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ABSTRACT

Intersections represent one of the most safety critical parts of the road network. They are characterised by a high risk of collisions with large impact angles and high speeds. In 2019, 20% of fatal crashes in metropolitan areas occurred at intersections. Knowledge of both the types and relative incidence of intersection crashes should assist in identifying effective treatments aimed at reducing the risk of casualty crashes (fatal, injury) in this critical part of the road network. Therefore, the objective of this report was to provide a broad overview of the various types of crashes occurring at intersections in South Australia. A top-down analysis was carried out on police reported road crashes that occurred in South Australia between 2013 and 2019 (inclusive). After an initial overview of all crashes at intersections, a more specific analysis was carried out on casualty crashes at intersections. Finally, a specific analysis was conducted on pedestrian-related casualty crashes at intersections. At each level of this top-down approach, a breakdown analysis was conducted to further examine the role of relevant factors such as type of control (signalised, priority, roundabouts), road environment (urban or rural) and speed limit. Results are presented in the form of various graphs and cover three major geographical areas: (i) the entire state, (ii) Adelaide metropolitan area only, (iii) outside of Adelaide metropolitan area. This information can be used to support and inform future research activities as well as the selection of appropriate countermeasures to improve safety at intersections.

KEYWORDS

Intersections, Fatal and injury crashes, Road environment, Speed limit, Intersection control

Summary

Intersections represent one of the most safety critical parts of the road network. They are characterised by a high risk of collisions with large impact angles and high speeds due to their nature of being the crossing point of multiple road segments. In 2019, 20% of fatal crashes in metropolitan areas occurred at intersections (DPTI, 2019). Knowledge of both the types and relative incidence of intersection crashes should assist in identifying effective treatments aimed at reducing the risk of casualty crashes in this critical part of the road network. The objective of this report is to provide a broad overview of the various types of crashes occurring at intersections in South Australia (SA).

An analysis of intersection crashes occurring in SA from 2013 to 2019 (inclusive) was carried out following a top-down approach. Initially a general overview of all crashes at intersections was undertaken, which was further refined to a focus on casualty (fatal or injury requiring hospital treatment/admission) crashes, and then narrowed down to casualty crashes involving pedestrians. The following findings were evident from the crash data analysis:

Crashes of any severity level

- Intersection crashes account for approximately 50% of crashes in the Adelaide metropolitan region, compared to around 25% of crashes outside of the metropolitan area.
- Intersection crashes tend to be spread across the entire road network. Recurrent crashes at the same intersections were rare, with the vast majority of intersections having no more than one crash per year on average.
- The distribution of adjacent direction, opposing direction and same travel direction intersection crashes are spread evenly in the Adelaide metropolitan region, whereas for the rest of the state, adjacent direction crashes are more prevalent.
- Intersection crashes occur most frequently at signalised and uncontrolled intersections in the Adelaide metropolitan area, whereas they occur most frequently at priority (give-way) and uncontrolled intersections in the rest of the state.

Fatal and injury crashes

- The risk of a fatality in an intersection crash involving pedestrians in the Adelaide metropolitan area is considerably higher (almost five times greater) than the average risk of fatality for intersection crashes involving any type of road users.
- Casualty crashes at signalised intersections are most frequent for vehicles manoeuvring or travelling in either the same direction or opposing directions, whereas for all other intersection controls casualty crashes are more prevalent between vehicles travelling in adjacent directions.
- The vast majority of casualty crashes at intersections in the Adelaide metropolitan region occur in zones with a speed limit of 60 km/h, whereas intersection casualty crashes in the rest of the state are evenly spread across speed zones ranging from 50 km/h to 100 km/h. However, pedestrian-related intersection crashes mostly occur within speed zones of 50 km/h and 60 km/h across both the Adelaide metropolitan region and the rest of the state.
- Across the whole state, the majority of casualty crashes at intersections occur either at crossroads or T-junctions. Crossroads represent the most frequent geometry for crashes at intersections controlled by either traffic signals, give-way priority or roundabouts. Almost all crashes occurring where no control was present happened at T-junctions. Almost all crashes occurring where no control was present happened at T-junctions (potentially due to an exposure factor, as the majority of T-junctions are uncontrolled).
- Head-on crashes are relatively rare at intersections.

These findings will support and inform future research activities as well as the selection of appropriate countermeasures to improve safety at intersections in SA.

Contents

1 Introduction

1.1 Background

Intersections represent one of the most safety critical parts of the road network. They are characterised by a high risk of collisions with large impact angles and high speeds due to their nature of being the crossing point of multiple road segments. In 2019, 20% of fatal crashes in metropolitan areas occurred at intersections (DPTI, 2019).

Knowledge of both the types and frequencies of intersection crashes should help in identifying effective treatments aimed at reducing the risk of casualty crashes in this critical part of the road network. The proportion and severity of crash types at intersections may vary based on factors such as type of control (signalised, priority, roundabouts), road environment (urban or rural) and speed limit. Additionally, the intersection geometry (e.g. tree or four legs) may also affect the frequency and severity of crashes.

1.2 Objective

The objective of this report is to provide a broad overview of the various types of crashes occurring at intersections in South Australia (SA). This information can be used to support and inform future research activities as well as the selection of appropriate countermeasures to improve safety at intersections.

2 Methodology

2.1 TARS crash dataset

The analysis was based on crash data that were reported in the South Australian Traffic Accident Reporting System (TARS) database, maintained by the Department for Infrastructure and Transport (DIT). The TARS dataset comprises of police-reported crashes, which have been additionally reviewed by DIT personnel before being included in the database. This analysis considered crashes that occurred in the 7-year period between 2013 and 2019 (inclusive).

The identification of crashes that occurred at intersections was based on those fields in the TARS database which are used to report the position of a crash relative to nearby roads. In TARS, up to three different roads can be associated to each reported crash. Crashes that occurred at an intersection could be identified as those events in the database for which only two roads were reported and the option for a third road (needed to identify midblock crashes between two intersections) was left blank.

This approach represents the most accurate and feasible way to identify intersection crashes in TARS. Nonetheless, a small amount of error may still be present if road names are not always properly reported (e.g. midblock crashes erroneously reported with only one of two in-between roads, or crashes at intersections between more than two roads reported also with the optional third name reserved to midblock crashes).

2.2 Data analysis

The analysis of the crash data was carried out following a top-down approach, as indicated in Figure 2.1. Initially, a general overview of all crashes at intersections was undertaken. The analysis was then refined to a focus on casualty crashes (i.e., resulting in fatalities or injuries) at intersections. Finally, the analysis narrowed down to casualty crashes at intersections involving pedestrians.

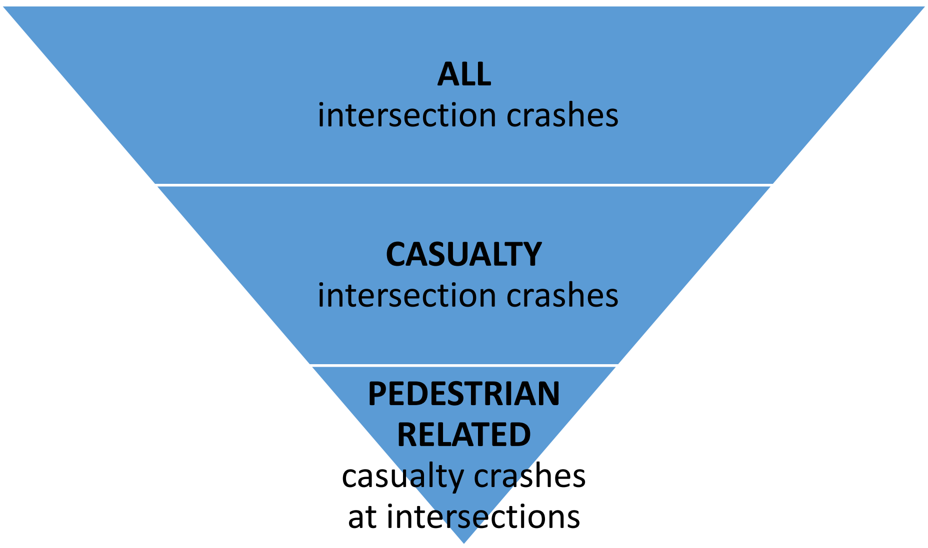


Figure 2.1
Top-down approach followed in the crash data analysis

A breakdown approach was used to further analyse the role of major relevant factors at any level of the top-down approach. Given the broad scope of this project as well as the limited resources, only those factors that were deemed to be the most relevant for intersection crashes were considered in the breakdown analysis, which included crash characteristics such as major crash modes (e.g. adjacent-direction crashes) as well as detailed crash types (e.g. right-turn crashes). The incidence of intersection crashes was the most common parameter evaluated in this analysis. In specific sections of this analysis, relative risks (i.e. a ratio between the risk and a baseline risk) were also evaluated in order to provide a comparison of the risk against a reference situation, such all road crashes or intersection crashes in a different geographical area. Finally, the yearly frequency of crashes at each intersection was also calculated to evaluate how often multiple crashes tended to occur at the same intersection.The following list provides an overview of the breakdown analysis for each of the three main categories of the top-down approach.

- **ALL intersection crashes**
  - Overall crash incidence and relative risks
  - Breakdown analysis by
    - Control types and crash severity
    - Number of crashes per intersection
- **CASUALTY intersection crashes**
  - Breakdown analysis by
    - Crash modes and control types
    - Speed limits and control types
    - Intersection geometry and control types
- **PEDESTRIAN-RELATED casualty crashes at intersections**
  - Overall crash incidence and relative risks
  - Breakdown analysis by
    - Control types and crash severity
    - Speed Limits and control types

Major crash modes and detailed crash types are reported in the crash data using the standardised codes in the Definition for Coding Accidents (DCA) in use in SA. Details of the DCA codes are provided in the Appendix.

2.2.1 Geographical extension

Three major geographical extensions were considered throughout the analysis of the crash data: (i) the entire state, (ii) Adelaide metropolitan area only, (iii) outside of Adelaide metropolitan area. The allocation of crashes to either the Adelaide metropolitan area or outside of the Adelaide metropolitan area was based on specific information on the crash statistical area as recorded in the TARS database. In the TARS database, the crash statistical area is classified using the following three options: inner Adelaide, outer Adelaide, and outside Adelaide. For details on the defi nition of each of these areas, please refer to TARS database dictionary (DIT, 2020). The definition of Adelaide metropolitan area used in this analysis comprises both the inner Adelaide and outer Adelaide areas defined in TARS.

2.2.2 Classification of crash severity

The following definitions of fatal crash, injury crash and crash of any severity was adopted throughout the analysis:

- **Fatal crash** – a crash that resulted in one or more fatalities
- **Injury crash** - a crash that resulted in at least one of the involved road users to be either admitted to hospital or treated at hospital

- **Crash of any severity** – a crash that resulted in any severity including fatality, serious injury, minor injury (i.e., visit to private doctor) as well as property damage only (PDO)

Note that, in case of crashes where both a fatality and injury were reported, the crash severity was classified as fatal. Also note that the threshold criteria to report PDO crashes in the TARS database increased at least three times throughout the temporal period covered by the analysis described in this report.

3 Results

Given the analytical nature of this work (i.e. statistical analysis of crashes at intersections), results of the crash data analysis are presented throughout this chapter in the form of various graphs. A brief interpretation of the results for each graph is provided at the beginning of each section. Each section is organised in such a way to provide an initial overall of the crash incidence and a subsequent breakdown analysis.

Results are presented separately for each of the following three major geographical areas:

I. entire state (Entire SA)
II. Adelaide (Adelaide metropolitan area)
III. outside of Adelaide (Rest of SA).

Note that results for the entire state and for the Adelaide metropolitan area tend to be very similar due to the fact that the vast majority of crashes in the entire state tend to occur in the Adelaide metropolitan area (i.e., crashes in Adelaide metropolitan area outweigh crashes in the rest of the state).

3.1 Overview of intersection crashes (any severity level)

3.1.1 Comparison of intersection crashes to all other crash types

Overall crash incidence

The proportion of intersection crashes in comparison to other crash types is shown in Figure 3.1. The vast majority of intersection crashes occurred in the Adelaide metropolitan region, with an annual average number of intersection crashes of **6,268** versus **858** in the rest of SA. Also, the incidence of intersection crashes in the Adelaide metropolitan area is almost double than in the rest of the state, with intersection crashes accounting for 50% of all crashes in the metropolitan area versus an incidence of slightly more than 25% in the rest of SA. These considerations are valid for intersection crashes of any severity level (including PDO) as well as for intersection crashes resulting in at least one casualty.

