



mainroads
WESTERN AUSTRALIA

*We're working for
Western Australia.*

Policy and Guidelines for Road Safety Assessments of High Risk Routes and Intersections

Printed copies are uncontrolled unless marked
otherwise. Refer to iRoads for current version.

D22#1160885
October 2022

Contents

1	POLICY STATEMENT	5
2	PRELIMINARY	6
2.1	Definitions	6
3	SCOPE	8
3.1	Purpose	8
3.2	Background	8
4	APPLICATION	9
4.1	Applicable locations	9
4.2	Route selection	9
4.2.1	Regional routes.....	9
4.3	Intersection selection	9
4.3.1	Regional intersections.....	9
4.4	Consultation.....	9
5	ASSESSMENT TEAM	10
5.1	Team leaders.....	10
5.2	Team members.....	10
5.3	Consultants.....	10
5.4	Conflict of interest	10
6	ASSESSMENT PROCESS	11
6.1	Initial assessment	11
6.2	Preliminary assessment.....	12
6.2.1	Crash Map and other crash data sources	12
6.2.2	Other data sources	12
6.2.3	Crash study summary.....	12
6.2.4	Results of preliminary assessment.....	12
6.3	Detailed assessment.....	13
6.3.1	Video survey	13
6.3.2	Digital Ballbank survey.....	13
6.3.3	Desktop assessment	13
6.3.4	Detailed site assessment.....	14
7	TREATMENT OPTIONS	15
7.1	Treatment selection	15
8	FUNDING	16
8.1	Economic appraisal.....	16
8.2	Estimated KSI crash reduction	16
8.3	Funding options	16
9	REPORT PREPARATION	17

9.1	Report templates	17
10	APPROVAL	18
10.1	Endorsement	18
10.2	Distribution.....	18
10.2.1	Main Roads team leader	18
10.2.2	Consultant or other agency team leader	18
10.3	Road safety audit.....	18
10.4	Close out	18
10.5	Court appearance	18
11	MONITORING	20

Document Control

Owner	Road Safety Branch
Custodian	Andy McMahon
Document Number	D22#1160885
Issue Date	31 October 2022
Review Frequency	3 Yearly

Amendments

Revision Number	Revision Date	Description of Key Changes	Section / Page No.

1 POLICY STATEMENT

Main Roads Western Australia is committed to its aspiration “To provide world class outcomes for the customer through a safe, reliable, and sustainable road-based transport system” by targeting four areas of focus, one of which is ‘Safety’ which aims to “Provide improved safety outcomes for all users of the transport network” as set out in our “Keeping WA Moving” strategic plan and our Commitment to Road Safety policy statement.

To assist Main Roads to concentrate on its ‘Safety’ area of focus, a strategic approach has been developed for conducting road safety assessments on high risk routes and intersections. This is a vital process for identifying road environmental factors that may have contributed to the causation or severity of crashes along routes and at intersections. The assessment process places emphasis on KSI crash risk and incorporates Safe System principles embedded within the process. This is to be achieved by focusing the assessment process on considering safe speeds and by providing forgiving roads and roadsides. This is to be delivered through a road safety assessment process that accepts people will always make mistakes and by considering the known limits to crash forces the human body can tolerate with the aim to reduce the risk of fatal and serious injury crashes.

To achieve this Main Roads require that:

- High risk route and intersection assessments shall be conducted on the State road network in accordance with the requirements of this policy and guidelines.

2 PRELIMINARY

2.1 Definitions

ANRAM means the Australian National Risk Assessment Model (ANRAM) that is a nationally-consistent risk-based road assessment program to identify road sections with the highest risk of severe crashes.

AusRAP means the Australian Road Assessment Program (AusRAP) that is an assessment process that systematically assesses risk on the major highways and freeways in Australia with the objective to reduce death and injuries.

Benefit Cost Ratio (BCR) means the present value of benefits (net operating and maintenance costs) divided by the present value of implementation costs. BCR serves as an indicator of a project's economic efficiency.

Casualty Crash means any crash where at least one person involved in the crash is injured and includes the following crash severities: Medical, Hospital or Fatal.

