road reserve.>*

Criteria to be addressed in the design shall include, but shall not be limited to, the following:

* Construction costs.
* Future maintenance costs.
* Traffic safety.
* Hydrological effects.
* Geotechnical conditions.
* Economic and social effects on land owners including severance.
* Environmental issues - Aboriginal sites, heritage sites, etc.
* Road user benefits.

The design shall be aesthetically pleasing to the road user and in harmony with the surrounding environment. The absolute minimum standards shall be avoided in all cases except where they are critical to the design. The design shall provide a high level of co-ordination between the horizontal alignment and the vertical alignment.

The design shall be in accordance with Main Roads’ Guidelines, refer to on-line Technical Library.

The Consultant shall ensure that the horizontal alignment and profile minimises the cost of construction whilst satisfying all the drainage, geotechnical, geometric, traffic safety and environmental requirements.

### 205.2.2 Horizontal Alignment

Refer to “MRWA Supplement to Austroads Guide to Road Design Part 3”, available at the on-line Technical Library.

### 205.2.3 Sight Distance

Refer to “MRWA Supplement to Austroads Guide to Road Design Part 3”, available at the on-line Technical Library.

### 205.2.4 Vertical Alignment

Refer to “MRWA Supplement to Austroads Guide to Road Design Part 3”, available at the on-line Technical Library.

## 205.3 Tie-ins

Where the road design is required to connect into existing alignment(s), such tie-ins shall be designed with minimum disturbance to the existing facility. If the geometry is not satisfactory it may be acceptable to extend the design section slightly and sacrifice a portion of the existing pavement.

The design shall provide for the continuity of geometry and form at the tie-ins.

## 205.4 Chainage to be Adopted

Chainages to be adopted for any road design shall be as shown on any Drawings or in other information provided by the Principal’s Representative.

Chainages to be adopted for road design should desirably correspond to Main Roads’ Straight Line Kilometres (SLK’s). The designer should consult the latest version of Main Roads’ SLK books for Highways and Main Roads to obtain the current data.

## 205.5 Stormwater Drainage

### 205.5.1 General

Main Roads' standard drawings for drainage system components such as stormwater gullies, drainage grates, manholes and culvert headwall treatments, are available at the on-line Technical Library. Alternative components will be considered provided they are supported with performance details.

Refer to “MRWA Supplement to Austroads Guide to Road Design Part 5A”, available at the on-line Technical Library.

For design ARI’s for piped drainage elements refer to “MRWA Supplement to Austroads Guide to Road Design Part 5B”, refer to on-line Technical Library.

For table drains and open drains design ARI’s refer to on-line Technical Library.

The failure mechanism of the drainage system shall be designed for a 100 year ARI in accordance with AUSTROADS "Waterway Design".

The stormwater drainage design shall consider runoff water quality and retain pollutants before releasing water from the system.

The locations of all drainage structures shall be specified by coordinates in the design drawings.

The drainage design shall be checked and approved by the appropriate authorities.

### 205.5.2 Ground Conditions

The existing ground conditions at drainage locations must be assessed as *“Aggressive” or “Non Aggressive”* for the purpose of selecting the appropriate cover to the reinforcement in precast concrete culvert and pipe units.

Refer to “MRWA Supplement to Austroads Guide to Road Design Part 5B, available at the on-line Technical Library.

<Complete to suit. Aggressive environments are described in the “MRWA Supplement to Austroads Guide to Road Design Part 5B”, refer to on-line Technical Library. Where the chemical composition of the soil is unknown then guidance should be sought from Senior Engineer Structures (SES).>

### 205.5.3 Pavement Spread Limits

Refer to “MRWA Supplement to Austroads Guide to Road Design Part 5A”, available at the on-line Technical Library.

### 205.5.4 Drainage Pipe Runs

Drainage pipe runs for longitudinal drainage shall be in accordance with “MRWA Supplement to Austroads Guide to Road Design Part 5A”, refer to on-line Technical Library and manufactured to Main Roads’ (TDP) Specification 404 “Culverts”.

### 205.5.5 Culverts

Drainage Recurrence Interval:

* Major Transverse Drainage Systems: 50 years

<Contact Senior Waterways Engineer (SWE) to determine the appropriate ARI.>

Culverts for cross-carriageway drainage shall be designed to use Main Roads’ approved products from commercially available sizes, manufactured to Main Roads’ (TDP) Specification 404 “Culverts”.