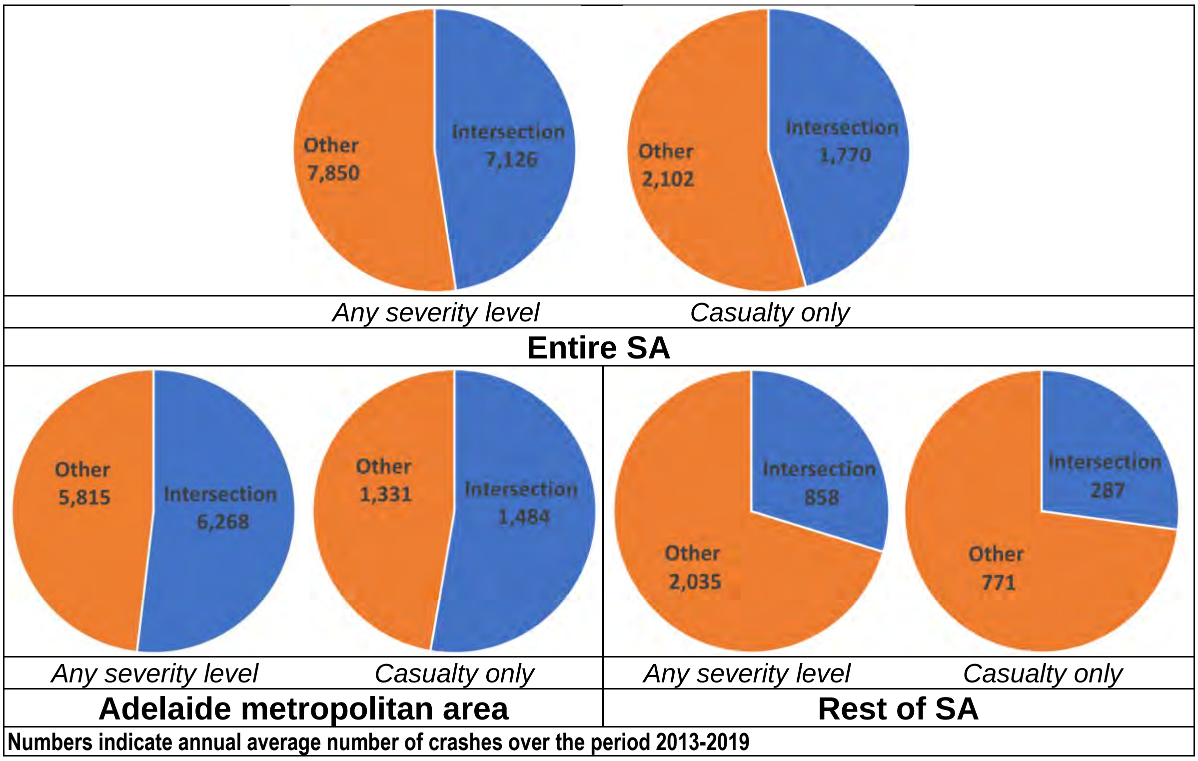


Figure 3.1
Proportion of intersection crashes compared to all other crash types

Relative risk for each level of crash severity (baseline risk: all road crashes)

For each of the reported severity levels, the risk of intersection crashes relative to the corresponding risk when considering the aggregation of all road crashes is shown in Figure 3.2. For crashes at intersections which resulted in fatalities (fatal) or serious injuries requiring hospitalisation (admitted to hospital) the value of those relative risks is below 1.0, indicating that the risk of such crash severity is lower at intersections compared to the overall risk of having a crash with a similar outcome in the road network. However, the risk of intersection crashes resulting in hospital treatment (treated at hospital) is comparable to the overall risk of having a crash with a similar outcome in the road network.

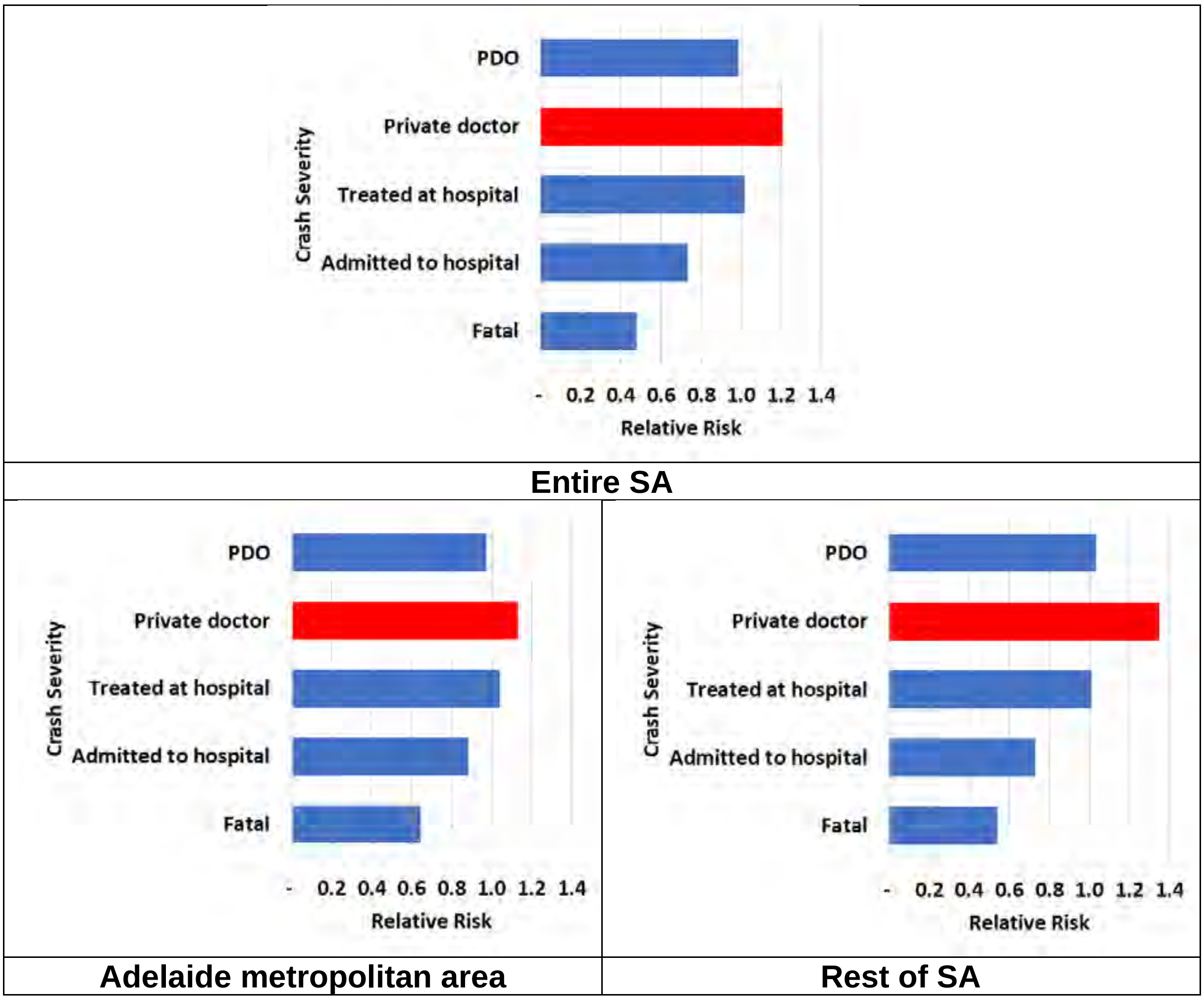


Figure 3.2
Relative risks of crash severities at intersections (compared to the corresponding risk for all road crashes)

3.1.2 Frequency of intersection crashes by control types

Overall incidence by control types (any severity levels)

The distribution of intersection crashes by types of control is shown in Figure 3.3. Intersection crashes in the Adelaide metropolitan area occurred most frequently at signalised (traffic signals) as well as uncontrolled intersections (no control), whereas in the rest of the state they tended to occur most frequently at priority-controlled (give-way) as well as uncontrolled intersections (no control). These considerations are valid for intersection crashes of any severity level (including PDO) as well as for intersection crashes resulting in a casualty.

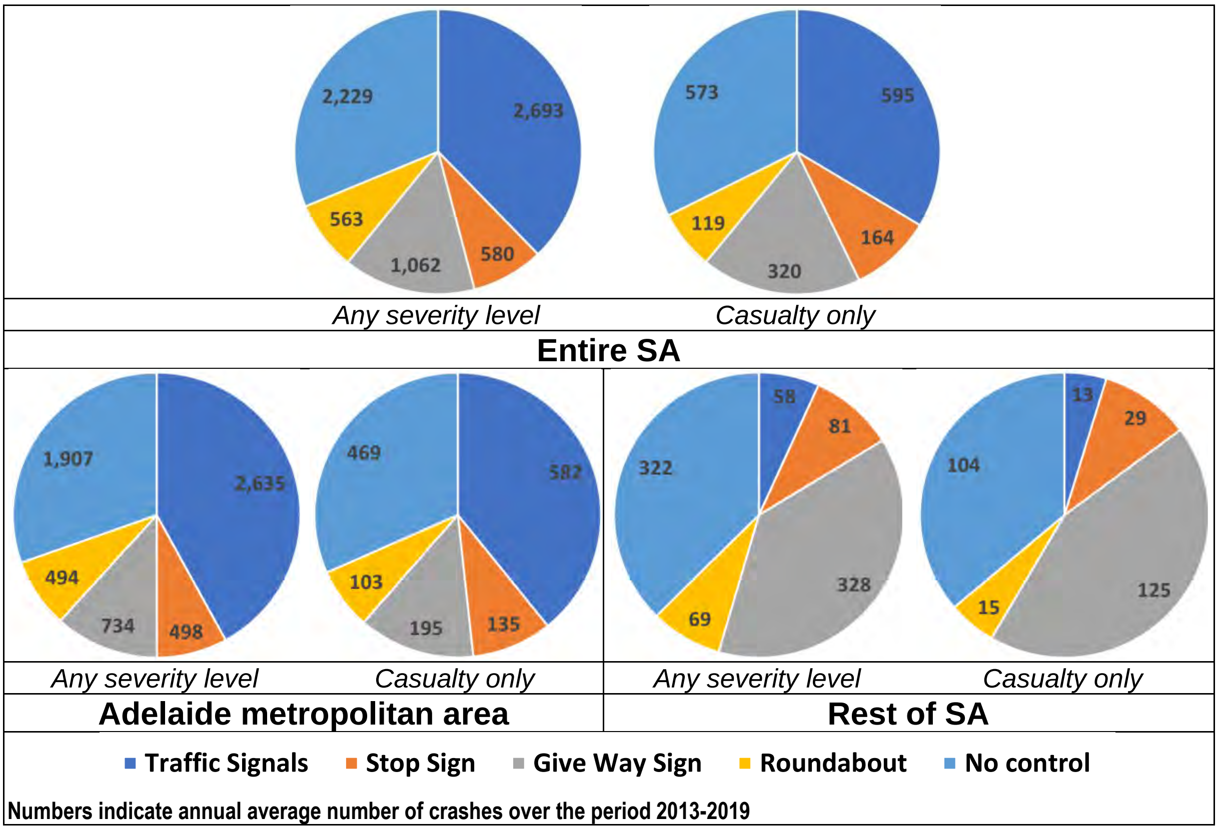


Figure 3.3
Distribution of intersection crashes by control type

Distribution by control types & levels of crash severity

The distribution of intersection crashes by types of control for each severity level is shown in Figure 3.4. Signalised (traffic signals) and uncontrolled (no controls) intersections were equally highly represented in fatal and injury crashes at intersections in the Adelaide metropolitan area, whereas in the rest of the state priority-controlled intersections with give-way signs were the most frequent type of intersections for crashes resulting in fatalities.

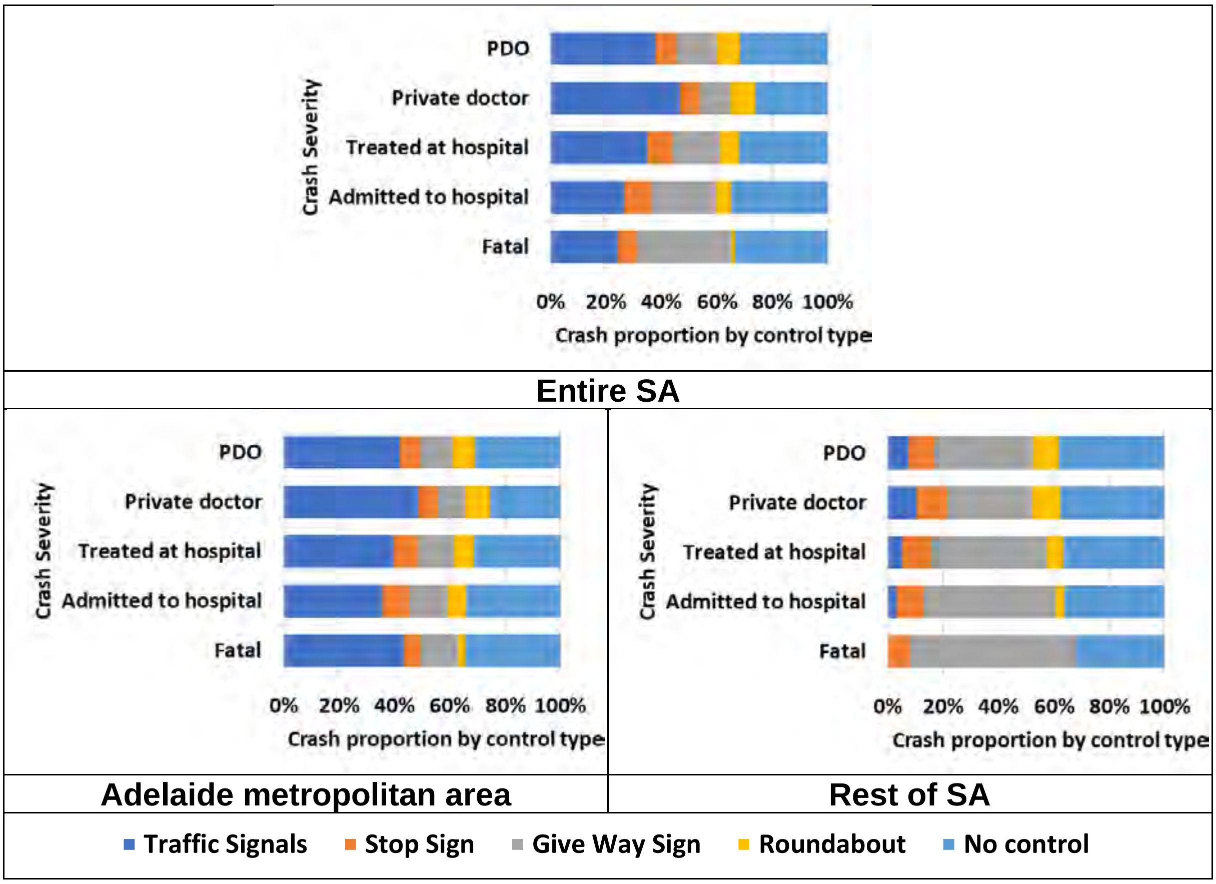


Figure 3.4
Distribution of intersection crashes by control type (for each severity level)

3.1.3 Frequency of intersection crashes by number of crashes per intersection

The frequency (yearly average) of the number of crashes of any severity level that occurred at the same intersection is shown in Figure 3.5. Recurrent crashes at the same intersection tended to be rare over the entire state road network, with the vast majority of intersections where a crash occurred being characterised by an average of no more than one crash per year. This trend applied to casualty crashes as well as all crash severities.

