Austroads

Research Report
AP-R610-20

Inclusion of Recent Road Safety Research into the Guide to Road Design

Summary of Research Reports

Inclusion of Recent Road Safety Research into the Guide to Road Design: Summary of Research Reports

Prepared by

Peter Aumann

Project Manager

James Hughes

Publisher

Austroads Ltd.
Level 9, 287 Elizabeth Street
Sydney NSW 2000 Australia
Phone: +61 2 8265 3300
austroads@austroads.com.au
www.austroads.com.au

Abstract

Recent Austroads research reports have been reviewed and any recommendations have been identified and assessed for their impact on the Guide to Road Design.

The recommendations related to updating design practices based on the outcomes of the research and possible amendments have been developed.

Thirty reports were reviewed, and the Road Design Task Force determined the application of the recommendations and inclusion within the Guide to Road Design.

The review also identified possible amendments to the Traffic Management guides, and this has been highlighted in the report.

To assist in incorporating research into the Guides, a procedure has been developed for Task Forces, that outlines the process from inception of the research project to amending the Guide. This process enables a consistent method to be followed and outcomes of research to be brought into practice in a timely manner.

Keywords

Road design, research reports, research recommendations, amendments, process for amendment.

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About Austroads

Austroads is the peak organisation of Australasian road transport and traffic agencies.

Austroads' purpose is to support our member organisations to deliver an improved Australasian road transport network. To succeed in this task, we undertake leading-edge road and transport research which underpins our input to policy development and published guidance on the design, construction and management of the road network and its associated infrastructure.

Austroads provides a collective approach that delivers value for money, encourages shared knowledge and drives consistency for road users.

Austroads is governed by a Board consisting of senior executive representatives from each of its eleven member organisations:

- Transport for NSW
- Department of Transport Victoria
- Queensland Department of Transport and Main Roads
- Main Roads Western Australia
- Department of Planning, Transport and Infrastructure South Australia
- Department of State Growth Tasmania
- Department of Infrastructure, Planning and Logistics Northern Territory
- Transport Canberra and City Services Directorate, Australian Capital Territory
- The Department of Infrastructure, Transport, Cities and Regional Development
- Australian Local Government Association
- New Zealand Transport Agency.

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1. Introduction

This project reviewed all Austroads safety-related research that contained recommended changes to the *Guide to Road Design: set* (Austroads 2019b). It summarises those research reports and documents how those recommendations are to be implemented by the Road Design Task Force.

The research reports that were reviewed are listed in Section 1.1.

1.1 Research Reports

Twenty-six reports, which included two technical advice documents from the Austroads Safety Barrier Assessment Panel, were nominated for review. A further report *Safe System Infrastructure on Mixed Use Arterials* (AP-T330-17) (Austroads 2017a) was published by Austroads near the end of this review and has also been included.

Further reports were identified that were published after the project commenced and these were included in the project, resulting in thirty research reports or technical guidance reports being reviewed. All of the reviewed reports are listed in Table 1.1.

Table 1.1: Research reports reviewed

No	Report reference	Title
1.	AP-R509-16 (Austroads 2016a)	*Safe System Assessment Framework*
2.	AP-R518-16 (Austroads 2016b)	*Safe System Roads for Local Government*
3.	AP-R460-14 (Austroads 2014a)	*Providing for Road User Error in the Safe System*
4.	AP-R488-15 (Austroads 2015a)	*Safe System in the Planning Process*
5.	AP-R498-15 (Austroads 2015b)	*Improving the Performance of Safe System Infrastructure: Final Report*
6.	AP-R514-16 (Austroads 2016c)	*Achieving Safe System Speeds on Urban Arterial Roads: Compendium of Good Practice*
7.	AP-R508-16 (Austroads 2016d)	*Speed Reduction Treatments for High-speed Environments*
8.	AP-R449-14 (Austroads 2014b)	*Methods for Reducing Speeds on Rural Roads Compendium of Good Practice*
9.	AP-R455-14 (Austroads 2014c)	*Model National Guidelines for Setting Speed Limits at High-risk Locations*
10.	AP-R515-16 (Austroads 2016k)	*Infrastructure Improvements to Reduce Motorcycle Casualties*
11.	AP-T293-15 (Austroads 2015c)	*Road Design for Heavy Vehicles*
12.	AP-R530-16 (Austroads 2016e)	*Older Road Users: Emerging Trends*
13.	AP-R519-16 (Austroads 2016f)	*Guidance on Median and Centreline Treatments to Reduce Head-on Casualties*
14.	AP-R481-15 (Austroads 2015d)	*Safety Provisions for Floodways over Roads*

No	Report reference	Title
15.	AP-T295-15 (Austroads 2015e)	*Road Geometry Study for Improved Rural Safety*
16.	AP-R450-14 (Austroads 2014d)	*Investigation of Key Crash Types: Run-off-road and Head-on Crashes in Urban Areas: Final Report*
17.	AP-R480-15 (Austroads 2015f)	*Investigation of Key Crash Types: Rear-end Crashes in Urban and Rural Environments*
18.	IR-232-15 (Austroads 2015g)	*Safe System Practice Amendments to the Guide to Road Design*
19.	IR-223-14 (Austroads 2014e)	*Safety Operational and Environmental Impacts of Changes to Speed Limits*
20.	IR-237-15 (Austroads 2015h)	*Updating the Guide to Road Safety Part 9: Roadside Hazard Management*
21.	IR-260-16 (Austroads 2016g)	*Road Safety Audit and Road Safety Engineering Toolkits: Usage Survey 2011-16*
22.	ASBAP[1] Technical Advice 17-001 (Austroads 2017b)	*Lapping of Guardrail Terminals*
23.	ASBAP Technical Advice 17-002 (Austroads 2017c)	*Proximity of Safety Barriers to Batter Hinge Point*
24.	SRD2068	*Road Cross Section Design for Road Stereotypes (including Network Safety Plans and a Safe System)*
25.	AP-T330-17 (Austroads 2017a)	*Safe System Infrastructure on Mixed-use Arterials*
26.	AP-R542-17 (Austroads 2017d)	*Bicycle Safety at Roundabouts*
27.	AP-R461-14 (Austroads 2014f)	*Assessment of the Effectiveness of On-road Bicycle Lanes at Roundabouts in Australia and New Zealand*
28.	AP-R560-18 (Austroads 2018)	*Towards Safe System Infrastructure Compendium of Current Knowledge*
29.	AP-R549-17 (Austroads 2017e)	*Improved Railway Crossing Design for Heavy Vehicles*
30.	Project NTM6021	*Safe Systems in the Guide to Traffic Management*

1.2 Methodology

To determine possible amendments to the *Guide to Road Design (GRD)-set* (Austroads 2019b), each of the reports or technical advice documents were reviewed and any recommendations relating to a Part of the *GRD-set* were identified.

Where it was identified that a Part was currently being reviewed, the most recent draft was obtained and included in the review of the Parts. This enabled any matters from the research reports to be identified and acknowledged. However, if a Part was already under review, then this research project recommends that the amendments to that Part are incorporated into its current review.

To obtain a broad snapshot of the inclusion of the outcomes of the report and extent of possible amendments, the outcomes of each report have been categorised as outlined in Table 1.2.

[1] ASBAP is Austroads Safety Barrier Assessment Panel.

Table 1.2: Impact on the Guide to Road Design

Category	Impact
1	Significant content/recommendations incorporated in part(s) of the GRD as soon as possible.
2	Content/recommendations incorporated in parts of GRD at the next revision.
3	Some content/recommendations partially incorporated into GRD at the next revision.
4	Content highlights useful background information for practitioners that should be referenced in the GRD.
5	Content/recommendations noted with potential for inclusion in GRD with further investigation.
6	Content noted with influence but without direct relevance to the GRD.
7	Content noted without direct relevance to the GRD.

2. Findings

The reports in Table 1.1 were reviewed to identify any recommendations or suggestions for updating the Guide to Road Design. Any report suggestions that were considered to be directed at the Guide to Road Safety or the Guide to Traffic Management were also identified, for consideration by the appropriate Task Force.

Some reports did not identify a part within the *GRD-set* (Austroads 2019b), and this made it difficult to translate the intent of the report and recommendation or suggestion into possible practice amendments and to refer to the appropriate Task Force.

Some Parts had been reviewed since the publishing of the research report and had incorporated some or all of the recommendations into the update. Where some of the recommendations had been incorporated, it was unclear whether the recommendations that had not been incorporated had been considered in the review.

The reports also contained many suggestions and some recommendations of a philosophical nature, particularly relating to the incorporation of the Safe System principles. These recommendations were typically not specific and would need any amendment to be developed into practice amendments.

A summary of the reports and recommendations and suggestions is contained in Section 3.

3. Review of the Road Safety Research Reports

Table 3.1 summarises each of the research reports, and comments on their suggestions/recommendations and the likely impact on the Guide to Road Design.

It then documents the possible amendments to the Guide to Road Design, and to the Guides to Road Safety and Traffic Management where appropriate, and uses Table 1.2 to categorise the impact of those amendments.

The last column in Table 3.1 documents the Road Design Task Force determination as to how those amendments are to be implemented.

After each report in the table, specific suggested actions for amendments to the GRD are documented.

In addition to this, four reports have been identified as having significant recommendations, and these are documented in Appendix A – Appendix D.

Table 3.1: Summary of reports and suggested amendments

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
1.	*Safe System Assessment Framework* (AP-R509-16) (Austroads 2016a)	This project developed an assessment framework to help road agencies methodically consider Safe System objectives in road infrastructure projects. The framework involves identifying the key crash types that result in death and serious injury, and uses a risk assessment approach, identifying elements that might contribute to severe outcomes. A treatment hierarchy is presented highlighting examples of Safe System solutions addressing each of the key crash problem types. Comment The assessment framework assists in demonstrating that design solutions are aligned with the Safe System approach. The suggested amendments are primarily applicable to *GRD Part 2: Design Considerations* (Austroads 2015i). *GRD Part 3: Geometric Design* (Austroads 2016i) and *GRD Part 6: Roadside Design, Safety and Barriers* (Austroads 2010) contain treatments in a hierarchal manner, and, whilst linking to the assessment framework reinforces this type of approach, cross-reference is not considered necessary.	Level of amendment: Category 2 and 4. *Part 2: Design Considerations* (Austroads 2015i) Section 1.4.2: Designing for Safety. Incorporates the hierarchy of controls concept for intersections, mid-block and roadsides. The Safe System Assessment Framework be referenced as a method to compare alternative treatments against the Safe System principles.	More philosophical than instructional guidance – this provides a framework that designers can use to compare how their alternatives stack up against Safe System principles. This represents another assessment tool rather than inclusion in the GRD. Include link to report or take parts of the report i.e. the assessment framework and include as appendix in *GRD Part 2*. See text below for Suggested amendments.
2.	*Safe System Roads for Local Government* (AP-R518-16) (Austroads 2016b)	The project aimed to develop a greater understanding of Safe System principles amongst local government practitioners and through this, increase application of the Safe System approach on local government-managed roads. The report details the development of the Safe System Hierarchy of Control framework and discusses the enhancements to the Road Safety Engineering Toolkit. Comment The report identified the road design guides for possible update but did not include specific recommendations.	Level of amendment: Category 2 and 4. Incorporation into the design guide series is very similar to the incorporation of the outputs from the *Safe System Assessment Framework* (AP-R509-16) (Austroads 2016a). *GRD Part 2* (Austroads 2015i) would be the same as provided for *Safe System Assessment Framework*.	Same as comment above (No 1) – strong relationships between these two reports. Include link to report or take parts of the report i.e. the assessment framework and include as appendix in *GRD Part 2* and highlight importance to urban environments.

<table>
<tr><th>No.</th><th>Report</th><th>Summary and Comment</th><th>Possible amendments</th><th>Road Design Task Force determination</th></tr>
<tr><td colspan="5">
Reference to reports No 1 and No 2.
GRD Part 2 (Austroads 2015i):
Section 1.4.2 – Insert the following paragraph:
The Safe System Assessment Framework provides designers with a methodical way of comparing the extent to which their proposed package of treatments aligns with the Safe System objectives. The framework includes all ‘pillars’ of the system, including an assessment of issues relating to the road and travel speeds. It also ensures consideration of other pillars which are typically included less often in infrastructure projects. These include road user issues and vehicle-related issues. Post-crash care is also considered. Each individual treatment option and the way in which it contributes to safety of the different quadrants of the Safe System is scored, considering the exposure, likelihood and severity. By summing these treatment scores, the designer can quickly get an impression of how their complete treatment package satisfies the Safe System objectives. Although it can be applied to any project, this process is particularly useful in an urban environment in focussing on the minor adjustments a designer can make to make incremental safety gains. It should be considered as one input to the decision-making process.
Section 3, Table 3.1:
Insert Safety and the Safe System objectives in this table, replacing the Project Management – Project scope and objective row.

Table 3.1
<table>
<tr><th>Design consideration</th><th>Type of information</th><th>Why needed</th><th>Nature of information</th><th>Likely source</th></tr>
<tr><td colspan="5">Safe System Objectives</td></tr>
<tr><td>Project scope and objective.</td><td>• Purpose of the project
• Safety Issues to be addressed.</td><td>• Understand limitation of design brief and basis to the project.
• Clearly define the expectations of the client/project sponsor.</td><td>• Project brief containing key points such as where, why, purpose and scope of the proposed road safety improvements.
• Crash data analysis.</td><td>Client/project sponsor, e.g. road jurisdiction, land developer.</td></tr>
<tr><td>Detailed design options.</td><td>Safe System Assessment Framework scoring matrices.</td><td>Demonstrable alignment with Safe System Objectives.</td><td>Safe System Assessment Framework scoring matrices.</td><td>Designer.</td></tr>
</table>
</td></tr>
</table>

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
3.	*Providing for Road User Error in the Safe System* (AP-R460-14) (Austroads 2014a)	This project investigated the feasibility and cost of moving towards a truly Safe System infrastructure considering driver fallibility or error. The report found that a small number of treatment types applied in the appropriate location would have protected many drivers who made errors. In particular: • sealed shoulders • roadside barriers • centreline wire rope safety barriers (WRSBs) would provide protection from the consequences of errors in 63% of all the crashes examined in this study. Comment The report does not contain specific recommendations; however, it demonstrates the benefits of treatments in combination. The Road Cross-section Design for Road Stereotypes (including Network Safety Plans) and a Safe System project demonstrates the safety benefits when treatments are used in combination.	Level of amendment: Category 1 (treatments) and 5 (treatments in combination). There is little guidance on the benefits of using treatments in combination in the *GRD-set* (Austroads 2019b). Inclusion of this type of information would require significant research and agreement on outcomes. The outcomes of the Austroads project Road Cross-section Design for Road Stereotypes (including Network Safety Plans) and a Safe System is aimed to provide guidance on benefits of treatments in combination.	Conclusions will be reflected in the outcome of Road Stereotypes project and should be considered concurrently with Austroads Project SSP2068.
4.	*Safe System in the Planning Process* (AP-R488-15) (Austroads 2015a)	The Safe System approach aims to support development of a forgiving transport system that is better able to accommodate human error and road user vulnerability. Although safety is recognised as a desired outcome of land-use planning, Safe System principles are not widely employed by planners. In dealing with the built form and transport, planners play a pivotal role in providing a safe environment for all people, irrespective of their mode of travel and travel purpose. Good planning and design sets the foundation for a safe road environment, which will protect people from death and serious injury. Transport and land-use planning influences the design and location of roads, how the road network is used, and what infrastructure safety investments are required. Considering and implementing Safe System principles early in the planning process achieves the best possible balance between the multiple objectives. Comment Report focusses on planning of road networks and is relevant for the *GTM Part 4*. No recommendations made for GRD.	Level of amendment: Category 6. Road Network planning is relevant for *Guide to Traffic Management Part 4: Network Management* (Austroads 2016h).	Although this may well become a new part in the future, a short discussion of this topic will be included in the review of *GRD Part 6 (Austroads 2010)*. Will also be included in the review of *GRD Parts 1* and *2* (Austroads 2015j, 2015ij), project SRD6107. Network Program is considering this report in updates to the *Guide to Traffic Management-set* (Austroads 2019c).

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
5.	*Improving the Performance of Safe System Infrastructure: Final Report* (AP-R498-15) (Austroads 2015b).	This report identified areas of improvement which would bring safety performance of selected Safe System infrastructure elements closer to the vision's objectives. The report summarises the key aspects of Safe System performance for signalised intersections, roundabouts, and wire rope barriers in wide-median, narrow-median and roadside applications. The project proposed a new approach to the definition of what constitutes road infrastructure aligned with Safe System objectives: • The hierarchy of Safe System treatments starts with those excluding the possibility of a crash altogether through removal of road user exposure or removing conflict points (e.g. a tunnel, forgiving median barriers, intersection closures). • The second tier would involve treatments limiting injury severity should the crash occur. These could include using geometry and speed limits to deliver low impact speeds and low impact angles or distributing roadside crash forces with forgiving barriers. If such treatments are not feasible, then solutions should be focussed on reducing crash likelihood and/or severity, such as reducing the number of conflict points, managing them (e.g. with signals), lowering speeds and providing system redundancies (e.g. shoulders, medians). Removing roadside hazards, shielding them with less forgiving barriers or incrementally reducing speed limits would act to reduce the occurrence of severe crashes. Guidance, warning and lighting also reduce the rates of road user error and crash likelihood, and thus contribute towards Safe System alignment. For signalised intersections, the leading severe crash factors were: • high entry speeds and unfavourable impact angles (e.g. right-angle, head-on) • red-light running, lack of full right-turn control • large size of site (multilane, high number of conflict points) • inadequate signal visibility • high pedestrian activity. The suggested solutions align the signalised intersection form closer to the Safe System ideal: • signalised roundabouts • horizontal and vertical deflections on entry.	Level of amendment: Category 3 and 5 The treatments identified to bring safety performance closer to the Safe System: – signalised roundabouts (for speed control), horizontal deflection, vertical deflections and double diamond cross-overs – all require further investigation to establish the benefits obtained, application and detailed design information. Consider including the guidance, based on the outcomes, in an appendix to *GRD Part 2* (Austroads 2015i). The information could be in the *Guide to Traffic Management-set* (Austroads 2019c) with cross-referencing in the *Guide to Road Design-set* (Austroads 2019b).	Wider implications for intersection choice and speed management treatments – predictably recommends further investigation and monitoring or assessment of treatment efficacy before more definitive advice can be included in the GRD or GTM. Could potentially form an Appendix to be updated as evaluations are completed. This would probably be best placed in *GRD Part 2*, given that the examples apply across parts of *GRD Part 3* (Austroads 2016i) and *Part 4* (Austroads 2017f). To be refined and considered as part of the review of *GRD Parts 1* and *2*, project SRD6107.

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
		For roundabouts, the focus was on improving safety performance for cyclists and motorcyclists. The key severe crash factors were related to: • high-speed approach and entry into the roundabout, and included multiple approach and circulating lanes • lack of effective approach deflection • high-speed exit conditions as a potentially contributing factor in injury crashes. The proposed Safe System solutions included: • reduction in approach and entry speeds such as tighter geometric design • raised stop lines/platforms. Identified supporting measures included arterial traffic calming, cyclist bypasses, and signalising roundabouts. Wire rope barriers generally deliver substantial safety improvement for most road users compared to other roadside design options. It is proposed that further research and development of guidance focusses on refinement based on application of optimal wire rope barrier systems for different locations, so that risk of severe injury outcome is minimised. <u>Summary</u> There is little formal research published on safety effects of signalised roundabouts. If this was to be considered as a mainstream Safe System solution, there is a need to bring together existing research on safety, operational efficiency and accessibility (e.g. public transport, heavy vehicles, cyclists, pedestrians), and to supplement this knowledge with safety evaluations of existing designs (e.g. effect on different crash types and severities). Such a project would draw on the findings to propose detailed design considerations applicable to signalised roundabouts. Evaluation of effectiveness of intersection speed limits needs to be carried out across a range of environments. Turbo roundabouts require systematic in-depth analysis of effectiveness, road rules compliance and applicability in Australian and New Zealand contexts before undertaking trials.		

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
		Radial roundabout design has been a subject of much conjecture. In-depth consideration of this design type's benefits and drawbacks is needed, especially its effect on off-path crashes. Improvement solutions best aligned with the Safe System objectives involved lowering crash severity through reduced intersection entry speeds and crash angles, and other features reducing crash likelihood. Possible treatments were assessed by an expert panel and their views on the application and design of the treatment were provided. The design-related issues were: • Low-speed signalised roundabout: – Provision of roundabout bypass would improve operational efficiency, especially where there was a heavy left-turn demand. – Needs careful management of approach speeds, which may involve approach geometry (medians, linemarking) or arterial road speed management (kerb build-outs, pedestrian refuges, perceptual treatments). – Irregularly shaped central island should be avoided as motorcyclists have stability problems when faced with rapid change of direction. – Stronger horizontal deflection may conflict with the need for wider swept path to accommodate trucks. • High-speed signalised roundabout: – Cyclists preferably moved around via a bypass. – Sightlines to signals may be an issue due to curved design and high approach speeds. – Signals with horizontal approach deflections. – Tennis ball design applicability to locations other than interchanges is yet to be tested. – Consider tight corners to control left-turning speeds. – Vertical deflections on approaches. Design guidance needs to be developed to apply at a wide range of high-speed sites, e.g. approach and departure slopes, platform lengths. Heavy vehicle, rider and bus issues also need to be identified. The project stopped short of suggesting guidance on wire rope selection.		

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
		Comment The report provided information on treatments; however, some of the nominated treatments require further investigation relating to their application and detail design.		
Reference to report 5. ***GRD Part 2* (Austroads 2015i):** **Section 3 Table 3.1** **Currently *this table* has little reference to safety. Suggest a significant update to this table that references the Safe System principles and objectives, and refer to the safety treatments outlined in the Safe System Assessment Framework (Recommendation for reports Nos 1 & 2).** **Include examples from report in an Appendix to *Parts 1* and/or *2* when appropriately evaluated.** ***GRD Parts 1* and *2* review (project SRD6107):** **Consider inclusion as part of the review of Parts 1 and 2.**				
6.	*Achieving Safe System Speeds on Urban Arterial Roads: Compendium of Good Practice* (AP-R514-16) (Austroads 2016c)	The Compendium of Good Practice provides information on speed and crash effectiveness, indicative costs, applicability, and current uses for 27 engineering-based treatments on urban arterial roads at intersections and mid-block locations. An inclusive definition has been used for urban arterial roads in this study, with information on treatments provided for 'higher traffic volume' roads. While the focus is on engineering (infrastructure) measures, some information on non-engineering-based treatments (e.g. enforcement, in-vehicle systems, road user education, and publicity) is also provided for completeness. Similarly, some information on speed management measures in work and school zones is provided. The underlying principles of the treatment types are provided, and each treatment is discussed in detail. However, the list of measures should not be as exhaustive, and gaps were found in the information on implementation of such measures and their evaluation. Most of the measures are adaptations of successful local area traffic management (LATM) measures put forward for application on busier and faster-flowing roads. Applying any treatment requires professional judgement and local knowledge. Commonly applied treatments include roundabouts, horizontal deflection on approach and lower speed limits at intersections; and pedestrian refuges, medians and variable speed limit signs at mid-block locations.	Level of amendment: Category 3 and 5. The report covers practices for speed and crash management on urban arterial roads. There are references to report 5: *Improving the Performance of Safe System Infrastructure: Final Report* (Austroads 2015b). Examples of good practice be included in an appendix *in GRD Part 3* (Austroads 2016i) and *Part 4* (Austroads 2017f) as appropriate. (The examples of good practice should be updated as evaluation of treatments is completed). Other Austroads Guides *GTM Part 5: Road Management* (Austroads 2017j) includes a section on speed limits, which includes some information on treatments to achieve a speed environment compatible with the road activity. The section could be expanded to include or cross-reference information from this report.	This references back to No 5 in terms of monitoring or assessing efficacy of speed management measures. *GRD Parts 3* and *4* could include the various treatment options that are available to manage speed but noting that the measure of their efficacy is limited. Potential for on-going updates as evaluations are completed. Suggest examples of good practice form Appendices. See text below for insertion in *GRD Parts 3* and *4*. It is also noted that project SAG6043: Speed Management – a Compendium of Effective Countermeasures and Strategies for Government and the Community, may provide further guidance.

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
		Several emerging treatments were identified as having considerable potential for effective long-term usage – signalised roundabouts, turbo roundabouts, road diets, raised intersections, wombat crossings, raised platforms at mid-block locations and dwell-on-red signals. The effectiveness measures for some of the treatments, based on existing literature, were less reliable, therefore, the information provided in the Compendium is supported by evaluations of a number of these treatments (road diets, raised intersections, wombat crossings, raised platforms at mid-block locations and dwell-on-red signals). This project strengthens the need for on-going robust evaluation of any measures implemented, and particularly for innovative measures. <u>Conclusions</u> Engineering/infrastructure measures that have the potential either in isolation or in combination to reduce current operating speeds between 60–80 km/h towards or under Safe System speeds have been the focus. The majority of the measures identified have evolved or have been adapted from past usage around the world on lower volume local roads, often under the banner of LATM. Key findings from the project include: • Commonly applied treatments on urban arterial roads include: – roundabouts, horizontal deflection on approach and lower speed limits at intersections – pedestrian refuges, medians, lower speed limits and variable speed limit signs at mid-block locations. • New and promising treatments include: – road diets, raised platforms and wombat crossings at mid-block locations – raised intersections, signalised roundabouts, turbo roundabouts and dwell-on-red signals at intersections.		

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
		Comment The treatments contained in the compendium provide some quantification of their effects; however, some require further investigation to develop appropriate locations and detailed design information, e.g. turbo roundabouts and raised platforms on high-speed roads. Section 3.3: Operating Speeds on Urban Roads, in the discussion on operating speeds, a reference to the report could provide commentary on possible treatments to manage speeds along roads; however, quantification of the treatment outcomes requires further research. *GRD Part 4*, Table 4.2: Considerations in the Location of Intersections: where approach speeds are sought to be reduced, there are some emerging treatments, e.g. horizontal deflections on approaches to an intersection, but further evaluation is needed for application and design criteria. The *GRD-set* (Austroads 2019b) contain some general information on speed-reducing treatments, but the effectiveness or outcomes of the treatment is unclear.		
Reference to report 6. **Pending wider inclusion in the next scheduled revision, add the appropriate treatments as example in the Appendices of both Parts 3 and 4 and add references to these appendices as follows:** ***GRD Part 3* – Section 1.5.1** **Examples of mid-block treatments that are consistent with the Safe System objectives are pedestrian refuges, medians, lower speed limits and variable speed limit signs. These are urban or urban fringe treatments where the need for multilane capacity makes effective speed management very difficult to achieve. Other emerging treatments such as road diets, raised platforms and wombat crossings require further evaluation at this stage.** ***GRD Part 4* – Section 1.3.1** **Example of intersection treatments that are consistent with the Safe System objectives are roundabouts and lower speed limits at, or in the vicinity of, intersections. The extent of these treatments will vary depending on the environment and how difficult effective 'self-explaining' speed management is to achieve. Other emerging treatments such as signalised or 'Turbo' roundabouts, raised intersections and dwell-on-red signals require further evaluation at this stage.**			

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
7.	*Speed Reduction Treatments for High-speed Environments* (AP-R508-16) (Austroads 2016d)	Speed management is a key component of the Safe System approach. The efficacy, including safety performance, of the various treatments and measures used to reduce vehicle speeds in high-speed environments is not well understood. This project aimed to provide a better understanding of the performance achieved by various types of speed-reducing treatments (or combinations of treatments) for high-speed environments. The project also sought to consider how desired speed can be aligned with a safe, anticipated operating speed with the goal of making high-speed roads more self-explanatory. This is expected to enable treatments to be applied more appropriately and effectively, with consequential benefits in maximising the safety and effectiveness of available funding levels for road improvements in high-speed environments. The project included a broad review of speed reduction treatments applicable to different types of road sections including intersections, transition areas, curves and mid-block sections and on road features that influenced speed in high-speed environments. The review of speed reduction treatments in higher-speed environments compiled information on a number of treatments including perceptual countermeasures, transverse rumble strips, vehicle activated signs, gateway treatments, route-based curve treatments, wide median centrelines and sight distance adjustments on intersection approaches. Based on the outcomes of this review, these treatments may merit further consideration for future Austroads research and guidance. On mid-block sections of high-speed roads where the speed environment remains consistent, drivers seek to maintain a desired speed in line with the posted speed limit or design speed applicable to a section of road. There are a number of road features from which drivers obtain cues that may influence their speed. The report identified a number of these features and compiled existing research into the effect of individual and combined road features on speed in high-speed environments. The research and guidance provided in a number of Austroads Guides on this topic merit further consideration for identifying road features that may aid in making high-speed roads more self-explanatory.	Level of amendment: Category 5. The effects of the roadside environment and vertical features is suggested requiring further research, including application and design criteria. *GRD Part 6* (Austroads 2010), application of roadside features and providing a safe environment could be introduced in a commentary, as emerging treatments requiring further investigation. *GRD Part 6B* (Austroads 2015k), Section 3.3.2 includes a brief comment on roadside features, but requires further research on the type of feature and the associated benefits.	Research was inconclusive and really requires further investigation. No action required at this stage.

Discussion and Conclusions

Speed Reduction Treatments – The review of speed reduction treatments in higher-speed environments identified information on a number of treatments. Based on the outcomes of this review, several treatments were identified which may merit further considerations for Austroads research and guidance as identified in Table 5.1 (below) (from Austroads 2016d).

Table 5.1: Speed reduction treatments identified that merit further consideration

Treatment	Road related area	Considerations for Austroads guidance
Treatments to support development of self-explaining roads	General	• Further research may consider implications of project findings for developing initial stage of a self-explaining road hierarchy.
Perceptual countermeasures including transverse pavement markings	Intersection approaches, sharp or out-of-context curve approaches	• May merit consideration for additional guidance on application, or referencing research that has considered the application and effectiveness of this treatment.
Transverse rumble strips	Intersection approaches and curves	• Discussed in Commentary 3 of the *Guide to Traffic Management – Part 10* (Austroads 2009a). This may merit cross-referencing from the *Guide to Road Design*. • May merit additional guidance on application, or referencing research that has considered the effectiveness of this treatment.
Vehicle activated signs	Intersection approaches, curves, transitions and other areas	• The effectiveness of this treatment was considered as part of previous Austroads research (Austroads 2014a). • May merit developing supplemental guidance on treatment for the *Guide to Road Design* or cross-reference to other Austroads Guides or reports.
Gateway treatments	Transition zones	• The application and effectiveness of this treatment was considered as part of a previous Austroads research (Austroads 2014a). • May consider developing standard design drawings and guidance for inclusion in the *Guide to Road Design*.
Route-based curve treatments	Curves	• Monitor developments and outcomes of VicRoads trial of route-based curve treatments to consider implications for Austroads guidance.
Wide median centrelines	Mid-block and route-based treatments	• May merit consideration for additional evaluation particularly where applied with a reduced posted speed.
Sight distance adjustments	Intersection approaches	• Application of treatment has been limited. • May merit further research to consider treatment due to the challenges with approach speeds at roundabouts in high-speed environments.

Implications for Austroads Guidance

The review of road features identified a number of considerations for Austroads Guides. These include:

GRD Part 3 (Austroads 2016i) provides guidance on a number of the geometric design features identified in Table 5.2: *Research and guidance related to road features in high-speed environments*. The research identified, and information provided in other Austroads Guides noted in the table may merit further consideration to enhance practitioner guidance on these road features.

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
		GRD Parts 6 and *6B* (Austroads 2010, 2015k) provide guidance on roadside features and facilities. There is merit in developing further guidance that discusses the influence of the roadside environment and vertical features on speed.		
8.	*Methods for Reducing Speeds on Rural Roads Compendium of Good Practice* (AP-R449-14) (Austroads 2014b)	Speed is a significant contributor to deaths and serious injuries on rural roads in both Australia and New Zealand. Research was undertaken on speed reduction in rural areas, with the key objective of providing information on effective techniques to reduce speed and speed-related crashes in rural areas, particularly those involving engineering-based solutions. The research included a literature review and international review of expert opinion; the development of a strategy for future research to address gaps in knowledge; data analysis; site visits; consultation with industry; rural speed workshops; trials of new treatments; and development of guidance. This report is designed to be a compendium of good practice to inform practitioners of the extent of the speed issue in rural areas and to provide guidance on effective actions that can be taken to reduce the incidence and severity of crashes on rural roads. Detailed information is provided on almost 30 road engineering treatments that may be used to reduce speeds at key locations on rural roads. Information is presented on the speed and crash reduction effectiveness of commonly used treatments. These include advance warning signs, chevron alignment markers, and advisory speed signs at curves; advance warning signs and roundabouts at intersections; and advance warning signs and buffer zones on the approach to towns. Key conclusions from the project are as follows: Information is now known regarding the speed and crash reduction effectiveness of commonly used treatments. These include: • advance warning signs, chevron alignment markers, and speed advisory signs at curves • advance warning signs and roundabouts at intersections • advance warning signs and buffer zones on the approach to towns.	Level of amendment: Category 3. *GRD Part 3* (Austroads 2016i), Section 3.4: Operating Speeds on Rural Roads, in the discussion on operating speeds, a reference to the report could provide commentary on possible treatments to manage speeds along roads; however, quantification of the treatment outcomes requires further research. *GRD Part 4* (Austroads 2017f), Table 4.2: Considerations in the location of intersections: where approach speeds are sought to be reduced, there are some emerging treatments, e.g. horizontal deflections on approaches to an intersection, but further evaluation is needed for application and design criteria. Other Austroads Guides Speed control treatments are referenced in Table 6.7 of *GTM Part 5* (Austroads 2017j). Cross-reference to *GTM Part 5* may be appropriate to inform the design of treatments where the design speed is sought to be reduced and the possible treatments to support the reduced speed.	Same as No 6 – *GRD Parts 3* and *4* could actually include the various treatment options that are available to manage speed but noting that the measure of their efficacy is limited. Potential for on-going updates as evaluations are completed. Suggest examples of good practice form Appendices. References need to be added to the GRD Parts as detailed below. Road Safety Task Force (RSTF), Network Task Force (NTF) and Traffic Management Working Group (TMWG) to be informed of recommendations for consideration for inclusion in the *GTM-set* (Austroads 2019b).

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
		Emerging treatments have been identified, and in several cases, data has been collected to determine the effectiveness of these treatments. New and promising treatments include: • vehicle-activated signs and route-based treatments at curves • speed management and vehicle-activated signs at rural intersections • rural gateway/threshold treatments on the entry to small towns in rural areas. Other treatments require further investigation, but show some promise including: • in-vehicle speed warning systems for curves (and potentially other locations on rural roads) • removing 'excess' sight distance at intersections, and methods to highlight the presence of intersections • road narrowing combined with reduced speed limits on rural roads.		
Suggested action: **Reference to Report 8.** **Pending wider inclusion in the next scheduled revision, add the appropriate treatments as examples in the Appendices of both *GRD Parts 3* and *4* (Austroads 2016i, 2017f) and add references to these appendices in the main body text as appropriate.** **Guide to Road Design:** ***GRD Part 3* – Section 5.10: Curves, include reference to the *GRS Part 3* (Austroads 2008a) and *GTM Part 5* (Austroads 2017j).** ***GRD Part 4* – Section 3.1: Sight Distance, include reference to *GRS Part 3* and *GTM Part 5*.** **Section 10.1: Level Crossing Approaches, based on report Appendix: A3 (A3.1, 3.2), refer to *GRS Part 3* and *GTM Part 5*.** ***GRD Part 4B* (Austroads 2015l) – Section 4.5.2: Approach and Entry Treatments, based on report Appendix A2 (A2.3), refer to *GRS Part 3* and *GTM Part 5*.** **Refer to the *Guide to Road Safety Part 3* (Austroads 2008a) and *Guide to Traffic Management Part 5* (Austroads 2017j),** **based on report Appendix: A4 (A4.4, A4.5); report Appendix: A5 (A5.1 – A5.3) and report Appendix: A2 (A2.1, A2.2), A2.4, A2.5, (A2.7 – A2.10).**			

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
9.	*Model National Guidelines for Setting Speed Limits at High-risk Locations* (AP-R455-14) (Austroads 2014c).	This project developed model national guidelines to assess and implement reduced speed limits on higher-risk roads and intersections not amenable to cost-effective engineering treatments. The model guidelines propose speed limit setting practice based on harm reduction, i.e. an intermediate step towards the Safe System. The model guidelines apply to different road categories and functions typical to Australia, while incorporating criteria for reduced speed limits based on severe crash risk: • on road lengths that are narrow, have a substantial level of roadside hazards, have many intersections or property entrances, are curvilinear or undulating, or have higher than average severe casualty crash rates • at higher-risk intersections, especially on high-volume outer-urban arterials, where engineering treatments are not feasible. The model guidelines encourage consistent speed limits based on the presence of severe crash risks, while minimising multiple speed zones over short distances. These objectives were achieved through review of the available research evidence and best practice in Australia, New Zealand and in other road safety leader countries. The model guidelines were developed in close consultation with Australian road agencies. The intent of the model guidelines is to inform future revisions of the Austroads Guides on speed limits. <u>Comment</u> No recommendations relating to the GRD were provided.	Level of amendment: Category 6 No recommendations relating to the GRD were provided. <u>Other Austroads Guides</u> Part of the project scope was to identify the potential changes to the *GTM Part 5: Road Management* (Austroads 2008c (now superseded) Section 5). Note: the *GTM Part 5* (Austroads 2017g), indicates that Section 6: Speed Limits has been updated with differential speed limits and amended guidance for establishing speed limits.	Little relevance to the GRD but could maybe include some text about safe and appropriate design speed where appropriate. Reference to appropriate guides has been covered in report 8.
10.	*Infrastructure Improvements to Reduce Motorcycle Casualties* (AP-R515-15) (Austroads 2016k).	Motorcycle crashes are a significant contributor to deaths and serious injury on our roads. In Australia, motorcycle riders made up 16% of all fatalities in 2012, and 22% of serious injury casualties despite representing only a very small percentage of total traffic volume (one per cent of vehicle kilometres travelled (VKT)). The rate of motorcyclist deaths per registered motorcycles is five times higher than the rate of occupant deaths per registered 4-wheeled vehicles. In recent years a clear upward trend in motorcycle crashes was identified in Australia and New Zealand.	Level of amendment: Category 3. The report contained recommendations across the suite of *GRD-set* (Austroads 2019b). Refer to Appendix A.	Designing for motorcyclists remains a topical subject and these recommendations be included in the various parts of the GRD-set. RDTF to consider the wording for each part suggested for the recommendations in Appendix A of this report. This will form part of the second stage of this project.

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
		This report highlights the relationship between motorcycle crashes and road infrastructure, and specifically, how road infrastructure influences both the likelihood of a crash occurring or the resulting severity of a crash. The objectives of the project were to: • determine the influence of road infrastructure elements in motorcycle-related crashes • identify countermeasures that have the potential to reduce the incidence and/or severity of such crashes. Road infrastructure elements considered included design parameters (e.g. horizontal alignment, superelevation), road surface condition (including skid resistance), roadside hazards and overall maintenance condition. The project focussed on providing guidance to practitioners, including a number of recommended updates to the Austroads Guides to Road Design, Traffic Management, Road Safety and Asset Management, some of these updates can be drawn directly from this report and some will need to be further researched before being changed within the Guides. Within the design and safety Guides, comprehensive guidance on what the issues are and how they influence motorcycle crash risk is not provided. There is not enough information for a practitioner to make comprehensive engineering decisions considering risk, cost and benefit to justify including decisions for motorcyclists in the design process or when proposing treatment options in road safety audits or programs. The report demonstrates that the design, and ongoing condition of the wearing course, in particular the surface friction, and advance warning, direction and curve quality/warning signage have a significant influence on motorcycle crash risk. The pavement technology and asset management Guides do not identify the needs of motorcyclists. The inclusion of information on motorcyclists, particularly with regard to identifying motorcyclist traffic volumes on lower order roads, and providing and maintaining a suitable standard of road infrastructure has the potential to significantly reduce motorcycle crash risk.		

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
		Recommendations It is recommended that the following general measures are considered by practitioners in safety, design, asset management, maintenance, pavement technology road engineering disciplines: • Motorcyclists should be recognised as a unique road user group and have specific needs related to road infrastructure. • The likelihood of a crash occurring, and its likely severity, are both important considerations; however, with more focus on treating road infrastructure elements that affect likelihood, further crash reductions can be achieved. • It is perhaps more economical to treat road infrastructure elements that affect the likelihood of a crash occurring. Greater reductions in fatal or serious injury crashes (FSIs) may be achieved through a targeted focus on reducing the likelihood of a crash occurring as well as reducing the severity of a crash. • As the proposed mitigation measures are road infrastructure-based treatments, over time they can be integrated into existing practice and therefore existing funding. • Motorcycle crash risk should be proactively identified, and a remedial action program developed through motorcycle-focused network safety assessments or road safety audits. Comment Many suggestions were provided relating the GRD-set (Austroads 2019b) and these are contained in Appendix A.		
11.	*Road Design for Heavy Vehicles* (AP-T293-15) (Austroads 2015c)	Crashes involving heavy vehicles across Australia and New Zealand continue to be a major road safety issue. While road design is a major factor in facilitating heavy vehicle movement, many road design criteria are not based on the requirements of heavy vehicles. This report aimed to: • update design criteria for intersections to allow appropriate opportunities for heavy vehicle entry and to investigate gap acceptance behaviour of heavy vehicle drivers • identify improvements in the current road design standards that will more safely accommodate heavy vehicle movements into the future.	Level of amendment: Category 3. Recommendations were provided for possible amendment across the suite of *GRD-set* (Austroads 2019b). Refer to Appendix B.	Designing for heavy vehicles (HVs) is always an economic decision. RDTF to consider the wording suggested for each part in the detailed recommendations in Appendix B of this report. This will form part of the second stage of this project.

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
		The literature review identified a number of road geometric features that influence the safety of heavy vehicles and specific issues related to the swept path of the vehicles and the relationship to lane widths and horizontal curves, intersection geometry and superelevation. The crash analysis identified that in Australia the most predominant types of crashes were between vehicles travelling in the same direction, off-path, head-on and adjacent approaches, whilst in New Zealand the predominant crashes were from adjacent approaches, vehicles travelling in the same direction and off-path. Other key points: • difficulty in negotiating small roundabouts due to the swept path • the need to consider the swept path of heavy vehicles at intersections • proximity of roadside furniture (particularly on oversize vehicle routes) • lengths of merge lanes being too short to enable heavy vehicles to reach the speed limit. Gap Selection Heavy Vehicles – Sufficient data was obtained to give a reasonable measurement of gap sizes for the majority of manoeuvres for the medium rigid vehicle class. However, there was a lack of heavy rigid and semi-trailer gap data and a considerable lack of truck-trailer and B-double gap data. Hence, for most manoeuvres and heavy vehicle classes there was not enough data to give a confident result for the critical gap size. From the data obtained, the critical gap range for each vehicle class and manoeuvre was found to be: medium rigid (5.6 sec to 8.6 sec), heavy rigid (5.4 sec to 9.0 sec), semi-trailer (7.6 sec to 11.4 sec), truck-trailer (6.8 sec to 10.6 sec) and B-double (8.2 sec to 19.2 sec). It was found that in order of increasing critical gap size the vehicle classes were; medium rigid, heavy rigid, truck/semi-trailer (these two classes were grouped together because it was not clear which class had the longer critical gap in general) and B-double. Other findings include: • Lower GCM vehicles accept smaller gaps. • Vehicles with a smaller overall length accept smaller gaps.		

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
		• The larger and heavier vehicle classes (truck/semi-trailers and B-doubles) tended to accept a much larger number of gaps which caused main road traffic to have to slow down than shorter and light vehicles (medium/heavy rigid trucks). • B-doubles had a significantly larger critical gap size range than other vehicle classes. Potential further work includes: • obtaining more data for heavy rigid, semi-trailer, truck-trailer and B-double vehicle classes for all manoeuvres • obtaining data for crossing manoeuvres across a two-lane major road • measuring gap sizes for sites with non-standard geometry (i.e. not an orthogonal T-type or cross intersection). The critical gap sizes for cars were found to be close (within 1.5 sec) to those in *GRD Part 4A* (Austroads 2017i), for all manoeuvre and intersection combinations that could be compared (same manoeuvre and number of lanes on the major road). The intersections used in the study had good sight distance, and therefore, subject cars had time to see the gap coming and prepare for it, potentially resulting in a smaller critical gap size than would be obtained for intersections with poorer sight distances. <u>Conclusions</u> The detailed investigation of heavy vehicles and road safety involved a number of tasks, each providing information that will assist in reducing the incidence and severity of road crashes involving these vehicles. Review of Literature – The review of literature identified those elements of road design which may influence the safety of heavy vehicles, and other road users as they interact across the road network. Specific issues include swept path as it relates to lane width and curves, acceleration and deceleration lanes, turning lanes, intersection geometry and superelevation.		