The minimum culvert sizes and RCP culvert classes shall be in accordance with “MRWA Supplement to Austroads Guide to Road Design Part 5B”, refer to on-line Technical Library.

Culvert invert levels shall be pegged on site to fine-tune the level and location.

Rock protection shall be provided in accordance with “MRWA Supplement to Austroads Guide to Road Design Part 5B”, refer to on-line Technical Library.

### 205.5.6 Subsoil Drains

Any investigation of soft or wet areas shall be undertaken in accordance with the procedures given in Section 204 **Ground Investigations and Pavement Design**.

The Consultant shall determine where subsoil drainage will be required to ensure adequate drainage of pavement subgrades and to prevent "wetting up", and shall design the system accordingly including any remedial measures which may be necessary to alleviate the problem. Subsoil drainage shall be designed in accordance with “MRWA Supplement to Austroads Guide to Road Design Part 5A”, refer to on-line Technical Library.

### 205.5.7 Open Drains and Levees

All open drains shall be designed in accordance with “MRWA Supplement to Austroads Guide to Road Design Part 5B”, refer to on-line Technical Library.

All levees shall be designed in accordance with “MRWA Supplement to Austroads Guide to Road Design Part 5B”, refer to on-line Technical Library.

Standard drain types are detailed in the MRWA Guideline Drawings that are available at the on-line Technical Library.

Off-road drainage shall be pegged on site to ensure that it will perform as designed.

### 205.5.8 Floodways

All floodways shall be designed in accordance with “MRWA Supplement to Austroads Guide to Road Design Part 5B”, refer to on-line Technical Library and Structures Engineering Branch’s Guideline “Floodway Design Guide” Document No. 6702-02-2230.

Floodway shoulder levels shall be pegged on site to fine-tune the level and location.

## 205.6 Noise Barriers/Screen Walls

Refer to MRWA guideline “Design of Fencing/Walls”, available at the on-line Technical Library.

## 205.7 Intersections

The proposed work consists of traffic engineering design in accordance with the layout shown on the concept drawings provided by the Principal’s Representative.

The Consultant shall submit preliminary intersection drawings inclusive of design vehicle turning paths to Main Roads for approval prior to commencing final intersection design.

Roadways and intersections shall be designed for a *<19m Semi-Trailer vehicle, B-Double vehicle, Double Road Train, Triple Road Train>*.The Turning Path Templates are found online under Main Roads’ “Guideline Drawings”.

<Select as required>

<Heavy Vehicle Services Branch should be contacted to determine the design vehicle for each project. In some circumstances the design vehicle(s) for each turn movement at an intersection may need to be specified. The design vehicle for a project may also be determined from the on-line Heavy Vehicle Restricted Access Vehicle Network maps.>

The Consultant shall submit intersection designs to the appropriate Local Government Authority for their concurrence.

Intersections shall be designed in accordance with “MRWA Supplement to Austroads Guide to Road Design Part 4, refer to on-line Technical Library, unless otherwise specified. Intersection edges are required to be designed both horizontally and vertically.

## 205.8 Bicycle and Pedestrian Facilities

Refer to “MRWA Supplement to Austroads Guide to Road Design Part 6A”, refer to on-line Technical Library.

## 205.9 Street Lighting

### 205.9.1 Highways and Main Roads with Declared Control of Access (Includes Freeways)

A street lighting design shall be prepared in accordance with “MRWA Lighting Design Guideline for Roadways and Public Spaces“, refer to on-line Technical Library.

### 205.9.2 Other Roads

For other roads under Main Roads’ control, street lighting shall be designed to Western Power Corporations requirements and the design shall generally be reviewed and approved for implementation by Western Power Corporation (WPC). If applicable, the Consultant may be required to arrange a lighting design to AS/NZS 1158 standards for WPC specific projects. Compliance with AS/NZS 1158 series shall be stated and confirmed by the Consultant.

## 205.10 Pavement Markings

Layout drawings for all pavement markings shall be prepared in accordance with Main Roads Standard Contract Drawings and “Drawing Presentation Guidelines”, refer to on-line Technical Library.

*<All pavement marking and sign drawings must be approved by Network Operations Directorate.>*

## 205.11 Traffic Signals

Layout and electrical drawings complete with documentation for any vehicular traffic signal works associated with the project shall be prepared in accordance with Main Roads’ “Vehicular Signals Guidelines”, refer to on-line Technical Library.