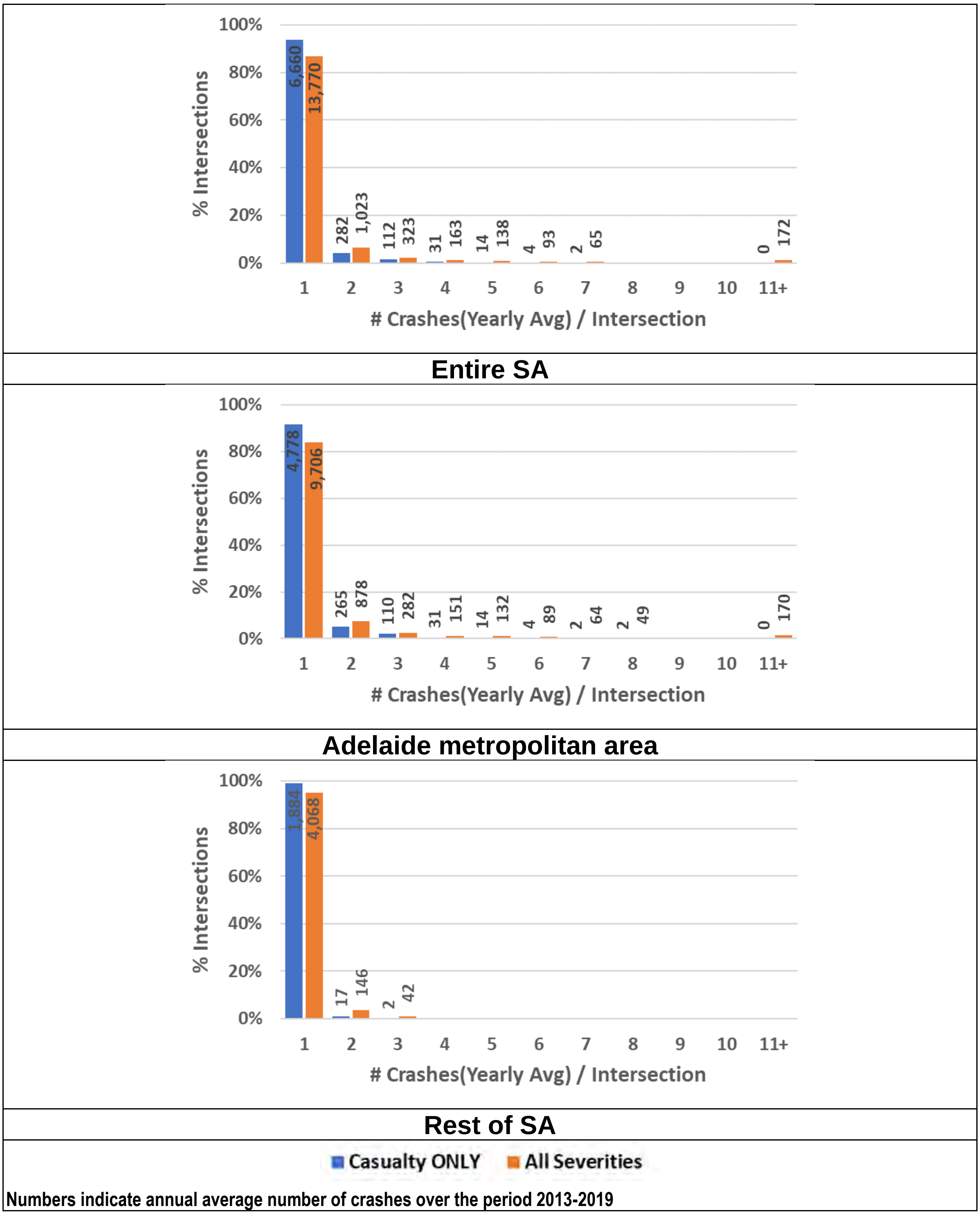


Figure 3.5
Distribution of crashes by number of crashes (yearly average) occurring per intersection

3.2 Casualty crashes at intersections

3.2.1 Frequency by intersection geometry & control types

Overall incidence by intersection geometry

Figure 3.6 shows the distribution of casualty crashes at intersections by intersection geometry. The majority of casualty crashes at intersections occurred either at crossroads or T-junctions. This trend applied to both the Adelaide metropolitan area and the rest of the state.

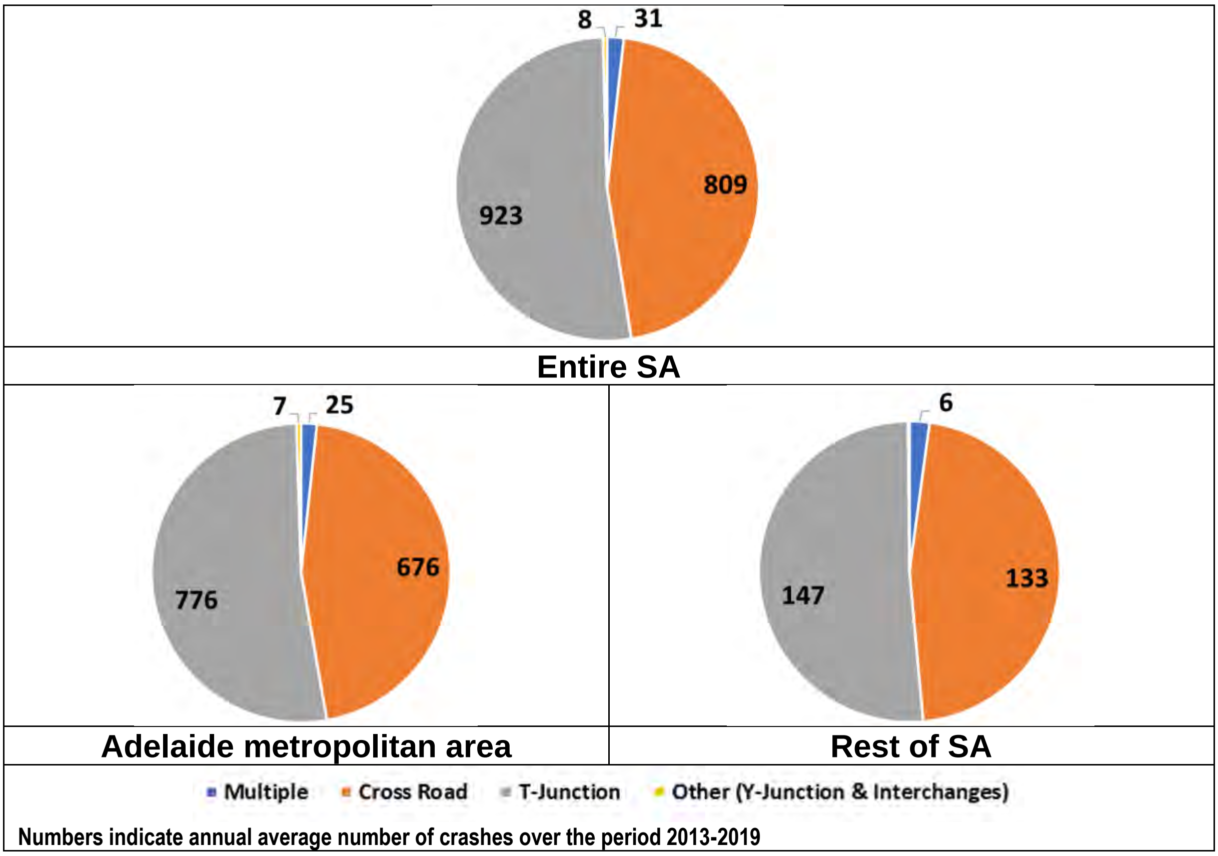


Figure 3.6
Distribution of casualty crashes at intersections by intersection geometry

Distribution by intersection geometry for each control type

The distribution of casualty crashes by intersection geometry and types of control is shown in Figure 3.7. Crossroads represented the most frequent geometry for crashes at signalised (traffic signals), priority-controlled (give way signs) and roundabout-controlled intersections (roundabouts). Almost all crashes occurring where no control was present happened at T-junctions. This is likely a result of exposure given that the majority of T-junctions are uncontrolled in South Australia. Intersection design guidance states that no control is required at three-leg intersections when identification of the terminating road is obvious to road users on all approaches.

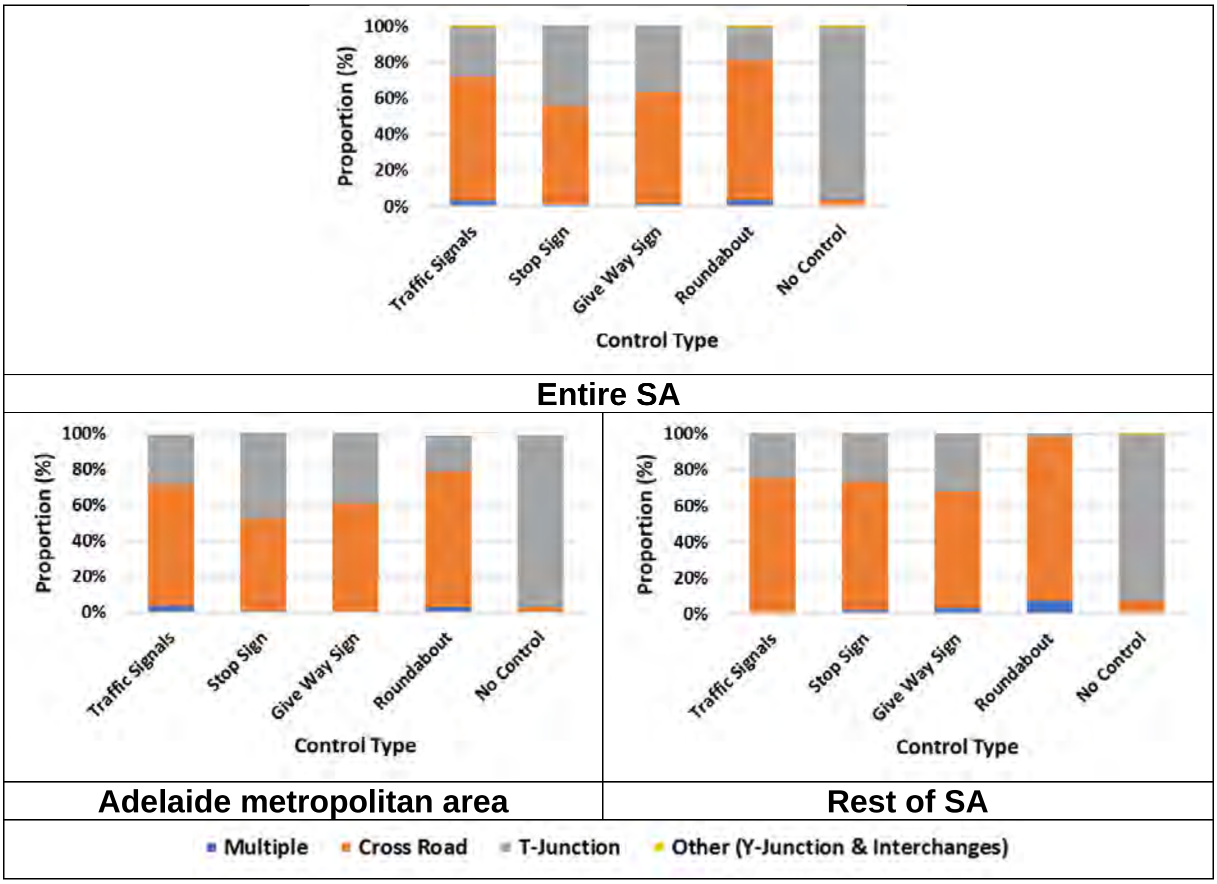


Figure 3.7
Distribution of casualty crashes at intersections by intersection geometry for each control type

3.2.2 Frequency by crash modes & control types

Overall incidence by crash modes

Figure 3.8 shows the distribution of major crash modes for intersection crashes which resulted in at least one casualty. Intersection crashes between vehicles travelling in adjacent, opposing, or same travel directions were equally common in the Adelaide metropolitan region, whereas crashes between vehicles travelling in adjacent directions were more prevalent in the rest of the state.

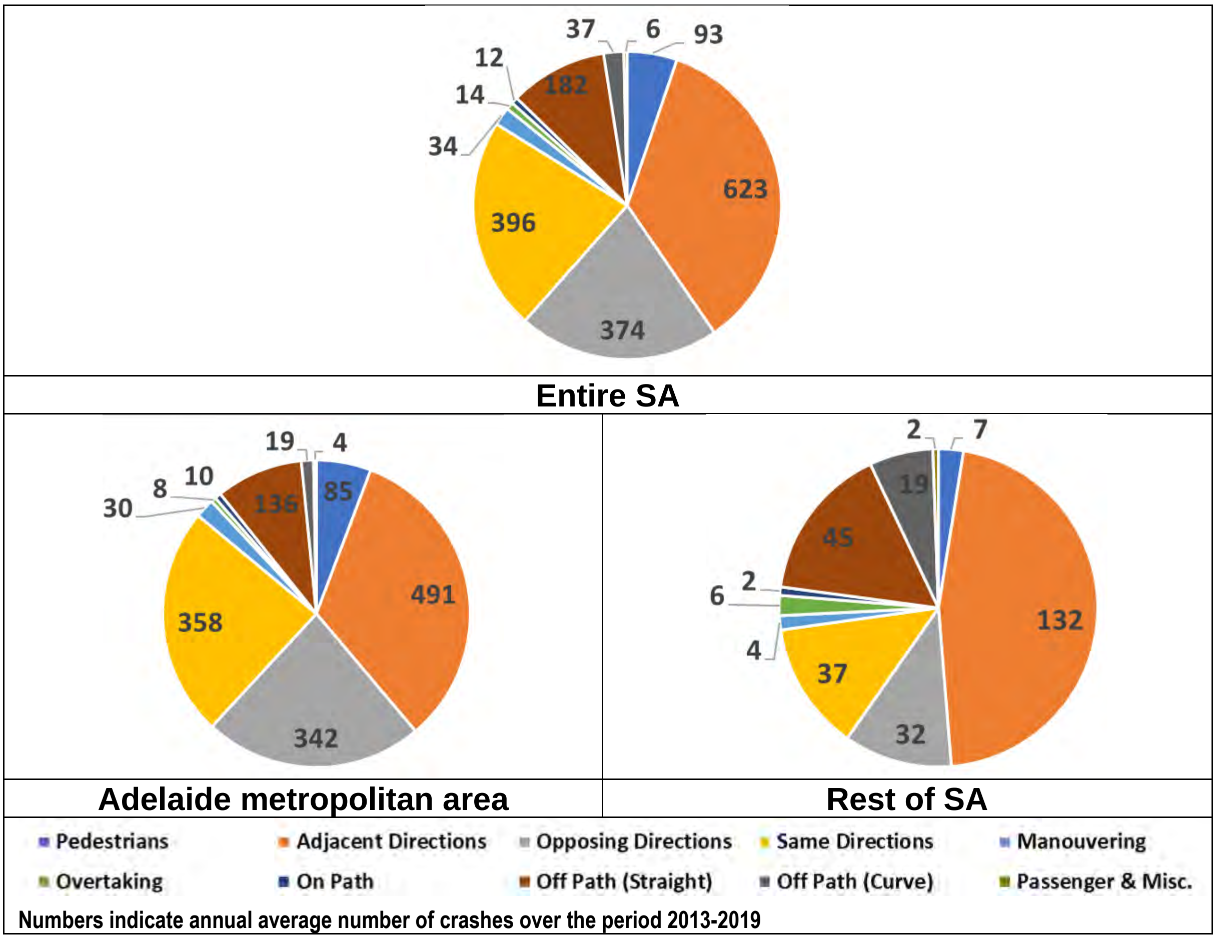


Figure 3.8
Distribution of casualty crashes at intersections by major crash modes

Distribution by crash modes for each control type

The distribution by crash modes and type of control for intersection crashes resulting in at least one casualty is shown in Figure 3.9. Casualty crashes at signalised intersections over the entire state network frequently occurred between vehicles travelling on either the same direction or opposing directions. For all the other types of controls as well as for uncontrolled intersections, crashes between vehicles travelling in adjacent directions were the most frequent.

