Improving Pedestrian Safety on Urban Arterials: Learning from Australasia

U.S. DOT Federal Highway Administration
Office of International Programs
April 30, 2024

Source: USDOT/Getty
Pedestrian Fatality Trends 2010 – 2021

Data Source: ITF and FARS

71% increase since 2010
## Linking Classification to Design Standards

<table>
<thead>
<tr>
<th>Design standards</th>
<th>Main streets</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General</strong></td>
<td>Main way</td>
</tr>
<tr>
<td>Place contexts</td>
<td>Urban and Suburban</td>
</tr>
<tr>
<td>Land uses</td>
<td>Various urban land uses</td>
</tr>
<tr>
<td>Built form frontages</td>
<td>Retail frontages</td>
</tr>
<tr>
<td>Access to properties</td>
<td>Direct access to frontages</td>
</tr>
<tr>
<td>Posted speed (km/h)</td>
<td>60-90</td>
</tr>
<tr>
<td>Design speed (km/h)</td>
<td>60-100</td>
</tr>
</tbody>
</table>

### Active transport

- **Level of active transport separation from motor vehicles**
  - Seperated
  - Separated

### Environment

- **Tree canopy cover targets**
  - Urban
  - Suburban
  - Rural

### Intersections

- **Intersection type**
  - At grade or separated
  - At grade

### Vehicles

- **Bus lane**
  - Yes
  - No

### Parking spaces

- **Parallel parking spaces**
  - Yes
  - No

### Sight distance

- **Greater than 50m**

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Source: Transport for New South Wales
Systemic Safety Integration – RSAs as a PROCESS

**Systemic Approach**

Span all stages of the project lifecycle:

1. Network / corridor-scale planning
2. Programming
3. Scoping / developing countermeasures
4. Project development / detailed design
5. Project delivery
6. Post project
7. Network operation / maintenance

**Safe System Principles**

- Safety in Design
- Movement and Place (Safe Mobility)

**Proactive Techniques**

- Network Safety Review
- QA Check
- TMP Design and Compliance Check
- Monitoring and Evaluation
- Road Safety Audit (including Thematic Audits)

**Predictive Techniques**

- Feasibility RSA
- Preliminary & Detailed RSA
- Construction RSA
- Pre-opening RSA
- Post-opening RSA (<3 months)
- Existing Road RSA

**Techniques such as ANRAM/AudRAPIRR**

**Reactive Techniques**

- Crash Data Analysis
- Treatment of Crash Locations
- At-scene Crash Assessments
- Crash Investigations
- Crash Reviews

Source: Austroads Managing Road Safety Audits
Collective Risk Map - Crashes

MegaMaps
Road to Zero Edition 2
Personal Risk – Crashes Normalized to Volume
Existing (Posted) Speed Limits

MegaMaps
Road to Zero Edition 2

- Operational layers
  - Crashes (2017 - 2021)
  - Speed Management Framework
  - Posted Speed Limits
  - One Network Framework
  - Road Safety Metric
  - Collective Risk
  - Personal Risk
  - Infrastructure Risk Rating
  - Safe and Appropriate Speeds
  - Mean Operating Speeds

Map showing existing posted speed limits with a focus on speed management framework.
## Gap-analysis (intersections)

Gap between existing network and 2050 end-state

<table>
<thead>
<tr>
<th>Car occupants</th>
<th>M&amp;P Rural</th>
<th>Rural Connectors</th>
<th>Interregional Connectors &amp; Rural Connectors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Activity streets, Main streets</td>
<td>Urban Connectors</td>
<td>Transit Corridors</td>
</tr>
<tr>
<td></td>
<td>40 km/h</td>
<td>50 km/h</td>
<td>60 km/h</td>
</tr>
<tr>
<td>Grade separation</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>Left in/left out with acceleration lane</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Roundabout (1-2 lane depending on radius)</td>
<td>22</td>
<td>1275</td>
<td>34</td>
</tr>
<tr>
<td>Signalised intersection with RSP</td>
<td>Green</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Signalised intersection (NOT PART OF END STATE)</td>
<td>68</td>
<td>1086</td>
<td>165</td>
</tr>
<tr>
<td>Priority with RISP/chicane</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Priority (with continous speed)</td>
<td>793</td>
<td>54039</td>
<td>852</td>
</tr>
<tr>
<td>Left in/left out</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Legend:
- Safe System aligned
- Acceptable with a 5-star vehicle
- Potentially high energy crash, but lower overall risk. Not acceptable but not necessarily not priority
- High energy, not acceptable
Phase One - Baseline and Scenarios 1-3

Lives saved to 2050 compared to Baseline:
- Scenario 1: 411
- Scenario 2: 2,434
- Scenario 3: 2,831
Example of a Safe System Assessment Matrix Score