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
		The review also highlights that when providing for heavy vehicle stopping sight distance on new roads, designers should be aware of high risk locations such as approaches to areas of speed change (e.g. deceleration lanes and exit ramps), where merging occurs, where heavy vehicles need to brake on low radius curves and construction zones. Grades and curves were also identified as high crash risk locations for heavy vehicles. To deal with this problem occurring on grades, road agencies may provide truck climbing lanes, strategically located roadside truck parking areas, arrester beds and escape ramps. It should be noted, however, that the selection of treatment, or combination of treatments, will be dependent on site-specific considerations. Research which examined the effect of sealed road shoulders on run-off-road and out-of-control crashes, revealed that heavy vehicle crashes of that type were reduced by 40%. The review also found that while 3.5 m lanes are considered as satisfactory for general heavy vehicle traffic, where rigid-plus-three and A-triple trucks operate, 3.7 m lanes should be provided. It was also found that where there were relatively high heavy vehicle volumes, barriers meeting test levels 4, 5 and 6 could be used to re-direct heavy vehicles. <u>Review of the Austroads Guide to Road Design</u> The outcomes of this task were substantial and have been provided in detail in Appendix B. All referencing to heavy vehicles, provided in each of the relevant parts of the Guide to Road Design, has been highlighted, together with many suggested revisions. <u>Comment</u> Many suggestions were provided relating the GRD series and these are contained in Appendix B.		
12.	*Older Road Users: Emerging Trends* (AP-R530-16) (Austroads 2016e)	The main objectives of this project were to: • identify trends in older road user crash locations and crash types as well as injury outcomes, help identify whether there are any significant gaps in current road safety strategies or whether these trends are largely driven by demographic shifts;	Level of amendment: Category 2. Generally, the *GRD-set* (Austroads 2019b) have increased the emphasis to consider all road users, including the older person.	The recommendations have already been included in the GRD where applicable. Many of the recommendations are aimed at influencing policy and strategic corridor treatments.

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
		• inform the development of countermeasures that reduce both the incidence of crashes and the severity of injury outcomes being experienced by older road users. The report provided the following recommendations relating to the GRD Parts: Risk to Older Pedestrians Recommendation 9: That jurisdictions continue to install and retrofit infrastructure that protects pedestrians in areas where there is a high risk of pedestrian crashes, such as areas of high pedestrian activity, and especially areas frequented by older pedestrians. Recommendation 10: That jurisdictions consider setting speed limits in areas of high pedestrian activity, especially areas frequented by older pedestrians, with reference to the high injury risk of older pedestrians. Crash Factors Recommendation 15: That jurisdictions consider the implementation of a program of improving safety at intersections through reductions in intersection complexity, including the elimination of right turns requiring gap acceptance decisions. (Reduced complexity can be achieved by full control of turns (i.e. elimination of right turns requiring gap acceptance decisions), elimination of roads intersecting at acute angles, and the use of roundabouts.) Recommendation 16: That jurisdictions consider the implementation of a program of improving safety at intersections through reductions in speed limits and the use of traffic calming measures such as plateaus. Recommendation 17: That, in light of new road design practices that are emerging in relation to speed management and intersection design, the guides developed for Austroads concerned with the safe design of roads for older road users be updated. <u>Comment</u> The suggestions relate to reducing complexity of intersections and speed limits. The determination of treatments is contained within the GTM and GRS series.	*GRD Part 4* (Austroads 2017f) includes commentary on the needs of the elderly person. Recommendation 9: Treatments contained within GRD Parts. <u>Other Austroads Guides</u> Recommendation 10: Setting of speed limits is a matter for *GRS-set* (Austroads 2019a). Recommendation 15: Matter for *GTM Part 6* (Austroads 2017h). When incorporated, translation to *GRD Parts 4, 4A, 4B and 4C* (Austroads 2017f, 2017i, 2015l, 2015m) to be considered. Recommendation 16: Matter for *GRS Part 3* (Austroads 2008a). Traffic calming treatments require further research for application and design. The emerging practices may relate to the type of intersection and its selection for a particular location. The GTM contains guidelines for intersection selection.	No additional updates to the guides required. Increase existing emphasis on the needs of the elderly. No updates to GRD identified and recommendations to be considered by the TMWG.

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
13.	*Guidance on Median and Centreline Treatments to Reduce Head-on Casualties* (AP-R519-16) (Austroads 2016f).	The primary objective of this report is to present an overview of median and centreline treatments to reduce head-on crashes. The report also introduces the road safety practitioner to other methods available to treat head-on crashes. A compendium of local and overseas practice and experience in minimising the risk and severity of head-on crashes is provided. It is intended to assist road safety practitioners identify effective actions that can be taken to reduce the incidence and severity of such crashes, with a focus on median and centreline treatments. While the body discusses road engineering measures that address the safe roads and speeds pillars of the Safe System framework, some details on methods to address the safe vehicles and road users pillars are included. In addition to discussing well-proven methods to address head-on crashes, this report also presents some innovative treatments for which there is currently insufficient data to confirm their benefits. Nonetheless, these methods are expected to be effective in reducing head-on crashes and may be of benefit in situations where the site crash history does not justify the expense associated with more established treatments. Opportunities for further research to confirm benefits of specific treatments have been highlighted. <u>Comment</u> The report provides an overview of 33 treatments, with an indication of safety benefit and cost to implement. There are no specific recommendations relating the GRD series.	Level of amendment: Category 3. *GRD Part 3* (Austroads 2016i), Section 4.7 discusses the man functions of medians. Section 4.7.1: Median width, provides guidance on a range of widths for functions the median may support. The Wide Centreline Treatment: In order to address the safety issue of head-on crashes on two-lane two-way roads, some road agencies have installed narrow medians with enhanced delineation called a Wide Centreline Treatment (WCLT) or narrow medians with wire rope safety barrier (WRSB). However, the details of these treatments may vary between jurisdictions and hence designers should refer to the relevant authority's guidelines. Appendix E provides some information on narrow medians with WRSB and Appendix F provides information on WCLT. Treatments identified relating to design were: • Wide centreline treatments (referenced in *GRD Part 3* Section 4.7.1 and Appendix F). • Medians – painted. Medians contained in *GRD Part 3*, Section 4.7.1. Reference to a painted median not included. • Wide centreline treatments (contained in *GRD Part 3*).	Review the precise wording in each part to ensure that the recommendations are fully covered. Suggest wording for review by RDTF where applicable. Potential to include in commentary in *GRD Part 3* or *Part 6*. The findings should certainly influence the safety factors referenced in the SSP2068 Road Stereotype project. Include references as noted below. For the next review of *GRD Part 3*, consider incorporating guidance currently contained in appendices into the main body of text.

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
			• Narrow medians with flexible barrier (contained in *GRD Part 3)*. *GRD Part 3* could be amended to include commentary on painted medians as a means of separating opposing flows of vehicles, e.g. include – painted medians are generally preferable to raised medians where the roadway is too narrow to install a raised median (i.e. the associated clearances are not possible), or where the costs are not justified. *GRD Part 6.* Current review includes commentary on medians. • Medians (contained in *GRD Part 6* (draft 2018)). • Median barriers (contained in *GRD Part 6* (draft 2018)).	
Reference to report 13. **Pending wider inclusion in the next scheduled revision, add the appropriate treatments as example in the Appendices of both *GRD Parts 3, 4* and *6* (Austroads 2016i, 2017f, 2010) and add references to these appendices in the main body text as appropriate.** ***Report Section 2: Centreline Treatment Examples*** ***GRD Part 3* – Section 4.7 – consider putting a section into the main text relating to centreline treatments, considered for network-wide treatments for all single carriageway roads with volume > 4000 vehicles per day in advance of the completion of Austroads project SSP2068 and reference Appendix F.** ***GRD Part 3* – Appendix F – insert examples, based on report Section 3 – Median Treatment Examples** ***GRD Part 3* – Section 4.7 – reference Appendix E** ***GRD Part 3* – Appendix E – insert examples** ***GRD Part 4* – Section 4.5.3 – Add dot point 'to provide sufficient width for the installation of a safety barrier system'.** ***GRD Part 4A (Austroads 2017i)* – Section 6.1.2 – Add paragraph:** **'In high speed areas, or where the intersection layout does not adequately mitigate the head-on collision risk, designers should consider supplementing the raised median with a barrier system.** **When considering which barrier system to install, designers should consider the impact that this will have on the general readability for all movements at the intersection as well as the barrier's more obvious impact on the different sight distance requirements*'.*** **Table 6.2 – Update note 3 to reflect the importance of a safety barrier even in a narrow median e.g. 1.5 m total width.** ***GRD Part 6* – Suggest that this report is a reference document for Austroads project TP2056: Review of *GRD Part 6*.**			

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
14.	*Safety Provisions for Floodways Over Roads* (AP-R481-15) (Austroads 2015d)	Floodways are typically used in situations where it is impractical to provide a bridge or culvert solution. Despite public campaigns on the risk of crossing a flooded floodway, fatalities continue to occur. Research has indicated that the vast majority of designated floodways are not to the required design and hydraulic standards, have inappropriate signage, and depth gauges can provide misleading information. This often leads to drivers underestimating the risk of crossing a flooded floodway. The main findings of the study were: • Many of the approximately 20 000 floodways found mainly on low-volume roads across Australia and New Zealand, have not been constructed with appropriate geometric/drainage elements and many lack the signage required by Australian Standards. • Lack of reliable records on floodway incidents in the standard crash databases makes it impossible to determine the complete characteristics of incidents and the scope of the safety problem. • The lack of measures such as warning signs, water depth gauges and associated guideposts to delineate a flooded roadway place drivers at a greater risk in deciding when to cross. The research also indicates the need to not only rely on current static warning signs but to make greater use of active warning systems for drivers to make appropriate crossing decisions. • Public advice currently provided not to cross flooded roadways is not seen as realistic, practical or appropriate, hence the need for better measures to promote greater safety. • Depth gauges provided at floodways are of limited value and may mislead drivers in crossing a flooded roadway. A more appropriate indicator is one that is based on combined effect of water depth and flow velocity on a 'design' vehicle type (i.e. car, 4WD, truck, etc.). • There are a number of new devices and technologies including automatic warning systems that could be applied to better inform motorists when not to cross a floodway. These devices can provide real-time information to alert drivers of floodway conditions by triggering flashing beacons, message signs and/or lowering of barriers when water depth and flow velocity reach pre-set values. They are, however, costly and are only suitable for critical sites and on high-volume roads.	Level of amendment: Category 5. The report identified that the design guidance enabled the flow characteristics to be determined; however, there was a gap in the guidance on the management of a floodway when in operation. There are conflicting recommendations from emergency service agencies and the guidance information, and this would need to be considered in any management arrangements. The preparation of a management guide/supplement would need to involve other Task Forces, and emergency services agencies. Consider the preparation of a supplement for the management of floodways, which could include the design.	Currently *GRD Part 3* cross-references *GRD Part 5B* (Austroads 2013c). Need to ensure that this project is reviewed and incorporated by the RSTF and NTF into the appropriate parts of each of their guide series. To be reviewed as the second stage of this project.

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
		• Implementation of improved measures at floodways should consider a management strategy that assesses risk, appropriate treatments, and the resources needed to bring about improvements over time. • It is recommended that further studies be undertaken to review legal appraisal of advice for drivers on floodways and new technologies which may assist drivers in making an informed decision about crossing safely. <u>Recommendations</u> The following recommendations are made to improve safety at floodways: • All signage at floodways should conform with AS 1742.2, except that depth gauges should be replaced in time with a better indicator relating to the product of water depth and velocity, as mentioned below: • A special floodway design supplement to the Austroads Road Design Guides should be prepared that will highlight all floodway design requirements in one document. This should enable practitioners to better check current designs, conduct safety audits and build future floodways appropriately. The supplement should include signage requirements, geometric, hydraulic and pavement/embankment design aspects, and risk assessment. • The feasibility of replacing existing depth gauges with a new static indicator that provides advice for a specific crossing on water depth and velocity relating to a vehicle type should be investigated. Such a study needs to establish its effectiveness to cater for each 'design' vehicle type and understanding by road users. If proven effective, such a new static indicator should be low-cost and able to be readily implemented on low-volume roads. • Special warning devices need to be provided at floodways where pedestrians and cyclists cross. • The use of yellow flashing beacons/message signs should be trialled to ascertain driver compliance. • The use of automated gates should be considered at very critical and high-risk locations to immediately close off a flooded		

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
		roadway site, which takes into account flow depth and velocity calculations. • An investigation into the use of in-vehicle warning systems, mobile phone messages or other similar navigational systems to provide drivers with real-time information at specific floodway crossings should be undertaken. • Criteria should be developed for when to implement active water-level detection and advanced warning systems at water crossings and flood-prone sections. This would ensure that limited resources are directed to higher-risk sites and that the most appropriate warning system is implemented at each site. Comment The issues identified relate to management of a floodway, particularly when flows are greater than the design storm event.		
15.	*Road Geometry Study for Improved Rural Safety* (AP-T295-15) Austroads 2015e)	This report identifies and quantifies geometric road design elements which contribute to casualty crash occurrence and severity on rural roads. These findings have been used to identify potential guidance revisions to reduce potential for rural road design contributing to crashes. The report proposes a number of possible changes to Austroads road design guides aimed at reducing casualty crash risk on rural roads. Most proposed changes involve: • clarification of guidance, e.g. for selection of design speed in challenging alignments • use of speed limits to control speeds • use of sealed shoulders • selection of barriers and clear zones • greater guidance for design of low-speed roundabouts. The report makes a number of suggestions about selection of rural intersection types to be included in future revisions of the Traffic Management guides. Conclusions and Proposed Actions Project Findings and Task Force Directions – This project has made findings based on literature reviews, evaluation of design improvements, and previous Task Force inputs in four areas of rural road design:	Level of amendment: Category 2. There are twenty recommendations, and these are outlined in Appendix C.	It would appear that the recommendations listed in Appendix C of this report have been considered and incorporated in the GRD where appropriate. Recommendations relating to the *GTM-set* (Austroads 2019c) to be forwarded to the TMWG for consideration.

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
		• horizontal and vertical alignment • cross-section • roadsides • intersections. The members were asked to consider each suggested design guidance change and agree whether: • it is open for consideration in the next review of the relevant road design guide • further evidence is needed before a consideration can be made. Gather available or generate new research on the subject • it is not likely to be considered in the road design guidelines. Comment A summary of the Task Force directions and agreed actions and impact on GRD is contained in Appendix C.		
16.	*Investigation of Key Crash Types: Run-off-road and Head-on Crashes in Urban Areas: Final Report* (AP-R450-14) (Austroads 2014d).	Run-off-road (ROR) and head-on crashes share many similar characteristics. ROR collisions are one of the most common crash types, whilst head-on crashes generally result in more severe outcomes. In order to achieve a Safe System, it is therefore important that factors that may reduce the incidence or severity of these crash types be identified. In order to achieve this, a literature review was undertaken to identify previous investigations into factors associated with ROR and head-on crashes in urban environments, measures that may be used to prevent crashes, and the effectiveness of these measures. Factors found to be related to an increased incidence or severity of urban ROR and head-on crashes relevant to road design were steep downhill gradients leading into curves, multiple curves within a short distance and limited sight distances Factors relating to GRD: Road Environment – The review of literature, data analysis, and/or site inspections identified the following road-environment factors associated with urban ROR and head-on collisions: Road geometry: Common risk factors for ROR and head-on crashes identified included: • complex curves (i.e. where there is more than one curve within 100 m of each other)	Level of amendment: Category 2. The recommendations and impact on the GRD is shown with the recommendations below.	This would influence the road stereotype treatments from a corridor perspective in selection of median/centreline treatments and edge protection at the higher risk locations. This project identifies corridor characteristics that increase the likelihood of loss-of-control. Consider amending *GRD Part 2* (Austroads 2015i) to include commentary relating to these corridor characteristics in addition to that already considered in lieu of the additional part to the GRD that would cover such matters. Findings to be incorporated into the *GRD-set* (Austroads 2019b) as identified. *GRD Part 4* and *4A* (Austroads 2017f, 2017i) – no amendments required.

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
		• steep downhill gradients leading into curves • limited sight distance • curves too tight for the set speed limit. It appears drivers are not reducing their speed to that indicated by speed advisory signs, and thus failing to navigate the curves. Roadside infrastructure: Roadside infrastructure that appeared visually to be more imposing, such as steep drops or W-beam guardrails, may be associated with an increase in the incidence of head-on collisions. It is hypothesised that drivers may be travelling closer to the centre of the road to provide a conscious buffer from the roadside infrastructure, but further research is required. Rigid roadside hazards within one metre of the roadway were commonly found at the crash sites visited. Data analysis shows that 79% of urban ROR casualty crashes in Australia resulted in a collision with a roadside object. Unsignalised intersections: The majority of urban ROR and head-on crashes occurred mid-block. Those that occurred at intersections were found to be far more prevalent when the intersection was unsignalised. When site inspections identified that a crash cluster did occur at a signalised intersection, the intersection generally featured some uncontrolled component (e.g. left-turn slip lane). Further investigation into this matter appears warranted.		*GRD Part 6* (Austroads 2010) – recommendations to be considered in project TP2056 Review of *GRD Part 6*.
		<u>Recommendations</u> Issues for Consideration as Part of the Austroads Guides Updates *Guide to Road Design Part 3* (Austroads 2016i): • Under Section 4.2.5, 'Urban Road Widths', the following paragraphs should be added: 'When it is considered necessary to apply narrow lane widths, specific consideration should be given to roadside hazard clear zones and posted speed limits. Particularly close or foreboding roadside hazards may encourage drivers to travel closer to the centreline. With narrower lanes, this may lead to an increase in head-on collisions.'	*GRD Part 3*, Section 4.2.5: Not included, consider suggested wording for inclusion.	

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
		'Narrow lane widths provide less room for error for drivers, increasing the risk of run-off-road collisions. In order to prevent serious roadside collisions, roadside hazards should be frangible and kept away from the carriageway edge.' • Under Section 4.12.2, 'Bus Stops – Urban', the last sentence of the third paragraph should be amended to state that: 'The location of bus stops must comply with the traffic regulations regarding distance from intersections and school crossings. The location should take into account the effects on traffic flow (including sight distance issues for re-entering buses) and the safety of pedestrians and other vehicles.' • Under Section 6.2, 'Coordination of Horizontal and Vertical Alignment – Safety Considerations', the following bullet point should be added to the list: 'Steep gradients, or even a gradual gradient over a prolonged length, can lead to high operating speeds due to insufficient braking. Sharp or complex curves at these sites should be avoided.' • Section 6.2, the last bullet point in this list should be amended to state: 'An intersection or rail crossing should be avoided at or near a crest vertical curve, sharp horizontal curve or extended steep gradient.' *Guide to Road Design Part 4: Intersection and Crossings: General* (Austroads 2017f): • In Table 3.2, in considerations for motor vehicle drivers, the following should be included: 'Consider adequate sight distance to peak queuing lengths as well as holding line.' *Guide to Road Design Part 4A: Unsignalised and Signalised Intersections* (Austroads 2010*,* now superseded*)* • Guidance should be provided on the risks associated with slip lanes, and the adequate sight distance issues and appropriate road geometry for slip lanes to be used.	*GRD Part 3,* Section 4.12.2: ~~in~~cluded. *Part 3,* Section 6.2: Not included, consider suggested wording for inclusion. *GRD Part 4* (Austroads 2017f), Table 3.1 :consider for inclusion. *GRD Part 4A* (Austroads 2017i): consider for inclusion. *GRD Part 5B* (Austroads 2013c): culverts have been identified as hazards and references *GRD Part 6* (Austroads draft 2018) for treatments.	

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
		Guide to Road Design Part 5: Drainage Design (2010, now superseded): • After the second paragraph of Section 3.1.5, 'Culverts', the following paragraph should be inserted: 'In particular, culverts should ideally be avoided, or at least guarded with a road safety barrier system at locations where run-off-road collisions present a greater risk. This includes roads with narrow lanes, sharp or frequent curves, limited sight distance, or steep gradients.' *Guide to Road Design Part 6: Roadside Design, Safety and Barriers* (Austroads 2010): • Section 5.4.1, 'Treatment for Trees', specifies that 'trees greater than 70 to 100 mm diameter (depending on the species)' should be removed or guarded by barriers. The guide does not specify which species, nor does it refer the reader to appropriate research on this topic. An extensive literature search has failed to identify any specifications of which species are frangible to which size diameter. It is strongly recommended that Austroads commission and publish research on this matter and include a reference to this research in this section of the guide. • Under Section 5.4.14, 'Road Safety Barriers', the following paragraph should be included: 'Road safety barriers positioned close to the roadway may encourage drivers to travel closer to the centreline. This increases the risk of head-on collisions, especially on narrow or curved carriageways. Removal of roadside hazards ideally, or their relocation, would generally be the preferred option in such instances'. • Under Section 6.2.1, 'Site Conditions', under the 'Offset' sub-headings, the first bullet point should be replaced with the following:	*GRD Part 6* (draft 2018): Treatments for Trees is included but does not specify species. Further research is required. Guidance is indicated that the possible treatments for trees are removal or installation of a safety barrier. Section deleted from draft 2018. No commentary provided. Section 6.2.1, Offset, could be amended to include this commentary. *GRD Part 6* (draft 2018) contains: Section 6.3.5 Offsets to Traffic Lane Indicates barriers should be located outside of the shy-line. Other risks outlined. Offset maximum of 4 m nominated; 1.5 m not included.	

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
		'The objective is to minimise both the probability of a road safety barrier being impacted by an errant vehicle and the severity of any collision with the barrier. The ideal location for roadside barriers is between 1.5 and 4 m. Within this range, it is desirable that road safety barriers be located as far as possible from the edge of the traffic lane as site conditions permit.' 'This will maximise the chance of the driver being able to regain control of the vehicle, and minimise the length of barrier required and the hazard it presents. Further, barriers too close to the roadway may encourage vehicles to travel closer to the centreline, leading to an increased risk of head-on collisions.' 'Barriers located further than 4 m from the roadway may lead to greater severity collisions due to the likely angle of impact.'		
Reference to report 16: **Suggest Wording to be inserted in the appropriate Guides as follows:** ***GRD Part 3* (Austroads 2016i) – Section 4.2.5 – insert the following paragraph:** ***'When narrow lane widths are being considered, offsets to roadside hazards and operating speeds are particularly relevant. Close or significant roadside hazards or vertical roadside features may encourage drivers to 'shy' and travel closer to the centreline, increasing the risk of head-on collisions. Narrow lane widths logically provide lower margins of driver error and less room for heavy vehicle tracking. This increases the risk of vehicles regularly tracking into the shoulder or onto a footpath'.*** **Section 6.2 – insert the following paragraph:** ***'Steep downhill gradients, or even a gradual downhill gradient over a prolonged length, can lead to involuntarily high operating speeds. The downstream geometric design must take account of this increased speed and drivers' perceptions (7.6.1). Out-of-context, low radius or compound curves, that may be difficult to read or misleading for drivers in these contexts should be avoided (Section 7.5.1).'*** ***GRD Part 4* – no amendments required.** ***GRD Part 6* – recommendations should be considered by Austroads project TP2056 – Review of GRD Part 6.**			
17.	*Investigation of Key Crash Types: Rear-end Crashes in Urban and Rural Environments* (AP-R480-15)	Rear-end crashes are one of the most common crash types occurring on roads in Australia and New Zealand. Given their prevalence at intersections and that about a quarter of all injury rear-end crashes result in fatality or serious injury outcomes, they are a focus of the Australian National Road Safety Strategy.	Level of amendment: Category 1. Included in *GRD Part 4* (Austroads 2017f). Other Austroads Guides	The GTM and GRS would appear to be more appropriate places to provide this advice. It is noted that *GRD Part 4* (Austroads 2017f) Section 6.3.4 has been reworded as recommended.

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
	(Austroads 2015f)	This project has conducted a literature review, crash data analyses and site inspections of typical crash clusters. Contributing factors to the incidence and severity of rear-end crashes were identified and categorised using an industry-standard humans, vehicles and road environment (HVE) model. Rear-end Crash Contributory Factors Road Environment – The project has identified the following road environment factors associated with rear-end crashes: Intersections: Rear-end crashes are more common at intersections, where there is a greater presence of, and interaction between, slow-moving and stationary traffic. Signalised intersections: Signalised intersections present a greater risk of rear-end crashes. The risk of rear-end crashes at signalised intersections is increased when: • the lead vehicle's position at the beginning of the yellow phase is such that the decision to decelerate or proceed through the intersection is unclear • red-light cameras without accompanying speed cameras are present • signalised intersections are closely spaced together. As signalised intersections are generally placed where the alignment is straight and level, there is a higher incidence of rear-end crashes on straight, level roads. Road geometry: After accounting for the influence of signalised intersections, rear-end crash risk increases on curves and slopes. Traffic density: Rear-end crashes are more common when traffic density is higher, such as during peak hours and on urban arterial roads. Work zones: Work zones introduce complexity and uncertainty, disrupt the regular flow of traffic and lead to an increase in traffic density. Also, work sites may feature a higher portion of heavy vehicles in the traffic flow. These factors all contribute to a higher rear-end crash risk. Lighting: Rear-end crash risk increases during times of darkness. Heavy vehicles are particularly prone to being struck during darkness.	Recommendations are also made to *GTM Part 6* (Austroads 2017h) and *GTM Part 8* (Austroads 2016j) and *GRS Part 8* (Austroads 2015n).	Recommendations to be forwarded to the NTF, RSTF and TMWG.

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
		Speed environment: Rear-end crash risk increases in higher speed zones. As many of these factors are particularly prevalent in urban environments, rear-end crashes are more common in these areas.		
		Recommendations and Conclusions Investigation of the predominant characteristics of these crash types provided the basis to identify road factors that may have contributed to the occurrence or severity of these types of crashes. From a road engineering perspective, there are a number of options available to road engineers to reduce the occurrence of rear-end crashes. Fewer options are available to reduce the severity of such crashes, with speed management being the most effective tool. To achieve greatest results, an array of available tools should be used together to reduce both rear-end crash rates, and their severity. Issues for Consideration as Part of the Austroads Guides Updates The series of Austroads Guides to Traffic Management, Road Design, and Road Safety have been reviewed to identify areas that could be updated to incorporate the findings of this research project. It is suggested that the following changes be implemented: Guide to Road Design Part 4: Intersections and Crossings: General (Austroads 2009, now superseded). • Section 6.3.4 discusses bus stops. The first sentence of the last paragraph on page 42 should be reworded to state that: 'In order to maintain traffic flow and reduce both delay and risk of collisions, wherever practical, bus stops should be located outside the general traffic lanes (e.g. within a parking or exclusive bus lane, or within a bus bay that is indented into the kerb).'		
18.	*Safe System Practice Amendments to the Guide to Road Design* IR-232-15 (Austroads 2015h)	The purpose of this project was to review the Guide to Road Design series, Parts 1, 2, 3, 4, 4A, 4B, 4C, 6, 6A and 6B with reference to the Safe System approach, and the associated principles to designing roads, and suggest areas within each of the Parts that may be amended to strengthen or incorporate these principles. The review identified areas within each Part that may be amended to incorporate the Safe System approach or principles. The amendments generally relate to the Safe System goal to eliminate, or reduce, the impacts of crashes. Comment	Level of amendment: Category 3. There are many recommendations across the nominated Parts. Amendments typically reinforce the application of the Safe System principles, which have been a key area for update within the Parts. The suggested amendments are contained in Appendix D.	The great majority of these are suggestions to increase the visibility of Safe System rather than firm recommendations that will change practice. *GRD Parts 1* and *2* (Austroads 2015j, 2015i) are due to be reviewed soon and the incorporation of SS principles will be a big part of that.

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
		There are many suggested improvement opportunities, of which many relate to reinforcing or emphasising the consideration of the Safe System principles.		*GRD Parts 3, 4* and *4A* (Austroads 2016i, 2017f, 2017i) have only recently been updated and the content ought to be reviewed against these detailed recommendations. *GRD Part 6* is being reviewed to incorporate Safe System principles and we should consider these recommendations. See Appendix D of this report. Safe System principles included in all parts, with a comprehensive review of recommendations to be included in the second stage.
19.	*Safety, Operational and Environmental Impacts of Changes to Speed Limits* (IR-223-14) (Austroads 2014e).	This project set out to analyse the safety, operational and environmental impact of speed limit changes on urban and rural arterial roads. Four routes were nominated by the NSW and Victorian road agencies for inclusion in the project. Two routes were identified for a reduction in the speed limit, one each in rural NSW and Victoria; two other routes, located in rural NSW, were identified for an increase in the existing speed limit. These routes, between defined journey start and end points, formed the basis of the data collection for analysis. While these routes are considered typical of rural arterial highways and urban/rural fringe sub-arterial roads, caution is required when seeking to apply the conclusions of this study more generally to determine the impact of speed limit changes. At the commencement of the project, six hypotheses were developed covering each of the safety, operational and environmental aspects being tested. The results of this study could inform policy as follows:	Level of amendment: Category 6. <u>Other Austroads Guides</u> Relevant for *Guide to Road Safety Part 3* (Austroads 2008a) and *GTM-set* (Austroads 2019c) on speed limits on sections of a road. Further research is suggested to strengthen the results.	More appropriate to GRS and GTM. Recommendations to be forwarded to the STF, NTF and TMWG.

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
		• The economic value of operational and environmental performance indicators may require review. The current economic value on travel time tends to disproportionately influence the overall economic effect of changes in speed limit; the practical reduction or increase in travel time for individual motorists for the routes in this study do not appear to be representative of the calculated saving or cost incurred. • Speed zone guidelines and the process for speed zone reviews should perhaps take into account a broader consideration of safety, operational and environmental effects during the assessment and review phase. The main conclusion drawn from the journey surveys and subsequent data analysis for this project is that a change in speed limit does have an effect on the operational and environmental performance of the traffic stream. The hypothesis relating to a change in crash occurrence and severity results was a theoretical analysis. The outcome aligned with the initially expected change of the project team; however, there was no change able to be measured and it was suggested that a review of the actual crash history for each route five years after the change in speed limits be undertaken to confirm if, and to what degree, the actual experience aligns with this theoretical analysis. The approach and outcomes of the study are considered to provide a practical and applied insight into the impact of a change in speed limit on defined journeys. Comment The report provides information on the effects of a change in speed limits; however, the safety benefits were not able to be confirmed with a comparison of the theoretical and measured outcomes.		
20.	*Updating the Guide to Road Safety Part 9: Roadside Hazard Management* (IR-237-15) (Austroads 2015h).	The draft GRS Part 9 focuses on a complete road safety system and the components required to achieve this, and a structure compatible with the new roadside safety management framework published in *Improving Roadside Safety: Summary Report* (Austroads 2014g).	Level of amendment: Category 3. No amendments for GRD identified. Other Austroads Guides *GRS Part 9* (Austroads 2008b) provides valuable information on roadside hazards and possible treatments.	The update of the *GRD Part 6* (Austroads 2010) – TP2056 should be synchronised with any updating of *GRS Part 9*.

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
		GRS Part 9 presents a précis of the Roadside Safety Management Framework, published in AP-R439-14. The framework provides a comprehensive process for detecting and assessing roadside safety risk, and the identification, assessment and design of remedial treatments. Users of this Guide should familiarise themselves with the framework and how it may apply to their task; the framework describes highly detailed steps, while this Guide provides a broad overview of design and treatment options. This Guide then details sections on helping vehicles to follow the road and remain on it, and treatment options for minimising the severity of any off-road excursions by errant vehicles. These sections do not provide detail on the design and implementation of treatments but rather a 'shopping list' of treatments to make the practitioner aware of a range of roadside hazard management options. The Guide focuses on designing roads and features of roads to reduce the potential for vehicles to lose control and run off the road and to minimise the potential for serious injury or death. A large number of comments were submitted in response to the draft of an updated *Guide to Road Safety Part 9: Roadside Hazard Management*. Comments from two organisations asserted that the draft Guide does not adhere to Safe System principles. On this point, other contributors were silent, and this is therefore an issue which requires further correspondence. A number of other comments demonstrate a clear difference of opinion between some organisations on two key issues. These are: • whether roadside hazards ought to be treated in a priority order which involves removing hazards if possible and practical • the place of wire rope barriers in the treatment of run-off-road crash risk, and whether the Guide should recommend the use of such barriers as a first option (i.e. before consideration of other treatments, including removal of hazards) or present them as one of several barrier options. Until agreement is reached on these issues, it will not be possible to complete the update of the Guide while accommodating the wishes of all contributors to the comment process. <u>Comment</u>	*GRS Part 9* is referenced in *GRD Part 6* (draft 2018). The references relate to roadside hazards, crashes and treatments. Section 1.3.2 – Crashes Section 3.3 – Roadside environment Section 3.4 – Designing to keep vehicles on a road Section 4.3 – Identifying hazards Section 5 Treatment options – it would be useful to include a cross-reference to *GRS Part 9* for further information on hazards and possible treatments.	

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
		GRS Part 9 provides information on treatments to keep vehicles on the road and minimise off-road crashes. Referencing the Guide into the Parts of GRD would provide useful information for a designer.		
21.	*Road Safety Audit and Road Safety Engineering Toolkits: Usage Survey, 2011–16* (IR-250-16) (Austroads 2016g)	This report summarises the usage data for the Road Safety Audit Toolkit and Road Safety Engineering Toolkit websites, for the period of July 2011 to May 2016. The usage data for the two sites show that neither site attracts particularly large numbers of visits, but visitor numbers have not declined at a rapid rate over the last five years. Usage patterns for the Engineering Toolkit appear more predictable and consistent than those of the Road Safety Audit Toolkit, and it is a more popular site when evaluated against all of the measures shown here. Neither Toolkit has received a great deal of publicity over the last five years, but visitor numbers have remained relatively stable during this time. Additionally, reliance on the Toolkits by readers of various Australian and international road safety guides, from which reference is made to the Toolkits, indicates that continued funding and maintenance of the Toolkits would be likely to generate improved visitor numbers.	Level of amendment: Category 7. Information relates to usage data for the Road Safety Audit Toolkit.	Noted.
22.	*Lapping of Guardrail Terminals*, ASBAP technical direction statements (Austroads 2017b)	ASBAP Technical Advice 17-001 (June 2017): *Lapping of Guardrail Terminals* Advice on the treatment of the departure end of semi-rigid steel safety barriers. Where a terminal used as a departure treatment that may be impacted by opposing traffic the terminal must be installed as though it were a leading terminal. <u>Recommendation</u> When a terminal is used as a departure treatment that can be impacted by opposing traffic, the terminal must be installed as though it were a leading terminal.	Level of amendment: Category 4. *GRD Part 6* (draft 2018) Sect 6.3.21: Contains ... barrier terminals should: perform acceptably when impacted from either direction, except when erected on a single direction carriageway where there is a low probability of a vehicle impacting the terminal from the reverse direction. Matters considered in current review of *GRD Part 6*.	Updates to the *GRD Part 6* (Austroads 2010) TP2056, should be synchronised with the latest edition of the ASBAP publications.

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
23.	*Proximity of Safety Barriers to Batter Hinge Point*, ASBAP technical direction statements (Austroads 2017c)	ASBAP Technical Advice 17-002 (August 2017): *Proximity of Safety Barriers to Batter Hinge Point.* Safety barriers should be installed with enough distance to hinge point to accommodate the barrier's design deflection and provide adequate lateral support for the system. Recommendation Safety barriers be installed with enough distance to the hinge points to allow a vehicle to remain upright during impact. Where these distances are reduced due to site constraints, footings and posts must be suitably designed to take account of the variations to slope stability, barrier proximity and the accepted level of performance of the barrier system. *GRD Part 6* (draft 2018): When barriers are used to shield embankments, consideration needs to be given to the provision of adequate ground support as over time softening of the verge may occur. Clearance of not less than 500 to 600 mm from the rear of the post to the top hinge point of a fill embankment should be provided, although this may vary due to soil conditions, batter slope, post depth, and other factors.	Level of amendment: Category 1. *GRD Part 6* (draft 2018) Section 6.2.1, Offset: Guidance includes consideration of the proximity of the barrier and the hinge point. The information would be strengthened by including the background to the hinge point and barrier proximity. Category 2 Section 6.3.4: Determine the Lateral Position of the Barrier (Step B3), Factors considered in lateral location Figure 6.2: Verge barrier location indicates the distance between the barrier and the hinge point may be reduced when there is no other option. Matters considered in current review of Part 6.	Updates to the *GRD Part 6* – TP2056 should be synchronised with the latest edition of the ASBAP publications.
24.	*Road Cross-section Design for Road Stereotypes (including Network Safety Plans) and a Safe System* SRD2068. In-progress.	This is a current project due for completion in June 2018. Progress to date has established a suite of road stereotypes and cross-sections relevant for the road stereotype. The road stereotypes are: Urban • freeways/motorways • arterial, combined multilane, single and dual carriageway • collector roads • local roads. Rural • freeways/ motorways • highways, 100/110 km/h, 2-lanes, dual carriageway • highways, AADT > 3000 vpd, 2-lanes, single carriageway • highways, AADT 1000–3000 vpd, 2-lanes, single carriageway • highways, AADT < 1000 vpd, 2-lanes, single carriageway	Inclusions of outcomes into the GRD series is still to be determined.	Will be referenced as a separate document and included in the appropriate Parts of the GRD, GTM and GRS when completed.

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
		• rural roads – sealed and unsealed, AADT > 1000 vpd, single carriageway • rural roads – sealed and unsealed, AADT < 1000 vpd, single carriageway • rural roads, mountainous terrain, single carriageway. For each road stereotype, cross-sections have been developed and an associated risk rating determined, based on an ANRAM assessment.		
25.	*Safe System Infrastructure on Mixed Use Arterials* (AP-T330-17) (Austroads 2017a)	The report provides a synthesis of key safety solutions as well as issues that need to be considered when effectively addressing safety on urban mixed-use arterial routes. Details for each case study are provided, as well as detailed information on the treatments that can be applied. Although it was not the intention of the study to fund construction at these locations, relevant road agencies will be using the results to plan future safety improvements at these and other sites. Key treatments included those that helped to manage vehicle speeds. Reduced design speed was considered in each case, and this typically involved lower speed limits (either on a full or part-time basis) supported by infrastructure, including raised platforms, gateway treatments, road narrowing, textured surfacing and additional measures. Other treatments to improve vulnerable road user safety are also considered including road narrowing, pedestrian crossing facilities, and cycle lanes and separated pathways. Each of these solutions needs to be considered within a broader area-wide assessment of route function. Key issues to consider when addressing risk on mixed-use urban arterial roads are also discussed, including the assessment of networks to determine functional classification and position within the road hierarchy, the process of risk assessment on these routes, the impact on traffic operations and other related issues. <u>Comments</u> This report provides information on a series of treatments without recommendation or detail but does include comments on applicability and implementation of treatments. The treatments are largely traffic management-related and so would be relevant to include in the GTM series.	Nil.	This is a collection of examples without any really thorough, useful evaluation. Could be referenced by the GRD as appropriate but actually quite a challenge to do so in an effective way. Case studies to be referred to NTF and TMWG.

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
		Recommendations There were no recommendations relating the *Guide to Road Design-set* (Austroads 2019b).		
26.	*Bicycle Safety at Roundabouts* (AP-R542-17) (Austroads 2017d)	This report investigates how the geometric design components of a roundabout may contribute to bicycle crashes. An Australian and New Zealand crash analysis found that most of the crashes occurred at urban local road roundabouts, in 50 km/h speed limit zones. The crashes predominantly occurred on the circulating lane near the entry for an approach road and were right-adjacent type crashes. The study included an in-depth investigation of 17 roundabouts across Queensland, New South Wales and Victoria. A geometric analysis identified that the entry geometry of the roundabouts investigated would permit relatively high entry speeds, in excess of the target speed of less than 30 km/h. This target speed was adopted for analysis purposes; however, further investigation to determine an appropriate speed to prevent or minimise fatal and serious injury outcomes for crashes involving motor vehicle and cyclists is needed. The motor vehicle speeds on the entry and circulating lanes were estimated using the ARNDT crash prediction model; however, the model was developed on rural roads and so the application of this model to urban local roads requires verification. For the purposes of this investigation, the ARNDT model was used to assess geometric alignments to achieve lower approach speeds and it was found that a roundabout with a radial type of alignment, used in countries in Europe, achieved approach and circulating speeds of less than 30 km/h. Sight distances were examined, and it was found that the available sight distance to vehicles approaching from the right did not meet the design requirements. There is some research which indicates that restricting the sight distance on the approach to a roundabout reduces the approach speeds of vehicles; however, this requires further investigation to develop design criteria. The report recommends further investigation into motor vehicle/cyclist crash outcomes and the effect of restricting sight distance on the approaches to a roundabout, and the development of design guidance for urban local road roundabouts.	Level of amendment: Category 3 & 4. Recommendations for the update to *Part 4B* slightly re-worded as recommended below.	Updates to *GRD Part 4B* (Austroads 2015l) should be incorporated as indicated – could be captured at the next update of this part of the GRD. Need to highlight recommendations for the GTM to the NTF and the TMWG. Further evaluation of restricted 'Criterion 3' sight distance to be included in update of *GRD Part 4B*.

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
Reference to report 26: **Suggest Wording to be inserted in *GRD Part 4B* (Austroads 2015l) as follows:** **Section 2.2: Design Principles** **Target speed for lane sharing should be < 30 km/h (Note: the design methods available to obtain this speed need to be developed); otherwise, consideration should be given to providing a separate facility for cyclists.** **Section 4: Geometric Design para. 4.5.1 and para. 5.3.3** **Specific guidance on geometric methods to achieve entry and circulating speeds of less than 30 km/h are still being developed and trialled. These are being assessed and will be included in future updates of this guide. The use of vertical displacement devices is an option to maintain reduced approach speeds, particularly in urban contexts. Attention is drawn to the *Guide to Traffic Management Part 8: Local Area Traffic Management* (Austroads 2016j).** **Para 5.3.4 – Roads with Shared Traffic** **Should be amended to refer to the target speed and Figure 5.1: Bicycle route through single-lane roundabout – no bicycle facility, should provide an example of a layout to achieve vehicle speeds of less than 30 km/h for the entry and circulating speeds.** **Section 5.3.5: Multilane Roundabouts** **Should be amended to recommend that if vehicle speeds on the approach and circulating lanes cannot be reduced to the target speed of 30 km/h, then separated facilities are to be provided, e.g. grade-separated crossing or off-road paths. It should be noted that achieving the target speed is unlikely when vehicles are able to track across the lanes, effectively increasing the travel path curve radius.** **Section 5.3.6: Bicycle Paths and Shared Paths at Roundabouts** **Should include additional information on and examples of acceptable methods, including any design information, to provide the smooth connection from the on-road bicycle lane to an off-road path.**				
27.	*Assessment of the Effectiveness of On-road Bicycle Lanes at Roundabouts in Australia and New Zealand* (AP-R461-14), (Austroads 2014f)	This report documents the research undertaken for Austroads on bicycle lanes at roundabouts. An extensive literature review informed empirical data gathering. The literature review revealed strong evidence that bicycle lanes on the approach and within roundabouts are associated with negative safety outcomes. Limited and inconclusive research was found on high-speed, multilane roundabouts. The dominant cyclist injury crash type involved a motorist entering a roundabout failing to give way to a circulating cyclist. Cyclists could maximise their safety by tracking closer towards the inscribed island.	Level of amendment: Category 5 & 6. Further research is recommended by the authors in the following areas: • What typical crash rates are for cyclists at roundabout with mixed traffic, cycle lanes, and cycle paths, • How cycle crash rates change where cycle-specific infrastructure was retrofitted to or removed from roundabouts, • Under what conditions can European practice that provides for pedestrian	The research was not very definitive or conclusive. The sample size was very small and appeared biased towards the researchers' pre-conceived impressions of the issues, i.e. subjectivity with too little objective substantive evidence.

