Objectives

• What the Concerns are for Freight?
• What Factors Go into “Good” Design?
• What should be Avoided?
• How to Balance Innovation & Design with Operations?
Why be Concerned with Freight?

- Over 54 Million Tons of Goods Moved Along System
  - Worth ~$48 Billion / Day
  - ~ 63 Tons / Person / Year
- By 2040
  - Tonnage to Increase by 45%
  - 9 Billion More Tons will be Hauled
- Over 44 Million Jobs Directly Dependent on Freight
- Last Mile always on a Truck

Source: Freight Facts & Figures 2017, Bureau of Transportation Statistics, USDOT

Infrastructure/Congestion/Funding

- Truck Parking
- Compliance, Safety, Accountability (CSA)
- Driver Distraction
- Road Conditions & Congestion
  - Wear & Tear
  - Waste Fuel & Increase Emissions
  - Additional Stress
- Congestion-Related Delays Cost ~$63.5 billion (2015)
A Look at Trucks & DDIs
Innovative Intersections – DDIs

Good for:
- Heavy Lefts On & Off Freeway Ramps
- Moderate, Unbalanced Crossroad Volumes
- Left Turn Safety Concerns
- Need for Added Capacity without Widening
- Good for Retrofit

Benefits:
- Safety!
  - Elimination of Left Crashes
  - Reduction in Right Angle & Rear End Crashes
- Often Less $$ & Quicker Construction
- Increased Capacity
- Reduced Delay & Congestion
Innovative Intersections – DDIs

A Trucking Perspective:
• Accommodates Large Commercial Vehicles
• No Issues Navigating Crossroad & Ramps
• Missouri DDI Survey
  • 83% Felt Maneuvering a Large Truck through was Easy & No Different from Other Interchange Types (Missouri DOT, Diverging Diamond Interchange Performance Evaluation (I-44 and Route 13))
Innovative Intersections – DDIs
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DDI: US 129 & W Bessemer St (Alcoa, TN)
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Innovative Intersections – DDIs
DDI: I-40 & Winfield Dunn Pkwy (Sevierville, TN)
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Innovative Intersections – DDIs

Design Considerations

- Engage Community Early
  - Especially Freight!
- Detour Routes
- Typical Design Vehicle
- Lane Widths
  - Widen – Crossover, Turning Movements
  - Single vs Double
  - Path Alignment – “Straight” Through
A Look at Trucks & Roundabouts
Innovative Intersections – Roundabouts
Innovative Intersections – Roundabouts

Good for:
  • Unbalanced Flow
  • High Turning Volumes
  • Reducing Speeds
  • Congestion

Benefits:
  • Safety!
    • Reduction of Crashes
  • Reduced Delay, Continuous Flow of Traffic
  • Less Expensive
    • Construction
    • O&M
A Trucking Perspective:

- Difficult to Navigate
- Often “Too Small”
- Travel Path Issues
- Don’t Know About Them – Routing Issues
ATRI Survey - Roundabouts & Large Trucks

• ~73% More Problematic vs. Other Intersections
• ~62% Cited Unique Problems

Why?
ATRI Survey - Roundabouts & Large Trucks

• Too Small to Accommodate Large Trucks
  • Trailer Encroachment (Center, 2nd Lane)
  • Running on Curbs
  • Elevated /Sloped Curbs Issues for 90° Turns

• Difficulty Accelerating to Merge into Traffic

• Blind-Spots/Distractions
  • Created on Right Side of Truck
  • Center Island Aesthetics

• Not Well Documented for Routing Purposes
  • Adds Costs $
ATRI Survey - Roundabouts & Large Trucks

Too Small to Accommodate Large Trucks

• “...engineered and constructed so as to be of a size that allows large trucks to fully utilize the circulating roadway without riding the trailer tires over the curb/apron of the roundabout island. At a minimum, these roundabouts must be of a size designed to fully accommodate the off-tracking of large truck pulling a 53' trailer that has its tandem wheels in the rearmost position.”

• “Increase the diameter of the roundabouts. Add directional signs well ahead of the roundabout. Improve public knowledge of the laws pertaining to roundabouts.”
Roundabouts - Design Considerations
Roundabouts - Design Considerations

Too Small/Encroachment

• One Size Does Not Fit All!
  • Fit the Road Classification & Users
    • Multiple Sizes
  • Circular vs. Irregular shapes
Roundabouts - Design Considerations

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Roundabouts – Design Considerations

Difficulty Accelerating to Merge into Traffic
• Truck Routes
• Increased Queue Lengths
• Increased Delays
ATRI Survey - Roundabouts & Large Trucks

Blind-spots/Distractions

• “Keep designs free of shrubs, curbs, rocks and signs, and anything that hinders the use of lowboys and other specialized equipment that is currently used to move today's O-D cargoes.”
ATRI Survey - Roundabouts & Large Trucks

**Blind-Spots/Distractions**

- Give Trucks Room to Maneuver
- Yield to Signs that Trucks Need Both Lanes
Not Well Documented for Routing Purposes

• “It is necessary for all areas to have a designated truck route. All truck routes should be free of this type of issue...We all have to compromise but why does it always have to be the truck driver that has to figure out a way around the problem?”

• “Do not build a roundabout anywhere before the state, city and county governments has looked at their long term planning for regional projects both public and private.”
Innovative Intersections – Roundabouts

Design Considerations

• Engage Community Early
  • Especially Freight
• Detour Routes
• Right Sizing
  • Typical Design Vehicle
• Lane Widths
  • Crossover Reverse Curves
  • Turning Movements (Outside Lanes)
• Curb Choices
  • Straight faced vs. Rolled-raised curb
• Path Alignment
  • Avoid Encroachment
The Future of Trucking – DDIs & Roundabouts

Connected & Autonomous Vehicles (CAV)
- Platooning
  - Geometrics
  - Lane & Shoulder Widths
  - Queue Lengths
- Signal Timings
  - Eco-Traffic Signal Priority
    - Extended Greens
    - ~ 4% Energy Benefit
- Eco-Speed Harmonization
- Dynamic Eco-Routing for Freight
Conclusions

DDIs & Roundabouts: How to Keep on Trucking Along

• Engage
  • Community Early - Especially Freight!

• Consider
  • Detour Routes & Planned Land Use

• Design
  • Typical Design Vehicle
  • Lane Widths
  • Curb Choices
Thank You!
Any Questions?

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