Accommodating Trucks

In Single and Multilane Roundabouts.

Crown and Vertical Design Issues

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Crown and Vertical Design Issues

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Monster Truck

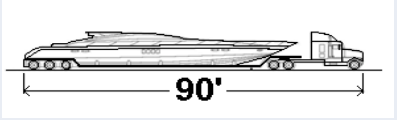
Independent Steerable Rear Bogie System (165', 220,000 lbs)

In my Roundabout?

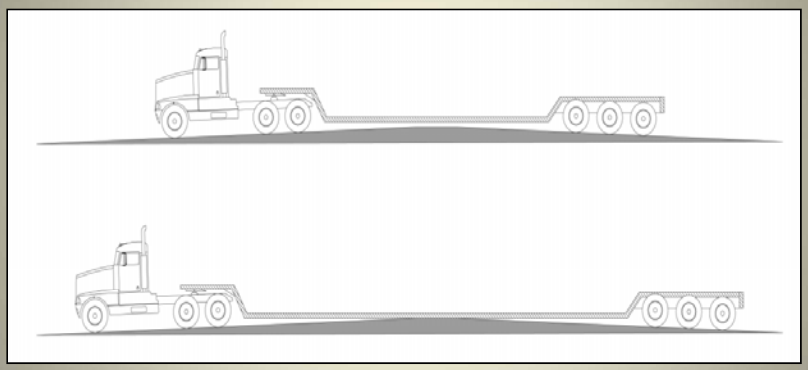
Circulatory Roadway Vertical Design

- Influences Speed Slightly
  - Entry Deflection Usually Dominates R-2 Speed
- Strongly Influences Trucks
  - Crown and Apron affect Ground Clearance
  - Crown and Apron affect Truck Stability
- Complex Interaction with Horizontal Design
  - Curves + Cross-Slopes = G Forces
  - Driver Expectation plays a Critical Role
  - No Clear Empirical Data on Effects of Cross Slope

Problem Vehicles

Lowboy Trucks 	**Same Dimensions as Combination Trucks** **No USDOT Minimum Ground Clearance !**
Car Haulers 	Same Dimensions as Combination Trucks No USDOT Minimum Ground Clearance 2 – to - 3 Inch is Common !
Specialty Vehicles 	What Do You Do with THIS ? ! How LOW can you GO? Roundabout Designer Limbo Dancing

Ground Clearance
Effect of both Height and Length



How Low is Too Low?

USDOT has No Regulations on Truck Ground Clearance.
Similar Lowboy hung on a Rail Crossing and derailed an AMTRAK Train.
What Could POSSIBLY Go Wrong at a Roundabout?

Lowboys and Aprons

An Apron needs to be HIGH enough to deter cars, or someone could be hurt.

Aprons need to be LOW enough to accommodate trucks, or something will be damaged.

Either way, it can cost you.

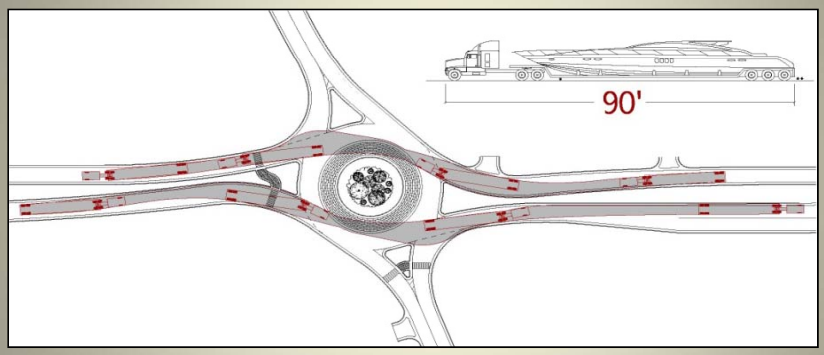
Know your design vehicle!