Comparative Safety Performance means the safety performance of a single intersection in comparison with other similar intersections. This considers KSI crash rate, intersection type, speed environment and traffic exposure.

Crash Location Report means a document prepared for or by Main Roads for the purpose of assessing a fatal crash location.

Crash Map means Main Roads relational GIS crash analysis application.

Crash Modification Factor (CMF) means a simple multiplication factor applied to the existing crash rate. Therefore, a CMF of less than one indicates a reduction in the crash rate, whilst a CMF greater than one indicates an increase.

Crash Reduction Factor (CRF) means the expected percentage reduction in crashes resulting from the implementation of a proposed treatment expressed as a percentage reduction.

Crash Study Summary means a summary of recorded crashes, predominant crash types, notable locations, patterns and trends evaluated when conducting an assessment.

Digital Ballbank Indicator means a digital measuring device recommended in Australian Standards for the determination of advisory speeds on substandard horizontal curves.

GIS means a Geographic Information System.

High Risk Route means a metropolitan or regional route prioritised throughout the State using KSI crash density and KSI crash rates and comparative high risk medical severity crashes.

High Risk Intersection means a metropolitan or regional intersection with a comparative safety performance that is rated 'Extremely Poor', 'Very Poor' or 'Poor' with a specified minimum number of KSI crashes occurring at a single intersection.

IRIS means IRIS reporting centre which is a database of crash, inventory and other data held by Main Roads.

KSI Crash means a crash where at least one person involved in the crash was either killed or seriously injured as the result of the crash.

KSI Crash Density means the number of mid-block KSI crashes per kilometre per year.

KSI Crash Rate means the number of mid-block KSI crashes per 100 Million Vehicle Kilometres Travelled (MVKT).

Local Road means any road under the control of Local Government.

Main Roads means Main Roads Western Australia.

Public road means any road either under the control of Main Roads, Local Government, or any other road accessible by the public (e.g. roads managed by other agencies but excludes private roads).

Property Damage Only Crash (PDO) means any crash where no person involved in the crash has been injured and damage to property has occurred as a result of the crash.

Road Safety Inspection means a formal examination of an existing road or road related area in which an independent, qualified team report on the crash potential and likely safety performance of the location. (Formerly known as an 'Existing Road Safety Audit')

Road View means Main Roads relational video application, which enables the integration of recorded video images with geospatial information, crash data and inventory attributes to assist the process of conducting crash analysis along road sections.

Programme Database means a database used to manage the programme of road safety assessments conducted at high risk routes and intersections throughout the State.

RUM Code means a Road User Movement code, which is a method of categorising different crash types.

State Road means a highway or main road under the control of Main Roads Western Australia and includes national highways.

TRIM means the records and electronic document management system used by Main Roads.

3 SCOPE

3.1 Purpose

The purpose of this document is to set out Main Roads policy and guidelines for conducting road safety assessments on high risk routes and intersections on the State road network in Western Australia.

3.2 Background

Road safety assessments of high risk routes and intersections are complementary to road safety audits and crash investigations for the consideration of road environment factors associated with crash risk at high risk locations throughout the State road network.

The aim of the annual programme of road safety assessment on high risk routes and intersections is to take an overarching holistic approach to the assessment of high risk locations 'State wide' in coordination with regions throughout the State. This will result in a State wide prioritised evidence led and targeted approach to the assessment and treatment of regional high risk locations throughout the State.

The objectives of the road safety assessments programme are to:

- annually determine a list of high risk regional locations to investigate;
- investigate the crash history at high risk locations;
- conduct detailed analysis of all crashes with a focus on KSI crash risk to determine trends or crash patterns (if any) and possible cause;
- inspect the road environment at high risk locations to determine if there are any road environment factors that may have contributed to crash risk, crash causation and/or severity;
- inspect the road environment and other available supporting information to identify any hazards or substandard road elements that pose a potential KSI crash risk;
- provide recommendations about potential proven effective targeted treatment options to mitigate crash patterns, crash risks and hazards identified at high risk locations;
- estimate the economic benefits of recommended treatment options;
- provide advice about potential funding sources available for recommended treatment options; and
- monitor the effectiveness of projects delivered that result from high risk assessments.

