

Accommodating Trucks

In Single and Multilane Roundabouts: Horizontal Design Issues



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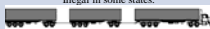
In Single and Multilane Roundabouts. Horizontal Design Issues

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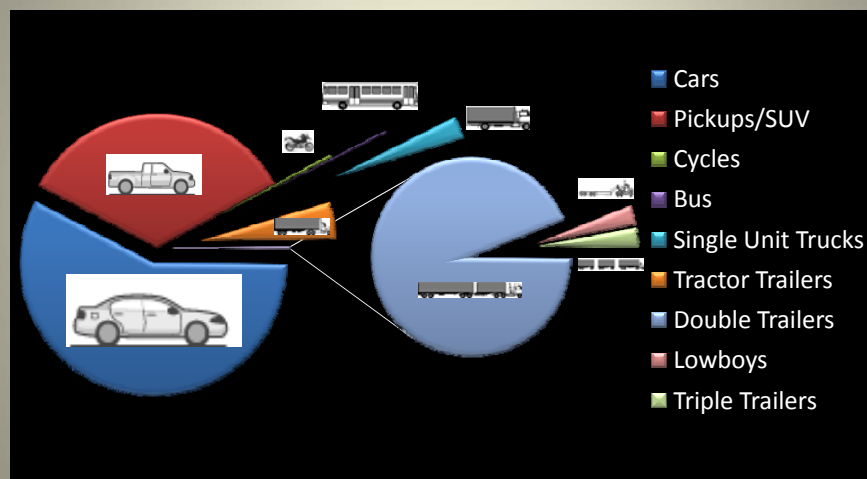
The Nature of the Truck Problem

- Mix of Cars, Trucks, Bikes, Buses, and Peds
- Each Location has a Different User Mix
- Each User has a Different Optimum Design
- Each Location has Different Site Constraints
- Designs must Balance Safety and Operations
- Unbalanced Designs Create Problems:
 - Crashes, Injuries, Delays, Environmental Impact

What's on US Roads? (Vehicle Percentage of US Vehicle Miles of Travel)

	Type	Height	Overall Length	Width of Track	Wheel Base	% US VMT
Light Vehicles 	Cars	5'	15'	6'	8.5'	57.5%
	Pickup/SUV	7'	19'	6.5'	11.5'	34.5%
	Cycles	5'	8'	3.5'	5.5'	0.3%
	TOTAL					92.3%
Buses 	2 Axle:	10.9'	40' Max	8.5'		
	3 Axle:		40' Max	8.0'	21.3'	
	School Articulated		36.4' (dgn)			
	TOTAL		65' Max			0.2%
Single Unit Trucks 	2 Axle:					2.4%
	3 Axle:	13'6"	30'	8.5'	25'	0.3%
	4+ Axle:					0.05%
	TOTAL					2.7%
Semitrailer Combinations 	3 Axle					0.1%
	4 Axle	13'6"	68-77.5'	8.5'	50'-71'	0.5%
	5 Axle					3.6%
	6 Axle					0.3%
	7+ Axle					.02%
	Lowboy					0.01%
	TOTAL					4.5%
Double Trailer Combinations 	5 Axle					0.2%
	6 Axle	13'6"	81.5'	8.5'	74.5'	.03%
	7 Axle		-		-	.03%
	8+ Axle		129.33'		120'	.03%
	TOTAL					0.3%
Triple Trailer Combinations <small>Illegal in some states.</small> 	TOTAL	13'6"	-123'	8.5'	3 x 28'	.01%

Graphic: What's on U.S. Roads?



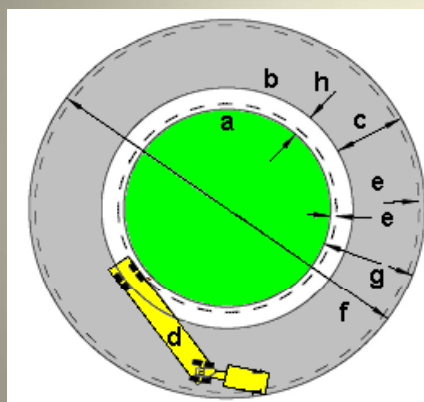
Each Site has a Different User Mix

- Freeways have More and Larger Trucks
 - Sometimes 40% trucks, rare pedestrians.
- Arterials mix fewer trucks
 - 3-15% and more frequent pedestrians
- Collectors: Few Trucks
 - ~ 1% or less depending on Land Use Classification
- Local Streets: Cars, Peds, School Buses
- Isolated Sites can have Special User Classes

