

# **Accommodating Trucks**

## **In Single and Multilane Roundabouts: Horizontal Design Issues**



# **Accommodating Trucks**







## **In Single and Multilane Roundabouts. Horizontal Design Issues**

Ed Waddell, Planning Manager  
Mike Gingrich, Senior Project Manager  
Ourston Roundabout Engineering

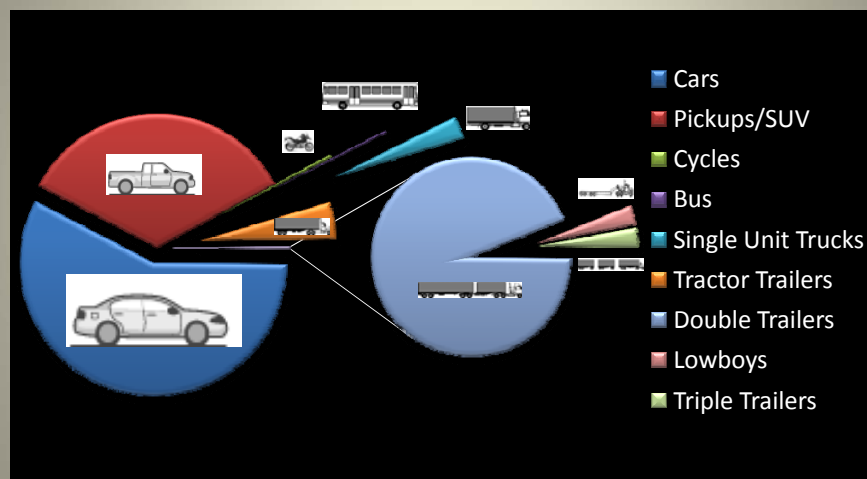
## The Nature of the Truck Problem

- 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
<b>Light Vehicles</b> 	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%
	<b>TOTAL</b>					<b>92.3%</b>
<b>Buses</b> 	2 Axle:	10.9'	40' Max	8.5'	21.3'	
	3 Axle:		40' Max	8.0'		
	School Articulated		36.4' (dgn)			
	<b>TOTAL</b>		65' Max			<b>0.2%</b>
<b>Single Unit Trucks</b> 	2 Axle:	13'6"	30'	8.5'	25'	2.4%
	3 Axle:					0.3%
	4+ Axle:					0.05%
	<b>TOTAL</b>					<b>2.7%</b>
<b>Semitrailer Combinations</b> 	3 Axle	13'6"	68-77.5'	8.5'	50'-71'	0.1%
	4 Axle					0.5%
	5 Axle					3.6%
	6 Axle					0.3%
	7+ Axle					.02%
	Lowboy					0.01%
	<b>TOTAL</b>					<b>4.5%</b>
<b>Double Trailer Combinations</b> 	5 Axle	13'6"	81.5'	8.5'	74.5'	0.2%
	6 Axle		-		-	.03%
	7 Axle		129.33'		120'	.03%
	8+ Axle					.03%
	<b>TOTAL</b>					<b>0.3%</b>
<b>Triple Trailer Combinations</b> Illegal in some states. 	<b>TOTAL</b>	13'6"	-123'	8.5'	3 x 28'	<b>.01%</b>

