Dallas – Fort Worth TexITE
Joint Meeting, 2018

Planning and Simulating Roundabouts in North Texas

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Outline

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Roundabout Planning

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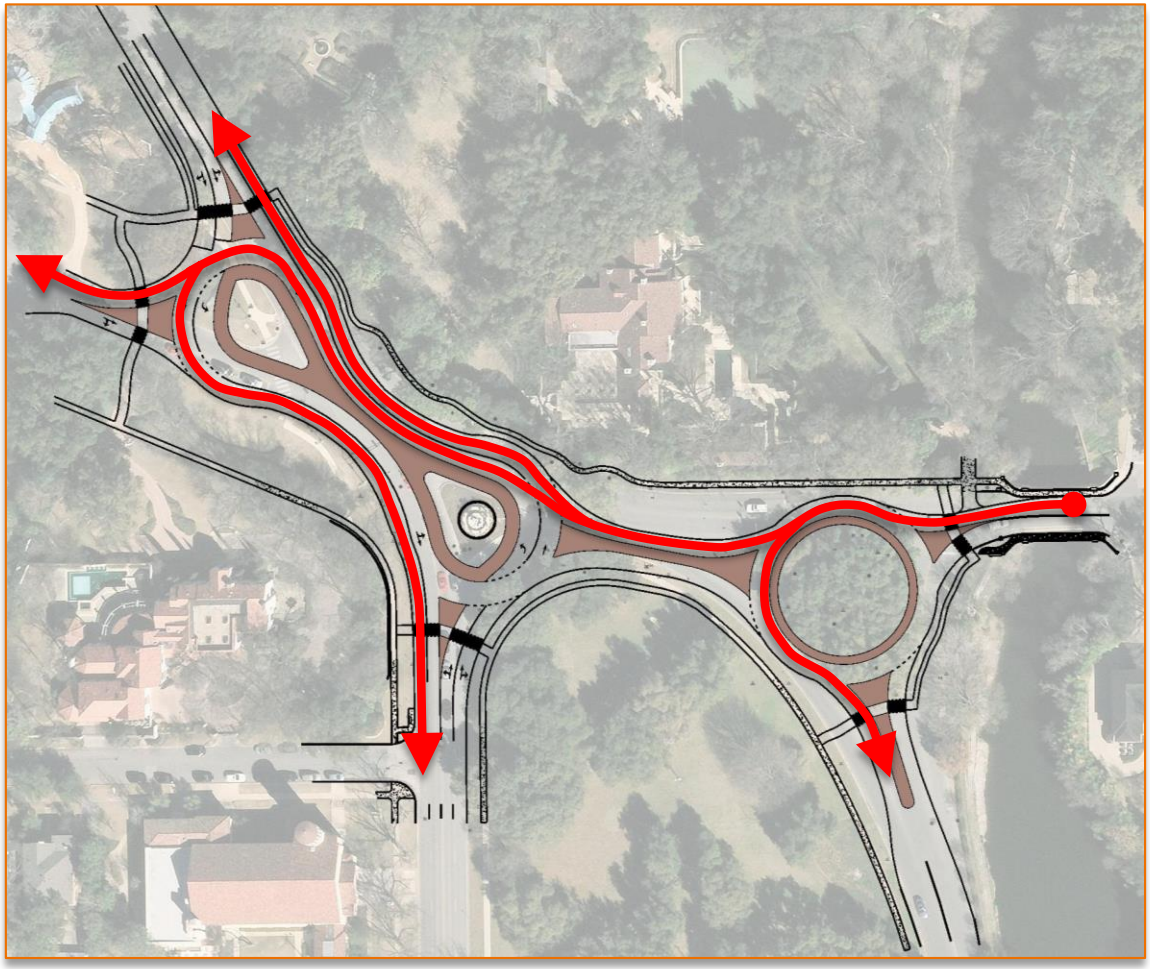
Roundabout Planning