Case Study: 90’ Boat Hauler

Six Inch Ground Clearance

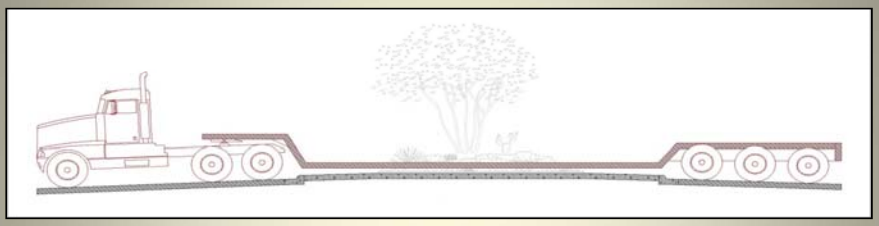
Special Vehicle 90’ Boat Hauler

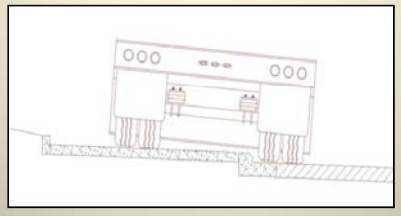
Through Movement Only, Roughly Once a Week



Check Ground Clearances

Longitudinal and Cross Slope

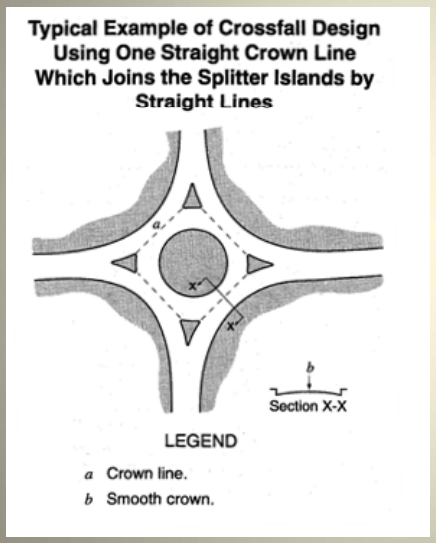


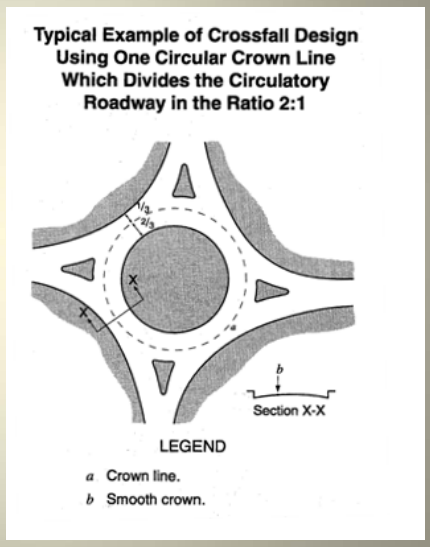


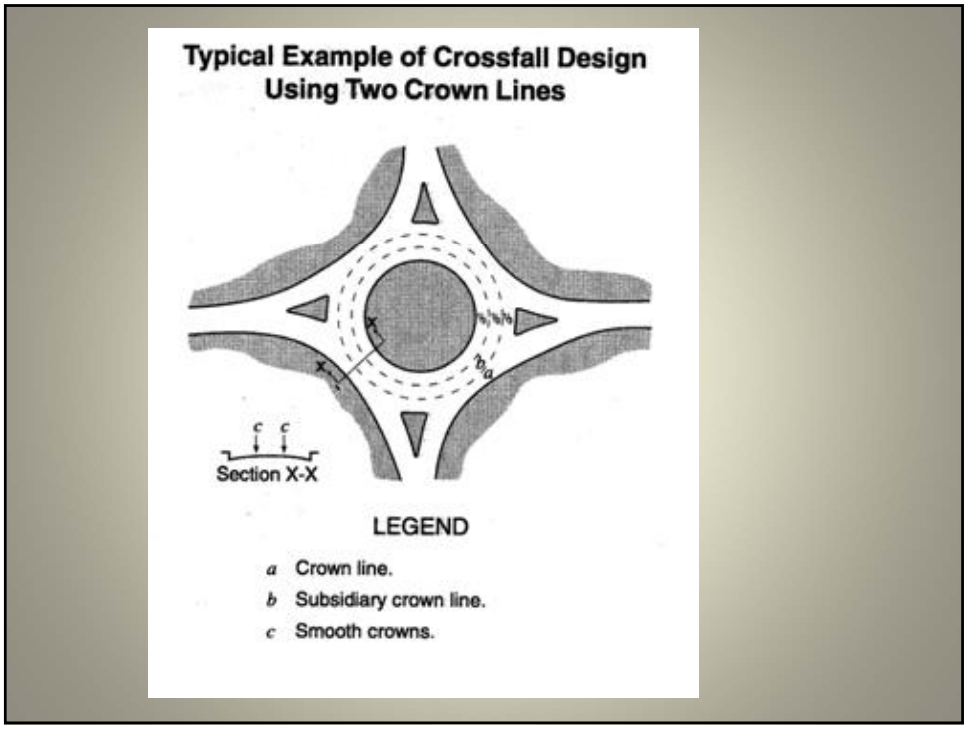
Circulatory Roadway Cross Sections

- **Banked / Super-Elevated**
  - Older US Styles
- **Crowned**
  - Common in UK and US Multi-lanes
- **Adverse Super-Elevated**
  - Common in France, some in US
- **Adverse Super-Elevated, with Apron**
  - Has been done in the US

