Conflict Path Awareness Analysis

Analysing the cyclist-driver interface

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Outline

• Background
• Process
• Examples
  – 3 environments
  – 4 crash types
• Reflection on the process
• Questions
Background

- Conflict points
- Trajectory and speed
- Road Rules say who *should* give way
- Requires *awareness* of the other road user
- Process to consider *awareness*

Sometimes awareness is impossible
High probability of low awareness

Obscured sightlines
Attention elsewhere

Crash risk high
Awareness

- Awareness Test [http://www.youtube.com/watch?v=pTv4y0t6vYo]

- “Looked but failed to see” phenomenon

- LBFTS crashes involve bicycles & motor cycles
  - Cyclist: “I saw the driver look”
  - Driver: “Cyclist came from nowhere”

→ Need to consider focus of driver attention

Conflict Path Awareness Analysis

- Systematic Process
- Considers “awareness” of road users
- Flexible
- Versatile
- Yields solutions
**Conflict Path Awareness Analysis**

**Context:** Crash Type & Road Scenario (general or specific)

**Awareness Diagram**
- Paths (primary conflict path (driver)).
- Constraints (known, likely).
- Awareness.
- Sightlines.

**Problem Statement**
- Can paths be adjusted ...
  - to remove conflict?
  - to lessen conflict?
  - realigned into awareness zones?

**Possible Solution**
- Can awareness zones be adjusted ...
  - to better match paths?

**Path & Awareness Questions**
- Awareness = attention = focus
- Largely determined by primary conflict path or expected primary conflict path
  - known or expected road environment

**Awareness**
- “Zone of Awareness”
- Guess the minds of road users
  - based on the known or expected road environment
Sample Contexts

A. Left Turn Side Swipe
   69% involve cyclists

B. Keep Clear
   Melbourne CBD location with highest incidence of cyclist severe injury crashes

C. Roundabouts – Entering-Circulating
   25-50% involve cyclists – 82% this type

Context A: Left-turn side swipe

69% involve cyclists¹
Dispersed distribution

¹VicRoads CrashStats 2012 – 5 year data for 2007-2011
A. Left-turn side swipe

Melbourne CBD location with a history of crashes of this type.¹

Downhill commuter cyclist route.

Approach paths are not within awareness zones.

Problem Statement:
Driver turns left from a place to the right of through traffic. Turning driver unaware of cyclists.

Possible Solution:
Driver 2-stage left turn.

Road Rules:
27. Driver must turn left from as close as possible to the left of the road. (50m in bicycle lanes.)

Awareness:
Easier driver task:
1. Check for cyclists → move to left edge of road
2. Check for pedestrians → turn corner

Road Design Principle:
Two simple driver tasks are safer than one complex task.
A. Left-turn side swipe

Implementation

- Add left turn arrow
- Relocate cycle lane & painted buffer
  - cyclists more visible to moving cars
  - cyclists outside “door zone”
- Add green colouring
- Extend dashed bicycle lane
  - clarify that drivers should merge left

Context B. “Keep Clear” Areas

Melbourne CBD location with highest incidence of cyclist severe injury crashes.¹

Downhill commuter cyclist route.

Car turns through queue of vehicles.

¹VicRoads CrashStats 2012
²VicRoads Districts 2002-2011
B. “Keep Clear” Areas

Two common crash types:

1. Right-Against Conflict
2. Left-Near Conflict

Need to consider each separately

B1. “Keep Clear” Areas

Approach paths are not within awareness zones.

With these constraints, visual awareness is impossible.
**B1. “Keep Clear” Areas**

**Awareness Diagram**

- **Paths**
- **Awareness**
- **Sightlines**

- Known
- Likely

Guess minds of drivers & cyclists

Approach paths are not within awareness zones.

With these constraints, visual awareness is impossible.

Typical engineering allowance:

- 2 – 2.5 sec reaction time
- + braking distance

**Problem Statement:**

Queued vehicles obscure sightlines.
B1. “Keep Clear” Areas

Problem Statement:
Queued vehicles obscure sightlines.

Possible Solution
- Extend “Keep Clear” area to provide sightlines
- Installed 2012

Right-Against Conflict

B2. “Keep Clear” Areas

Left-Near Conflict

Approach paths are not within awareness zones.
**Problem Statement:**

- Turning driver unaware of cyclists.
- Driver props (illegally) within Keep Clear area (across bike lane).

**Possible Solution**

- Shift "Keep Clear" line to obstruct the turn
- Green coloured cycle lane
- "Keep Clear" facing side road traffic
- Installed early 2012
Context C. Roundabouts

- 24% of crashes at roundabouts involve cyclists
- Cyclist crashes known to be under-reported
- 82% - Entering car strikes circulating cyclist
- LBFTS research:
  - Drivers look to right, but do not see cyclists

C. Roundabouts

Melbourne location with a history of cyclist entering-circulating crashes.1

Commuter cyclist route.

