Innovative Intersections
Barriers for Pedestrians and Bicyclists – RCUTS and Roundabouts

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Preface

Best practices for RCIs and roundabouts to facilitate transportation for all users
Restricted Crossing U–Turn (RCUT)

Crossing a rural divided highway using a Reduced Conflict Intersection

Left hand turn onto divided highway using a Reduced Conflict Intersection
Restricted Crossing U–Turn (RCUT)

- Decreased delay
- Increased safety
- Good capacity
- Easy signal progression
- Creates a barrier for pedestrians
Restricted Crossing U–Turn (RCUT)

Source: FHWA
Restricted Crossing U–Turn (RCUT)
## Restricted Crossing U-Turn (RCUT)

![Diagonal cross diagram](image)

**Figure 4.2. Diagonal cross.**

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Protected pedestrian movements.</td>
<td>• Pedestrian movement from the southeast to the northwest quadrant will be longer due to the diagonal crossing length.</td>
</tr>
<tr>
<td>• Pedestrian phases work well with two-stage traffic crossings.</td>
<td></td>
</tr>
<tr>
<td>• Expect no interruption to traffic flow.</td>
<td></td>
</tr>
<tr>
<td>• Favors a direct path between the southwest and northeast quadrants.</td>
<td></td>
</tr>
<tr>
<td>• Right turn on red from the minor street do not conflict with pedestrians any more than at a conventional intersection.</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.1. Assumed advantages and disadvantages to the pedestrian diagonal cross.
## Restricted Crossing U-Turn (RCUT)

![Image: Median cross.](image)

### Table 4.2. Assumed advantages and disadvantages for the pedestrian median cross.

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Pedestrian paths at right angles, no angled paths.</td>
<td>• The major street pedestrian path would conflict with the left turning vehicles from the major street.</td>
</tr>
<tr>
<td>• Shorter crossing distances.</td>
<td>• An exclusive pedestrian signal phase would be required at each major street crossing, adding vehicular delay for the mainline left turn movement.</td>
</tr>
</tbody>
</table>

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Pedestrian and Bicycle Accommodations on Superstreets NCDOT 1/2014
Restricted Crossing U–Turn (RCUT)

Figure 4.4. Two-stage Barnes Dance cross.

Table 4.3. Assumed advantages and disadvantages for the pedestrian two-stage Barnes Dance cross.

<table>
<thead>
<tr>
<th>Advantages:</th>
<th>Disadvantages:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Direct link between all quadrants increases pedestrian access.</td>
<td>• Major street pedestrian path would conflict with several vehicle paths and require an exclusive pedestrian signal phase.</td>
</tr>
<tr>
<td></td>
<td>• The addition of the pedestrian signal phase would add to vehicular delay.</td>
</tr>
</tbody>
</table>
Restricted Crossing U-Turn (RCUT)

Figure 4.5. Midblock cross.

Table 4.4. Assumed advantages and disadvantages for the pedestrian midblock cross.

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Offers a crossing at the midblock, which may be in addition to a crossing at the main intersection.</td>
<td></td>
</tr>
<tr>
<td>• One of the two crossings would work well with the current vehicle signal at the U-turn.</td>
<td></td>
</tr>
<tr>
<td>• Midblock crossings would work well for closely spaced U-turns in a corridor of multiple superstreets.</td>
<td></td>
</tr>
<tr>
<td>• Provides a crossing opportunity at a midblock location where transit could be incorporated.</td>
<td></td>
</tr>
<tr>
<td>• Possible added delay to the outbound vehicles from the side street movements at the midblock cross.</td>
<td></td>
</tr>
</tbody>
</table>
Restricted Crossing U–Turn (RCUT)

Table 4.5. Assumed advantages and disadvantages for the bicycle U-turn option.

<table>
<thead>
<tr>
<th>Advantages:</th>
<th>Disadvantages:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Bicyclists travel a shorter distance to the median cut as opposed to the vehicular U-turn.</td>
<td>• Bicyclists traveling on the left side of the street is not common, making this movement unfamiliar to bicyclists as well as vehicles.</td>
</tr>
<tr>
<td>• Bicyclists’ movements could work well with current vehicular signals.</td>
<td>• Possible storage concerns for multiple bicyclists traveling through the median cut at the same time.</td>
</tr>
<tr>
<td>• The exclusive bicycle U-turn separates bicyclists from motorists, making the U-turn maneuver safer than when sharing the vehicular U-turn.</td>
<td>• May not be a viable option for extremely long mainline left turn bays</td>
</tr>
<tr>
<td>• Favored by individuals on the expert panel who prefer to cycle with vehicles.</td>
<td></td>
</tr>
</tbody>
</table>

Figure 4.6. Bicycle U-turn option.
**Table 4.6. Assumed advantages and disadvantages to the bicycle direct cross.**

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Directly crossing the major street offers the shortest distance to the</td>
<td>• Traveling on the left side is an unusual lane position for bicyclists and</td>
</tr>
<tr>
<td>bicyclists.</td>
<td>may be unexpected to motorists.</td>
</tr>
<tr>
<td>• Bicyclists have less exposure to the major street traffic.</td>
<td>• Additional signals exclusively for bicyclists need to be installed.</td>
</tr>
<tr>
<td></td>
<td>• Additional design consideration needed for the bicyclists crossing the</td>
</tr>
<tr>
<td></td>
<td>major street left turns.</td>
</tr>
<tr>
<td></td>
<td>• Four different crossing movements.</td>
</tr>
</tbody>
</table>

**Figure 4.7. Direct cross.**
Restricted Crossing U–Turn (RCUT) Treatments that Help

- LPI when signalized
- Consistently providing pedestrian cut-throughs in the median
- Slip ramps
- Unique phasing
Roundabouts

- Reduced delay
- Increased safety, especially with single-lane roundabouts
- Slower speeds (Energy = ½ X mass X speed X speed)
Roundabouts

Chance of Pedestrian Death If Hit By a Motor Vehicle

- 20 mph: 5%
- 30 mph: 40%
- 40 mph: 80%
- 50 mph: 100%

* Literatuure Review on Vehicle Travel Speeds and Pedestrian Injuries – Final Report DOT HS 809 021, October 1999
Roundabouts

Source – Roundabouts: An Informational Guide (FHWA)
Roundabouts

- MN – 25 pedestrian crashes, only 1 serious in 10 years
  - Number of roundabouts varied, up to around 300
- Melbourne, Australia study
  - Roughly the same size/population as 7 county Metro
  - ~4,000 roundabouts
  - 1996–2000
    - 57 total ped crashes
    - 0 fatals
    - 32% required hospitalization
Roundabouts

- Increased pedestrian safety
  - Shorter crossing distances
  - Pedestrians only look in one direction
  - Driver at signals watch the light
  - Drivers at typical intersections tend to look left and turn right
  - Pedestrian crossing separated from intersection – allows for one step at a time. Shorter crossing distances
  - Two-stage crossings
Roundabouts

- Decreased pedestrian safety
  - Vehicles don’t stop
  - ADA concerns
  - Become a barrier without facilities
Roundabouts

Source: kitsapsun.com
Roundabouts

Source: kitsapsun.com
Roundabouts

- Pedestrian
  - PROWAG and the new AASHTO Pedestrian Guide will require beacons or signals on multilane roundabouts.
  - Eliminate pedestrian barriers, regardless of volume. Set the bar low!

- Bicycle
  - Slip ramps important

Source: greatergreaterwashington.org
Questions?

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