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
		Cyclist lateral tracking was observed at urban roundabouts, which showed that they commonly travelled close to the centre of the traffic lane. Where bicycle lanes were present in the circulating carriageway, they were rarely used by riders. When lane markings were changed at roundabouts to encourage lane sharing, this significantly shifted cyclist positions. It was concluded that the presence of bicycle lanes within the roundabout may serve to discourage lane sharing. High-speed, multilane roundabouts were not studied due to the unacceptable risk the researchers would have been exposed to. Motorist approach speeds across a range of single lane and multilane roundabouts were measured and found to be surprisingly similar. Within 20 m of the holding line, horizontal and vertical deflection, or limited visibility to the right could be used to reduce vehicle speeds to an equitable speed of desirably 25 km/h (maximum 30 km/h); this would provide greater time for motorists to scan for conflicting movements (including cyclists) and to reduce the severity of any crash that may occur. This additional time would be likely to reduce the most frequent conflict between motorists and cyclists. A key conclusion from the research is that new or modified roundabouts would ideally either have equitable speeds or provide for cyclists so that they do not have to enter the circulating carriageway. The tangential roundabout design philosophy of English-speaking countries maximises capacity, whilst the radial design philosophy of continental European countries maximises safety of all users. Other useful geometric elements are vertical deflection, horizontal deflection, and tighter approach radii. Strong evidence was found that lane markings that encourage cyclists to 'claim the lane' (for example sharrows) can be effective and are recommended where speeds are equitable. Bicycle lanes on the approach should terminate some distance behind the holding line where speeds are low. Where equitable speeds are achieved, approach lanes should not exceed 3.0 m in width so that drivers do not attempt to enter the roundabout alongside cyclists. Where equitable speeds are unachievable, consideration should be given to physical separation on the approach and departure. The report authors cannot provide conclusive guidance on circulatory cycle lanes due to a lack of data, and more research is required.	and cyclist right-of-way at roundabouts be incorporated into Australasian practice, • How the marking of cycle lanes up to and through roundabouts influences lateral tracking of cyclists, • How the provision of physically protected cycle lanes changes crash rates, including for motorcyclists and bunches of sport cyclists, • What the relationship is between lateral tracking of cyclists and their crash rate, • What the implications are of providing advanced bicycle storage boxes at roundabouts, and whether approach cycle lanes are always required in conjunction with these storage boxes (including a review of Australian Road Rule 247A), • How negotiation speed through roundabouts is affected by horizontal and vertical deflection, and by visibility, and in turn how this influences safety, • What are the implications of adopting the radial design philosophy • What the environments are (in terms of speed, traffic volume, etc) that might be suitable for roundabouts of radial design, • What the implications of possibly changing Australian Road Rule 247 would be (requiring cyclists to use bicycle lanes unless it is impractical to do so).	There is little doubt that the body of evidence supports 'lane claiming' and speed reduction and these principles should be further reinforced in the next revision of *GRD Part 4B* (Austroads 2015l).

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
		All the evidence is pointing towards speed being the major road safety issue at roundabouts. If the underlying fundamental problem is addressed, then the question that this research is supposed to answer (will bicycle lanes at roundabouts improve safety?) will become secondary. Our research shows conclusively that cyclists maximise their safety when they occupy a lane, and this is most easily achieved when speeds are equitable.		
28.	*Towards Safe System Infrastructure Compendium of Current Knowledge* (AP-R560-18) (Austroads 2018)	This report provides information on the application of the Safe System principles to the planning, design and management of roads. The information covers the speed management, median treatments, roadsides, intersections, vulnerable road users, e.g. cyclists and pedestrians, motorcyclists and heavy vehicle safety.	Level of amendment: Category 3. This report presents the evidence that supports the need for a change in approach to hazard management and alignment with Safe System principles. Its implementation is covered by the report 18 – *Safe System Practice Amendments to the Guide to Road Design* (Austroads 2015g) and Appendix D.	
29.	*Improved Railway Crossing Design for Heavy Vehicles* (AP-R549-17) (Austroads 2017e).	The report identifies road design improvements to better cater for the safe passage of heavy vehicles through railway level crossings. Crashes involving heavy vehicles have been identified as a major safety issue in Australia and New Zealand with the volume of heavy vehicles expected to significantly increase over the next 5 to 10 years. An analysis of heavy vehicle crashes at railway level crossings across Australia and New Zealand found that many locations did not have warning signs installed to the standards at the time of the crash, sight distances for approaching vehicle drivers were obstructed by development on abutting properties or vegetation, and delineation was poorly maintained. Several opportunities for improvements were identified, principally to guidance on applying the sight lines and sight distances for a range of approaches, particularly on curved roads. Other improvements suggested including the addition of a short stacking warning sign and improving delineation by having all road approaches sealed to enable pavement markings, such as RAIL X and edge lines.	Level of amendment: Category 2 & 3. A number of improvement treatments are contained in *GTM Part 6* (Austroads 2017h) and further improvements have been suggested as a result of the investigation described in this report. These improvements and outcomes will be required to be considered as part of the next review of AS 1742.7:2016 and *GRD Part 4* (Austroads 2017f). The suggested improvements to the *GRD Part 4* (Austroads 2017f) that should be considered as part of these reviews are indicated below:	Ensure that the Working group for the update of AS 1742.7:2016 and the GTM are aware of the recommendations. Include text in GRD as noted.

No.	Report	Summary and Comment	Possible amendments	Road Design Task Force determination
Reference to Report No 29: **Suggest Wording to be inserted in *GRD Part 4* as follows:** **Section 3.7: Importance of seal and approach delineation:** **'The sealing of the approaches provides a stable surface for vehicle deceleration and acceleration and compared to an unsealed road approach. As a result, the sight distances required for road vehicles are reduced. Sealing the approaches also enables pavement markings to be installed. This would improve delineation and increase driver awareness of the crossing'.** **Section 5.2: Design Vehicle, include reference to Appendix D of AS 1742.7:2016.** **Section 10.2: Sight Lines, include reference to AS 1742.7:2016.**				
30.	*Safe Systems in the Guide to Traffic Management* (NTM6012).	The draft report provides the outcomes of a Safe Systems review of the *Guide to Traffic Management* (GTM) (Austroads 2019c). The GTM is a series of documents providing guidance for practitioners involved in traffic engineering, road design and road safety, and addresses treatment selection, such as intersection treatments, therefore plays an important role in influencing treatments used on road networks. Strengthening the guidance relating to treatments and their likely effectiveness in alignment with the Safe System philosophy presents an opportunity to integrate Safe System into traffic engineering and management activities. The report demonstrates where there is an opportunity to further embed Safe System into the GTM series based on recent research and presents new and revised content to address many of the Safe System gaps in the GTM to strengthen the guidance relating to treatments and their likely effectiveness in aligning with Safe System philosophy.	Level of amendment: Category 3 & 6 NOTE: the reviewed version is a final draft and not the final, published document. The majority of the recommendations are specific to the GTM; however, the following sections of the GRD should ensure consistency with some of the recommendations as follows: *GTM Part 4* (Austroads 2016h), Section 4.5 will have the following text: 'Corridor strategies should include a 15–20 year transformation treatment to achieving a Safe System compliant corridor in stages'. *GTM Part 5* (Austroads 2017j): Items 5.4 through to 5.7 should reflect the outcome of project SSP2068. *GTM Part 6* (Austroads 2017h): Para 6.1 Sections 2.2 and 2.3. *GRD Part 4, 4A* and *4C* (Austroads 2017f, 2017i, 2015m) need to reference examples of intersections and interchanges that achieve the Safe System principles. *GRD Parts 3, 4* and *6A* should reference these examples of treatments.	The TMWG should ensure that the Safe System is ALWAYS referred to as such and NOT Safe Systems!! Include text in GRD that is consistent with the changes to the GTM as noted. Will require further review with the TMWG once the GTM updates are complete.

4. Process for Incorporating Practice Amendments into Guides

4.1 Background

A research project report may contain conclusions or suggested recommendations of updates to current guidance information (Austroads Guides).

As such, in finalising the report, comments are sought from Austroads Task Forces and Working Groups, as identified in the contract, in relation to the impact of these recommendations and their suitability for translation into Guides.

The reports may be split into 7 categories according to the level of impact of the content, as shown in Table 4.1.

Table 4.1: Category of impact on guides

Category	Impact
1	Significant content/recommendations incorporated in part(s) of a guide as soon as possible.
2	Content/recommendations incorporated in parts of a guide at the next revision.
3	Some content/recommendations partially incorporated into a guide at the next revision.
4	Content highlights useful background information for practitioners that should be referenced in a guide.
5	Content/recommendations noted with potential for inclusion in a guide with further investigation.
6	Content noted with influence but without direct relevance to a guide.
7	Content noted without direct relevance to a guide.

Where suggestions or recommendations are made to update Guides, the report should identify the Guide series and relevant Part(s) considered appropriate for any update. Depending upon the scope, the report may or may not make specific wording recommendations for the guides. However, the relevant Task Force will ultimately decide upon the wording to be included in a guide.

When a report provides an update or examples of current practices and does not contain any specific recommendations to update Guide advice, the report is usually aimed at simply providing illustrative information for practitioners. This type of report would typically be cross-referenced by other Guide Parts as a way of providing examples of methods or treatments.

When a report contains suggestions or recommendations relating to changes in practice, the recommendations identify, sometimes very broadly, the Guide series or Guide Part that currently provides information on the subject and suggests or recommends an action to carry out a more substantial update. These suggestions or recommendations may still be specific, as before, where the Guide, Part and Section are identified; or they may be more general, where the changes apply more widely to a Guide series. In the latter case, the relevant Part(s) and corresponding updates need to be identified by the appropriate Task Force or Working Group.

The suggested or recommended updates could be circulated to the Task Forces, identified as having interests in the subject area, for their comments. However, this can result in a Task Force not being identified as having an interest and so not having an opportunity to provide comment at this draft stage of the report. To ensure that relevant Parts that may require updating are identified, the suggested or recommended updates should be circulated to all Task Forces.

When changes to one Guide Part require a change to also occur to another Austroads Guide Part, to ensure information consistency, the wording in the 'other' Part will need to be undertaken in association with the relevant Task Force.

When a report suggests or recommends an update to the guidance, it is important that, wherever possible, the recommendation identifies the Guide series, the Parts within the Guide series (where appropriate) and the action required, i.e. review content to include (suggested content) or amend content. The relevant Task Force(s) responsible for the Guide content must then consider the wording of any updates or changes for incorporation into the Guide content.

It is important to note that the relevant Task Forces are ultimately responsible for the contents of the Guides. Each Task Force should ensure that any changes in wording are appropriate and amended in the Guides as required. Such changes to the wording of any recommendation should be noted as part of this process.

Following endorsement by the Task Forces, the Project Report is then circulated for approval by the Austroads Board members.

Following approval of the Report, the amendments will be incorporated into the guides. The Report should then be updated with the status of the recommendations and where they have been adopted or noted in the corresponding Guide.

This last task is a most important step that enables practitioners to establish the status of research recommendations and, therefore, their applicability to current practice.

4.2 The Process

The process for developing and implementing outcomes of a research report is outlined below:

1. Project initiation – Task Forces with likely interest in the project identified and advised of the project.
2. Draft report identifies the Guide series and Guide Part(s) likely to be updated based on the outcomes of the Project.
3. Draft report circulated to responsible Task Force(s) and other Task Forces, identified in point 1, for comments, particularly on the wording of the suggestions or recommendations.
4. When a draft report includes suggestions or recommendations, the Guides, Guide Parts and Sections possibly requiring update, with suggested text, may (according to the project brief) be identified/nominated for each suggestion/recommendation.
5. Feedback from the relevant Task Forces, including the impact category, is recorded in the project report to be circulated for endorsement.
6. Updated text and information (as necessary) for inclusion into Guides is prepared and circulated to relevant Task Forces for comments/agreement as a separate and independent process.
7. When accepted, the Project report is finalised and sent to Austroads for the standard formal endorsement process.
8. Following endorsement, updates are incorporated into Guides and the research report added to the list of reference documents.
9. As Guide updates are published, the relevant sections are referenced in a 'live' Addendum to the final research report.
10. Suggestions and recommendations could be included in a summary table, a 'Recommendation Tracking Form' which allows the suggestions/recommendations to be readily identified and progress of amendments tracked. An example of a possible table is shown in Table 4.2.

A flowchart of this process is shown in Figure 4.1.

Figure 4.1: Flowchart for incorporating research report outcomes into guides

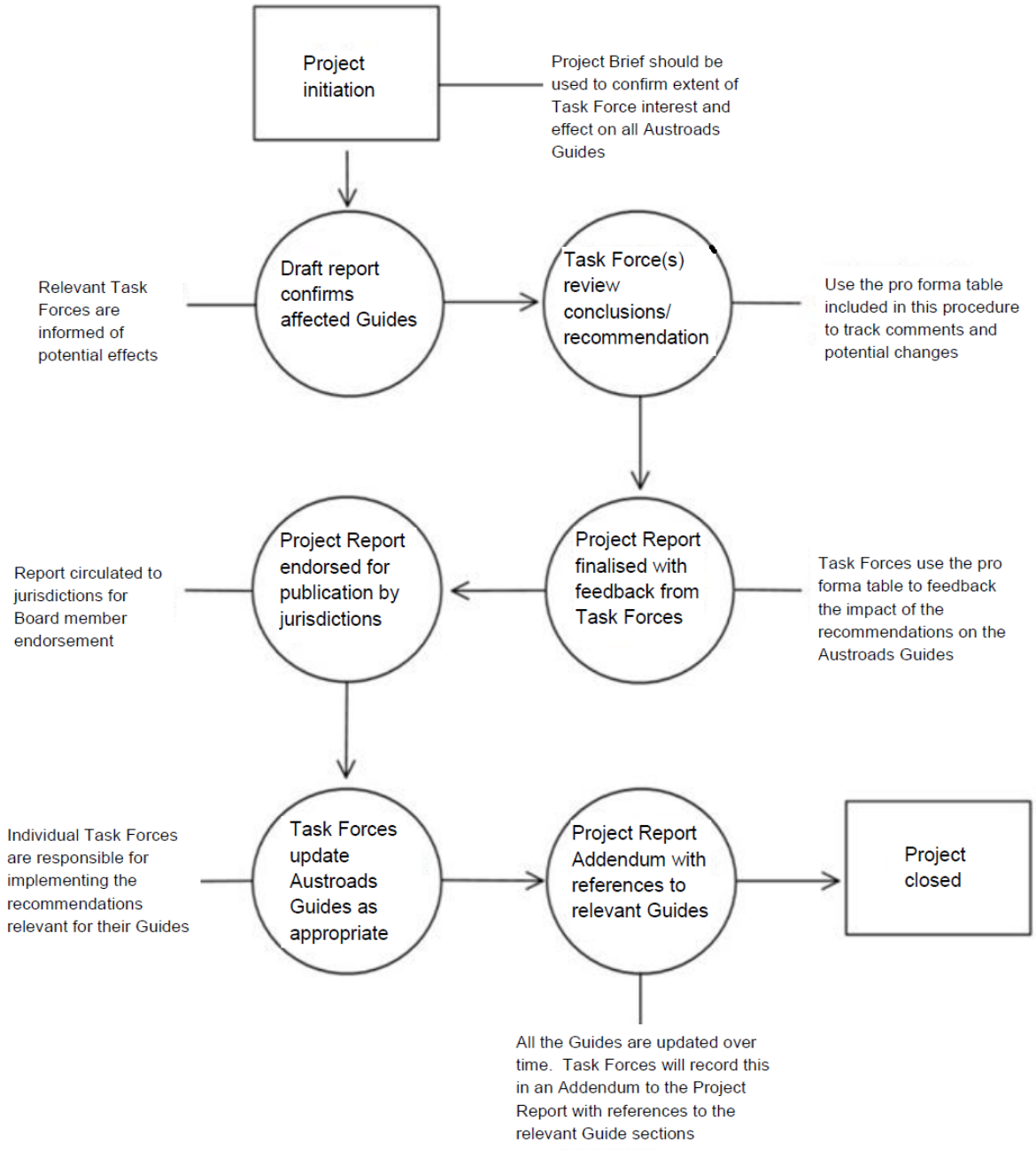


Table 4.2: Example recommendation tracking form

Report	Outcomes	Possible amendments	Road Design Task Force determination
Methods for Reducing Speeds on Rural Roads: Compendium of Good Practice (AP-R449-14) (Austroads 2014b)	Speed is a significant contributor to deaths and serious injuries on rural roads in both Australia and New Zealand. Research was undertaken on speed reduction in rural areas, with the key objective of providing information on effective techniques to reduce speed and speed-related crashes in rural areas, particularly those involving engineering-based solutions. The research included a literature review and international review of expert opinion; the development of a strategy for future research to address gaps in knowledge; data analysis; site visits; consultation with industry; rural speed workshops; trials of new treatments; and development of guidance. This report is designed to be a compendium of good practice to inform practitioners of the extent of the speed issue in rural areas and to provide guidance on effective actions that can be taken to reduce the incidence and severity of crashes on rural roads. Detailed information is provided on almost 30 road engineering treatments that may be used to reduce speeds at key locations on rural roads. Information is presented on the speed and crash reduction effectiveness of commonly used treatments. These include advance warning signs, chevron alignment markers, and advisory speed signs at curves; advance warning signs and roundabouts at intersections; and advance warning signs and buffer zones on the approach to towns. Emerging treatments have been identified, although less reliable information is available on their effectiveness. New and promising treatments include vehicle-activated signs and route-based curve treatments at curves; speed management and vehicle-activated signs at rural intersections; and rural gateway/threshold treatments on the entry to small towns. Other treatments require further investigation but show some promise. These include in-vehicle speed warning systems for curves (and potentially other locations on rural roads); removing 'excess' sight distance at intersections, and methods to highlight the presence of intersections; and road narrowing combined with reduced speed limits. Key conclusions from the project are as follows: • Information is now known on the speed and crash reduction effectiveness of commonly used treatments. These include: – advance warning signs, chevron alignment markers, and speed advisory signs at curves	Category 2 & 3 for the Guide to Road Design *GRD Part 3* (Austroads 2016i), Section 3.4: Operating Speeds on Rural Roads: in the discussion on operating speeds, a reference to the report could provide commentary on possible treatments to manage speeds along roads; however, quantification of the treatment outcomes requires further research. *GRD Part 4* (Austroads 2017f), Table 4.2: Considerations in the Location of Intersections: where approach speeds are sought to be reduced, there are some emerging treatments, e.g. horizontal deflections on approaches to an intersection, but further evaluation is needed for application and design criteria. Other Austroads Guides Speed control treatments are referenced in Table 6.7 of *GTM Part 5: Road Management* (Austroads 2017g). Cross-reference to *GTM Part 5* may be appropriate to inform the design of treatments where the design speed is sought to be reduced and the possible treatments to support the reduced speed.	*GRD Parts 3* and *4* (Austroads 2016i, 2017f) could include the various treatment options that are available to manage speed but noting that the measure of their efficacy is limited. Immediate updates to *Parts 3, 4,* and *4B* (Austroads 2016i, 2017f, 2015l) are listed below. Potential for further, on-going updates as evaluations are completed. Examples of good practice will be incorporated in an Appendix. NTF and TMWG advised of recommendations.

Report	Outcomes	Possible amendments	Road Design Task Force determination
	– advance warning signs and roundabouts at intersections – advance warning signs and buffer zones on the approach to towns. • Emerging treatments have been identified, and in several cases, data has been collected to determine the effectiveness of these treatments. New and promising treatments include: – Vehicle-activated signs and route-based treatments at curves – speed management and vehicle-activated signs at rural intersections – rural gateway/threshold treatments on the entry to small towns in rural areas. • Other treatments require further investigation but show some promise including: – in-vehicle speed warning systems for curves (and potentially other locations on rural roads) – removing 'excess' sight distance at intersections, and methods to highlight the presence of intersections – road narrowing combined with reduced speed limits on rural roads. Comment Some of the treatments contained in the compendium require further investigation to develop appropriate location for the treatment and detail design information which have been identified in the report.		
Suggested action: **Reference to report AP-R449-14** **Pending wider inclusion in the next scheduled revision, add the appropriate treatments as example in the Appendices of both Parts 3 and 4 and add references to these appendices in the main body text as appropriate.** ***Guide to Road Design*:** ***Part 3* – Section 5.10: Curves, based on report Appendix: A.1 (A.1.3 through to A.1.9).** ***Part 4* – Section 3.1: Sight Distance, based on report Appendix: A.2 (A.2.6).** **Section 10.1: Level Crossing Approaches, based on report Appendix: A.3 (A.3.1, A.3.2).** ***Part 4B* – Section 4.5.2: Approach and Entry Treatments, based on report Appendix A.2 (A.2.3).** ***Guide to Road Safety Part 3: Speed Limits and Speed Management* (2008a) and *Guide to Traffic Management Part 5: Road Management* (Austroads 2017g),** **Based on report Appendix: A.4 (A.4.4, A.4.5).** **Report Appendix: A.5 (A.5.1 - A5.3); Appendix: A.2 (A.2.1, A.2.2); A.2.4, A.2.5, (A.2.7 – A.2.10).**			

5. Conclusion

In reviewing the reports, it was found that many of them identify possible amendments but lack specific recommendations that may be readily considered in any review. Identifying relevant Parts and Sections would assist in incorporating the recommendations or suggestions.

The reports reviewed identified many areas for amendments within the Guide to Road Design-set, which are outlined in Section 3. The recommendations for updates to the Parts, and suggested amendments, provide opportunities to further enhance the Guide to Road Design-set when next reviewed.

References

Austroads 2008a, Guide to road safety part 3: speed limits and speed management, AGRS03-08, Austroads, Sydney, NSW.

Austroads 2008b, *Guide to road safety part 9: roadside hazard management*, AGRS09-08, Austroads, Sydney, NSW.

Austroads 2009, *Guide to road design part 8: process and documentation*, AGRD08-09, Austroads, Sydney, NSW.

Austroads 2010, *Guide to road design part 6: roadside design, safety and barriers*, AGRD06-10, Austroads, Sydney, NSW.

Austroads 2013a, *Guide to road design part 5: drainage – general and hydrology considerations*, AGRD05-13, Austroads, Sydney, NSW.

Austroads 2013b, *Guide to road design part 5A: drainage – road surface, networks, basins and subsurface*, AGRD05A-13, Austroads, Sydney, NSW.

Austroads 2013c, *Guide to road design part 5B: drainage – open channels, culverts and floodways*, AGRD05B-13, Austroads, Sydney, NSW.

Austroads 2013d, *Austroads design vehicle and turning path templates guide*, AP-G34-13, Austroads, Sydney, NSW.

Austroads 2013e, *Expanded operating speed model*, AP-T299-13, Austroads, Sydney, NSW.

Austroads 2014a, *Providing for road user error in the safe system*, AP-R460-14, Austroads, Sydney, NSW.

Austroads 2014b, *Methods for reducing speeds on rural roads: compendium of good practice*, AP-R449-14, Austroads, Sydney, NSW.

Austroads 2014c, *Model national guidelines for setting speed limits at high-risk locations*, AP-R455-14, Austroads, Sydney, NSW.

Austroads 2014d*, Investigation of key crash types: run-off-road and head-on crashes in urban areas final report*, AP-R450-14, Austroads, Sydney, NSW.

Austroads 2014e, *Safety operational and environmental impacts of changes to speed limits*, IR-223-14, Austroads, Sydney, NSW. Output of Project ST1647

Austroads 2014f, *Assessment of the effectiveness of on-road bicycle lanes at roundabouts in Australia and New Zealand*, AP-R461-14, Austroads, Sydney, NSW.

Austroads 2014g, *Improving roadside safety: summary report*, AP R437 14, Austroads, Sydney, NSW.

Austroads 2015a, *Safe system in the planning process*, AP-R488-15, Austroads, Sydney, NSW.

Austroads 2015b, *Improving the performance of safe system infrastructure: final report*, AP-R498-15, Austroads, Sydney, NSW.

Austroads 2015c, *Road design for heavy vehicles*, AP-T293-15, Austroads, Sydney, NSW.

Austroads 2015d, *Safety provisions for floodways over roads*, AP-R481-15, Austroads, Sydney, NSW.

Austroads 2015e, *Road geometry study for improved rural safety*, AP-T295-15, Austroads, Sydney, NSW.

Austroads 2015f, *Investigation of key crash types: rear-end crashes in urban and rural environments*, AP-R480-15, Austroads, Sydney, NSW.

Austroads 2015g, *Safe system practice amendments to the guide to road design*, IR-232-15, Austroads, Sydney, NSW. Output of Project SP1705

Austroads, 2015h, *Updating the guide to road safety part 9: roadside hazard management*, IR-237-15, Austroads, Sydney, NSW. Output of Project ST1773

Austroads 2015i, *Guide to road design part 2: design considerations*, AGRD02-15, Austroads, Sydney, NSW.

Austroads 2015j, *Guide to road design part 1: introduction to road design*, AGRD01-15, Austroads, Sydney, NSW.

Austroads 2015k, *Guide to road design part 6B: roadside environment*, AGRD06B-15, Austroads, Sydney, NSW.

Austroads 2015l, *Guide to road design part 4B: roundabouts*, AGRD04B-15, Austroads, Sydney, NSW.

Austroads 2015m, *Guide to road design part 4C: interchanges*, AGRD04C-15, Austroads, Sydney, NSW.

Austroads 2015n, *Guide to road safety part 8: treatment of crash locations*, AGRS08-15, Austroads, Sydney, NSW.

Austroads 2016a, *Safe system assessment framework*, AP-R509-16, Austroads, Sydney, NSW.

Austroads 2016b, *Safe system roads for local government*, AP-R518-16, Austroads, Sydney, NSW.

Austroads 2016c, *Achieving safe system speeds on urban arterial roads: compendium of good practice*, AP-R514-16, Austroads, Sydney, NSW.

Austroads 2016d, *Speed reduction treatments for high-speed environments*, AP-R508-16, Austroads, Sydney, NSW.

Austroads 2016e, *Older road users: emerging trends*, AP-R530-16, Austroads, Sydney, NSW.

Austroads 2016f, *Guidance on median and centreline treatments to reduce head-on casualties*, AP-R519-16, Austroads, Sydney, NSW.

Austroads 2016g, *Road safety audit and road safety engineering toolkits: usage survey 2011-16*, IR-250-16, Austroads, Sydney, NSW. Output of Project ST1771

Austroads 2016h, *Guide to traffic management part 4: network management*, AGTM04-16, Austroads, Sydney, NSW.

Austroads 2016i, *Guide to road design part 3: geometric design*, AGRD03-16, Austroads, Sydney, NSW.

Austroads 2016j, *Guide to traffic management part 8: local area traffic management*, AGTM08-16, Austroads, Sydney, NSW.

Austroads 2016k, *Infrastructure improvements to reduce motorcycle casualties*, AP-R515-16, Austroads, Sydney, NSW.

Austroads 2017a, *Safe system infrastructure on mixed use arterials*, AP-T330-17, Austroads, Sydney, NSW.

Austroads 2017b, *Lapping of guardrail terminals*, SBTA 17-001, Austroads, Sydney, NSW.

Austroads 2017c, *Proximity of safety barriers to batter hinge point*, SBTA 17-002, Austroads, Sydney, NSW.

Austroads 2017d, *Bicycle safety at roundabouts*, AP-R542-17, Austroads, Sydney, NSW.

Austroads 2017e, *Improved railway crossing design for heavy vehicles*, AP-R549-17, Austroads, Sydney, NSW.

Austroads 2017f, *Guide to road design part 4: intersections and crossings - general*, AGRD04-17, Austroads, Sydney, NSW.

Austroads 2017g, *Guide to traffic management part 5: road management*, AGTM05-17, Austroads, Sydney, NSW.

Austroads 2017h, *Guide to traffic management part 6: intersections, interchanges and crossings*, AGTM06-17, Austroads, Sydney, NSW.

Austroads 2017i, *Guide to road design part 4A: unsignalised and signalised intersections*, AGRD04A-17, Austroads, Sydney, NSW.

Austroads 2017j, *Guide to traffic management part 5: road management*, AGTM05-17, Austroads, Sydney, NSW.

Austroads 2017k, *Guide to road design part 6A: paths for walking and cycling*, AGRD06A-17, Austroads, Sydney, NSW.

Austroads 2018, *Towards safe system infrastructure compendium of current knowledge*, AP-R560-18, Austroads, Sydney, NSW.

Austroads 2019a, *Guide to road safety: set*, Austroads, Sydney, NSW.

Austroads 2019b, *Guide to road design: set*, Austroads, Sydney, NSW

Austroads 2019c, *Guide to traffic management: set*, Austroads, Sydney, NSW.

Land Transport New Zealand 2007, *On-road tracking curves for heavy vehicles*, Land Transport New Zealand, Wellington, NZ.

Prem, H, Ramsay, E, Fletcher, C, George, R & Gleeson, B 1999*, Estimation of lane width requirements for heavy vehicles on straight paths*, AAR 342, ARRB Transport Research, Vermont South, Vic.

Superseded

Austroads 2008c, *Guide to traffic management part 5: road management*, AGTM05-08, Austroads, Sydney, NSW.

Austroads 2008d, *Guide to traffic management part 11: parking*, AGTM11-08, Austroads, Sydney, NSW.

Australian and NEW Zealand Standards

AS/NZS1158 set:2010: *Lighting for roads and public spaces*.

AS 2890.5-1993**:** *Parking facilities - On-street parking.*

AS 1742.2-2009: *Manual of uniform traffic control devices - Traffic control devices for general use.*

AS 1742.12-2017: *Manual of uniform traffic control devices - Bus, transit, tram and truck lanes.*

Appendix A Motorcyclist Casualties – Suggested Amendments

The research report *Infrastructure Improvements to Reduce Motorcycle Casualties* (AP-R515-16) identified many amendments, and these are outlined in Table A 1.

The amendments relate to emphasising the consideration of motorcyclists in determining the type or characteristics of infrastructure being place within a road, e.g. kerb types and pit cover locations.

Table A 1: Motorcyclist casualties – suggested amendments

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
All parts of the Guide				
All parts of the Guide	The Guide to Road Design does not definitively outline guidance for greenfield or brownfield design nor a risk-based approach. Each design element is separated throughout Parts 1–8, guidance is not given on how to use a risk-based design approach or achieve a 'safe design'/Safe System compliant design.	Provide further guidance on holistic design, inclusive of the effective combinations that design elements have on various road users (inclusive of motorcycles). An AusRAP style matrix could be used to demonstrate the resulting risk of a design.	This approach is similar to a performance-based design approach. The development of this approach would require a complete re-write and significant change to current practice. Needs to be considered by the RDTF.	A complete review will be assessed following the current restructure work as a priority in next round of projects.
***GRD Part 2: Design Considerations* (2015i)**				
1 Design Objectives	Motorcyclists have different characteristics compared to other road users. Vehicles, heavy vehicles, pedestrians and cyclists, public transport vehicles have been addressed as specific road users. Motorcyclists have not been included as a unique road user group.	Include an additional section e.g. (1.10) on providing for motorcyclists, identifying them as unique road users with different needs and characteristics compared to vehicles and other road users. This would include consideration of both commuting and recreational motorcyclists and outline high-risk locations such as horizontal curves and intersections.	Highlight vulnerability and importance of regular and thorough maintenance.	Highlight vulnerability and importance of regular and thorough maintenance.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
1.1 Introduction	Motorcyclists have not been included as a separate user group.	Include motorcyclists as a user group.	Expand to include a paragraph to reference motorcyclists. Additional section, possibly 1.10, as described in previous comments.	As per No 1 above.
2.4.2 Factors that Influence Design Standards	This section refers to motorcycles as a motorised road user; however, no additional discussion is provided regarding how the operating characteristics of motorcycles may influence the road design. Discussion is provided for other road users.	Provide discussion regarding how the operating characteristics of motorcycles may influence the road design (e.g. provision of good sight distance, attention to curves, a clear predictable delineated roadway with a consistent road surface).	Expand Section 2.4.2: The vehicle, to include information relating to motorcyclists. Highlight the issues but needs referencing to a Guide to Traffic Management and the Guide to Asset Management series.	Agreed.
***GRD Part 3: Geometric Design* (2016i)**				
3.0 Speed Parameters	The operating speed model caters for passenger cars and does not reflect the operating speeds of motorcycles on various road types and environments. It is unclear if this caters for motorcycles, or on how to apply this to motorcycles. The operating speed of motorcycles may or may not affect the geometric design of an alignment; however, it may identify differences in operating speeds, which may alter how mitigation measures such as advanced warning signage, delineation, surface friction and drainage may be accounted for on curves.	Review the operating speed model to see if it reflects motorcycles. Research would need to be undertaken to determine an operating speed for motorcycles. Identify differences in speeds between motorcycles and vehicles. This may highlight where mitigation measures may be required to be implemented to cater for motorcyclists.	No change needed to GRD.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
4.0 Cross-section	The cross-section width, particularly at horizontal curves, impacts on a motorcyclist. Although the vehicle is small relative to cars and trucks etc., it uses the full travel lane width when negotiating a horizontal curve. The width of the travel lane affects the sight distance and selected riding path a motorcyclist takes on a curve, the manoeuvring width around a hazard on the road surface, and the stopping distance and stability whilst braking when leant over on a curve, most importantly the distance (head-on zone) between opposing traffic streams on undivided roads. The shoulder width affects the likelihood of a motorcyclist recovering or reducing impact speed once the travel lane is left. These differences are not discussed in this section. Table 2.1 currently provides issues and good practice relating to motorcyclists. The issues identified relate to: • motorcyclist travel line around curves and sight distance based on the travel line • sight distance when rider is in a leant over position • separation from opposing vehicle flow when travelling on horizontal curves. Amend to add: These issues could be incorporated into Table 2.1. Specific recommendations not provided, and the design criteria currently provided covers these issues.	Provide discussion regarding how cross-section properties are important for motorcyclists with regards to moving a motorcycle away from the head-on zone, providing additional sight lines and riding path options, giving particular attention to formation width on horizontal curves. Further information provided in comments below – 7.9 Pavement widening on horizontal curves.	No change needed to GRD	No change at this stage.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
4.6.4 Kerb and Channel	There is no mention of the effects of the conspicuity of kerbs (concrete on concrete pavement or kerbing at night) profile, height or location on motorcycles, especially at intersections and on curves. Barrier kerbs, if struck, may re-direct the path of a motorcycle or result in them losing control. It should also be noted that some states allow lane filtering, and this adversely sees an increase in shoulder use by motorcycles. An unfavourable barrier type is likely to snag a motorcycle foot peg whilst a motorcycle is using a reduced width to navigate between a vehicle and the kerb.	Provide guidance on the effects of kerbs on motorcycles, identify the risks and appropriate countermeasures such as lane/shoulder width and lighting or delineation.	Section 4.6.4 includes: Other guidance on the appropriate type and placement of kerb and channel which provides information on the types of kerbs and issues relating to the kerb profile. Expand this information to include effects of barrier kerbs, some road safety barriers and suggest treatments to minimise, including shoulder width, delineation of kerbs.	Agree that semi-mountable kerbs ought to be more prevalent in preference to vertical faced (barrier) options. Many local authorities have their own policies that are based on the perception that vertical kerbs (in particular) will assist in protecting pedestrians whereas semi-mountable or fully mountable provide a more balanced safety environment for all network users.
4.10 On-street Parking	No guidance is provided with regard to maintaining an adequate distance between the travel lane and parked vehicle. An opening vehicle door (parallel parking) or the front or rear of a car may enter the through lane during parking manoeuvres. Additional width between a parked vehicle and the through lane will grant a motorcycle additional time to identify and evade any part of a parked car entering the through lane.	Provide guidance on maintaining a 'buffer' between a parked car and the through lane. The buffer would be more critical in areas with high traffic volumes and/or roads with reduced lane widths. The width would vary dependent on the curve radius and possible motorcycle lean angles, this would need to be investigated further.	Section 4.10.2: Parallel Parking includes reference to a buffer and suggests widths based on traffic speeds. Section 4.10.3: Angle Parking and 4.10.4: Centre-of-Road Parking do not have reference to a buffer. Inclusion of a buffer could be included for angle parking, widths to be determined. Buffer width suggested for bicycle lanes is 1.0 m (*GRD Part 3* (Austroads 2016i), Figure 4.38). Note 1: This principle should be included in *GTM Part 11: Parking* (Austroads 2008d, superseded) and AS 2890.5: On-street Parking. Note 2: On a high-speed (≥ 60 km/h) on-street parking, in *GTM Part 11: Parking*, is suggested to be prohibited.	Motorcyclists expected to travel in the centre of the traffic lane. Specific treatment requires demonstration of the need and the width of the separation.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
5.0 Sight Distance	Sufficient sight distance is crucial to motorcyclists. The consequence for a motorcyclist not having enough time to perceive and react to a hazardous situation is potentially severe. Therefore, it is important that attention be given to sight distance for motorcyclists, particularly on curves. Table 5.3 provides the coefficient of deceleration for different vehicle types, and different road surface types and conditions. There are no coefficients of deceleration for motorcycles provided in the table. Current practice is to adopt those for vehicles.	Investigate whether specific coefficient of deceleration values are required for motorcycles or whether the current values for vehicles are appropriate. This would enable the stopping sight distance to be calculated for motorcycles.	Further research on coefficients of deceleration sought. No amendment to GRD identified.	More advice and consideration of variations in driver eye height, object height and headlight efficacy on curves.
7.0 Horizontal Alignment	The effects of various curve types, curve lengths, curve combinations, curve radius and frequency of curves and motorcycle crash risk is not discussed. Motorcycles have a higher crash risk on curves than passenger vehicles.	Provide guidance on horizontal curve design for motorcycles. Undertake research to define the risk factors per design element and provide guidance accordingly. Issues include handling on a curve, counter-steering and lean affected by: • changes in alignment • curve radius • visibility of the alignment being followed.	Reference is made within *GRD Part 3* relating to motorcyclist instability issues on some curves. Further research on coefficients of deceleration required. Expand the information to include the motorcycle operational characteristics and need to consider the issues listed.	As above
7.7.6 Rate of Rotation	If the maximum rate of rotation on a curve is exceeded, a motorcyclist is at greater risk of losing control while negotiating the curve compared to other vehicles. This may be more prevalent on different road surfaces when wet. Foot pegs are susceptible to contacting the road surface on compound curves.	Provide guidance on rate of rotation maximum values for motorcycles. Undertake research to define the effects of the existing maximum rate of rotation values on motorcycles and provide guidance.	Further research on effects of the rate of crossfall rotation required. No specific amendment to GRD identified.	No additional comments.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
7.8 Curves with Adverse Crossfall	Adverse crossfall (camber) is hazardous as motorcycles rely on 'grip' between the road surface and tyre to maintain control when negotiating a curve. This is exacerbated by the motorcycle leaning even further due to the adverse camber. Table 7.10 gives minimum radius curves for various operating speeds for which adverse crossfall may be considered. The maximum side friction values used in this table are for all vehicle types. The motorcycle dynamics are different to other vehicles.	Undertake research to determine whether there is a need for a specific coefficient of side friction/curve radius combination specific to motorcycles. Provide guidance as required.	Further research on the effects of crossfall rotation required. No specific amendment to GRD identified.	No additional comments.
7.9 Pavement Widening on Horizontal Curves	A wider lane and shoulder on curves allow a motorcyclist to select a safe riding path while also maintaining a buffer (head-on zone) to vehicles in the opposing lane (left-hand curve) or the shoulder (right-hand curve). It should be differentiated that this is not providing a lane wider than 3.5 m as per the existing guidance for heavy vehicles, the discussion is around providing a wider formation than what might already be in place or than what is recommended based on road type and AADT on curves only, i.e. the straight may have a 0.5 m sealed shoulder, lane width of 3 m, the curve would benefit from a 1.0 m sealed shoulder and 3.3 m lane. No discussion is provided regarding the benefits of wider formations of curves for motorcyclists.	Provide discussion of the benefits of wider formations on curves for motorcyclists.. Wide sealed shoulders should also be provided to allow an errant motorcycle to recover or use the width to avoid a hazard in the through lane.	Section 4.3.4 Sealed Shoulder Widening on the Outside of Curves suggests consideration be given to providing a widened sealed shoulder on the outside of horizontal curves. Provision of wide centrelines is contained in Sect 4.7.1: Median Width, as a means to separate opposing traffic flows. There is no specific reference to motorcyclists and expansion of commentary on the benefits to motorcyclist of a wide centreline treatment and curve widening could be expanded, although benefits specifically for motorcyclists apply to other road users.	Expand commentary on the benefits of asymmetrical widening to accommodate errant vehicle paths to reinforce the current practice.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
9.4 Overtaking Lanes	Inadequate overtaking provisions may lead to unsafe overtaking manoeuvres, particularly when the average speed of a vehicle over a length of road is slower than the average speed of a motorcycle. This may be due to repeated and tight horizontal geometry. A motorcyclist sitting behind slower vehicle/vehicles may overtake at non-designated and unsafe locations.	Develop an operating speed model for motorcyclists as per the proposed action for 3.0 Speed Parameters. Pending on the findings, include guidance on the need for overtaking opportunities where there is an imbalance in average speeds for motorcycles and vehicles.	RDTF to consider research for operating speeds for motorcycles and inclusion in the Operating Speed Model.	Agreed.
***GRD Part 4: Intersection and Crossings: General* (Austroads 2017f).**				
3.7.1 Pavement Markings and Signs	There is no guidance on the skid resistant properties of pavement markings needed for motorcycles. Pavement markings located in braking, accelerating or turning locations will affect the stability of a motorcycle if they do not provide sufficient surface texture. The paint is not always durable and deteriorates over time resulting in no night-time delineation.	Provide guidance on the use of suitable pavement marking materials/paint. General information relating to skid resistant markings is contained in *GRD Part 3*, Table 2.1: Issues relating to motorcyclists..., which indicates *adopt pavement markings with the same skid resistance as the rest of the road. Do not use large areas of it in traffic lanes*.	Expand the information to include the same information as contained in *GRD Part 3*, Table 2.1. Provides other benefits to road users	Agreed.
3.7.2 Road Lighting	There is no guidance on the effects lighting has on motorcycles, including the importance of clearly showing the layout, lane designation, presence of surface hazards and debris, surface texture, kerbing and roadside hazards at night	Provide guidance on the use of lighting and type of kerb appropriate for the needs of motorcycles.	Section 3.7.2: Road Lighting. Expand the commentary to include a reference to the type of kerbing, e.g. semi-mountable kerb profile and the benefits to motorcyclists of lighting. Cross-reference is made to AS/NZS 1158 and *GRD Part 6B* (Austroads 2015k) for guidance on the design of road lighting.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
5.2 Design Vehicles	The introduction of this section says 'The physical and operating characteristics of vehicles using the road control some specific elements in geometric design' however the characteristics of a motorcycle are not included.	Provide guidance on the special needs of motorcycles, make references to sections within the document that should be considered during the design process.	Section 5.2 outlines the physical characteristics of vehicles, relating to widths and lengths. Specific requirements for vehicles are contained within sections on the specific element. Inclusion of an outline of special needs of motorcycles is better located within the section providing guidance on the element. See also Section 1.6.1 and 1.6.2.	May need to definitively state that the characteristics of motorcycle performance are within the limits of the parameters used for the rest of the vehicle fleet. These are issue for consideration and resolution as part of future updating.
Not in Guide Location of Pavement Marking and Service Pit Covers	There is no guidance on the effects of the location of linemarking, pavement markers or service pit cover locations on intersection approaches, departures and turning paths.	Provide guidance on the location of linemarking, pavement markers or service pit cover locations on intersection approaches, departures and turning paths and the effects these have on turning motorcycles. (This should also be provided in Parts 4A and 4B).	*GRD Part 4*: Table 3.1: expanded to include information relating to motorcyclist (currently includes heavy vehicles, bicyclists, pedestrians and buses).	Agreed.
***GRD Part 4A: Unsignalised and Signalised Intersections* (2017i)**				
Not in Guide Location of Pavement Marking and Service Pit Covers	There is no guidance on the effects of the location of linemarking, pavement markers or service pit cover locations on intersection approaches, departures and turning paths.	Provide guidance on the location of linemarking, pavement markers or service pit cover locations on intersection approaches, departures and turning paths and the effects these have on turning motorcycles.	Tables 2.1 and 2.2 include information on pit locations, but not specifically relating to travels paths or motorcyclists. Include a reference in Table 2.1 to motorcyclists and the desire for a uniform surface, particularly when turning.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
3.2 Sight Distance Requirements for Vehicles at Intersections	The requirements and distances are provided for passenger vehicles only. There is no mention of the needs for motorcycles nor the vulnerability of motorcycles to multiple vehicle crashes at intersections.	Review the coefficient of deceleration values and determine if these are relevant for motorcycles, this should consider weather, pavement type and pavement life/condition. Provide guidance on the vulnerability of motorcycles at intersections, i.e. a passenger vehicle not seeing a motorcycle, a motorcycle having an increased stopping distance in the wet or dry when the road surface has poor surface texture or surface hazards such as pavement defects, a slippery linemarking or service pit cover. An increased sight distance will also provide a motorcyclist an opportunity to identify a vehicle and act accordingly before emergency braking is required. Investigate if the SISD should be increased to be measured from the approach to the hold line as opposed to the hold line, thus giving motorcyclists increased time to safely decelerate and avoid a collision. Provide guidance on the effect that lane width may have on a motorcyclist avoiding a collision.	Research to establish the coefficients of deceleration is needed. Vulnerabilities of a motorcyclist and included in *GRD Part 4* Table 3.1. RDTF to consider repeating information through each Part (currently cross-referencing used). Research to establish the SISD would be required. Research to establish the safety benefits would be needed.	Not believed to result in improved information for designers.
4.8 Warrants for BA, AU and CH Turn Treatments	The warrants are based on passenger vehicle AADT and cater for the needs of passenger vehicles. The warrants are based on turning volumes and road user protection combined. Motorcycles are vulnerable, particularly when stored in a through lane to turn right or left. This vulnerability may also lead to a motorcyclist feeling pressure to make a turn quickly and not wait for a suitable gap.	Include guidance for providing protected turn lanes to separate motorcycles from a through lane when stopped to turn. Warrants could be based on vehicle AADT, motorcycle AADT, sight distances, operating speed, percentage of heavy vehicles and crash history on the link.	Warrants are contained in *GTM Part 6* (Austroads 2017h). Replication is being removed from Parts with cross-referencing to the appropriate Part included.	Refer to TMWG.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
Not in Guide Skid Resistance	There is no guidance on the skid resistance properties of pavement markings needed for motorcycles. Pavement markings located in braking, accelerating or turning locations will affect the stability of a motorcycle if they do not provide sufficient surface texture.	Provide guidance on the use of suitable pavement marking paint.	Part 4 contains: Section 3.7.1: Pavement markings and signs, be expanded to include reference to the use of skid resistant pavement markings and retaining the cross-references for more information. This is also an area Standards Australia or New Zealand provide information.	Agreed.
Not in Guide Skid Resistance	There is no guidance on the skid resistant or coefficient of friction properties of a pavement type (asphalt mix, chip seal or concrete), including drainage properties and performance for motorcycles. This is crucial for a motorcycle turning through an intersection, especially one with an adverse crossfall.	Provide guidance on the use of suitable pavement and resulting surface performance.	Guide to Pavement Technology would need to include this information in the design of a pavement.	Refer to Pavements Task Force.
Not in Guide Motorcycle Lanes and Jump Start Areas	Currently the road design standards do not consider providing motorcycle lanes and jump start areas at intersections. Currently this is informally allowed in some states by changes to legalise lane filtering.	Provide guidance on what situations to provide motorcycle lanes. Consideration should be given as to how these will be designed (particularly when interacting with turning or slip lanes) and should consider interaction/sharing with cyclists.	This is a matter for *GTM Part 6*.	Refer to TMWG. Evidence based dimensional recommendations are not known at this stage.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
Part 4B: Roundabouts **(2015l)**				
3 Sight Distance	The requirements and distances are provided for passenger vehicles only. There is no mention of the needs for motorcycles nor the vulnerability of motorcycles at intersections. Higher speeds of motorcycles through roundabouts is also not considered (see entry geometry). Specific guidance is provided for trucks but not motorcycles. The importance of early identification of motorcycles by other road users is not highlighted.	Provide guidance on the complexities of motorcycle stopping distance, particularly with regard to stopping distances on curves (i.e. curve approaches or on the circulating carriageway). Provide guidance highlighting the importance of conspicuity of the presence and layout of the roundabout from the approaches. Research needs to be undertaken with regard to open or restricted sight lines and the effects they may have on motorcyclist behaviour i.e. the influence it has on motorcyclists acknowledging the need to yield or maintaining speed if entry geometry does not restrict motorcycle approach speeds.	The stopping distances needs further investigation. Section 1.6: Safety Performance of Roundabouts. Includes information on motorcyclists at roundabouts. Considered appropriate.	Evidence to support dimensional guidance is not currently available to support this.
4.5 Entry Geometry	Approach entry curve radius design guidance is provided for passenger vehicles. A motorcycle speed is not as effectively reduced by an entry radius as it is narrower than a vehicle and can effectively use the lane width to continue straight through the curve. This asks the question of sight distance requirements and assumed approach speeds used to design for sight distance.	Research motorcycle speeds on various entry curve radii. Provide guidance on how to manage approach speeds of motorcycles or provide sight distance so as a motorcycle can adjust speed or yield to avoid a collision with a vehicle on the roundabout.	Research on managing motorcyclists' speeds is needed.	The performance of motorcyclists at roundabouts is catered for by the current designs. There does not seem to be any features that require consideration for change. The use of semi-mountable kerbs and the need to reduce aprons and apron lips in favour of larger roundabouts could be considered as part of further research.
4.10.1 Crossfalls	There is no specific guidance to cater for motorcycles, however there is for heavy vehicles. However, motorcycles may have to negotiate adverse crossfall, superelevated crossfall whilst passing through or turning on a roundabout. Motorcycle stability is reliant on consistent geometry and surface friction, this is not mentioned.	Provide guidance on how to design a roundabout that does not adversely affect motorcycles. This would include guidance on pavement type and performance in wet weather and the combined effects of surface friction and adverse and/or changing crossfalls/superelevation.	Research on parameters to provide stability is needed.	

