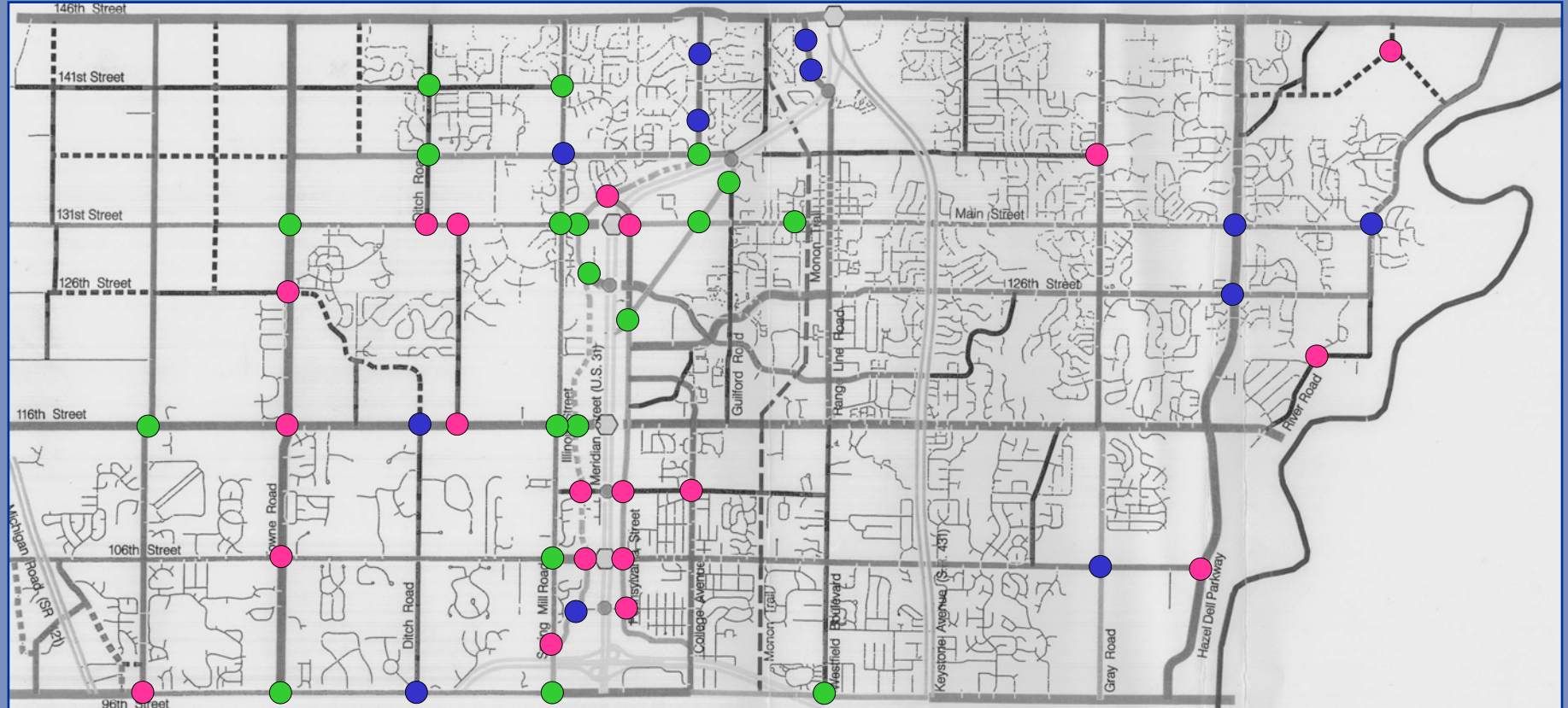


# City of Carmel Roundabouts



 in place

 under construction or design

 planned

# what about roundabouts?

a hamilton county/city of carmel case study ■ road school 2005 ■ purdue university



**AMERICAN CONSULTING**

# definition of a modern roundabout

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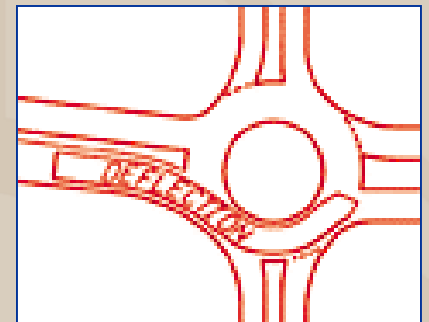
- Yield at entry

- Yield signs
- Yield lines
- Circulating traffic has right-of-way



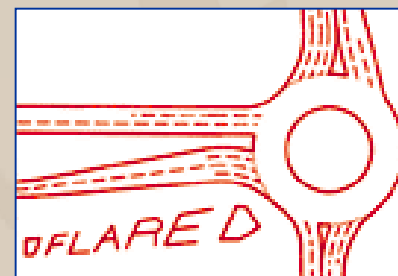
- Deflection of entering vehicle path

- Accomplished using 'splitter islands'



- Entry flare

- Lane width is increased near yield line
- Not mandatory



# origin of the modern roundabout

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- England – November 1966
  - Reversal of traffic priority at roundabouts to “yield on entry”
  - Result: low delay and high safety
  - Experiment was a huge success!
  - US was slow to accept the idea
  - First US modern roundabout in 1990

# roundabout vs. traffic circle

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Roundabouts	Traffic circles
Low to high capacity	Low capacity
Yield signs and yield lines at entry	Stop signs and stop bars
Flare on entries	No flare
No parking near roundabout	Parking on circulatory roadway
Pedestrians discouraged from using circulatory roadway	Pedestrians on central island



# Indianapolis – monument circle

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Not a roundabout!