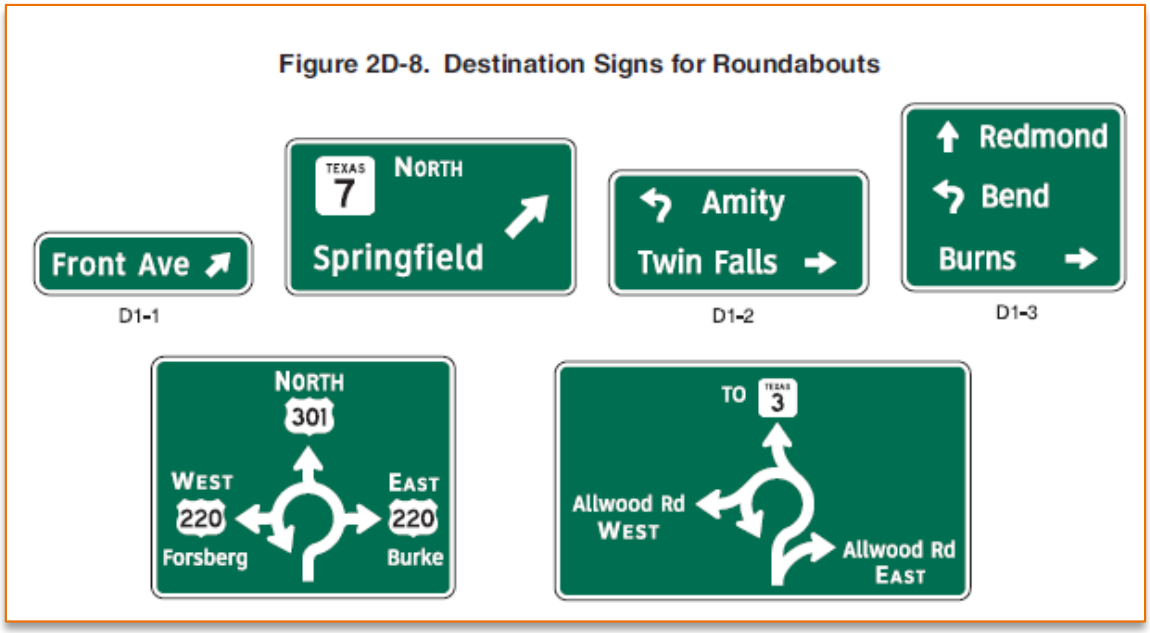
1. Simplifying & Explaining Pathing
2. Accounting for Large Vehicles
3. Showing how Roundabouts are Safer
4. Economic Benefits vs. Construction Costs

Explaining Roundabout Pathing



- Generally, lane changing within a roundabout should be avoided
- For complex layouts, important to illustrate vehicle movements

Signing



Source: Texas MUTCD

- Signing at roundabout entrances should direct driver to appropriate lane
- Signing within circular roadway tells driver when to exit

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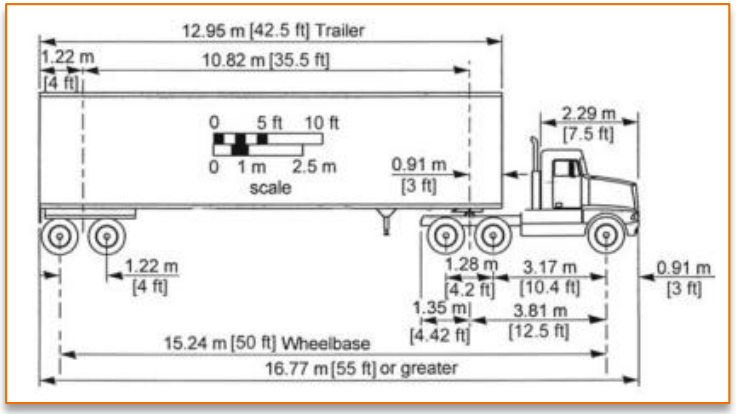
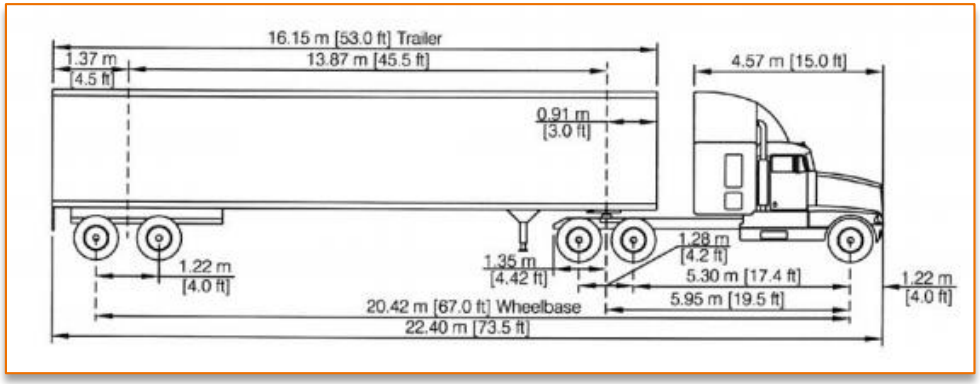
Trucks & Emergency Vehicles

- WB-50 for *all* roundabouts (unless client requesting otherwise)
- Usually WB-67 for suburban/rural roundabouts
- Find the largest emergency vehicle (usually fire truck) in respective town/city – they must use roundabout without driving on truck apron

WB-50



WB-67



Source: AASHTO "Green Book"