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



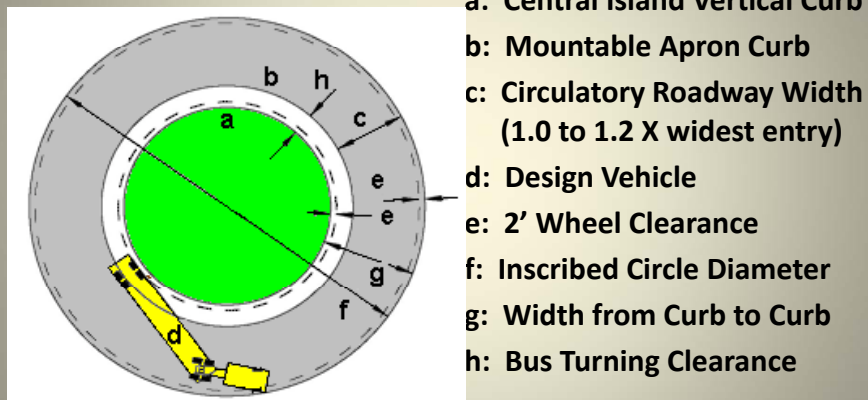
## Each Site has a Different User Mix

- 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

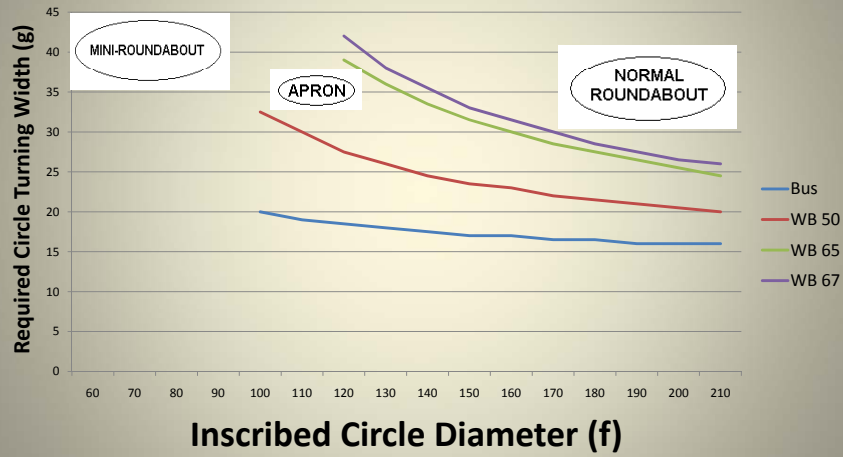
## Issues:

- 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.

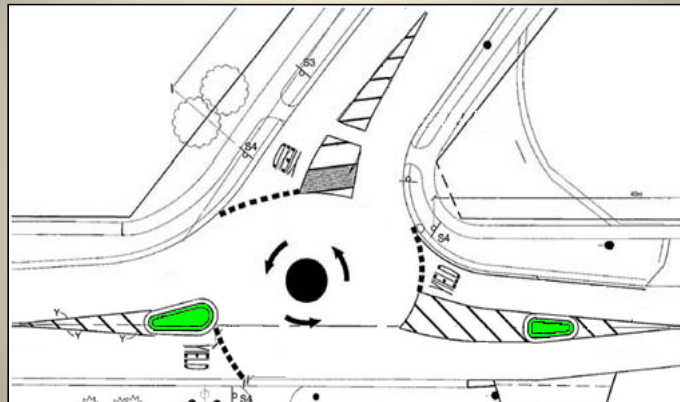
## Estimating Circulatory Roadway Width (Normal Roundabouts)