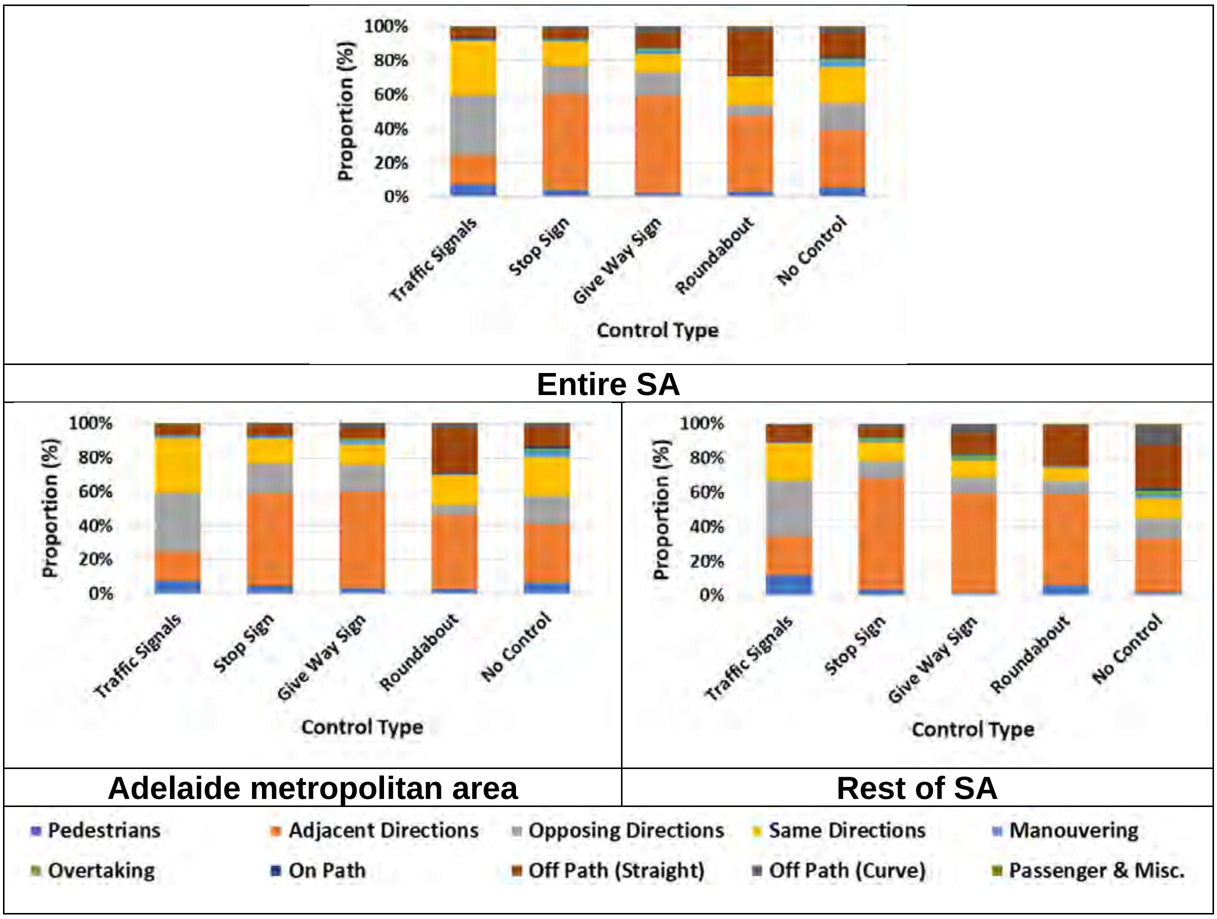


Figure 3.9
Distribution of casualty crashes at intersections by major crash modes for each control type

Crashes between vehicles from **adjacent** directions

Overall incidence by crash types (DCA codes) - The distribution by detailed crash modes for intersection crashes between vehicles travelling in adjacent directions, which resulted in at least one casualty, is shown in Figure 3.10. The two most frequent scenarios for casualty crashes between vehicles travelling in adjacent directions at intersections are: (a) both vehicles crossing the intersection along straight trajectories (cross traffic) and (b) a vehicle turning right into an adjacent leg being hit by another vehicle travelling straight along the adjacent leg of the intersection (right near). A visual representation of these two specific crash modes (DCA codes 110 and 113) can be found in the schematic in the Appendix. These two crash scenarios are equally common in the Adelaide metropolitan region, whereas crashes with both vehicles performing a right turn tend to be more prevalent than the cross-traffic scenario in the rest of the state.

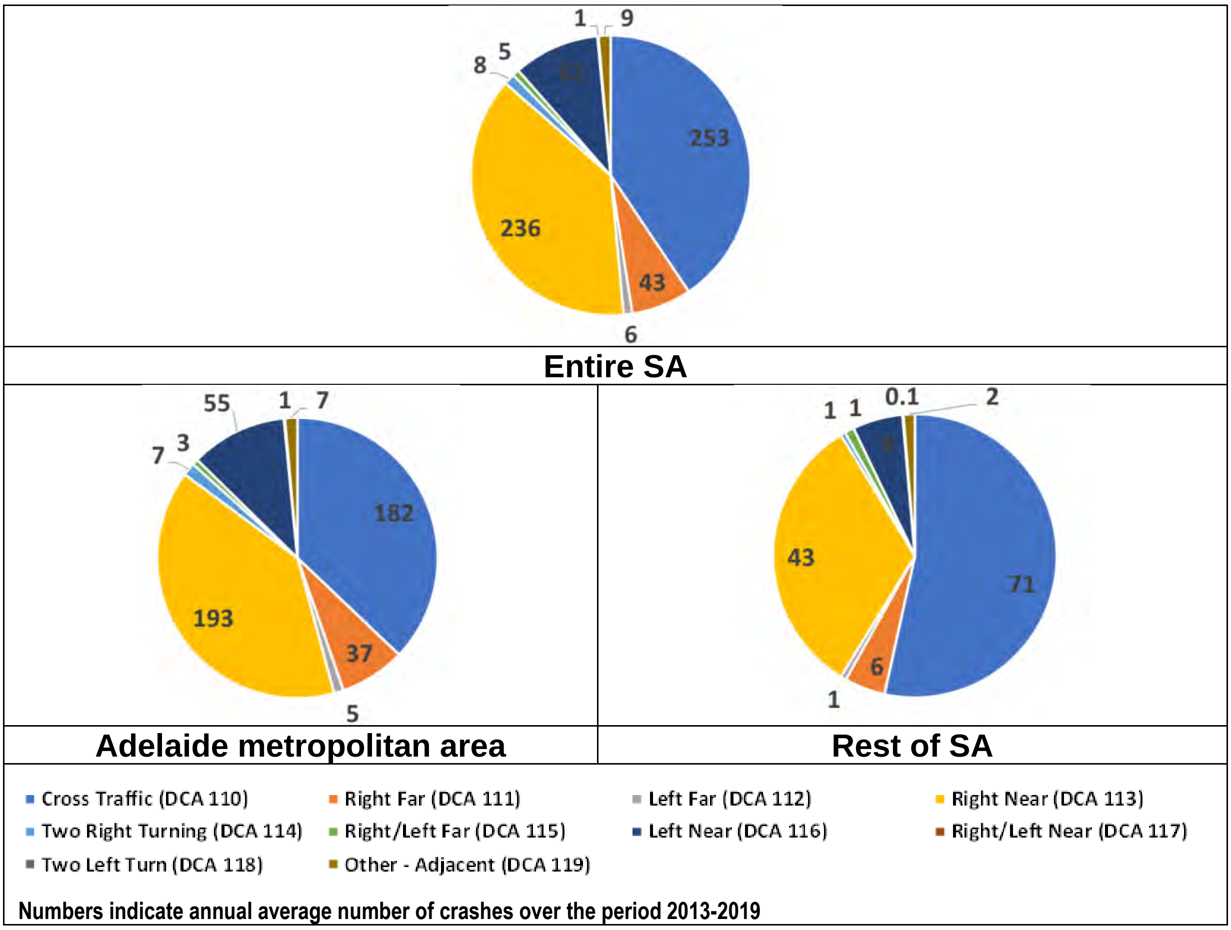


Figure 3.10
Distribution of adjacent-direction casualty crashes at intersections by DCA codes

Distribution of adjacent-direction crashes by control types - The distribution by detailed crash modes and control types for intersection crashes between vehicles travelling in adjacent directions, which resulted in at least one casualty, is shown in Figure 3.11. Right-near crashes are overrepresented at uncontrolled intersections (no control) in both the Adelaide metropolitan area and the rest of the state. Similarly, cross-traffic crashes represent the vast majority of crashes occurring at roundabouts. Note that outside of Adelaide cross-traffic crashes tend to occur slightly more frequently than in the Adelaide metropolitan area at signalised intersections (traffic signals) as well as at priority-controlled intersections (stop and give-way signs).

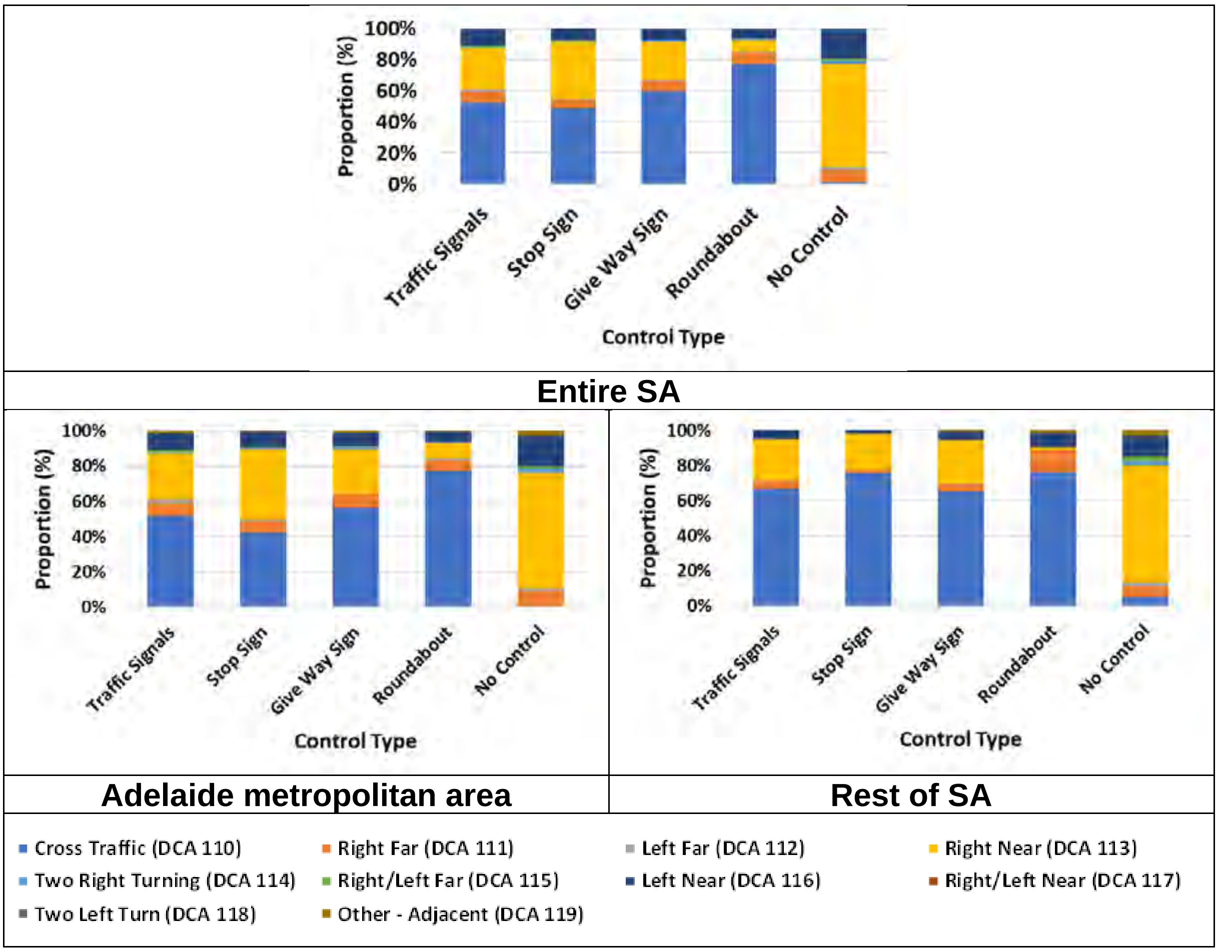


Figure 3.11
Distribution of adjacent-direction casualty crashes at intersections by DCA codes for each control type

Crashes between vehicles from **opposing** directions

Overall incidence by crash types (DCA codes) - The distribution by detailed crash modes for intersection crashes between vehicles travelling in opposite directions, which resulted in at least one casualty, is shown in Figure 3.12. The vast majority of casualty crashes between vehicles travelling on opposing directions at intersections occurred when one vehicle is turning right into an adjacent leg of the intersection and the other vehicle is travelling through the intersection (right through). This trend applies over the entire state.