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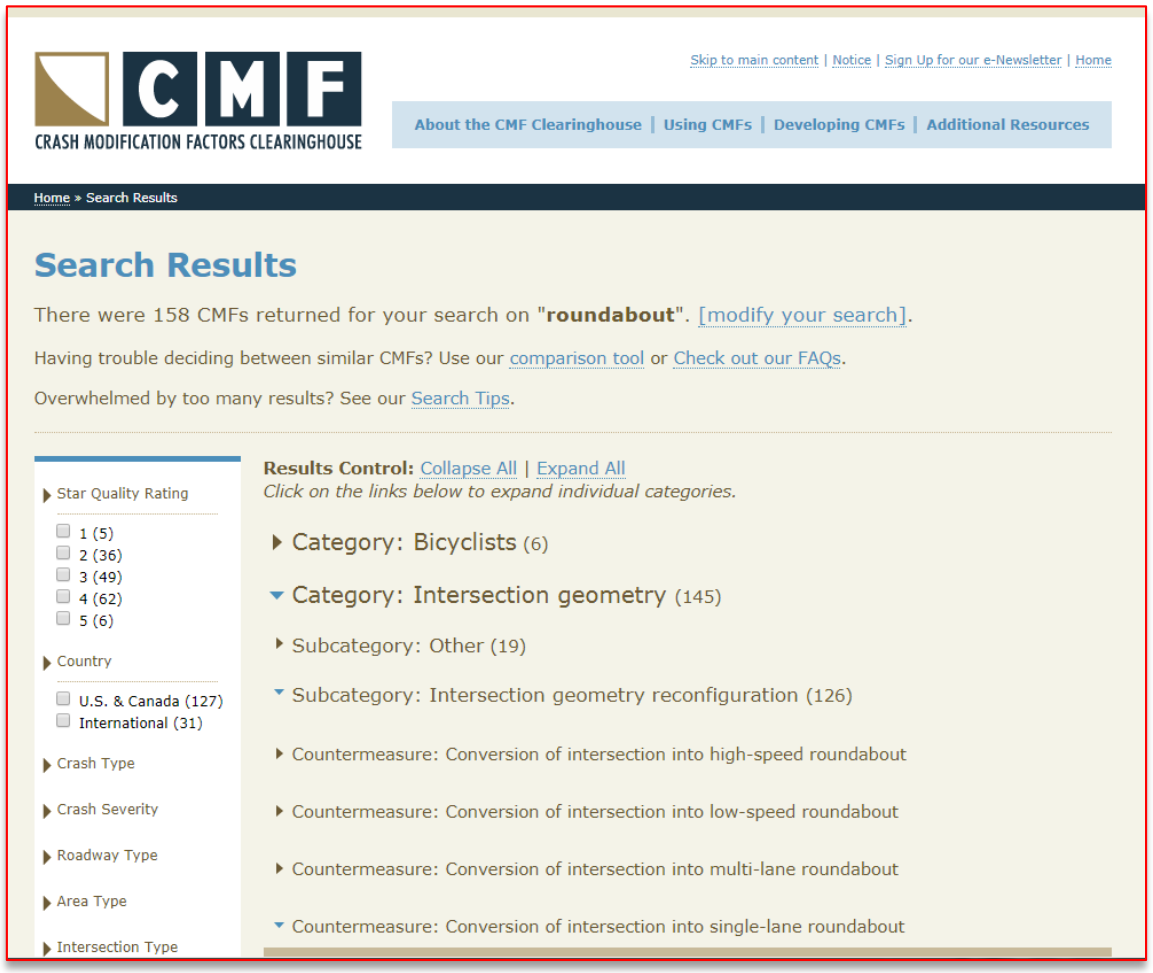
Safety



Source: Crash Modification Factors Clearinghouse

- Lots of research done on safety benefits of building roundabouts
- Studies done by NCHRP, FHWA, IIHS, others...
- Crash Modification Factors Clearinghouse gathers data on safety
  http://www.cmfclearinghouse.org/

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Running a Cost-Benefit Analysis

Option	Construction Cost	Yearly Maintenance Cost	Yearly Delay Cost
Existing (Status Quo)	$0	$5,500	$767k
Roundabout	$3.1 million	$0	$287k
Signalization Option #1	$315k	$5,500	$516k
Signalization Option #2	$195k	$5,500	$474k

- Typically, roundabouts are more expensive than traditional intersections, esp. if ROW is needed
- This cost is offset slightly by not having to maintain a signal

