Road Planning and Design Manual
Edition 2: Volume 3

Supplement to Austroads Guide to Road Design
Part 8: Process and Documentation

December 2015
Relationship with Austroads Guide to Road Design – Part 8 (2009)

The Department of Transport and Main Roads has, in principle, agreed to adopt the standards published in the *Austroads Guide to Road Design (2009) Part 8: Process and Documentation*.

When reference is made to other parts of the *Austroads Guide to Road Design* or the *Austroads Guide to Traffic Management*, the reader should also refer to Transport and Main Roads related manuals:

- *Road Planning and Design Manual*
- *Traffic and Road Use Management Manual*.

Where a section does not appear in the body of this supplement, the *Austroads Guide to Road Design – Part 8* criteria is accepted unamended.

This supplement:

1. has precedence over the *Austroads Guide to Road Design – Part 8* when applied in Queensland
2. details additional requirements, including *accepted with amendments* (additions or differences), *new or not accepted*
3. has the same structure (section numbering, headings and contents) as *Austroads Guide to Road Design – Part 8*.

The following table summarises the relationship between the *Austroads Guide to Road Design – Part 8* and this supplement using the following criteria:

| Accepted: | Where a section does not appear in the body of this supplement, the *Austroads Guide to Road Design – Part 8* is accepted. |
| Accepted with Amendments: | Part or all of the section has been accepted with additions and/or differences. |
| New: | There is no equivalent section in the Austroads Guide. |
| Not accepted: | The section of the Austroads Guide is not accepted. |

<table>
<thead>
<tr>
<th>Austroads Guide to Road Design – Part 8</th>
<th>RPDM Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Introduction</td>
<td></td>
</tr>
<tr>
<td>1.1 Scope of this guide</td>
<td>Accepted with amendments</td>
</tr>
<tr>
<td>1.2 International standard</td>
<td>Accepted</td>
</tr>
<tr>
<td>1.3 Road safety</td>
<td>Accepted</td>
</tr>
<tr>
<td>1.4 Terminology</td>
<td>Accepted</td>
</tr>
<tr>
<td>1.5 Phases of design</td>
<td>Accepted with amendments</td>
</tr>
<tr>
<td>1.6 Depth of design detail versus construction delivery mechanism</td>
<td>Accepted</td>
</tr>
<tr>
<td>1.7 Compliance with the Professional Engineers Act 2002</td>
<td>New</td>
</tr>
</tbody>
</table>
### 2 Preparation for design

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Overview</td>
<td>Accepted</td>
</tr>
<tr>
<td>2.2</td>
<td>Design control process</td>
<td>Accepted</td>
</tr>
<tr>
<td>2.3</td>
<td>Use of design control aids</td>
<td>Accepted</td>
</tr>
<tr>
<td>2.4</td>
<td>Client and designer interaction</td>
<td>Accepted</td>
</tr>
<tr>
<td>2.5</td>
<td>Scope of the design</td>
<td>Accepted with amendments</td>
</tr>
<tr>
<td>2.6</td>
<td>Design development inputs</td>
<td>Accepted</td>
</tr>
<tr>
<td>2.7</td>
<td>Design development output</td>
<td>Accepted</td>
</tr>
</tbody>
</table>

### 3 Design development

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>Overview</td>
<td>Accepted</td>
</tr>
<tr>
<td>3.2</td>
<td>Producing the road design</td>
<td>Accepted</td>
</tr>
<tr>
<td>3.3</td>
<td>Matters specific to each design phase</td>
<td>Accepted</td>
</tr>
<tr>
<td>3.4</td>
<td>Design control</td>
<td>Accepted</td>
</tr>
<tr>
<td>3.5</td>
<td>Design self checks</td>
<td>Accepted</td>
</tr>
<tr>
<td>3.6</td>
<td>Design interfaces</td>
<td>Accepted</td>
</tr>
<tr>
<td>3.7</td>
<td>Workplace health and safety/safe design</td>
<td>Accepted with amendments</td>
</tr>
<tr>
<td>3.8</td>
<td>Constructability and maintainability</td>
<td>Accepted</td>
</tr>
<tr>
<td>3.9</td>
<td>Extending the design domain</td>
<td>Accepted with amendments</td>
</tr>
<tr>
<td>3.10</td>
<td>Quantities</td>
<td>Accepted</td>
</tr>
</tbody>
</table>

