Planning & Design of Mini and Compact Roundabouts:

Scalability of Roundabouts

Blair C. Perry, PE

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Traditional Single Lane Roundabouts

- Typically 130’-180’ diameter
Mini Roundabouts - Context

• Typical context: Urban neighborhoods, business districts, shopping centers
• Where a full roundabout won’t fit
• Low speeds
• Low volumes
  o ADT <15,000 veh/day (total entering)
  o Low truck volumes ~3% (study)
• Comparable major/minor traffic volumes
• Often built within existing intersection
• 72% Crash Reduction Factor
Mini Roundabouts – Design Elements

- Diameter: Typically <90’
- Fully traversable center island
  - Mountable or striped
- Central island sized to provide deflection
- Splitter islands: Mountable or striped
- NCHRP Report 672
- New chapter in ALDOT Manual
Mini Roundabouts – Example
Tollgate Road at MacPhail Road
Bel Air, MD

BEFORE

• ~60’ Diameter
• Built 2012

AFTER
Mini Roundabouts – Example
Tollgate Road at MacPhail Road
Bel Air, MD
Mini Roundabouts – Design Vehicle Philosophy
FHWA/VHB Study

- Design elements for 97% of vehicles using the roundabout daily
- Make raised elements traversable by the top 3% of large vehicles using the intersection
Compact Roundabouts

• Typical context: Urban/suburban areas, rural highways, interchanges, neighborhoods

• Mini < Compact < Full size single lane roundabout
  o Size
  o Speeds
  o Volumes
  o Truck volumes
  o ICD

• Where a full size roundabout won’t fit

• Rule of Thumb: < 15,000 veh/day (total entering)
Compact Roundabouts – Design Details

- **ICD:** 90’-100’ +/-
- **Circulatory Roadway Width (CRW):** 16’-19’
  - Design vehicle determines
- **Center island:** Raised or flush and striped
  - Truck apron
  - Often fully traversable
- **Splitter islands:** Raised or striped
- **Curb and gutter typical on outside**
  - Some agencies using paved shoulders on outside
Mini & Compact Roundabouts - Design Elements – Center Island

- Center island
  - Big enough to provide good deflection
  - Often fully traversable
  - Center island clearly visible
    - Raised and mountable
    - Colored
    - Striped
Mini & Compact Roundabouts - Design Elements – Circulating Lane

- Circulatory Roadway Width (CRW)
  - Keep as narrow as possible
  - Accommodate passenger cars and school buses in CRW
Mini & Compact Roundabouts – Design Elements

- Curbs
  - Key design element
  - 2”-3” tall rolled curbs
  - Good to use
  - Inside & outside

Source: Figure 3.58, ALDOT Roundabout Planning, Design, and Operations Manual
Mini & Compact Roundabouts – Design Details

• Wide Dotted Edge Line Extension
  ○ Typically also serves as entrance line
Mini & Compact Roundabouts – Design Details

- Splitter Islands
  - Raised, traversable or flush (stamped or painted)
    - General order of preference
  - Design vehicle turning movements will determine
  - Flush (painted)
    - Slow speeds
    - Vehicles regularly travel over splitter islands (small minis)
Mini & Compact Roundabouts – Design Details

- Pedestrian Crossings (*NCHRP Report 672*)
  - Same guidelines as larger roundabouts
    - **Crosswalk 20’ back from entrance**
      - Walkway thru splitter same width as crosswalk, ideally 10’ wide
  - For splitter island width ≥ 6’:
    - Pedestrian refuge area
    - Use detectable warning strips
  - For splitter island width < 6’:
    - Walkway thru splitter island
    - Single stage crossing
    - No detectable warning strips

Source: NCHRP Report 672, Exhibit 6-12
KEY DESIGN ELEMENT – DO YOU KNOW YOUR DESIGN VEHICLE??

- Volume and type of large trucks
  - WB-67s (Interstate tractor trailer)??
- School bus (S-BUS-40 design vehicle)
  - Circulating bus stays in lane

Don’t really want this

Source: NCHRP Report 672, Exhibit 6-19
Design Vehicles

What’s My Design Vehicle(s)?