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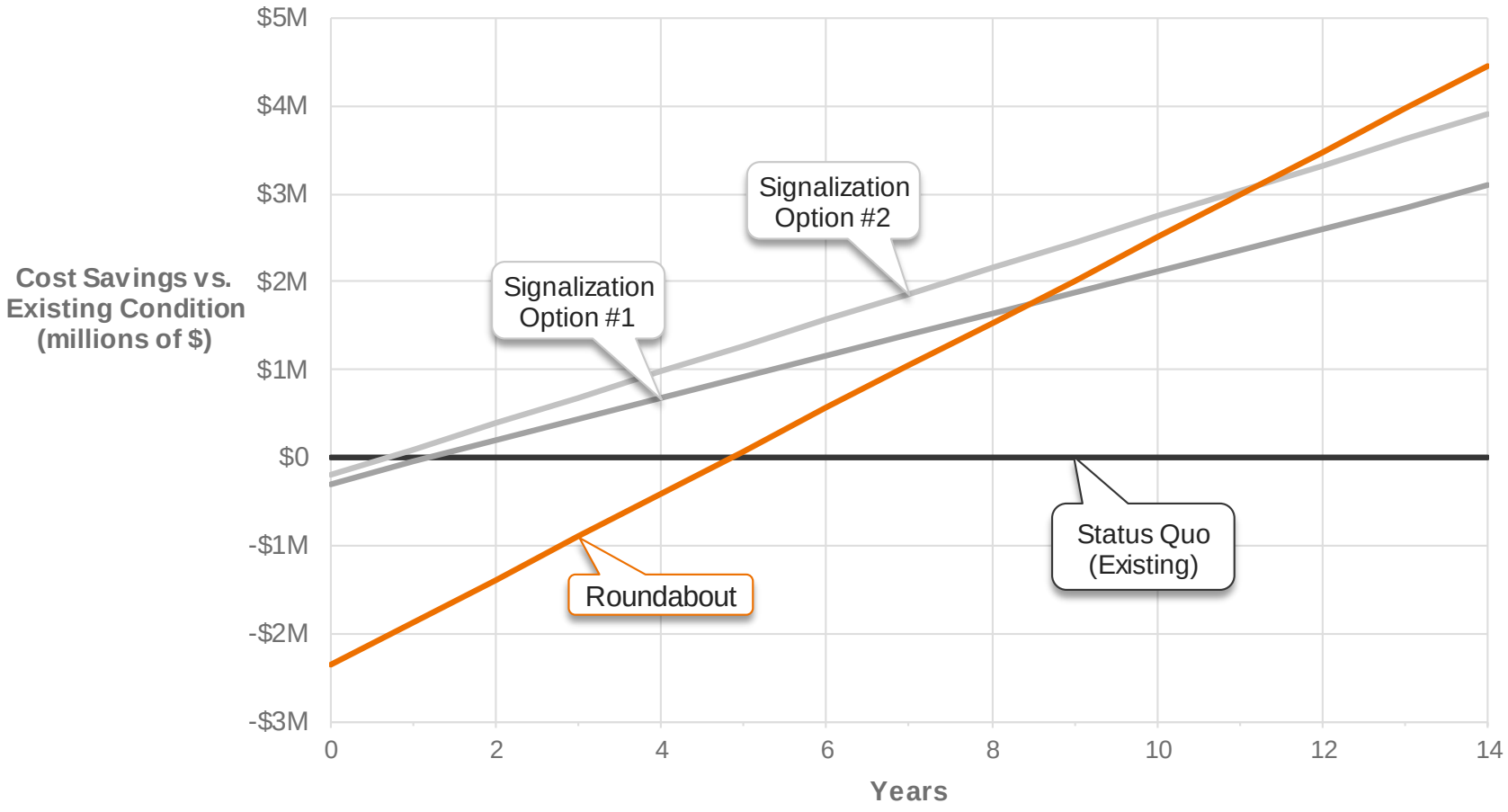
Running a Cost-Benefit Analysis



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Roundabout Simulation

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What are we trying to answer?

1. Will a roundabout operate better than a traffic signal or stop control?

2. When will the design “break down”?

Modeling Tools

(Sidra)

(Synchro)

PTV VISSIM

Reliance on the HCM

"True" Microscopic Simulation

TransModeler
Traffic Simulation Software

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HCM vs. Sidra Standard Capacity Models