### 4 Design review, verification and validation

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>Overview</td>
<td>Accepted</td>
</tr>
<tr>
<td>4.2</td>
<td>Independence in the process</td>
<td>Accepted</td>
</tr>
<tr>
<td>4.3</td>
<td>Design review</td>
<td>Accepted</td>
</tr>
<tr>
<td>4.4</td>
<td>Additional aspects to the review process</td>
<td>Accepted</td>
</tr>
<tr>
<td>4.5</td>
<td>Design interface review</td>
<td>Accepted</td>
</tr>
<tr>
<td>4.6</td>
<td>Incorporating the review response</td>
<td>Accepted</td>
</tr>
<tr>
<td>4.7</td>
<td>Dealing with design non-conformance/departures</td>
<td>Accepted</td>
</tr>
<tr>
<td>4.8</td>
<td>Dealing with variations</td>
<td>Accepted</td>
</tr>
<tr>
<td>4.9</td>
<td>Design development verification</td>
<td>Accepted</td>
</tr>
<tr>
<td>4.10</td>
<td>Design development validation</td>
<td>Accepted</td>
</tr>
</tbody>
</table>

### 5 Design audit process

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1</td>
<td>Overview</td>
<td>Accepted</td>
</tr>
<tr>
<td>5.2</td>
<td>Design process audit</td>
<td>Accepted</td>
</tr>
<tr>
<td>5.3</td>
<td>Design product audit</td>
<td>Accepted</td>
</tr>
<tr>
<td>Austroads Guide to Road Design – Part 8</td>
<td>RPDM Relationship</td>
<td></td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>-------------------</td>
<td></td>
</tr>
<tr>
<td><strong>6 Presentation of outputs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.1 Overview</td>
<td>Accepted</td>
<td></td>
</tr>
<tr>
<td>6.2 Typical sheet contents</td>
<td>Accepted</td>
<td></td>
</tr>
<tr>
<td>6.3 Organisation of CADD data</td>
<td>Accepted</td>
<td></td>
</tr>
<tr>
<td>6.4 Preparation of CADD drawings</td>
<td>Accepted</td>
<td></td>
</tr>
<tr>
<td>6.5 Phase 2 – design composition</td>
<td>Accepted</td>
<td></td>
</tr>
<tr>
<td>6.6 Phase 3 – design composition</td>
<td>Accepted</td>
<td></td>
</tr>
<tr>
<td>6.7 Standard feature labels for data groups</td>
<td>Accepted</td>
<td></td>
</tr>
<tr>
<td>6.8 Standard symbols</td>
<td>Accepted</td>
<td></td>
</tr>
<tr>
<td>6.9 Supplementary design elements and criteria</td>
<td>Accepted</td>
<td></td>
</tr>
<tr>
<td><strong>References</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>References</td>
<td>Accepted with amendments</td>
<td></td>
</tr>
</tbody>
</table>
1 Introduction

1.5 Phases of design

Difference

The information in this section of Austroads Guide to Road Design – Part 8 is accepted as being for information only. The design development process to be applied in Queensland is outlined in the Transport and Main Roads Preconstruction Processes Manual, Chapter 4 (refer to Sections 4.3 and 4.4).

1.7 Compliance with the Professional Engineers Act 2002

There is no equivalent Section 1.7 in Austroads Guide to Road Design – Part 8.

New

All transport infrastructure designs produced for the Department of Transport and Main Roads in Queensland must be certified by a Registered Professional Engineer of Queensland (RPEQ). If there is any reduction in the standard, the certifying RPEQ needs to ensure that sufficient engineering rigor is undertaken. The reduction in standard must be justifiable/defendable to ensure it doesn’t adversely affect suitable and recognised levels of safety and operation of the road.

It is the role of the RPEQ to ensure that the use of the design standards are appropriate given the context of the project, and that the departments’ processes have been followed.

No RPEQ should accept the engineering responsibility for any design or design component that cannot be justified and defended.

If the design cannot meet the expectations of the brief within budget because particular design exceptions are unable to be justified, then the designer would be expected to work with the project manager to reduce costs by scope reduction (e.g. shortening the job or removing components that don’t adversely affect the desired outcomes from the project brief).

2 Preparation for design

2.5.1 The design brief

Addition

The design brief should be based on the templates that have been developed for the four major stages of preconstruction. The Transport and Main Roads templates are available on the departmental website and include:

i. C7521 Options Analysis
ii. C7522 Business Case
iii. C7523 Preliminary Design
iv. C7524 Detailed Design.

The development of the design brief utilising the content of the relevant functional specification templates provides a structured framework to ensure:

- the scope is adequately defined
• the management of the design is undertaken in such a way that the original scope is adequately and regularly monitored against the identified needs and functionality (utilising the Design Development Report), and
• any identified changes to scope are appropriately investigated and approval sought before being undertaken.

Measures of success (Success Criteria) need to be detailed in the design brief to facilitate the design review process at completion of the design. These may include reduction in design cost or timeframes, reduced project risk, innovative solutions, project learnings or improved processes that may be transferrable to future projects.