# roundabout vs. rotary

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Roundabouts	Rotary
Low to high capacity	Medium to high capacity
Yield signs and yield lines at entry	Free-flow entry with no control
Flare on entries	Tangential entries
Low speeds	High speeds
Little or no weaving	Heavy weaving movements
Small Inscribed Circle Diameter (ICD)	Very large ICD

# a rotary is not a roundabout

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Kingston, NY (photo by New York State DOT)

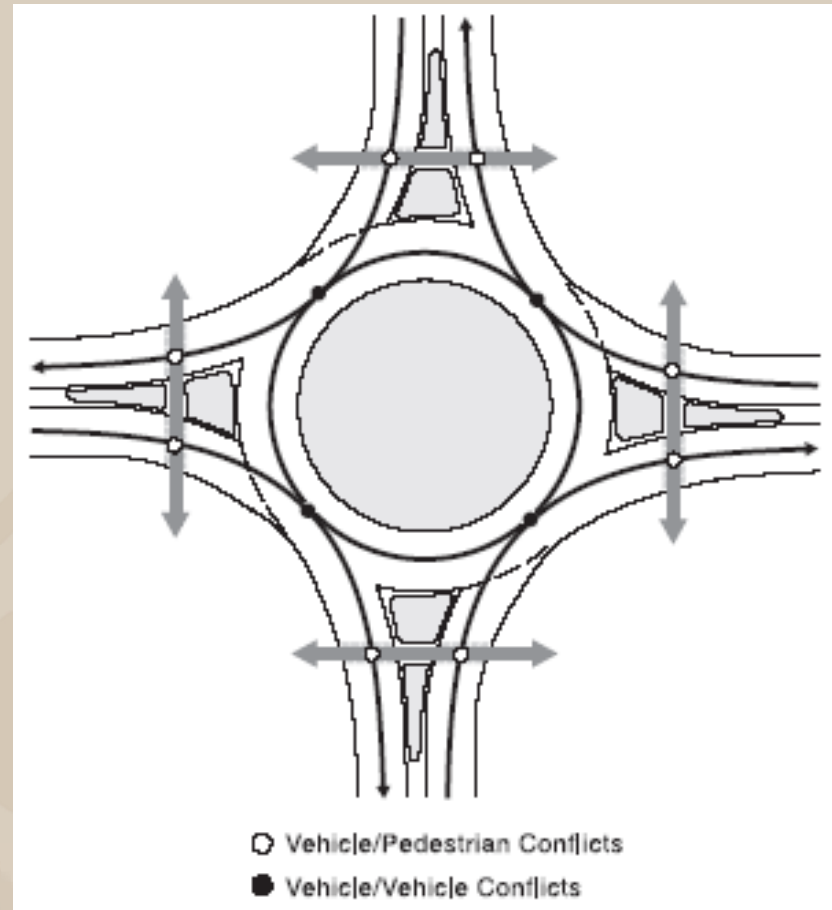
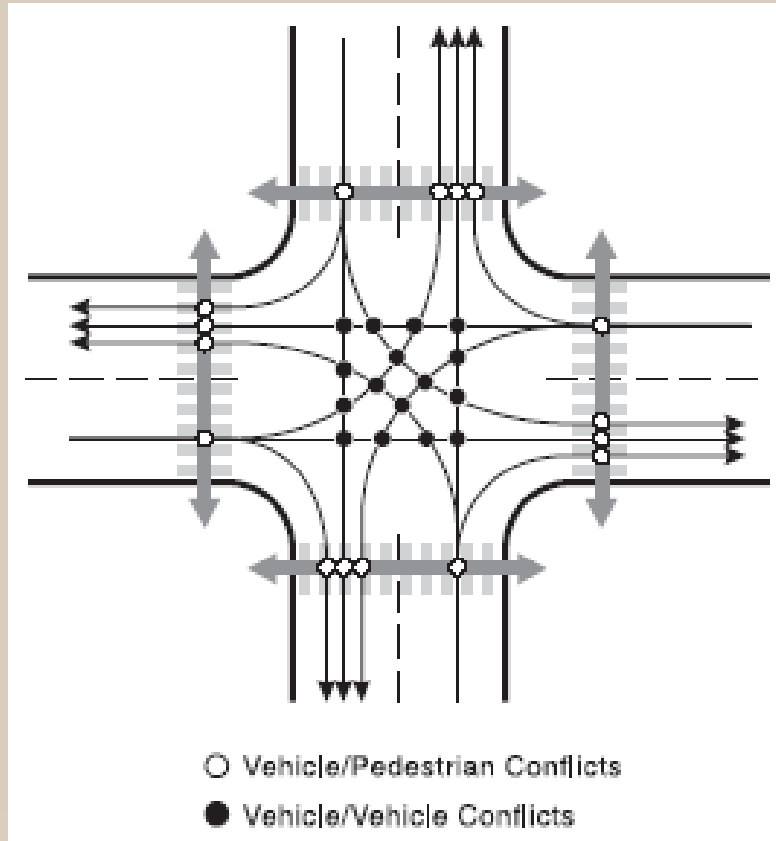