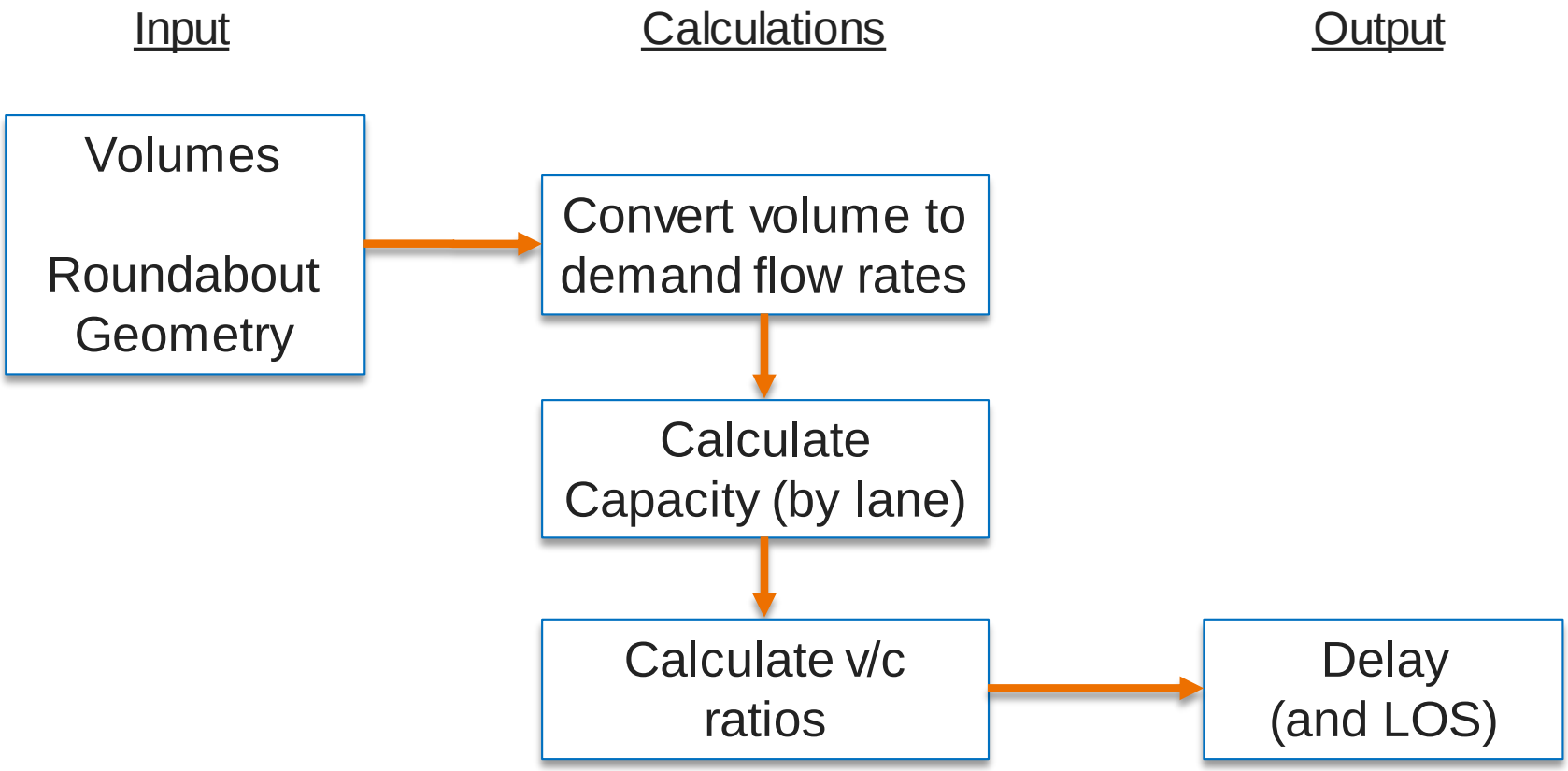
HCM 2010

- Based on observations at American roundabouts
- More well-known and accepted (in USA)

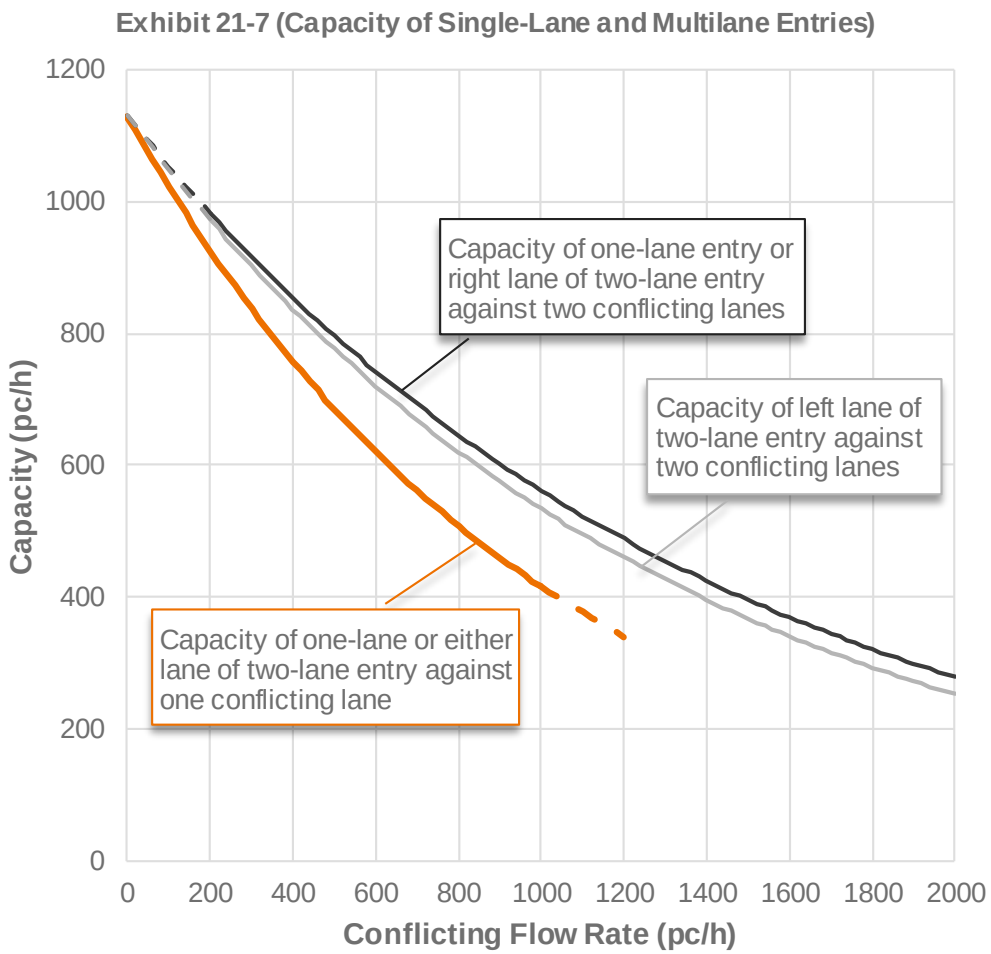
Sidra Standard

- Takes roundabout geometry into account
- Follow-up headway & critical gap affected by circulating flow rate
- Over-capacity approaches affect circulating flow rate (i.e. result in less delay for downstream approaches)

