Innovative Intersections and Interchanges

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In Collaboration With:
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Presentation Outline

• Overview of Innovative Intersections
  – FHWA Every Day Counts Program
• Freight Accommodation at Roundabouts
• Introduction to Other Emerging Innovative Intersections
• Emerging Trends
• Questions
Overview of Innovative Intersections

Source: Jeff Shaw, FHWA; Talking Freight: Innovative Intersections webinar (September 21, 2016)
Mainstreaming Innovative Intersections

Roundabouts

Median U-Turns

Diverging Diamond Interchange (DDI)

Restricted-Crossing U-Turn (RCUT)

Displaced Left-Turn (DLT)

Source: FHWA

Source: Jeff Shaw, FHWA; Talking Freight: Innovative Intersections webinar (September 21, 2016)
Why Innovative Intersections?

Intersections represent about $\frac{1}{4}$ of all traffic fatalities...

...and HALF of all severe crashes

Intersections are a major safety issue and may become bottlenecks along high volume roadways

Source: Mark Doctor, FHWA; Jeff Shaw, FHWA; Talking Freight: Innovative Intersections webinar (September 21, 2016)
Intersection Safety Facts

» Angle crashes account for over 40% of fatal crashes at intersections

» Left turn crashes account for over 20% of fatal crashes at intersections

» Ped/Bike crashes account for 25% of fatal crashes at signalized intersections

Source: Mark Doctor, FHWA; Jeff Shaw, FHWA; Talking Freight: Innovative Intersections webinar (September 21, 2016)
Innovative Intersections Benefits

SAFETY
- Fewer and less severe conflict points
- Speed management benefits
- Significant crash reductions

MOBILITY
- Synchronized movements
- Reduced delay and congestion
- Pedestrian and bicycle opportunities

VALUE
- Less right-of-way impact
- Decreased capital and lifecycle costs
- Quicker construction
- Higher B/C

Source: Jeff Shaw, FHWA; Talking Freight: Innovative Intersections webinar (September 21, 2016)
Outreach & Education

http://www.youtube.com/USDOTFHWA

http://safety.fhwa.dot.gov/intersection/

Source: Jeff Shaw, FHWA; Talking Freight: Innovative Intersections webinar (September 21, 2016)
FHWA Every Day Counts II Project Update

• KLS ENGINEERS & SPECIALIZED FREIGHT SOLUTIONS conducted outreach to standard and specialized carriers, pilot cars, and emergency responders.

• Technical oversight provided by ATA, SC&RA, OOIDA, State DOT Permit Officials and FHWA

• Goal is to avoid the negative feedback from the trucking industry as a lessons learned with the introduction and implementation of roundabouts

• Project scope covered each of the innovative intersection topic areas covered on the previous slides.

• Outreach: many states already have existing innovative intersections
  – Examples: MO, MN, NC, UT, VA and WI

• Feedback from EDC II outreach is being integrated into national design guidance to be used by state and local road agencies and their contract designers
Freight Accommodation Fundamentals

- *Innovative intersections require similar considerations to conventional intersections*
- Requirements vary by state, but principles are consistent.
  - Design Vehicle(s)
  - Check Vehicle(s)
  - Collaboratively determine the design and check vehicles with local agency, including how each vehicle is to be accommodated.
    - Identify the representative cross-section of vehicles that will use the intersection regularly.
    - Use software to check vehicle paths and refine geometry.
Intersection Examples: Truck Aprons

Google Earth image
Supporting Freight Accommodation

• Designate freight corridors to support planning for large vehicles and preserving OSOW routes.

• Establish standardized check vehicle packages for designated OSOW routes that are representative of the normal range of OSOW vehicle types for the state/region.

• Provide mechanism for designers to have access to historical permit data
  – Potential pit-fall: Is historical information representative of future uses?
ROUNDABOUTS

Polk County, FL

Source: Florida DOT

Florence, KS

Source: Kansas DOT
Roundabout Inventory – Through 2014

- Roundabouts currently operate in every state in the U.S.
- Over 25 years of US experience

Roundabout Design – Emphasis on Principles

- Design checks performed to verify:
  - Slow and consistent fastest path speeds
  - Accommodation of design vehicles
  - Appropriate sight distance and visibility
  - Appropriate vehicle alignment and channelization
  - Appropriate features for pedestrian and bicycle users

- NCHRP Report 672 serves as FDOT’s roundabout design guide

Source: NCHRP Report 672
Oregon Example “Roundabout Rodeo”

- Full-scale test in two locations
- Tested 18 truck/trailer combinations
  - Up to 130’ in length
- All test vehicles made it through the roundabout

Source: Kittelson & Associates, Inc.
ODOT images: Total Length 113’, Booster Trailer Length 90’, Axle Width – 13.5’; & Tractor with 75’ trailer and manufactured home load, Total Length=101’, Load Width=14’

Source: Kittelson & Associates, Inc.
ODOT images: Tractor with 70' logging trailer and 102' long load, Total Length=112’ and Tractor with 101’ booster trailer, Total Length=125’

Source: Kittelson & Associates, Inc.
Oversize Vehicles at Roundabouts

Dolly rig at roundabout in Pennsylvania

Source: Peter Lynch
Sample Strategies for OSOW at Roundabouts

• Wider Central Island Truck aprons
• Outside aprons (AKA “Blisters”)
• Mountable splitter islands
• Removable signs for swept path.
• Bypass Treatment
• Central Island Cut Through
Example: Carrington, North Dakota  
ND 200/US 52 at US 281/US 52

BEFORE

AFTER

Estimated N-W path  
Upper Mid400 combination trailer

Eliminate mountable curb around splitter island

Increase track apron width

Current plan is production

Extend lane limits

Additional Pavement Summary

- Additional truck apron pavement 902 SY
- Additional truck splitter pavement 1,266 SY

Proposed OSOW modification

Source: Peter Lynch
Example: Olean, New York

- Specialized Freight Solutions worked directly with roundabout designer to address freight accommodation for corridor accessing Dresser Rand/Siemens plant.
  - Mountable Center Island
  - Mountable Medians
  - Removable Signs.

