CRISP
CAPITAL REGION INTERSECTION SAFETY PARTNERSHIP

MONASH University
Accident Research Centre

EXECUTIVE SUMMARY

September 2014

An Application of the Safe System Approach to Intersections in the Capital Region – Task 6 Workshop and Task 7 Road Safety Auditing

Introduction

The Capital Region Intersection Partnership (CRISP) was founded in 2001 by municipalities and other stakeholders to share resources and expertise to reduce the frequency and severity of intersection collisions in the Alberta Capital Region. Its current and targeted aim is to reduce crashes and trauma at intersections through advances in safety performance within the road-transport system.

In January 2012, CRISP engaged the Monash University Accident Research Centre (MUARC) to conduct a practical, evidence-based research project to apply the Safe System road safety philosophy to selected 'poorly performing' intersections in the City of Edmonton, Strathcona County and City of St. Albert (CRISP partner jurisdictions).

The two-phase study included seven tasks. The first five tasks, including identification of poorly performing intersections in the region and consideration of Safe Systems intersection designs, was completed in 2012 and reported in March 2013. Phase 2, which included a workshop to assess the design feasibility of innovative intersection designs (Task 6) and a review of road safety auditing (Task 7), was completed in January 2014.

The purpose of this report is to summarise the outcomes of Phase 2.

What is Safe System?

The Safe System framework was created to provide an ethical and practical platform for the design of road-transport systems. As a philosophy, Safe System challenges the common belief that death and serious injury are an unavoidable part of road-transport systems. As an approach to safe intersection design, Safe System focuses both on collision avoidance and mitigating the impact when collisions do occur.

Assessing the Design Feasibility of Innovative Intersection Designs (Task 6)

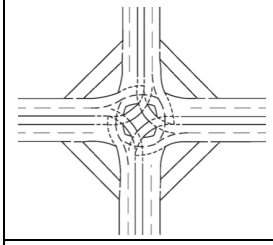
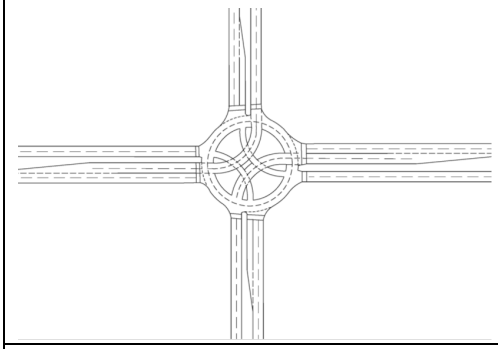
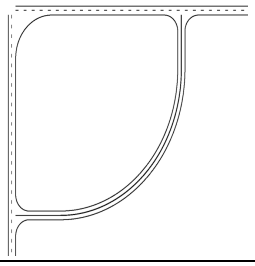
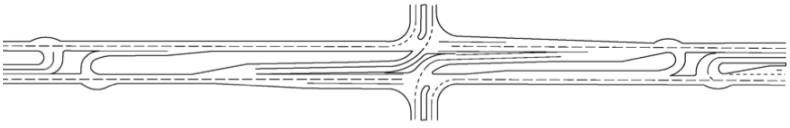
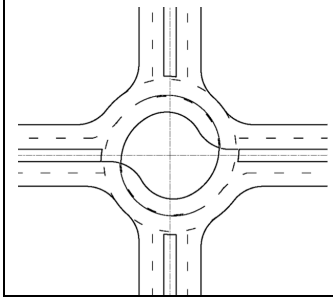
A workshop was held in Edmonton with traffic safety stakeholders to assess the feasibility of innovative intersection designs when applied to actual intersections in the Alberta Capital Region. Two problematic intersections from each of the three jurisdictions were selected for further consideration by workshop participants. Five innovative intersection designs were proposed to address the problems at these intersections.

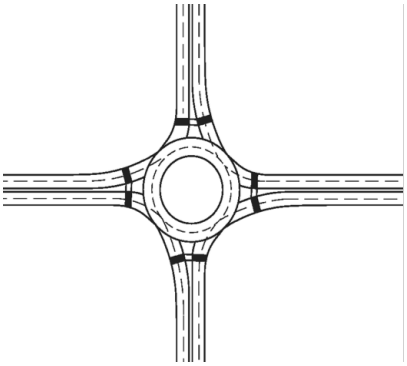
Participants were asked to answer the following questions:

- What do you like about this configuration? What are its advantages/pros?
- What do you not like about this configuration? What are its disadvantages/cons?
- What changes or modifications would you make to this configuration?

Results of these discussions were summarized by the researchers. Perceived advantages and disadvantages of each design are presented in Table 1. The most common concerns were related to intersection capacity/volume issues. Other concerns included 'driver confusion' and the need for longer signal phasing. Participants also pointed to the challenge of winter maintenance in some of the designs.