## Effect of Design Vehicle on Roundabout Geometry



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

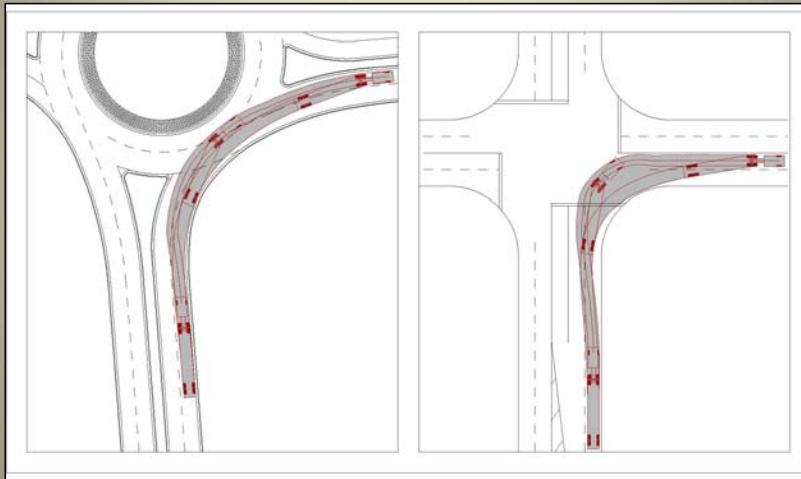


## Can a Truck Get Through This?



## 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**





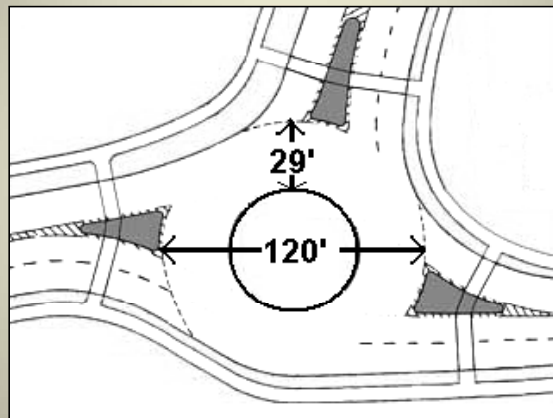
## When Space is Too Tight to Turn: Truck Aprons

For Trucks, not Pedestrians!

Is it too High? Or too Low?



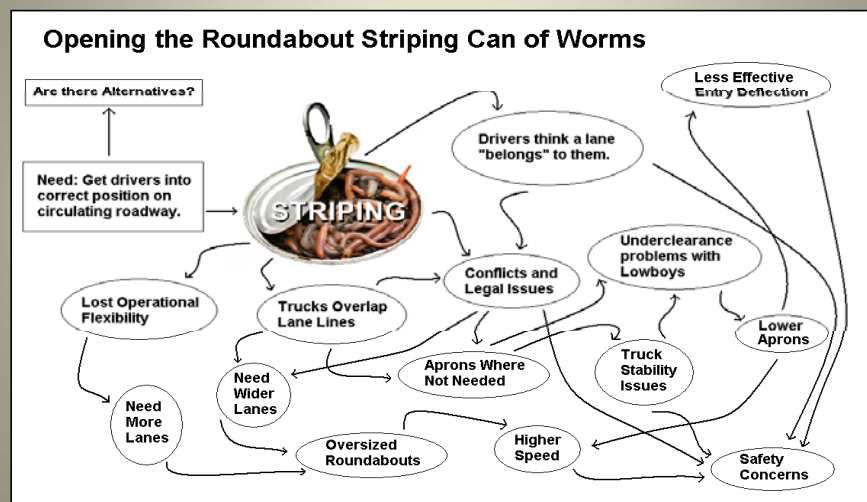
## Use the Full Roadway to Turn the Truck