The significant elements that are to be included in the design brief should include but are not limited to:

• liaison with the Principal
• project management
• environmental management
• public consultation
• hydraulic analysis and design
• public utility plant
• lighting, traffic signals, and intelligent transport systems
• landscaping and/or revegetation
• geotechnical investigations
• road/bridge design and drawings
• design development reports and project plans
• safety in design
• detailed estimate of cost
• contract documentation
• road safety audits and risk mitigation
• constructability requirements
• integration with adjacent infrastructure
• maintenance requirements
• operations requirements
• durability/whole of life performance and intervention requirements.

The road infrastructure project scope is defined within the context of the required outcomes, and in accordance with the operational objectives outlined in the component elements contained in the design brief. It is important that the elements in the design brief clearly define what is “in scope” and “out of scope” for the project.
Decisions made during the design process are to be recorded in the design development report. Sample contents for the design development reports are available from Transport and Main Roads Design Development Report (Large Projects) and Design Development Report (Small Projects).

Innovation in design is encouraged and should figure prominently in the design brief. The department expects design consultants to actively optimise design, and seek guidance on innovative options and the risk appetite of the client. Consultants are expected to consider and deliver, where appropriate, suitable extensions of the design domain that provide savings and an appropriate level of safety.

Processes for the inclusion of innovations within the design brief are included in Transport and Main Roads Project Scoping Guideline and Engineering Innovation within the Department of Transport and Main Roads.

3 Design development

3.7 Workplace health and safety/safe design

3.7.1 Overview

Addition

The State of Queensland is responsible for regulating and enforcing its work health and safety laws. All transport infrastructure projects must comply with Queensland’s Work Health and Safety legislation, which includes the Workplace Health and Safety Work Health and Safety Act (2011) and Work Health and Safety Regulation (2011).

Further guidance on the inclusion of these requirements within the design of transport infrastructure can be found in the Workplace Health and Safety Safe Design of Structures Code of Practice.

3.7.3 Documentation

Addition

The content in Austroads Guide to Road Design - Part 8 is acknowledged to provide an overview of the documentation requirements for the safety in design report. In addition, in Queensland the following are also required.

Safety in Design Report

The content of a Safety in Design Report, where required:

- Must document risks to the health and safety of construction and maintenance personnel both during the initial construction of the project and while undertaking construction/maintenance/demolition activities at any future stage.

- May document risks to individuals travelling through the construction site, including vehicular and pedestrian traffic, if the risks are considered to be of significance and not specifically covered in standard reference material outlined below. Suitable risk mitigation strategies for this scenario can be achieved by applying the appropriate design criteria in this Road Planning and Design Manual and the Transport and Main Roads Manual of Uniform Traffic Control Devices.

- Would not normally include risks to drivers travelling through the project after construction has been completed. These risks should be mitigated by applying the appropriate design criteria in
The Safety in Design Report will be passed from phase to phase along with other design development documentation to demonstrate a continuous flow of risk identification and elimination/mitigation.

### 3.7.4 Procedure

**Addition**

The content in *Austroads Guide to Road Design - Part 8* is acknowledged to provide an overview of the procedure for the Safety in Design Report. In addition, in Queensland the following are also required.

The Safety in Design Report is required to be completed at the following stages of the design process:

- **Concept Phase - Business Case**
  

- **Development Phase – Preliminary Design**
  

- **Development Phase – Detailed Design**
  

The department will follow a similar path to that outlined in the WorkCover *Safe Design of Structures Code of Practice*. The WorkCover *Legislative Guide – Designer Written Report for a Structure (LG-DR)* provides additional guidance on the design procedures for safety in design.

**Step 1:** Identify stakeholders who will need to be consulted with during the design development starting at the concept stage and undertake some initial planning and design activities based on information obtained during the options analysis stage.

**Step 2:** Document perceived risks to personnel during the construction, maintenance or demolition phases of the project.

**Step 3:** Undertake consultation with relevant stakeholders to determine whether the risk can be eliminated from the design or minimised as far as is reasonably practicable. Reference to recognised standards should be made in order to determine how the hazard may be prevented or eliminated. People with specific skills and expertise from the construction, maintenance, and health and safety areas will need to be included in the design team or consulted during the design process to fill any knowledge gaps.

**Step 4:** Document all remaining risks that will need controls to be implemented in the relevant phase of the project lifecycle. Where temporary works and traffic control arrangements are proposed during construction, risk assessment of these measures also needs to be done. Documented risks and risk assessments should accompany the design at all times.
**Step 5:** For designs with unusual or atypical features, review the design and compile a Safety in Design Report that demonstrates how each of the steps above have been undertaken. Compilation of the resultant risk assessment matrix to be passed to the next phase of the design development, construction, or maintenance activities should be included as part of the report.