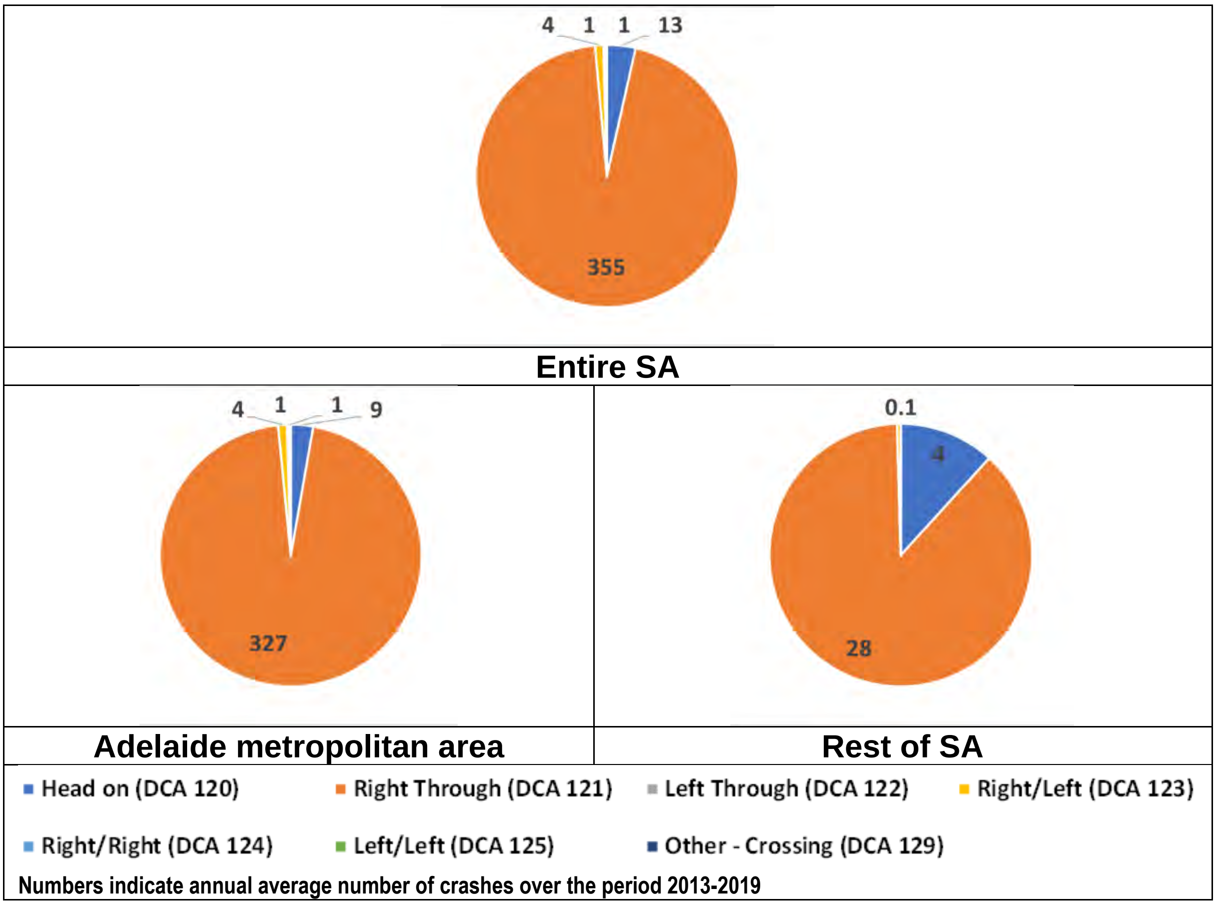


Figure 3.12
Distribution of opposing-direction casualty crashes at intersections by DCA codes

Distribution of opposing-direction crashes by control types - The distribution by detailed crash modes and control types for intersection crashes between vehicles travelling in opposite directions, which resulted in at least one casualty, is shown in Figure 3.13. The vast majority of casualty crashes occurred at intersections with any type of controls (including uncontrolled) are right-through. Head-on crashes at intersections accounted only for a minor portion of the casualties. It is interesting to note that in the Adelaide metropolitan area, head-on crashes occurred also at roundabouts. These head-on casualty crashes at roundabouts were caused by one of the following three reasons: (a) one of the vehicles lost control and mounted over the raised median strip while entering/exiting the roundabout, (b) one of the vehicles negotiated the roundabout the wrong way, or (c) one of the vehicles entered the roundabout in the wrong direction.

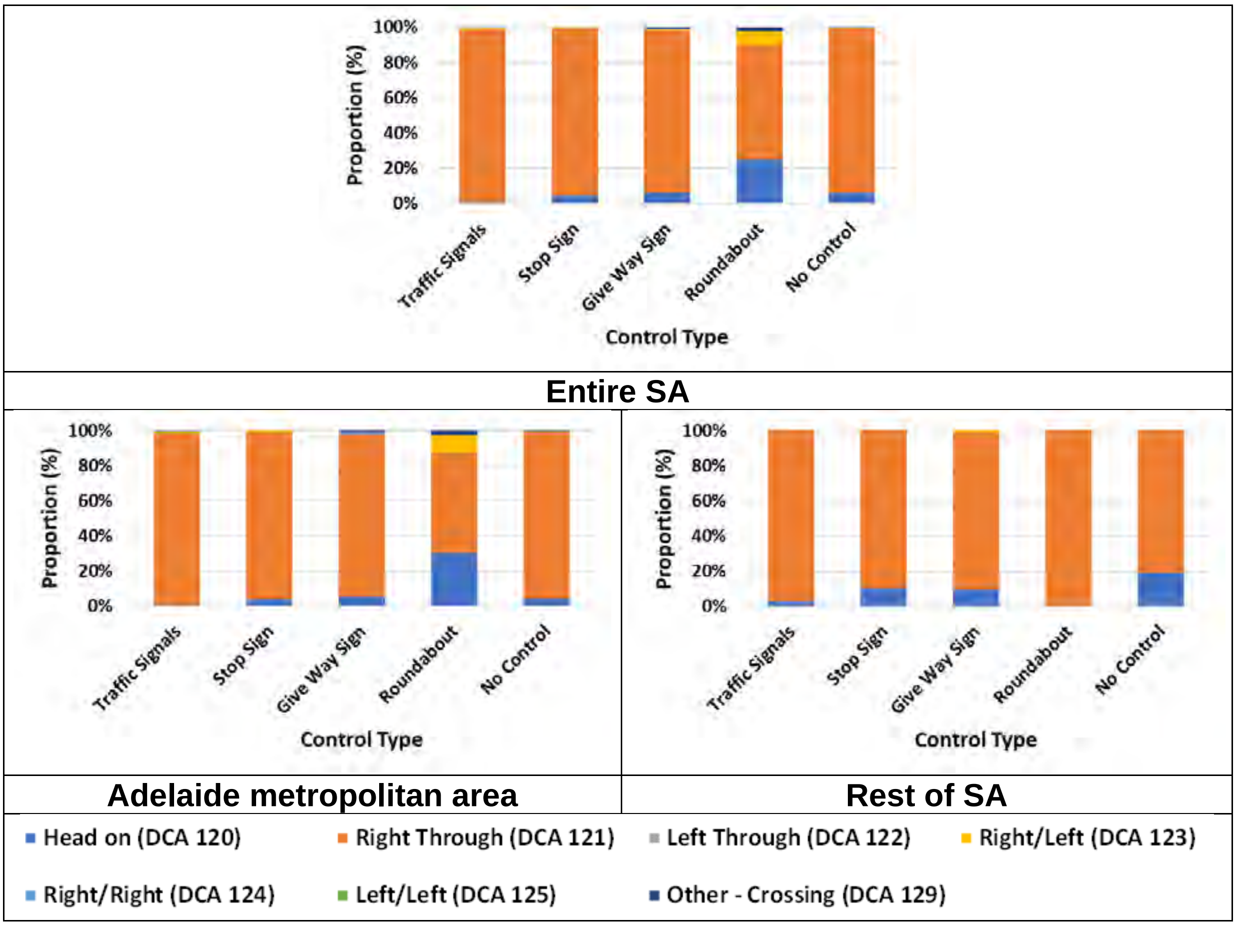


Figure 3.13
Distribution of opposing-direction casualty crashes at intersections by DCA codes for each control type

Crashes between vehicles in **same** direction

Overall incidence by crash types (DCA codes) - The distribution by detailed crash modes for intersection crashes between vehicles travelling in the same directions, which resulted in at least one casualty, is shown in Figure 3.14. The two most frequent scenarios for casualty crashes between vehicles travelling in the same direction at intersections were: (a) both vehicles travelling on a straight path and following each other (rear end) and (b) the leading vehicle turning right into an adjacent leg of the intersection with the following vehicle moving straight (right end). Among these two crash scenarios, rear-end crashes were the most frequent in the Adelaide metropolitan region, whereas right-end crashes were the most frequent in the rest of the state.

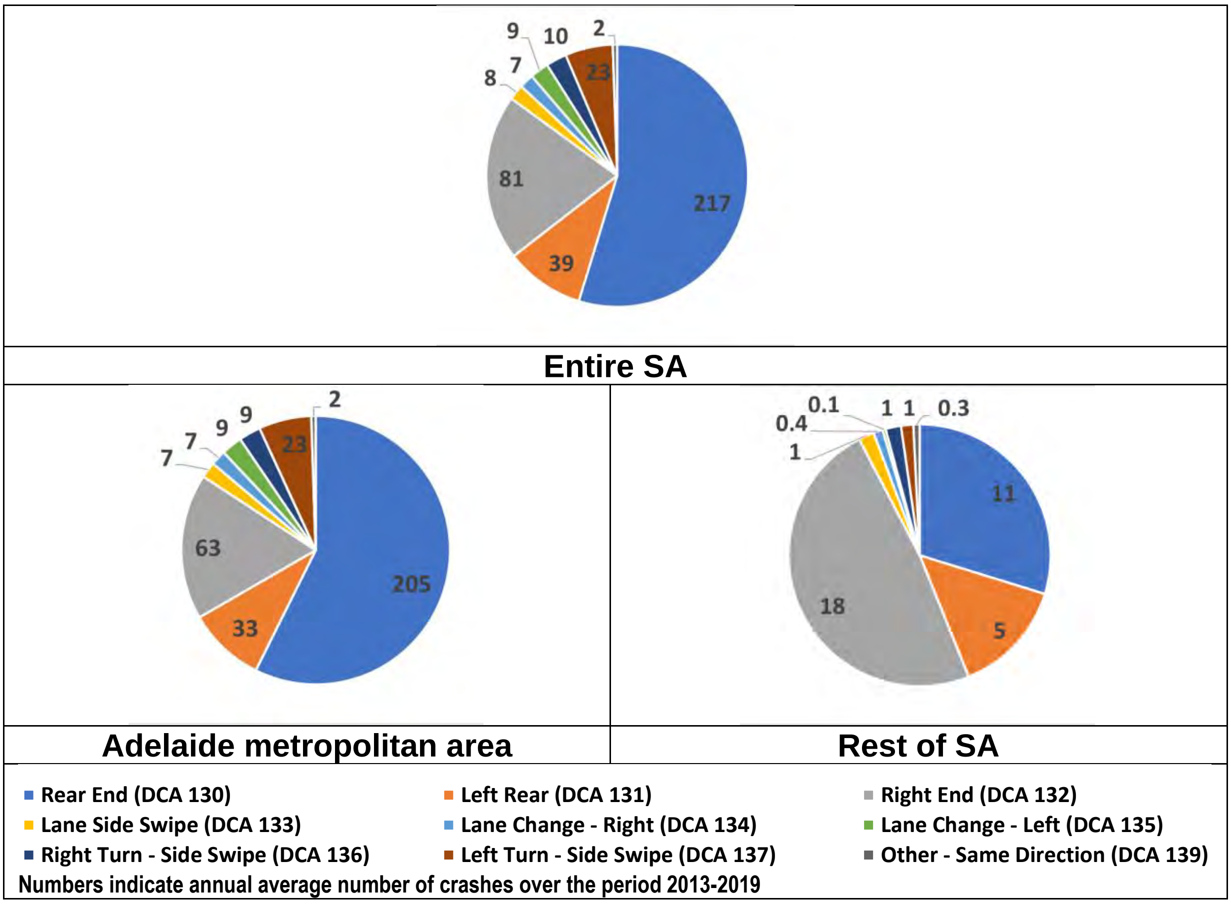


Figure 3.14
Distribution of same-direction casualty crashes at intersections by DCA codes

Distribution of same-direction crashes by control types - The distribution by detailed crash modes and control types for intersection crashes between vehicles travelling in the same direction, which resulted in at least one casualty, is shown in Figure 3.15. Rear-end casualty crashes were the most common types of crashes at signalised intersections (traffic signals) as well as roundabouts, but they tended to be less frequent at priority-controlled intersections with give-way signs. Outside of the Adelaide metropolitan area, right-end crashes tended to be the most common types of casualty crashes at uncontrolled intersections (no control) and priority-controlled intersections with give-way signs.