# benefits of a roundabout

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- Keep traffic moving (efficient)
  - Yield instead of stop
- Aesthetically pleasing
  - Central island provides opportunity for landscaping
- Less pollution
  - Air
  - Noise
- Safer than conventional intersections
  - Greater than 90% reduction in fatalities!!
  - Studies performed by Insurance Institute of Highway Safety

# safety



# pedestrian fatality in pedestrian/vehicle crash

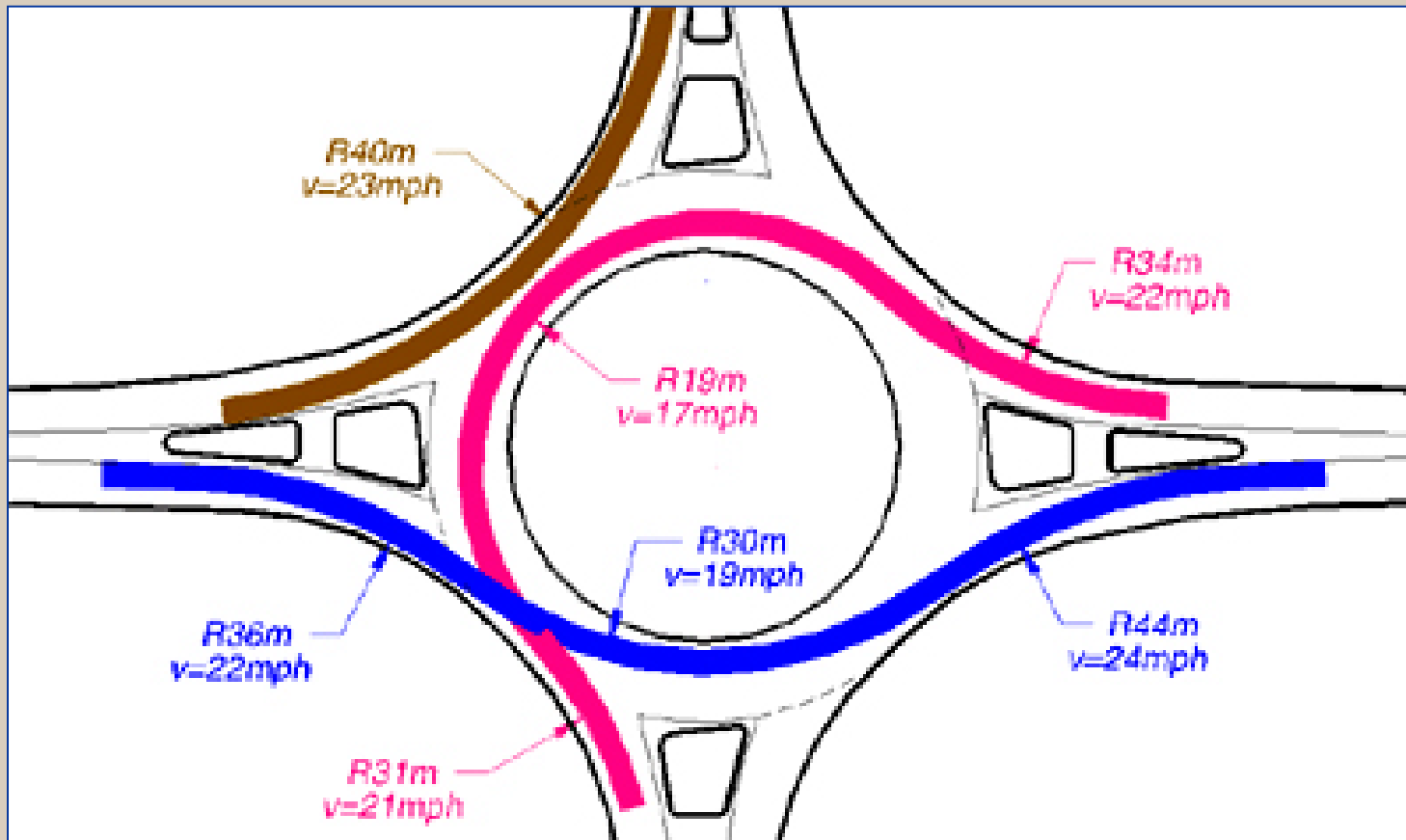
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Vehicle Speed	Odds of Pedestrian Death, Source 1	Odds of Pedestrian Death, Source 2
20 mph	5%	5%
30 mph	45%	37%
40 mph	85%	83%

Source 1: Limpert, Rudolph. Motor Vehicle Accident Reconstruction and Cause Analysis. Fourth Edition. Charlottesville, VA. The Michie Company, 1994, p. 663.

Source 2: *Vehicle Speeds and the Incidence of Fatal Pedestrian Collisions*, Australian Federal Office of Road Safety, Report CR 146, October 1994, by McLean AJ, Anderson RW, Farmer MJB, Lee BH, Brooks CG.