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
6 Pavement Markings and Signage	In Table 6.1 there is no guidance on the skid resistance properties of pavement markings needed for motorcycles. Pavement markings located in braking, accelerating or turning locations will affect the stability of a motorcycle if they do not provide sufficient surface texture.	Provide guidance on the use of suitable pavement marking paint. General information relating to skid resistant markings is contained in *GRD Part 3*, Table 2.1: Issues relating to motorcyclists..., which indicates *adopt pavement markings with the same skid resistance as the rest of the road. Do not use large areas of it in traffic lanes*.	Expand Table 6.1 to include the same information as contained in *GRD Part 3*, Table 2.1.	
Not in Guide Surface Friction/Skid Resistance	There is no guidance on the skid resistant or coefficient of friction properties of a pavement type (asphalt mix, chip seal or concrete), including of drainage properties and performance for motorcycles. This is crucial for a motorcycle turning on the circulating carriageway, especially one with an adverse crossfall.	Provide guidance on the use of suitable pavement marking paint wearing course surface friction (focus on circulating carriageway), drainage and landscaping watering systems.	General information is available as outlined for Section 6. Specific information is not contained in the Parts or AS 1742.2: *Manual of uniform traffic control devices-: Traffic control devices for general use*. This type of information would be expected in a Standards Australia or New Zealand publication. See also Section 6.	

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
Not in Guide Kerb Delineation and Profile	There is no mention of the effects of kerb conspicuousness (concrete on concrete pavement or kerbing at night) profile, height or location on motorcycles, especially at intersections and on curves (including curves on intersections, e.g. central island and kerbing on left turns). Barrier kerbs, if struck, may re-direct the path of a motorcycle or result in loss of control. It should also be noted that some states allow lane filtering, resulting in an increase number of motorcyclists using the shoulders. An unfavourable barrier type is likely to snag a motorcycle foot peg whilst a motorcycle is using a reduced width to navigate between a vehicle and the kerb. Guidance is provided for buses with regard to kerb height and type, however not for motorcycles.	Provide guidance on the effects of kerbs on motorcycles in *GRD Parts 4, 4A* and *4B*. Identify the risks and appropriate countermeasures such as lane/shoulder width and lighting or delineation.	See also *GRD Part 4*, Sections 3.7.1 and 3.7.2 for reference to kerbs. The type of kerb is referenced in relation to buses and encroachment areas (Part 4B).	Need to provide consistent advice regarding the relevance of kerb profiles for motorcycles.
***GRD Part 5: Drainage: General and Hydrology Considerations* (2013a)**				
4.2 Road User Considerations	This section contains the general needs of road users and specific mention of public transport vehicles, bicycles and pedestrians; however, there is no mention of motorcyclists. Water on the road surface is particularly hazardous to motorcyclists, having only two wheels in contact with the road surface. Water on the road may reduce the friction between the road surface and the motorcycle tyre which reduces stopping distance and side-friction. The importance of the location of drainage pits, pipes and other drainage structures in intersection design is discussed. The location of these is mentioned as a potential hazard to pedestrians and bicyclists. These can also be hazardous to motorcyclists.	Provide guidance regarding the impact of a wet road surface on motorcyclists. Include consideration of motorcyclists with regard to the location of drainage pits, pipes and other drainage structures at intersections.	Section 4.2 includes information on locating drainage pits but does not specifically include motorcyclists. Expand to include a reference to motorcyclists in addition to pedestrians and cyclists. Wet road surface also depends on the type of pavement and would be relevant to the Guide to Pavement Technology.	Agreed – use of motorcycle-friendly pit-covers and gratings with appropriately aligned bars and skid resistance.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
Skid Resistance (Now in *GRD Part 5A* Section 4.8)	In the surface drainage section, there is a subsection on skid resistance. This section does not go into specific needs of road users; however, the consequence of poor skid resistance is significant to the safety motorcyclists.	Provide discussion regarding how poor skid resistance due to water on the road impacts on motorcyclists including tyre spray restricting vision, a motorcyclist changing riding path or evasive action when water on the road is identified, reducing or loss of friction between surface and tyres which in turn affects motorcycle stability when braking and cornering.	*GRD Part 5A*, Section 4.8, provides information on skid resistance. Expansion of information relating to motorcyclists could be included.	Agreed.
Aquaplaning Potential (now in *GRD Part 5A*, Section 4)	This section does not discuss how aquaplaning impacts specific road users; however, the consequence of water ponding on the road surface and aquaplaning is significant to the safety of motorcyclists.	Provide discussion regarding how aquaplaning impacts on motorcyclists. Considerations include: • tyre spray affecting rider vision • tendency to avoid a hazard and possible swerve from travel path • reduction in surface friction affects stability.	Section 2.5.3 contains general information on the effects of aquaplaning, with a cross-reference to *GRD Part 5A* for preventing and managing aquaplaning. Suggest Section 2.5.3 be expanded to include information relating to motorcyclists.	Prompt agreed.
***GRD Part 5A: Drainage: Road Surface, Networks, Basins and Subsurface* (2013b)**				
4.0 Aquaplaning	This section explains how aquaplaning occurs and describes the factors that influence aquaplaning. Aquaplaning is hazardous to all road users; however, it is particularly hazardous to motorcyclists. This needs to be highlighted.	Include discussion regarding how aquaplaning impacts on motorcyclists.	*GRD Part 5*, Section 2.5.3 contains general information on the effects of aquaplaning, with a cross-reference to *GRD Part 5A* for preventing and managing aquaplaning. Suggest a cross-reference to *GRD Part 5*, Section 2.5.3 be added avoiding replication of information.	Relative probability risk of aquaplaning for a motorcycle travelling at the same speed as a car with the same surface water depth is not known. However, the consequential risk is greater.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
4.8 Skid Resistance	In the surface drainage section, there is a subsection on skid resistance. This section does not go into specific needs of road users; however, the consequence of poor skid resistance is significant to the safety motorcyclists.	Provide discussion regarding how poor skid resistance due to water on the road impacts on motorcyclists including tyre spray restricting vision, a motorcyclist changing riding path or evasive action when water on the road is identified, reducing or loss of friction between surface and tyres which in turn affects motorcycle stability when braking and cornering.	Section 4.8 provides information on skid resistance. Expansion of information, as indicated, relating to motorcyclists could be included.	Dimensional guidance is not clear and may be part of future project.
5.0 Kerbed Drainage	This section discusses a range of items regarding the use of kerbed drainage. Under this section there is a subsection on 'non-motorised road users' which outlines some of the key considerations for these road users when designing kerbed drainage. Consideration also needs to be given to the needs of motorcyclists, for example, the location of drainage pits near corners or braking areas and intersections, types of drainage pits, covers being a road surface hazard etc.	Include an additional subsection to provide guidance on the design of kerbed drainage infrastructure and its impact on motorcyclists.	Section 5.2.1 provides a number of factors in undertaking the design and this should be expanded to include the issues as identified relating to motorcyclists. *GRD Part 5*, Section 4.2 includes information on locating drainage pits but does not specifically include motorcyclists.	Agreed.
6.2.8 Road User Considerations	This section discusses the requirements for the placement of access chamber covers for piped drainage networks for non-motorised road users. However, there is no mention of motorcyclists. Drainage manhole/access covers are a road surface hazard to motorcyclists.	Provide guidance regarding the placement of access chamber covers/manholes with respect to motorcyclists.	Expand the information to include the issues relating to motorcyclists, same as for *GRD Part 5*, Section 4.2 also provides information on locating drainage pits (which includes access chambers).	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
GRD Part 6: Roadside Design, Safety and Barriers **(draft 2019)**				
6.2 Factors Considered in Barrier Selection	Motorcycles are considered throughout this section; however, more detail could be provided regarding how certain features and types of barriers impact motorcyclists e.g. capping of posts, end treatments, types of underrun protection, vandalism/fire damage of mesh options etc. Photographs/illustrations showing suitable barriers for use along motorcycle routes would be beneficial.	Incorporate additional guidance on suitable barrier systems and features for motorcyclists including photographs/illustrations. Provide guidance on where barriers are most likely to be struck and where to start and end under-rail treatments on a curve.	Section 6.1.3 has been included to expand the information relating to motorcyclists.	Noted.

Amend the following Parts

Addition to *GRD Part 2*: Section 1: Design Considerations, Motorcyclists, transfer Table 2.1 from *GRD Part 3*.

***GRD Part 3*: Section 4.6.4: Additional comment in paragraph 'Semi-mountable kerb' preference with words from the report 'Barrier kerbs, if struck, may re-direct the path of a motorcycle or result in them losing control'.**

***GRD Part 4*:**

Section 3.7.1: Add comment on pavement marking based on information in Table 2.1 in *GRD Part 3*.

Section 3.7.2: Add a new third paragraph to: 'Lighting provides additional benefits to road users to assist in identifying intersection alignments, surface hazards and defects, presence of kerbing and roadside hazards.'

***GRD Part 4A*:**

Section 2.1: Table 2.1: add to *Left-turn and right-turn treatment* the consideration of – providing a uniform pavement surface along the turning path.

Section 2.1: Table 2.1: add to *Roadside areas* – locating pits outside of the travel paths.

***GRD Part 4B*:**

Section 1.6: Fourth paragraph (referencing motorcyclists), add dot points –

- **Using semi-mountable kerbs**
- **Minimising the use of aprons and apron lips, and providing a larger central island**

***GRD Part 5*: Third paragraph additional dot point –**

- **Drainage pits and covers are located clear of the travel lanes. Pit covers are motorcycle-friendly and any gratings are aligned transverse to the travel path and have a skid resistant surface.**

***GRD Part 5A*:**

Section 4.8: Add a new third paragraph – 'Poor skid resistance due to water on the road impacts on motorcyclists including tyre spray restricting vision, a motorcyclist changing riding path, or evasive action when water on the road is identified. A reduction or loss of friction between surface and tyres affects motorcycle stability when braking and cornering.'

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
Section 5.2.1: Add dot points: • **Locating drainage pits to minimise flows across an intersection** • **Locating pits around corners, close to the travel paths, particularly motorcyclists and cyclists** • **Avoid locating grated pits in braking areas and turning paths** • **The type of pit covers to be used types to avoid the cover becoming a hazard.**				

Appendix B Road Design for Heavy Vehicles – Suggested Amendments

The *Road Design for Heavy Vehicles* (AP-T293-15) research report provided many comments and these are outlined in Table B 1.

Table B 1: Road design for heavy vehicles – suggested amendments

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
***GRD Part 1: Introduction to Road Design* (Austroads 2015j)**				
While no referencing has been made in Part 1, Section 5: Design Process, of heavy vehicles, there is the opportunity to highlight the need, as appropriate, to consider the characteristics of trucks/heavy vehicles when designing roads.			Nil.	Agreed.
***GRD Part 2: Design Considerations* (Austroads 2015i)**				
1.7 Reducing Freight Costs	Reference is made to the need to cater for the special requirements of heavy vehicles (HV).	Retain.	Nil.	Agreed.
2.4.2 Factors that Influence Design Standards – The Vehicle	The guide highlights a number of factors that influence how a road design performs, one of which is heavy vehicles. The guide describes how the tracking characteristics of larger design vehicles influence geometric design. It informs how larger vehicles take up greater width (swept path), as they travel around relatively small curves (e.g. less than 200 m) or turn at intersections. The need to provide greater lane width to allow for the 'tracking' of the design vehicle is also made as is the reference to *Austroads Design Vehicle and Turning Path Templates Guide* (2013d). Reference is made to height and stability of the HV as it negotiates tight turns, and in relation to overhang on roads that have excessive crossfall in the left lane that may result in reduced clearances to poles, trees, etc.	Revise to update the reference to the *Austroads Design Vehicle and Turning Path Templates Guide* (2013d), and to include reference to the Land Transport New Zealand guide *On-road Tracking Curves for Heavy Vehicles* (Land Transport NZ 2007).	*GRD Part 2* includes reference to Austroads turning templates only. Add the reference to Land transport New Zealand tracking curves.	Agreed – note LTNZ now NZTA.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
	HV dynamics are also highlighted as a design factor that influences horizontal alignment, sight distance, grading, traffic signal design, railway level crossings and auxiliary lane provision.			
2.4.2 Factors that Influence Design Standards – Road Factors	The guide describes the effect of grade on vehicle speeds as an example of its impact on the road design. Raised for consideration are the reduced operating speeds of laden trucks on long up-grades, and the requirement for trucks to significantly reduce their speeds prior to steep downgrades.	Elaborate to describe the manner in which drivers of HVs may be alerted as to when and to what degree they should commence to reduce their speed prior to a steep grade. This will also require referencing to AS 1742.2-2009, Section 4.9.3.	AS 1742.2:2009, Section 4.9.3 contains information on signage treatments for steep grades. Suggest that a cross-reference to AS 1742.2 be added to the paragraph *Road factors,* with supporting commentary for treatments to alert drivers of an approaching steep grade.	Agreed.
Commentary P	Comments are made on the HV influence on the general level of service, including space, speeds, and structural (pavement) and geometric design (i.e. widening on curves and the need for overtaking lanes).	Retain.	Nil.	Agreed.
***GRD Part 3: Geometric Design* (2016i)**				
2.2.3 Design Parameters – Traffic Volume and Composition	The guide indicates that expected traffic volumes and the composition of the traffic (i.e. number or proportion of HVs) are generally used as the basis for the cross-section and geometry of a road.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
2.2.5, now 2.2.7 in 2016 edn Design Parameters – Design Vehicle	The guide describes the historical four types of design vehicles, which include a prime mover (19.0 m), single unit truck/bus (12.5 m) and service vehicle (8.8 m). The operation of larger vehicles such as B-doubles or Type 1 and 2 road trains is also noted, indicating that they can be found in some rural areas and increasingly in urban areas of Australia. As road agencies have specific practices regarding their operation, designers are referred to these agencies to assist them in evaluating the choice of the design vehicle for any road project. Designers are also alerted to the seasonal implications associated with the haulage of produce by HVs. Designers are further provided with the *Austroads Design Vehicle and Turning Path Templates* (2006b) (superseded), and the Land Transport New Zealand *On-road Tracking Curves for Heavy Vehicles* (2007) for specific details related to vehicle turning paths of these standard HVs.	Revise to update the reference to the *Austroads Design Vehicle and Turning Path Templates Guide* (2013d). RDTF to consider aligning road agency practices in relation to the operation of B-doubles or Type 1 and 2 road trains, thus providing a consistent approach in the choice of the design vehicle for any road project.	*GRD Part 3*: update incorporated. RDTF for consideration on nominating the larger design vehicles for the same road classification to provide consistency.	Selection of appropriate design and check vehicle for any project has a key influence on the design. Linking this to the road classification or stereotype makes a lot of sense. The Guide would be improved with the guidance in this respect.
3.1 Speed Parameters – General	The guide indicates that where possible operating speeds should be measured for both cars and trucks. Readers are subsequently referred to Section 3.6 for guidance or estimation of truck operating speeds.	Retain.	Nil.	Agreed.
3.2.4 Terminology – Vehicle Speeds on Roads	The guide indicates that driver operating speeds are constrained by factors including vehicle performance (e.g. cars vs trucks).	Retain	Nil.	Agreed.
3.3.1 Operating Speeds on Urban Roads – Freeways (Access Controlled Roads)	Operating speeds – the guide indicates that on these types of roads vertical alignments tend to have flatter grades in order to minimise the difference in speed between cars and trucks.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
3.5.2 Determining Operating Speeds using the Operating Speed Model – Driver Behaviour	The guide indicates that truck drivers generally decelerate to the appropriate speed for a curve by the start of the curve.	Retain.	Nil.	Agreed.
3.5.4 Determining Operating Speeds using the Operating Speed Model – Vehicle Characteristics	The guide provides two design vehicles; one a car and the other a truck. The truck design vehicle truck nominated is a semi-trailer 19.0 m. Readers are subsequently referred to Table 3.4 to obtain truck speeds.	Retain.	Nil.	Agreed.
3.5.9 Determining Operating Speeds using the Operating Speed Model – Use of Operating Speed in the Design of Rural Roads	Designers are informed that the normal design procedure is to prepare a preliminary alignment and grading with standards that are as high as practical. Further, those minimum standards must be appropriate for the terrain, the road function and either equal to or greater than the expected 85th percentile operating speed for the road with consideration given to trucks as well as cars. It was also noted that on a road below 100 km/h operating speed, operating speeds would vary along its entirety. A number of basic design steps are provided, one of which related to trucks, i.e. to check for potential problem sites for trucks.	Retain.	Nil.	Agreed.
3.6 Operating Speed of Trucks	While the car remains the vehicle type for the design of road alignments, practitioners need to check to ensure that they are safe for trucks. As there is no operating speed model for trucks, and in the absence of truck speed data, the approach is to use a 'modified' car operating speed model.	In light of the outcomes of the Austroads project AP-T299-13 (TS1456): *Expanded Operating Speed Model* (Austroads 2013e), which found that the results 'generally aligned with the guidance provided in' *GRD Part 3*, it is proposed that the current model be retained.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
	The guide indicates that truck speeds should be taken as the same as cars (1) on high-speed roads, and (2) on flat terrain where there is sufficient length of acceleration for trucks. If the above is not the case, then a car/truck speed relationship is provided in Table 3.4.. The table provides information on the operating speeds for trucks, when measurement of the speeds is not available. Further research is suggested for examining truck speeds on the individual road geometric elements. To this end Austroads undertook a research project (AP-T299-13, *Expanded Operating Speed Model,* (Austroads 2013e)), which in part investigated the provision of an operating speed model for articulated trucks on rural roads. A conclusion of the study was that articulated trucks were generally found to travel slower than cars upon entry and at mid-point to a curve, while the speed reduction due to the curve for both vehicle types was similar.	It is also of note that the study indicated that as the investigations were based on roads with no grade, there would be benefit in examining the influence of gradients or other factors on truck driver behaviour.		
3.7 Operating Speed of Trucks	Figure 3.9: Determination of truck speeds on grade, 19 m semi-trailer (33 t), and 12 litre diesel carrying an average load (9.7 kW/t), shows the truck speeds for acceleration/deceleration lengths and corresponding grades.	Retain.	Nil.	Agreed.
4.1 Cross-section – General	The guide lists a number of factors that should be considered in the type of cross-section to be adopted. One of the factors indicated is the number and type of trucks to be catered for.	Retain.	Nil.	Agreed.
4.2.1 Traffic Lanes – General	The guide indicates that the number and width of traffic lanes depends on the number of trucks.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
4.2.3 Traffic Lanes – Crown Lines	As trucks cross crowns they may be prone to instability. The extent of this instability is dependent on the length of the crown, the change in crossfall, the crossing angle, vehicle speed and the general stability of the truck. The guide indicates that for truck stability a 6% grade change is close to the limit and should therefore not be exceeded.	Truck stability – no recent research available. Retain current limits.	Nil.	Agreed.
4.2.4 Traffic Lanes – Traffic Lane Widths	The guide indicates that providing standard lane widths of 3.5 m enables trucks to pass or overtake without either vehicle needing to move to the outer edge of a lane. The guide also indicates that most freight-efficient vehicles could travel comfortably along roads that have a usable lane width of 3.5 m (Prem et al. 1999). It also noted that Prem el al. (1999) found that because of tracking, rigid-plus-three and A-triples required 3.7 m lane widths. It should be noted that the conclusions made by Prem et al. (1999) are based on the outcome of computer modelling. The guide highlights the need to provide lanes that are wide enough on curves to accommodate the additional tracking that may be required by trucks and refers readers to Section 7.9 – Pavement Widening on Horizontal Curves within the guide. The guide also advises against the use of lanes wider than 4.6 m as it may result in two cars travelling side-by-side. Should additional width be required then it is advised that an edge line be provided at 3.5 m with a full depth pavement to the required width.	Retain. Where rigid-plus-three and A-triples are operated consideration should be given to revising the guidelines to provide lanes that are 3.7 m wide. *GRD Part 3* contains this suggestion. Need to refer to outcome of suggestion for Sect 2.2.7.	Nil.	Agreed.
4.2.5 Traffic Lanes – Urban Road Widths	Table 4.3: Lane widths, indicates values of 3.3 to 3.5 m as a general traffic lane width, while along roads that carry 'high' truck volumes a wide kerbside lane of 4.2 m is indicated.	Retain in the absence of further information.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
	There may be a need to better describe what a 'high' truck volume is. Currently this is a subjective description.			
4.2.5 Traffic Lanes – Urban Road Widths	Table 4.4: Urban Freeway Widths indicates that a 3 m shoulder should be provided to enable a stopped truck to be clear of traffic.	Retain.	Nil.	Agreed.
4.3.2 Shoulders – Width	Similar comment to the above is provided.	Retain.	Nil.	Agreed.
4.3.3 Shoulders – Shoulder Sealing	A 1.0 m seal is suggested where AADT > 2000 vpd, and 10% heavy vehicles. Roads and Maritime Services specify the shoulder to be sealed when AADT > 2000, with 10% heavy vehicles.	Roads and Maritime Services to confirm.	Current suggestion is for 1.0 m seal. Full seal of shoulder width suggested.	For further discussion and consideration.
4.4.1 Verge – Verge Widths	Figure 4.5 indicates the minimum verge width of 0.8 m under structures. The guide indicates that it is desirable that the surface be reinforced concrete so as to accommodate the likelihood of a truck parking in the shade of the structure.	Retain.	Nil.	Agreed.
4.4.2. Section 4.4.3 in 2016 edn Verge – Verge Rounding	Table 4.10: Verge rounding, indicates that where HV > 250 vpd one way, median slopes should be 17% or flatter.	Consideration should be given to revise the reference to the median slope from 17% to 10:1 or flatter.	Suggest amending note to Table 4.10 to indicate median slope to be 10:1 or flatter (refer also to comments for 4.5)	Agreed.
4.5 Batters	The guide indicates that batter slopes of 10:1 (H:V) are recoverable for trucks.	Retain.	Nil.	Agreed.
4.5 Batters	The guide indicates that where the proportion of heavy vehicles is 10% or more embankment slopes of 6% or more are desirable.	Consideration should be given to revising to indicate 10:1 or flatter is desirable.	Current wording provides for 6:1 desirable (being traversable) with 10:1 being recoverable for heavy vehicles. Suggest amending to indicate desirable as 10:1. (refer also to comments 4.4.2, 4.4.3).	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
			(Part 6 (2018 draft) suggests batter slopes 6:1. Consistency needed across the Parts.	
4.6.4 Roadside Drainage – Kerb and Channel	The guide indicates that the use of a kerb within the swept path of trucks, on the outer edge of low radius curves be avoided, as it can contribute to truck roll-overs.	Retain.	Nil.	Agreed.
4.7.1 Medians – Median Width	The guide refers to 'numerous studies' that show that 90% of vehicles that run off the road recover 15 m from the edge of the carriageway, while 80% recover within 10 m. The guide further indicates that for medians less than 15 m, or with large traffic volumes on high-speed roads, road safety barriers should be considered. The guide also indicates that in rural areas, median widths that are greater than15 m could be accommodated as the associated additional costs are small. General considerations are provided with respect to traffic volumes and risk assessment factors which include proportion of trucks in the traffic stream. It should be noted that the referenced studies above are very dated and more recent studies (e.g. *Improving Roadside Safety: Summary Report* (Austroads 2014g)), have concluded that a large proportion of vehicles that run off the road travel beyond 15 m from the edge of the carriageway.	Review section considering the outcomes of Austroads report *Improving Roadside Safety: Summary Report* (Austroads 2014g). In light of the more recent research, and the need to provide safer crash outcomes associated with HVs running off the road, consideration should be given to the use of rigid barriers (height 1.07 m – TL5/height 2.29 m – TL6) based on a risk assessment (i.e. volume, %trucks and speed).	*GRD Part 3* suggests median width for: Urban – 20 m (for recovery) Rural – 20 m, < 20 m with large volumes, high-speed roads, safety barriers should be considered. Suggest: that the 20 m width of a median be retained but a risk assessment be included for inclusion of a barrier.	Disagree – the default for a multilane median divided carriageway road should always be a barrier system, regardless of the width. If one is to be omitted, then a risk assessment should be carried out to justify that. GRD Part 6 is being updated to reflect this under project TP2056.
4.7.1 Medians – Median Width	The guide advises that median width may be varied. For example, local widening may be required at intersections to accommodate crossing or turning trucks.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
4.7.2 Median slopes	Where at-grade intersections are provided across a median, Table 4.15: Median slopes indicates that the maximum slope at the median opening should be 33:1. See also Section 4.2.3.	Retain.	Nil.	Agreed.
4.8.4 Bicycle Lanes – Cross-section and Clearances	The guide indicates that for traffic volumes of less than 3000 vpd, cyclists and vehicles generally share the road. For more highly trafficked roads desirable clearance to cyclists are provided in Table 4.16: Clearance to cyclist envelope from adjacent truck. Cyclist clearances are suggested to cater for side wind forces exerted on a cyclist by heavy vehicles.	Retain.	Nil.	Agreed.
4.9.2 High Occupancy Vehicle (HOV) Lanes – Bus Lanes	Table 4.21: Widths of bus travel lanes on new roads are provided in the guide.	Retain.	Nil.	Agreed.
4.10 On-street Parking –General	The guide provides a reference to on-street parking facilities for trucks.	Retain.	Nil.	Agreed.
5.2.1 Sight Distance – Driver Eye Height	The guide provides guidance on driver eye height for commercial vehicles/trucks of 2.40 m (see also Table 5.1: Vertical height parameters). The 2.40 m truck driver eye height is indicated to be particularly important for checking the impact of overhead structures on sight distance.	Retain.	Nil.	Agreed.
5.2.2 Sight Distance – Driver Reaction Time	Table 5.2: Driver reaction times reference is made to the driver reaction times being at the 85th percentile for cars and heavy vehicles.	Retain.	Nil.	Agreed.
5.2.3 Sight Distance – Longitudinal Deceleration	Table 5.3: Design domain for coefficient of deceleration within the guide indicates a coefficient of deceleration for trucks at 0.29, and buses at 0.15.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
5.3 Stopping Sight Distance	The guide indicates that stopping sight distance for both cars and trucks is a mandatory design requirement.	Retain.	Nil.	Agreed.
5.3.2 Stopping Sight Distance – Truck Stopping Sight Distance	The guide informs that the truck SSD is generally measured between the truck driver eye height of 2.4 m and a 0.2 m high stationary object on the road (for a crest), and for a car tail-light forward of a sag of 0.8 m. See also Figure 5.3: Truck stopping sight distance.	Retain.	Nil.	Agreed.
5.3.2 Stopping Sight Distance – Truck Stopping Sight Distance	Designers are advised that they should consider providing truck SSD in a number of potentially hazardous locations (e.g. approaches to railway level crossings, intersections on or near a crest, vertical curves, etc.)	Retain.	Nil.	Agreed.
5.3.2 Stopping Sight Distance – Truck Stopping Sight Distance	Table 5.5 provides truck stopping sight distances, based on d = 0.29 for roads with varying operating speeds and reaction times, and with corrections due to grade.	Retain.	Nil.	Agreed.
5.4 Sight Distance on Horizontal Curves	Where lateral obstructions off the pavement (e.g. bridge pier, safety barrier, cut slope, etc.), restrict sight distance or cannot be removed the radius of the curve should be selected to allow adequate SSD for (cars and) trucks.	Retain.	Nil.	Agreed.
5.5 Sight Distance Requirements on Horizontal Curves with Roadside Barriers/Wall/Bridge Structures	General comments on the impacts on SSD where a road is widened to provide adequate sight distance and if this is excessive, the operational impacts of cars and trucks parked in this area.	Retain.	Nil.	Agreed.
5.5.1	Minimum shoulder widths and manoeuvre times apply where object heights > 0.8 m are used for SSD.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
Sight Distance Requirements on Horizontal Curves with Roadside Barriers/Wall/Bridge Structures – Requirements where Sighting over Roadside Barriers is Possible				
5.5.1 Sight Distance Requirements on Horizontal Curves with Roadside Barriers/Wall/Bridge Structures – Requirements where Sighting over Roadside Barriers is Possible	Table 5.6: Minimum shoulder widths and manoeuvre times for sight distances over roadside safety barriers on horizontal curves is provided.	Retain.	Nil.	Agreed.
5.5.2 Sight Distance Requirements on Horizontal Curves with Roadside Barriers/Wall/Bridge Structures – Requirements where there is no Line of Sight over Roadside	The guide identifies instances where a line of sight is not possible (e.g. high retaining walls, tunnels and bridge structures), thus making it very difficult to provide an SSD for trucks. Where this is the case, it is advised to redesign the horizontal and vertical alignments to achieve the sight distance criteria indicated in Section 5.5.1 of the guide. If this is not possible minimum capabilities are provided. For trucks it is to provide a minimum shoulder width of 4.0 m and a minimum manoeuvre time to 0.8 m high object of reaction time plus 3.5 sec.	General comment – retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
5.6.4 Overtaking Sight Distance – Determination of Percentage of Road Providing Overtaking	Table 5.7: Overtaking sight distances for determining overtaking zones on MCV routes when MCV speeds are 10 km/h or less than the operating speeds, and Table 5.8: Overtaking sight distances for determining overtaking zones on MCV routes when MCV speeds are equal to the operating speeds, are provided. Note: MCV – Multi-combination vehicles include semi-trailers, B-doubles, Type 1 and 2 road trains.	Retain.	Nil.	Agreed.
5.7 Manoeuvre Sight Distance	Manoeuvre Sight Distance (MSD) was previously used when SSD could not be practically applied. The current situation is that less conservative, yet realistic values of some of the parameters of the SSD model are provided in constrained areas (e.g. use of a higher coefficient of deceleration). As an example, where object heights of greater than 0.8 m for truck stopping are used for sight distance over barriers, minimum shoulder widths and minimum manoeuvre times apply (ref to Table 5.6: Minimum shoulder widths and manoeuvre times for sight distances over roadside safety barriers on horizontal curves).	Retain.	Nil.	Agreed.
7.1 Horizontal Alignment – General	Designers should avoid 'locating features that are likely to cause large or special vehicles to brake on curves, such as intersections where the major road is on a small curve radius'. This should be re-written to better clarify the situation and to strengthen the safety associated with heavy vehicles.	Consideration be given to re-writing as, 'Designers should strongly avoid locating features that are likely to require large or "special" vehicles to brake on curves causing them to possibly lose stability or control. For example, the location of an intersection where the major road is on a small radius curve'.	Suggest including the additional information as indicated.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
7.5.1 Types of Horizontal Curves – Compound Curves	Refers to a change in friction demand between curves of different radii (i.e. compound curves), which can cause instability problems for motorcyclists and trucks.	Consideration should be given to revising the text to indicate that where there is a significant proportion of heavy vehicles (i.e. 10% or more), compound curves be strongly discouraged and that a single circular curve be provided.	Compound curves are not favoured and where practicable compound curves are replaced with a single circular curve. Suggest amending the information to indicate that this treatment be preferred or not used, where HVs > 10%.	The risks associated with compound curves and the need for a consistent side friction demand should be reinforced.
7.5.2 Types of Horizontal Curves – Broken Back Curves	Broken back curves refers to curves turning in the same direction connected by a short straight section or a large radius connecting curve. The guide advises that broken back curves should be avoided if possible as it is almost impossible to provide the required amount of superelevation. As a consequence, instability would be created for motorcycles and trucks.	Retain.	Nil.	Agreed.
7.5.3 Types of Horizontal Curves – Reverse Curves	Reverse curves should be joined by a tangent of at least 0.6 V or spirals to allow for tracking of large vehicles. Where deceleration is required on the approaches to a lower radius curve enough distance must be provided to allow the driver to respond and decelerate.	Retain.	Nil.	Agreed.
7.5.4 Types of Horizontal Curves – Transition Curves	Transition curves or spirals are generally used to connect straights and circular curves to smooth vehicle travel within a lane. For trucks, transition curves allow tracking on low radius curves.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
7.5.4 Types of Horizontal Curves – Transition Curves	The guide indicates that where lanes are 3.5 m or less, provision 'shall' be made for the transition paths of trucks, and that where circumstances prevent the provision of a transition curve in this situation consideration should be given to having wider lanes with or without sealed shoulders.	Retain.	Nil.	Agreed.
7.6 Side Friction and Minimum Curve Size	Table 7.4: Recommended side friction factors for cars and trucks provides side friction values for trucks at varying operating speeds.	Retain.	Nil.	Agreed.
7.7 Superelevation	Superelevation is primarily used for safety. Amongst a number of factors that need to be taken into consideration in its application, are the stability of high laden trucks where there is adverse cross-fall and the need to increase superelevation on downgrades.	Retain.	Nil.	Agreed.
7.7.9 Superelevation – Positioning of Superelevation Run-off without Transitions	The guide indicates that positioning of superelevation run-off and the natural steering path assist in reducing the roll and lateral movement of trucks.	General comment – retain.	Nil.	Agreed.
7.9 Pavement Widening on Horizontal Curves	The guide indicates that pavement may require widening to maintain the lateral clearance between vehicles that is equal to that provided on straight sections of road. Table 7.11: Curve widening per lane for current Austroads vehicles, provides the widening for a range of curve radii and MCVs (i.e. single unit truck or bus, prime mover and semi-trailer and Types 1 and 2 road trains).	Suggest consideration may be given to increasing slightly the curve widening values (e.g. rounding up to the nearest 0.05).	2016 edn, Table 7.13: Values have been rounded to nearest 0.10.	Done.
8.2.5 Vertical Controls – Vertical Clearances, Truck and Bus Template	The guide advises that templates for trucks and buses should be used for commercial entrances and describes truck and bus clearances from the paved surface.	Retain.	Nil.	Agreed.
8.5 Grades – General	Refers to grades being as flat as possible to minimise the freight costs, due to fuel consumption and slower speeds.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
8.5.2 Grades – Vehicle Operation on Grades	Refers to the need for trucks in the lower power ranges being able to climb the grade.	Retain.	Nil.	Agreed.
8.5.2 Grades – Vehicle Operation on Grades	The guide highlights three aspects associated with grades, two of which relate to heavy vehicles. It is a requirement that poor performing vehicles (such as trucks), must be able to climb a grade. It is acknowledged that grades create speed variations across different vehicle types (i.e. cars, trucks and buses). In the latter case, reduced passing opportunities increase crash risk as faster moving vehicles attempt to pass those travelling slower.	Retain. Consideration should be given to including advice strongly recommending the provision of passing opportunities (i.e. passing lanes and turn out bays).	Table 8.2 contains information on provision of auxiliary lanes where HV speeds are slower. Suggest the information be expanded to suggest the provision of passing lanes or turn-out bays.	Revise the wording to strengthen the advice.
8.5.2 Grades – Vehicle Operation on Grades	Table 8.2: Effect of grade on vehicle type, outlines the impact on heavy vehicles of grade.	Retain.	Nil.	Agreed.
8.5.4 Grades – Length of Steep Grades	The guide informs that there is a need to consider the length of grade in addition to the maximum grade. The AASHTO term ‘critical length of grade’ is used to indicate the maximum length of a designated upgrade on which a loaded truck can operate without unreasonable reduction in speed. The current requirement is that an MCV should be able to maintain a speed of 70 km/h on a 1% grade.	Retain.	Nil.	Agreed.
8.6.3 Vertical Curves – Crest Vertical Curves, Sight Distance Criteria (Crest)	Table 8.7: Minimum size crest vertical curve (K value) for sealed roads (S < L), and Table 8.8: Minimum size crest vertical curve (K value) for sealed roads to satisfy intermediate sight distance (S < L), provide stopping sight distances for trucks (day and night).	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
8.6.5 Vertical Curves – Sight Distance Criteria (Sag), Overhead Obstructions	The guide describes overhead obstructions (e.g. road or rail overpasses, sign gantries, etc.) that, especially for trucks, may limit available sight distance on sag vertical curves given their higher driver eye height.	Retain.	Nil.	Agreed.
9.4.1 Overtaking Lanes – General, Overtaking Opportunities	The guide indicates that on existing high traffic volume four-lane roads, which have a high proportion of heavy vehicles, may need auxiliary (passing) lanes on grades.	Consideration should be given to revising the text to give greater guidance as to the percentage of HV where 'auxiliary (passing) lanes on grade' should be provided (e.g. ≥ 10%).	Table 9.1 provides guidance on provision of passing lanes. Suggest retention.	Agreed.
9.4.1 Overtaking Lanes – General, Warrants	The provision of overtaking lanes is based on traffic volume, percentage of slow-moving vehicles (including light trucks and cars towing trailers, caravans and boats), and the availability of passing opportunities along adjacent road sections. Table 9.1: Traffic volume guidelines for providing overtaking lanes, provides guidance for designers.	Consideration should be given to providing roads with greater passing opportunities. Designers should be providing 'good' passing opportunities (i.e. 30–70%), with 'moderate' (i.e. 10–30%) as a minimum.	Table 9.1 provides some guidance on % length providing overtaking based on a % of slow vehicles. Suggest retention.	Agreed.
9.5.2 Climbing Lanes – Warrants	The guide indicates that passing lanes are warranted when truck speeds are ≤ 40 km/h, and that they should be considered where: • long grades over 8% occur • there are significant crashes attributable to slow-moving trucks • heavy trucks from an abutting industry enter the traffic stream on an up-grade.	Revise to include as a warrant, 'where the proportion of heavy vehicles ≥ 10% of the traffic flow'.	Table 9.4 includes guidance for up to 20% of slow vehicles. Suggest retention.	Agreed.
9.5.3 Climbing Lanes – Length	The commencement of a climbing lane is where the speed of a truck commences to fall from 40 km/h. The end point of a climbing lane is where the truck has accelerated to the operating speed minus 15 km/h and continues to accelerate.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
9.5.3 Climbing Lanes – Length	Table 9.5: Grade/distance warrants (lengths (m) to reduce truck vehicle speeds to 40 km/h), provides the distance for roads with varying approach speeds and grades at which truck speeds reduce to 40 km/h.	Retain.	Nil.	Agreed.
9.5.3 Climbing Lanes – Length	Figure 3.9 (Section 3.7), and Figure 9.3 to Figure 9.6, provide curves upon which truck speeds on grades can be assessed. Each of the figures provides two curves, one for deceleration length and other for acceleration length, and each of the sets of curves relate to different types of MCVs, i.e. 19 m semi-trailers (33 t and 42.5 t), B-double (62.4 t), Type 1 road train (89.8 t) and Type 2 road train (140 t) respectively.	Retain.	Nil.	Agreed.
9.6.2 Slow Vehicle Turnouts, and Figure 9.7	The guide describes the situation under which 'slow vehicle turnouts', 'passing bays' or 'slow vehicle bays' may be provided. The situation may arise where there are steep grades where truck speeds fall to less than 20 km/h and a full climbing lane cannot be provided. In such cases they may be provided as a means of reducing traffic delays. The guide indicates that all of the following conditions need to be met for passing bays: • long grades over 8% • high proportion of heavy vehicles • low overall volumes • construction costs are too high or the environmental amenity of the area precludes the construction of a climbing lane.	Revise the text as follows: • to indicate that an objective of slow turn outs is to also reduce crash risk and, therefore, to improve safety (in addition to improving traffic flow) • raise the threshold from speed less than 20 km/h to less than 40 km/h where climbing lanes cannot be provided • revise 'high proportion of heavy vehicles' to ≥ 10% of the traffic is heavy vehicles If the road segment has a crash history involving heavy vehicles, an overtaking slow turn out (or climbing lanes) will be required to be provided. Amend the last dot point that is required to be met as follows:	Suggest including the text as indicated.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
		• 'if the road segment has no crash history associated with heavy vehicles and overtaking, consideration will be required to consider construction costs and impact on environmental amenity.'		
9.7 Descending Lanes	The guide indicates that on steep descents, speeds of trucks will be as low as on equivalent up grades as illustrated in Figure 3.9 and Figures 9.3 to 9.6.	Retain.	Nil.	Agreed.
A.3.1 EDD for Stopping Sight Distance – Application of EDD for Stopping Sight Distance	The base case is provided for the object height for trucks (i.e. 0.8 m) for SSD for EDD situations.	Retain.	Nil.	Agreed.
A.3.1 EDD for Stopping Sight Distance – General Considerations	The guide indicates that under EDD for SSD particular attention must be given to truck requirements on routes with high numbers of heavy vehicles, and that some capability should be provided on any road.	Retain.	Nil.	Agreed.
A.3.2 EDD for Stopping Sight Distance – Base and Check Cases, Base Cases	The guide informs that it is mandatory to provide drivers with capability for truck stopping during daylight hours (i.e. Truck-Day Base Case).	Retain.	Nil.	Agreed.
A.3.2 EDD for Stopping Sight Distance – Base and Check Cases, Check Cases	The guide indicates that adequate capability be provided for trucks travelling on unlit roads at night (i.e. Truck-Night Check Case).	General comment. May need to re-write to clearly inform designers of what is meant.	Consider re-writing to explain the assessment. Suggest retention.	To review.
A.3.3 EDD for Stopping Sight Distance – Vertical Height Parameters	Table A 4: vertical height parameters under EDD provides these parameters, i.e. truck eye driver height (2.4 m) and object cut-off height, road surface (0.0 m), car tail-lights/stop lights/turn indicator (0.8 m), and top of car (1.25 m) during the Truck-Day Base Case under EDD.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
A.3.4 EDD for Stopping Sight Distance – Driver Reaction Time	Driver reaction times are provided under EDD. In extremely constrained locations the guide indicates that the Truck-Day Base Case may use a 2 sec reaction time in lieu of a 2.5 sec reaction time on the higher driver workload (i.e. more alert driver).	Review to align truck driver reaction time with car driver reaction time (i.e. 2.5 sec) in 'extremely constrained locations'.	Nil. Research required.	Agreed.
A.3.5 EDD for Stopping Sight Distance – Longitudinal Deceleration	Table A 6: Coefficient of deceleration on sealed roads under EDD is provided for trucks in the Truck-Day base case under EDD. It covers truck braking for single unit trucks, semi-trailers and B-doubles.	Retain.	Nil.	Agreed.
A.3.6 EDD for Stopping Sight Distance – EDD Stopping Sight Distance for Cars, Application of the Base and Check Cases	EDD stopping sight distances are provided for Trucks in Base and Check Cases. Table A 10 provides minimum EDD SSD for the Truck-Base Case, and it is indicated that it is satisfactory for the stopping capability for the Truck-Night Check Case. Tables A 8, A 9 and A 11 provide grade corrections to SSD for 'd' values of 0.61, 0.46 and 0.29 respectively.	Retain.	Nil.	Agreed.
A.3.7 EDD for Stopping Sight Distance – Shoulder/Traversable Widths and Manoeuvre Times	Guide provides guidance under EDD whereby adequate width is provided to enable sufficient time manoeuvring around small objects. For the Truck-Day Base Case the object height is 0.8 m and the minimum truck driver eye height is 2.4 m. Table A 12: Minimum shoulder/traversable widths and manoeuvre times under EDD SSD provides guidance for practitioners.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
A.3.8 EDD for Stopping Sight Distance – EDD Crest Vertical Curve Size	The guide indicates that for trucks using the Truck-Day SSD and the vertical height parameters in Table A 7: Minimum EDD SSD for normal-day base case for sealed roads with level grades (m), Table A 10: Minimum EDD SSD for Truck-Day Base Case for sealed roads with level grades (m) and Table A 4: Vertical Height Parameters under EDD, the resultant crest vertical curve sizes are able to be provided in Tables A 13, A 14, A 15 and A 16 respectively for the Normal-Day Base Case. Table A 17 is also provided for the Truck-Day Base Case using object heights of 0.8 m and 1.25 m.	Retain.	Nil.	Agreed.
A.3.9 EDD for Stopping Sight Distance – Sight Distance Requirements on Horizontal Curves where there is no Line of Sight over Barriers/Structures	The guide identifies circumstances where a line of sight is not possible for trucks which as a result, may adversely impact on the SSD for trucks. Where this occurs, it is preferable to redesign vertical and horizontal alignments to meet SSD criteria provided in Section A.3.7. The guide indicates that should this not be possible for truck manoeuvrability, then at a minimum the following should be provided: • minimum shoulder width = 3.5 m • minimum manoeuvre time to a 0.8 m height object = reaction time + 3 secs.	Retain.	Nil.	Agreed.
A.4 EDD for Horizontal Curves with Adverse Superelevation	Refers to superelevation supporting the use of the maximum side friction demand, provided the use supports the truck operating speeds.	Retain.	Nil.	Agreed.
B.4 Operating Speed of Trucks	The guide defines the operating speed of trucks.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
C.2.4 Additional Considerations when Using the Operating Speed Model – Effects of Grades	The guide provides commentary on the effect of long uphill grades on the operating speed of trucks. It further indicates that if possible, a vehicle simulation model be used to predict truck speeds for average loaded prime movers and semi-trailers. The commentary also informs that trucks might need to significantly reduce their speed prior to steep (> 8%) downhill grades or long grades as flat as 5%.	Retain.	Nil.	Agreed.
Appendix D Theory of Movement in a Circular Path	The guide refers to a truck stability formula for adverse crossfall due to factors such as high centre of mass of trucks.	Retain.	Nil.	Agreed.
D.2.1 Side Friction Force on Vehicle – Sliding	Guide refers to trucks losing stability on wet surfaces by sliding.	General comment – retain.	Nil.	Agreed.
D.2.1 Side Friction Force on Vehicle – Overturning	Guide refers to truck stability as it travels around a non-superelevated curve.	Retain.	Nil.	Agreed.
D.2.3 Side Friction Force on Vehicle – Other Factors Affecting Truck Stability	Guide refers to other factors that affect truck stability, such as adverse superelevation, dynamic effects associated with wheel bounce.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
Appendix F.1 Transition Curves (Spirals) – General	Guide refers to the travel paths of vehicles from straight to circular horizontal curves and the greater problems trucks have with their greater width, longer wheel bases and the advantages of transition curves.	Retain.	Nil.	Agreed.
F.1.1 Transition Curves (Spirals) – Effect on Braking	Guide refers to braking on curves and the tendency of articulated vehicles to jack-knife.	Retain.	Nil.	Agreed.
Commentary C3	Guide refers to factors that may influence operating speeds and that high truck composition in the general traffic stream may contribute to a higher risk perception which could lower vehicle speeds.	Retain.	Nil.	Agreed.
Commentary C4	Guide refers to the operating speeds of laden trucks being significantly reduced on long uphill grades.	Retain.	Nil.	Agreed.
Commentary C5 Vehicle Sway Limits for Multi-combination Vehicles	Guide provides information on the minimum lane widths for various heavy vehicles.	Retain.	Nil.	Agreed.
Commentary C6	Guide refers to high productivity freight vehicles and performance-based standards.	Retain.	Nil.	Agreed.
Commentary C13.1 Longitudinal Deceleration (Longitudinal Friction Factor)	Guide provides information on coefficients of deceleration for different driving conditions.	Retain.	Nil.	Agreed.
Commentary C14.1 Truck Stopping Sight Distance	The reasons for longer truck braking distances is provided.	Retain.	Nil.	Agreed.
Commentary C16	Guide refers to the disadvantages of transition curves in relation to truck braking.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
***GRD Part 4: Intersections and Crossings: General* (2017f)**				
3.2 Provision for Large/Special Vehicles	The guide indicates that the design vehicle used in the functional design of a road is representative of at least 85% of the vehicles that would use the road. Larger heavy vehicles (e.g. 33 m B-triple and 30 m super B-double), may be used as the design vehicle, in which case they should be able to enter and depart from the intersection in the correct lane. Where larger heavy vehicles occasionally use an intersection, under restricted conditions, the design of the intersection may be based on lane encroachment. The Section also indicates the need to check for B-doubles and special vehicles where the need is demonstrated and in problem areas. For larger heavy vehicles, the guide provides important design aspects that are required to be considered, e.g. swept path, truck SSD requirements and truck stability.	Broaden the commentary to include the A-triples where they operate or on the class of road they are expected.	Suggest adding reference to A-triples as indicated. Note: Link to *GRD Part 3* on the selection of the design vehicles 2017 edn: RDTF for selection of design vehicles.	Agreed.
4.2 Basic Data for Design	Table 4.1: Factors to consider regarding function, current situation and the future, provides a general reference to trucks in the context that in the current situation they are part of the traffic mix, and in the future, they may be part of a planned route change.	Retain.	Nil.	Agreed.
4.3 Location of Intersections	Table 4.1: Considerations in the location of intersections, indicates for road design that because of the potential problems with sight distances, operational and safety issues and, wherever practical, intersections should not be located on roads with steep gradients. A steep downgrade within an intersection results in adverse crossfall for turning trucks which may cause roll-overs.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
4.5.2 Road Cross-section – Traffic Lanes, Types of Cross-sections and Lanes	This section of the guide describes the types of cross-section in rural and urban areas through at-grade intersections. In urban areas, special purpose lanes may also be provided (e.g. transit and bus lanes). It is of note that while truck lanes are provided for in AS 1742.12: *Bus, transit, tram and truck lanes*, in practice they have not been widely used in Australia. The guide does however indicate that on freight routes or open roads carrying 'significant' truck volumes, adequate lane widths for trucks need to be provided. It should be noted that the Section 5.2 indicates that design vehicle selection should be based on the functional classification of the intersecting roads (ref Table 5.1 and 5.2); therefore, this last point should be deleted. Refer also to Section 4.1.4 of the *Austroads Design Vehicle and Turning Templates Guide* (Austroads 2013d).	It is suggested that the RDTF consider criteria, or a review be undertaken to identify 'truck lane' criteria that may be applied that would reduce the risk of crashes involving heavy vehicles. A further suggestion is to remove the reference to catering for trucks on freight routes.	Note: Link to *GRD Part 3* on the selection of the design vehicles 2017 edn: RDTF for selection of design vehicles. Suggest amendment.	Agreed.
4.5.2 Road Cross-section – Traffic Lanes, Lane Widths	The guide indicates that the desirable width of a lane is 3.5 m. It is of note that the lane width required for rigid-plus-three and A-triples lane width is 3.7 m (ARR Special report 342 by Prem et al. 1999). (Ref to Section 3.3 which discusses consideration for large and special vehicles). *GRD Part 3* (Austroads 2016i), Section 4.2.4 nominates a lane width of 3.7 m for rigid-plus-three and A-triples, due to the tracking capability of multi-combination trailers.	Reference the need to assess the suitability of lane widths for A-triples, where these vehicles are likely to use the intersection. Where rigid-plus-three and A-triples are operated consider revising the guidelines to provide lanes that are 3.7 m wide.	Nil. 2017 edn: includes consideration should be given to providing 3.7 m lanes.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
5.2 Design Vehicles	The guide describes the different design vehicle types that may be used (e.g. car – 5.0 m, service vehicle 8.8 m, single unit truck or bus – 12.5 m and prime mover or semi-trailer – 19.0 m).	Retain.	Nil.	Agreed.
5.3 Checking Vehicles	While it is indicated that the 'design vehicle' is the largest vehicle expected to perform a movement at an intersection, the choice made will be dependent on the number of vehicles expected to undertake a movement. Table 5.1 and 5.2 provide the selection of design and checking vehicles with typical turning radii in Australia and New Zealand respectively. In each case it is provided for at intersections with differing functional road classifications. The checking vehicles nominated in Table 5.1 are consistent with the *Austroads Design Vehicle and Turning Path Templates Guide* (Austroads 2013d). These larger vehicles are typically the B-double.	Retain.	Nil.	Agreed.
5.4 Restricted Access Vehicles	The guide provides commentary for the restricted access vehicles, operating under permits for the purposes of checking intersection design on routes where these vehicles are permitted to operate.	Retain.	Nil.	Agreed.
6.4.2 Tram Facilities – Tram Lanes	General reference is provided to the AS 1742.12 *Part 12*: *Bus, transit, tram and truck lanes*.	To note.	Nil.	Agreed.
7.2.3 Property Access – Rural Roads	The design vehicle for property access is the largest vehicle likely to access the property, with the minimum design vehicle being a single unit truck. Examples of intersection layouts for articulated trucks are provided.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
	Figure 7.2 provides an example of the 'minimum' rural property access (single and dual carriageways), while Figure 7.3 and Figure 7.4 provide examples for articulated vehicles on dual and single carriageway roads respectively.			
7.2.3 Property Access – Rural Roads	Table 7.2: Property access considerations on rural roads, describes issues for consideration on high-speed single and divided rural roads. It indicates that 'Direct access can be considered where safety factors justify an additional access within 3 km of a U-turn facility. Such a factor could be to allow for easier manoeuvrability for articulated trucks in contrast to a 180 ° turn on a minimum 12 m turning path radius available at a U-turn facility.' This should be revised to more clearly describe the safety considerations and the approach that may be adopted to enhance safety.	It is suggested that consideration be given to re-writing as follows: 'Where it is unsafe to provide direct access for a right turning truck (e.g. where the turning truck protrudes into the through lane), property access may be provided via a downstream U-turn facility. The placement of such a facility is expected to be based on a network-wide strategy (i.e. U-turn facility spacing). Should such a facility not be available within 3 km, consideration should be given to providing a channelised right-turn treatment (CHR) of adequate truck storage length. Ref to the *Guide to Road Design GRD Part 4A: Unsignalised and Signalised Intersections* (Austroads 2017i)	Nil. 2017 edn Table 7.3. Has been included in 2017 edn.	Agreed.
7.3.3 Median Openings – Design Requirements	Table 7.3: Considerations relating to the design of median openings provides the consideration with varying context for median openings. Median opening for 'High-speed rural roads' should be designed for articulated vehicles, as this may be the only option for turning around broken-down vehicles or allowing for emergency vehicles, as the closest multi-directional interchange could be 10–20 km away.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
	Where there are a significant number of semi-trailers or B-doubles that require access to a divided road it may be necessary to provide a median wide enough to safely store the vehicle (e.g. B-doubles require about 30 m). The width of median openings on 'High-speed urban freeways' is restricted to that of a single unit truck. This is because of the close spacings of interchanges in an urban environment and the need to restrict median widths. For median openings for 'High-speed urban divided roads': access for industrial properties should be examined to consider whether the distances to travel are excessive distances and require the need to perform U-turns.			
9.6.3 Cyclist Crossings – Path Crossings of Side Roads – Types of Crossings of Side Roads, Bent-out Treatment	Figure 9.10: Bicycle path crossing bent-out at side road – illustrates a treatment that provides priority for cyclists. This desirable minimum distance between the path and the parallel road, suitable for a single unit bus/truck and clearance is 15 m. This may be suitable where there are a significant number of large vehicles.	General comment – retain pending the outcome of the current review as part of the update of *GRD Part 4* (Austroads 2017f).	Nil. 2017 edn. Indicates the treatment may be suitable where there are few HVs.	Agreed.
10.3 Rail Crossings – Horizontal Alignment	Sight distance to a train and the stopping distance to the train tracks are described. The guide indicates that the stopping distance must not be less than the truck stopping sight distance. Supporting reference should also be made to the *Guide to Road Design: Part 3: Geometric Design* (*GRD Part 3*) Table 5.5: Truck stopping distances.	Revise to include the reference to *GRD Part 3* (Austroads 2010a) (superseded).	Nil. Has been included in 2017 edn.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
Appendix B.5 Derivation of Sight Distance Requirements at Railway Level Crossings – Case 2: Sight Distance Required for STOP Sign Control	Table B3: Heavy vehicle speed/acceleration performance (RTA 1990 and QT 1993, cited in Austroads 2009c) provide acceleration values obtained from 1990 and 1993 reports. As the values may be dated it may be appropriate to identify more recent values.	Consideration should be given to obtaining recent vehicle performance data.	Nil. Has been included in the 2017 edn.	Agreed.
***GRD Part 4A: Unsignalised and Signalised Intersections* (2017i)**				
2.2.2 Alignment of Intersection Approaches – Vertical Alignment	Steep upgrades (i.e. ≥ 3%), on approaches generally result in sight distance and operational problems. For the side roads this may necessitate grading the road for 10 m to < 3%. If a significant number of trucks use the side road it should then be used as the design vehicle and the distance graded should reflect this. Downgrades should be no steeper than 3% (max 5%) to limit the impact of steep grades on stopping distance. The guide indicates that as an alternative to achieving the 5%, and to cater for truck stopping sight distance, high friction surfaces or transverse grooving should be provided. It is considered that the latter information should be revised to reflect and acknowledge the need to ensure that high friction surfaces or transverse grooving approaches need to be maintained.	Consideration should be given to indicating the need to ensure that where high friction surfaces or transverse grooving approaches are provided, it needs be maintained.	Suggest inclusion of additional text on maintenance.	High friction 'add-on' surfacing is not really suitable for heavy vehicle traffic – requires high maintenance. Better to increase structural integrity of pavement to accommodate longer term wear and tear.
2.2.2 Alignment of Intersection Approaches – Vertical Alignment	The guide informs that in a situation where at a T-intersection a leg is placed on the outside of a superelevation curve it is important to 'achieve the best possible SD outcome'. The favoured option, Line 2, illustrated in Figure 2.5: Sight distance to T-intersection, provides an island on the minor road with signage warning motorists of the intersection ahead.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
	Figure 2.6: Sight distance to T-intersection on a major curve, has a requirement that the island should be visible for all trucks approaching from the appropriate truck stopping sight distance.			
2.2.4 Alignment of Intersection Approaches – Superelevation at or near Intersections	Adverse crossfall should not increase markedly throughout the turning movement. Where longitudinal grades are ≥ 5% and trucks with high loads turn at the intersection, a flatter area in the longitudinal grade may be needed.	Retain.	Nil.	Agreed.
3.2.1 Sight Distance Requirements for Vehicles at Intersections – Approach Sight Distance (ASD), Provision of ASD for Trucks	Approach sight distance should be provided for trucks approaching the intersection at the 85th percentile operating speed to ensure they are able to stop safely.	Check coefficient of deceleration value of 0.22 for a source. This value does not appear elsewhere in the GRD.	Nil. Source not identified, matter of retention for RDTF.	Agreed.
3.2.2 Sight Distance – Safe Intersection Sight Distance (SISD)	Table 3.2: SISD for sealed roads (S < L) of the guide provides SISD for trucks during day and night-time conditions. A coefficient of deceleration for the truck and a coefficient of deceleration for the truck at night situation are included in the table. Observation times 1.8 sec and 3.0 sec.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
5.2.1 Deceleration Turn Lane Length – Components of Deceleration Turn Lanes	The guide indicates that the length of deceleration lanes is based on the performance of a car and not a truck, because of the relatively high cost of providing for the latter. It indicates that trucks commence to brake when they are travelling in the through lane prior to entering the deceleration lane. It is noted, however, that consideration should be given to providing a longer deceleration lane where there are high traffic volumes. It is considered that in rural areas, longer deceleration lanes designed for trucks be provided where arterial roads intersect.	Consideration should be given to revising to indicate that longer deceleration lanes designed for trucks be provided where arterial roads intersect. Inclusion of guidance on the volume of HVs when longer lanes should be provided would strengthen the consideration. As a comparison, guidance on the provision of slow vehicle lanes is contained in Part 3, Table 9.4 for partial passing lanes ranges from ≥ 5% to 20%.	2017 edn Section 5.2.1. Inclusion of additional consideration. For RDTF.	Makes sense to consider longer deceleration portion when truck percentage reaches a certain threshold. Suggested as a threshold but requires agreement.
5.2.2 Deceleration Turn Lane Length – Determination of Deceleration Turning Lane Length	The issue discussed is similar to the above, namely that where there is a high percentage of heavy vehicles, consideration may be given to increasing the length above that required of cars to reduce interference to traffic flows. It is reiterated that heavy vehicles may reduce speed in the through lane.	As above.	2017 edn Section 5.2.2. Inclusion of additional consideration. For RDTF.	As 5.2.1.
5.3.1 Determination of Acceleration Lane Length for Cars – General	The guide indicates that the design of an acceleration lane is normally based on cars; it is further indicated that there may be situations where the design needs to consider the performance of trucks.	Retain.		Ditto 5.2.1 although acceleration lengths for trucks are much more difficult to define and can be very long (and therefore expensive).