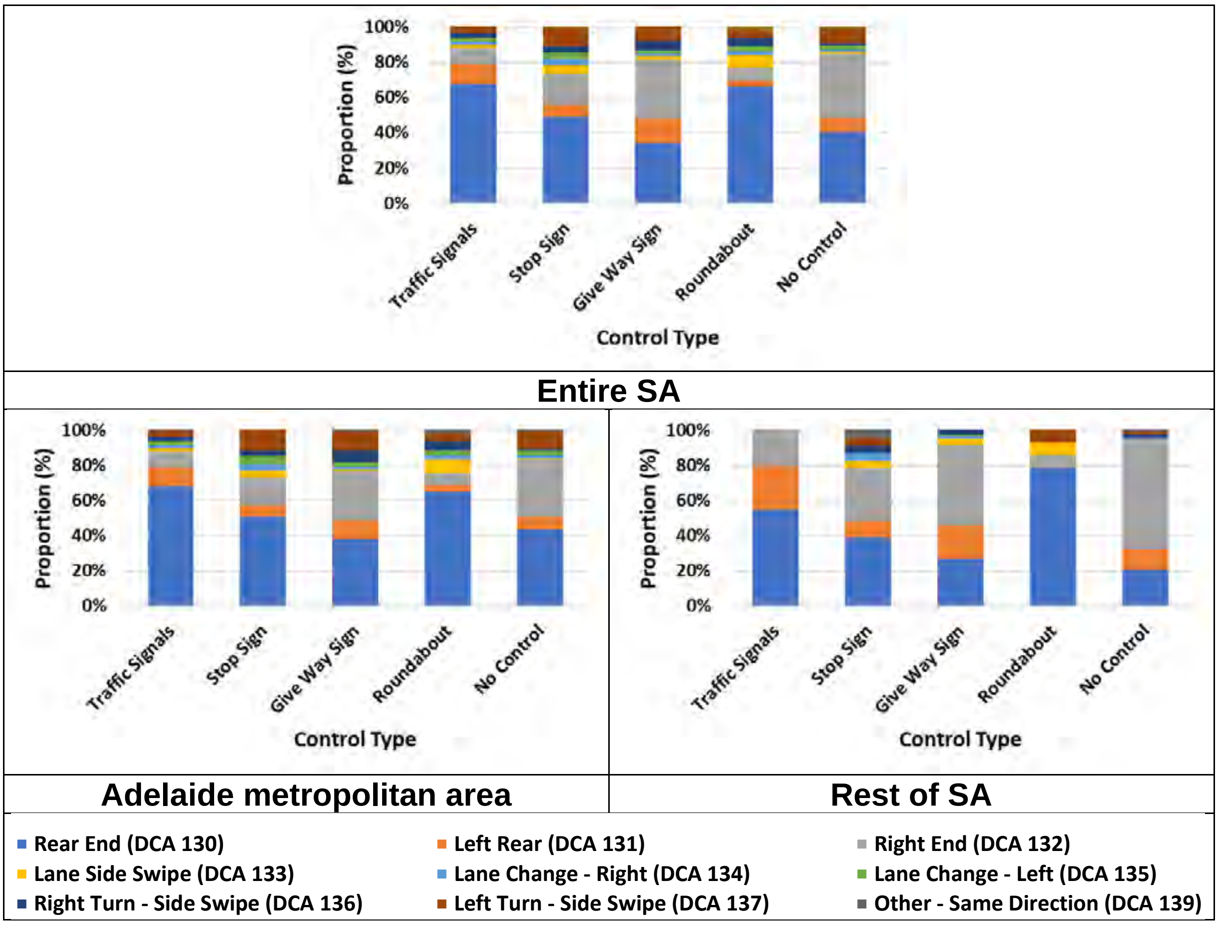


Figure 3.15
Distribution of same-direction casualty crashes at intersections by DCA codes for each control type

3.2.3 Frequency by speed limits & control types

Overall incidence by speed limits

The distribution by speed limits for intersection crashes resulting in at least one casualty is shown in Figure 3.16. The vast majority of casualty crashes at intersections in metropolitan Adelaide occurred in zones with a speed limit of 60 km/h, whereas in the rest of the state they were more evenly spread across speed zones ranging from 50 km/h to 100 km/h. The outcome in the Adelaide metropolitan area is likely to be at least partially affected by greater exposure to 60 km/h speed zones compared to other speed zones (e.g., a large number of intersections are located in 60 km/h speed zones, the majority of traffic travels through this speed zone, or a combination of both factors).

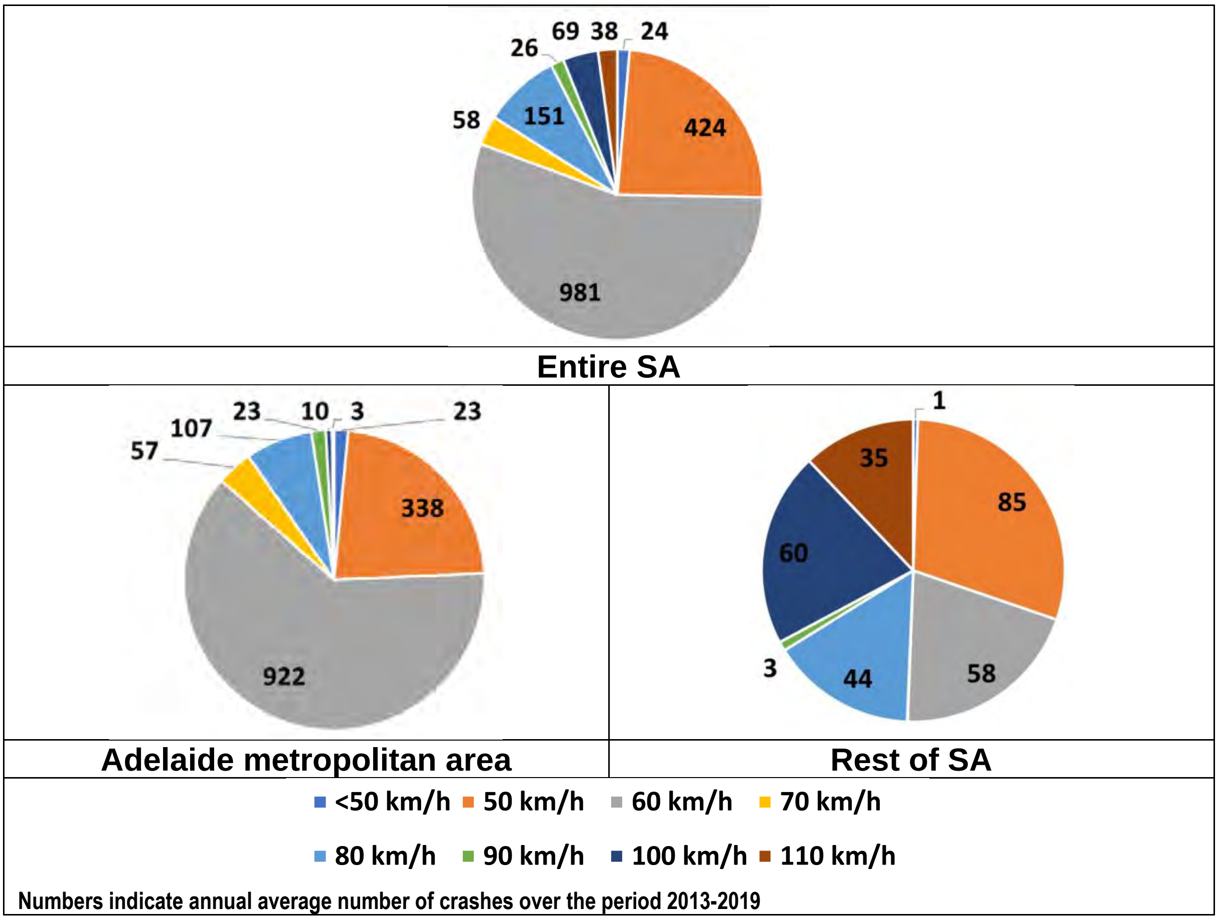


Figure 3.16
Distribution of casualty crashes at intersections by speed limits

Distribution by speed limits for each control type

The distribution by speed limits and types of control for intersection crashes resulting in at least one casualty is shown in Figure 3.17. Casualty crashes at signalised intersections (traffic signals) were most frequent in speed zones of 60 km/h in both the Adelaide metropolitan area and the rest of the state. For casualty crashes at roundabouts the most frequent speed zones are both 50 km/h and 60 km/h. This reflects the common practice of imposing a lower speed limit in proximity to signalised intersections and roundabouts in both metropolitan and rural areas. At intersections with other types of control as well as uncontrolled intersections (no control), casualty crashes in the rest of the state tended to occur in higher speed zones than in the Adelaide metropolitan area. This outcome is likely to be at least partially affected by a greater exposure to higher speed limits in rural areas (e.g., most non-signalised intersections in rural areas tend to be located in speed zones with a high speed limit, the majority of traffic travels on roads with high speed limits, or a combination of both factors).

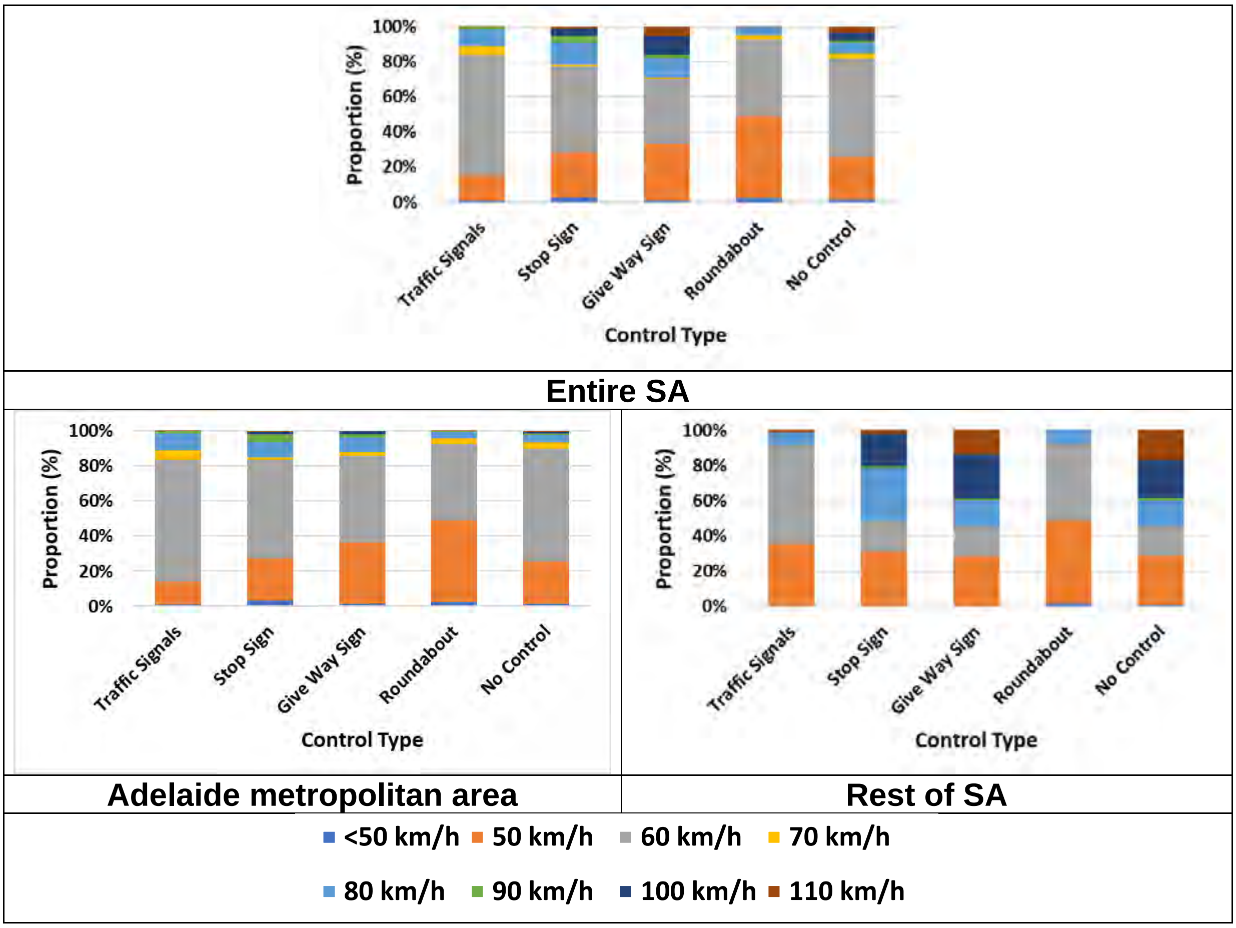


Figure 3.17
Distribution of casualty crashes at intersections by speed limits for each control type

3.3 Casualty crashes involving pedestrians

3.3.1 Overall crash incidence

The proportion of pedestrian-related casualty crashes at intersections relative to all casualty crashes occurring at intersections is shown in Figure 3.18. Pedestrian-related crashes represent a minority of all the casualty crashes that occurred at intersections throughout the entire state. The majority of pedestrian-related casualty crashes at intersections occurred within the Adelaide metropolitan area.