# speed reduction



Source: FHWA Design Guide

# roundabout design

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- No “cookie-cutter” solutions – each design is unique to its surroundings
- Design is quite complicated – not just a circle with standard radii on entries and exits
- Principles vs. design standards
- Counter-intuitive when compared to traditional intersection design



# roundabout design

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- Design considerations
  - Vehicle speeds
    - Entry and exit radii
    - Circulatory roadway diameter
  - Design vehicle negotiation of roundabout
  - Vehicle path overlap (multi-lane roundabouts)
  - Capacity
  - Lighting
  - Signs and pavement markings
  - Vehicle sight distances
  - Pedestrian crossing locations and refuges

# case study: clay terrace roundabouts

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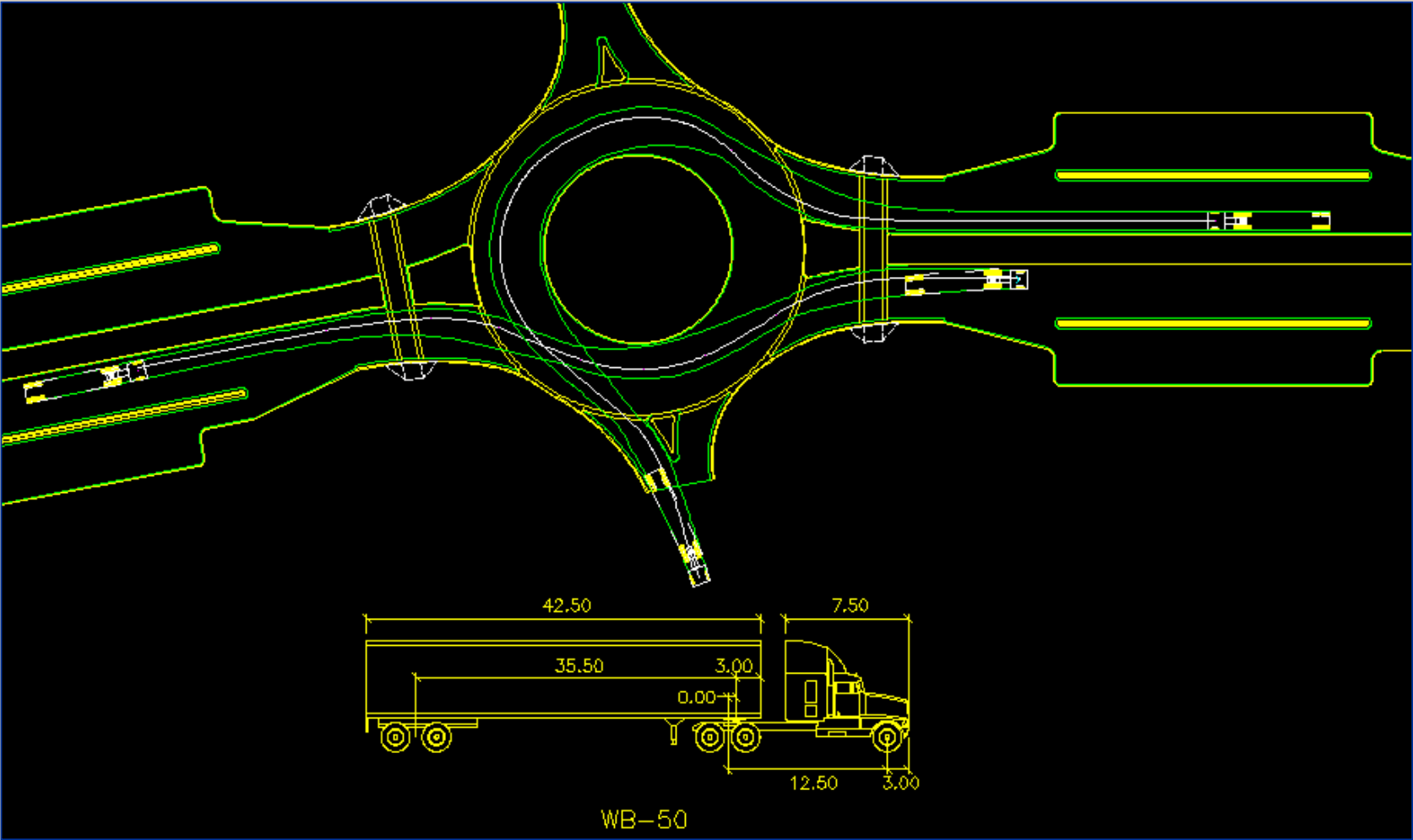


# clay terrace

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- Geometric features of Clay Terrace roundabouts
  - FHWA Classification: Urban Double-Lane
  - 150' inscribed circle diameter (ICD)
- Unique characteristics
  - Amount of pedestrians and pedestrian interaction with roundabout traffic
  - Proximity of roundabouts to traffic signals
  - Paved with brick pavers