4 APPLICATION

4.1 Applicable locations

This policy and guideline applies to all regional high risk routes and intersections identified on the State road network in Western Australia.

4.2 Route selection

4.2.1 Regional routes

Road safety assessments shall be conducted on the current list of high risk regional routes prioritised using the 'Rural Rank' and 'Respective Area Rank' for all regional high risk routes.

The aim of the programme is that at least 5 regional routes are assessed per annum.

4.3 Intersection selection

4.3.1 Regional intersections

Road safety assessments shall be conducted on the current list of high risk regional intersections prioritised using the 'Rural Rank' and 'Respective Area Rank' of each intersection for all regional high risk intersections.

The aim of the programme is that at least 5 regional intersections are assessed per annum.

4.4 Consultation

The assessment team leader shall ensure that consultation is undertaken with regional managers, project managers and asset managers to coordinate road safety assessments with other planned, ongoing or recently completed studies or works on the State road network.

5 ASSESSMENT TEAM

A road safety assessment team shall consist of at least two people, comprising members appropriately experienced and trained in road safety engineering or crash investigation with knowledge of current practice in road design or traffic engineering principles, who will undertake the road safety assessment.

5.1 Team leaders

A road safety assessment team leader must be a Main Roads/IPWEA-WA accredited Senior Road Safety Auditor. The assessment team leader shall also have successfully completed recognised road safety engineering training.

The current list of Main Roads/IPWEA-WA accredited Senior Road Safety Auditors can be found on the Road Safety Audit Portal website. www.road-safety-audit-wa.org

5.2 Team members

A road safety assessment team member must be at least a Main Roads/IPWEA-WA Audit Team Trainee. The assessment team member shall also have successfully completed recognised road safety engineering training.

The current list of Main Roads/IPWEA-WA Audit Team Trainees can be found on the Road Safety Audit Portal website. www.road-safety-audit-wa.org

5.3 Consultants

A suitably qualified consultant may be used to assist in the preparation of road safety assessments, either as a team leader or as a team member.

Consultants with expertise in a particular field may be commissioned to prepare an independent road safety assessment and shall be a Main Roads/IPWEA-WA accredited Senior Road Safety Auditor who has successfully completed recognised road safety engineering training.

5.4 Conflict of interest

Team leaders/members shall excuse themselves from participation in the road safety assessment if:

- They perceive any possibility of duress or coercion by their employer or employer's staff in relation to the assessment.

Persons who are not a Main Roads/IPWEA-WA Audit Team Trainee or who have not successfully completed recognised road safety engineering training may participate as an observer if invited to do so by the assessment team leader.

6 ASSESSMENT PROCESS

The road safety assessment process considers a combination of reactive and proactive approaches which may result in recommended treatments that aim to reduce the overall crash risk at known high risk routes and intersections or a combination of both.

Road safety assessment teams should use this policy and guideline in conjunction with *Austroads Guide to Road Safety Part 2: Safe Roads* and *Austroads Guide to Road Safety Part 3: Safe Speed* for further information about general crash analysis, treatment selection and speed management principles.

The initial assessment of the overall prioritised road safety assessment programme shall be re-assessed every year on completion of the re-ranking of high risk routes and intersections by the Road Safety Branch Research and Evaluation team following the validation of crash data by AGI branch.

6.1 Initial assessment

An initial assessment shall be undertaken for a selected regional area referring to the current high risk route and intersection prioritised lists and the associated layers found in Main Roads Crash Map application. This should consider the interaction of high risk routes and intersections and their extents. The initial assessment may result in applicable overlapping routes and intersections being combined into a single road safety assessment area. The results of which shall be recorded by the assessment team leader in the 'road safety assessment programme database'.

Once the initial assessment area or areas have been determined, the team leader shall then consult the relevant regional manager, project managers and asset managers about the planned assessment location. This is undertaken to coordinate road safety assessments with other planned, ongoing or recently completed studies or works on the State road network.