The Report should highlight any unusual or atypical features that pose a risk to health and safety of workers during the construction phase.

### 3.9 Extending the design domain

#### 3.9.1 Departmental approval for EDD

There is no equivalent Section 3.9.1 in *Austroads Guide to Road Design – Part 8*.

**New**

The implementation of the Extended Design Domain (EDD) concept was approved for use in the department by the then Deputy Director General in May 2004. This direction was further supported by a similar memorandum in 2007. The following guidelines are still as relevant now as they were when first implemented and reflect the current departmental position to be followed regarding the use of EDD:

1. The type of projects where the use of EDD standards is appropriate.
2. Certification (i.e. formal sign-off) of the use of EDD standards.
3. For those projects where the application of EDD standards is considered more difficult or non-standard, referral of those projects using EDD standards to Engineering and Technology (E&T) Branch.
4. Inclusion and justification of the use of EDD standards in Options Analysis and Business Case development.
5. Specifying the use of EDD standards in project documentation including briefs to consultants.
6. Documentation of the rationale of the use of the EDD, and
7. Using design values below the EDD requires a rigorous risk management approach, mitigating treatments and an even higher level of supporting documentation than for EDD.

#### 3.9.2 Process for justifying design exceptions

There is no equivalent Section 3.9.2 in *Austroads Guide to Road Design – Part 8*.

**New**

The concept of design exceptions, i.e. values below EDD, as discussed in point 7 above and the process for considering design exceptions is shown in Figure 8-1. The principles of the department’s project development process are based on a robust design exception process as outlined below:

- determine the costs and impacts of meeting NDD standards
- develop and evaluate multiple alternatives
- evaluate risk
- evaluate mitigation strategies
• document, review and approve
• monitor and evaluate in-service performance.

The extent of the work at each phase will depend on the size of the project as well as the degree of non-conformance anticipated. However, all of the elements need to be addressed to ensure that the outcome is robust and able to be defended in any litigation that may arise.

**Figure 8-1 – Process for design exceptions**

1. Review background information
2. Review crash data, operating speeds and other special considerations
3. Understand the required standard for geometric elements
4. Can we retain the design exception?
5. No
   - Consider construction sequencing, methods and/or redesign
5. Yes
   - Mitigation of the specific design exception or generally throughout the construction site.
6. Are mitigation treatments required?
7. Yes
   - Mitigation of the specific design exception or generally throughout the construction site.
   - Review, document & approve
8. No
   - Identify if there are other minima
   - Assess costs & impacts
   - Conduct a risk analysis
   - Review the capability provided by each alternative
   - Develop & evaluate alternatives
   - Mitigation of the specific design exception or generally throughout the construction site.
   - Review, document & approve
Types of Design Exception

There are three broad forms of design exception to be considered:

1. A pre-existing design exception – these design exceptions are typically those where an upgrade project is occurring and an existing design exception, inherent in the existing road layout, is proposed to be retained. Examples include:
   - an existing vertical crest curve not meeting sight distance requirements on a section of road to be resurfaced and widened on the existing formation
   - an existing short length merge on the exit from a signalised intersection which is being upgraded on the cross road
   - existing narrow lanes in a constrained urban area which are being retained with reallocation of the roadside space to introduce bus lanes.

2. The introduction of a new design exception to the road network based on other similar designs existing on the road network. While not meeting design standards the similar designs perform to an acceptable safety level. The key element to these types of design exceptions are that precedents exist elsewhere in the network to support the expected performance. Examples of these may include:
   - introduction of a short merge on the exit to a roundabout which has been converted from one lane to two lane
   - widening of a roundabout approach from one to two lanes but with lane widths and/or alignment not meeting EDD
   - introducing a vertical crest not meeting sight distance criteria in a constrained location but with mitigating treatments similar to other nearby locations on the same road.

3. The introduction of a new design exception to the road network for which there is no precedent and which do not conform to current road design practice. These are referred to as Pilot projects. These design elements may arise when introduction of an innovative new design concept is proposed, or when constraints force designers to develop a design which has not previously been applied elsewhere on the network. These projects are to be assessed as trials for new designs that have no precedent in existing design practice with an unknown potential performance. Due to the lack of comparable data, Pilot projects present levels of risk to road users that may not be readily estimated or known. They therefore require a more rigorous level of assessment and post implementation monitoring to ensure that risks to road users are managed appropriately.

3.9.3 Developing alternatives

There is no equivalent Section 3.9.3 in Austroads Guide to Road Design – Part 8.