## 120' Diameter, 29' Roadway Width No Truck Apron



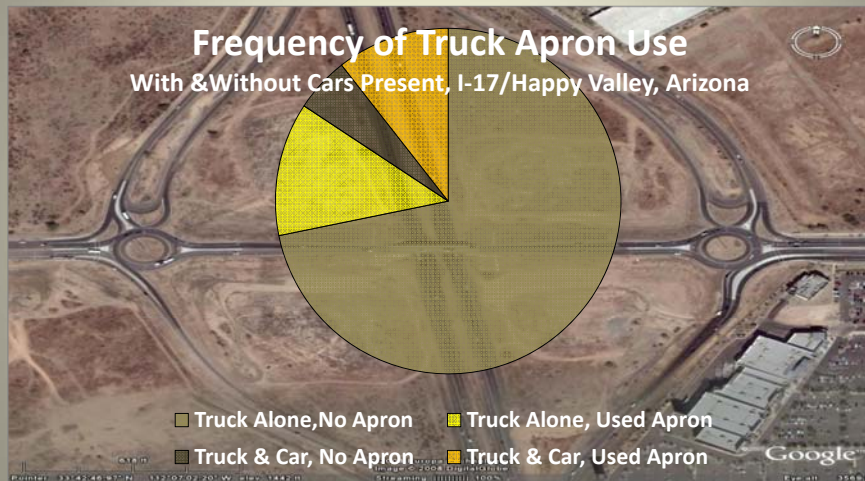
## The Striping Can of Worms



# Happy Valley Interchange Phoenix, AZ



## But, Do Trucks Use the Apron?



## Happy Valley Northbound Ramps



## Side-By Side? Note the Banked Exit



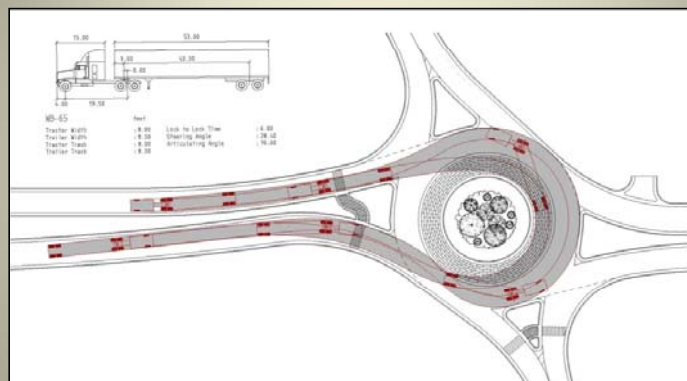
## Gates Pass Throughs



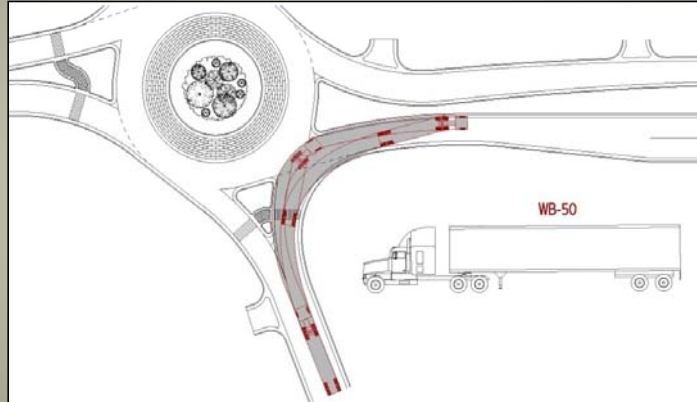
- Handy For:
  - Oversize Trucks
  - Maintenance
  - Detours
  - & Unexpected

## 65' Wheel Base U-Turn

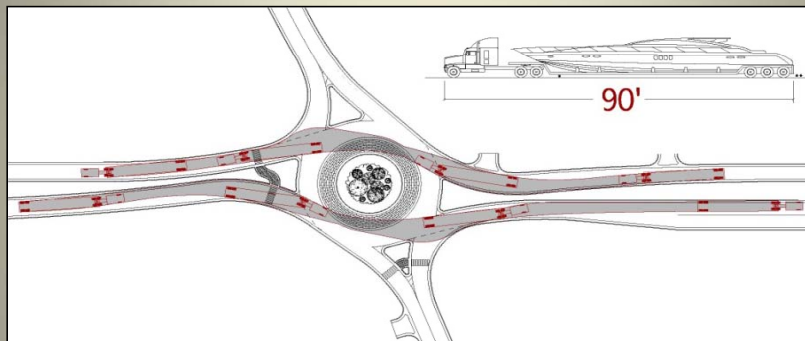
Every Day



## 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.

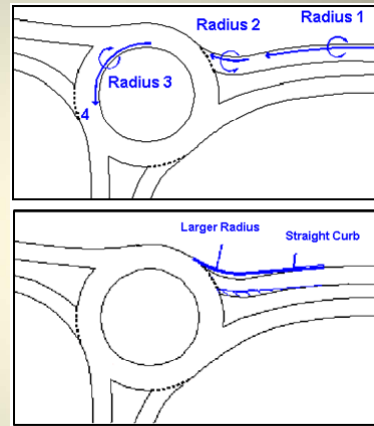
At certain speeds, certain curves match that rocking frequency

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?**