Table 1 – Proposed Intersection Designs for Problematic Intersections

Intersection Design	Perceived Advantages	Perceived Disadvantages
Squircle 	• Reduced collision speeds Favourable impact angles	• Capacity issues • Potential to cause driver confusion • Winter maintenance
Cut-through 	• Less complicated than existing intersections • Reduce incidence of right angle and left turn across path collisions • Reduced number of conflict points • Reduced conflict speeds • Improved conflict angles	• Accommodation of heavy vehicles • Signal timing issues
Quadrant Roadway 	• Reduced traffic volumes, improved capacity (subject to appropriate • signal timing) • Removal of problematic left-hand turns	• Land acquisition requirements • Rerouting of turning traffic along local streets • Some right-angle conflict points remain
Super Street 	• Reduced conflict points	• Higher speeds • Traffic flow 'turbulence'
Turbo Roundabout 	• Improved conflict angles • Reduced speeds • Efficient use of land	• Capacity limitations • Winter maintenance • Accommodation for cyclists and pedestrians

Roundabout 	• Elimination of right-angle impacts • Reduced conflict speeds • Improved conflict angles • Driver familiarity	• Capacity issues • Accommodation for heavy vehicles
Reduced Speed Limits and Raised Platform Intersections	• None noted	• Difficulty of enforcing lower speed limits.

The Squircle, Turbo Roundabout and traditional Roundabout were viewed most favourably by workshop participants, who felt that any concerns could be addressed in the design phase. There seemed to be little support for lower-cost options, like reduced approach speeds or raised platform intersections, but they were identified as possible solutions when 'other options' were considered.

Based on the feedback from workshop participants and the experience of the MUARC research team, Safe System solutions were recommended for each of the six problematic intersections included in Task 6. These solutions are presented in Table 2. Due to time constraints the workshop participants examined only the intersections in Table 2, not at all 16 intersections identified in the Phase I report.

Table 2 – Problematic Intersections and Safe System Solutions

Jurisdiction	Selected Problematic Intersections	Option Preferred by Workshop Participants	Other Options from Workshop Participants
City of Edmonton	34 Avenue NW and 91 Street NW	• Cut-through, with right-turn slip lanes	• Diverging diamond interchange
	107 Avenue and 142 Street	• Cut-through	• Signalise current site
Strathcona County	Baseline Road and Broadmoor Boulevard	• Cut-through	• Re-grading (stop-gap) • Reduce approach speeds • Limit allowed manoeuvres • Grade separation ('fly over') • Full interchange
	Wye Road and Sherwood Drive	• Cut-through, with right-turn slip lanes	• Grade separation ('fly over') • Grade separation roundabout
City of St. Albert	St Albert Trail and St Anne Street	• Roundabout • Turbo Roundabout	• None
	St Albert Trail and Villeneuve Road	• Roundabout	• Squircle and Cut-through

Road Safety Auditing and Safe System Intersection Design (Task 7)

Road safety auditing emerged in Europe in the 1970s, when road safety practitioners recognized that many collisions could be avoided if attention was paid to safety performance at the planning and design stages of new roadways. It developed as a way to avoid 'building-in' road safety problems and today is a formal process for 'getting it right the first time.'

While road safety auditing can play an important role in all stages of road construction, it is most valuable in the early stages when the cost of correcting safety deficiencies is still very low (compared to redesign and road re-construction). If the wrong decisions are made in the early stages, it can take 5-10 years before a problem is officially recognised and a solution implemented. In some cases, it is simply unaffordable to correct a safety problem that has been built in.

To meet the aspirations of Safe System intersection design, intersections should be designed, first, to reduce the risk of collisions and, second, to reduce the relative risk of fatal or serious injury. In a 2010 study, MUARC identified four principles for Safe System design of intersections that should be part of any road safety auditing process to address these dual needs. These principles include:

1. **Fewer vehicles** - Can the number of vehicles using the intersection be reduced to minimise the total number of conflicts per unit of time?
2. **Fewer intersections** - Can the intersection be eliminated from the network?
3. **Fewer conflict points per intersection** - Can the intersection be designed to create the least number of conflict points and hence eliminate opportunities for collisions to occur?
4. **Impact speeds and impact angles constrained to biomechanically tolerable levels** - Can the intersection be designed to ensure:

- impact speeds not exceeding 50 km/h, for 90° conflict angles?
- conflict angles that are 'Safe System compatible' with the travel speeds for impact speeds between 50 km/h and 70 km/h?
- the lowest practicable levels of crash risk, for travel speeds above 70 km/h?

MUARC has developed the following flowchart that can guide designers and decision-makers to select appropriate speeds and designs, in line with the above principles.