New

To defend a decision to adopt a design exception, the RPEQ will be required to demonstrate that in the process of adopting it, an evaluation of the impacts of providing the chosen design parameter value/s has been undertaken. Alternatives including one that meets the Normal Design Domain (NDD) or Extended Design Domain (EDD) standards will need to be developed and evaluated to a level that is reasonable and practical for the particular design.
Evaluation and assessment will require:

- Presentation of information to demonstrate the impacts of meeting the minimum or lower design criteria. This can include but is not limited to:
  - construction costs
  - environmental consequences
  - right-of-way impacts, and
  - community involvement/concerns.

- Sufficient information to demonstrate the consequences of using a design value that does not meet the minimum criteria must be provided. Where appropriate, this may include but is not limited to:
  - impacts on traffic serviceability (i.e. level of service)
  - impacts on safety (i.e. crash history)
  - impacts on traffic operations, and
  - impacts on future maintenance.

- A written summary of the information is required and has to be submitted for review.

This will require sufficient design to allow reasonable estimates of cost to be developed and the impacts to be assessed. It is not sufficient to assume that retention of the existing is the only solution that needs to be evaluated.

### 3.9.4 Evaluation and risk assessment

There is no equivalent Section 3.9.4 in Austroads Guide to Road Design – Part 8.

*New*

Risk assessment is an essential part of all design but especially so for a design incorporating design exceptions. Evaluating the risk comprises an important part of the sequence of activities required.

The following questions need to be addressed both singly and in combination in order to assess the risk involved.

- What are the traffic volumes, the composition of traffic, and speeds?
- What is the degree/severity of the design exception?
- Are there multiple design exceptions at the same location?
- What is the length of the design exception?
- What is the expected duration of the design exception?
- Where is the location of the design exception relative to other risk factors?
- What is the substantive safety at the design exception location?

Further exploration of the impact of these considerations is outlined below.
Traffic

Important inputs include the total volume and the type of traffic. The type refers both to the types of vehicles (specifically the heavy vehicles) and the type of user (e.g. tourist drivers; commuter traffic; local agricultural users).

The expectations of drivers unfamiliar with the road will be different from those of commuter traffic or local users. Unfamiliar drivers require greater reaction and decision times than regular commuters.

The type of heavy vehicles is also important. The longer vehicles will require greater distances to manoeuvre and are less capable of deviating from their course when confronted by a situation requiring such action.

The speed of traffic in the section should be assessed from measurements at the site and the 85th percentile speed determined. This will provide an accurate assessment of the required design speed, assuming that the proposed works do not result in an increase in that speed.

Combined geometric features

It is always a requirement of the design process that the combination of design elements at a site be considered.

While an exception in one element may be able to be considered, more than one at the same site becomes increasingly difficult to justify and needs very careful consideration.

For example, the combination of sub-standard horizontal and vertical geometry together is unlikely. In all cases, other elements at the site should be designed to better than minimum standards to compensate for the sub-standard element.

In all cases, the design adopted must be justified in an EDD and design exception report.

Length of the design exception

Consideration needs to be given to whether this issue being considered is an isolated element or one of a series of such elements.

An isolated element (e.g. crest curve) may be provided with mitigation more easily than a series of sub-standard elements over some distance. If the series of elements occurs within a section where the speed is modified by the horizontal geometry, then the operating speed may be reduced and the retention of the geometry made more acceptable. Reduction of the posted speed in these circumstances may provide an acceptable mitigating option.

Duration of the design exception

Further consideration must also be given to the length of time that the current geometry be retained.

Is it intended that the design exception will be retained for a longer period or is it intended to reconstruct the section in the reasonably near future (say within five years)? A long term requirement provides a significantly different perspective to the problem.

Location with respect to other risk factors

The combination of other geometric features was discussed above.

The location of roadside furniture and/or trees also has to be considered. If the exception is to be retained, then action to address these features will be required.
Substantive safety at the site

The substantive safety will be determined by the crash history of the site (and similar sites elsewhere) and the types of crashes that have occurred. These details must be obtained and careful analysis of them carried out.

It is necessary that the proposed works do not make the substantive safety any worse; preferably, the works should improve the situation.

The likely effects of the proposals may be assessed using such tools as the Austroads (2014) Australian National Risk Assessment Model (ANRAM), the ARRB Road Safety Risk Manager software, the Highway Safety Manual (AASHTO 2010). Austroads (2010a) and Austroads (2010b) also provide information on crash modification factors.

Design exception BCR option assessment

Generally a design exception is supported on the basis that the incremental costs to remove the design exception do not warrant the additional construction costs to do so. In undertaking a BCR assessment of a design exception the following elements are to be assessed.