If it is deemed by the assessment team leader that a road safety assessment is not required as the result of other planned, ongoing or recently completed studies or works, this outcome shall be recorded by the assessment team leader in the 'road safety assessment programme database'.

All initial assessment locations that do not conflict with other planned or recently completed works following consultation shall progress to the preliminary assessment stage.

6.2 Preliminary assessment

A desktop crash study shall be conducted for identified high risk locations to determine the predominant crash types and any crash patterns or trends at the assessment location. This assessment should include all recorded crashes that have occurred at the assessment location for the current 5 years of available crash data.

6.2.1 Crash Map and other crash data sources

The preliminary assessment shall consider, but not be limited to, the following reports and sources of available crash information:

- Crash Map crash query summary report;
- crash factor matrix report (casualty crashes/PDO crashes);
- crash behaviour matrix report (casualty crashes/PDO crashes)
- crash patterns report;
- collision diagrams; and
- crash location reports for any fatal crashes.

6.2.2 Other data sources

Other data sources that may be useful to complement preliminary assessments include:

- Austroads [Infrastructure Risk Rating](#) tool (IRR tool);
- AusRAP star rating data;
- IRIS asset inventory data;
- [Traffic Map](#) traffic volume and composition data; and
- [Traffic Map](#) speed survey data.

6.2.3 Crash study summary

A 'crash study summary' shall be prepared to identify the predominant crash types and any patterns or trends at the assessment location with emphasis placed on KSI crash risk.

6.2.4 Results of preliminary assessment

The preliminary assessment will either conclude that a detailed assessment is required, or that no further action is required at this time. If it is deemed by the assessment team leader that there are no crash patterns or other potential crash risk factors identified at the assessment location the annotation 'No further action is required at this time – continue to monitor' shall be recorded in the road safety assessment programme database and the assessment will be concluded at the preliminary assessment stage.

On completion of the preliminary assessment, if it is deemed necessary by the assessment team leader, a detailed assessment shall be conducted.

6.3 Detailed assessment

A site inspection must be conducted in daylight conditions and where feasible during the hours of darkness for all detailed assessments. The inspection should include: the capture of video; photographs; site measurements; and ballbank surveys (if applicable).

6.3.1 Video survey

A video survey shall be conducted for all detailed assessments. The video should be captured using a vehicle mounted GPS enabled video camera that is supported by Main Roads relational Road View video application.

6.3.1.1 Route assessments

Video should be captured in both directions along all assessed routes.

6.3.1.2 Intersection assessments

Video should be captured on all approaches to assessed intersections.

6.3.2 Digital Ballbank survey

A review of the IRIS 'Geometry / Alignment Details' or 'Gipsitrac Geometry / Alignment Details' reports with reference to the *Austrroads Guide to Road Design Part 3: Geometric Design* horizontal curve table must be conducted for route assessments to determine if a digital ballbank survey is considered necessary.

A digital ballbank survey is conducted to determine advisory speeds at substandard horizontal curves when undertaking road safety assessments when considered necessary on all high risk routes. This survey, if feasible, should be conducted at the same time as the video survey and 3 individual survey runs should be captured in both directions of travel for curvilinear road sections.

6.3.3 Desktop assessment

A detailed desktop assessment shall be undertaken to consider the results of the preliminary crash study, video survey information, measurements and other data and photographs collected during the site inspections.

6.3.3.1 Video assessment of high risk routes

The video surveys captured and associated metadata files should be loaded onto the Main Roads relational Road View application. The following attributes should be reviewed with the video to complete the detailed desktop assessment:

- crash query summary;
- collision diagrams;
- crash details;
- map layers, speed limit information and speed environment;
- traffic and speed data, and ballbank survey results (if applicable);
- sightlines (SSD / SISD / ASD / CSD);
- existing traffic signs and guide post provision;
- surfaced lane and shoulder widths;
- roadside hazards and hazard ratings; and
- alignment details.

The 'Coordinate List' feature in Road View should be utilised by the assessment team to complete the video assessment. This feature is used to identify the geographic location details of potential road elements and hazards that may be related to crash risk, crash causation or crash severity along the route being assessed.