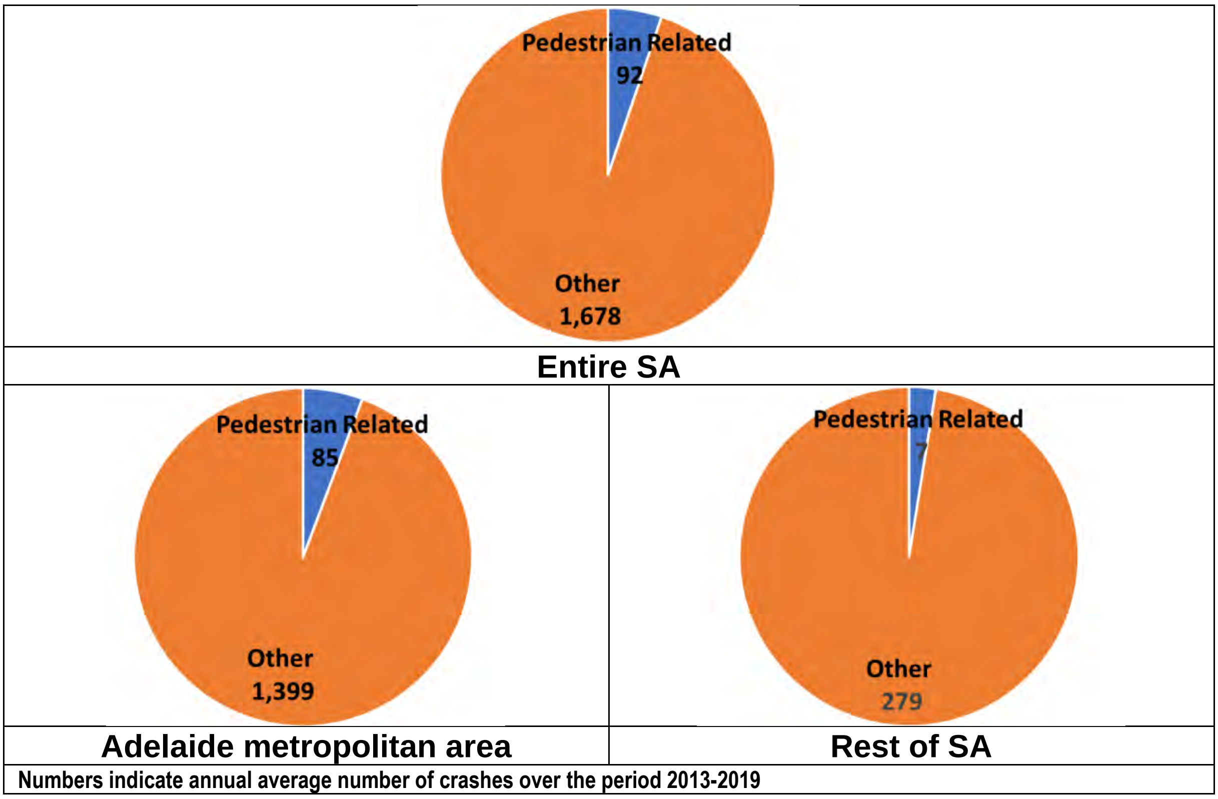
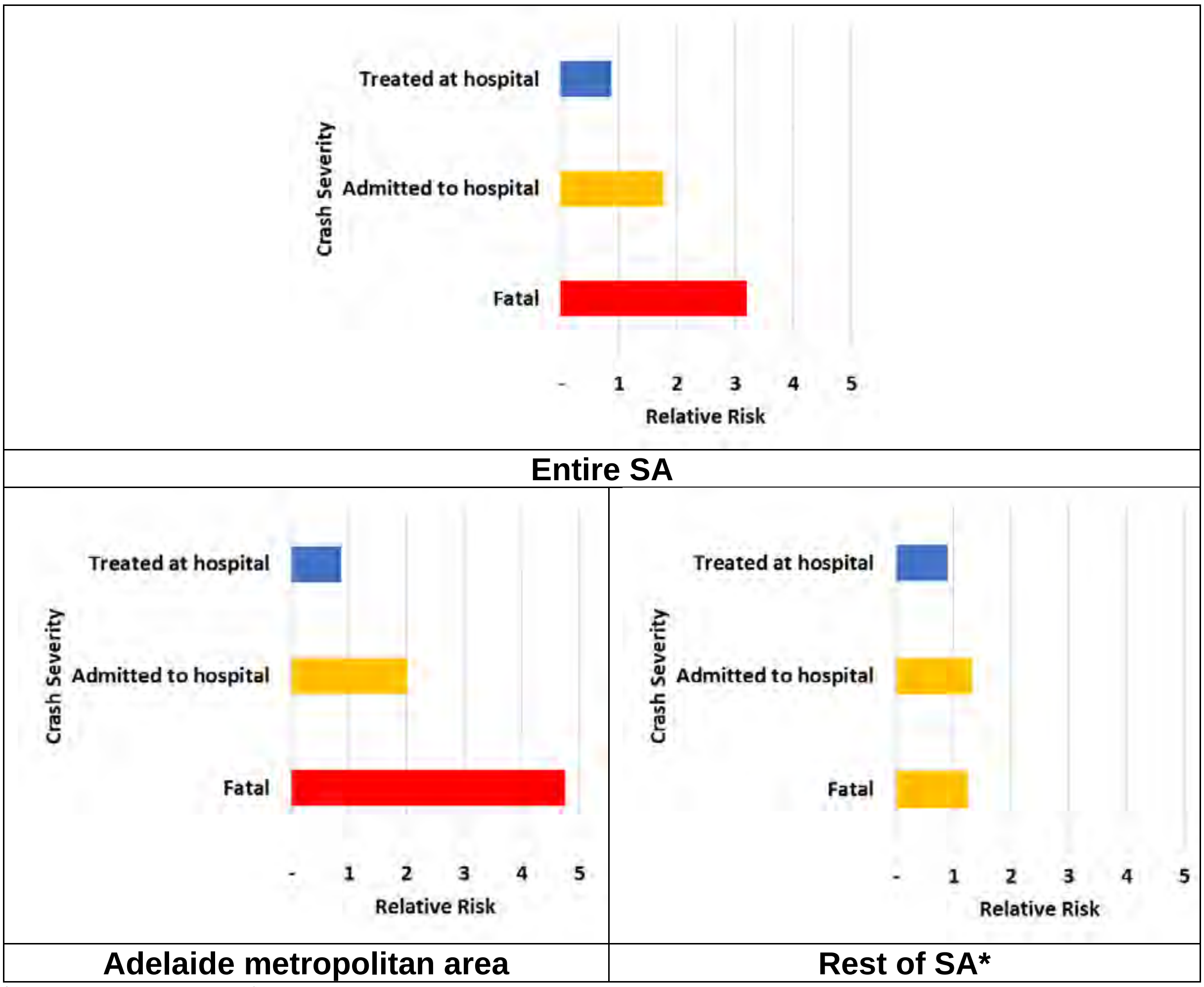


Figure 3.18
Proportion of pedestrian-related casualty crashes at intersections vs. all other intersection casualty crashes
(only fatal and injury crashes considered)

3.3.2 Relative risk for each level of crash severity (baseline risk: all intersection crash types)

The risk of a fatality in an intersection crash involving pedestrians in the Adelaide metropolitan area is considerably higher (almost five times greater) than for all intersection crashes, as shown in Figure 3.19.



* Based on a small sample of 7 crashes

Figure 3.19
Relative risks of pedestrian-related crash severities at intersections
(compared to corresponding risk for all intersection crashes)

3.3.3 Frequency of intersection crashes by control types & severity

Overall incidence by control types (casualty crashes only)

The distribution by control types for pedestrian-related casualty crashes at intersections is shown in Figure 3.20. Casualty crashes involving pedestrians in the Adelaide metropolitan area tended to occur mostly at signalised (traffic signals) and uncontrolled (no control) intersections, whereas they were almost evenly distributed between any types of control in the rest of the state (although numbers were very low).

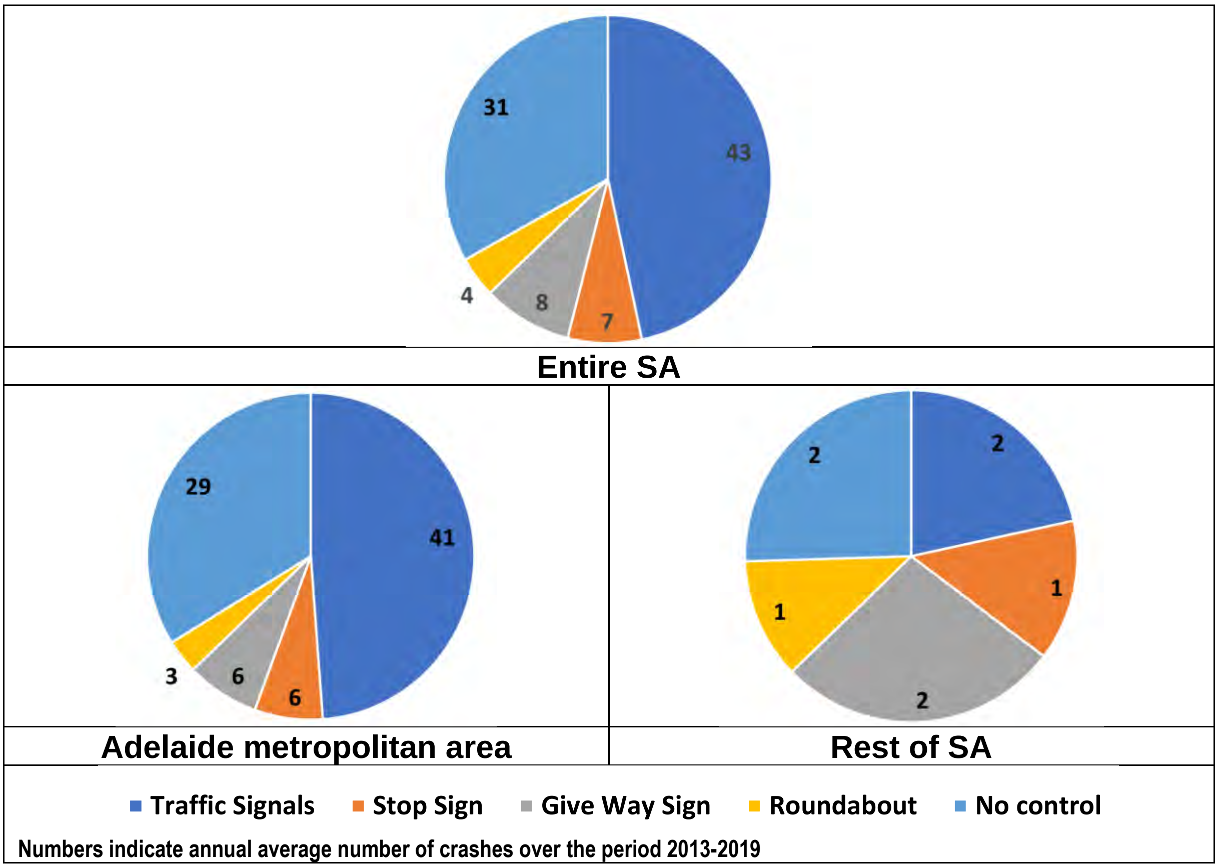


Figure 3.20
Distribution of intersection crashes by control type (casualty crashes ONLY)

Distribution by control types & levels of crash severity

The distribution of pedestrian-related casualty intersection crashes by control for each of the three casualty levels is shown in Figure 3.21. Fatal crashes involving pedestrians in the Adelaide metropolitan area were most frequent at signalised (traffic signals) and uncontrolled (no control) intersections, whereas in the rest of the state they were localised at priority intersections with give way signs as well as uncontrolled (no control) intersections.

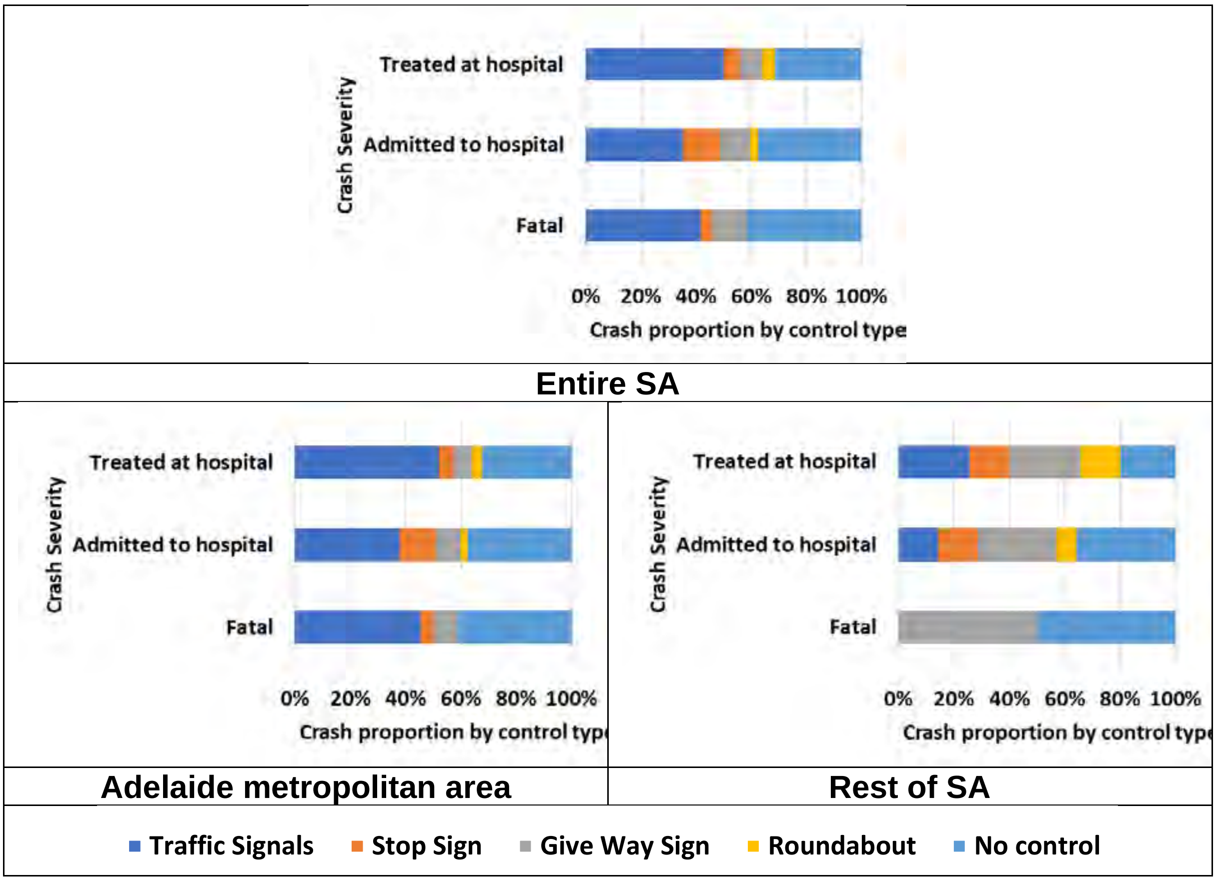


Figure 3.21
Distribution of intersection crashes by control type (for each severity level)

3.3.4 Frequency by speed limits & control types

Overall incidence by speed limits

The distribution of speed limits for pedestrian-related casualty crashes at intersections is shown in Figure 3.22. Pedestrian-related casualty crashes at intersections in the Adelaide metropolitan tended to occur mostly in speed zones of 50 km/h and 60 km/h, whereas they were most frequent in 50 km/h zones in the rest of the state (although numbers are very low).

