Roundabouts on California State Highways

Calmentor Workshop April 22, 2014

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Caltrans District 6 Maintenance and Operations

Presentation

- New Caltrans Mission Statement
- Why Install a Roundabout on the State Highway System?
- Roundabout Basics and Examples
- Currently Proposed and Future Roundabouts in District 6
- Intersection Control Evaluation (ICE)
- Business Opportunities

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Caltrans Mission Statement

- Old: Caltrans improves mobility across California
- New: Provide a safe, sustainable, integrated and efficient transportation system to enhance California's economy and livability.

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Why Install Roundabouts on the SHS?

- Safety – Reduced number of crashes and severity compared to signalized intersections, eliminates head-on or broadside crashes, no warrants to satisfy
- Operations – Less delay and more capacity than signals, periodic retiming not necessary as with signals
- Maintenance – Fewer electricians needed, no signal call-outs

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Why Install Roundabouts on the SHS?

- Cost Effectiveness – Potential to increase capacity without extensive structure work at interchanges or lane additions at intersections
- Accommodation of All Users – Slower vehicular speeds, shorter pedestrian crossing distances with fewer lanes, potential for road diets
- Sensitivity to Local Needs – Gateways to communities, traffic calming

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Why Install Roundabouts on the SHS?

- Sustainability – Social, environmental, and economic responsibility
- Every Day Counts 2 – FHWA initiative encourages alternative intersection and geometrics to improve safety for all users

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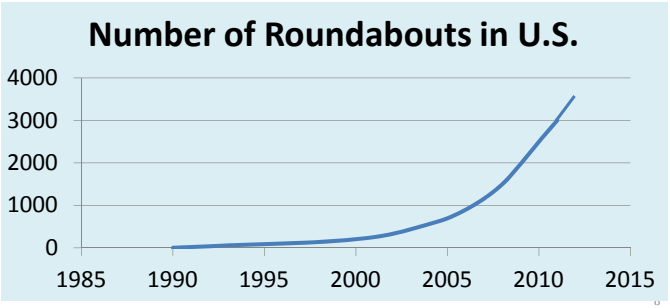
Reedley Roundabout

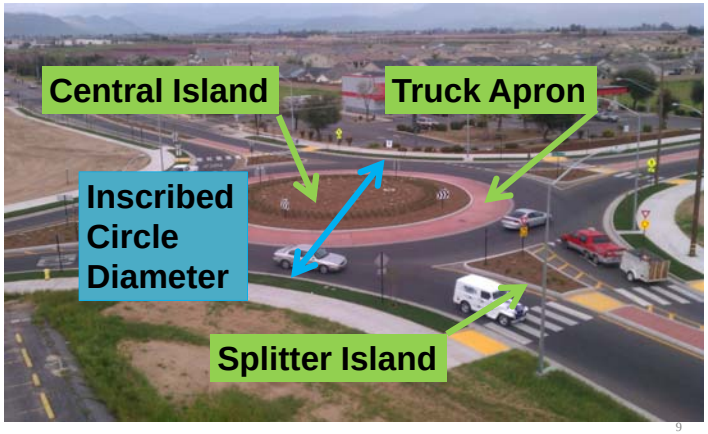
Buttonwillow and Dinuba Avenues in Reedley

Roundabouts in the U.S.

- 3,500 in U.S.
- 20 on California State Highways



Roundabout Basics



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Roundabout Categories

Design Element	Mini-Roundabout	Single-Lane Roundabout	Multilane Roundabout
Desirable maximum entry design speed	15 to 20 mph (25 to 30 km/h)	20 to 25 mph (30 to 40 km/h)	25 to 30 mph (40 to 50 km/h)
Maximum number of entering lanes per approach	1	1	2+
Typical inscribed circle diameter	45 to 90 ft (13 to 27 m)	90 to 180 ft (27 to 55 m)	150 to 300 ft (46 to 91 m)
Central island treatment	Fully traversable	Raised (may have traversable apron)	Raised (may have traversable apron)
Typical daily service volumes on 4-leg roundabout below which may be expected to operate without requiring a detailed capacity analysis (veh/day)*	Up to approximately 15,000	Up to approximately 25,000	Up to approximately 45,000 for two-lane roundabout

*Operational analysis needed to verify upper limit for specific applications or for roundabouts with more than two lanes or four legs.