6.3.3.2 Video assessment of high risk intersections

The video surveys captured and associated metadata files should be loaded onto the Main Roads relational Road View application. The following attributes should be reviewed with the video to complete the detailed desktop assessment:

- crash query summary;
- collision diagrams;
- crash details;
- map layers, speed limit information and speed environment;
- traffic and speed data;
- sightlines (SISD / ASD / CSD);
- existing traffic signs and guide post provision;
- surfaced lane and shoulder widths;
- level of intersection control;
- roadside hazards; and
- alignment details.

The video assessment should be conducted to identify potential road elements and hazards that may be related to crash risk, crash causation or crash severity at the intersection being assessed.

6.3.4 Detailed site assessment

A final detailed site inspection may be undertaken by the assessment team, if deemed necessary, to confirm any final details following completion of the video assessment. This may also be of benefit to determine the feasibility of recommended treatment options. This final check may also be undertaken by conducting a final review of the video survey.

7 TREATMENT OPTIONS

7.1 Treatment selection

The assessment team when selecting the most effective proven treatments to deliver the best road safety outcome shall aim to achieve at least a **50 % reduction in fatal and serious injury crashes** at the assessment location. This must be achieved to meet the minimum KSI targets set out in Main Roads Commitment to Road Safety policy statement and set out in the [National](#) and [State](#) road safety strategies.

The assessment team shall refer to the results from the detailed assessment to select suitable cost-effective proven treatment options for any identified crash risks at the assessment location. The assessment team should firstly focus treatment selection on the list of possible Safe System primary and supporting treatments outlined in tables 4.5 to 4.11 in the [Austroads Safe System Assessment Framework](#) prior to considering other treatment options.

The assessment team should refer to the following resources to determine suitable proven effective treatment options:

- *Austroads Safe System Assessment Framework* – Safe System treatments (tables 4.5-4.11);
- Crash Map treatments and associated CRF spreadsheets;
- ROSMA Treatment Resource Guide (D15#686638); and
- *Austroads Guide to Road Safety Part 2: Safe Roads*.

The assessment team should identify any feasible low, medium and high cost treatment options and relate the possible options to the Main Roads Commitment to Road Safety policy statement crash reduction target.

When conducting assessments on regional routes, the assessment team shall refer to the [Cross Section Maps](#) which provide information about the optimised cross section requirements on regional routes, to apply consistent seal and formation widths across the regional road network.

8 FUNDING

8.1 Economic appraisal

The key objectives of economic appraisal are to ensure that treatments are cost-effective, and that they optimise road safety benefits producing the greatest potential reduction in fatal and serious crashes within available financial resources.

The assessment team should conduct an economic appraisal to determine the maximum project value that can be allocated for proposed low, medium and high cost treatment options to achieve a Benefit Cost Ratio (BCR) of 1.0 and 2.0. This is calculated using the current year crash costs, discount rate, and Crash Reduction Factors (CRF) and treatment life using Main Roads Crash Map application.

Austrroads Guide to Road Safety Part 2: Safe Roads provides details about the calculation method to determine a Benefit Cost Ratio (BCR) for road safety projects.

8.2 Estimated KSI crash reduction

The estimated KSI crash reduction for each of the proposed low, medium and high cost treatment options should be determined using the 'High Risk Assessments – KSI Crash Reduction Calculator'. This should be completed by firstly identifying the CRFs for each of the RUM code crash types and number of crashes treated by each countermeasure [at an individual crash level] for all KSI crashes that have occurred.

The CRFs and number of crashes treated should then be determined for all treatable crashes that have occurred in the assessment area for the following crash types that are less survivable above associated travel speeds that have the potential to result in a high severity crash outcome:

- Car/pedestrian (vulnerable road users): **30 km/h**
- Car/motorcyclist (vulnerable road users): **30 km/h**
- Car/tree or pole (run off road impact object): **40 km/h**
- Car/car (side impact – right angle): **50 km/h**
- Car/car (head-on): **70 km/h**

The RUM code crash types that are treated by multiple treatments should then be identified and converted from CRFs to CMFs for each crash and the CMFs should be multiplied to determine the diminished reductions for each RUM code crash type and converted back to CRFs.