HCM 2010 Methodology (brief)



HCM 2010: Capacity



- Capacity is based on:
  - # of circulating lanes
  - conflicting flow rate
  - driver behavior
- Equations based on empirical observations (in USA)
- From HCM 2010:
  - *"U.S. drivers presently seem to display more hesitation ..., which results in lower observed capacities [than that in other countries]."*

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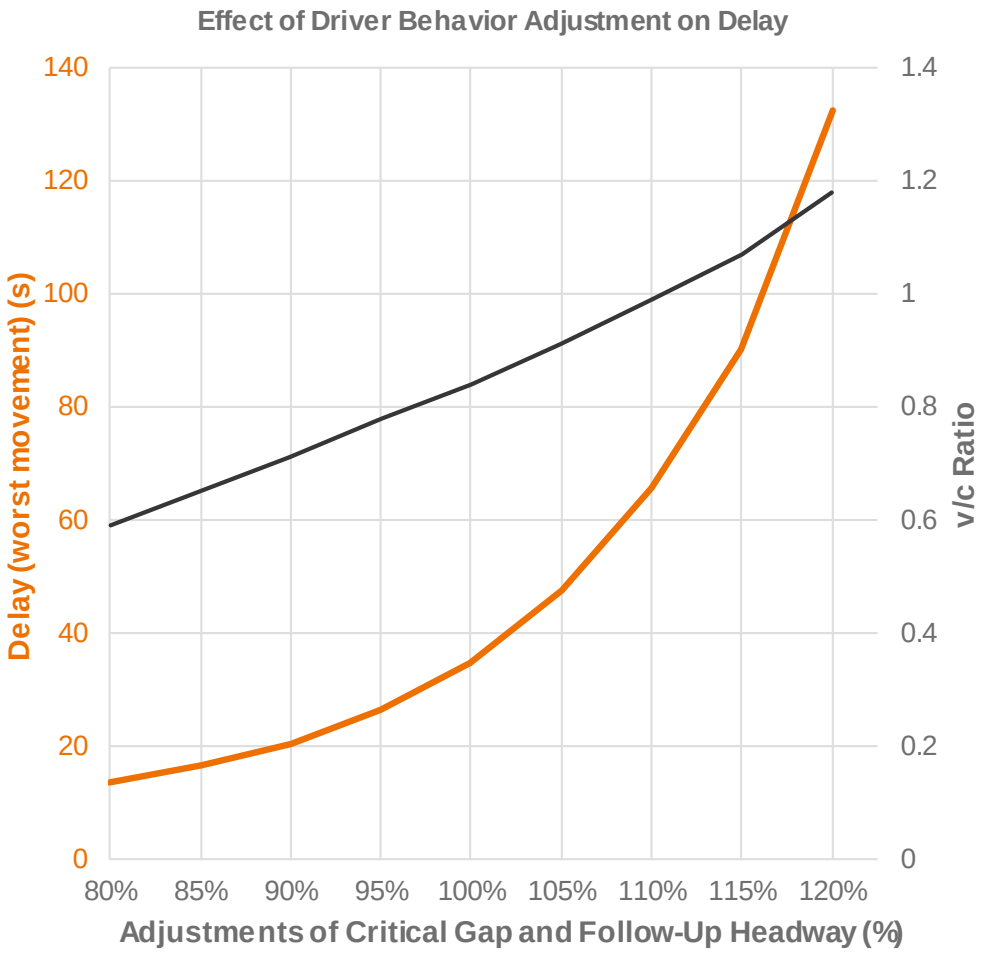
Calibrating Roundabout Capacity

- HCM suggests calibrating driver behavior to local conditions
- Problem: budget rarely covers researching driver behavior
- Alternative: sensitivity analysis

Sensitivity Analysis (HCM)



- Sensitivity analysis done by adjusting the critical headway and follow-up headway
- 100% refers to the default parameters used by HCM