# design vehicle





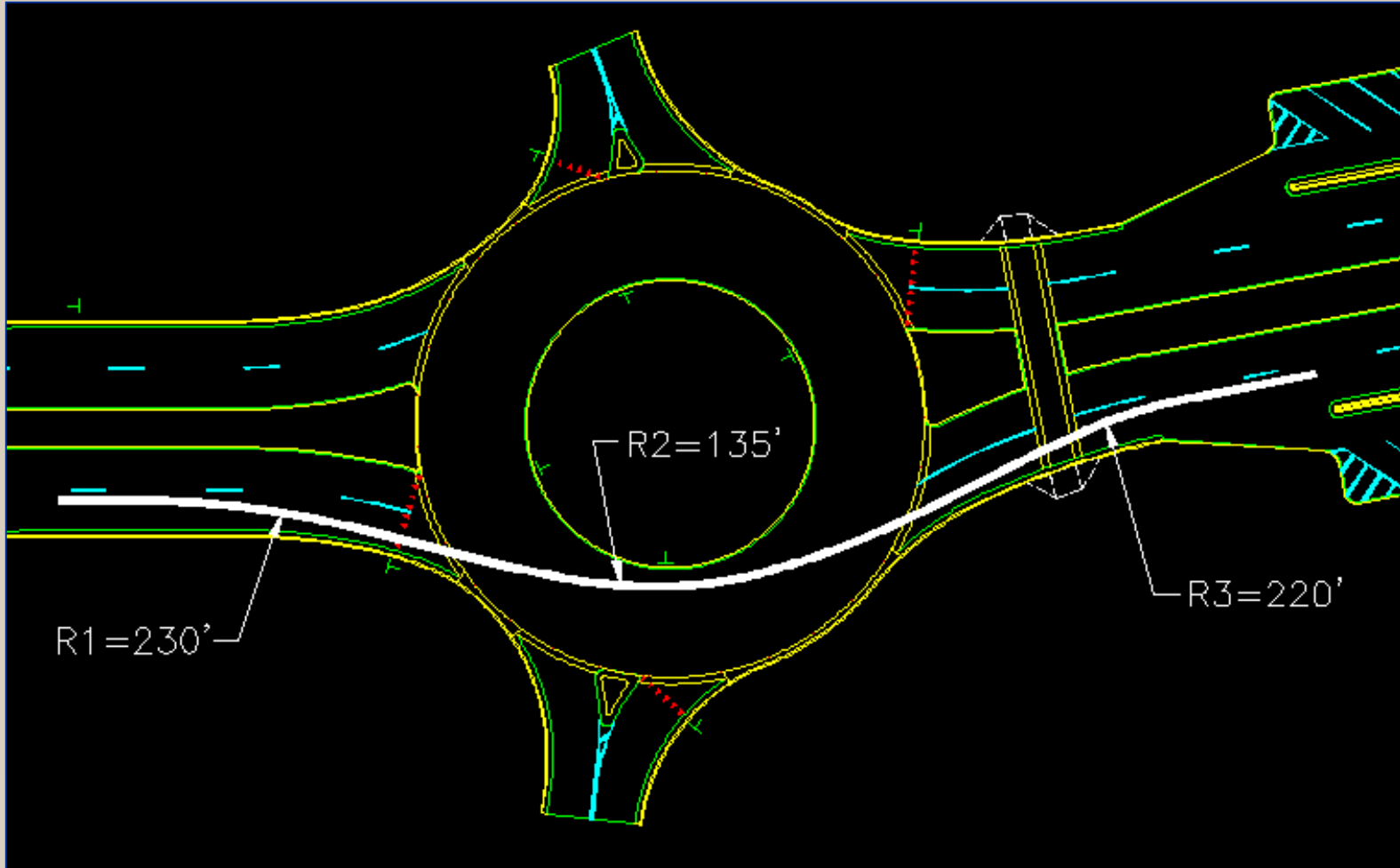
# design vehicle

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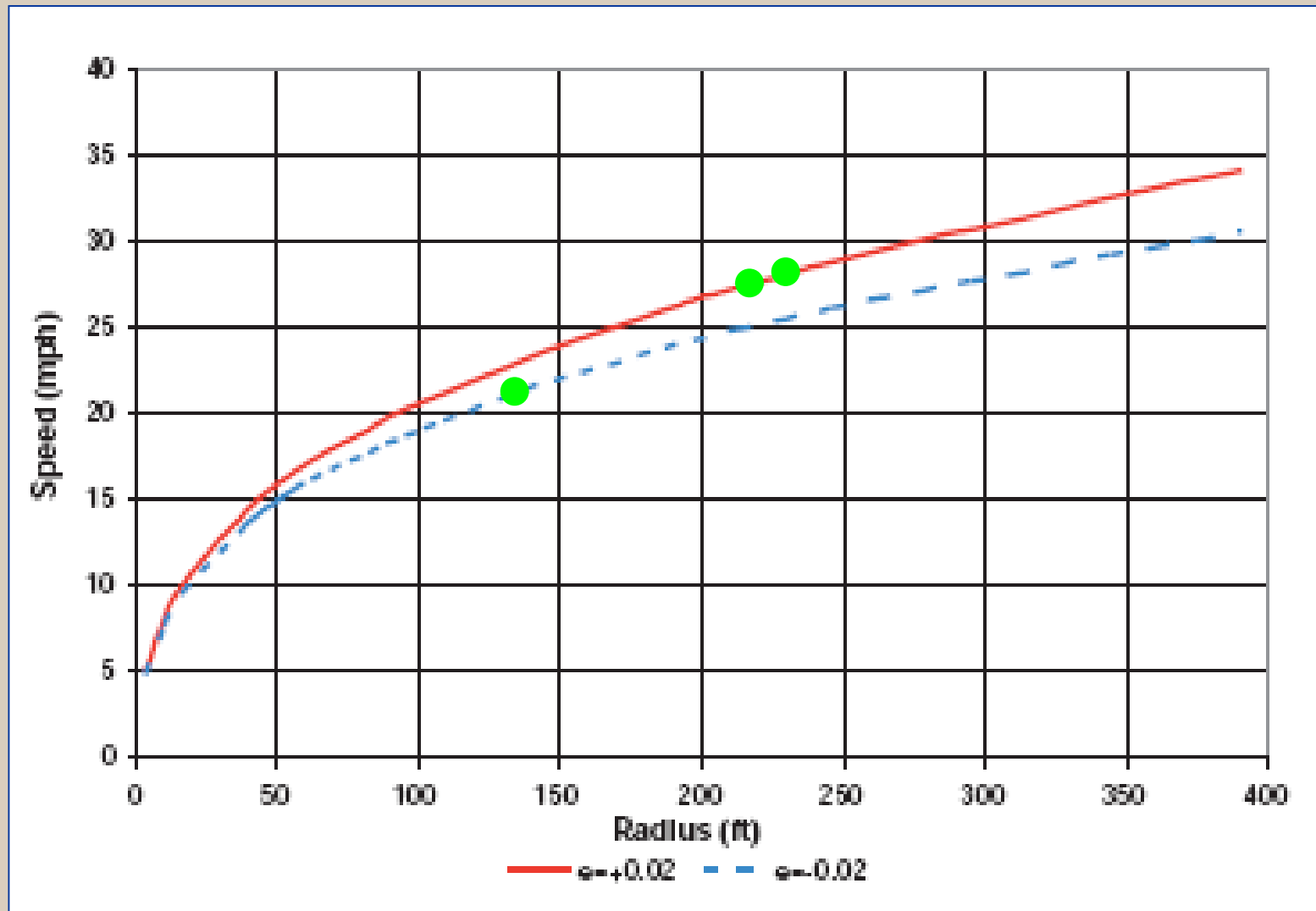




# fastest path



# fastest path



# pedestrians

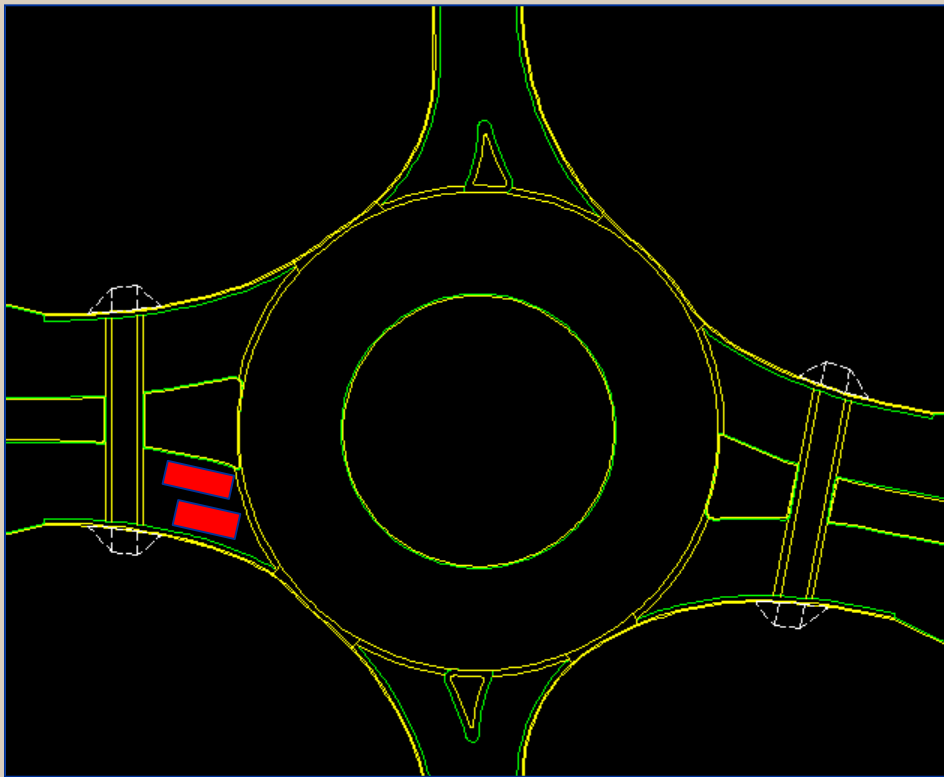
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- Lifestyle Center
  - Located near affluent neighborhoods
  - Upscale in nature
  - Open-air concept
  - Combination of shopping and office space
  - “Glorified Strip Mall”
  - Many pedestrians

# pedestrians

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- Pedestrian crossing locations – 25' back from yield line at roundabouts