All CRFs should then be added together for all KSI and less survivable crash types and divided by the total number of crashes to be treated to determine the average KSI crash reduction. The average KSI crash reduction should be calculated for each treatment level e.g. low, medium and high cost treatment options.

Low, medium, and high cost treatment options should be evaluated to provide options to project managers for instances where there may be financial constraints that may preclude the delivery of the ultimate treatment option. This approach may also enable a staged delivery approach towards the ultimate treatment option.

8.3 Funding options

Information about funding Road Safety Programs can be found on [Main Roads website](#).

9 REPORT PREPARATION

9.1 Report templates

All road safety assessments conducted on the State road network shall be completed using the Main Roads road safety assessment report templates. The templates can be found on the [Crash Investigation](#) page on Main Roads website.

10 APPROVAL

10.1 Endorsement

All road safety assessment reports shall be reviewed and endorsed by the Main Roads Road Safety Engineering Manager prior to distribution.

10.2 Distribution

10.2.1 Main Roads team leader

An assessment team leader directly employed by Main Roads shall arrange for the road safety assessment report to be recorded on the relevant TRIM file and electronically forwarded with a workflow action assigned to the asset owner, project owner, regional manager or the delegated representative and copied to Budget and Investment Planning branch.

10.2.2 Consultant or other agency team leader

Consultants or other agency team leaders shall arrange for the road safety assessment report to be electronically forwarded to the Main Roads Road Safety Engineering Manager, who will review and endorse the report prior to arranging the report to be forwarded to the asset owner, project owner, regional manager or the delegated representative.

The Road Safety Engineering Manager shall arrange for the full road safety assessment report to be recorded on the relevant TRIM file.

10.3 Road safety audit

All projects that involve a permanent change to the State road network must have the required stages of road safety audits conducted on the project in accordance with the requirements of Main Roads [Policy and Guidelines for Road Safety Audit](#).

10.4 Close out

The asset owner, project owner, regional manager or the delegated representative shall respond to the assessment report within one calendar month and arrange for the response to be recorded on the relevant TRIM file and a copy forwarded to the assessment team leader.

10.5 Court appearance

The Main Roads Road Safety Engineering Manager and road safety assessment team leader is responsible for the contents of the road safety assessment report but not the subsequent actions by the asset owner, project owner, regional manager or the delegated representative.

There may be instances where the Main Roads Road Safety Engineering Manager or the road safety assessment team leader is requested to appear in court via:

- Subpoena,
- Summons, or
- Contact to be a witness by:
 - Police officer (prosecuting or coroner's court),
 - Counsel assisting (coroner's court),
 - State Solicitors Office (State government agencies),

- Lawyer acting for party to or interest in an action.

In all instances such requests shall be referred to the Manager Legal and Insurance Services Branch to determine the most appropriate representatives (refer to Delegation of Authority clause 17.3).

11 MONITORING

Post-implementation monitoring is essential to ascertain the positive and negative effects of a treatment and improve the accuracy and confidence of a particular treatment's effectiveness in subsequent projects.

Monitoring details should include the start and end dates of the construction period and details of the road environmental changes undertaken as part of the project. This information must be provided by project leaders to the road safety assessment team leader for all road safety assessment projects that secure funding and are subsequently implemented. The road safety assessment team leader shall ensure that the implementation dates and details of the road environmental changes implemented are recorded on the 'road safety assessment programme database'.

The road safety assessment team leader shall then set up a monitoring area using the monitoring feature on Main Roads Crash Map application for all projects that have resulted from the high risk routes and intersection assessment programme.

The road safety assessment team leader shall ensure that monitoring is conducted at 1 year, 3 year and 5 year intervals in the period before and following the introduction of crash treatment measures. This is to enable a before and after implementation crash history comparison to be conducted to evaluate each projects performance.

The results of this monitoring shall be collated and recorded on the 'road safety assessment programme database' and the results shall be used to inform the crash reduction factors listed in Main Roads Treatment Resource Guide and accessed via Crash Map to improve the evaluation of future treatments.