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
5.4 Acceleration Lane Design for Trucks	The guide indicates that the speed differential between trucks and the merging through traffic needs to be considered when designing acceleration lanes. It is indicated that the accelerating trucks should be no less than 20 km/h than the speed of the merging through traffic, particularly on designated truck routes. Where truck merge speed differentials are > 30 km/h consideration should be given to extending the acceleration lane. If this is not achievable, the guide indicates options for consideration. One option involves the provision of a BAL or a high-entry angle CHL, the other option refers to Tables 5.6: Acceleration lane length (m) for semi-trailer from rest to a specified speed on a level or downgrade, and 5.7: Acceleration lane lengths (m) for semi-trailers to accelerate from rest on an upgrade. The section provides unclear and conflicting information. While the Tables' references indicate acceleration lane lengths in ideal circumstances, they are provided for consideration when in a constrained situation. The consideration of the option to use type BAL and CHL intersections where desirable acceleration lane lengths are not able to be provided requires reconsideration as these treatments may increase crash risk. In these situations, the speed differential between fast moving through traffic and entering heavy vehicle traffic would be at its greatest.	Consideration should be given to: ▪ referring to Table 5.6 and 5.7 as an introduction to Section 5.5 ▪ removing the option to use type BAL and CHL intersections where desirable acceleration lane lengths are not able to be provided.	2017 edn, Section 5.4. Tables 5.7 and 5.8. Cross-reference has been included. For RDTF.	Done. Review.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
6.1 Traffic Islands and Medians – General	The guide indicates that the design of traffic islands and medians is site-specific taking account of a number of factors, one being the proportion of heavy vehicles within the traffic stream. Where an island is installed, the swept path of the large vehicles needs to be considered in locating traffic furniture.	Consideration may be given to advising that where installed, the swept path of large vehicles needs to be considered in locating traffic furniture.	Contained in Part 4 2017 edn Section A.15.1. Contained in Section 6.1.1, third paragraph.	Agreed.
7.1 Right-turn Treatments – Design Procedure – Introduction (now Part 4: Appendix A.16.1)	The guide provides general information on the issues or information needed to develop a detailed layout. One of the considerations is truck movement.	Retain.	Nil.	Agreed.
7.2 Opposed Right-turns – General (Now Part 4: Appendix A.16.2).	Reference is made to clearance requirements for trucks during concurrent opposing right-turn manoeuvres and choosing the appropriate turning radius. Figures 7.1 and 7.2 are provided for clearances for single and double-opposed right-turn lanes. Figure 7.3 depicts a dual turn opposed by a single lane. Reference is subsequently made to the *Austroads Design Vehicle and Turning Path Templates Guide* (Austroads 2013d).	It should be noted that the review of Part 4 of the GRD (Austroads 2009c) has included these figures for consideration, and it is suggested that they be replaced with a single figure with supporting commentary.	Nil. Contained in Part 4 2017 edn Section A.16.2. Has been included in update.	Agreed.
7.4 (2017 edn) 7.6.5: Rural Right-turn Treatments – Divided Roads – Rural Wide Median Treatment	The guide informs that large medians are designed to enable the B-double design vehicle to turn and cross, which requires about 30 m of width.	Retain.	Nil.	Agreed.
7.4 (2017 edn) 7.6.5 Rural Right-turn Treatments – Divided Roads – Rural Wide Median Treatment	The guide discusses alignment of vehicles to enable a stand-up angle of 85°, which is particularly important to enable drivers of trucks and vans to have clear sight lines.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
7.4 (2017 edn). 7.6.5 Rural Right-turn Treatments – Divided Roads – Rural Wide Median Treatment	Figure 7.16: Rural wide median provides an example of a layout of this type. To reduce the speed differential, and therefore crash risk, between trucks (and cars) entering the major road with high-speed through traffic, acceleration lanes should be provided.	Consideration should be given to revising Figure 7.16 to illustrate an acceleration lane for vehicles entering the major road.	Considered in review with no amendment. Nil.	Agreed.
A.17.2 (*GRD Part 4,* 2017 edn) 8.3.1 Urban Left-turn Treatments – Urban Basic Left-turn Treatment (BAL), Single Radius Left-turn and Tapers in a Low Speed Environment	This is described as a simple left-turn treatment. The design vehicle should turn from the left lane onto the intersecting road without crossing the centreline. Figure 8.8: Basic left-turn (BAL) on an urban road shows the design vehicle (12.5 m or longer), turning from the kerbside lane. The minor road in this case would serve an industrial area.	Consideration should be given to adding the following text, 'the design vehicle, 12.5 m or longer, while not crossing the centreline may find it necessary to cross the adjacent lane'.	Suggest inclusion of text as proposed (similar to *Single Radius Left-turn without Tapers, Low Speed Environment)*. Shown in *GRD Part 4*, Figure A 37, no further amendment needed.	Agreed.
17.2 (*GRD Part 4,* 2017 edn.) 8.3.1 Urban Left-turn Treatments – Urban Basic Left-turn Treatment (BAL), Single Radius Left-turn Without Tapers, Low Speed Environment	In an urban intersection predominantly used by cars, light trucks and only occasionally by larger vehicles, it may be appropriate to design for the occasional large vehicle to turn from the inner lane (where provided). Figure 8.9: Application of a check vehicle swept path to a single radius (BAL) for an urban intersection shows the minimum treatment in a low-speed low-volume constrained environment. Such a treatment is used only when the checking vehicle (e.g. 19.0 m semi-trailer) access to the minor road is only required on a very infrequent basis.	Consider adding the following text, 'the checking vehicle, 12.5 m or longer, while not crossing the centreline may find it necessary to cross the adjacent lane'.	Nil. Has been included in 2017 edn.	Agreed.
17.2 (*GRD Part 4*, 2017 edn) 8.3.1 Urban Left-turn Treatments – Urban Basic Left-turn Treatment (BAL), Single Radius Left-turn without Tapers, Low Speed Environment	Table 8.3: Minimum left-turn kerb radii provide the minimum radius for an initial design for the minor roads when a semi-trailer (19.0 m) or truck/bus (12.5 m) is used as the design vehicle.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
Appendix A17.2 (*GRD Part 4* 2017 edn) 8.3.5 Urban Left-turn Treatments – Urban Channelised Left-turn Treatment (CHL) with Acceleration Lane	The guide indicates that CHL treatments are 'useful' where left turning heavy vehicles will cause excessive slowing in the major road traffic stream. Figure 8.13: Urban CHL with acceleration provides an illustration of this type of intersection.	Consideration should be given to revising to indicate that CHL, with an acceleration lane, should be provided on high-speed roads as a means of reducing speed differentials between slow moving heavy vehicles turning, and fast moving through traffic, thereby reducing crash risk.	Nil. Has been included in 2017 edn.	Agreed.
8.3.2 Urban Left-turn Treatments – Left-turn Treatments for Large Vehicles	It is indicated that providing for large vehicles such as road trains at BAL creates large areas of roadway that potentially will lead to safety problems for smaller vehicles as their travel paths may be undefined. A means of addressing this is to provide normal turning roadway with an adjacent additional (turning) area that is visually different or slightly raised that maybe traversed by the large vehicle but will discourage encroachment by smaller vehicles. Figures 8.16 and 8.17 provide examples of this type of treatment.	Retain.	Nil.	Agreed.
Appendix A.18.1 (*GRD Part 4* 2017 edn) 9.1 U-Turn Treatments – General	A U-turn manoeuvre is problematic for larger heavy vehicles as it may be impractical to provide enough space for the vehicles. In industrial/commercial areas it may be desirable to provide this facility but they must be suitably located and designed. The U-turn lanes in such circumstances should have suitable deceleration and storage lengths.	Retain.	Nil.	Agreed.
Appendix A.18.3 (*GRD Part 4* 2017 edn) 9.3 U-Turn Treatments – Urban Roads	The guide provides example layouts (Figures 9.1, 9.2 and 9.3), of divided urban roads that have sufficient space and demand for heavy vehicle U-turns.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
Appendix B.6.1 (*GRD Part 4* 2017 edn) 10.6.4 Traffic Lanes – Cyclist Facilities, Head Start and Expanded Storage Areas	The guide indicates that this storage area is provided so that cyclists can be readily seen by motorists, in particular by truck drivers.	Retain.	Nil.	Agreed.
Appendix A.2.1 Extended Design Domain (EDD) for Intersections – EDD for Sight Distance at Intersections, Application of EDD for Sight Distance at Intersections	As a general consideration, the guide indicates that under EDD, for sight distance at intersections, specific attention must be given to checking the turning requirements of trucks on routes with high numbers of heavy vehicles, with some capability provided on all roads.	Retain.	Nil.	Agreed.
Appendix A.2.2 Extended Design Domain (EDD) for Intersections – Base and Check Cases	General comments are provided for the base and check cases applying to day and night.	Retain.	Nil.	Agreed.
Appendix A.2.3 Extended Design Domain (EDD) for Intersections – EDD Approach Sight Distance (ASD)	It is indicated that the EDD sight distance values and corresponding crest curve sizes for the base cases used for trucks are an eye height of 2.4 m (object height 0.0 m) and longitudinal deceleration of d = 0.29.	Retain.	Nil.	Agreed.
Appendix A.2.3 Extended Design Domain (EDD) for Intersections – EDD Approach Sight Distance (ASD)	Table A 6: Minimum EDD approach sight distance and corresponding crest vertical curve size for the truck-day base case for sealed roads with level grades (m), provides EDD approach sight distance for truck-day base case d = 0.29, reaction times 1.5 sec, 2.0 sec and 2.5 sec.	Retain.	Nil.	Agreed.
Appendix A.2.4 Observation Times for EDD Safe Intersection Sight Distance	Table A 8: Driver observation time for safe intersection sight distance under EDD, lists observation times applicable to the truck-day base case, with a truck night time of 1.0 sec.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
Appendix A.2.5 EDD Safe Intersection Sight Distance (SISD)	The guide provides the eye and object heights for truck-day, reaction times for truck-day/truck-night and longitudinal deceleration for truck-day/truck-night (d = 0.29).	Retain.	Nil.	Agreed.
Appendix A.2.5 EDD Safe Intersection Sight Distance (SISD)	Table A 14: EDD SISD for sealed roads with level grades truck-day base case observation time of 2.5 sec, provides SISD and K values for reaction times of 1.5, 2.0 and 2.5 sec (d = 0.29).	Retain.	Nil.	Agreed.
Appendix A.2.6 Sight Distance at Constrained Urban Intersections	The desirable criteria at both signalised and unsignalised intersections are ASD and SISD. Where ASD is not possible at some urban intersections because of severe sight restrictions on sight lines, SSD to the tail-lights of cars stopped at the end of vehicle queues will be required. Figure A 1: Sight distance to back of queue depicts the SSD for an approaching vehicle to the line of queued vehicles, and as it relates to approaching heavy vehicle driver eye height to tail-light height (i.e. 2.4 to 0.8 m).	Retain.	Nil.	Agreed.
Appendix A.3.1 EDD for Sight Distance at Domestic Accesses – Application of EDD for Sight Distance at Domestic Accesses	Under EDD for property access sight distance, there will be a need to provide enough capability for trucks stopping during daylight hours (i.e. truck-day base case).	Retain.	Nil.	Agreed.
Now Appendix B.1 Appendix C.1 Truck Stability at Intersections – Introduction	Truck instability at intersections that leads to rollover or out-of-control crashes result in persons injured or killed, traffic congestion and general costs to the community. Truck stability in intersection design is therefore a critical factor in maintaining safety for trucks.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
Now Appendix B.2. Appendix C.2 Lateral Friction Force on Vehicles	Commentary on the factors affecting truck stability is provided, for example, rollover thresholds, heights of centre of gravity, truck speed and road surface. Figure C 1: Variations of friction factors with speed and Figure C 2: Overturning moment on a turning truck is provided to assist practitioners.	Retain.	Nil.	Agreed.
Now Appendix B3. Appendix C.3 Other Factors that Affect Truck Stability	Other factors that affect truck stability are highlighted including: adverse superelevation, dynamic affects associated with wheel bounce, wheel rigidity between wheel linkages between the prime-mover and the trailer on an articulated truck and changes in geometry occurring on low radius curves. When these factors are considered, the critical rollover threshold (i.e. critical lateral acceleration) is 0.24 g. Table C 2: Stability parameters for trucks are provided for trucks with varying centre of gravities.	Retain.	Nil.	Agreed.
Now Appendix B4. Appendix C.4 Critical Turning Speeds for Trucks in Intersections	Once turning paths have been determined, using turning templates (for the design vehicle), minimum crossfalls or maximum adverse crossfalls can be determined for each turning path. Table C 3: Critical truck turning speeds, shows radius and superelevation combinations with critical speeds.	Retain.	Nil.	Agreed.
Now Appendix C2.2. Appendix E.2.2 Swept Paths for Road Trains at High Entry Angle Left-turn Treatments – Alternative Treatment	Figures E 1 and E 2: Swept path provisions for road trains at channelised left-turns are provided as normal and alternative treatments respectively. The E 2 alternative is provided where the site has a high volume of large single unit trucks and prime movers, and semi-trailer combinations.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
Now Commentary 4 Commentary 11	The commentary provides graphs showing the speed profile of a semi-trailer on nominal upgrades and downgrades as they approach their merging with through traffic. The graphs indicate distances for trucks to reach speeds from 20 to 100 km/h on the various grades. This information is used to indicate the length of the acceleration lanes.	Current vehicle fleet performance assessment needed to support any change.	Nil. Noted.	Agreed.
***GRD Part 4B: Roundabouts* (2015I)**				
3.3 Sight Distance – Truck Stopping Sight Distance	While the sight distance requirements at roundabouts are based on cars, there is the need to ensure that trucks are able to stop safely as they approach at the 85th percentile operating speed. The guide indicates that Truck Stopping Sight Distance (TSSD) should also be provided on tight horizontal curves, on/near vertical curves and at intersections which are trafficked by a significant number of large or special vehicles. It is also indicated that when a structure passes over a roundabout approach, which is a sag curve, the design should check that TSSD is provided through the underpass (eye height 2.4 m with the car tail-light object height of 0.8 m).	Consideration should be given to quantifying what a 'significant volume of large or special vehicles' is. While a proportion of traffic could be specified, such as ≥ 10%, an indicative number may need to be provided on high volume roads where the proportion of HVs is less than 10% but volumes are high.	Suggest a volume of ≥ 10%. A significant volume to be determined.	Agreed – needs a review and a threshold agreed.
4.4.3 Central Island Shape – Minimum Central Island Radius	Table 4.1: Guide for selecting the minimum central island radius for a circular roundabout, provides the absolute minimum central island radius for a single unit truck (7 m) which is used as the design right-turn vehicle for a single lane roundabout where the desired entry speed is ≤ 40 km/h.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
4.4.3 Central Island Shape – Minimum Central Island Radius	The criteria used in Table 4.1 are in part based on the largest right-turning design vehicle being a semi-trailer and the swept path of the design vehicle not requiring an encroachment area. It is also indicated that the central island radius will, in general require to be increased if the design vehicle is larger than a semi-trailer. The guide further informs that in constrained locations an encroachment area may be used by the checking design vehicle or occasional over-dimensional vehicle (e.g. garbage truck in a local area).	Retain.	Nil.	Agreed.
4.6.1 Circulating Carriageway – Design Vehicle and Vehicle Swept Paths	The guide indicates that the swept path requirements may differ according to the different paths through the roundabout, e.g. the straight through path for a B-double (25 m) may differ to the right-turn movement of a single unit truck if it does not need this movement to be catered for. This situation may arise if particularly heavy vehicles are restricted to designated routes or the turning volume is extremely low. In the latter case encroachment areas may need to be provided.	Retain.	Nil.	Agreed.
4.6.2 Circulating Carriageway – Width of Circulating Carriageway	Tables 4.3 and 4.4 provide preliminary guidance as to circulating road widths for single and 2-lane roundabouts. The varying widths are provided for single unit trucks (12.5 m), semi-trailers (19.0 m) B-doubles (25.0 m) and Type 1 and 2 road trains.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
4.10.1 Superelevation, Gradient and Drainage – Crossfalls, Positive or Adverse Crossfalls	The guide indicates that if there is **adverse** crossfall on the circulating carriageway there is a **higher** risk of a single vehicle truck crash **than where there is positive** superelevation. It is subsequently indicated that **positive** superelevation on the circulating roadway **reduces** single vehicle truck crashes.	This information appears to be contradictory in that there is an implication in the first comment that there is an increased risk of a single vehicle truck crash which conflicts with the second comment that indicates a reduction. Revise text to clarify the situation.	Suggest deleting the following sentence: An adverse crossfall or positive superelevation of 0.02 m/m may be provided if construction tolerances are tightly controlled as it would provide additional driver comfort.	The two are consistent. However, the additional risk is so small, and the advantages of outward sloping circulating carriageways outweigh such risks that this section should be re-visited.
4.10.1 Superelevation, Gradient and Drainage – Crossfalls, Use of the Crown in the Circulating Carriageway	It is indicated that where a crown is within the circulating road, crossfalls should not exceed 2.5% (5% grade change).	Retain.	Nil.	Agreed.
4.10.1 Superelevation, Gradient and Drainage – Crossfalls, Roundabout Radius, Crossfall and Heavy Vehicle Stability	It is indicated that centre islands sized 10 to 40 m require special attention as operating speeds may be close to the overturning speeds for high vehicles.	Retain.	Nil.	Agreed.
4.11.2 Special Treatments – Wide Undivided Streets and T-intersections	The guide informs that treatments are usually applied in local streets, but need to cater for emergency services, e.g. fire trucks.	Retain.	Nil.	Agreed.
5.3.3 Cyclists – Bicycle Lanes at Single-lane Roundabouts, Collector Roads or Arterials with no Physical Separation of Bicycle Lanes	The guide indicates that the treatment is suitable for bicycle routes at local street intersections and assumes low volumes of heavy vehicles.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
***GRD Part 4C: Interchanges* (2015m)**				
3.2.2 Forms of Interchange – Other Considerations, Underpass or Overpass	It is indicated that the major road assists operations if located at a lower level than the minor road. As a consequence, it assists trucks exiting to slow on the upgrade and entering to accelerate on the downgrade.	Retain.	Nil.	Agreed.
4.2 Structures – Form of Structure	Reference is provided to the protection of bridge piers and it is suggested that a barrier capable of containing a heavy vehicle may be needed.	Retain.	Nil.	Agreed.
4.4.2 Pedestrian/Cyclist Grade Separations, Safety Barriers at Pedestrian Bridges	It is indicated that there should be a preference for a single span to avoid the risks with a central pier.	Retain.	Nil.	Agreed.
4.6 Retaining Walls	It is indicated that the base of the retaining wall should be shielded by a safety barrier to protect it from being struck by a truck. Alternatively, the wall could have an appropriate concrete barrier profile constructed into its base.	Retain.	Nil.	Agreed.
5.2.1 Ramp Cross-section Number of Lanes on Ramps, Exit Ramps	It is indicated that single exit ramps should be widened to two lanes, as indicated in Figure 11.2, where the truck exit speed is less than 50 km/h at the nose and if a significant number of trucks use the ramp.	It is suggested that guidance/criteria be provided on what a 'significant number of trucks' is.	Significant needs to be identified. Definition needs to be consistent across the design guides.	Agreed.
5.2.1 Ramp Cross-section Number of Lanes on Ramps, Entry Ramps	It is indicated that for single entry ramps where the design speed of the through traffic is ≥ 80 km/h, another entry ramp lane should be provided, as shown in Figure 11.7(b), when: • the single lane on the ramp is > 300 m on a level grade, and • an accelerating truck from a rest position at the terminus of the ramp would not be expected to reach 50 km/h at the nose, and • a significant number of trucks use the ramp.	As above.	See previous, significant needs to be identified.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
5.2.2 Cross-section, Ramp Lane Widths	It is indicated that loop-lane widths should allow for a semi-trailer and car; where there is a significant percentage of heavy vehicles the width should be able to accommodate the largest design vehicle side-by-side with a single unit truck.	Guidance or an indication should be given as to what a 'significant percentage of heavy vehicles' is. It should be noted that on high volume roads a low percentage value of HVs may translate to a high number, and therefore high relative crash risk.	See previous, significant needs to be identified.	Agreed.
6.1 Design Speed – General	The guide informs that the design speed for elements of an interchange is the operating speed of that element. It is also indicated that the speed adopted by a driver within an interchange is dependent on the combined impact of a number of factors, one of which is the proportion of heavy vehicle traffic.	Retain.	Nil.	Agreed.
6.4.2 Ramps – Other Considerations	As a further consideration of ramp design speed, it is indicated that relative speeds between vehicles should not exceed 10 km/h which can be difficult where there are trucks in the traffic stream. Loop ramps may not offer a satisfactory level of service and stability for heavy vehicles.	Retain.	Nil.	Agreed.
7.4 Sight Distance – Exit Ramp Nose	The guide indicates that where the entry ramp coincides with a left turning curve on the major road, designers should be aware that vehicles approaching on the freeway can be in the blind spot of entering trucks. A possible solution suggested is the provision of a parallel auxiliary lane to enable entering drivers more time to sight vehicles in the adjacent lane to merge safely.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
8.2.1 Horizontal Alignment – Minor Road, Curvature	The guide informs that if the minor road needs to be on a curve it should have a radius that is as large as possible. One of the reasons being that the superelevation on a curved bridge may cause instability of a truck turning from exit ramps or onto entry ramps.	Retain.	Nil.	Agreed.
8.3.4 Ramps – Service Interchanges, Diagonal Ramps	It is indicated that on flat entry ramps 300 m long an average truck can accelerate from a stop to about 50 to 60 km/h and the speed decrement at the merge is excessive. On many occasions it is impractical to provide very long entry ramps, and therefore they should be 300 to 450 m. As a general principle it is preferable to provide an auxiliary lane on the freeway at the entry, rather than a longer ramp.	Retain.	Nil.	Agreed.
8.3.4 Ramps – Service Interchanges, Diagonal Ramps	For ramps that have a significant number of trucks and an uphill grade (> 3%), two lanes might be considered on the ramp to enable light vehicles to overtake trucks.	Consideration should be given to providing guidance as to what a 'significant number of trucks' is.	See previous, significant needs to be identified.	Agreed.
9.1.1 Vertical Alignment – Major Road Grading Options	Table 9.1: Factors affecting interchange configuration indicates that an advantage of having the major road under the minor road is to assist in the truck entry speed onto the major road, and on the uphill exit which assists in slowing the truck. (See also Section 3.2.2)	Retain.	Nil.	Agreed.
9.3 Ramps – Ramp Gradients for System Interchanges	It is indicated that the selection of the gradient of ramps should take account of the high number of trucks that use the ramps.	Suggested that guidance be provided as to what a 'high number of trucks' is.	See previous, significant needs to be identified.	Agreed.
10.1 Ramp Terminals at Minor Roads – Ramp Terminal Locations	One of four requirements for the locations of ramp terminals is that the longitudinal grade of the minor road, at the terminal, should not exceed 3%, thus ensuring that turning trucks remain stable.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
GRD Part 6: Roadside Design, Safety and Barriers **(2018 edn draft)**				**This section needs to be part of the current Part 6 review project**
3.4.2 Design to Keep Vehicles on the Road – Combining Design Parameters and Consistent Design	The reference to HVs relates to the need to have consideration of the impact of HVs and risk with the mix of HVs with other vehicles, particularly when steep grades are involved.	Retain.	Nil.	Agreed.
4.2.2 Design to Mitigate Hazards – Design Step D1: Determine Area of Interest Determine the Clear Zone, Considerations in Applying Clear Zones to Designs – Determine the Clear Zone	Reference is made to the clear zone in Table 4.1 and hazard corridor in Appendix C. It is highlighted that guidance in both cases does not take into consideration errant HVs. Rather, designers are referred to Section 6.3.13. It is of note that the section deals with barrier design and their level of containment, rather than the determination resulting in provision of a run-out area free of hazards.	Consideration should be given to undertaking an investigation to identify the appropriateness of applying clear zone principles (i.e. determination of a run-out area free of hazards and a 'hazard corridor') that may be applied for HVs as an option to the installation of a barrier. Retain pending the outcome of an investigation.	*GRD Part 6* (2018 draft). Research still required.	Agreed.
4.2.2 Design to Mitigate Hazards – Design Step D1: Determine Area of Interest Determine the Clear Zone, Effect of Embankment Slope	The guide indicates that trucks, should they run off the road, are able to recover on an embankment slope of 10:1, while at 6:1 they are traversable. Slopes steeper than these values are unsafe for trucks (i.e. unrecoverable which may cause a rollover). It is further indicated that ideally a safe roadside should be flat, especially for trucks that run off the road. Figure 4.4 is provided as an example of a parallel slope and clear zone.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
2018 edn, Section 4.3.5 Design Step D2: Identify Hazards – Embankment Assessment Process	The guide indicates that for HVs it is desirable that embankment slopes be provided at 6:1 or flatter where they could be reasonably achieved, particularly where there are high truck volumes. (Refer to Table 4.4).	The current guidance is subjective as to what truck volumes constitute a 'high volume'. It is also suggested that to minimise the risk of rollover HV crashes, embankment slopes of 6:1 or flatter be provided where achievable on roads speed zoned at greater than 60 km/h.	*GRD Part 6* (2018 draft). Consideration of HVs for auxiliary lanes ranges from 5% to 20%. A definition of high volume could be within this range. RDTF to determine.	Agreed.
2018 edn, Section 4.2.4 High Consequence Hazards, Opposing Vehicles and Medians	The guide highlights the high consequences of cross-median crashes on some high-speed duplicated roads (with medians even greater than 20 m), which have particularly high HV volumes, and the need to consider safety barriers to reduce the risk of these types of crashes occurring. The guide subsequently refers practitioners to their relevant road authority for policy and guidelines.	Investigate Australasian HV crash data to determine the geometric (e.g. cross-section, alignment), and operational (e.g. road function, traffic volume, % HV and speed limit) characteristics of roads to identify factors that may contribute to increased risk of cross-median crashes). Following a review of jurisdictional policies and practices, and in light of the analysis of HV crash data, develop a consistent approach in the installation of median barriers for HVs.	*GRD Part 6* 2018 draft, suggests the use of median barriers may depend on jurisdictional policies.	Agreed.
4.6.3 Hazard Risk Assessment – Risk Step R2 – Determine the Severity Index	The guide indicates that severity indices, which are based on average crash costs when a vehicle impacts a roadside hazard (including safety barriers), are not appropriate for trucks.	The task of calculating the currently unavailable cost of HV crashes and incorporating them within severity indices is considered to be a major and complex task that may not add significantly to the assessment outcome. Retain.	Nil.	Agreed.
6.2 Factors Considered in Barrier Selection	Table 6.1: Selection criteria for roadside barriers, indicates that the cost of providing barriers to contain and re-direct heavy vehicles is generally high.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
6.3 Road safety Barrier Design Process – Step B1 Collect Site Information	The guide indicates that the volume of heavy vehicles may be required in the process.	Retain.	Nil.	Agreed.
6.3.5 Road Safety Barrier Design Process – Offset to Travel Lane, Maintenance Access	The guide indicates that in some circumstances, consideration should be given to offsetting the safety barrier a sufficient distance from the road (e.g. 4 m) to allow a road maintenance truck to stop clear of traffic while undertaking routine maintenance.	Consideration should be given to revising the guide to indicate that where it is achievable, a sufficient distance from the road (e.g. 4 m) be allowed to enable road maintenance trucks to be stopped.	Included in draft edn (2018).	Agreed.
6.3.13 Step B5 – Determine the Barrier Containment Level Required, General	The guide refers to the containment levels that may be generally required, and provides by way of example the need to protect vital infrastructure (e.g. bridge pier or electrical sub-station) from HV impact. This section of the guide also indicates that road database and traffic measurements can be used to determine HV volumes and therefore whether or not the HV should be used as the design vehicle. This decision will also be based on the consequences of HV (truck or bus) impacts.	Retain.	Nil.	Agreed.
6.3.13 Step B5 – Determine the Barrier Containment Level Required, Design for Heavy Vehicles	The guide indicates that a normal barrier will not contain an HV, and those HV safety barriers (i.e. containments at TL5 and TL6) are rarely used, are expensive and can cause extensive damage to cars. Consequently, they should be used with bridges and other scenarios where the consequences of the HV running off the road are extreme (e.g. the HV falling off a bridge, running off a curve and striking a building, etc.).	Review to consider the use of TL5 and TL6 on major freight routes at high-crash-risk locations. These locations will be based on the geometric features of roads that increase the risk of HV run-off-road crashes and on HV volumes. Threshold values will be required to be determined. Retain pending the determination of these values.	Included in draft edn (2018).	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
6.3.15 Step 7 – Determine Dynamic Deflection, Barriers for Heavy Vehicles	The guide deals with the use of two-stage barrier systems for heavy vehicles. While in most cases a single HV barrier system is applied, there may be circumstances when two are provided. The situation may arise where the first barrier system (not designed for HVs) is used to protect vehicle occupants of an errant vehicle, with the second being used to protect a vital piece of infrastructure from being impacted by an HV.	Retain.	Nil.	Agreed.
6.3.18 Step B8 – Determine Vehicle Roll Allowance and System Width, Vehicle Roll Allowance	Except for rigid concrete barriers, all barriers deflect upon impact. The vehicle roll allowance is the amount of deflection that may occur with a semi-rigid barrier plus an indicative line of roll experienced by an impacting vehicle. These values are provided in Table 6.8 and involve a vehicle that is 4.3 m high (e.g. high rigid van or articulated truck).	Retain.	Nil.	Agreed.
6.3.18 Step B10 – Check that the Working Width is Less than the Barrier-to-hazard Clearance	This step checks the working width against the barrier-to-hazard clearance (i.e. if the working width is greater than the barrier-to-hazard width then the barrier will not prevent impact with the hazard). If the working width is greater, the guide asks the designer to consider the use of a two-stage barrier as applied to barriers for HVs.	Retain.	Nil.	Agreed.
7.2.1 Design for Steep Downgrades	The guide highlights that on steep downgrades there is the need to prevent/limit the consequences of a runaway HV. The guide advises that measures should be taken to alert HV drivers of the steep approaching descent, regulating to ensure that a driver of an HV uses low gears and that containment facilities be provided for runaway HVs.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
7.2.1 Design for Steep Downgrades – Containment Facilities, Gravity Safety Ramps	A description of gravity safety ramps is provided.	General comment – retain.	Nil.	Agreed.
7.2.2 Design for Steep Downgrades – Containment Facilities, Arrester Beds	A description of arrester beds is provided.	Retain.	Nil.	Agreed.
7.2.3 Design for Steep Downgrades – Containment Facilities, Dragnets	A description of dragnets is provided.	Retain.	Nil.	Agreed.
7.3 Warrant Investigation	The guide indicates downgrades on which the brakes of HVs may potentially fade. Table 7.1 provides the combination of these grades, together with minimum continuous road lengths, which if met, should trigger an investigation to deal with potential runaway HVs.	Retain.	Nil.	Agreed.
7.5 Key Design Considerations	The reference to HVs in the guide relates to ensuring that there is adequate workspace for heavy vehicle removal (e.g. lifting cranes), when designing facilities for runaway HVs.	Retain.	Nil.	Agreed.
7.6.1 Design Process, Outline of Process	Figure 7.1 in the guide provides in a flow chart the step-by-step process required to be followed in the design treatment process of steep downgrades. A key feature of the process is the requirement to consider HVs.	Retain.	Nil.	Agreed.
7.6.2 Step S1 – Determine Vehicle Entry Speed	Step 1 of the process informs that HV runaway speed very rarely exceeds 130 to 140 km/h. On this basis, it advises that escape ramps should therefore be designed for a minimum entry speed of 130 km/h with 140 km/h being preferred.	It is suggested that it be revised to indicate that design entry speeds be at least 140 km/h.	*GRD Part 6* (2018 draft). Suggests a preference for an entry speed of the 140 km/h. Retain.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
7.6.3 Step S2 – Evaluate Truck Stability on Approach	Step 2 of the process requires the evaluation of truck stability.	Retain.	Nil.	Agreed.
7.6.8 Step S7 – Design the Facility, Arrester Beds	The guide indicates that areas on both sides of an arrester bed may be required where HVs on a route carry heavy or difficult loads that require retrieval vehicles or cranes from both sides. Table 7.5 indicates that a width of 5 m is required for arrester beds for HVs.	Retain.	Nil.	Agreed.
7.6.9 Step S8 – Design End Treatment	The guide provides a very brief section that advises of the consequences associated with an HV passing through and out of a ramp or arrester bed. The point is made that crash cushions are designed for cars and have limited effectiveness for trucks. The guide also informs that end treatments should only be considered before a rigid object such as a rock face. The information provided to designers is that they should consider the use of a dragnet system if a 'fail-safe' end treatment is unavailable.	Retain.	Nil.	Agreed.
7.6.10 Step S9 – Design Vehicle Recovery Facilities	The guide describes arrester bed requirements for access and anchors for crashes and tow trucks for safety ramps and arrester beds.	Retain.	Nil.	Agreed.
7.6.11 Step S10 – Design Delineation.	The guide refers practitioners to signage requirements as per Australian and NZ standards.	Retain.	Nil.	Agreed.
7.6.12 Step S11 – Design Truck Parking Areas	The guide describes the provision of parking areas (i.e. areas before the steep descent to allow drivers of HVs to stop and check their brakes) and brake rest areas (i.e. an area set aside part-way down the descent which allows the drivers of HVs to conduct a brake check).	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
Appendix A.1.2 Terminology – Other General Engineering and Road Safety Terms	This section includes definitions in relation to HVs.	Retain.	Nil.	Agreed.
Now Appendix C.2 Examples of Clear Zone Calculations, Example 2	In the worked example a reference is made to the need to consider the clear zone should the volume of HVs be significant.	It is considered that the worked example is very limited. It should be expanded to describe how the clear zone should be recalculated to account for HVs. Guidance should also be provided as to what percentage of HV traffic should be exceeded before HVs should be considered.	Research on criteria on HV and clear zones required and the definition of HV volume consideration.	Agreed.
Now Appendix G – G.2.2 Treatment for Bridges – Treatments for Bridge Piers, Abutment, End Posts and Tunnel Portals	The guide indicates that piers over roads (overpasses) should desirably be protected by crash cushions or safety barriers. The guide indicates that it may be necessary to shield piers with a two-stage system.	Retain.	Nil.	Agreed.
Commentary 2 Combination of Design Parameters – Vertical Alignment	Table C2.1 Considerations in relation to designing roads for safety, indicates that for vertical alignments 'steep grades are prohibitive for HVs. It is advised that grades of 6% or greater have a significant impact for HVs downhill as well as uphill travel. The guide further informs that on very long downhill lengths, particularly those with horizontal and reverse curves, HVs are expected to experience brake fade.	The last unsafe scenario described does not proceed to describe how the problem may be ameliorated. Consideration should be given to advising that when there are very long downhill road lengths, strategically located brake rest areas are required to be provided.	Some comment provided in Section 7.6.12. The suggested amendment of requiring the installation of the brake rest areas needs to be discussed by the RDTF.	Agreed.
Commentary 2 Combination of Design Parameters – Horizontal Alignment	Table C2.1 for horizontal alignment indicates that extra lane width may be required on curves to maintain safe separation between opposing flows of traffic where there are significant volumes of HVs.	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
Commentary 2 Combination of Design Parameters – Road Surface	Table C2.1 informs that roads with high volumes of HVs may require a higher standard of construction and maintenance than roads that carry low volumes of HVs.	Retain.	Nil.	Agreed.
Commentary 2 Vehicle Mix Considerations	The guide recognises that there is an increasing proportion of HV travel across the road network and that crashes involving HVs are of a high severity. Table C2.3 provides the parameters designers should examine when designing for HVs.	The table provided is brief and should include other road design variables such as road cross-section, clear zones, embankments and safety barriers.	Table C2.3. Inclusion of the variables would strengthen the considerations.	Agreed.
Now Commentary 10 Escape Ramps	The guide advises that ascending grade ramps without arrester beds are not encouraged in areas with moderate to high commercial vehicles as HVs can roll back and jack-knife when they come to rest.	Consideration should be given to revising to indicate that where there are moderate to high proportions of HVs, arrester beds are required on ascending escape ramps.	Included in draft edn (2018).	Agreed.
***GRD Part 6A: Paths for Walking and Cycling* (2017k)**				
Now Appendix C.1 Path Construction and Maintenance – General Requirements	The guide indicates that there should be ease of access to allow for maintenance trucks.	Retain.	Nil.	Agreed.
Appendix C.4.1 Pavements for Bicycle Paths	It is indicated that the pavements need to be designed to carry the weight of maintenance trucks.	Retain.	Nil.	Agreed.
***GRD Part 6B: Roadside Environment* (2015k)**				
Now Section 1.5.2 Factors to be Considered – Other Important Considerations	It is indicated that truck parking areas, as part of jurisdictions rest area policy and strategy, should be considered in design.	Retain.	Nil.	Rest facilities are currently a separate document under revision – we should certainly include a reference.
3.4.2 Rest Facilities – Road Design Considerations for Rest Areas and Service Centres, Truck Parking Areas	The guide provides a brief description of truck parking areas.	Retain.	Nil.	