*<All traffic signal drawings must be in accordance with Traffic Signals Approval Policy – Network Operations Directorate.>*

## 205.12 Roadside Help Phones

Roadside Help Phones shall be designed in accordance with MRWA Guideline “Emergency Stopping Bays and Roadside Help Phones”, refer to on-line Technical Library.

## 205.13 Guide Posts

A Guide Post schedule must be produced in accordance with MRWA Guideline “Design of Guide Posts”, refer to on-line Technical Library.

## 205.14 Signs

The appropriate signing layout drawings for all signs, e.g. warning, parking, guide and regulatory, etc. for the project shall be prepared in accordance with the Australian Standard “Manual of Uniform Traffic Control Devices: AS 1742 Parts 1 to 15” and Main Roads’ Guidelines, refer to on-line Technical Library:

* “Sign Structural Design”.
* “Drawing Presentation Guidelines”.
* “Standard Contract Drawings – Pavement Marking”.

Precedence shall be given to Main Roads Guidelines in the event of a conflict.

*<All pavement marking and sign drawings must be approved by Network Operations Directorate.>*

## 205.15 Driveways

Driveways shall be designed in accordance with Main Roads’ Guideline “Driveways”, refer to on-line Technical Library. It is the Consultant’s responsibility to design all driveways. Existing driveways shall be reinstated in their current location unless they are considered unsafe or a more suitable location is available.

Connections to all existing property accesses shall also be provided in the design.

Driveway edges are typically only designed horizontally, but the driveway centreline is required to be designed both horizontally and vertically.

<Note for some projects it may be necessary to design the edges of a driveway vertically as well. If so then the above paragraph should be amended as necessary.>

Negotiations on the relocation of driveways will be undertaken by the Principal’s Representative.

## 205.16 Bus Bays

Bus bays shall be designed in accordance with “MRWA Supplement to Austroads Guide to Road Design Part 4”, refer to on-line Technical Library.

## 205.17 Road Safety Audits

Refer to MRWA “Policy and Guidelines for Road Safety Audit”, available on the Main Roads’ website under “Technical & Commercial > Road Safety”.

## 205.18 Fencing

Fencing may require the relocation of existing fencing only, or the design of new fencing to the same standard as existing fencing.

Refer to MRWA Guideline “Design of Fencing/Walls”, available at the on-line Technical Library.

## 205.19 Standard Drawings

Copies of Main Roads’ standard drawings shall be obtained on-line at the Main Roads Technical Library.

## 205.20 Road Drawings

Concept Design Stage, 5% Design Stage and 15% Design Stage

Drawings submitted at these design stages shall comprise the following:

1. Scheme Plan - Scale 1:1000, 1:2000, 1:5000 or to suit
2. Typical Cross Sections - Scale 1:50, 1:100, 1:200 or to suit
3. Plan and Profile - Scale 1:1000/1:100 or 1:2000/1:200
4. Intersection Layout - Scale 1:250 or 1:500
5. Cross Sections - Scale 1:100, 1:200 or 1:400
6. Drainage Strategy Plan - Scale 1:250, 1:500, 1:1000, 1:2000 or to suit
7. Road Safety Barrier and Kerbing Plan - Scale 1:500 or 1:1000
8. Lane Configuration Plan - Scale 1:500, 1:1000, 1:2000, 1:5000 or to suit
9. Major Signs Strategy - Scale 1:500, 1:1000, 1:2000, 1:5000 or to suit
10. Bicycle Direction Signage Strategy - Scale 1:500, 1:1000, 1:2000 or to suit
11. Speed Zone Strategy - Scale 1:500, 1:1000, 1:2000, 1:5000 or to suit

<Example only - amend list as required. Refer to Main Roads’ “Drawing Presentation Guidelines” available at the Technical Library for further details.>

85% Design Stage and 100% Design Stage

Drawings submitted at these design stages shall comprise the following:

