Safety Balance Between Accessibility & Mobility Needs

The Perfect Mix !!!

- Little Local Traffic
- Expressway
- Freeway
- Increased proportion of through traffic and speeds
- Major Arterial
- Minor Arterial
- Collector
- Local and Access
- Cul-de-sac
- No Through Traffic
- Complete Access Control
- Increasing Access
- Unrestricted Access
Junctions / Intersections

Intersection is an area shared by two or more roads. This area is designated for the vehicles to turn to different directions to reach their desired destinations.
Life Cycle of Intersections

Levels of Intersection Control

Another Form of Hierarchy

**Passive Control**
1. No control
2. Traffic Signs
3. Traffic signs plus road marking

**Semi Control**
1. Channelization
2. Roundabouts

**Active Control**
1. Traffic Signals
2. Grade Separated Intersection
3. Grade Separated Interchange
   1. Trumpet interchange
   2. Diamond interchange
   3. Clover leaf interchange
Intersections / Interchanges

Channelization of traffic through a three legged intersection

Channelization of traffic through a four legged intersection

Trumpet interchange

Diamond interchange

Cloverleaf Interchange

Roundabout & Rotary

Roundabout

Rotary

Weave area

Modern Roundabout and Classic Rotary design and traffic movements
Design of sight distance at intersections may be used on three possible conditions:

- Enabling approaching vehicle to change the speed
- Enabling approaching vehicle to stop
- Enabling stopped vehicle to cross a main road.

Turning Radius

A function of road hierarchy and visibility
Traffic Island

A function of available ROW and turning radius

Operating speeds of 20 – 30 kmph – suitable and advisable for local roads

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Traffic Island

A function of available ROW and turning radius

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Merging & Diverging

Improperly designed entry ramp
Safety at Highways - Merging Sections
Diverging Sections

**TAPER DIVERGE**

**PARALLEL DIVERGE**

Design _ Merge Lane Layouts

**A - Taper Merge**

**B - Parallel Merge**
Design Merge Lane Layouts

C - Ghost Island Merge
(Only used where design flows on mainline are light, there are 3 lanes or more on mainline and merging flow is over one lane capacity.)

D - 2 Lane Urban Merge

Design Merge Lane Layouts

F - Lane Gain with Ghost Island Merge (OPTION 1 - PREFERRED)

F - Lane Gain with Ghost Island Merge (OPTION 2 - ALTERNATIVE)
What is wrong ??....

Roundabout Intersections

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School of Planning and Architecture, New Delhi
It may be described as an enlarged road intersection, where all entering vehicles can find suitable gaps to move around an island in one direction before they can move out of the traffic flow into their respective directions radiating from the island.

Difference in Rotary and Roundabout

**Roundabout**

- smaller in size
- Drivers yield at entry to traffic in the roundabout, then enter the intersection and exit at their desired street
- Maintain relatively low speeds (< 40 kmph)
- No pedestrian activity on central island.
- Large entry angle helps to create entry deflection to control speed through the roundabout.

**Rotary**

- Rotary is bigger in size
- Drivers enter a traffic circle in a straight line and do not have to yield
- Higher speeds allowed (> 40 kmph)
- Some large traffic circles allow pedestrian crossing to and from the central island.
- Splitter Island Optional
- Entry angle likely to be reduced to allow higher speed at entry.
Distinguishing Roundabouts from Other Circular Intersections

<table>
<thead>
<tr>
<th>Roundabouts</th>
<th>Traffic Circles</th>
</tr>
</thead>
</table>

(a) Traffic control
Yield control is used on all entries. The circulatory roadway has no control. *Santa Barbara, CA*

Some traffic circles use stop control, or no control, on one or more entries. *Hagerstown, MD*

(b) Priority to circulating vehicles
Circulating vehicles have the right-of-way. *Santa Barbara, CA*

Some traffic circles require circulating traffic to yield to entering traffic. *Sarasota, FL*
Modern Roundabout Characteristics

- yield on entry
- central island deflects traffic and forces it to slow down
- splitter islands that separate entering and exiting traffic.
- designed to accommodate vehicles of all sizes
**Traffic Safety:** studies have shown that conversion of traffic signal- or stop sign-controlled intersections to roundabouts reduced injury crashes by 75-90% and all crashes by 35-40%.
FROM INTERSECTIONS TO ROUNDABOUTS

1. Mini roundabouts
2. Turbo roundabouts
3. Raindrop
4. Twin or dumb bell
5. Two geometry
6. Super circle or magic roundabout
7. Through about or Cut-through Roundabouts

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**Recommended Maximum Entry Design Speeds.**

<table>
<thead>
<tr>
<th>Site Category</th>
<th>Recommended Maximum Entry Design Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mini-Roundabout</td>
<td>25 km/h (15 mph)</td>
</tr>
<tr>
<td>Urban Compact</td>
<td>25 km/h (15 mph)</td>
</tr>
<tr>
<td>Urban Single Lane</td>
<td>35 km/h (20 mph)</td>
</tr>
<tr>
<td>Urban Double Lane</td>
<td>40 km/h (25 mph)</td>
</tr>
<tr>
<td>Rural Single Lane</td>
<td>40 km/h (25 mph)</td>
</tr>
<tr>
<td>Rural Double Lane</td>
<td>50 km/h (30 mph)</td>
</tr>
</tbody>
</table>