Table 8-1 - Elements for inclusion the BCR option assessment

<table>
<thead>
<tr>
<th>Item</th>
<th>Benefit</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost differential between design</td>
<td>Benefit associated with implementing the</td>
<td>Cost of crash rate in comparison</td>
</tr>
<tr>
<td>exception and NDD/EDD</td>
<td>design exception</td>
<td>with that expected for the NDD/EDD design</td>
</tr>
<tr>
<td>Crash rates</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mitigating treatments</td>
<td></td>
<td>Cost to implement</td>
</tr>
<tr>
<td>Monitoring</td>
<td></td>
<td>Cost to undertake</td>
</tr>
<tr>
<td>Remedial treatments</td>
<td></td>
<td>Cost to implement</td>
</tr>
<tr>
<td>Operational performance</td>
<td></td>
<td>Cost compared with that for NDD/EDD design</td>
</tr>
</tbody>
</table>

In considering crash costs and operational costs, it may be that the resultant design overall leads to an improvement in comparison with the existing situation. These improvements would be considered as part of the overall BCR for the works. In assessment of the design exception, it is expected that the crash and operational performance would be worse than that achieved if a NDD/EDD compliant design was implemented.

3.9.5 Risk management categories

There are four categories of risk – physical, legal, moral/ethical and financial. Table 8.2 sets out some typical considerations for these categories with some comments on the likelihood of occurrence and potential consequences. Each situation will have to be analysed on its merits and the detail determined for that situation.

3.9.6 Mitigation

Section 3.4 of the Transport and Main Roads Guidelines for Road Design on Brownfield Sites discusses the requirement for mitigation strategies. Specific actions to mitigate the effects of a proposed design exception have to be assessed for each case and costed as part of the works
proposed. Each case will need to be treated on its merits but some general approaches have been suggested elsewhere in these guidelines.

Table 8-2 - Considerations for various risk categories

<table>
<thead>
<tr>
<th>Risk Category</th>
<th>Typical Considerations</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical</td>
<td>Roadside hazards – poles, sign supports, trees, steep batters.</td>
<td>Need to consider clear zones, treatment of hazards (frangible poles, safety barrier). Clearance required to be based on reliable research and past experience. Likelihood and severity of crashes increases with less clearance.</td>
</tr>
<tr>
<td></td>
<td>Blockage of carriageway (object, vehicle).</td>
<td>Manoeuvring space required where sight distance &lt; NDD – avoidance of blockages. Likelihood of blockages is medium and consequences can be high if no space to avoid them.</td>
</tr>
<tr>
<td></td>
<td>Lack of visibility.</td>
<td>Misleading cues will result in a high likelihood of crashes of potentially high consequence – depends on space available and clearance to hazards.</td>
</tr>
<tr>
<td></td>
<td>Misleading cues to drivers.</td>
<td>Likelihood of water on road will be related to the immunity provided; likelihood of crashes should be low but consequences can be high.</td>
</tr>
<tr>
<td></td>
<td>Inadequate space for vehicle size (tracking of multi-combination vehicles).</td>
<td>Accessibility and intersections with inadequate visibility will have a high likelihood of crashes with high consequences.</td>
</tr>
<tr>
<td></td>
<td>Inadequate space for manoeuvring around obstacles.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inadequate surface friction.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Water on road (e.g. floodway).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Access points/intersections.</td>
<td></td>
</tr>
<tr>
<td>Legal</td>
<td>Litigation based on negligence.</td>
<td>High probability of litigation when crashes occur. High consequences (compensation, punishment) if negligence proven.</td>
</tr>
<tr>
<td></td>
<td>Personal injury claims.</td>
<td>High consequences (failure to defend) if inadequate documentation.</td>
</tr>
<tr>
<td></td>
<td>Inadequate information to defend the design decisions.</td>
<td></td>
</tr>
<tr>
<td>Moral/Ethical</td>
<td>Responsibility to provide a safe driving environment (as far as reasonably practical).</td>
<td>Moral and ethical responsibility to apply skills to provide a reasonable level of safety; careful analysis, consideration of performance and appropriate documentation should minimise the risk.</td>
</tr>
<tr>
<td></td>
<td>Breaching the RPEQ Code of Practice.</td>
<td>For individual engineers, breaching Code of Practice can result in high penalties (including loss of registration) under the Qld PE Act.</td>
</tr>
<tr>
<td></td>
<td>Breaching the Engineering Profession’s Code of Ethics.</td>
<td>For individual engineers, breaching the Code of Ethics can result in loss of membership (members of EA) and loss of Registration on NPER.</td>
</tr>
<tr>
<td>Financial</td>
<td>Exceeding the budget allocation for the project.</td>
<td>Ensure all costs are accounted for in the proposal, reasonable alternatives have been assessed and the most cost effective has been adopted.</td>
</tr>
<tr>
<td></td>
<td>Inadequate BCR to justify the work.</td>
<td>Compensation is a consequence of all of the risks identified above.</td>
</tr>
<tr>
<td></td>
<td>Insufficient funds to adequately complete the required work.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Large compensation payments for crash victims.</td>
<td></td>
</tr>
</tbody>
</table>
3.9.7 Review and documentation