Source: NCHRP Report 6-72 Exhibit 1-9

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River Park – Has Design Issues

Fresno State – Chestnut/Barstow

North Fresno – Copper River

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Visalia Before

Visalia Roundabout

Lindsay Roundabout

Neighborhood Traffic Circle – Not a Rbt

Belmont Circle – Not a Roundabout

I-80/SR-89 in Truckee

SR-138 in Palmdale

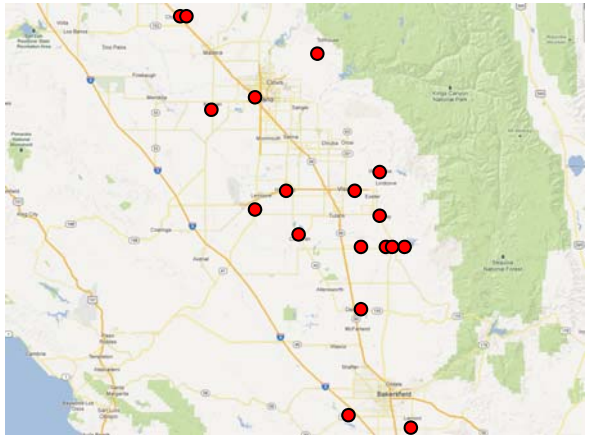
I-5 at Haysley Canyon Rd in Santa Clarita

SR-1 and Simpson Lane in Fort Bragg

SR-246 and Purisma Road in Lompoc

I-5 and Deschutes Road in Anderson

District 6 Roundabout Projects



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District 6 Roundabout Projects

1. SR-41 at Kansas Avenue
2. SR-43/119/Enos Lane west of Bakersfield
3. SR-43/137/Whitley Ave east of Corcoran
4. SR-65 at Hermosa Street in Lindsay
5. SR-99 at NB off-ramp to McKinley Ave in Fresno (designed by others)
6. SR-99/233 NB ramps in Chowchilla
7. SR-99/233 SB ramps in Chowchilla
8. SR-145 at Jensen Ave south of Kerman
9. SR-155 at Browning Road in Delano
10. SR-168 at Auberry Road in Prather
11. SR-184/223 at Wheeler Ridge Road south of Lamont
12. SR-190 at Bliss Lane/Road 152 east of Tipton
13. SR-190 at Westwood Road west of Porterville
14. SR-190 at Plano Street in east Porterville
15. SR-190 at Road 284 east of Porterville
16. SR-198 at WB ramps at Hanford-Armona Road
17. SR-198 at EB ramps to Farmersville Blvd (designed by others)
18. SR-216/245 in Woodlake (designed by others)

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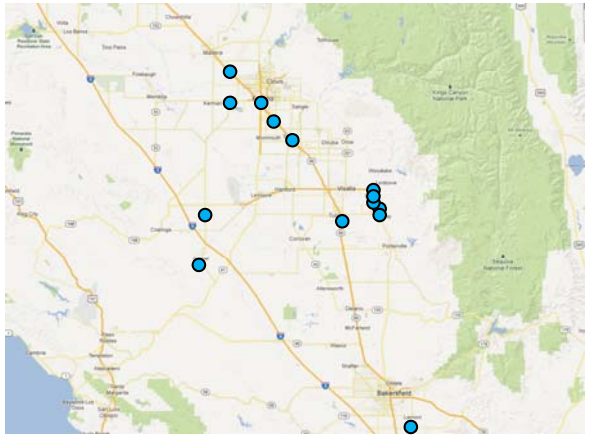
Future D6 Roundabout Projects



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Future D6 Roundabout Projects

1. I-5 at Frazier Mountain Parkway near Frazier Park
2. SR-33/180 in Mendota
3. SR-49 at Westlake Drive in Oakhurst
4. SR-99 at Paige Street interchange
5. SR-99 at Mountain View Ave interchange in Selma
6. SR-99 at Merced Street interchange in Fowler
7. SR-99 at American Avenue interchange
8. SR-99 at Avenue 7 interchange south of Madera
9. SR-137 at Oakmore Street in Tulare
10. SR-180 at 9th Street in Mendota
11. SR-180 at Dickenson Avenue west of Fresno
12. SR-269 at San Joaquin Street in Avenal
13. SR-269 at Palmer Avenue in Huron
14. SR-269 at Myrtle Avenue/4th Street in Huron
15. SR-269 at Tornado Avenue in Huron

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Safety

Roundabouts, compared to two-way stops, all-way stops, and traffic signals

- 35% Reduction in All Accidents
- 76% Reduction in Injury Accidents
- 90% Reduction in Fatal Accidents

Source: *National Cooperative Highway Research Program Report 572* in a study of 55 roundabouts in the United States. Comparing 9 intersections converted from traffic signals to roundabouts, there was a reduction of 48% in all accidents and 78% in fatal+injury accidents.