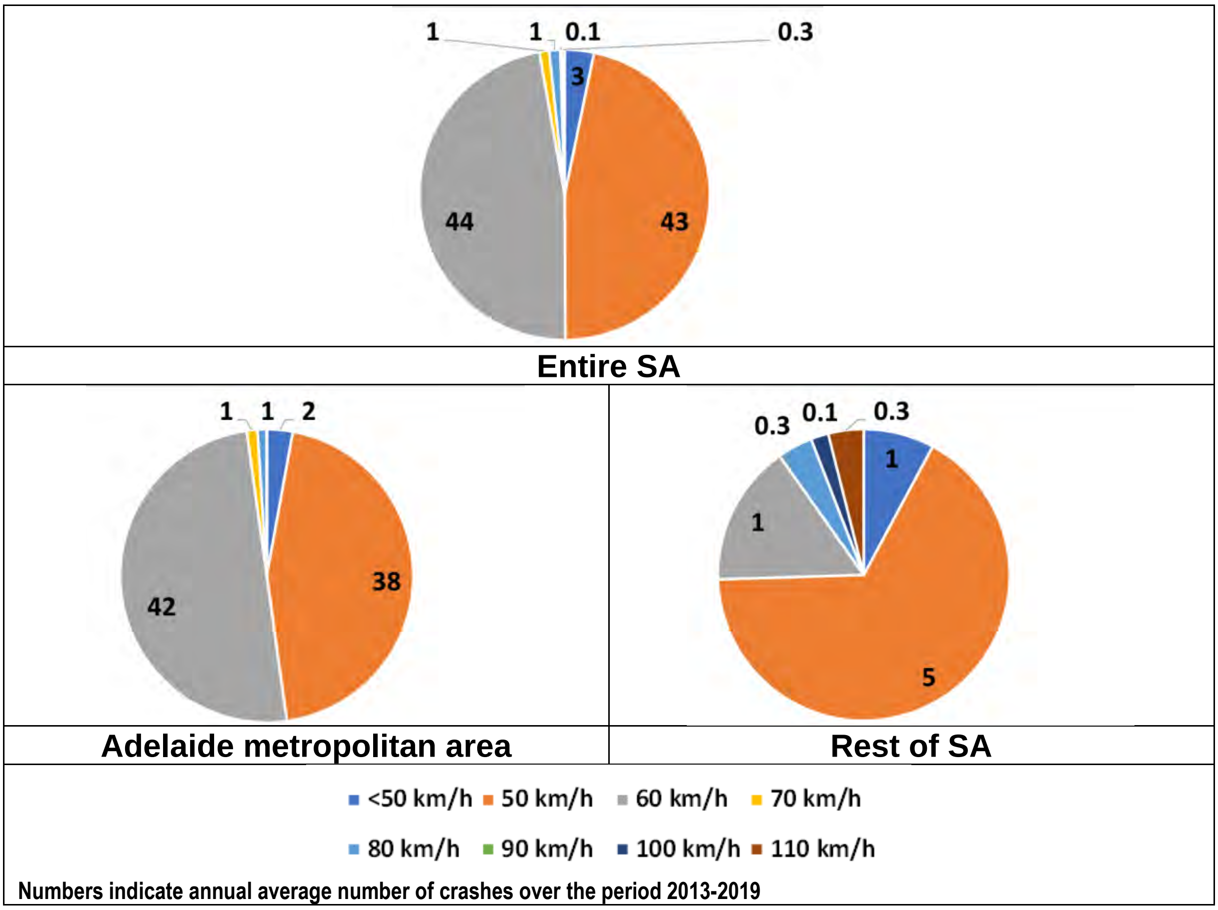


Figure 3.22
Distribution of pedestrian-related casualty crashes at intersections by speed limits

Distribution by speed limits for each control type

The distribution of speed limits for pedestrian-related casualty crashes at intersections for each control type is shown in the plots of Figure 3.23. In the Adelaide metropolitan area, pedestrian-related casualty crashes were almost equally frequent in both 50 km/h and 60 km/h speed zones for any type of control, whereas they tended to occur more frequently in the 50 km/h speed zone at signalised (traffic signals), priority (give-way and stop signs), and uncontrolled (no control) intersections in the rest of the state.

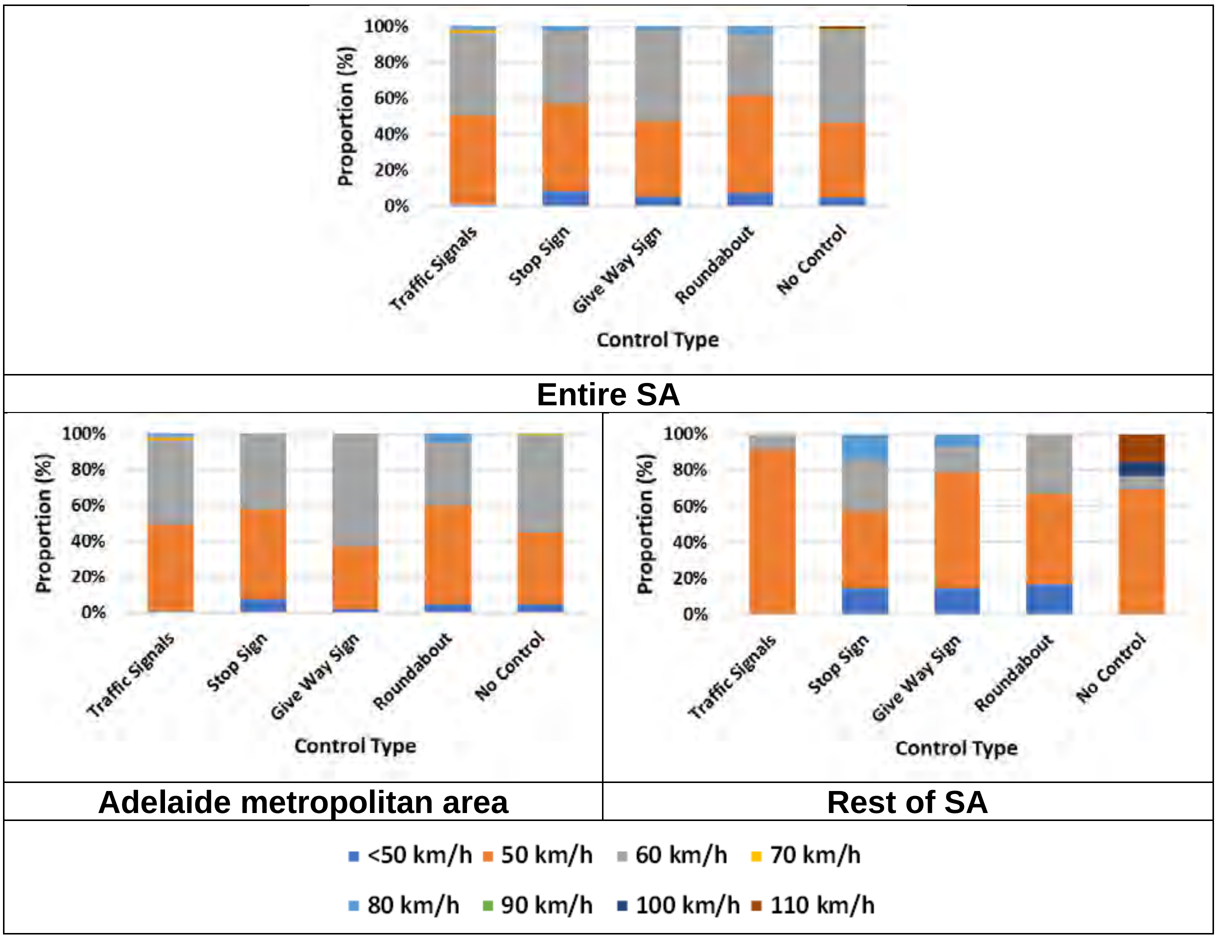


Figure 3.23
Distribution of pedestrian-related casualty crashes at intersections by speed limits for each control type

4 Conclusions

4.1 Profile of intersection crashes

Given the scope of this analysis being that of providing an overall view of the types of crashes at intersections, conclusions provided in this section will be limited to concise high-level considerations on the results of the crash data analysis. Considerations are made regarding crashes of any severity level as well as crashes that result in casualties.

The following findings for crashes of any severity level can be inferred from the results of the crash data analysis:

- Intersection crashes account for approximately 50% of crashes in the Adelaide metropolitan region, compared to around 25% of crashes outside of the metropolitan area.
- Intersection crashes tend to be spread across the entire road network. Recurrent crashes at the same intersections were rare, with the vast majority of intersections having no more than one crash per year on average.
- The distribution of adjacent direction, opposing direction and same travel direction intersection crashes are spread evenly in the Adelaide metropolitan region, whereas for the rest of the state, adjacent direction crashes are more prevalent.
- Intersection crashes occur most frequently at signalised and uncontrolled intersections in the Adelaide metropolitan area, whereas they occur most frequently at priority (give-way) and uncontrolled intersections in the rest of the state.

The following findings for casualty crashes can be inferred from the results of the crash data analysis:

- The risk of a fatality in an intersection crash involving pedestrians in the Adelaide metropolitan area is considerably higher (almost 5 times) than the average risk of fatality for intersection crashes involving any type of road users.
- Casualty crashes at signalised intersections are most frequent for vehicles manoeuvring or travelling in either the same direction or opposing directions, whereas for all other intersection controls casualty crashes are more prevalent between vehicles travelling in adjacent directions.
- The vast majority of casualty crashes at intersections in the Adelaide metropolitan region occur in zones with a speed limit of 60 km/h, whereas intersection casualty crashes are evenly spread across speed zones ranging from 50 km/h to 100 km/h in the rest of the state. However, pedestrian-related intersection crashes mostly occur within speed zones of 50 km/h and 60 km/h across both the Adelaide metropolitan region and the rest of the state.
- Across the whole state, the majority of casualty crashes at intersections occur either at crossroads or T-junctions. Crossroads represent the most frequent geometry for crashes at intersections controlled by either traffic signals, give-way priority or roundabouts. Almost all crashes occurring where no control was present happened at T-junctions (potentially due to an exposure factor, as the majority of T-junctions are uncontrolled).
- Head-on crashes are relatively rare at intersections.

4.2 Limitations and recommendations for further analysis

A limitation of this study is that the analysis of crashes did not take into account any potential exposure effect. For some of the parameters analysed, such as the type of junction, the speed limits or the type of control, some options may be either overrepresented or underrepresented in the road network (e.g., the majority of intersections may be located through speed limit zones equal or below 60 km/h in the Adelaide metropolitan area, or uncontrolled intersections may be overrepresented outside of the Adelaide metropolitan area).

Additionally, given the broad scope of this analysis as well as the limited resources, only those factors that were deemed likely to be relevant to intersection crashes were considered. Further future analysis of crashes at intersection should consider the potential effect that different intersection design features and environments may have on both the crash risk and severity. Design features to consider in such future analysis include:

- Number of lanes at each intersection leg
- Filtered/unfiltered right turn at signalised intersections
- Slip lanes for left turns
- Traffic volume

Note that any of the above-suggested crash analyses would require coding of information regarding the relevant intersection characteristics (e.g., number of lanes). Since these characteristics are not readily available in the current TARS database, they will need to be identified through other sources and linked to the crash data in order to perform the suggested additional analysis. Potentially, some of the design features may need to be manually coded. In that case, the analysis would have to be carried on a sample of crashes to limit the number of manual classifications to a reasonable amount.

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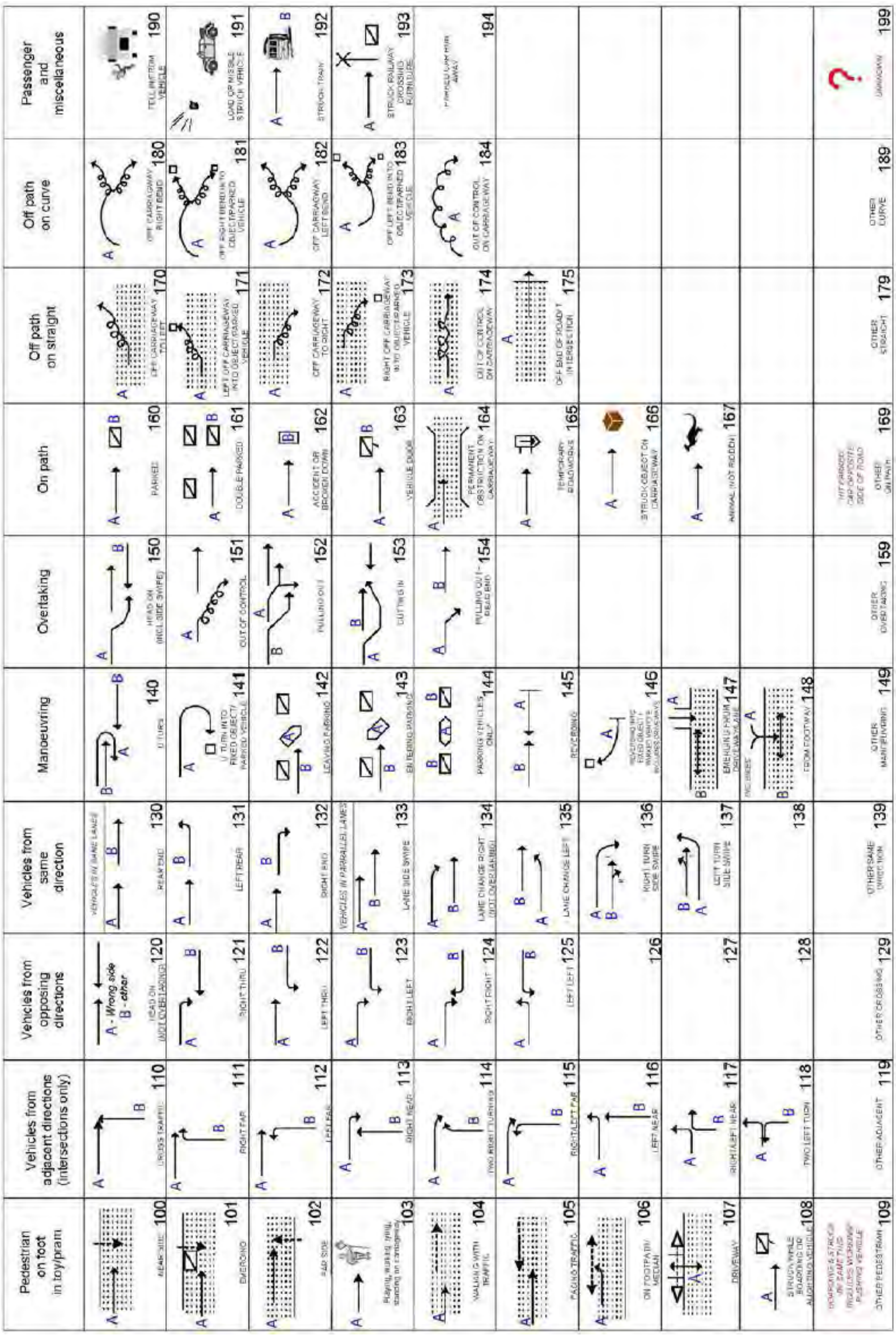
Appendix – Definition for Coding Accidents in South Australia



DCA codes in use in South Australia