The requirements for review, documentation and approval are defined in Chapters 4 and 6 of the Transport and Main Roads Preconstruction Processes Manual. This also gives general guidance on the content required in the documentation.

The department specifies that a Design Development Report be generated as an output from each of the stages of project development beginning at the Options Analysis Stage.

The department requires the documentation of the following factors in the design documentation:

- project requirements
- existing conditions
- developing scope and identifying design inputs
- design parameters and issues
- design details
- record of design issues arising from process activities
- road safety audits, and
- actions.

The adoption of EDD is considered in the section of the Design Development Report relating to design parameters and issues. This section also provides for the documentation of potential impacts from the projects and anticipated project risks.

It is important that the documentation is clear and complete in terms understandable to others who may not be familiar with the project. It must also be clear to those who may need to defend the decisions a long time after the project is implemented.

The amount of documentation required and the content will vary according to the complexity of the EDD or design exception elements, and the level of intrusion into the extended design domain.

An example of a case where simple documentation may be appropriate could be a simple vertical crest on a horizontal straight where supplementary manoeuvre widening is available to provide capability to avoid small objects. In this example there is no crash history; no change in operating speed, no other geometric minima and it is only a minor intrusion into EDD.

In other cases, a significant intrusion into EDD might be considered in an extremely constrained area, but the level of documentation should be more detailed. For example a Safe Intersection Sight Distance (SISD) value that is towards the bottom end of the EDD in conjunction with other design minima such as a tight horizontal curve.

For all design classes an EDD and Design Exceptions Summary Report is required if certain geometric parameters and/or elements require assessment and an EDD/design exception is being proposed. Refer to Table 2.1 of Volume 1 of this RPDM which details the minimum assessment for each design class.

Volume 1 of this RPDM expands on this with the level of design effort expected. Note that following a speed assessment the original nominated design class should be re-categorised so the works do not make the road ‘less safe’.
Whatever EDD and design exception documentation is prepared should form part of the design development report.

### 3.9.8 Monitoring and evaluation

Where a design exception forms an element within a road project design, the project must include planning for the monitoring of the design exception and potential implementation of remedial treatments.

In all cases, the design exception needs to be systematically monitored to validate the decisions made and to provide information to make improvements to the process.

Where it is found that the decision has not been successful in terms of maintaining or improving the substantive safety, the monitoring system will provide the information to allow appropriate modifications to be made to the road in question. A suitable system should collect data, analyse results and incorporate lessons learned in relevant guidelines and manuals.

The regime for the monitoring of the project performance post-implementation must be identified during the planning/design phase to allow an assessment of the project performance against that expected during the crash and risk analysis of the project. Where, the risk analysis identifies residual risks with a potential high severity outcome, or risks that cannot be accurately quantified, a higher level of monitoring will be required.

In considering the monitoring requirements to be addressed in the design report, the following need to be addressed:

- What is the recommended monitoring that should be used to determine whether the original problems have been dealt with in an “on-going” manner?
- What are the issues that should be reviewed immediately after completion of the site works, after five years in service and at the end of fifteen years’ service?

An essential input into the monitoring process will be the crash statistics for the site in question. It may be necessary to examine the performance of adjacent sections to determine whether the works had a “migration” effect where crashes did not reduce but migrated to an adjacent section of road.

Each instance will need to be examined to see what the appropriate monitoring programme should be.

At the least, the following measures will be needed:

1. Roadway characteristics – cross section, geometry.
2. Signs and marking.
3. Presence of other road furniture (signals, lighting).
4. Crash history for as long a period as possible – not less than three years. This data should include the type, location, time, severity of crashes.
5. Traffic characteristics (volume, proportion and type of heavy vehicles, pedestrians (if applicable), cyclists (if applicable), speed).

For design exceptions where experience and crash histories indicate satisfactory performance, the normal black spot and safer roads sooner programs may suffice as the monitoring regime. For design exceptions, that are more unique and/or where their values are well outside of the design domain, a greater level of monitoring should be applied.
Planning should also be undertaken to implement appropriate alternative treatments where unacceptable safety risks become evident. This planning of remedial treatments should be undertaken as part of the design process for the design exception as shown in Figure 8.2.