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**Recommended Inscribed Circle Diameter Ranges**

<table>
<thead>
<tr>
<th>Site Category</th>
<th>Typical Design Vehicle</th>
<th>Inscribed Circle Diameter Range*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mini-Roundabout</td>
<td>Single-Unit Truck</td>
<td>13–25m (45–80 ft)</td>
</tr>
<tr>
<td>Urban Compact</td>
<td>Single-Unit Truck/Bus</td>
<td>25–30m (80–100 ft)</td>
</tr>
<tr>
<td>Urban Single Lane</td>
<td>WB-15 (WB-50)</td>
<td>30–40m (100–130 ft)</td>
</tr>
<tr>
<td>Urban Double Lane</td>
<td>WB-15 (WB-50)</td>
<td>45–55m (150–180 ft)</td>
</tr>
<tr>
<td>Rural Single Lane</td>
<td>WB-20 (WB-67)</td>
<td>35–40m (115–130 ft)</td>
</tr>
<tr>
<td>Rural Double Lane</td>
<td>WB-20 (WB-67)</td>
<td>55–60m (180–200 ft)</td>
</tr>
</tbody>
</table>

* Assumes 90-degree angles between entries and no more than four legs.

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COMPARISON WITH OTHER INTERSECTIONS

**TWO LANE APPROACHES**

- Possible Roundabout Capacity (4000 vph)
- Practical Roundabout Capacity (2000 vph)
- Signal
- Roundabout

**SINGLE LANE APPROACHES**

- Signal without Turn Bays
- Roundabout

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Why Roundabouts ??

LEGEND
- Red: Area required for roundabouts but not for signals
- Blue: Area required for signals but not for roundabouts

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Raindrop Roundabouts

- Do not form a complete circle and have a "raindrop" shape.
- Eliminate direct U-turn movements.
- Can be provided to accommodate high turning movements.

7. Hamburger or Through about or Cut – through Roundabouts

- The hamburger roundabout is a type of roundabout with a straight-through section of carriageway regarding major roads.
- It has a split central island with a splitter island between the two halves of the central island.
- The width of the intermediate splitter island is equal to the length of one heavy vehicle or one bus (or more, but not less).
- The inscribed circular diameter of the hamburger roundabout is about 60 m or more.
### Issues concerning Safety

**Motor vehicle Conflicts**

- At traditional junctions with stop signs or traffic lights, the most serious accidents are right-angle, left-turn, or head-on collisions that can be severe because vehicles may be moving fast and collide at high angles of impact.

- Roundabouts eliminate these crashes as all vehicles travel in the same direction and most crashes are glancing blows at low angles of impact.

- Roundabouts are safer than traffic circles and junctions as they reduce conflict points.

Source: AASHTO

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WRONGLY DESIGNED
VISIBILITY BLOCK

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ELEMENTS OF ROUNDABOUTS WITH SEPARATED BIKE LANES

1) Bicycle Crossing
2) Yield Markings
3) Bicycle Stop Line
4) 8 ft. Curb Radius
5) Channelizing Island
The following steps may be followed when deciding whether to implement a roundabout at an intersection:

• Step 1: Consider the context.
• Step 2: Determine the preliminary lane configuration
• Step 3: Identify the type
• Step 4: Determine the space requirements.
• Step 5: If additional space must be acquired or alternative intersection forms are viable, an economic evaluation may be useful

Roundabout Geometric design

• Slow entry speeds
• Appropriate number of lanes
• Smooth channelization
• Adequate accommodation for design vehicles
• Meeting needs of pedestrians and bicyclists
• Appropriate sight distance and visibility
Sample Theoretical Speed Profile

Vehicle Path Radii
Roundabouts at Highways

Design Concepts

Elements of the Functional Area of an Intersection
Design of Priority Intersections

Ghost Island Junction

Left Hand Skew Junction

Cross Roads
Geometric Design Features

Carriageway Widths

Major / Minor Priority Junction with a Ghost Island

- **a**  Turning Length (+ Queuing length, if required)
- **b**  Deceleration Length
- **c**  Through Lane Width
- **d**  Turning Lane width
- **e**  Direct Taper Length

Geometric Design Features

Carriageway Widths

Minor Road Approaches

- **a**  7.3m nominal width
- **b**  4.0m in all cases
- **c**  4.5m for ghost island,
  5.0m for single lane dualling, dual carriageway.
- **d**  4.0m for ghost island,
  4.5m for single lane dualling, dual carriageway,
  5.5m if two lane approach.
Geometric Design Features

Central Reserve Opening & Traffic Islands

Method of Regulating the Priority in the Central Reserve Opening

Geometric Design Features

Stagger Distances

Major / Minor Priority Junction with Skew Minor Road

a. Turning Length
b. Deceleration Length
c. Through Lane Width
d. Turning Lane Width
e. Minor Road Entry Width
Stagger Distances

Major / Minor Priority Junction with Skew Minor Road

- Turning Length
- Deceleration Length
- Through Lane Width
- Turning Lane Width
- Minor Road Entry Width

Stagger Distances

Major / Minor Priority Junction with Curve on Major Road

- Turning Length
- Deceleration Length
- Through Lane Width
- Turning Lane Width
- Radius of outside of carriageway varies to accommodate taper and horizontal alignment of major road
THANK YOU FOR YOUR ATTENTION

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