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
3.4.3 Rest Facilities – Siting of Service Centres and Rest Areas, Spacing Intervals	The guide recommends that on major undivided roads truck parking areas be provided on both sides of the road.	Retain.	Nil.	
3.4.3 Rest Facilities – Siting of Service Centres and Rest Areas, Proximity to a Town	The guide indicates that where traffic volumes and demand warrants/criteria are met, a truck parking bay should be provided 20 to 30 km from a township to enable drivers to rest and check their load.	Retain.	Nil.	
3.4.3 Rest Facilities – Siting of Service Centres and Rest Areas, Location	Table 3.2: Considerations in the location of rest areas and truck parking bays are provided.	Retain.	Nil.	
3.4.4 Rest Facilities – Design of Service Centre and Rest Areas, Freeways/Motorways	It is indicated that to maximise safety, and to provide ease of ingress and egress to rest areas or truck bays, access should be provided via ramps.	Retain.	Nil.	
3.4.4 Rest Facilities – Design of Service Centre and Rest Areas, Roads Other than Freeways/Motorways	The guide indicates that deceleration lanes should be provided at all facilities to assist all traffic, including heavy vehicles, to enter the rest areas. To assist heavy vehicles, it is indicated that they should be considered, even if the lanes are as short as 200 m. Part 6B includes: Acceleration lanes may be considered to enable heavy vehicles to enter the road. Even a short lane (e.g. 200 m) may offer an advantage as it enables an approaching motorist to determine what is happening with an entering truck	Consideration should be given to revising to indicate that acceleration lanes should be provided where the rest areas are used by drivers of heavy vehicles.	Strengthening of wording. RDTF to consider.	
3.4.4 Rest Facilities – Design of Service Centre and Rest Areas, Lighting	The guide provides a general description of lighting requirements for truck parking areas.	Retain.	Nil.	
3.4.5 Rest Facilities – Signage	The guide provides a general description of signing requirements for truck parking areas.	Retain.	Nil.	

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
4.2.5 Road Lighting – Road Lighting Design	Road lighting design requirements are provided. Table 4.3: Factors influencing the lighting layout highlight truck stops as a factor.	Retain.	Nil.	Agreed.
4.4.1 Off-street Parking – Introduction, Potential Issues	It is indicated that the design of off-road parking should ensure that trucks are provided with appropriate and separate spaces.	Retain.	Nil.	Agreed.
4.4.1 Off-street Parking – Off-street Parking, Relevant Guidelines	The relevant Austroads parking guidelines, which include those for trucks, are referenced.	Retain.	Nil.	Agreed.
4.4.2 Off-street Parking – Design Principles, General	The guide indicates that off-street parking within a major road reserve generally involves parking, in part, within a truck parking area (usually on rural roads).	Retain.	Nil.	Agreed.
4.4.4 Off-street Parking – Interface with Roads, Nature of Off-street Parking in Road Reservations	It is indicated that rest areas, service centres and truck parking bays may be located within road reservations.	Retain.	Nil.	Agreed.
4.4.6 Off-street Parking – Parking Areas for Large Vehicles	The guide describes parking facilities for heavy vehicles and car-caravan combinations.	Retain.	Nil.	Agreed.
***GRD Part 8: Process and Documentation* (2009)**				
2.6.6 Design Development Inputs – Further Considerations	The issue of rest areas and truck stops are included as items for further consideration in design.	Retain.	Nil.	Agreed.
3.8.2 Construction and Maintainability – Provision for Traffic, General	Specific issues are raised as warranting consideration within various contexts. One of the considerations was; can the site be accessed by trucks and plant/equipment?	Retain.	Nil.	Agreed.

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
4.9.5 Design Development Verification – Documentation	Checks include truck stopping distance and truck clearance times.	Retain.	Nil.	Agreed.

Amend the following Parts

***GRD Part 2*:**

Section 2.4.2: Factors that Influence Design Standards – *The Vehicle*: add reference to Land Transport New Zealand Guide *On-road Tracking Curves for Heavy Vehicles* (2007).

Section 2.4.2: Factors that Influence Design Standards – Road Factors; add to paragraph Road factors a cross-reference to AS 1742.9 for information on treatments to alert drivers of an approaching steep grade.

***GRD Part 3*:**

Section 2.2.7: First paragraph add – 'The design and check vehicle need to be appropriate for classification and function of the road. For example, some roads carry relatively high volumes of B-doubles or Type 1 and 2 road trains and where this is the case, may be more suitable as the design or check vehicle.'

Section 4.4.3: Table 4.10: Table note 2 to be amended to – *2 Where truck volume exceeds 250 vpd one-way, median slopes should be 10% or flatter.*

Section 4.5: Paragraph commencing 'Crashes can occur where vehicles run off the road..' amend the third sentence to read 'However, where truck volumes are high (10% and more), embankment slopes flatter than 10:1 are desirable, as this batter slope is considered to be recoverable for trucks.'

Section 7.1: General: Sixth paragraph first sentence amend to read 'Designers should strongly avoid locating features that are likely to require large or 'special' vehicles to brake on curves causing them to possibly lose stability or control. For example, the location of an intersection where the major road is on a small radius curve.'

Section 7.5.1: First paragraph, new second sentence – 'The use of compound curves is not favoured due to drivers not perceiving the change in curvature and not anticipating a change in side friction demand. To minimise the operational problems, the curves should be designed requiring a consistent side friction demand.'

Section 8.5.2: First paragraph, add fourth dot point: 'Where grades cause the disparities in vehicle speeds, and particularly where there is a relatively high percentage of heavy vehicles or cars towing caravans or trailers, passing lanes or turn-out bays should be considered to enable the faster moving vehicles to pass.'

Section 9.6.2: Second paragraph, amend second sentence: 'Slow vehicle turnouts can reduce the crash risk by providing an opportunity for slower moving vehicles to move into a separate lane, allowing faster vehicles to pass. This improves the safety and traffic flow. A slow vehicle turnout (passing bay) may be provided as shown on Figure 9.13.'

Third paragraph: First sentence: amend to: 'On steep grades where truck speeds can reduce to a "crawl" speed less than 40 km/h and a full climbing lane cannot be provided, passing bays may provide an improvement to traffic flow.'

Second dot point to read: 'proportion of heavy vehicles is ≥ 10% of the traffic'.

GRD Part 4

Section 3.2: First paragraph, Second sentence: 'Larger vehicles (e.g. 35.4 m B-triple, 30 m super B-double, A-triples) may be selected as the design vehicle, in which case they should enter and depart from the intersection in the correct lane/s.'

Section	Comments	Proposed actions for consideration	Suggested amendments	Road Design Task Force determination
Section 4.5.2: Types of cross-sections and lanes: Fourth paragraph: amend to read: 'While truck lanes are included in AS 1742.12:2000, they have not been implemented in Australia. However, it is important to provide adequate lane widths for trucks wherever there are a significant number of heavy vehicles using an intersection.' ***GRD Part 4A*** **Section 5.2.1: Second paragraph: new dot point: 'At the intersection of arterial roads, a longer deceleration length is provided when the volume of trucks is ≥ 10%.'**				

Appendix C Road Geometry Study for Improved Rural Safety – Suggested Amendments

The *Road Geometry Study for Improved Rural Safety* (AP-T295-15) research report provided many comments regarding design guidance and these are outlined in Table C 1.

Table C 1: Road geometry study for improved rural roads – suggested amendments

Section	Key crash likelihood & severity factors	Suggested design guidance changes	Consensus on the suggested changes/ comments	Road Design Task Force determination
***GRD Part 3: Geometric Design* (2016i)**				
	Horizontal alignment			
7.1	Out-of-context curve (tight radius, high-speed reduction).	Strengthen design speed selection guidance to avoid out-of-context curves and other low-speed elements (e.g. to force an alignment change).	The content included in *GRD Part 3*, Section 7.1.	Completed.
	High curve frequency along a route.	Reduce the expected speed limit in recognition of the topography and road hierarchy which may lead to curved alignment (see Section 6.1.4).	Suggest *GRD Part 3*, Section 7.1: It was also found that higher curve frequency was associated with increased risk of run-off-road casualty crashes. A road with 2.5 curves per km had double the crash rate of a straight road. Operating speed and relationship to speed limit to be discussed for length for application, context in the corridor.	Radius range needs to be determined. For discussion with the RDTF.

Section	Key crash likelihood & severity factors	Suggested design guidance changes	Consensus on the suggested changes/ comments	Road Design Task Force determination
	Curve combined with grade.	Stronger discouragement of combining sharp curvature (< 600 m) with grade steeper than 6% in high speed environments.	*GRD Part 3*, Section 7.1 includes avoidance of sudden reductions in standards such as isolated small radius curves, with no reference to steep grades. Suggest including the following as third dot point to third paragraph: *The risk of run-off-road casualty crashes is greatly increased where a curves radius < 600 m is combined with a grade i> 6% in high-speed environments.*	Agreed.
	Curves to the right.	Emphasise positive safety benefits of sealing shoulders on high-speed roads.	*GRD Part 3*, Section 4.3.3 has been expanded to indicate benefits of providing sealed shoulders.	Completed.
	Vertical alignment			
	Downhill grade > 6%.	Strengthen guidance to avoid downhill grade > 6% in high-speed environments. Suggest a lower speed limit if conditions continue over a significant distance.	*GRD Part 3*, Section 8.5.1 and 8.5.5 includes information on the steep grades. The lower speed limit suggestion could be considered. Suggest the reference to speed limit be referenced to the *Guide to Road Safety: Part 3* (Austroads 2008a).	Agreed. The advice against adverse crossfall on steep downgrades should also be strengthened.
	Crests and sags with a sharp vertical curve (< 600 m).	Strengthen guidance to avoid sharp vertical curves (crests and sags) in high-speed environments. Suggest a lower speed limit if conditions continue over a significant distance. (see Section 6.2).	*GRD Part 3* (2016i) includes this information.	Completed.

Section	Key crash likelihood & severity factors	Suggested design guidance changes	Consensus on the suggested changes/ comments	Road Design Task Force determination
	Cross-section (see Section 4.3)			
	Narrow pavement width (< 6 m).	Consider minimum 9 m pavement width for high-speed roads.	Report indicates that the risk of run-off-road casualty crashes was 2.7 times higher on roads with narrow pavements (< 6 m) when compared to roads with 9–10 m pavements. *GRD Part 3*, Section 4.2.6 indicates: Table 4.5, Lane and shoulder widths suggests a minimum carriageway width of 8.7 m for < 150 vpd and 9.2 m for 150–500 vpd. Widths based on traffic volumes. On two-lane sealed roads, the total width of seal should desirably be not less than 7.2 m to allow adequate width for passing. There is no specific reference to high-speed roads. The current guidance seems appropriate.	This will be covered by SRD2068.
	Narrow lane widths (< 3.5 m).	Strengthen the importance of using adequate lane widths (≥ 3.5 m).	*GRD Part 3*, Section 4.2.6, Table 4.5 indicates roads < 500 vpd, lane widths be 2 x 3.1 m and that the desirable lane width on rural roads is 3.5 m. The current guidance seems appropriate.	Agreed.
	Little or no sealed shoulder.	Recommend wider shoulders on the outside of curves (Roads and Maritime Services example).	*GRD Part 3*, Section 4.3.4 and Section 7.9 suggest wider shoulders on the outside of curves.	Completed.
		Emphasise positive safety benefits of sealing shoulders on high-speed roads.	*GRD Part 3*, Section 4.3.3 has been amended to include the information.	Completed.
		Recommend provision and maintenance of unsealed shoulder wherever practicable.	*GRD Part 3*, included (Section 4.3.2)	Completed.

Section	Key crash likelihood & severity factors	Suggested design guidance changes	Consensus on the suggested changes/ comments	Road Design Task Force determination
***GRD Part 4: Intersections and Crossings: General* (2017f)**				
	Intersections			
	Priority controlled rural intersections.	Emphasise safety benefits of roundabouts within the current guidelines; promote their application ahead of priority intersections.	Belongs in the *Guide to Traffic Management*-set (Austroads 2219c). Suggest to refer the matter to the GTM.	Agreed. Though we should reinforce the reduction in all approach speeds at intersections as the only real Safe System treatment as an alternative to roundabouts.
		Strongly discourage cross-intersections in favour of T-intersections.	Belongs in the *GTM-set*. Suggest to refer the matter to the GTM.	
		Promote intersection channelisation and side road traffic islands.	Further research needed.	
	Right-left staggered T intersection design.	Discourage right-left staggered T's in favour of left-right staggered.	Belongs in the Guide to Traffic Management. Suggest referring the matter to the GTM.	Agreed.
***GR Part 4B: Roundabouts* (2015l)**				
	Multiple approach and circulating lanes at roundabouts; high speeds in roundabouts.	Strengthen/clarify guidance on achieving low approach and circulating speeds at roundabouts (more examples, typical scenarios).	Design speeds of 20–30 km/h identified for local road roundabouts. Design tools to achieve these speeds needs to be agreed. Current guidance suggests use of the ARNDT software program to estimate speeds. The current guidance seems appropriate.	Agreed.
		Develop guidance on use of extended raised traffic islands on roundabout approaches for improved channelisation.	Not likely to be considered (already in the guidelines). Use of raised approach islands not overt. Benefits of the raised islands would need to be identified.	Agreed.
		Trial Turbo roundabouts.	Further research needed.	Agreed.

Section	Key crash likelihood & severity factors	Suggested design guidance changes	Consensus on the suggested changes/ comments	Road Design Task Force determination
***GRD Part 6 Roadside Design, Safety and Barriers*, (2018 draft)**				
	Roadsides			**Will inform current review.**
	High speeds.	Implement changes to *GRD Part 6* in line with recommendations of Improving Roadside Safety (Austroads 2014), i.e.: • removing focus on clear zones • greater use of flexible barriers that include wire rope safety barriers (WRSB), noting the implications associated with their maintenance in remote areas. • use other road design features to reduce FSI risk • Safe System + economic optimisation approach for each road location/stereotype.	*GRD Part 6* (2018 draft) Emphasis has amended to risk reduction (clear zone concepts still included). Inclusion of Table 5.1: Crash types and effectiveness of treatments, provides greater information on treatments. Safe System and economic optimisation included but in a general sense. A method for this optimisation would need to be outlined.	Noted.
	Presence of roadside slopes steeper than 1:3.5.			Noted.
	Roads with narrow clear zones.			Noted.
	Severe roadside hazards such as trees, poles, embankments.			Noted.
	High density of hazards (> 50 per 100 m).			Noted.
Amend the following Parts ***GRD Part 3*:** **Section 7.1: Third paragraph: add dot point: 'The risk of run-off-road casualty crashes is greatly increased where a curves radius < 600 m is combined with a grade > 6% in high-speed environments.'** **Section 8.5.5: First paragraph: add dot points:** • **Adverse crossfall should be avoided on high-speed roads with downhill grades steeper than 4%.** • **If the steep (i.e. ≥ 6%) downhill grade continues for long distances, consider lowering the speed limit for this section of road. Refer *to GRS Part 3* (Austroads 2008a) for guidance on speed limits.** ***GRD Part 4*:** **Section 4.4: amend the first paragraph to read: 'Approach speeds to an intersection should be reduced to minimise the impact forces should a crash occur. The design speed for traffic on a priority road at intersections will also depend on the alignment standard adopted for the road in general (*GRD Part 3*).'** **Refer to intersection treatments and safety benefits be considered by the TMWG for inclusion in the *GTM Part 6* (Austroads 2017h).**				

Appendix D Safe System Practice Amendments to the Guide to Road Design – Suggested Amendments

The *Safe System Practice Amendments to the Guide to Road Design* (IR-232-15) (Austroads 2015g) research report provided many comments and these are outlined in Table D 1 – Table D 10. This report provided suggestions based on editions of the Parts prior to 2012 whereas the suggested amendments in Table D 1 relate to the updated Parts. It should be noted that the Parts may have structure and content changes and references to sections may change.

Table D 1: *GRD Part 1: Introduction to Design* (2015k)

Section	Comments	Suggested amendments	Road Design Task Force determination
1	**Scope of the Guide to Road Design**		
1.2	The purpose of road design is to produce economical and efficient road designs and it is suggested that this be amended to incorporate the adoption of, or embracing of, Safe System principles. 2015 edn, Road Safety and Road Design contained in Section 2.3. The consideration is the prominence or first reference to the Safe System principles.	Consider expanding Section 1.2 to bring the reference to Safe System principles earlier in the Part.	Suggest that the emphasis should be changed – 'the purpose of road design is to produce as safe a road network as is practically affordable that is also economical and efficient'.
1.3	The application of the Guide to Road Design provides commentary on consideration of the capability and behaviour of road users, and reinforcement of the recognition and link to the Safe System principles is suggested. Include commentary on designing roads, following the Safe System principles.	Same as above.	Emphasise safe roads that are economical and efficient.
2	**Context of the Road Design Process**		
2	This section outlines a possible final approval process that may rest with persons removed from the design process. Further commentary is needed advising on the process for making a final decision on the incorporation of Safe System elements into the design, and for the rationale if they are not incorporated. A clear process is needed to assign responsibility. Need to be considered in context of interaction with other influences on the design, e.g. cost, environmental impact. 2015 edn, Section updated and restructured. Figure 2.1 (2010 edn) Project management delivery paths not included.	Retain current commentary.	Need to value safety more highly and much less emphasis on the accrual of very small benefits by a large number of vehicles – which is a spurious argument.

Section	Comments	Suggested amendments	Road Design Task Force determination
3	**Road Design Philosophy and Principles**		
3.1	Commentary is provided on the aim of design to 'optimise the operational efficiency and safety within given constraints'. The designer needs to be provided with clear guidance in determining the balance between the adoption of the Safe System principles and consideration of competing needs and constraints Suggest that consideration of the safety aspects, i.e. following the Safe System approach be the highest priority and recognising other competing priorities.	Consider strengthening the emphasis on safety outcomes.	See comment on Section 1.2 and 2 above.
3.4.2	The consistency of the road for the same function or classification is supported by elements of the road. Section 3.4.2 on cross-section, qualifies this approach, by using the term 'should', which allows inconsistency in the decision on the element. Expand on the idea of similar cross-sections as a way of maintaining homogeneity.	Consider strengthening the emphasis on consistency of cross-section to assist in a providing a consistent appearance to drivers for the same classification of road.	This is not considered important and is not a very judicial use of very limited funds. It is aspirational and should be positioned as such.
3.4.3	The designer, in determining an operating speed for the road, needs to consider the road and roadside features and select a speed that is appropriate for the road and roadside characteristics and the resultant crash types or crash impacts that may occur. 2015 edn, Section 3.4.3: Design Speed	Retain current commentary.	Agreed.
4	**Design Considerations**		
4	The design considerations should include safety alongside the economic, social and environment, as factors to consider. Greater emphasis on the consideration of safety issues is needed. 2015 edn includes reference to safety.	Retain current commentary.	Needs rewording to emphasise safety.
5	**Design Process**		
5.1	Audits are part of the design process, and incorporating a Safe System audit stage into the design process would be appropriate. 2015 edn, Figure 5.1: Typical road planning and design process, includes detailed design, but not any greater design-related detail. As part of the design process a design audit may be undertaken, and this matter is contained within *GRD Part 8: Process and Documentation* (Austroads 2009).	Retain current commentary.	Scoping should include a problem statement that encompasses all the identified issues to be mitigated or resolved. All projects should be assessed (audited) against Safe System principles.
5.2.3	The emphasis on providing a safer road would be appropriate in the scoping of the project. An emphasis should be placed on building a safer road. 2015 edn, Section 5.2.3 deleted.	Nil.	–

Table D 2: ***GRD Part 2: Design Considerations*** **(2015i)**

Section	Comments	Suggested amendments	Road Design Task Force determination
1	**Design Objectives**		
1.1	Road safety is within the list of design objectives, but the emphasis on safety through the adoption of the Safe System principles is not listed. The prominence of this objective needs to be raised.	Consider strengthening the emphasis on safety outcomes.	Agreed.
1.2	The strategic fit of the project lists government policies and economic strategies, and whilst the Safe System is government policy, the emphasis on safety is not disclosed. Reinforcing the safety element could be achieved by listing the road safety strategies with the other strategies. 2015 edn, Section 1.4: Safety Objectives considered appropriate for this information.	Retain current commentary.	Agreed, possibly emphasise the importance of safety by referencing Section 1.4.
1.4	The safety objectives should have a reference to the Safe System principles. The Safe System principles should be outlined as part of the safety objectives. 2015 edn, Section 1.4 contains some of the concepts aligning with the Safe System principles.	Retain current commentary.	Agreed.
1.4.1	The emphasis on eliminating or reducing the impacts of crashes should be included to achieve a safer road environment. Suggest adding dot point to this effect. 2015 edn, Section 1.4.1 has expanded the information relating to the Safe System principles.	Retain the current commentary.	Agreed.
1.4.2	To support the Safe System principles, include the Safe System elements of speed, separation of road users, etc. in this section. 2015 edn, Section 1.4.1 has expanded the information relating to the Safe System principles.	Retain the current commentary.	Agreed.
1.4.2	Add commentary on ensuring that the speed limit and operating speed are appropriate for the intersection type based on the Safe System speeds for collision types. 2015 edn, Section 1.4.1 has expanded the information relating to the Safe System principles.	Retain the current commentary.	Agreed.
1.4.2	The design needs to establish a road environment that is 'forgiving'. This includes implementing measures to keep the crash impact forces below the thresholds where fatalities and serious injuries occur. 2015 edn, Section 1.4.1 has expanded the information relating to the Safe System principles.	Retain the current commentary.	Agreed.
1.5	Community expectations are mixed, and the adoption of the Safe System approach will need community education, so they become supporters of the approach. Include community expectations of a Safe System so that they are more inclined to accept speed reduction and other treatments.	Consider for inclusion.	Strengthen the importance of communication and getting the public on-board. This has been particularly troublesome in NZ with local accessways.

Section	Comments	Suggested amendments	Road Design Task Force determination
2	**Context Sensitive Design**		
2	The context sensitive design approach lists factors that should be considered in developing a design solution. The trade-off of safety is inconsistent with the Safe System approach. Commentary on considering the safety factor in assessing trade-off is needed.	Consider for inclusion.	Agreed.
2.1	Using the design domain concepts refers to adopting design values that may be less safe or assessing changes in safety. Emphasis on safety and the adoption of Safe System principles when selecting design domains should be made. 2015 edn, Section 2.1 includes reference to the Safe System principles.	Retain current commentary.	Agreed.
2.3	Reference to the use of the extended design domain (EDD) when adoption of these values 'will not result in significantly higher accident rates' seems inconsistent with the development of the project that would normally have an expectation that safety would be improved. Use of the extended design domain needs to be considered with the safety outcomes of adopting these design values. 2015 edn, Section 2.3 contains reference to the use of EDD values and safety outcomes.	Retain current commentary.	Could emphasise the need to fully assess the risks associated with the use of EDD.
2.4.1	Reference is made to higher functional classes of road having higher design standards. This does not seem consistent with the adoption of safety as the main principle. Need to review the concept that higher classifications of roads have a higher design standard. Under a Safe System, all roads should be designed to minimise the crash impacts and the number of crashes, no matter what the function or traffic flow. 2015 edn, Section 2.4.1 discusses the functions of roads, with higher classification roads having higher standards. This follows the risk-based approach to design.	Retain the current commentary.	We could insert a reference to SRD2068 to improve the link between cross-section element width and safety.
2.4.2	In discussing the factors that influence design standards, the link to the Safe System principles may help designers appreciate the Safe System principles in that they do not just relate to the road component. Relate the factors to the principles involved in a Safe System, e.g. safe vehicles, safe and competent road users. 2015 edn references Section 1.4 which has been expanded to include this type of information.	Retain current commentary.	Agreed.
2.4.3	Include the Safe System speeds as a guide for when looking at other speed parameters. Matter best included in other Parts, e.g. *Guide to Road Safety Part 3: Speed Limits and Speed Management* with commentary on the speeds.	Retain current commentary.	Agreed.
3	**Design Considerations**		

Section	Comments	Suggested amendments	Road Design Task Force determination
Table 3.1	Construction factors In assessing the factors that are considered in developing a design, the safety benefits should be included as part of the 'whole-of-life' costs. The whole-of-life relates to the design life, renewal and maintenance costs. Consideration of safety benefits should be considered with the level of disruption and ease of maintenance activity. These matters could be considered within the construction factors.	Consider for inclusion.	Agreed.
Table 3.1	Industrial factors The Safe System includes the operation of the road and this includes the maintenance. Include the need to design for maintenance as well as the construction.	Same as above.	Agreed.
	Commentaries		
Commentary A	Reference is made to different levels of safety being built into a road. This seems inconsistent with the Safe System principles. Alignment with the Safe System principles is needed. 2015 edn, Commentary 2, includes this type of discussion.	Retain current commentary.	Agreed.
Commentary B and Commentary M	The value of safety benefits needs to be considered when conducting the economic analysis, and this should be referenced to reinforce this part of the economics of a project. 2015 edn, Commentary 3 includes this type of discussion. Commentary 14 provides general information and not explicit on matters.	Retain current commentary.	Agreed.

Table D 3: *GRD Part 3: Geometric Design* (2016i)

Section	Comments	Suggested amendments	Road Design Task Force consideration
1	**Introduction**		
	Nil	–	–
2	**Fundamental Considerations**		
2.2.3	The development of the cross-section (in particular) and geometry, considers the traffic volume and composition. Suggest the composition of the traffic include reference to the vulnerable road users, e.g. cyclists. 2016 edn contains greater emphasis on vulnerable road users (new Section 2.2.4: Vulnerable Road Users).	Retain current commentary.	We should insert a reference to SRD2068 to improve the link between cross-section element width and safety.

Section	Comments	Suggested amendments	Road Design Task Force consideration
2.2.4	In setting the design speed for a road, consideration is given to the types of road users. On the higher speed roads, the speed differentials of the different types of road users, particularly cyclists, needs to be considered. Suggest that consideration be included on how the differing road users should be accommodated when selecting a design speed. 2016 edn contains greater emphasis on vulnerable road users (new Section 2.2.4: Vulnerable Road Users). Reference is made to Section 3: Speed Parameters for discussion on the factors influencing design speed.	Retain current commentary.	No comments.
3	**Speed Parameters**		
3.1	Design speeds are based on the 85th percentile speeds. A cornerstone from Table 6 of Australia's road safety strategy (Australian Transport Council 2011) for Safe People is the encouragement of safe, consistent and compliant behaviour. This does not remove the need to consider the road users who travel faster than the 85th percentile speeds. Suggest that consideration should be given to the effects on road users who may make a mistake and exceed the design speed. 2016 edn, Section 3.1 includes commentary on the aim to provide a road system that contributes to the prevention of vehicle crashes. The commentary is more general than the suggested amendment but is considered to be appropriate for this section.	Retain current commentary.	We should emphasise the importance of speed management through intersections.
3.2.5	The definitions for high, intermediate and low-speed roads are provided, with low speeds being 69 km/h or less. A key issue within the Safe System context is the appropriate speeds for particular circumstances or situations. To further support the adoption of speeds, the inclusion of appropriate speeds for situations where there are pedestrians and cyclists would assist designers to adopt design speeds for these circumstances. Suggest that a further definition be added for very low speeds, i.e. 30 km/h or less for locations where there is a mix of road users. 2015 edn, Section 3.2.5, could be expanded to include appropriate speeds for situations where vulnerable road users are in close proximity to motor vehicles. The definition of terms, low/medium/high are mixed through the Austroads guides and a common definition would be helpful.	Expand to include vehicle speeds for situations where vulnerable road users are in close proximity to motor vehicle.	Agreed – see also note associated with Section 3.1 above.
3.2.3 and 3.3	The design speed for a road should be consistent for the roads of the same function or classification. This should be reinforced in the discussion provided in these sections. Suggest the selection of the design speed for roads of the same function or classification be reinforced. Commentary in Section 3.3 discusses operating speed for urban roads and includes consideration of the functional classification. This is considered appropriate.	Retain current commentary.	Disagree with researcher's comment – depends entirely on the context – hence stereotypes.

Section	Comments	Suggested amendments	Road Design Task Force consideration
3.3	Table 3.1 lists some roads by constructed form and some by function. To assist in the selection of a design speed, the typical classification or function of the road with the constructed form may be useful in reinforcing the consistent approach to road function speed and road form. Suggest that typical classifications or function be included in Table 3.1 to reinforce this consistency. Note: The speeds on the types of urban roads may need review with the changing speed management approaches in residential streets.	For consideration.	Reference to SRD2068 to improve the link between cross-section element width and safety.
4	**Cross-section**		
4.1	The considerations for the determination of the cross-section include several elements, including safety. Section 4 of *GRD Part 3* covers the verge and median areas, and suggested areas for improvement for these areas are later given in this table. The outcomes of Austroads project ST1427 Improving Roadside Safety provide an indication of the treatments for roadside areas, and cross-referencing to *GRD Part 6* (Austroads 2010d) to inform the designers of the issues with roadsides would support consideration of the safety elements.	Nil.	Reference to SRD2068 to improve the link between cross-section element width and safety throughout this section.
4.1	Figure 4.1, the flowchart includes an action to 'assess safety of selected proposal'. The outcome of this assessment then continues to preliminary design. The assessment may require reviewing the elements that preceded this action to obtain the safety outcomes being sought. Suggest that an option should be included to return to the elements that precede this action.	For consideration.	
4.2.5	Table 4.3: wide kerbside lanes, 4.2–4.5 m wide, are suggested for locations where motorists and cyclists can use the same lane. In the urban situation, it is likely the posted speeds would be 60 km/h or 80 km/h and the separation between the motor vehicles and cyclists is minimal. The provision of these wide lanes to cater for both vehicle types should be supported with appropriate posted speeds, i.e. 30 km/h or less, or provide a separate path for the cyclists. See also comments for Section 4.8.11. Reducing speeds to 30 km/h on an arterial road which contains an on-road bicycle lane may not be appropriate for capacity and driver expectation issues.	Retain current commentary.	
4.2.6	Rural road widths – Table 4.5 suggests shoulder widths for a range of AADTs, from 0 m for < 150 vpd to 2.5 m for > 3000 vpd. Where there are significant numbers of cyclists, consideration should be given to sealing the shoulder.	Same as 4.2.5.	