**Figure 8-2 – Evaluation, monitoring and planning of alternative treatments for design exceptions**

The design exception process must identify the planning and resourcing for the monitoring and remedial treatment tasks during the planning/design phase of the project. In addition the cost implications associated with the monitoring and alternative treatments should be included within the BCR analysis of the design exception as they are a key element of the acceptance of the design exception.

**Monitoring Regime**

For each of the types of design exception, different monitoring regime levels have been defined to align with the general risk profile for each type. However, each design exception should be assessed to establish the most appropriate level of monitoring based on the risk profile associated with the design exception. In some circumstances it may be necessary to implement a monitoring regime higher than the typical levels described below. A monitoring regime lower than that described below would not typically be appropriate.
Table 8-3 - Levels of monitoring regime for design exceptions

<table>
<thead>
<tr>
<th>Monitoring Regime Level</th>
<th>Design Exception Type (typically)</th>
<th>Typical Situations</th>
</tr>
</thead>
</table>
| Low                     | Existing design exception retained. | - These design exceptions generally considered to be low risk.  
- Typically relate to existing design exceptions which are not substantially impacted by the project works.  
- The existing crash history is known, and is relatively low with a low severity (no fatal or seriously injured) for any crashes related to the design exception.  
- The risk profile has not substantially changed due with the retention of the design exception. |
| Medium                  | New design exception with precedent. | - These design exceptions are typically a low to medium risk.  
- The design performance can be estimated based on performance of other precedent examples. |
| High                    | PILOT - new design exception without precedent. | - These design exceptions are considered to be a high or unknown risk.  
- Generally when the design exception is associated with a design feature that has a potential for high severity outcomes (e.g. head on crashes, high relative conflict speeds or steep embankments).  
- Particularly for PILOT projects where the design performance cannot be established from precedents elsewhere on the network.  
- May also apply to other design exceptions where a high risk potential outcome has been introduced. |

The particular features for each of the levels of monitoring for the regime are currently under development and consultation and will be included in this document when finalised. Monitoring data may typically include a selection of the following:

- video monitoring of driver behaviour
- video monitoring of particular potential hazards
- crash data review
- fatal and serious injury crash review
- traffic operational performance (for example, queues, delays).

Remedial treatments

Associated with the implementation and monitoring of the design exception is the necessity to plan for remedial treatments if unacceptable safety risks eventuate. The degree of monitoring and the subsequent level to which a remedial treatment plan is developed will be dependent on the residual risk deemed to exist with the implemented design exception.

For example where a project is retaining an existing design exception with minor improvements only to the road in the vicinity of the site, then there may be a high degree of confidence that there has been
little change in the risk profile. When coupled with an existing low crash history, a remedial treatment plan may not be required.

At the other extreme, a design incorporating an untested design exception (i.e. a pilot project) with high potential safety risks requires an immediate remedial plan should significant safety concerns eventuate. In this case the remedial plan is required that can be implemented at very short notice and therefore should be developed prior to the design exception being constructed. The remedial plan may either remove the design exception or return the site to its original layout within a short period.

The features for each of the levels of monitoring for the regime are currently under development and consultation and will be included in this document when finalised.

Indicative levels of remedial treatments required for each type of design exception are currently under development and consultation and will be included in this document when finalised. Engineering judgement is required for each design exception to select the appropriate level of monitoring and remedial treatment development dependent on the risk analysis undertaken for the project.
References

Transport and Main Roads publication references refer to the latest published document on the departmental website (www.tmr.qld.gov.au).

Additions


Austroads (2014) *Australian national risk assessment model*, Sydney, NSW

Transport and Main Roads *Design development report (large projects)*, Brisbane, QLD

Transport and Main Roads *Design development report (small projects)*, Brisbane, QLD

Transport and Main Roads *Engineering Innovation within the Department of Transport and Main Roads*, Brisbane, QLD

Transport and Main Roads *Functional specification templates C7521 Options analysis*, Brisbane, QLD

Transport and Main Roads *Functional specification templates C7522 Business case*, Brisbane, QLD

Transport and Main Roads *Functional specification templates C7523 Preliminary design*, Brisbane, QLD

Transport and Main Roads *Functional specification templates C7524 Detailed design*, Brisbane, QLD

Transport and Main Roads *Guidelines for road design on brownfield sites*, Brisbane, QLD

Transport and Main Roads *Manual of uniform traffic control devices*, Brisbane, QLD

Transport and Main Roads *Preconstruction processes manual*, Brisbane, QLD

Transport and Main Roads *Project scoping guideline*