1. Cover Sheet
2. Locality Plan and Index Sheet - Scale to suit
3. Scheme Plan - Scale 1:1000, 1:2000, 1:5000 or to suit
4. Typical Cross Sections and Details - Scale 1:50, 1:100, 1:200 or to suit
5. Plan and Profile - Scale 1:1000/1:100 or 1:2000/1:200
6. Intersection Layout - Scale 1:250 or 1:500
7. Cross Sections - Scale 1:100, 1:200 or 1:400
8. Drainage Plan - Scale 1:250, 1:500 or 1:1000
9. Road Safety Barrier and Kerbing Plan - Scale 1:500 or 1:1000
10. Services / Utilities Plan - Scale 1:250, 1:500 or 1:1000
11. Fencing, Noise Wall and Retaining Wall Plan - Scale 1:500, 1:1000 or 1:2000
12. Pavement and Surfacing Plan - Scale 1:500, 1:1000 or 1:2000
13. Culvert Schedule
14. Culvert Cross Sections - Scale 1:100 or 1:200
15. Pavement Marking and Minor Signing - Scale 1:250 or 1:500
16. Major Sign and Bicycle Direction Sign Plan - Scale to suit
17. Major Direction Sign Design - Scale to suit
18. Sign Post Schedule - Scale to Suit

<Example only - amend list as required. Refer to Main Roads’ “Drawing Presentation Guidelines” available at the Technical Library for further details.>

Phase 4 – Final Submission

The principal of the company who is authorised to take responsibility for the technical content shall sign and date the drawings at this time.

Drawings produced shall be supplied to Main Roads in AutoCAD (dwg format) or Microstation (dgn format) in accordance with the standards and other requirements as set out in Main Roads’ “Drawing Presentation Guidelines”, refer to on-line Technical Library. All drawings shall be plotted in PDF format and named accordingly. They shall use Main Roads standard title blocks and be numbered in accordance with the Main Roads Drawing Numbering System. One or more blocks of drawing numbers will be made available as required. Standard title block drawings in AutoCAD format can be downloaded from the Main Roads’ “Drawing Presentation Guidelines”, refer to on-line Technical Library.

## 205.21 Road Design and Survey and Mapping Models

The completed design and/or ground survey models shall be provided in accordance with:

* Road and Traffic Engineering Branch’s “OpenRoads Design Standards”
* Asset & Geospatial Information Branch’s “Data Lodgement Guideline”

Refer to on-line Technical Library for further details.

The Consultant is required to check the road design model by examining the 20m interval cross-section drawings to ensure that the design templates have been correctly applied. In particular the following aspects shall be checked:

* Batter slopes;
* Pavement crossfalls;
* Superelevation transitions; and
* Pavement thicknesses.

## 205.22 Traffic Management Plans

Refer to the Main Roads Traffic Management Policies and Guidelines on the website under “Working on Roads”.

## 205.23 Pavement Widenings

Existing Pavements that are being resurfaced and/or widened, must have superelevation rates on curves which are:

* no greater than 2% above the rates specified in Main Roads’ Horizontal Curve Tables;
* no less than the rates required to maintain side friction demand within the desirable limits specified in “MRWA Supplement to Austroads Guide to Road Design Part 3”, refer to on-line Technical Library.; and
* transitioned at the curve ends in accordance with Main Roads’ Horizontal Curve Tables.

## 205.24 Designer Identified Construction Hazards

The following “high risk construction work” is considered to be within the capability of a competent and experienced road contractor normally engaged by Main Roads and may or may not be directly relevant to this project.

(a) construction work involving a risk of a person falling 2 metres or more;

(b) construction work on telecommunications towers

(c) construction work involving demolition;

(d) construction work involving disturbing or removing asbestos;

(e) construction work involving alteration to a structure that requires the structure to be temporarily supported to prevent its collapse;

(f) construction work involving a confined space;

(g) construction work involving excavation to a depth of more than 1.5 metres;

(h) the construction of tunnels;

(i) construction work involving the use of explosives;

(j) construction work on or near pressurised gas pipes (including distribution mains);

(k) construction work on or near chemical, fuel or refrigerant lines;

(l) construction work on or near energised electrical installations and lines (whether overhead or underground);

(m) construction work in an area that may have a contaminated or flammable atmosphere;

(n) construction work involving tilt‑up or precast concrete;

(o) construction work on or adjacent to roads or railways that are in use;

(p) work on a construction site where there is movement of powered mobile plant;

(q) construction work in an area where there are artificial extremes of temperature;

(r) construction work in, over or adjacent to water or other liquids if there is a risk of drowning;

(s) construction work involving diving;

Other high risk construction work associated with the design of this project comprises:

[and then describe those risks for this project]

Or

No other high risk construction work has been identified for this project.

1. **Microsimulation Traffic Models**

If Consultants are required to develop a microsimulation traffic model, then the Principal’s Representative should consult with Main Roads’ Operational Modelling & Visualisation Manager in Network Operations Directorate regarding appropriate guidelines to be followed.