- School Bus (S-BUS-40)
  - Circulatory Roadway Width
- WB-67
- Other
  - Moving truck
  - Fire ladder truck
    - Rear Overhang
  - Log trucks (log overhang)
    - Oncoming traffic
    - Signs
    - Peds
- Can be different for different movements
Accommodating Oversize/Overweight (OS/OW) Vehicles

- Oversize/Overweight (OSOW) Vehicles
  - Mobile home hauler
  - Bridge girder hauler
  - Airline parts hauler (Airbus)
  - Combine

- Check Freight Network
- Check with ALDOT Vehicle Enforcement Office

Source: Wisconsin DOT Roundabout Guide

Source: ALDOT Roundabout Planning, Design and Operations Manual, Chapter 3
Outside truck aprons to accommodate larger design vehicles

- Use outside truck aprons to keep entry & exit widths narrower and accommodate large or OS/OW trucks
Outside truck aprons
Mini & Compact Roundabouts Examples
Mini Roundabouts
Redmond, WA
- ICD: 73’-88’ (Oval shaped)
- Downtown/business area
- CRW: 15’
- AADT: 15,000 veh/day
- Crash Reduction 100%
Mini Roundabouts
Mill Creek, WA
• Arterial turns
• ICD: 70’
• CRW: 18’

Before

After
Mini Roundabouts - Lake Stevens, WA

- ICD: 64’
- CRW: 16’
- Converted stop controlled intersections
Compact Roundabouts - Ferndale, WA
I-5 Interchange at Slater Road

• 13,000 ADT
• PM traffic backed up onto 70 mph I-5
• Roundabouts eliminated queues
Compact Roundabouts
Slater Rd at Pacific Hwy
Ferndale, WA
• 82’ ICD
• 17’ CRW
• Raised painted splitter islands
• Raised, paved striped central island
• Flush, paved outside shoulders
• Fits within existing pavement
• Under $100,000
Compact Roundabouts
Slater Rd at Pacific Hwy
Ferndale, WA
• Raised (yellow) splitter islands

Photo: Brian Walsh, WSDOT
Compact Roundabouts
Slater Rd at Pacific Hwy
Ferndale, WA
• Concrete curbing around center island
• Asphalt paved interior of center island

Photo: Brian Walsh, WSDOT
Compact Roundabouts
I-5 NB Ramps at Slater Rd.
Ferndale, WA
- 90’ ICD
- 17’ CRW
- Raised painted splitter islands
- Raised, paved central island
- Paved shoulders
- WB to NB right turn bypass lane for heavy right turn movement
  - Watch for entry path overlap
Compact Roundabouts
I-5 SB Ramps at Slate Rd.
Ferndale, WA
• 94’ ICD (end of ramp)
• 17’ CRW
• Raised painted splitter islands
• Raised, paved central island
• Paved shoulders
• EB to SB right turn bypass lane for heavy right turn movement
Compact Roundabouts
I-5 SB Ramps at Slate Rd.
Ferndale, WA
• 94’ ICD (end of ramp)
• 17’ CRW
• Raised painted splitter islands
• Raised, paved central island
• Paved shoulders

Photo: Brian Walsh, WSDOT
Convert Stop Controlled Intersection to Mini Roundabout
SR-11/SR-124/Galilee Church Road, Jackson County, GA

• All way stop controlled intersection
• Rural area
• Problem: About 50 car recurring queue on SR-11 SB
Solution: 90’ diameter compact roundabout

“Designed” in 4 days

Constructed in 9 days over several weekends by GDOT crews

Cost: ~$63,000
SR-11/SR-124/Galilee Church Road, Jackson County, GA

- Mini roundabout with 90’ ICD
- Construction time: 9 days
- Built with State forces
- Completed 7 ½ weeks after problem identified
- Cost: ~$63,000
- Reduced crashes
- ¼ mile stopped queue reduced to 8-10 car rolling queue

Source: Mini-Roundabouts for the U.S. and Traffic Models, VDOT Statewide Roundabout Workshop, Wei Zhang, Ph.D., P.E., Program Manager, FHWA Intersection Safety R&D
US-50 at Thompson Creek Road, Stevensville, MD
• Constructed 2007
• 75’ ICD
• 19’ CRW
US-50 at Thompson Creek Road, Stevensville, MD
US-50 at Thompson Creek Road, Stevensville, MD