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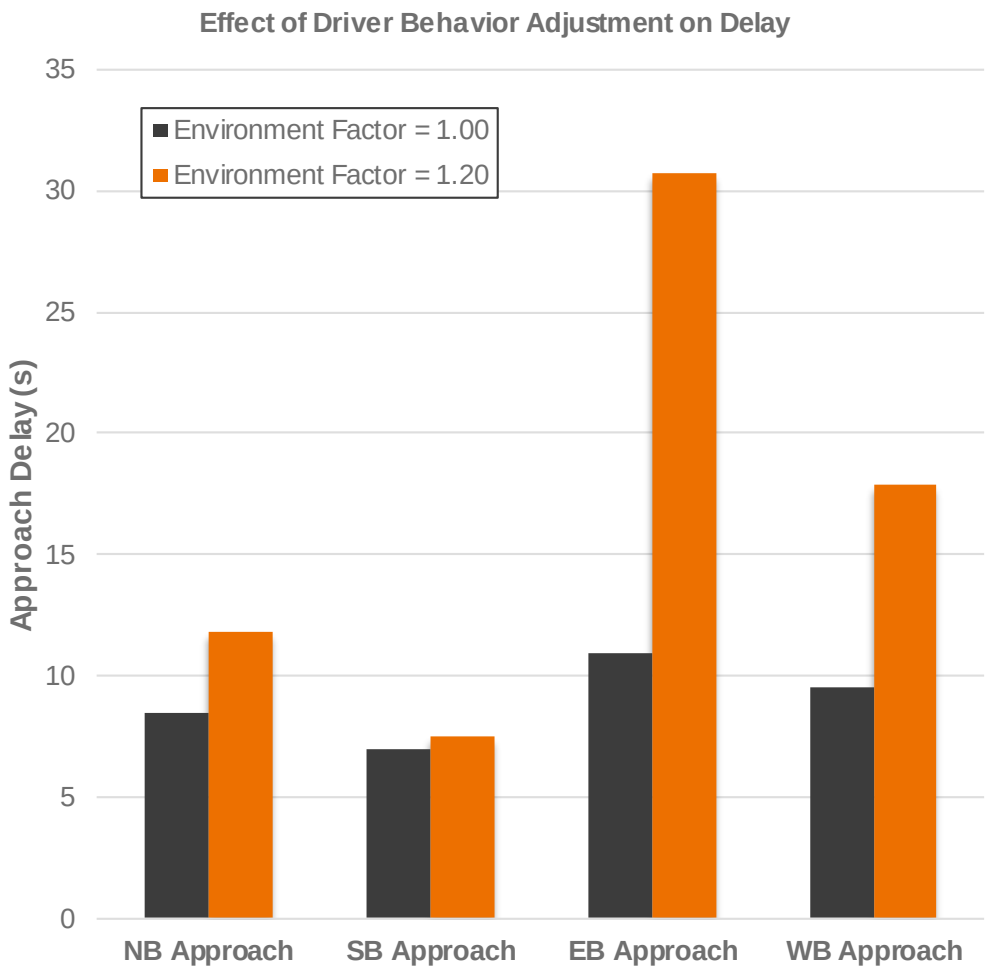
Sensitivity Analysis (Sidra)



- Using the Sidra capacity model, adjust the "Environment Factor" parameter
- For the US, 1.20 is suggested
- For Europe/Australia, 1.00 is suggested

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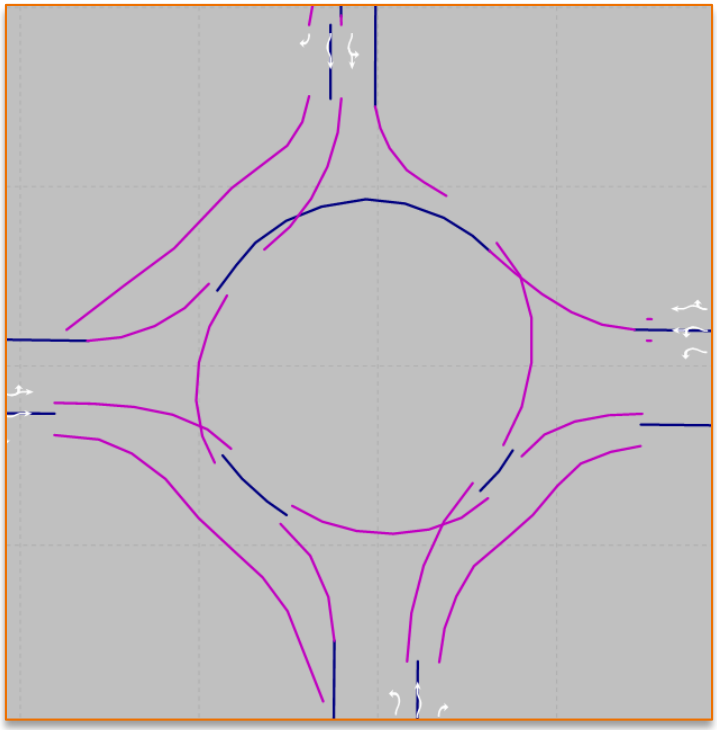
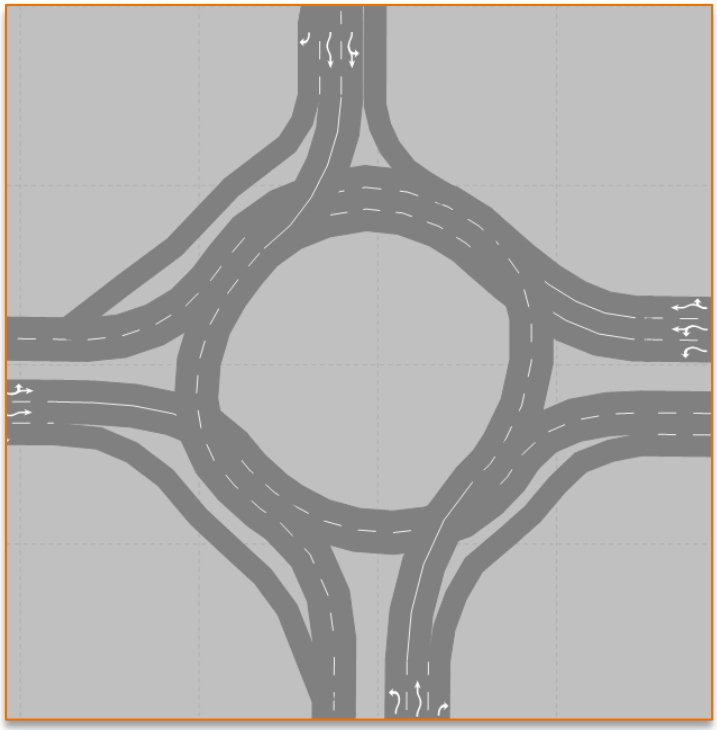
Why Vissim?