1. **Roadside Stopping Places**

If there is a requirement for the Consultant to design Roadside Stopping Places then the following clause shall be included.

## 205.25 Roadside Stopping Places

### 205.25.1 Rest Areas (Short Break and ’24 Hour’)

Rest Areas (Short Break and ’24 Hour’) shall be designed in accordance with MRWA “Policy and Guidelines for Rest Areas”, refer to on-line Technical Library.

<amend as necessary>

### 205.25.2 Scenic Lookouts

Scenic Lookouts shall be designed in accordance with MRWA “Policy and Guidelines for Rest Areas”, refer to on-line Technical Library.

<amend as necessary>

### 205.25.3 Heavy Vehicle Assembly Areas

Heavy Vehicle Assembly Areas shall be designed in accordance with MRWA “Policy and Guidelines for Rest Areas”, refer to on-line Technical Library.

<amend as necessary>

### 205.25.4 Information Bays

Information Bays shall be designed in accordance with MRWA “Policy and Guidelines for Rest Areas”, refer to on-line Technical Library.

<amend as necessary>

### 205.25.5 Parking Bays

Parking Bays shall be designed in accordance with MRWA “Policy and Guidelines for Rest Areas”, refer to on-line Technical Library.

<amend as necessary>

Reconstruction of Existing Parking Bays shall be designed in accordance with MRWA “Policy and Guidelines for Rest Areas”, refer to on-line Technical Library.

<amend as necessary>

### 205.25.6 School Bus Bays

School Bus Bays shall be designed in accordance with MRWA “Policy and Guidelines for Rest Areas”, refer to on-line Technical Library.

<amend as necessary>

1. **Intelligent Transport Systems (ITS)**

If there is a requirement for the Consultant to design Intelligent Transport Systems, then the Principal’s Representative shall consult with the Manager Intelligent Transport Systems Operations in Network Operations Directorate.

## 205.26 Intelligent Transport Systems (ITS)

ITS shall be designed in accordance with MRWA Guideline “Intelligent Transport Systems (ITS)”, refer to on-line Technical Library.

1. **Emergency Stopping Bays**

If there is a requirement for the Consultant to design Emergency Stopping Bays then the following clause shall be included.

## 205.27 Emergency Stopping Bays

Emergency Stopping Bays shall be designed in accordance with MRWA Guideline “Emergency Stopping Bays and Roadside Help Phones”, refer to on-line Technical Library.

## 205.28 Safety Barriers

The Consultant shall identify roadside hazards, assess the need for safety barriers, identify locations and type of barrier required, and produce a report. Safety barrier locations, length of need, barrier type and terminal type shall be clearly shown on the relevant plan/profile drawings and intersection drawings.

The Consultant should refer to Austroads Guide to Road Design, Part 6: Roadside Design, Safety and Barriers (2009); the MRWA “Supplement to Austroads Guide to Road Design Part 6” and “List of Approved Road Safety Barrier Systems”, available at the on-line Technical Library.

## 205.29 Road Safety Management (ROSMA)

The ROSMA process is a simple process; the purpose of which is to review treatments selected to ensure the Road Trauma risk expected at the location will meet or exceed state and national road trauma reduction targets (wherever practical).

The Consultant shall ensure a ROSMA assessment has been undertaken on the treatment being proposed at the location. This is done by completing the [ROSMA Project Details Template](https://www.mainroads.wa.gov.au/technical-commercial/road-safety/management-system-rosma/) (https://www.mainroads.wa.gov.au/technical-commercial/road-safety/management-system-rosma/) and emailing it to roadsafety@mainroads.wa.gov.au

GUIDANCE NOTES

***DELETE GUIDANCE NOTES FROM FINAL DOCUMENT AFTER USING FOR REFERENCE***

All edits to downloaded Briefs shall be tracked (most word processing software allows this to be done automatically). Deletions shall be struck through e.g. ~~example~~. Insertions shall be in italics e.g. *example*. If **all** information relating to a clause is deleted then the clause number should be retained and the words "**NOT USED**" should be inserted.

The proposed documents with tracked changes shall be submitted to Main Roads for review, prior to printing the final batch of documents. When this final printing is carried out, changes are saved and the tracked changes option is to be **turned off**.

The Custodian of this section of the Brief is Mr Con Magriplis (Principal Design Consultant) ph: 138 138.