Entering speeds:  
~27 mph

Exiting speeds:  
~27 mph

Circulating speeds:  
~15 mph

# pedestrians

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*Myth:* Roundabouts and pedestrians don't mix

*Facts:*

- Roundabouts slow vehicles – reducing number and severity of vehicle/pedestrian crashes
- Pedestrians must only look one direction at a time
- High safety ratings even at school crossings and in areas with a high percentage of elderly residents
- U.K. studies show 50% reduction in pedestrian crashes at roundabouts as opposed to traditional intersections



# pedestrians

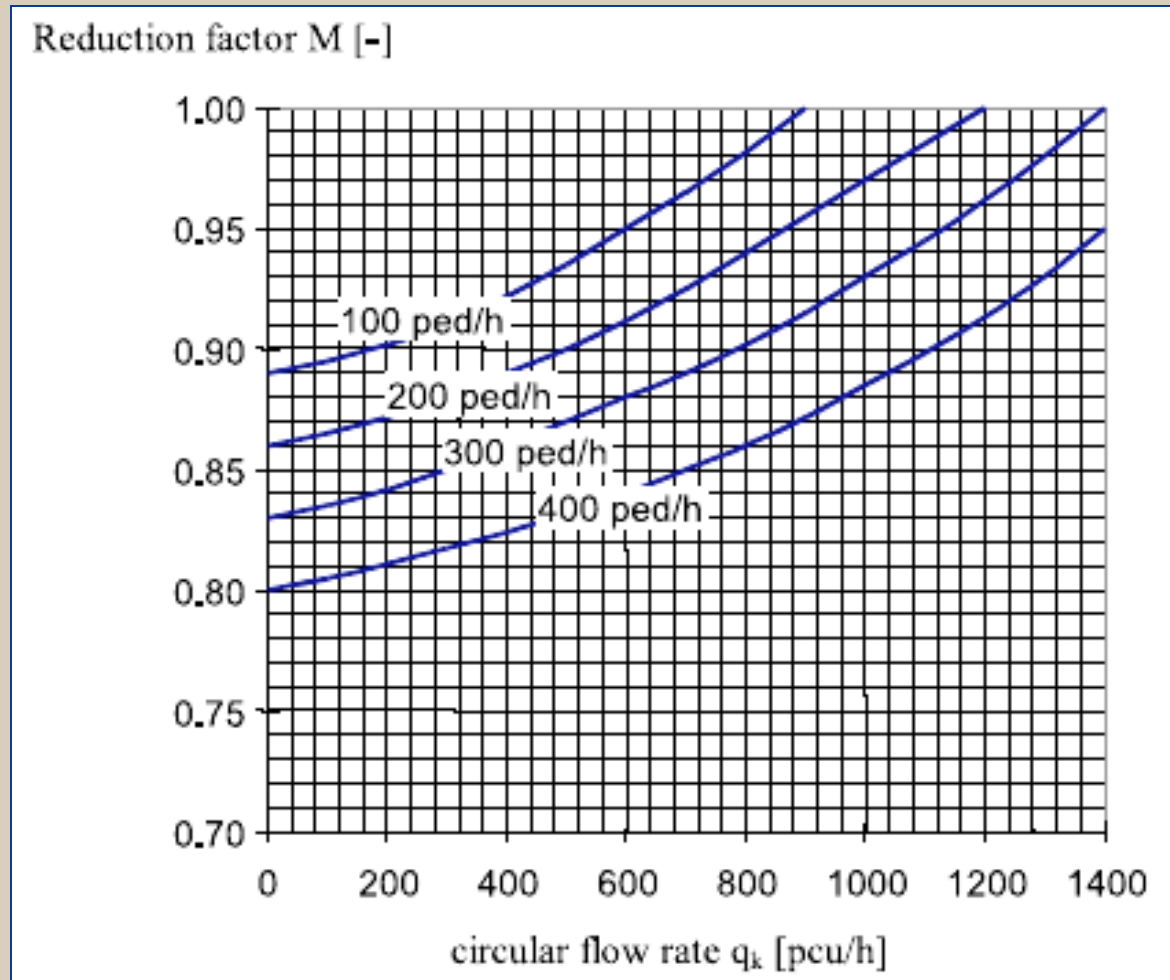
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## *Facts (cont'd.):*

- When compared to 4-way intersections of similar traffic volumes, pedestrians can negotiate a roundabout much quicker
- Too heavy of pedestrian volumes can cause traffic to queue or to back up into the circulatory roadway

# pedestrians

## Effect of pedestrians on capacity of a two-lane roundabout



Source: FHWA Design Guide

# pedestrians

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- Mall atmosphere
- Many pedestrians not using marked crosswalk locations
- Mid-block crossings?
- Pedestrian railing or landscaping to discourage crossing at an unmarked location