Southbound circulating cyclists + Westbound entering drivers
C. Roundabouts

**Problem Statement:**
Cyclists do not approach from where drivers look. Cyclists attention away from “problem” driver to the left. Sightlines to “fast” cyclists may be obscured.

**Path & Awareness Questions**
1. Can paths be adjusted …
   - realigned into awareness zone?

Encourage cyclists to follow “expected path”.
- education
C. Roundabouts

Problem Statement:
Cyclists do not approach from where drivers look. Cyclists attention away from "problem" driver to the left. Sightlines to "fast" cyclists may be obscured.

Path & Awareness Questions
1. Can paths be adjusted …
   - realigned into awareness zone?

Encourage cyclist to follow "expected path".
- education
- engineering

Remove circulating bicycle lane.
Kerb extensions.
Bicycle logos centred and 45° arrow.

Possible Solution
- Installed early 2012

Conflict Path Awareness Analysis

Context: Crash Type & Road Scenario
(general or specific)

Awareness Diagram
primary conflict path (driver)
car bike

Paths
Constraints
known likely
Awareness
Sightlines

Guess minds of drivers & cyclists

Problem Statement

Path & Awareness Questions
- Can paths be adjusted …
  - to remove conflict?
  - to lessen conflict?
  - realigned into awareness zones?
- Can awareness zones be adjusted …
  - to better match paths?

Cumming, B 2012
Conflict Path Awareness Analysis

<table>
<thead>
<tr>
<th>Context</th>
<th>Crash type</th>
<th>Problem</th>
<th>Solution</th>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>All intersections</td>
<td>Left turn side swipe</td>
<td>Driver turns left, not from left edge of road.</td>
<td>Change car path.</td>
<td>Paths</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Turning driver unaware of cyclists.</td>
<td>Bike lane closer &amp; green.</td>
<td>Awareness</td>
</tr>
<tr>
<td>Keep Left areas</td>
<td>Right-through</td>
<td>Obscured sight-lines.</td>
<td>Relocate Keep Clear area</td>
<td>Remove</td>
</tr>
<tr>
<td></td>
<td>Left-near</td>
<td>Driver discipline.</td>
<td>Relocate Keep Clear area.</td>
<td>obstruction</td>
</tr>
<tr>
<td>Roundabout</td>
<td>Entering-circulating</td>
<td>Driver attention (obscured sightlines)</td>
<td>Relocate cyclist path into driver “zone of awareness”.</td>
<td>Awareness</td>
</tr>
</tbody>
</table>

- Systematic Process
- Considers “awareness” of road users
- Flexible
- Versatile
- Yields solutions
Conflict Path Awareness Analysis

Context: Crash Type & Road Scenario (general or specific)

Awareness Diagram
- primary conflict path (driver)
  - car
  - bike
- known likely
- awareness zones
- sightlines

Problem Statement

Possible Solution

Path & Awareness Questions
- Can paths be adjusted …
  - to remove conflict?
  - to lessen conflict?
  - realigned into awareness zones?
- Can awareness zones be adjusted …
  - to better match paths?

Extra Slides
C. Roundabouts

New designs to make roundabouts safer
- Position cyclists in centre of lanes
- Slow cars on approach for safe merge with bikes
- Improve ability of approaching drivers to see other vehicles

Update roundabout design guidelines
- Remove circulating cycle lanes
- Remove cycle lanes at entries

A Bicycle Friendly (1-lane) Roundabout

Narrowing to slow approaching cars
Behavoiural sign for cyclists
Warning to cars of bike merge
Warning to cars of bikes in lane
Clear directions:
Cyclists look & signal
Cyclists merge
Cyclists ride here
Cyclists diverge
Radial entries for safety:
- better visibility
- slower
Entry narrowing to slow all vehicles

Cumming, B (2011) "Roundabouts: Why they are dangerous for cyclists and what can be done about it" in Transport Engineering in Australia
Roundabouts

Examples:

Rural City of Mildura (Vic) intersection of 12th St & San Mateo Ave, Mildura

- Green/white bike logos in middle of lanes at entries, circulating & exits
- Bike lanes terminate prior to entries with ‘Bike Merge Areas’
- Bike Merge advice to drivers & cyclists
- Raised ‘Riley kerb’ lane narrowing at corners, but still accommodate large vehicles
- Installed – mid-2012
Roundabouts

Examples:

City of Newcastle (NSW)
- Logos in middle of lanes indicate lateral positioning for safety & bike routes
- Installed mid-2011

City of Darebin (Vic)
- “Sharrows” in middle of lanes at Raglan St entries
- Bicycle lanes & sharrows installed mid-2011

City of Yarra (Vic)
- “Sharrows” in middle of lanes at all entries
- Bike symbols with merge arrows at all approaches
- Installed early-2012