Issues:

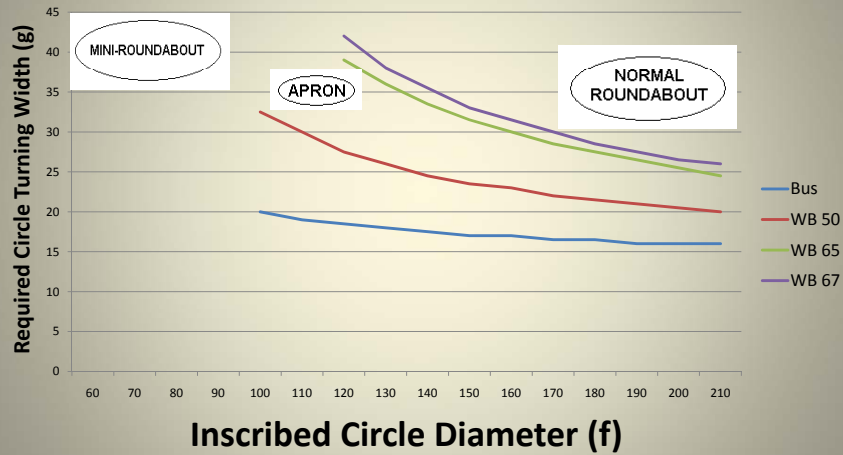
- Unbalancing a design for a few users puts more frequent users at Greater Risk of Failure.
- A reasonable measure of Frequency of Use is necessary.
- How frequently must a user arrive to be considered in the design?
- Ultimately, this is a policy decision.
- Consider: Land Use, Roadway Class, and Site.

Estimating Circulatory Roadway Width (Normal Roundabouts)

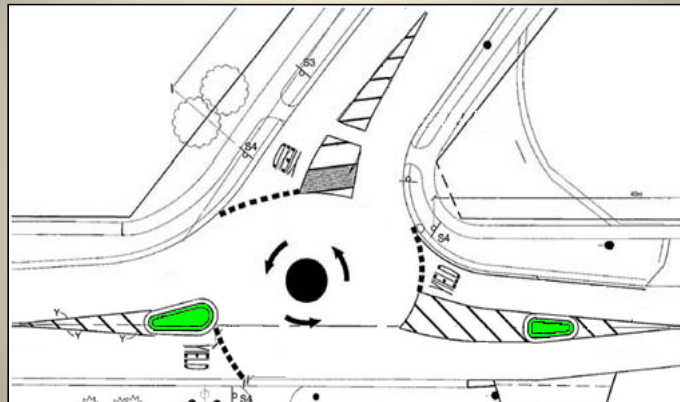


- a: Central Island Vertical Curb
- b: Mountable Apron Curb
- c: Circulatory Roadway Width
(1.0 to 1.2 X widest entry)
- d: Design Vehicle
- e: 2' Wheel Clearance
- f: Inscribed Circle Diameter
- g: Width from Curb to Curb
- h: Bus Turning Clearance

Effect of Design Vehicle on Roundabout Geometry



Mini-Roundabout: 69' Diameter, 28' Circ. Roadway Width

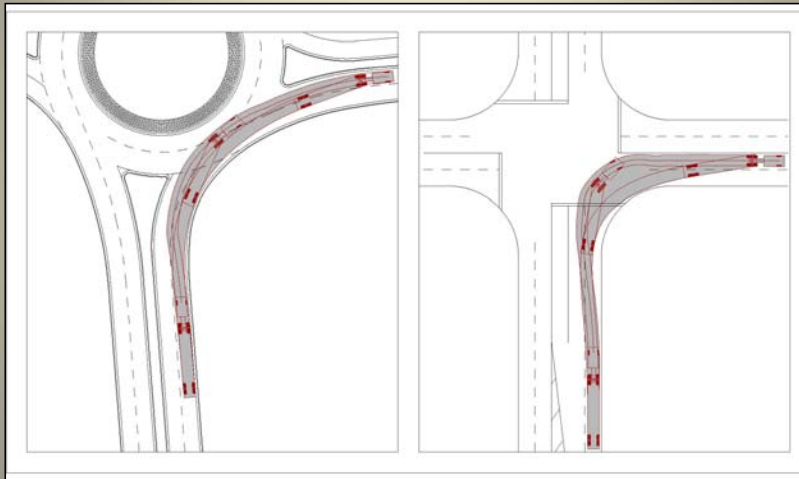


Can a Truck Get Through This?