Source: Peter Lynch
Example: SR 44 at Grand Ave, Deland, FL

Truck “Blister”

Source: Justin Bansen
Example: Mountable Aprons

Courtesy of Kelli Owen (10)

Source: Kansas Roundabout Guide, 2nd Edition
Example: Bypass Lanes (Marion County, KS)

Source: Kansas Roundabout Guide, 2nd Edition
Example: Advanced Left-Turn Movement (Netherlands)

Bing Maps. Image courtesy of Simmons ©2013 Microsoft Corporation

Source: Kansas Roundabout Guide, 2nd Edition
Example: Central Island Cut-Through

Courtesy of Uroš Brumec and Brilon Werner

Source: Kansas Roundabout Guide, 2nd Edition
Diverging Diamond Interchange (DDI)

Aerial Image Sources: Google Earth

Source: Kansas DOT
DDI Design Principles

• Principles
  – Design vehicle
  – Design speed
  – Crossover design
  – Path alignment
Restricted Crossing U-Turns (RCUT)
Supersteets / J-Turns

Source: Wisconsin DOT

Source: North Carolina DOT
Restricted Crossing U-Turns (RCUT)  
Supersteets / J-Turns

• Cross street (minor road) traffic turns right, then accesses U-turn to proceed in desired direction.

• Main and U-turn intersections can be either signalized ("Superstreet") or not ("J-Turn")

Source: FHWA and Gilbert Chlewicki; Talking Freight: Innovative Intersections webinar (September 21, 2016)

Source: Wisconsin DOT
Traditional Divided Highway Intersection

Far-Side Right-Angle Collisions

Source: FHWA and Gilbert Chlewicki; Talking Freight: Innovative Intersections webinar (September 21, 2016)
Accommodating Truck Movements

Source: FHWA and Gilbert Chlewicki; Talking Freight: Innovative Intersections webinar (September 21, 2016)
RCUT Intersection - Loon

- Loons can minimize median width
- Other treatments can also help u-turning vehicles, such as mountable curbs, strengthened shoulders, right turn lanes, acceleration lanes, etc.

Source: FHWA Alternative Intersections/Interchanges: Informational Report
Median U-Turn (MUT)

Aerial Image Sources: Google Earth
Vehicles on the major street (or the street with the median) that want to turn left are directed through the main intersection to a U-turn movement at a downstream directional crossover (usually signalized), and proceed back to the main intersection to then turn right onto the minor street.

Source: FHWA and Gilbert Chlewicki; Talking Freight: Innovative Intersections webinar (September 21, 2016)
Vehicles on the minor street that wish to turn left at the major street are directed to turn right, make a U-turn movement at the same crossover, and then proceed through the main intersection.

Source: FHWA and Gilbert Chlewicki; Talking Freight: Innovative Intersections webinar (September 21, 2016)
Displaced Left-Turn (DLT)

AKA Continuous Flow Intersection (CFI)

Distinguishing Feature:
Left-turn movement (on one or more approaches) strategically relocated to the far-side of the opposing roadway via interconnected signalized crossover in advance of the main intersection

Source: Bing Maps

Source: FHWA and Gilbert Chlewicki; Talking Freight: Innovative Intersections webinar (September 21, 2016)
DLT – Dayton Ohio

Aerial Image Sources: Google Earth
Rural DLT – Oxford, MS

Aerial Image Sources: Google Earth
DLT Freight Accommodation

- S-curves through crossovers
  - Lane widths typically wider
  - Dual turns should accommodate the design vehicle
  - Accommodating some trucks may require using both lanes (if that is a legal maneuver within the given jurisdiction).

Source: FHWA Displace Left Turn Intersection Informational Guide
Design Guidance

- Dual left-turns at Main Intersection
  - Dual turns should accommodate the design vehicle

Side-by-side left-turn maneuver

Semi-truck maneuver at crossover

Source: FHWA Displace Left Turn Intersection Informational Guide
Emerging Issues

• One and Done – Efforts are sometimes made by the designers to reach out to one or two carriers have their equipment run through a built design or do a computer model and call it good.
  – Positive – Appreciate the effort and carrier member’s assistance
  – Negatives – Are the vehicles a representative sample of all specialized vehicles that may use this corridor?
    • For example blades and bridge beams are not low boys/perimeters/dolly rigs/schnabels/platforms/ etc.
Emerging Issues (Continued)

• Concerns with continued use of 6 to 8 inch curbs and narrow single lane roundabout designs on major routes.
  – States have been working to identify routes historically used and have been receptive to outside discussions feedback and best practices.

• Local Roundabouts – Last mile, near producers/receivers, port and rail (trans load) facilities

• Monotubes and other fixed overhead obstructions and poles in sweeps
  – Consider having signals on turn tables or arm swings (Port of Houston – Federal Road)

• Utility coordination – Raise wires over or bury wires under roadway when state comes in and reconstructs a roadway
What Can We Do?

- Carriers/shippers/receivers/Ports/Rail Terminals – Alert SC&RA (Steven Todd)
- Permit officials let regional chairs know and they alert SC&RA
Questions?

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