SH3 / SH54 Intersection – Existing Intersection

<table>
<thead>
<tr>
<th></th>
<th>ROR</th>
<th>HO</th>
<th>INT</th>
<th>OTHER</th>
<th>PED</th>
<th>CYC</th>
<th>MIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Likelihood</td>
<td>3/4</td>
<td>3/4</td>
<td>4/4</td>
<td>2/4</td>
<td>0/4</td>
<td>1/4</td>
<td>2/4</td>
</tr>
<tr>
<td>Product</td>
<td>27/64</td>
<td>36/64</td>
<td>48/64</td>
<td>12/64</td>
<td>0/64</td>
<td>8/64</td>
<td>24/64</td>
</tr>
</tbody>
</table>
### Example of a Safe System Assessment Matrix Score

**SH3 / SH54 Intersection – Roundabout Option**

<table>
<thead>
<tr>
<th></th>
<th>ROR</th>
<th>HO</th>
<th>INT</th>
<th>OTHER</th>
<th>PED</th>
<th>CYC</th>
<th>M/C</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Likelihood</strong></td>
<td>3/4</td>
<td>1/4</td>
<td>1/4</td>
<td>1/4</td>
<td>9/4</td>
<td>2/4</td>
<td>2/4</td>
</tr>
<tr>
<td><strong>Severity</strong></td>
<td>2/4</td>
<td>1/4</td>
<td>1/4</td>
<td>1/4</td>
<td>2/4</td>
<td>1/4</td>
<td>1/4</td>
</tr>
<tr>
<td><strong>Product</strong></td>
<td>12/64</td>
<td>3/64</td>
<td>6/64</td>
<td>3/64</td>
<td>0/64</td>
<td>4/64</td>
<td>6/64</td>
</tr>
</tbody>
</table>
### Safe System Assessments from Vic Roads

#### Road A1

<table>
<thead>
<tr>
<th></th>
<th>Safe System Assessment Score</th>
<th>improvement</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing conditions</td>
<td>324 / 448</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Original design</td>
<td>284 / 448</td>
<td>12%</td>
<td>$130M</td>
</tr>
<tr>
<td>After Safe System Assessment</td>
<td>176 / 448</td>
<td>45%</td>
<td>$130M</td>
</tr>
</tbody>
</table>

(38% improvement from original design)
Figure 2.1: Proposed traffic island cycle diversion area (left) compared to existing arrangement (right).
<table>
<thead>
<tr>
<th>Frequency Rating:</th>
<th>Severity Rating:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crashes are likely to be Occasional</td>
<td>Death or serious injury is likely</td>
</tr>
</tbody>
</table>

**Designer Response:**
Point 1 – Island length will be reduced to eliminate the restriction for vehicles entering and exiting out of 387/389 Lower Queen Street. Point 2 – Berryfield Drive is expected to accommodate 12,000 vehicles per day and therefore we envisage that this lane will be highly utilised. Reducing the stacking length of this lane will reduce the level of service and exacerbate the risk of vehicles encroaching onto the through lane during peak times. No change recommended. Point 3 – A single through/left turn lane will be very wide and encourage high speeds along Lower Queen Street. The reason for the island is to discourage left turning vehicles entering the left turn lane into Berryfield Drive early. No change recommended. Point 4 – Agreed, we will include a note in the next set of drawings to replace this sump grate.

**Safety Engineer:**
Agree with the SAT that the island may force an awkward and uncomfortable manoeuvre for cyclists, particularly for less confident cyclists opting to use the exit ramp and shared path. Also agree with the designer that a physical deterrent is needed to prevent left turn vehicles from using the cycle lane and road width as an extended left turn lane. Designer to consider a physical island and or safe hit bollards as a cycle lane buffer instead of the drawn island.

**Client Decision:**
Designer to consider a physical island and or something similar to safe hit bollards as a cycle lane buffer instead of the drawn island. My preference is not to use safe hit posts.

**Action Taken:**
Click here to enter text.
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Source: Austroads Managing Road Safety Audits
Study Team

Shari Schaftlein
(Study Team Lead)
Director, Office of Human Environment
Federal Highway Administration
Shari.Schaftlein@dot.gov

Darren Buck (Study Team Co-Lead)
Pedestrian and Bicycle Program Coordinator
Federal Highway Administration
Darren.Buck@dot.gov

Tamara Redmon
Pedestrian and Bicyclist Safety Program Manager
Federal Highway Administration
Tamara.Redmon@dot.gov

Rachel Carpenter
Chief Safety Officer
California Department of Transportation
rachel.carpenter@dot.ca.gov

Mark A. Cole, PE
State Traffic Operations Engineer
Virginia Department of Transportation
Mark.Cole@VDOT.Virginia.gov

Lee Austin
Central Area Engineer
City of Austin, TX
Lee.Austin@austintexas.gov

Laura Sandt
Director, Pedestrian and Bike Information Center
University of North Carolina Highway Safety Research Center
sandt@hsrc.unc.edu

Jonah Chiarenza
Community Planner (Report Lead)
U.S. DOT Volpe Center
Jonah.Chiarenza@dot.gov

in coordination with:
Help us advance these findings in Massachusetts

Jonah Chiarenza
USDOT Volpe Center
Jonah.Chiarenza@dot.gov

Shari Schaftlein | Director, Office of Human Environment
Federal Highway Administration
Shari.Schaftlein@dot.gov

Source: USDOT/Getty