Truck Right Turns:

As with a Signal, Trucks Use Adjacent Lanes



Traffic Too Heavy to Turn Wide? Widen the Right Turn Lane.



Internal Bypass Lanes Add Capacity and Increase Turn Radius



Still Too Tight? External Bypass Lanes. Free-Flow? Or Yield Controlled?



Free-Flow Bypass Lane



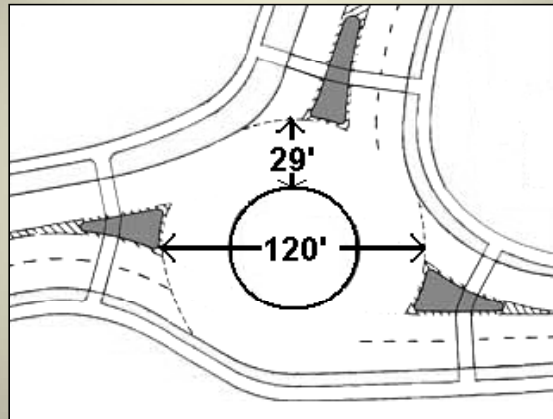
When Space is Too Tight to Turn: Truck Aprons

For Trucks, not Pedestrians!

Is it too High? Or too Low?



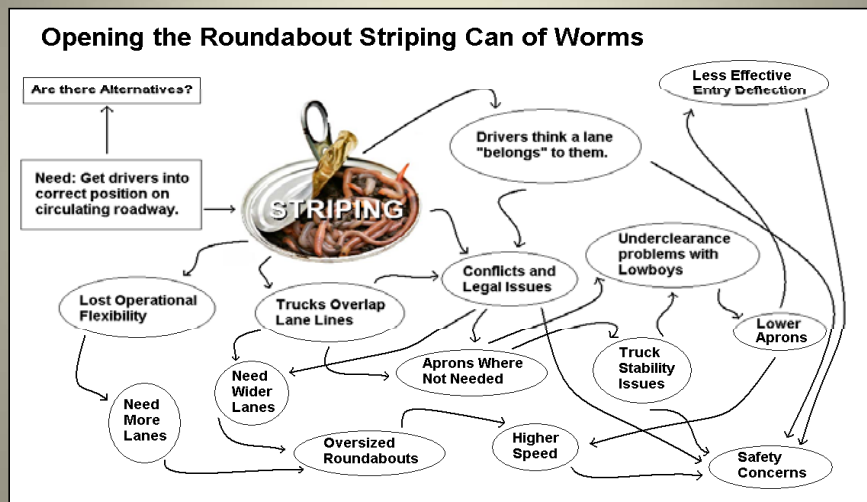
Use the Full Roadway to Turn the Truck



120' Diameter, 29' Roadway Width No Truck Apron



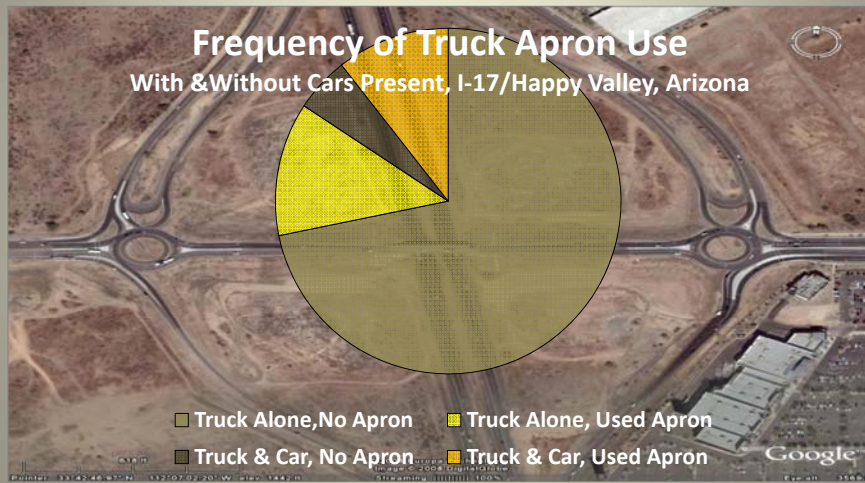
The Striping Can of Worms



Happy Valley Interchange Phoenix, AZ



But, Do Trucks Use the Apron?