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Why Are Roundabouts Safe?

- Slower Speeds – 15 to 20 mph
- No Right Angle Accidents
- Fewer Conflict Points

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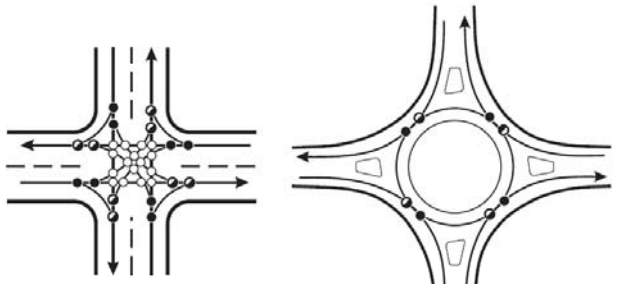
Conflict Points



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- Diverging
- Merging
- Crossing

8 Conflict Points

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Roundabout Operations

Roundabouts, compared to traffic signals and all-way stops

- Reduced Delay
- Increased Capacity

2004 Kansas DOT study between traffic signals and roundabouts showed vehicle delay was reduced by 65% and vehicle stops were reduced by 52%.

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Road Diets

- Eliminate through lanes and regain capacity by replacing signals with roundabouts
- Safer pedestrian crossings at both the roundabout and other intersections
- Consider for ADT of up to 20,000

Pedestrian and Bicyclists

- Pedestrians
  - Cross one direction of traffic at a time
  - Low traffic speeds

- Bicyclists can navigate roundabouts either as motor vehicles or pedestrians

Considerations for Multi-Lane Crossings

Pedestrian Hybrid Beacon "HAWK"

Rectangular Rapid Flashing Beacon

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Trucks

- Designed for largest legal California trucks and oversized vehicles, including agricultural vehicles

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Trucks in Multilane Roundabouts

- Case 1 – Trucks overlap into adjacent lane (not to be used on California highways)
- Case 2 – Trucks stay in own lane at entries but overlap in circulatory roadway and exits
- Case 3 – Trucks stay in own lane at approaches, circulatory roadway, and exits (Potential criteria: Consider when 5-axle truck volume is greater than or equal to 11%, or, when 5-axle truck ADT is 100 or higher)

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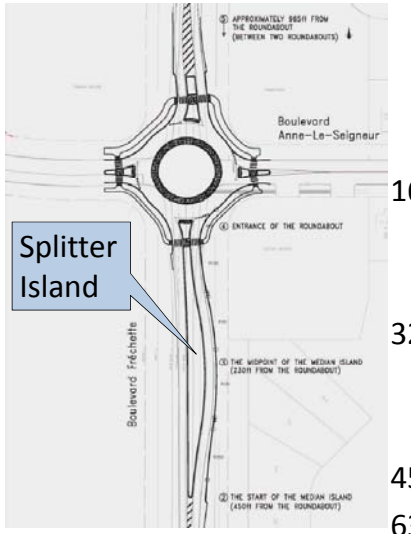

High-Speed Approaches

16 mph
32 mph
45 mph
63 mph

- Advance flashing beacons and signing
- Raised islands and curbing
- Raised central island

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Fog

- Advance flashing beacons
- Signing
- Raised islands
- Lighting

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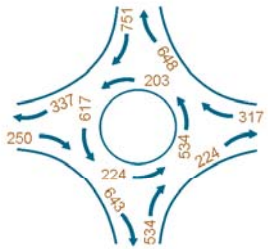
Central Island

- Mounded to prevent headlights from shining through
- Drought tolerant landscaping, such as buckwheat
- Local agency may place and maintain enhanced landscaping
- Refrain from placing fixed objects

Design Process

- Add conflicting entry and circulatory volumes to determine initial lane configuration



Volume Range (sum of entering and conflicting volumes)	Number of Lanes Required
0 to 1,000 veh/h	▪ Single-lane entry likely to be sufficient
1,000 to 1,300 veh/h	▪ Two-lane entry may be needed ▪ Single-lane may be sufficient based upon more detailed analysis.
1,300 to 1,800 veh/h	▪ Two-lane entry likely to be sufficient
Above 1,800 veh/h	▪ More than two entering lanes may be required ▪ A more detailed capacity evaluation should be conducted to verify lane numbers and arrangements.