- Help visualize how the roundabout will work
- Client wants a video for public presentation
- Complex roundabout layouts
- Using signalization for roundabout metering (also in Sidra)

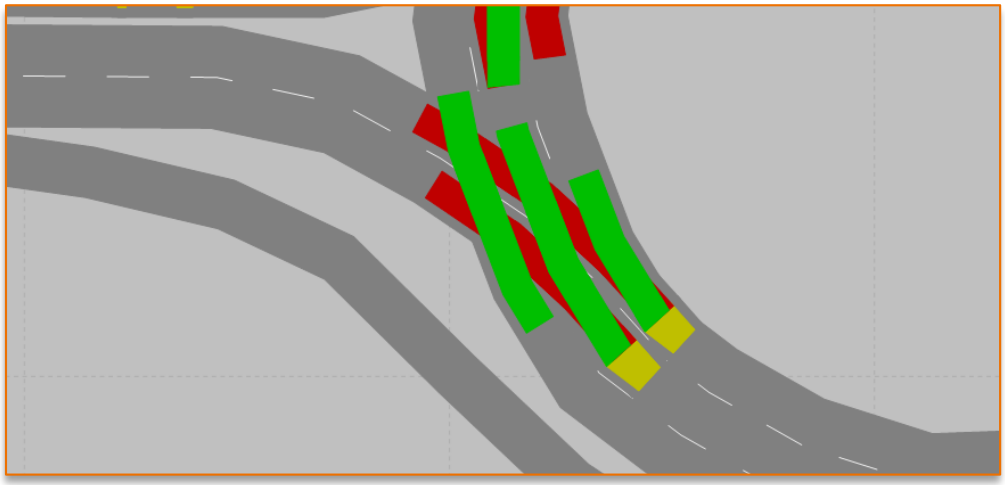
Vissim: Drawing Roundabout Links

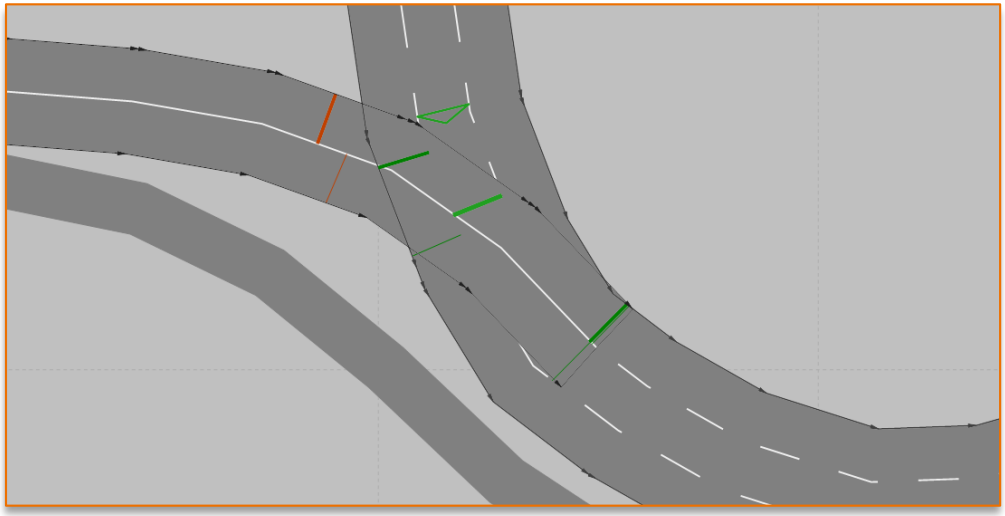
- Strategy: avoid large conflict areas
- Generally avoid running connectors into links; instead, have two connectors join at beginning of link





Vissim: Priority Rules vs. Conflict Areas





- Generally, conflict areas are used in most cases. Priority rules are generally more of a “legacy” object
- Using priority rules can allow for better control of critical gap on a per-lane basis
- Takes longer than using conflict areas

Level of Service Considerations

- LOS for Unsignalized Intersections is normally applied to roundabouts
- HCM 2010: *"At the time of publication...no research was available on travel perception of quality of service at roundabouts".*
- Sidra makes available its own LOS thresholds for roundabouts

	Standard	LOS
Delay = 53s	Signalized Intersection	D
	Roundabout (Sidra)	E
	Unsignalized Intersection	**F**

Thank you!

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Source: Swindon Advertiser (www.swindonadvertiser.co.uk)