- Constructed using only thermoplastic
- ~$50,000
I-5 NB Ramp Terminal at Kelso Drive
Longview, WA

- Ramp queue from stop sign back into I-5 mainline during PM peak
  - Operational and safety concern
- Confusing intersection
  - Wrong way movements
I-5 NB Ramp Terminal at Kelso Drive
Longview, WA

- ~100’ ICD
- 19’ CRW
- Queue reduction
- Safer

After
Hitchingham Rd (N-S)/Textile Rd (E-W)/Stony Creek Rd (NE-SW)

Ypsilanti, MI

- Rural, low density residential / farming
- 2-lane suburban highways
- 45 mph speed limits
- AWSC intersections on Textile Rd
- Almost 13,000 veh/day total entering

The Problem

- 3 intersections 600’-700’ apart
- Backups & queues on all approaches
Textile Rd at Stony Creek Rd.

- 90’ ICD

- 19’ CRW

- Chicane entries on higher speed approaches
Textile Rd at Hitchingham Rd.

- 90’ ICD
- 19’ CRW
- Chicane entries on higher speed approaches
FHWA/VHB Study

- Frequent drivers liked conversion from AWSC to mini roundabouts
- Fatal & Injury crashes eliminated since construction
- PDO crashes decreased slightly for one intersection
- PDO crashes increased for second intersection
- Reduced peak hour queues and delays

Hitchingham Rd (N-S)/Textile Rd (E-W)/Stony Creek Rd (NE-SW)
Ypsilanti, MI
Mini Roundabout - Lynden, WA

• 84’ ICD
• 17’ CRW
• Raised painted splitter islands
• Paved central island
Mini & Compact Roundabouts
Alabama Projects
East Limestone Road at Capshaw Rd, Limestone County

- Medium density residential, suburban area
- Built up, commercial intersection
- Two, two-lane county roads
- Four-way stop
- Operational problems
- Next step: Traffic signal?
- Roundabout???
East Limestone Road at Capshaw Rd, Limestone County
Small “Standard” Roundabout
• 124’ ICD
• 19’ +/- CRW
• Outside truck aprons needed for WB-67 trailer off-tracking
• Short splitter islands
• Good entry deflection
• Truck apron with central island
Impacts
- ~ 0.18 Ac ROW (Commercial)
- 4 properties
- Bank & Office
  - Drive thru
  - Brick sign
- Gas station
  - USTs
  - Sign
  - Air center
- Strip Center
  - Lose 1-2 parking spaces
  - Drive aisle impacts
  - Sign
- Utilities
  - Overhead power on west side
  - Sanitary sewer on west side
  - Buried phone on west side
Mini Roundabout

- 90’ ICD
- 16’ CRW
- Outside truck aprons for WB-67 off-tracking
- Mountable curb for outside truck aprons
  - Speed control
- Short Splitter islands 50’ (minimum)
- Deflection is adequate
- Fully traversable center island & splitter islands
Impacts

- ~ 0.18 0.10 Req'd ROW
- 4 properties
- Bank & Office
  - Drive thru – can work with
  - Brick sign
- Gas station
  - USTs
    - Sign – close – tweak ROW
    - Air center
- Strip Center
  - Lose 1 parking space maybe
  - Drive aisle impacts - less
  - Sign
- Utilities – Still impacts but fewer
  - Overhead power on west side
  - Sanitary sewer on west side
  - Buried phone on west side
Design Vehicle Turning Movement Checks

- School Bus (S-BUS-40)
  - Stay in lane
Design Vehicle Turning Movement Checks

- School Bus
  - Stay in lane
Design Vehicle Turning Movement Checks

- WB-67 (Tractor Trailer)
  - Fully traversable central island
  - Fully Traversable splitter islands
  - Outside truck aprons
Design Vehicle Turning Movement Checks

- WB-67 (Tractor Trailer)
  - Fully traversable central island
  - Fully Traversable splitter islands
  - Outside truck aprons
5th Street at Cardinal Airport Rd – Northport, AL