Section	Comments	Suggested amendments	Road Design Task Force consideration
	The table does not refer to any speed limits but relies on the AADT to indicate the width of the shoulder and minimum shoulder seal. With possible high-speed differential and possibly narrow shoulders, the cyclist may be near an overtaking vehicle, travelling at a high speed. Alternatively, separate bicycle paths should be provided to remove the need for sharing of the same road space. Suggest Table 4.5 includes reference to appropriate speeds limits where cyclists share the same road space.		Reference to SRD2068 to improve the link between cross-section element width and safety throughout this section.
4.7	Guidance is provided on the main functions of medians and that they are commonly provided to improve safety. Separating the opposing flows provides safety benefits and there is little guidance on when a median should be provided. Suggest that additional guidance on when, or the circumstances in which, a median should be provided.	Consider for inclusion.	
4.7.1	Median widths are suggested in Table 4.14 for a range of situations. Recent research on roadside safety, Austroads project ST1427 Improving Roadside Safety, provided information on treatment of roadsides. The widths of medians were included in the research and it is suggested that the widths in this table be reviewed after considering the outcomes of project ST1427. 2016 edn, Table 4.14: Urban median widths, recovery area amended to 20 m. Report suggests the installation of barriers.	Retain current commentary.	
4.7.1	Median widths are suggested in Table 4.14 for a range of situations. Recent research on roadside safety, Austroads project ST1427 Improving Roadside Safety, provided information on treatment of roadsides. Vehicles have been found to cross medians that are wider than 15 m, and the commentary refers the designer to the jurisdiction policy. The use of median and/or centre-of-road barriers has been demonstrated to reduce crashes, and provision of a median barrier to reduce crashes could be strengthened.	Same as previous.	
4.8.1	The provision of bicycle facilities is indicated to be based on a hierarchy of needs, with off-road paths being the highest priority. The priorities then include on-road bicycle lanes, but there is no reference to the posted speed of the road for these facilities. The mixing of the cyclists with the motor traffic should occur at very low speeds, i.e. 30 km/h or less, and so separate cyclist paths should be provided. Moving towards the Safe System, Austroads report AP-R410-12 *Cycling on Higher Speed Roads* (Austroads 2012a) provides some information on catering for cyclists in these situations. 2016 edn, reference to AP-R410-12 not included. Consider possible improvements contained within the report.	Consider for inclusion.	

Section	Comments	Suggested amendments	Road Design Task Force consideration
4.8.4	On roads which carry < 3000 vpd, cars and bicycles share the road. There is no distinction on this guidance with travel speeds. Guidance for > 3000 vpd and higher speeds indicates that the lane should be wide enough for the cars and bicycles to be able to travel side-by-side. It is suggested that consideration be given to separating the cyclists, particularly on higher speed roads. Figure 4.28: Road clearances and Table 4.17: Clearance to cyclist envelope from adjacent truck provides guidance on clearances and posted speed limits. Section 4.8.4 amended to reference local streets that carry < 3000 vpd.	Retain current commentary.	Reference to SRD2068 to improve the link between cross-section element width and safety throughout this section.
4.8.4	Where there is a demand for cyclists to pass within the bicycle lane during times when the road is congested, a minimum bicycle lane width of 2.0 m is suggested. Whilst the congested road may be operating at a lower speed limit, the proximity of the vehicles to the passing cyclist may be close. Separation of bicycles from motor traffic would be preferable, particularly where the speeds are > 60 km/h. Suggest that along the higher speed roads, particularly urban roads, the bicycle paths be separated from the motor traffic. 2016 edn, Section 4.8.1 includes treatments for cyclists, including off-road bicycle paths and supporting commentary relating to separation between motor vehicles and cyclists. A cross-reference for warrants for the type of facility is provided to *GTM Part 4: Network Management* (Austroads 2016h).	Retain the current commentary.	
4.8.5 (4.8.10,11)	Where kerbside parking is permitted, it is suggested the separation be increased by 1.0 m from the back of kerb to provide clearance from car doors. The interaction between the bicycles and vehicles entering and leaving, and vehicle occupants leaving their vehicles provides a conflict point. Suggest that the provision of a bicycle lane alongside the parking lane be provided where there is a low turnover of vehicles. (As a guide AS 2890.5 *Parking Facilities – On-street Parking* provides some indicators for low, medium and high turnover parking spaces). The commentary does not reference vehicle turnover. Reference to AS 2890.5 would strengthen this guidance to considerations for separated bicycle lanes.	Include a cross-reference to AS 2890.5.	Agreed.

Section	Comments	Suggested amendments	Road Design Task Force consideration
4.8.6	Contra-flow bicycle lanes are considered suitable in urban environments where sufficient road width is available to provide a safe treatment. The contra-flow lane should be physically separated from the motor traffic but is considered generally appropriate without the physical separation in speed zones up to 50 km/h. In this lower speed environment, there is a possibility of a head-on crash with speeds > 50km/h. Suggest that contra-flow lanes be physically separated from the motor traffic lanes to reduce the possible conflict points for head-on crashes. 2016 edn, includes reference to contra-flow lanes without physical separation to 50 km/h are only appropriate in speed zones up to 50 km/h.	Retain current commentary.	Agreed.
4.8.7	Exclusive bicycle lanes – these are preferred without any physical separation with Table 4.17 indicating speed ranges from 60 km/h to 100 km/h posted speed limit. Separation of the bicycle lane from the motor traffic in these speed ranges would be preferable. 2016 edn, Section 4.8.7 includes reference to separation of bicycle facilities on high-speed roads, i.e. > 80 km/h (Table 4.18).	Retain current commentary.	Agreed.
4.8.8	Peak period exclusive bicycle lanes – these are suggested as a possible treatment when there is no other option possible. During the peak traffic flow times, the road commonly has a clearway posted, preventing kerbside parking. The vehicle speeds during these times of peak traffic flow may be lower than the posted limit, but there may be a large speed differential, particularly on the higher speed roads (accepting that the higher speed roads may not allow parking at any time). This type of treatment may be appropriate on roads where the speed differential is low. Suggest this section consider this guidance.	Retain current commentary.	Agreed.
4.8.9	Sealed shoulders – refer to comments for Section 4.2.6.	See 4.2.6.	Agreed.

Section	Comments	Suggested amendments	Road Design Task Force consideration
4.8.10	Bicycle/car Parking Lanes – with Parallel Parking: The combination of parking and cyclists introduces conflict points with vehicles entering and leaving the spaces and vehicle doors being opened. The widths suggested in Table 4.18 (2010 edn) are indicated to provide acceptable clearances with speed limits up to 80 km/h. This would result in a high-speed differential between the cyclists and the vehicle traffic. There are conflict points with this arrangement, and the widths to reduce the likelihood of conflict may result in other vehicles travelling in the road space. A high turnover of vehicles within the parking areas would increase the likely conflicts. It is suggested that the provision of this type of facility be reviewed for appropriateness, or if there is no other treatment available, it is provided on the low-speed roads and where turnover of parking within the parking areas is low.	See 4.8.5.	Agreed.
4.8.10	Bicycle/car Parking Lanes – Angle Parking: The hazards are identified within the guide for the awareness of the designer. The reversing requirement in leaving the parking bays can be difficult for some drivers, with visibility restricted by other parked vehicles. It is suggested that the provision of this type of facility be reviewed for appropriateness or if there is no other treatment available, it is provided on the low-speed roads and where turnover of parking within the parking areas is low.	Consider provision of this facility in low-speed environments.	Agreed.
4.8.11	Wide Kerbside Lanes – the provision of these to accommodate cyclists is suggested on roads up to 80 km/h. The speed differentials could be large on the higher speed roads. Parking is generally still permitted in the wide kerbside lane, which creates conflicts with the vehicles entering and leaving the parking space and vehicle occupants entering and leaving the vehicle. Suggest that if a separate cycle path is not able to be provided, the use of wide kerbside lanes be considered in conjunction with the speed limit and level of vehicle activity moving into and out of the lane.	See 4.8.4.	Agreed.
4.9.2	Bus Lanes: Table 4.21 (2010 edn) indicates a mix of vehicles including bicycles, up to 80 km/h. The speed differentials and issues with parking identified through Section 4.8 of *GRD Part 3* are also relevant in the development of Table 4.21. Suggest that commentary be provided that the use of kerbside lanes for bicycles is considered as a treatment when there are no alternatives to separate the bicycles from the motor vehicle traffic.	See 4.8.4.	Agreed.

Section	Comments	Suggested amendments	Road Design Task Force consideration
4.9.2	Undivided roads Collector and distributor roads may have 60 km/h speed limits posted. The combination of parking and bicycle lanes are suggested along these roads, which have similar issues to those previously referred through Section 4.8. Suggest that the provision of the bicycle/shared lane be considered in the lower speed and low-volume roads.	Retain current commentary.	Agreed.
4.9.2	Providing for cyclists within bus lanes The considerations for providing for cyclists in bus lanes should consider the speed differential of the vehicles along the road. Suggest that the design speed be included in the considerations. 2016 edn, Table 4.23: Width of kerbside bus lanes incorporating bicycle lanes, provides varying lane width related to speed zone.	Retain current commentary.	Agreed.
4.9.2	Table 4.22 (2010 edn) provides guidance on the width of bus lanes on roads up to 80 km/h, with indication that the lanes can be shared with cyclists. Consideration should be given to the speed, if providing for bicycles.	See previous.	Agreed.
4.10.2	On-street Parking – Parallel Parking Entering and leaving parking spaces from a through traffic lane introduces slow-moving and reversing movements that may conflict with the traffic flow. These movements would need to be able to be identified by other drivers so they can take appropriate actions. It is suggested that the clearances be provided from 0.5 m for a 60 km/h road, increasing to 3.0 m where the speed limit is 90 km/h or greater. Suggest that parking, with the resulting manoeuvres required to enter and leave a parking space, be on roads with lower speed limits. 2016 edn does not include reference to speed zones. Guidance relates to turnover of vehicles. This information could be expanded to provide guidance relating to speed zones. AS 2890 would also need amending.	Consider expanding the information as suggested. Matter for TMWG, provision of parking covered in *GTM Part 5*.	Agreed.
4.10.3	On-street Parking – Angle Parking Similar issues that arise with parallel parking arise with angle parking. Utilising the through lane for manoeuvring creates conflict points. These conflicts preferably would be removed, or if unable to be removed, the speeds managed to reduce the likelihood of conflict occurring.	See previous (4.10.2).	Agreed.

Section	Comments	Suggested amendments	Road Design Task Force consideration
4.10.6	Parking for people with disabilities – On-street parking for people with disabilities creates conflict for the person entering or leaving the vehicle. Access to the footpath is not always obvious or provided in a location that requires travel along the road. Preferably, spaces would be provided in a nearby off-street car park, or traffic speeds managed to reduce the likelihood of conflicts occurring. Suggest that on-street parking is provided on low-speed roads and when there is no other off-street car park available.	See previous (4.10.2).	Agreed.
4.11.1	Service roads – two-way service roads are indicated to increase confusion and glare issues with headlights when narrow outer separators are used, and increase conflicting movements at intersections. For these reasons, one-way service roads are indicated to be preferred. Traffic speeds in service roads should be established considering the conflicting movements and property access arrangements. Suggest the use of a two-way service road when there is no alternative, and that the conflict points and operation issues are considered in determining whether to proceed with the two-way operation and strengthen the lower speed limits for these roads. The matter is an issue for *GTM Part 5: Road Management* (Austroads 2017g).	Nil.	Agreed.
4.11.2	Outer separator – guidance is provided on typical widths and slopes for the outer separator. Commonly, the traffic flow in the service road will be in the same direction as the main carriageway, but this is not always the case. In these circumstances, the outer separator forms a similar function to a median and cross-over crashes may occur. Suggest that consideration be given to providing barriers in these circumstances.	Consider for inclusion.	Reference to SRD2068 to improve the link between cross-section element width and safety throughout this section.
4.11.2	Outer separator – the width of outer separators are usually relatively narrow and errant vehicles may travel across the separator. Providing roadside furniture in a separator needs to consider this possibility. The crash impact should be minimised should a crash occur. Suggest that roadside furniture, including poles, be frangible or protected from errant vehicles to minimise the impacts of a crash should it occur.	Consider for inclusion.	Reference to SRD2068 to improve the link between cross-section element width and safety throughout this section.
4.11.3	Urban border – the urban border includes provision for footpaths. The proximity to the traffic lane typically will be narrow, with typical urban border widths indicated in Table 4.28 being 4.6 m to 7.3 m. In many instances, these distances will be narrower, particularly on constrained sites where road widening has occurred from original construction. Preferably greater separation of the motor vehicles from the pedestrians would be undertaken. Where this is not able to be achieved, then other actions, such as installation of barriers or reducing traffic speeds should be considered.	Consider for inclusion.	Reference to SRD2068 to improve the link between cross-section element width and safety throughout this section.

Section	Comments	Suggested amendments	Road Design Task Force consideration
4.12.2	On major urban roads, it is suggested that the provision of an indented bus bay may be required. The slowing and stopping of the bus results in a speed differential for the users of the lane the bus uses. Preferably, the bus would stop clear of the traffic lane, to separate the vehicles with the speed differential; however, the difficulties of re-entering the traffic flow can cause potential conflict and operational delays to the bus. Consideration should be given to separating the bus travel from the through lanes, e.g. with the installation of bus lanes, or the risks of the bus re-entering the traffic flows or retaining the stopping position within a traffic lane be assessed. Consideration could also be given to the speeds along the section of road, where the bus has to undertake these movements. Guidance on bus lanes is contained in Section 4.9.2. Matter needs to be considered in *GTM Part 5* (Austroads 2017g).	Consider for inclusion.	Should reference Austroads Guide to Traffic Management (GTM).
4.12.3	Bus stops in rural areas can have low passenger numbers and infrequent usage times. The stops should be identified to alert other road users to their presence, and if appropriate, the times they are used, e.g. for school bus stops. The pick-up and set-down areas are usually near the traffic lanes, which can bring the passengers in close proximity to the passing road users. These areas should be separated from the other road users and consideration given to preventing errant vehicles from reaching the passengers.	Consider for inclusion.	Agreed.
4.12.3	The location of bus shelters is indicated to be beyond the clear zone. Errant vehicles may travel across this area and consideration to preventing the errant vehicle reaching the bus shelter should be considered. The matter is a balance between accessibility and risk. Siting of bus shelters includes consideration of other matters including road geometry.	Retain current commentary.	Consider protection with appropriate risk profile.
5	**Sight Distance**		
5.1	The sight distance provided along a road should be consistent with roads of the same function or classification. It is suggested that the goal to provide the same roads with consistent standards should be reinforced. Design philosophy includes the consistent application of the design standards.	Retain current commentary.	Agreed.

Section	Comments	Suggested amendments	Road Design Task Force consideration
5.2	Object height The sight distance parameter for object height is indicated to be a compromise between the length of sight distance and the cost of construction. To provide drivers with awareness of the road conditions, consideration should be given to adopting a zero-object height. Where this is not able to be adopted, supporting treatments, such as pavement widening (lane or shoulder) to allow manoeuvring space, or reducing the speed zoning, should be considered.	Consider for inclusion.	This is actually not Safe System thinking and the adoption of a zero-object height in isolation could be very expensive. A driver only needs to see enough of the road pavement to assist delineation and predictability. Allowing manoeuvre space for anything above zero is unnecessary.
5.2.2	Drivers are assumed to be alert when driving; however, the reaction times can vary with the drivers, e.g. older drivers may have a longer reaction time compared with younger drivers. A range of driver reaction times is contained in Table 5.2. The adoption of reaction time values less than the desirable values should be assessed with the road conditions, some of which are outlined in Table 5.2. In adopting these lower parameters, the impact this may have should be assessed and consideration be given to providing supporting treatments.	Consider for inclusion.	A driver has only to slow to < 30 km/h to achieve a Safe Aystem compliant impact. While it is agreed that the emphasis should be on the importance of retaining reaction times, this has to be considered with additional braking force required.
5.5.1	The provision of manoeuvre capability for objects 0.2 m or greater is to be considered. For objects less than 0.2 m, the manoeuvre capability is not needed as the objects are assumed not to be a major hazard to vehicles. Objects less than 0.2 m may cause a reaction from drivers, and it is suggested that consideration be given to providing the manoeuvre capability for these situations.	Consider for inclusion.	Disagree, much less likely to cause death or serious injury to vehicle occupants for the reasons given for 5.2 above.
6	**Coordination of Horizontal and Vertical Alignment**		
6.1	The guide indicates that where possible, the horizontal and vertical alignments should be coordinated for appearance and safety. Suggest that where this is not able to be achieved, a cross-reference for actions to support the differences in speeds be provided.	Consider for inclusion.	Where necessary, the designer should assess how misleading the geometry is for drivers and modify the design accordingly.

Section	Comments	Suggested amendments	Road Design Task Force consideration
6.2	It is suggested that relationships, as described in the guide, should be applied to the design wherever possible for safety, aesthetic and drainage reasons. Suggest that the application for safety consideration be strengthened to apply the relationships, unless a risk assessment is undertaken of the alternatives and is acceptable to the jurisdiction. Unclear on suggestions.	Nil.	Not sure how big an issue this is – some guidance about the extent of consideration that impinges on safety.
7	**Horizontal Alignment**		
7.6.1	The selection of a curve, particularly the minimum radius curves as shown in Table 7.5, relies on the development of side friction. The designer should be aware of the surface conditions or characteristics to develop the friction. Suggest that designers consider the surface conditions or characteristics that occur over the design life of the surface in adopting the radii or surface material. 2016 edn, Section 7.6 contains, (in part), commentary that the side friction depends on the tyre and condition of the road surface. Could expand to include the life of the surface for the assumed condition.	Consider for inclusion.	Disagree – designers have to assume a competent road surface capable of delivering the appropriate level of friction for superelevation and braking.
7.9	Pavement widening on curves to allow for tracking and overhang of vehicles supports the separation of the vehicles. Curve widening in the shoulder areas to provide improved opportunity for an errant vehicle to be corrected should be included as part of the considerations of the curve design. Suggest that on curves, widening of the shoulders be considered as part of the design of the curve. 2016 edn includes Section 4.3.4 Sealed shoulder widening on the outside of curves. A cross-reference to Section 4.3.4 would strengthen this approach.	Consider for inclusion.	Paper on the application of asymmetrical shoulder widening on curves could be included in appendices.
8	**Vertical Alignment**		
8.6.3	Hidden dip grading – commentary is provided on avoiding a hidden dip, wherever possible, due to perception or illusion being created of continuity of the pavement and obscuring views of obstacles on the road and approaching vehicles. This can be similar to the effect of a 'hidden hazard'. Commentary is provided that if the hidden dip cannot be avoided, supportive treatments that inform the drivers of the road profile, such as road edge guide posts, can be used to assist drivers. Suggest that the section be strengthened to indicate that hidden dips be avoided, but if this cannot be achieved, reference to supporting treatments to alert drivers to this circumstance.	Consider for inclusion.	Probably more relevant to 6.1 – tends to be more a retrofit issue than 'greenfields' – sharp crests and sags within straight or larger radius curves.

Section	Comments	Suggested amendments	Road Design Task Force consideration
8.6.3	Floodways – the commentary raises the issue of drivers entering a floodway with water flowing across the floodway. The flow depth may be able to be indicated to the drivers through the installation of depth markers, but the flow velocity and pavement surface condition may not be able to be determined by the drivers. Suggest that when a floodway is operating and the road pavement conditions cannot be observed by the driver, drivers be advised not to cross the flowing water. (Note that the management of floodways is a current Austroads project). This matter is suggested for further guidance in report AP-R481-15.	Refer to consideration of AP-R481-15.	Agreed.
9	**Auxiliary Lanes**		
9.4	Figures 9.1 and 9.2 Overtaking lanes – Figures 9.1 and 9.2 show the slow lane merge into the overtaking or faster lane. From the experiences in Sweden, where the fast lane merges into the slow lane, this merge arrangement to assist in the speed differentials of the two lanes could be considered.	Consider for inclusion.	Requires further discussion by the RDTF. (Having a run-out shoulder would seem to provide greater level of safety than a run-out in the median).
10	**Bridge Considerations**		
10.2	Designers should consider the safety of all road users, with reference to cyclists, when determining the appropriate cross-section. Suggest that reference to cyclists be a normal part of the comments, not in brackets. Pedestrian facilities should be similarly identified. 2016 edn includes 'Designers shall consider the safety of all road users (especially cyclists) when determining the appropriate'. Considered appropriate.	Nil.	Reference to SSP2068 to improve the link between cross-section element width and safety also applies to bridges.
10.2	Commentary indicates that, where necessary, a bridge should be provided with additional width to carry a kerbed footway. Similarly, comments from the second paragraph, separating pedestrian usage from the motor traffic, should be suggested.	Consider for inclusion.	Only where it is provided on the rest of the corridor or is considered reasonable future-proofing.

Section	Comments	Suggested amendments	Road Design Task Force consideration
	Appendices		
A1	The guide suggests that extended design domain (EDD) values are applied in certain circumstances, i.e. reviewing existing geometry of roads, realignment of a few geometric elements on existing roads in constrained locations, etc. The application of these values requires road agency approval, and only one EDD parameter should be used in any application. One element that may strengthen the use of EDD parameters is the assessment of the safety issues occurring at the location, and these parameters are applied where it is demonstrated that the location does not have safety issues. This may be implied from other parts of the Guide, but it is suggested that it would be useful to reinforce this aspect in this section.	Consider for inclusion.	Agree that use of EDD may still result in an improvement of the balance of safety in a specific location and is therefore potentially better than doing nothing.
A3.1	The use of EDD values is based on an acceptable level of driver capability. The degree of capability can vary between the age groups and levels of experience. Determining what is an acceptable level of driver capability may be difficult for some designers to adequately assess. Suggest that guidance be provided on driver capability.	Retain current commentary.	Agreed.
A3.3	Vertical Height Parameters – comments as provided for section 5.2.	–	–
	Commentaries		
Commentary 8	The relationship between shoulder width and crashes should be reviewed following the completion of the Austroads project ST1427 *Improving Roadside Safety* (Austroads 2014g). 2016 edn, Commentary 7.	Consider for inclusion.	Should be consistent.
Commentary 9.6	Guide to choose type of facility for cyclists in New Zealand – provides Figure C9.2 for provision of facilities for cyclists in relation to traffic speed and volumes. The figure suggests a range of speeds and volumes and treatments suitable for cyclists. The separation of cyclists from motor traffic due to the differences in speed and vehicle mass follows the Safe System principles. Suggest that the application of this figure be reviewed. 2016 edn does not contain Figure C9.2.	Nil. Note: figure not contained in 2016 edn.	Review the need for the retention of the chart.

Table D 4: ***GRD Part 4: Intersections and Crossings: General* (2017f)**

Section	Comments	Suggested amendments	Road Design Task Force considerations
1	**Introduction**		
1.3.1	Update to incorporate reference to current National Road Safety Strategies.	Completed (Section 1.3.3)	Agreed.
1.4	Explain how using EDD values might conflict with Safe System principles. Part 2 discusses this matter.	Considered appropriate.	Agreed.
1.6.2	Currently, lighting is up to each jurisdiction. Consistent application of this type of facility should be included to provide road users with a consistent road appearance for similar roads. Now Section 3.7.2. Linked to AS/NZS 1158-set (*Lighting for Roads and Public Spaces*). Focus on conflict points, e.g. intersections, bus stops, and on-road obstacles, such as traffic island kerbing.	Considered appropriate.	Agreed.
1.6.3	The clear zone concept may limit the area that is examined for, or considered for, the placement of infrastructure. Considerations should be to the whole road reservation as errant vehicles may travel well beyond the current clear zone distances. 2017edn Section 3.7.3.	Consider for inclusion.	Agreed – ref *GRD Part 6* (Austroads 2010).
1.6.4	Designers should consider the maintenance activities and take into account placement of infrastructure elements so that traffic disruption is minimised. The aim is to retain consistent traffic operations. 2017 edn Section 3.7.4.	Consider for inclusion. Note included.	Agreed.
1.6.4	Add consideration that in urban areas with large pedestrian numbers, it may be necessary to provide barriers for protection on pedestrian islands.	Consider for inclusion.	Agreed.
2	**Types of Intersections**		
2.2	The design should commence with the identification of treatments that meet the principles and then, if this is unable to be implemented, determining the next best treatment, including any supporting treatments to achieve the goal of meeting the Safe System principles.	The types of intersections and process for selection are referenced to *GTM Part 6: Intersections, Interchanges and Crossing*. Considered appropriate.	GTM should reference the Safe System Assessment Framework.
2.3	All intersection types can be signalised; change text to reflect this, and state when signalisation or metering of roundabouts is usually required or why roundabouts are not usually signalised. 2017 edn, the types of intersections and process for selection are referenced to *GTM Part 6: Intersections, Interchanges and Crossing.*	Considered appropriate.	Agreed – We could re-position roundabouts as being more *Safe System* compliant?

Section	Comments	Suggested amendments	Road Design Task Force considerations
3	**Road Design Considerations for Intersections**		
3.1	The design considerations for an intersection needs to consider the principles of separation of, and reducing or minimising the number of conflicting movements, reducing the impact forces on road users should a collision occur, and providing an alignment that users can understand to provide them with certainty on their movements through the intersection. Treatments that meet or move towards meeting these aims could be listed to assist in the development of the design layout. 2016 edn, This suggestion links to *GTM Part 6*.	Considered appropriate.	Agreed – We could re-position roundabouts as being more *Safe System* compliant.
3.2	Road designers need to consider the characteristics of road users as well as the different types of road users, e.g. younger drivers, older drivers. 2016 edn, Section 3.1.	Consider for inclusion.	It is unclear what would be done differently.
3.2	Motor vehicle drivers – include reference to the younger/older persons to reinforce consideration for the characteristics that these groups exhibit, i.e. consideration for the lack of experience in the younger driver or the reduced perception and response times that older persons may experience. 2016 edn, Table 3.1.	Consider for inclusion.	Safe System designs for high-risk road users. This will require clarification when considered.
4	**Design Process**		
4.1	Fig 4.1 The design process does not include an audit of the design and this should be included. Figure 4.1 includes an evaluation process step, with input of constraints. The assessment of the safety performance should be included in a review and identified in the flow chart. Include a Safe System audit/review as part of the design/evaluation process. 2016 edn does not include Figure 4.1.	Nil.	No comments.
Table 4.1	Current situation The identification of possible conflict points should be included. The designer should then assess methods to eliminate or reduce the impact of conflict points that are unable to be eliminated, to reduce the impact on vehicle occupants should a crash occur. Include the identification of potential conflict points that might not be highlighted by the crash history.	Considered appropriate.	Agreed – a matter possibly for the GTM.
Table 4.1	Changes in the future Outputs – speed zoning is a general comment, but the issue is the approach speeds, and these may be different to the speed zoning. Include potential for future innovations in road safety, as well as traffic changes.	Consider for inclusion.	Agreed – though it is believed that it will be very difficult to implement. More a matter for the GTM?

Section	Comments	Suggested amendments	Road Design Task Force considerations
Table 4.2	Road Design The approach speeds on all legs are key considerations. Treatments may also be implemented on the major legs, and commentary on approach speeds should be included. Refer to speed-reducing treatments on the minor leg of an intersection. The approach speed on all legs of an intersection is important, and this emphasis is inconsistent with the Safe System principles.	Consider for inclusion. Note: included in Table 4.2.	Agreed – importance of speed management, provision of appropriate visual clues and assessment of driver workload should be emphasised. Also needs to be updated in GTM.
4.4	Design speeds – the speeds which can be tolerated in a crash need to be understood. The direction of impact and the effect of reducing speed need to also be considered. The issue is determining when lower limits are to be installed, taking into consideration the driver's acceptance. Setting the design speeds of the approaches to the intersection has an influence on the safety performance. The speeds should be managed to reduce the impacts of collisions, should they occur, to achieve a safer intersection. Add commentary to reinforce the need to consider approach speeds, to minimise the impacts of collisions when setting a design speed through the intersection.	Consider for inclusion.	Agreed – it is believed that that this section requires a significant re-write to reflect Safe System tolerances and associated speed management.
4.5.1	Cross-section elements The aim for consistent cross-section along roads of the same function or classification should be included. 2016 edn includes commentary on consistent cross-sections for roads of the same classification.	Retain current commentary.	Reference Austroads project SRD2068.
4.5.4	The roadside area includes the areas used by pedestrians, and this should be reinforced. The reinforcement of clear zones at intersections is important. The conflict with pedestrians at intersections is not emphasised here. The treatment of the intersection for these different road users should be emphasised.	Consider for inclusion.	Agreed – needs wider discussion. What constitutes roadside at an intersection need to be clarified.
5	**Design Vehicle**		
5.3	Checking vehicles – the acceptance of the vehicle travelling across the area outside of the road pavement, identifies the potential risk for pedestrians. The retention of this approach should be reviewed.	Consider for inclusion.	Not sure about the wording 'over-running' kerbs where footpaths are concerned – could improve wording.
5.5	Add further commentary on the role visibility plays in allowing drivers time to react to hazards.	Retain current commentary.	Agreed.

Section	Comments	Suggested amendments	Road Design Task Force considerations
6	**Public Transport at Intersections**		
6.3.2	The separation of different types of road users is preferred. Providing for Buses and Cyclists – in constrained areas, the bus lane may be shared with cyclists. Separation of road users is desirable. 2016 edn includes the reference to separated bus and bicycle lanes.	Retain current commentary.	Agreed.
6.3.3	The placement of high levels of pedestrian activity at the stops places pedestrians in a vulnerable area. The protection of pedestrians needs to be considered, which could include treatments such as barriers or vehicle speed reductions. Bus Facilities in Medians – providing this high activity operation in a median places the users between traffic flows, and protection of these users from the traffic on the main carriageway is not listed as a consideration.	Consider for inclusion. Note included.	Agreed.
6.3.4	The location of bus stops needs to also consider likely pedestrian travel directions. Similar to considerations as for Section 6.3.3. Bus Stops – Consider the safety implications for passengers departing buses and waiting for them. Stops need to be considered in terms of pedestrians, not just vehicles. 2016 edn includes reference to pedestrian travel paths and safety barrier protection.	Retain current commentary. Note: included.	Agreed – perhaps repeat in 6.3.3 as well.
6.3.4	Bus stop layout The movement of bus passengers to and from the bus stop needs to be considered, such as travel paths, crossing locations. Bus Stops – Include comments on how to protect passengers once they have alighted from their choice of transport or are awaiting its arrival.	See previous.	Agreed.
6.4	Tram facilities operate on roads, and where the tram stops are located, the vulnerability of the tram passengers alighting or disembarking the tram needs to be considered. The provision of facilities should take into account the speed zone. Tram Facilities – Further commentary is needed on the safety issues associated with the use of trams and how to mitigate conflicts through the design. Trams typically operate at a different speed to other motorised traffic. With the tram line placed along the centre of a road, there is conflict between the different road users. Separating these vehicles would be the better solution. The passengers alighting to or from a tram that is located in the centre of a road are exposed to other traffic. The location of tram stops to separate them from other road users should be considered. 2016 edn, Section deleted.	Nil.	Noted but needs to consider all road users including cyclists and flow / mix of traffic.

Section	Comments	Suggested amendments	Road Design Task Force considerations
7	**Property Access and Median Openings**		
7.1	The selection of operating speeds should take into consideration the number and form of the property access arrangements. General – the number of property access points should be considered with the selection of the road operating speed. Commentary should be made to alert the designer to the influences of these elements in determining the design parameters. The *Guide to Road Safety: Part 3* (Austroads 2008a) provides some background on setting speed limits. Selection of the operating speed for the section of road should consider the type and frequency of the median openings and property access arrangements.	Consider for inclusion.	It is believed that this is influenced more by stereotype and the nature of the corridor rather than the density of accessways.
7.3	Median openings		
7.3.1	General – The location of median openings is important to reduce the number of conflicting movements. Figure 7.5 shows the median opening at the junction with a minor road, and whilst this provides convenient access for the minor road, the number of conflict points is higher than if the median was located away from an intersecting minor road. Include commentary on the safety aspects of having openings in the median in comparison with the economics of it. In a Safe System, the safety should be more important than the economics. Suggest deleting the typical median opening, Figure 7.5. 2017 edn commentary includes reference to safety outcomes of a treatment. Figure 7.5 deleted.	Retain current commentary.	No comments.
7.3.2	Location – The location of crossings in urban areas, at 400 m to 800 m spacing and signalised, provides guidance on the controls at intersections. Locating intersections needs assessment of the treatments and their likely safety benefits in determining the appropriate treatments. 2017 edn, commentary deleted.	Nil.	No comments.
7.3.2	The spacing of openings should also consider the response rates for emergency services access, to attend to crashes or spills. Location – Need to include access for emergency response and maintenance activities. 2017 edn, commentary deleted.	Nil.	No comments.

Section	Comments	Suggested amendments	Road Design Task Force considerations
8	**Pedestrian Crossings**		
8.1.1	The introductory comments should include reference to the conflict points that can be created when pedestrians cross roads. The type of crossing may be determined prior to the design, but the designer has an opportunity to influence the infrastructure provided taking account of the operating speeds of the road. 2017 edn includes commentary on conflict points.	Retain current commentary.	Agreed
8.1.2	Types of Crossings Selection of a crossing provides either space separation, i.e. grade separated, bridge or time separated, e.g. signals, or reduce speeds to allow mixing of pedestrians and vehicles. The selection of the type of crossing should also include consideration of the road operating speed. At-grade crossings may need to have speed-reducing treatments installed in conjunction with the crossing. 2017 edn includes consideration of speed limits.	Retain current commentary.	We should increase the emphasis on an appropriate speed environment.
Table 8.1	Access to roadway Mid-block Crossings on Roads – Include the use of measures to protect pedestrians, e.g. barriers, clearances from vehicles. To assist in the identification and maintaining separation, the approaches to the crossing point should have a vertical element, e.g. kerb.	Consider for inclusion. Note: included.	Agreed.
8.2.2	Pedestrian refuges Commentary is provided on the width of the pedestrian refuge, and the consideration for fencing to prevent pedestrians moving directly onto the second carriageway. Whilst waiting within the refuge, the pedestrian is in a vulnerable location, with vehicles passing on both sides of the refuge, and a fence for pedestrian guidance provides little protection from an errant vehicle. Suggestion not clear.	Retain current commentary.	Agreed.
8.2.2	Pedestrian Crossing Treatments – Need to change the approach to pedestrians on a median. Leaving people in the median to increase traffic flow places them in a vulnerable position. Elements such as road operating speed and median width, allowing for protection of pedestrians waiting on the median, need to be considered in selecting the treatment.	Consider for inclusion.	This section appears quite comprehensive and appears to have more than adequate advice on pros and cons of treatment options.
8.2.3	Time Separated (Controlled Traffic) Facilities – Pedestrian zebra crossing – these can provide separation but there is still some possibility of a crash. Vehicle speeds should also be considered in establishing a crossing, to include raising the awareness of the motor traffic to the location of the crossing and sight distance to a pedestrian using the crossing. 2017 edn, Section B.5.2.	Consider for inclusion.	

Section	Comments	Suggested amendments	Road Design Task Force considerations
9	**Cyclist Crossings**		
9.1	Introduction – Further commentary is needed on how to deal with cyclists in a Safe System. As a vulnerable road user, they cannot just be looked at in the same way as cars.	Consider for inclusion.	Agreed.
9.2.3	Refuges away from intersections – Thought needs to be given to providing protection for cyclists from errant vehicles. This is the same as for pedestrians, with the operating speed of the road and the need for protection of waiting cyclists. The issue in cyclists crossing a road is whether to require the cyclist to dismount. This would depend on the circumstances, such as type of road, crossing distance, visibility. 2017 edn, Appendix C.1.3.	Consider for inclusion.	Wording in this section could be improved to be better aligned with SS principles and current appropriate practice being implemented worldwide.
9.6.3	Types of Crossings of Side Roads – The treatment providing priority to the cyclist relies on the motorist recognising the priority as they are about to undertake their turning movements. Refer also to Figure 9.9. At a side road, bending the path to provide sufficient length of side road to accommodate the length of a car, clear of the through lane, places a conflict point where the vehicle may be accelerating. Placing the control of a give-way sign may also be difficult to be seen by the turning vehicle driver. 2017 edn does not include this commentary.		
10	**Rail Crossings**		
10.1	General – Commentary is needed on the treatments to meet the Safe System philosophy. The grade-separated crossing is the best approach, ensuring adequate sight lines, controls to avoid conflicts between the trains and other road users, and providing information to the road users of the presence of the crossing. With the number of road/rail crossings spread across the road network, grade separating these may not be achieved, and where this cannot be achieved, providing information, both overt and covert, to the road and rail users will move towards meeting the Safe System goal. 2017 edn includes commentary on preference for grade separation.	Retain current commentary.	Agreed.
C	**Commentary**		
C1.1	Intersection function – More emphasis is needed on prioritising safety over traffic flow. Suggestion not clear.	Nil.	No comments.
C4	The information within this commentary would be useful incorporated into the main body of the guide. 2017 edn, included in Section 8.1.1.	Retain current commentary.	No comments.

Section	Comments	Suggested amendments	Road Design Task Force considerations
C5	The use of a centre of road refuge places pedestrians in a vulnerable area in close proximity to the passing traffic. The need for protection treatments, such as barriers, should be included in the assessment of the treatment. 2017 edn, Section 8.2.2.	Consider for inclusion.	Suggest leave as is – could make minor changes to wording when considered for inclusion.

Table D 5: ***GRD Part 4A: Unsignalised and Signalised Intersections*** **(2017i)**

Section	Comments	Suggested amendments	Road Design Task Force consideration
1	**Introduction**		
1.3	Add a paragraph cross-referencing the Safe System speeds from *GRD Part 4* (Austroads 2009a) (superseded). 2017 edn, commentary not included.	Nil.	No comments.
1.4	Add comment on how using values outside of the normal design domain (NDD) requires evidence that adopting the design value will not compromise the safety performance. 2017 edn, Section 1.3.	Consider for inclusion.	Agreed – minor wording change.
1.7	Add commentary about how under a Safe System, in many situations a grade-separated intersection may be the only appropriate design. 2017 edn includes Section 1.4: Intersection Safety and the Safe System Approach.	Retain current commentary.	Agreed.
2	**Layout Design Process**		
2.1	The design process seems to commence after the decision has been made on the type of intersection. This should be clearer, as the type of intersection selected may require a number of iterations to assess and review the impacts of the selection of the geometric elements. Also add a stage into the design process chart to check the consideration of the Safe System principles.	Consider for inclusion.	*GTM Part 6* should be used to establish form of intersection. Should reference Safe System Assessment Framework as compliance level check.
Table 2.1	Establish the alignment. The consideration of the alignment of the approach roads to the intersection should include an assessment of the impact forces, as a 90° intersection angle may not achieve the safest outcome. A flatter angle may reduce the impact forces if a crash occurs, but the approach angle would also need to be assessed to consider the sight distance available and the capability of the driver to observe the sight distance. 2017 edn does not include this commentary.	Nil.	No comments.

Section	Comments	Suggested amendments	Road Design Task Force consideration
2.2.2	Add commentary on how the alignment of approaches is important to control the approach angles to minimise crash impacts but also considering the sight distances and the driver's capability to observe the sight distance. 2017 edn, Section 2.2.1, includes preference for straight horizontal alignments, intersecting as close as possible to 90º.	Retain current commentary.	Agreed.
2.2.2	The short vertical curve on the approach to an intersection needs to be supported by other treatments to alert road users of the presence of the intersection. The commentary should be strengthened to include this aspect. 2017 edn includes commentary on providing a median in the minor road as a cue to drivers.	Retain current commentary.	Agreed.
3	**Sight Distance**		
3.4	Approach sight distance (ASD) at domestic properties not being necessary rely on visitors to be frequent, but this can lead to confusion as the visitor searches for the access. It should be preferable to provide the sight distance. 2017 edn includes suggested commentary.	Retain current commentary.	Agreed.
4	**Types of Intersections and their Selection**		
4.1	Needs commentary about keeping Safe System principles in mind when choosing an intersection. 2017 edn includes reference to *GTM Part 6*, which is the prime source for information on types of intersections and their selection. This is considered appropriate.	Retain current commentary.	Agreed.
4.4.1	More emphasis needs to be put on choosing a design that fits with the Safe System principles, e.g. reducing crash impact forces. 2017 edn, section transferred to *GRD Part 4*, Section A.3.1.	Consider for inclusion.	Covered adequately by *GRD Part 4* (Austroads 2017f).
4.4.1	This paragraph includes a list of considerations for the selection of the intersection treatment. The assessment of the considerations needs some guidance. This matter would be better contained in *GTM Part 6*.	Nil.	No comments.
4.5	The current approach is not consistent with the Safe System, as it puts the emphasis on crash history. Need to allow for potential crashes even if they have not happened already. The application of these treatments needs to be assessed, and if retained, assess the traffic conditions which are appropriate for the treatment. 2017 edn, section transferred to *GRD Part 4*, Section A.5. Matter best contained in *GTM Part 6*.	Nil.	No comments.

Section	Comments	Suggested amendments	Road Design Task Force consideration
4.6	Need to add further commentary on the conditions under which it would be appropriate to use auxiliary right-turn and auxiliary left-turn treatments when applying the Safe System philosophy. 2017 edn, section transferred to *GRD Part 4*, Section A.6. Matter best contained in *GTM Part 6*.	Nil.	No comments.
4.7	Add commentary emphasising that channelised turns are preferable when compared to auxiliary turn treatments. 2017 edn, section transferred to *GRD Part 4*, Section A.7. Matter best contained in *GTM Part 6*.	Nil.	No comments.
4.8	This section needs to be reviewed dependent upon the guidance provided in Sections 4.5 and 4.6. Matter best contained in *GTM Part 6*.	Nil.	No comments.
4.10.1, 4.10.2	The basic median opening provides conflict points within the median opening. These conflicting movements are not preferable and so guidance is needed on when this type of treatment is considered appropriate. 2017 edn, section transferred to *GRD Part 4*, Section A.10. Matter best contained in *GTM Part 6*.	Nil.	No comments.
4.11	The requirement for a low-cost treatment is not in keeping with Safe System principles, in which cost should not be more important than safety. 2017 edn, section transferred to *GRD Part 4*, Section A.10.4. Matter best contained in *GTM Part 6*.	Nil.	No comments.
4.11	Change emphasis to not having to justify using the safer treatment (left-right stagger) but to having to justify using the right-left treatment. Safer option should be the default. 2017 edn, section transferred to *GRD Part 4*, Section A.10.4. Matter best contained in *GTM Part 6*.	Nil.	No comments.
5	**Auxiliary Lanes**		
5.2.1	Make safety the priority. 2017 edn, section transferred to *GRD Part 4*, Section A.14. Matter best contained in *GTM Part 6*.	Nil.	No comments.
5.2.1	Add information on consideration of the potential conflict angles/types that are likely at the intersection. 2017 edn, section transferred to *GRD Part 4*, Section A.14. Matter best contained in *GTM Part 6*.	Nil.	No comments.

Section	Comments	Suggested amendments	Road Design Task Force consideration
6	**Traffic Islands and Medians**		
6.1	Provide commentary on the safety benefits of medians and traffic islands. Medians to separate opposing traffic flows support the Safe System principles. Traffic islands are located very close to the traffic lanes to reduce the time needed for a pedestrian to cross. The operating speeds on these roads are commonly up to 80 km/h. Urban intersections, in particular, will have pedestrians and cyclists using the intersection islands to assist them to cross the road. This arrangement of proximity and high-speed makes these types of locations highly vulnerable to errant vehicles. 2017 edn, section transferred to *GRD Part 4*, Section A.15.1. Matter best contained in *GTM Part 6.*	Nil.	No comments.
6.2.1	The indication of the size of the splitter island does not include consideration of other road users, and these should be included in the assessment of the island and its size. 2017 edn, Section 6.1.1 refers to the need to provide refuge for pedestrians.	Retain current commentary.	Agreed.
6.2.1	Sizing of a traffic island includes consideration of pedestrians and cyclists and roadside furniture. Whilst the roadside furniture includes fencing, on the higher speed roads, i.e. ≥ 60 km/h, protective treatments for these vulnerable road users need to be considered. 2017 edn, Section 6.1.1 includes the need to accommodate pedestrians and cyclists.	Retain current commentary.	Agreed.
6.6.1	Add commentary on the placement of drainage pits, cross-reference to the updated *Guide to Road Design Part 5: Drainage: General and Hydrology Considerations* (Austroads 2013a). 2017 edn, Section 6.5 includes this cross-reference.	Retain current commentary.	Agreed.
7	**Right-turn Treatments – Layout Design Details**		
7.1	The wording of the opening paragraph seems to shift the emphasis from safety. Suggest rewording to retain the safety importance. 2017 edn, section transferred to *GRD Part 4*, Section A.16.1. Matter best contained in *GTM Part 6*.	Nil.	No comments.
7.1	Add a point on ensuring that the speed is appropriate for the potential collision types under a Safe System. 2017 edn, section transferred to *GRD Part 4*, Section A.16.1. Matter best contained in *GTM Part 6*.	Nil.	No comments.
7.5.1, 7.7	The use of the basic auxiliary right treatment has been previously indicated to result in higher crash rates than other right-turn treatments. Use of this treatment may need some warrants for its use. 2017 edn, section transferred to *GRD Part 4*, Section A.16.5. Matter best contained in *GTM Part 6*.	Nil.	No comments.