Source: New York State Department of Transportation
NCHRP Report 672 Exhibit 3-14

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Design Process

- Use Sidra 6.0 or Rodel software to analyze
- Use Vissim for multiple roundabouts
- Iterative process balancing the constraints and performance objectives
- Requires a high level of expertise, multiple iterations
- Can use TORUS program for preliminary design
- Peer reviews

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Roundabout Benefits

- Eliminates broadside and head-on accidents
- Less delay
- Reduced fuel consumption, emissions, and noise from less stopping and starting
- Less vehicle wear and tear
- Calms traffic
- More aesthetically pleasing with opportunity for attractive landscaping
- Allows trucks to make U-turns

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Barriers to Roundabouts

- Roundabouts are not yet mainstream
- Poorly designed roundabouts or traffic circles discourage receptiveness
- A need for right-of-way at the intersection may sway towards an easier but not necessarily better solution
- Fear of change

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Intersection Control Evaluation (ICE)

- Two-Step Process
  - Step 1: Engineering Assessment of Intersection Control Options and Other Strategies
  - Step 2: Design and Traffic Analysis of Practical Control Alternatives
- Roundabout Conceptual Approval Report (RCAR) no longer needed

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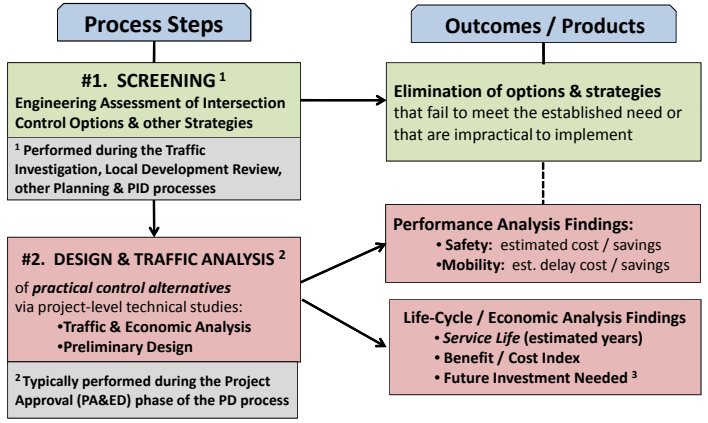
ICE Process Steps, Activities & Outcomes



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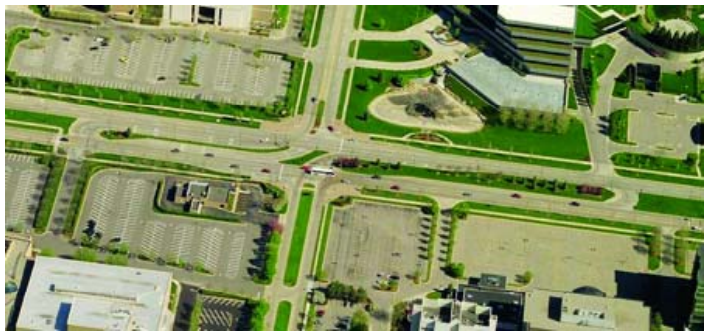
Diverging Diamond Interchange (DDI)

Restricted Crossing U-Turn (RCUT) Intersection



30% increase in throughput
40% decrease in network intersection travel time
18 conflict points instead of 32 at traditional intersection
North Carolina: 51% decrease in fatal+injury crash rate

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ICE Guidance and Resources

•http://www.dot.ca.gov/hq/traffops/liaisons/ice.html

•Highway Design Manual Update

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Business Opportunities

- Traffic studies for mitigation to development proposals
- ICE process for development and local agency proposals
- Roundabout designs for local agencies to construct by permit

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MOVE OVER

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