Context
- Medium/low density residential
- Nearby public park
- Cut-through traffic
5th Street at Cardinal Airport Rd – Northport, AL
Existing Conditions
- All-Way Stop Control
- 9600 veh/day entering
- 94% passenger vehicles
- 0.8% medium/large trucks
- 35 mph speed limit
- No crashes at intersection
5th Street at Cardinal Airport Rd – Northport, AL

Existing Conditions

- All-Way Stop Control
- 2016 PM LOS → E
- 2038 AM & PM LOS → F
- Predominant movements
  - WB to NB right turn
  - SB to EB left turn
5<sup>th</sup> Street at Cardinal Airport Rd – Northport, AL
Compact Roundabout
- 105’ ICD
- 16’ CRW
- 15.5’ wide truck apron
- 2018 LOS → A/B
- 2038 LOS → A/B
- Traffic calming feature
- Accommodates WB-67s
  - Outside truck aprons
  - Raised, traversable splitter islands
- Outside curb and gutter
- Private property access
- Estimated cost $500,000 (incl. ROW & CE&I)
5th Street at Cardinal Airport Rd – Northport, AL
Compact Roundabout

- Minimal ROW
  - 5 properties
  - 0.036 Acres total
- Access management
  - Consolidated drives

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5th Street at Cardinal Airport Rd – Northport, AL
Compact Roundabout
• Design Vehicle(s) Turning Movement Check
  o School Bus (S-BUS-40)
5th Street at Cardinal Airport Rd – Northport, AL
Compact Roundabout
• Design Vehicle(s) Turning Movement Check
  ○ School Bus (S-BUS-40)
5th Street at Cardinal Airport Rd – Northport, AL
Compact Roundabout

- Design Vehicle(s) Turning Movement Check
  - Charter Bus
  - Larger than S-BUS-40
5th Street at Cardinal Airport Rd – Northport, AL
Compact Roundabout
• Design Vehicle(s) Turning Movement Check
  o WB-67 (Tractor Trailer)
5th Street at Cardinal Airport Rd – Northport, AL
Compact Roundabout

- Design Vehicle(s) Turning Movement Check
  - WB-67
- Dictates truck apron width
- Outside truck apron or add’l pavement needed
5th Street at Cardinal Airport Rd – Northport, AL
Compact Roundabout
- Design Vehicle(s) Turning Movement Check
  - WB-67
- Outside truck apron or add’l pavement needed
Mini & Compact Roundabouts
As a Traffic Calming Feature
5th Street at West Circle/Kentuck Park – Northport, AL

Context

• In City
• Transition area from lower density residential to medium density residential with some commercial
5th Street at West Circle/Kentuck Park – Northport, AL
Existing Conditions
• Side street stop
• 9600 veh/day on 5th St.
• 94% passenger vehicles
• 0.8% medium/large trucks
• 35 mph speed limit
• 48 mph 85th %ile speed
5th Street at West Circle/Kentuck Park – Northport, AL
Existing Conditions
• Crashes (5 years)
5th Street at West Circle/Kentuck Park – Northport, AL

Proposed Mini Roundabout

- 90’ ICD
- 18’ CRW
- Raised concrete splitter islands
- 0.65 Ac ROW / Perm Esmt
  - Includes ROW/Esmt for shared-use path
  - Mostly City/County-owned property
5th Street at West Circle/Kentuck Park – Northport, AL

Proposed Mini Roundabout
- Bicycle Accommodations
- Go through roundabout like a vehicle
  - More experienced cyclists
- Bike Ramps
- Shared-Use Paths
5th Street at West Circle/Kentuck Park – Northport, AL

Design Vehicle(s) Turning
Movement Checks

• School Bus (S-BUS-40)
5th Street at West Circle/Kentuck Park – Northport, AL
Design Vehicle(s) Turning Movement Checks
- Charter bus
  - Longer wheel base than S-BUS-40
5th Street at West Circle/Kentuck Park – Northport, AL

Design Vehicle(s) Turning Movement Checks

- Charter bus
  - Longer wheel base than S-BUS-40
QUESTIONS?

Blair Perry, P.E.
Alabama State Transportation Leader
205-298-9232
blair_perry@gspnet.com