Happy Valley Northbound Ramps



Side-By-Side? Note the Banked Exit



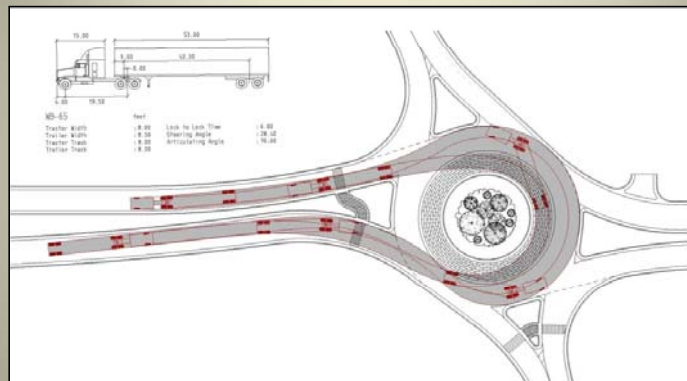
Gates Pass Throughs



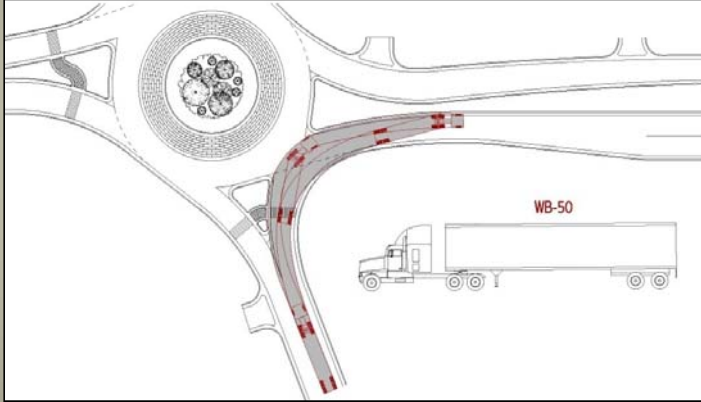
- Handy For:
 - Oversize Trucks
 - Maintenance
 - Detours
 - & Unexpected

65' Wheel Base U-Turn

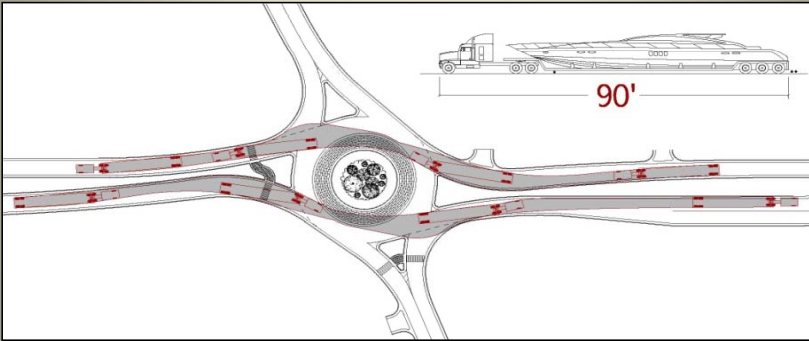
Every Day



50' Wheel Base Neighborhood Access If Needed



Special Vehicle 90' Boat Hauler Through Movement Only, Roughly Once a Week



Truck Suspension Harmonics

Truck suspensions rock at a natural frequency.

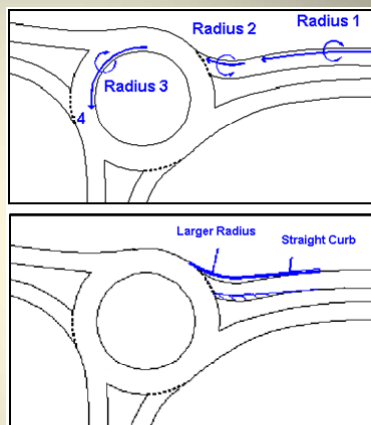
At certain speeds, certain curves match that rocking frequency

Like a swing goes that higher if you push at the right time,

a truck rocks further if it rocks at the right rhythm...

and over it goes – AT 15 MPH.

A solution – Dampen out the harmonics.



Summary:

- Wide variety of Users and Design Vehicles
- Larger Vehicles > Wider Road Geometry:
 - May Reduce Deflection – Need Vertical Deflection
 - May Increase Crashes/Injuries for Light Vehicles
 - Special Vehicle May only need Certain Movements
- Stripes: Raise Many Issues:
 - Legal, Safety, ROW, Aprons, Truck Stability

Questions?