Roadway Crown Types







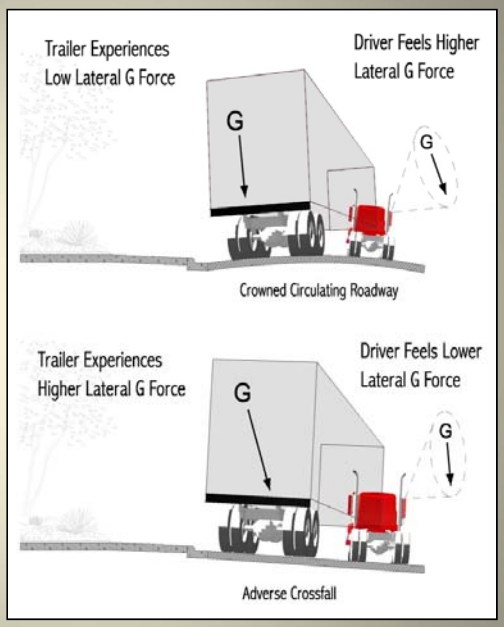
Crowned vs Adverse Super

Crowned:

- **UK Typical, Vail, Avon,**
- **Inner 2/3rds drain inward**
- **Outer 1/3rd, drains outward**
- **Driver feels more G than trailer**

Adverse Super-elevation

- **French Typical, Michigan**
- **Originally for drainage**
- **But…had to drain central island anyway**
- **Others have followed.**



Adverse Super Elevation

Does a Driver feel More Lateral G, or Less than the Trailer?

A Little Faster

How Much More to Overturn?

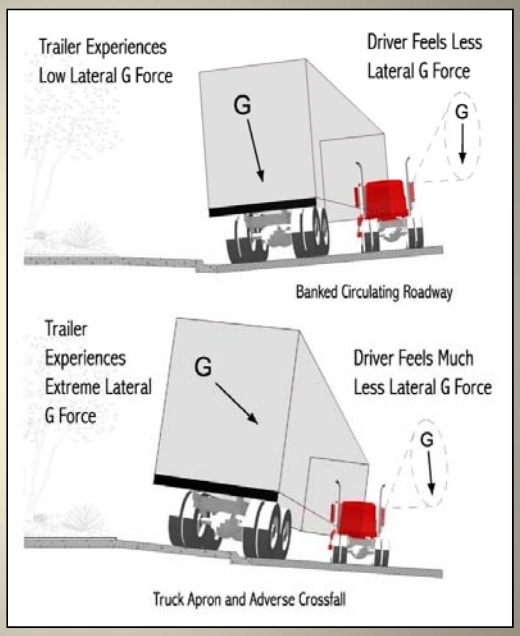
Banked vs Apron

Banked:

- Provides greater stability
- Speed control is at the Entry
- Driver still feels less G than trailer
- Central Island Drainage

Apron:

- Adds more Height/Tilt
- With One Wheel On - oops?
- What Happens if Too Fast !?
- Max "G" Difference between Driver and Trailer



Five Common Reasons for Truck Overturns

1. Long straight high speed approach
2. Inadequate entry deflection
3. Low circulating flow past the entry
4. Excessive visibility to the left
5. Significant tightening of radius

Source: Transport Research Laboratory

Three Additional Reasons for Overturns

1. **Excessive grade breaks / cross fall changes on circulatory roadway or exits**
2. **Excessive adverse super-elevation on the outside lane of the circulatory roadway**
3. **Excessive entry path deflection**

Source: UK Highways Agency

Summary:

- Wide variety of Users and Design Vehicles
- Under Clearance Needs to be Considered
  - Better Regulations are Needed (USDOT/States)
  - Designers Need to be Aware for Vertical Design
- Vertical Design Affects Truck Stability
  - Complex Interaction (Load Height, G Force, Speed, Driver Reaction, Successive Horizontal Curve)
  - More Research – Field Data, Computer Simulation

Questions?