Safety At Traffic Signals For Cyclists And Pedestrians

Rohit Singh | Beca
Shane Turner | Beca
Tim Hughes | NZTA
Gary Nates | Beca

Overview

- Hierarchy of provision for bicycles
- Research undertaken
- Data collection
- Before and after study results
- Crash prediction models
- Key conclusions

Hierarchy of Bicycle Provision

Traffic volume reduction → Traffic speed reduction → Junction treatment, hazard site treatment, traffic management → Conversion of footways/footpaths into shared use for pedestrians and cyclists → Cycle tracks away from roads → Reallocation of carriageway space

How effective are these treatments?

Studies Undertaken

1. Effectiveness and Selection of Intersection Treatments for Cyclists, 2010
   - 102 four-arm intersections (383 approaches)
   - Christchurch | Adelaide
   - Study outcomes: Before-after study
   - Crash prediction models for cycle crashes

   - 238 three-arm and four-arm intersections (889 approaches)
   - Auckland | Wellington | Hamilton Christchurch | Dunedin | Melbourne
   - Study outcomes: Crash prediction models for motor vehicle and pedestrian crashes
What are Crash Prediction Models?

"You want proof? I'll give you proof!"

Data Collection

Traffic signals database

- Crash data (CAS, VicRoads)
- Counts: MV, cyclists, pedestrians
- SCATS pedestrian phase data (Study 2)
- SCATS signal phasing (Study 2)
- Layout and geometry

Data Collection: Signal Layout and Geometry

Key Crash Types: Cyclists

- Crossing, both straight (HA)
- Right turn against (LB)
- Same direction, rear end, sideswipe (A*FG*)
- Left turn sideswipe (GB+AC)
- All other crashes
Before and After Analysis

<table>
<thead>
<tr>
<th>% change in crashes after installation of cycle facilities:</th>
<th>Christchurch</th>
<th>Adelaide</th>
</tr>
</thead>
<tbody>
<tr>
<td>% reduction, by crash type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crossing, both straight</td>
<td>20%</td>
<td>37%</td>
</tr>
<tr>
<td>Right Turn against</td>
<td>-3%</td>
<td>-1%</td>
</tr>
<tr>
<td>Same direction, rear end, sideswipe</td>
<td>-4%</td>
<td>-16%</td>
</tr>
<tr>
<td>Left turn sideswipe</td>
<td>58%</td>
<td>-103%</td>
</tr>
<tr>
<td>All other cycle crashes</td>
<td>77%</td>
<td>-186%</td>
</tr>
</tbody>
</table>

% reduction, by lane arrangement

<table>
<thead>
<tr>
<th>% reduction, by lane arrangement</th>
<th>Christchurch</th>
<th>Adelaide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sites with shared left turns</td>
<td>40%</td>
<td>-40%</td>
</tr>
<tr>
<td>Sites with exclusive left turns</td>
<td>3%</td>
<td>-36%</td>
</tr>
<tr>
<td>Sites with free left turns (FLTs)</td>
<td>-39%</td>
<td>-30%</td>
</tr>
<tr>
<td>Sites with coloured facilities</td>
<td>39%</td>
<td></td>
</tr>
</tbody>
</table>

Cyclist Crash Models

- 20 models across 5 key crash categories.
- Model types:
  - All sites
  - Christchurch sites only
  - Presence/absence of cycle treatments
  - Design parameters (e.g., cycle lane width)

Cyclist Crash Models

Both clear positives...

- Coloured treatments.
- Adequate total width
- Transition facilities

...and conflicting results

- Cycle storage boxes.
- Fewer right angle crashes at deeper intersections?

Pedestrian Crash Models

Right angle (NA and NB)

Right turning motor vehicle (pedestrian crossing) (ND and NF).
RS5

for the left most traffic lane plus any cycle lane

Esp same direction crashes.
There is evidence that shared lanes increase crashes of this type + also for left turn sideswipe.
Rohit Singh, 27/03/2011

RS6

mitigate right angle but increase right turn against crashes.
However the addition of colour may make a storage box safer. Deeper boxes
Rohit Singh, 27/03/2011

RS8

Rohit Singh 27/03/2011
It maybe that cyclists are more careful when crossing major roads, than when they are cycling along major roads.
Rohit Singh, 27/03/2011

RS9

have a beneficial effect on left turn sideswipe crashes.
To ensure they succeed at preventing left turn sideswipe crashes, colour is most important and width less of an issue.
Rohit Singh, 27/03/2011
### Pedestrian Crash Models

<table>
<thead>
<tr>
<th>Crash Type</th>
<th>Model Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right angle</td>
<td></td>
</tr>
<tr>
<td>Longer cycle, all-red times: more</td>
<td>FCycle facilities</td>
</tr>
<tr>
<td>crashes</td>
<td>FShared turns</td>
</tr>
<tr>
<td></td>
<td>FSplit phasing</td>
</tr>
<tr>
<td></td>
<td>FMed island</td>
</tr>
<tr>
<td>Right turning/pedestrian crossing</td>
<td></td>
</tr>
<tr>
<td>Longer amber times: more crashes</td>
<td>FFull RT Protection</td>
</tr>
<tr>
<td></td>
<td>FSequential</td>
</tr>
<tr>
<td></td>
<td>FCoordinated</td>
</tr>
<tr>
<td></td>
<td>FMed island</td>
</tr>
</tbody>
</table>

### What are the models saying?

Conclusions: Cycle Crashes

The overall effect of cycle lanes was neutral. Quality of provisions is important.

- Cycle lanes built to high standards improve cyclist safety
- Those built to lesser standards can reduce cyclist safety

Conclusions: Cycle Crashes (contd.)

Crashes at sites with coloured cycle lanes (all within Christchurch) decreased by 39%
Conclusions: Cycle Crashes (contd.)

Sites with shared left-turn and through lanes
Higher initial crash rates, but benefit the most from coloured cycle lanes and advanced storage boxes.

Sites with exclusive left turn lanes
Much safer for cyclists, but benefit from coloured transition cycle lanes marked across the diverge area to the limit line.

Conclusions: Cycle Crashes (contd.)

Adequate total width in the kerbside approach lane is more important than the presence or width of a cycle lane within this space.

Conclusions: Pedestrian Crashes

Longer cycle times = more pedestrian crashes

Conclusions: Pedestrian Crashes (contd.)

Split phasing and full right turn protection are 25-35% safer for pedestrians as compared to filter right turns.
Questions?

No math jokes

The only thing I love more than a fine wine is a fine explanation.

Please