Section	Comments	Suggested amendments	Road Design Task Force consideration
7.5.3	Indicates that there are no warrants for provision of raised medians. The raised kerb can increase the visibility of the turn lane, and warrants may be beneficial in the identification to approaching drivers of the intersection and increase the protection for the turning vehicles. 2017 edn, section transferred to *GRD Part 4*, Section A.16.3. Matter best contained in *GTM Part 6*.	Nil.	No comments.
7.5.4, 7.5.5	The use of staggered T-intersections relies on turns being undertaken in vulnerable locations, and their use may need additional treatment such as protected turn islands and/or warrants for use of the different types, i.e. left or right stagger (see also Figure 7.8). 2017 edn section transferred to *GRD Part 4*, Section A.16.4, A.16.5. Matter best contained in *GTM Part 6*.	Nil.	No comments.
8	**Left-turn Treatments**		
8.1.1	*GTM Part 6* (Austroads 2017h) refers to channelised left-turn treatment being preferred. This suggestion should be consistent in application. Suggest amending to provide consistency between the Guides. 2017 edn, section transferred to *GRD Part 4*, Section A.17. Matter best contained in *GTM Part 6*.	Nil.	No comments.
8.1.2	Consider adding a bullet point to include consideration of potential conflict angles when designing the turning treatment. 2017 edn, Section 8.1.1.	Consider for inclusion.	In order to make a significant difference to the impact energy, the angle would have to be changed such that it would severely compromise the driver's ability to acknowledge and perceive the speed of oncoming traffic in order to make an appropriate decision.
8.2	Figures The left turn provides a sealed (preferred) shoulder, which may result in vehicles using this area to move off the through lane and reduce the sight distance for drivers turning from the minor road. The holding line location may be better in a different location, closer to the through lane.	Consider for inclusion.	Agreed – Ought to be reviewed – values of set-back seem unusually large.
8.2.4 8.2.5	Consider adding commentary on a channelised Left-turn being the preferred option and how strong arguments are needed not to use it.	Consider for inclusion.	Not sure the recommendation is understood.

Section	Comments	Suggested amendments	Road Design Task Force consideration
8.3.6	Add statement that under a Safe System, bicycle paths should preferably be physically separated from motorised traffic. 2017 edn, section transferred to *GRD Part 4*, Section A.17.1. Matter best contained in *GTM Part 6*.	Nil.	No comments.
9	**U-turn Treatments**		
9.1	Add commentary that consideration needs to be given to angles and speeds when designing a U-turn to meet Safe System principles. 2017 edn, section transferred to *GRD Part 4*, Section A.18.1. Matter best contained in *GTM Part 6*.	Nil.	No comments.
10	**Signalised Intersections**		
10.1	Consider including separation of vehicle types as a consideration under a Safe System. 2017 edn, section transferred to *GRD Part 4*, Appendix B Matter best contained in *GTM Part 6*.	Nil.	No comments.
10.2	Add comment about the need to consider placement and design of traffic signals and signal control equipment to reinforce consideration of the locations of the signal hardware. 2017 edn, section transferred to *GRD Part 4*, Section B.2.1. Matter best contained in *GTM Part 6*.	Nil.	No comments.
10.4	Sight distances need to be sufficient to see traffic signals at signalised intersections. Conspicuity of the signals also needs to be considered, including the background to the signals. 2017 edn, Section 9.2. Considered appropriate.	Retain current commentary.	Ought to have some commentary about visibility of signal heads and readability of intersection/navigation.
10.5.2	Include commentary on providing adequate space and site distances for signage. 2017 edn, section transferred to *GRD Part 4*, Section B.3.2. Matter best contained in *GTM Part 6*.	Nil.	No comments.
10.6.3	Pedestrian fences, bollards and barriers. Add bullet point on adding protection for pedestrians and cyclists on refuge islands. 2017 edn, section transferred to *GRD Part 4*, Section B.5. Matter best contained in *GTM Part 6*.	Nil.	No comments.
10.6.4	If this treatment should not be used, what is the preferred option? 2017 edn, section transferred to *GRD Part 4*, Section B.6.1. Matter best contained in *GTM Part 6*.	Nil.	No comments.

Section	Comments	Suggested amendments	Road Design Task Force consideration
	Appendix A		
A.1	Add commentary to describe how the use of EDD should not compromise safety.	Consider for inclusion.	General requirement – could craft a standard paragraph.

Table D 6: ***GRD Part 4B: Roundabouts*** **(2015l)**

Section	Comments	Suggested amendments	Road Design Task Force considerations
1	**Introduction**		
	Nil	–	No comments.
2	**Design Principles and Procedure**		
2.2	Cost as a primary consideration does not fit with the Safe System principle, but as it will always be a consideration, guidance is needed on how to balance these two conflicting factors. 2015 edn, cost not indicated to be a primary factor.	Retain current commentary.	Agreed.
2.3	Safety should be a consideration and needs adding into the design process.	Nil.	No comments.
3	**Sight Distance**		
3.2.2	Add comment to state why the speed relating to the road users and the speeds desired, to increase the likelihood of surviving crashes, are important, e.g. if there is possible conflict with pedestrians, the speeds need to be 30 km/h or lower. Section relates to sight distance assessment.	Nil.	No comments.
4	**Geometric Design**		
4.1	Reference is made to entry speeds, but there is little guidance on appropriate entry speeds for the various situations likely to be encountered, e.g. high-speed rural roundabout with no pedestrian function compared with a high-speed urban roundabout where pedestrians are expected. Suggest some guidance be included on appropriate entry speeds based on the road users expected to use the road.	Consider for inclusion.	Agreed – some guidance around the importance of speed management relating to the context and ped/cyclist use would be beneficial.
4.3.6	Expand to provide commentary on the need to consider the interaction between the different types of vehicles (if they are not in separate lanes) and the appropriate speed in these locations. Section relates to bus and transit lanes. Unclear on intent of suggestion.	Nil.	No comments.

Section	Comments	Suggested amendments	Road Design Task Force considerations
4.4.1	Figure 4.1 The shape of the centre island, in terms of slope, needs to be equivalent to, or flatter than, the recoverable slope. The shapes also need to consider how the vehicle behaves as it travels over the changing grades.	Consider for inclusion.	Agreed – though speeds are likely to be low.
4.5.1	Commentary on the angles of the conflict points to minimise the impact of a crash could assist the designer to appreciate the interaction of geometry and the severity of a crash.	Consider for inclusion.	Agreed – mention reduced energy impact and improved outcome.
4.5.2	Add comment on appropriate entry speed under a Safe System.	Consider for inclusion.	Covered but not explicitly.
4.5.3	The addition of guidance, such as a cross-reference to speed reduction treatments and effectiveness of the treatments.	Consider for inclusion.	Expand commentary relating to context
4.5.6	Splitter islands should be sufficient to provide protection for the pedestrians. The approach speeds may indicate the type of protection that should be considered. 2015 edn, Section 4.5.4.	Consider for inclusion.	Agreed.
4.6.3	Add comment about how encroachment area should not be part of the pedestrian path or pedestrian storage area.	Consider for inclusion.	Agreed.
4.6.3	Figure 4.12 shows encroachment areas on a roundabout. A 40–60 mm difference between pavement level and the raised encroachment area may be a hazard for road users such as motorcyclists and bicyclists. Suggest this detail be removed to remove this possible hazard. 2015 edn, Figure 4.11, profile aimed to discourage drivers of passenger vehicles. Delineation may minimise this issue.	Consider for inclusion.	Need for further discussion.
4.7	The exit curves can influence the speed of the driver leaving the roundabout. Should the driver misjudge the speed for the exit manoeuvre, they may run off the pavement. This roadside area at the exit should be clear of hazards and support recovery of the vehicle. Suggest strengthening the commentary on ensuring the roadside areas at the exit points are clear of hazards and has a recoverable area for errant vehicles. 2015 edn, Section 4.7 includes this commentary.	Retain current commentary.	Agreed.
5	**Pedestrian and Cyclist Treatments**		
5.1	Add commentary on appropriate speed under a Safe System and catering for all road users, including pedestrians and cyclists. 2015 edn, Section 5.1, includes reference to controlled crossing and *GTM Part 6*.	Consider for inclusion.	Agreed – emphasise importance of speed management.
5.2	Add to third bullet need to consider pedestrian separation/protection when they are waiting on the splitter islands. 2015 edn, Section 5.2.2.	Consider for inclusion.	Agreed.

Section	Comments	Suggested amendments	Road Design Task Force considerations
5	Include grade-separated designs like underpasses and bridges for pedestrians and cyclists. Separation of the movements should be the first consideration, then reducing speeds and providing protective treatments. Also, the outcomes of the Austroads project NS1722 *Assessment of the Effectiveness of On-road Bicycle Lanes at Roundabouts in Australia and New Zealand* (Austroads 2014f) needs to be considered with the Safe System principles.	Consider for inclusion.	On-going discussion topic.
6	**Pavement Markings and Signing**		
6.1	Placement of signs needs to be considered with the types of road users and the visibility from between each of the road users, e.g. a sign obscuring a pedestrian does not provide awareness to the other road users of their presence.	Consider for inclusion.	Agreed.
7	**Roadway Lighting at Roundabouts**		
7.2, 7.3	The lighting diagrams, Figures 7.1 and 7.2, show the location of the lighting poles. Additional information on the poles in likely run-off areas would assist in selecting locations for the poles, or the use of frangible poles. 2015 edn, Figures deleted.	Retain current commentary.	Agreed.
8	**Landscaping and Street Furniture**		
8.1	Achieving the appropriate balance between road safety and local amenity – needs to reinforce the safety considerations, then the local amenity. 2015 edn, Section 7.1 safety referenced before local amenity.	Retain current commentary.	Agreed.

Note: The advice relating to GRD Part 4B should be included in a wider revision and expansion of this part of the guide that will encompass compact and mini roundabouts, their design and use and the compliance of roundabouts as a Safe System intersection solution.

Table D 7: GRD Part 4C: Interchanges (2015m)

Section	Comments	Suggested amendments	Road Design Task Force considerations
1	**Introduction**		
1.8.1	Safety needs to be included as a factor to consider in interchange development. 2015 edn, Section 1.8.1 discusses staged development. Considered appropriate.	Retain current commentary.	Agreed.
2	**Design Considerations, Process and Principles**		
2.2.1	The safety performance of the design should be a key consideration of interchange design. 2015 edn, Section 2.2.1 includes this consideration.	Retain current commentary.	Agreed.
2.3.3	The preliminary design stage should include a review of the layout to assess the operation of the interchange, including the safety performance of the selected treatments. 2015 edn, includes reference to this suggestion.	Retain current commentary.	Agreed.
2.3.4	The detail design should be reviewed, including the roadside areas for appropriate clear zones to ensure the principles of a Safe System are being considered.	Consider for inclusion.	Agreed – but should reference appropriate safety treatments and protection rather than clear zones!
2.4.1	Safety criteria should be included with the other criteria. 2015 edn includes the physical elements forming an interchange. Reference to safety is contained in earlier sections.	Retain current commentary.	Agreed.
3	**Forms of Interchange**		
	Nil	–	–
4	**Structures**		
4.1.1	Figures 4.1 to 4.3 show abutments with the surrounding features of different abutment treatments and the lead-in batters. The shape of the spill through the abutment is commonly steeper than a recoverable slope. It is not clear how these areas are treated, and so additional information is needed on the components. 2015 edn includes consideration of the abutment shape and the possible need for a safety barrier.	Retain current commentary.	Should strengthen the wording – especially around the desirability of piers in the median.
4.2	The bridge pier location needs to be assessed for protection. The wording in this section may need strengthening to reinforce the need for assessment. 2015 en. includes consideration of the abutment shape and possible need for a safety barrier.	Retain current commentary.	Should strengthen the wording – especially around the desirability of piers in the median.

Section	Comments	Suggested amendments	Road Design Task Force considerations
5	**Cross-section**		
	Nil	–	–
6	**Design Speed**		
6.3, 6.4	The selection of the design speed through the interchange should take into consideration the road user conflicts that could occur. The speed then adopted should be supported by treatments to reduce the impacts of any crashes.	For consideration.	Agreed – local road intersections should ideally operate at Safe System compliant speeds.
7	**Sight Distance**		
7.2	Where piers are needed, they should be protected with safety barriers so that they are not a hazard to errant vehicles. Strengthening of the commentary to refer to the need to consider safety treatments should a pier be required.	For consideration.	Should strengthen the wording relating to piers in the median and provision of SSD.
8	**Horizontal Alignment**		
	Nil	–	–
9	**Vertical Alignment**		
9.2.2	The speed, both the approach and through intersection speed, need to be considered for their role in minimising the impacts of any crash.	Nil.	No comments.
10	**Ramp Terminals at Minor Roads**		
10.3	The entry radius that is conducive to higher speeds increases the impact forces should a crash occur. The selection of the radius should be determined after considering the other road users and the possible conflicts.	For consideration.	Need to emphasise the trade-off and compromises at each intersection and the importance of speed management.
11	**Ramp Terminals at the Major Road**		
	Nil	–	–
12	**Ramps on Two-lane Two-way Freeways**		
	Nil	–	–
13	**Pedestrians**		
13.1	Pedestrians along freeways, e.g. drivers from broken-down vehicles, may travel along the freeway in close proximity to high-speed traffic. Providing facilities for these circumstances, to separate the travel paths and/or minimise the length of the travel path, needs to be considered.	For consideration.	Provision of a level area behind safety barrier systems.

Section	Comments	Suggested amendments	Road Design Task Force considerations
14	**Cyclists**		
14.1	On high-speed roads, cyclists preferably would be separated from the motor traffic with a separate path provided. 2015 edn includes suggestion of providing facilities within the corridor, including shared path or alternative route.	Retain current commentary.	Agreed – would be helpful if the advice were strengthened about the appropriateness of cyclists on expressways; particularly at interchanges.
15	**Pavement Markings, Signs and Lighting**		
15.3	Lighting should be applied consistently along a road, e.g. at intersections, to provide continuity of the road standard for the road users to understand.	For consideration.	
16	**Landscaping and Street Furniture**		
	Nil	–	–
17	**Other Considerations**		
	Nil	–	–

Amend the following Sections

***GRD Part 1*:**

Section 3.1 add to first paragraph: 'The purpose of road design is to produce as safe a road network as is practically affordable that is also economical and efficient. The design process commences and develops a plan…'

Section 4: First paragraph, to read: 'Design considerations include all the things that are important from an engineering and community perspective that impact on the outcome of the design. They must include providing the safest possible design within the economic, social, and environmental considerations for the development of a road project.'

GRD Part 2

Section 1.1: Second paragraph: second sentence: amend to read: 'The objectives of new and existing road projects should be carefully considered to achieve the safest possible road while balancing the level of traffic service, whole-of-life costs, flexibility for future upgrading or rehabilitation, and environmental impact.'

Bring the safety objective to the first dot point.

Section 1.5: First paragraph: to read: 'The involvement of stakeholders, particularly community groups and the general public is important so these groups may obtain a better understanding of likely safety outcomes and the methods available to achieve these outcomes. Involving stakeholders throughout the planning...'

Section 2

Third paragraph new first sentence: 'In considering the trade-offs, the impact on the safety outcomes should be identified, when these factors are included.'

Section 3

Table 3.1, Construction factors: Whole-of-life costs: add the 'Crash cost savings in the costs'.

Table 3.1: Industrial factors: add 'Design to include consideration of the maintenance tasks'.

GRD Part 3

Section 2.2.3: First paragraph: add cross-reference to the outcomes of the Project SRD2068.

Section	Comments	Suggested amendments	Road Design Task Force considerations
Section 3.1: First paragraph: add: 'Designers should also consider vehicle speeds on the approaches to intersections, and it is important that speeds are managed to reduce the impacts of a crash, should one occur.' **Section 3.2.5: First paragraph: add dot point: 'very low speed ≤ 30 km/h' and amend low speed to 69 to 31 km/h.** **Section 4: Third paragraph add: 'For further information on the contribution of cross-section elements, refer to (the outcomes of SRD2068).'** **Section 4.8.10:Fourth paragraph: add dot point: 'for information on parking turnover rates refer to AS 2890.5'.** **Section 4.10.2: Matter for the *GTM Part 5* (Austroads 2017g).** **Section 4.11.2: Fifth paragraph: add reference to outcomes of SRD2068.Section 4.12.1: Add new third paragraph: 'Information on locating bus stops and bus bays can be found in *GTM Part 5* (Austroads 2017g).** **Section 4.12.3: Second paragraph: add dot point: 'bus stop waiting areas need to be visible to passing drivers and separated from other road users and, where there is high risk, the waiting area is protected from errant vehicles'.** **Section 6.1: Third paragraph: 'Where the horizontal and vertical geometry is unable to be coordinated, the designer should review the alignments and modify the design to minimise any impacts.'** **Section 7.9: First paragraph: add 'For more information on the benefits of widening on horizontal curve refer to *The Application of Asymmetrical Design Principles to Rural Roads* (Levett 2005).'** **Section 8.6.3: Floodways: add fourth paragraph: 'For more information on floodways refer to *Safety Provisions for*** ***Floodways Over Roads* (Austroads 2015d).'** **Section A1: Fourth paragraph: new fourth numbered point: 'EDD parameters should not be used where safety issues have been identified.'** **C7: add: 'For information on the safety benefits of different shoulder widths refer to *Improving Roadside Safety: Summary Report* (Austroads 2014g).** ***GRD Part 4*** **Section 3.7.3: Third paragraph: add: 'Guidance on the roadside treatments is contained in *GRD Part 6* (Austroads in press).'** **Section 3.7.3: Urban intersections: First paragraph: add as fourth dot point: 'where there are large numbers of pedestrians waiting on traffic islands, it may be necessary to provide barriers for their protection'.** **Section 2: *GTM Part 6* to reference the Safe System Framework and consider the emphasis on use of roundabouts.** **Table 4.1 , add: 'the identification of potential conflict points that might not be highlighted by the crash history.', and:** **'potential for future innovations in road safety, as well as traffic changes'** **Appendices A, B and C: review content of Appendices A, B and C to identify material contained in *GTM Part 6*. Retention in *GRD Part 4* not necessary.** **Section 5.3: Third3rd paragraph: First sentence: to read 'The checking vehicle may be permitted to run over kerbs where there are no pedestrian paths or standing areas, and encroach on adjacent lanes.'** **Section 8.1.2: First paragraph: re-order with first dot point to read: 'selection of appropriate speed limits'.** ***GRD Part 4A*** **Section 1.3: Second paragraph add sentence: 'Using values outside of the Normal Design Domain (NDD) requires evidence that adopting the design value will not compromise the safety performance.'** **Section 8.2.1: Figures 8.2, 8.3, 8.4: Amend to show minor road holding line closer to the edge of the through lane.** **Section 9.2: Second paragraph: second sentence: to read 'Stopping sight distance (SSD) should be available at all points on each roadway and to the signal displays.'**		

Section	Comments	Suggested amendments	Road Design Task Force considerations
GRD Part 4B			
Section 4.1: Add new paragraph: 'In designing a roundabout, appropriate entry speeds need to be adopted, and these speeds depend on the function and types of approach roads and the expected road users. As a guide, for an appropriately designed roundabout, the speed may be 50 km/h for an arterial road and 25–30 km/h for a local residential street.			
Section 4.4.1: Figure 4.1: amend to indicate surface slopes flatter than 6:1.			
Section 4.5.1: First paragraph: add new third dot point: 'potential for fatal and serious injury by establishing angles at conflict points to minimise the impact of a crash'.			

Table D 8: ***GRD Part 6: Roadside Design, Safety and Barriers*** **(draft 2018)**

Section	Comments	Suggested amendments	Road Design Task Force considerations
1	**Introduction**		
1.3.1	Update to incorporate reference to current National Road Safety Strategies. 2018 draft edn, Section 1.2.1 updated.	Retain current commentary.	No comments.
1.3.2	The Safe System seeks to minimise the impacts of crashes, and so the approach should include reference to having crash impacts, should a crash occur, to be at a tolerable level. 2018 draft edn includes strengthened commentary on providing a Safe System.	Retain current commentary.	No comments.
2	**Roadside Design**		
	Nil	–	–
3	**Designing for Safety**		
3.1	If a vehicle leaves the road, the roadside should be designed to minimise the likelihood of a crash occurring. Suggest rewording to strengthen the aim to minimise the likelihood of a crash. 2018 draft edn strengthens this commentary.	Retain current commentary.	No comments.
3.3	The aim of road design is to achieve safer roads. The Guide indicates the aim is to 'achieve a practical and economic balance between the assessed risks of hazardous consequences and the measures needed to mitigate those risks'. A Safe System aims to achieve the best safety outcome, and in determining a treatment, the practicality and economics influences a decision, but the aim should be to achieve the best outcome. Suggest the paragraph be amended to include the aim of achieving the best safety outcomes and to take into consideration the practicability and economic restrictions. 2018 draft edn includes the aim to achieve the best possible safety.	Retain current commentary.	No comments.

Section	Comments	Suggested amendments	Road Design Task Force considerations
3.3	The choice of treatment methods should aim to eliminate hazards or reduce the impact forces should a crash occur. The current emphasis on cost-effective solutions relies on the definition placed on 'effective', and this would be better worded to indicate the safety outcomes sought. 2018 draft edn includes aims to reduce the risk of impact.	Retain current commentary.	No comments.
3.4.1	The caution on the use of centre-of-road barriers may be able to be removed as an option, with the qualification that they need to be appropriately designed, considering the road geometry (e.g. road width), and types of road users (e.g. heavy vehicles and property access requirements). 2018 draft edn strengthens the suggestion on centre-of-road barriers.	Retain current commentary.	No comments.
4	**Design to Mitigate Hazards**		
4.1	The design process indicates that the first step is Step 1: Determination of clear zone widths and an area of interest. The use of the clear zone concept indicates a distance for consideration of hazards. This term may restrict the assessment area to this distance. The consideration of roadside hazards should extend across the road reservation and include immediately adjacent development. So, the area of interest needs to be determined. Suggest delete reference to clear zone. 2018 draft edn provides a hazard mitigation process that contains Step 1: Determination of the roadside area of interest.	Retain current commentary.	No comments.
4.2.2	Determine the clear zone Assessment of hazards should include the roadside and adjacent development. 2018 draft edn has a reduced emphasis on clear zones.	Nil.	No comments.
4.2.2	What is a clear zone? The clear zone concept may limit the assessment area of the roadside and this concept should be replaced with the roadside area. Suggest that Section 4.2 should be re-written to change from clear zone to the roadside area.	As previous.	No comments.
4.3.2	The identification of roadside poles as likely to be hazardous to motorcyclists is a philosophy to consider for all road users. These objects, e.g. frangible poles, which are considered suitable for other vehicles, have been identified as likely to be hazardous to motorcyclists, and so the consideration of all road users needs to assessed in selecting appropriate treatments. The current wording of minimising the number of objects and making them as forgiving as practicable is accepting that there may be some circumstances where this may not occur. Treating the hazard needs to be assessed prior to determining the final treatment. Suggest amending the paragraph to include a reference to assessing the roadside objects for impacts to all road users. 2018 draft edn outlines the types of hazards, and assessment is contained in other sections. Reference is made to all road users.	Retain current commentary.	No comments.

Section	Comments	Suggested amendments	Road Design Task Force considerations
4.3.2	Some poles within the road environment are rigid, i.e. traffic signal poles. Consideration of the means to reduce the impacts of crashes on these poles needs to be given. The impacts apply to the vehicle's occupants and the pole (as they provide safety benefits as well). 2018 draft edn includes reference to all road users which includes vehicle occupants.	Retain current commentary.	No comments.
4.3.2	Table 4.3 (Road safety barriers) Include comments on motorcyclists likely to be injured when hitting road safety barriers. In assessing the barriers, consideration should be made on the impacts on motorcyclists. Suggest the wording be amended to provide for consideration of the impacts a barrier may have on motorcyclists. 2018 draft edn, Table deleted. Commentary references road users.	Consider for inclusion.	No comments.
4.3.4	Flow chart and Table 4.4 Embankment with adverse crash history – suggests that locations with at least three casualty crashes be considered for remedial treatment. Similar situations should be considered for treatment, based on the circumstances that are contributing to the crashes, not necessarily after crashes occur. Suggest that embankments that are assessed irrespective of crash history. 2018 draft edn, Section 4.2.4.	Consider for inclusion. Note: Flowchart (2018 edn) contains consideration of a barrier, even with no crash history. Matter seems to be covered.	No comments.
4.3.5	Commentary is made on designing for the 85th percentile speed, and that selecting a design speed higher than the 85th percentile requires a much greater clear zone distance and a wider area of interest. The incremental risk reduction by increasing the width of the area of interest does not warrant the expense. The design should include assessment of the hazards in the run-off areas and take them into consideration in determining appropriate treatments. Commentary is provided at the end of the paragraph relating to managing potential consequences of a hazard outside the area of interest. Suggest that greater emphasis is made on consideration of the hazards. 2018 draft edn, Section 4.2.4. Commentary included on identification of risks and consideration of hazards.	Retain current commentary.	No comments.
4.3.5	Reference is made to assessment of hazards beyond the calculated clear zone width. The assessment should be made on the roadside area and adjacent development. Suggest reference to clear zone be replaced with assessment of hazards beyond the area of interest. 2018 draft edn, See previous.	See previous.	No comments.

Section	Comments	Suggested amendments	Road Design Task Force considerations
4.3.5	Opposing vehicles and medians Commentary is provided for consideration of head-on collisions, with the issue left to jurisdictional policy. Centre-of-road and/or median barriers are being used with reports of significant reductions in crashes. Guidelines for the provision of centre-of-road barriers to prevent the cross-median crashes relies on jurisdiction policy. This is moving towards the Safe System principles, but the application of the median barriers should be strengthened to provide the designer with the circumstances on when this type of barrier should be included in the project. 2018 draft edn strengthens reference to median barriers.	Retain current commentary.	No comments.
4.5.1	The quantitative methods for detailed investigation of hazards and treatment options involve an economic evaluation of the crash costs. The reduction of FSIs is a goal of the Safe System and so, this should be included in the assessment. It can be related to costs, but the measure focussing on the FSIs is the goal. Suggest that reference to FSIs be included in the assessment.	Consider for inclusion.	No comments.
4.5.2	The quantitative assessment, similar to comments for Section 4.5.1.	See previous	–
4.5.2	The primary benefit in selecting one design over another is indicated to be based on reduction in future crash costs. The reduction in fatal and serious injuries is the focus of a Safe System and so this should be the primary benefit.	See previous.	–
5	**Treatment Options**		
5.2	The treatment options refer to safety barriers being considered when the other measures are insufficient or impractical. This guidance should be reviewed in light of recent research outcomes on roadside safety outlined in Austroads project ST1427 *Improving Roadside Safety*. 2018 draft edn, Section 5.3 Table 5.1 includes a comparison of the effectiveness of treatment options, including barriers.	For consideration.	No comments.
5.3	Table 5.1 is intended to provide general guidance on the types of treatments that are likely to be most effective as a countermeasure for the different types of crashes. The application of the nominated treatments contained in the table assists in moving towards achieving a Safe System, but it may be preferable to include commentary on the assessment of the effectiveness of a treatment and the need to consider supporting treatments to achieve a better outcome.	See previous.	No comments.
6	**Road Safety Barriers**		
6.2.1	Table 6.2 The key considerations in barrier selection should include the types of road users. The table contains site considerations. Suggest that the title be amended to reflect the site considerations. 2018 draft edn, Table 6.2 includes reference to road users and site considerations. Considered appropriate.	Nil.	No comments.

Section	Comments	Suggested amendments	Road Design Task Force considerations
6.3.10 and 6.3.11	Barriers in median locations are outlined for three widths of median, narrow, 4.5 m to 10 m, and wider medians. The Guide indicates that on narrow medians, the appropriate treatment is to provide a centrally located barrier. The commentary could be strengthened to provide guidance on the application of this treatment. 2018 draft edn, Section 6.3.9 includes guidance on barrier location in medians.	Retain current commentary.	No comments.
6.3.11	The width of a median to enable all errant vehicles to come to rest would be extremely wide, depending on the surface conditions of the median. Consideration should be given to providing a treatment to prevent vehicles crossing over the median. 2018 draft edn, Section 6.3.9, broadens commentary on wider medians.	Retain current commentary.	No comments.
6.5	Road safety barriers for vulnerable road users – prominence of this should be increased. The design process precedes this section and consideration of the vulnerable road users should be included in the design process. Suggest moving the section to be after 6.1. 2018 draft edn, Section 6.1.3 provides guidance on road safety barriers for vulnerable road users.	Retain current commentary.	No comments.
6.5.2	Pedestrians and cyclist treatments – at intersections there can be a concentration of all the road users, bringing vulnerable road users (e.g. the pedestrians and cyclists) close together, and the treatments to provide protection to these road users, whilst retaining the road functions, needs to be considered. Reference is made to intermediate and high-speed roads for consideration of a barrier, the intermediate speeds (70 km/h to 90 km/h) are higher than the collision speed of 30 km/h. Suggest rewording of this paragraph to consider barriers where the path is in the clear zone, e.g. for all roads > 30 km/h posted limit. 2018 draft edn, Section 6.1.3. Practicability of providing a road safety barrier requires assessment.	Consider for inclusion.	No comments.
7	**Design for Steep Downgrades**		
	Nil	–	–
	Appendices		
Appendix B	Table B1 Reference to clear zone needs to be consistent with document. (Refer to Section 4.2). Clear zone has been included in 2018 draft and so inclusion is relevant.	Consider for inclusion.	No comments.
Appendix D	Examples of clear zone calculations – the clear zone concept will rely on the outcomes of Section 4.2.	See previous.	No comments.

Section	Comments	Suggested amendments	Road Design Task Force considerations
	Commentaries		
C2.1	Table C2.1 Element: Shoulder width – the third paragraph indicates the decision to seal shoulders depends on the road category, traffic volume and crash record. Sealing of shoulders has been found to reduce the number of run-off-road crashes and so should be undertaken. 2018 draft edn, Guidance refers to sealing shoulders to assist errant vehicle recovery.	Retain current commentary.	No comments.

Note: The advice relating to GRD Part 6 should be included in the wider revision of this part of the guide (TP2056) that will extensively incorporate the Safe System and its practical application to enable the design as compliant a roadside solution as practicable.

Table D 9: *GRD Part 6A: Pedestrian and Cyclist Paths* (2017k)

Section	Comments	Suggested amendments	Road Design Task Force considerations
1	**Introduction**		
1.3	A brief overview is provided of the Safe System approach and it is suggested that a cross-reference be made to *GRD Part 6* (Austroads Draft 2019) which contains additional Safe System information. 2017 edn includes a cross-reference to *GRD Part 1* for further information.	Retain current commentary.	No comments.
1.3	The outline of the Safe System approach does not include commentary, specifically aimed at the pedestrian and cyclist users, being considered vulnerable road users. Suggest additional commentary aimed at these particular road user groups, e.g. allocation of space, separation from motor vehicles, protection where separation is unable to be achieved. 2017 edn, Section 1.3 includes commentary relating to pedestrians and cyclists.	Retain current commentary.	No comments.
2	**Planning and Need for a Path**		
2.2.2	Pedestrian paths – an exception to providing a separate footpath is suggested for roads with very low volumes and speeds, i.e. < 40 km/h. Suggest this be < 30 km/h, rather than < 40 km/h, to be consistent with the speeds that are currently identified as those above which the chances of surviving decrease rapidly. 2017 edn, Commentary 1 includes general principles for the provision of footpaths which indicates low or very low operating speeds.	Retain current commentary.	No comments.

Section	Comments	Suggested amendments	Road Design Task Force considerations
2.2.2	Table 2.1 The table outlining the principles used in New Zealand does not indicate a speed environment. To guide the provision of a footpath, the speed environment should be included in the assessment.	Consider for inclusion. Note: *GRS Part 3* covers speed limits and speed management. Suggest cross-reference to this Part.	Agreed.
3	**Types of Paths**		
3.3	The different users of the bicycle paths, i.e. commuter and recreational users can travel at very different speeds and usually there is little difference to distinguish between these types of paths to the cyclists. Providing some distinction that can be identified by the cyclists may assist in the operation of the path, e.g. this could be through the sign characteristics placed along a path. 2017 edn, Section 2.3 indicates the need to cater for a wide range of users. Indicating the type of user does not appear practicable.	Retain current commentary. Note: In many areas, the provision of a separate path for the higher speed cyclists is not practicable solution.	Need to consider the type of cyclist from an intended and anticipated use and operating speed; we should segregate where there are safety implications.
4	**Path User Requirements**		
4.2.1	The requirements for bicycle paths should also include provision for run-off-path areas, to allow the cyclist to recover or stop in a safe manner. This is similar to the run-off-road principles for vehicles. 2017 edn, Section 5.5.2 includes this suggestion.	Retain current commentary.	No comments.
5	**Location of Paths**		
5.2	The factors that influence path location include the proximity to vehicle traffic, particularly where the vehicle traffic speed is greater than 30 km/h. Suggest that reference is made to the preferred alignment being separated from motor vehicle traffic, being outside a clear zone, or consideration of providing a barrier to shield against the errant vehicles. 2017 edn, Section 4.2. Emphasis on urban areas and includes commentary on separation.	Retain current commentary.	This Part deals with off-road facilities – on-road should be part of *GRD Parts 3, 4* and *4A* (Austroads 2016i, 2017f, 2017i).

Section	Comments	Suggested amendments	Road Design Task Force considerations
5.3	Figure 5.1 Commentary is provided that on urban arterial road reservations, adequate clearance is provided from road traffic, with 1.0 m shown in Figure 5.1, and where wider clearances or physical barriers may be appropriate, e.g. where the path is alongside higher speed roads, i.e. 80 km/h or above. Alternatively, paths can be located alongside low-speed roads (preferably < 30 km/h). The separation of pedestrians and cyclists from the road traffic ideally would place them beyond the clear zone distances. This becomes impractical in most circumstances, and so the design process should reflect the approach of providing separation, assessing the risks from errant vehicles, and providing the appropriate infrastructure to align with the assessment. An element to consider is the on-road and off-road circumstances, where the off-road is relatively close to the road. On-road, the road users are more likely to be aware of each other, whereas off-road, the path users may not be as aware of the road users compared with the on-road paths. Off-road paths would still rely on the users to be alert to the actions of the road users. 2017 edn, Figure 5.8. Commentary includes clearances where there are high speed limits (> 80 km/h).	Retain current commentary.	Agreed – need to apply common sense to path position and separation particularly in relation to speed limits and volumes.
5.3	Table 5.1 Factors for consideration should include the road speed (refer to previous comments). Paths near property boundaries can have very short sight distances to vehicles leaving a property; similarly, the driver has very short sight distances to path users. Locating paths along, or near, property boundaries should be provided with adequate sight distances to allow the driver or cyclist to be identified and action taken to prevent a collision. In a residential area, providing this sight distance can be problematic with property owners commonly planting up to their front boundary. Suggest the locations of paths be located away from property boundaries where the sight lines can be provided. 2017 edn, Table 4.1. Restrictions on visibility included in the Table as a factor in determining the path location. Considered appropriate.	Retain current commentary. Note: there is some overlap, but is used to retain context, rather than provide guidance.	Agreed – there seems to be a fair amount of overlap with *GRD Parts 3, 4* and *4A*.
6	**Design Criteria for Pedestrian Paths**		
	Nil.	–	–
7	**Path Design Criteria for Bicycles**		
7.2	The bicycle operating speeds, when considered for shared use paths, should include consideration of the volumes of bicycles and pedestrians, particularly the age groups of the pedestrians for their capability to respond to the bicycles. Older pedestrians may be vulnerable to injury from a collision with a bicycle ridden at high-speed. 2017 edn, Section 5.1. This section discusses bicycle operating speed. The need to consider path users is contained in Section 3.	Retain current commentary.	Agreed – need to apply common sense to shared paths and separation, particularly in relation to relative speeds and volumes.

Section	Comments	Suggested amendments	Road Design Task Force considerations
7.5.3	The widths of shared use paths should take into account the path user characteristics; similar to the comments for Section 7.2. 2017 edn, Section 5.1.4. Path width discussion and suggested widths has been expanded and includes type of path and expected volumes of pedestrians and cyclists.	Retain current commentary.	Agreed.
7.5.4	Figure 7.2 The separation of paths with low height kerbs can be difficult to see, and if they are used, they need to be identifiable by the cyclists. Suggest that if a kerb is used, consideration be made to having traversable kerbs. 2017 edn, Figure 2.4 includes traversable treatments.	Retain current commentary.	Noted that it could do better.
7.6.2	Figure 7.3 The cross-section of the path shown in Figure 7.3 shows four types of treatments. The batter slopes on two of the cross-sections show catch drains close to the path. The shape of these catch drains should not present a hazard. Suggest the cross-sections be reviewed and commentary on the shape of catch drains be added. 2017 edn, Figure 5.14. Reference to *GRD Part 5B* is included for guidance on swales and catch drains. Figure could be enhanced with guidance on channel slopes.	Consider for inclusion.	Agreed – enhance advice.
8	**Intersections of Paths with Roads**		
8.1	Path connections to a road create a location where there can be a concentration of pedestrians close to traffic lanes. These areas are vulnerable to errant vehicles and consideration should be given to providing protection for the pedestrians, or vehicle speeds reduced to < 30 km/h. 2017 edn, Section 7.1. Guidance relates to the types of treatments to minimise further hazards to path users.	Retain current commentary.	Agreed – need to apply common sense to path position and separation, particularly in relation proximity to traffic to speed limits and volumes.
9	**Paths Remote from Roads**		
9.3	The intersection of paths should include information to identify to the path user that they are approaching an intersection in order to alert them to possible conflicting movements. Suggest the inclusion of advance warning information, e.g. linemarking or signing to alert path users they are approaching an intersection. 2017 edn, Section 6.3 includes information on signing and pavement markings at intersections of paths.	Retain current commentary.	Agreed.

Section	Comments	Suggested amendments	Road Design Task Force considerations
10	**Path Terminal Treatments**		
10.1	An indication is provided that a basic requirement is that cyclists be able to maintain their speed in undertaking a road crossing. The sight distance required to enable this to occur safely is relatively long, and in urban areas, off-road paths are often constructed through highly developed areas, which can result in restricted sight distance along the intersecting road. Paragraph 9 provides commentary on situations when restrictive devices may be unavoidable, and cyclists need to be slowed down. In many situations, particularly in urban areas, the sight distance available to the cyclists will be less than the amount needed, and so, restrictive devices are likely to be required. Suggest the wording of Paragraph 7 be amended to indicate that the cyclist's preference is to maintain speed, and site conditions, including the available sight distance, need to be assessed to guide the installation of any terminal treatment. 2017 edn, Section 7.5. Commentary on safety.	Retain current commentary.	Agreed – it is important that cyclists are not unduly distracted by having to negotiate speed reduction devices close to an intersection. It is potentially more important, however, that cyclists moderate their speed so that intersections are negotiated safely.
11	**Provision for Cyclists at Structures**		
	Nil.	–	–
12	**Construction and Maintenance Considerations for Paths**		
	Nil.	–	–
	Appendices		
C.3	The Bicycle Safety Audit checklist provides guidance on elements to be considered and includes the alignment and cross-section elements. Not included within the elements for consideration is the run-off areas alongside the path.	Suggest that the run-off areas alongside the path should be included in a review.	No comments.
	Commentaries		
C3	Pedestrian use of a road shoulder is preferable to the use of traffic lanes. In some situations, the pedestrian use may be regular, e.g. on a rural school bus route where the bus stop may be established away from the final destination of the student and relies on the use of the road shoulder to travel to and from the bus stop. The acceptance of the use of the shoulder should be assessed for suitability of use by pedestrians. 2017 edn, Section C1.2.2 indicates a preference for off-road paths.	Retain current commentary.	Agreed.
Amend the following Sections **Section 2.2.2, Table 2.1: add cross-reference to *GRS Part 3* (Austroads 2008a) for appropriate speed limits.** **Section 5.10, Figure 5.14: amend the figure to include batter and slopes of 1:5 (V:H).**			

Table D 10: ***GRD Part 6B: Roadside Environment*** **(2015k)**

Section	Comments	Suggested amendments	Road Design Task Force considerations
1	**Introduction**		
1.4	The design objectives should foremost be the safety of the road users. To reinforce this aspect, suggest that the safety points listed, particularly points 7 and 8, be placed at the head of the list.	Consider for inclusion.	Agreed, re-order dot points.
1.4.3 1.3.1 (2015 edn)	A brief overview is provided of the Safe System approach and suggest a cross-reference to *GRD Part 6* (Austroads 2019 draft), which contains additional information that would assist if the designer was seeking further information. Additional cross-reference would be useful.	Consider for inclusion.	Agreed.
2	**Environmental Aspects**		
	Nil	–	–
3	**Roadside Amenity**		
3.3.3	Cost considerations – commentary is provided on the circumstances when traffic management is not required, for circumstances where roadside maintenance activities are undertaken behind road safety barriers and beyond the clear zone. This aspect should be reviewed with the findings from Austroads project ST1427 *Improving Roadside Safety* (Austroads 2014g). Current commentary indicates traffic management in some form is usually required. This matter is better described in a worksite traffic management manual.	Retaining current commentary.	Agree, but could be expanded to consider Safety in Design (SiD) and Maintenance in Design (MiD).
4	**Roadside Infrastructure**		
4.1.2	Flood depth indicators are suggested for use to allow motorists to make a decision on whether to proceed across the flooded road. Road conditions are not necessarily able to be observed in this situation. The guidance on crossing the flooded road without being able to assess the road conditions seems to be inconsistent with the Safe System principles of having a driver aware of the road conditions and making decisions with this information. Note: The safety at floodways is a current Austroads project. The project recommended development of a floodway management manual. Refer to Project: *Safety Provisions for Floodways over Roads*.	Refer to report AP-R481-15.	Agree with also the inclusion of its recommendations in *GRD Part 4/4A* – see Item 14 of this report.
4.1.3	Lighting Poles – Lighting poles should preferably be frangible type poles. Suggest this is reflected in the Guide. 2015 edn includes this information.	Retain current commentary.	Wording could be improved.

Section	Comments	Suggested amendments	Road Design Task Force considerations
4.1.3	Rigid Poles – Where rigid poles are installed, protection from errant vehicles is likely to be required. Suggest the treatment of rigid poles be strengthened to include the need for protection of these poles. 2015 edn includes this information.	Retain current commentary.	Agreed.
	Appendices		
	Nil.	–	–

Amend the following Sections

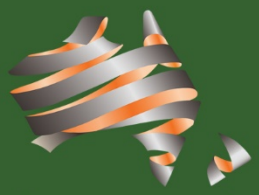
Section 1.4: re-order to have the following listed first:

- **ensure the safety of the travelling public by providing appropriate roadside furniture and lighting facilities**
- **in urban areas, apply appropriate urban design concepts to improve amenity and the safety of the area through which the road passes**
- **improve visual amenity and safe travel by appropriate design of urban and regional features and landscaping**

Section 1.3.1: fourth paragraph: add cross-reference to *GRD Part 1* and *Part 2* for further information on the Safe System and design.

Section 3.3.2: add third paragraph. 'For further information on safety in design refer to Health and Safety in Design Minimum standard (NZTA 2016).'

Section 4.1.2, Guide posts: third paragraph: add cross-reference to *Safety Provisions for Floodways over Roads* (Austroads 2015d).



Austroads

Level 9, 287 Elizabeth Street
Sydney NSW 2000 Australia

Phone: +61 2 8265 3300

austroads@austroads.com.au
www.austroads.com.au