# pedestrians



# pedestrians

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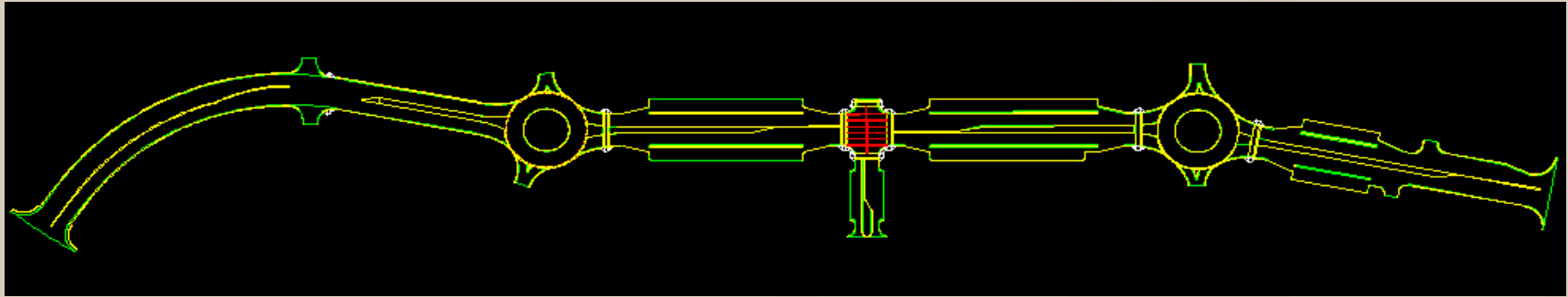
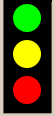




# traffic signals

US 31

146<sup>th</sup> St



←—————→  
Approx. distance: 3,000 ft.



# traffic signals

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- In general, nearby traffic signals do not harm the operation of roundabouts
  - Depends on demand at each intersection
  - Must make sure queues from traffic signal do not back up into roundabout
- Roundabouts disrupt coordination when placed along a corridor with a traffic signal system
  - Traffic signal systems rely on vehicle platooning for maximum efficiency
  - Platoons are dispersed at yield signs

# traffic signals

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- Suggestions
  - Use a roundabout/roundabout combination
  - Roundabouts work well with random arrivals – they don't need platoons for maximum efficiency
  - If a signal is nearby, simulate signal timings to assure that queues will not back up into roundabout

# brick pavers

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- Why use pavers?
  - Aesthetically pleasing
  - Encourage low circulating speeds
- Issues with pavers
  - Cost
  - Pavement markings in circulatory roadway are infeasible – acceptable at Clay Terrace
  - Must have strong foundation
  - Must use caution when snow plowing

# brick pavers

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- Aesthetically pleasing





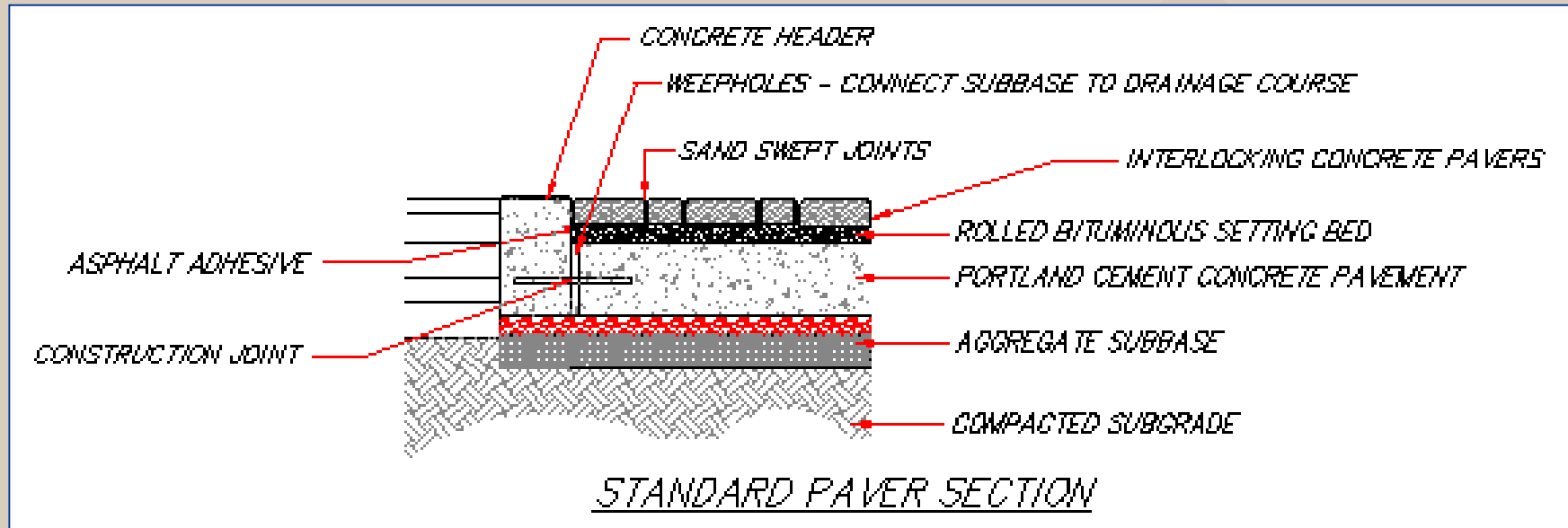
# brick pavers

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- Aesthetically pleasing



# brick pavers



# brick pavers

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- Snow plowing
  - If foundation settles, this causes “lipping”
  - Snow plow blades can get caught
    - Use a rubber blade tip -OR-
    - Raise blade slightly to remove bulk of snow and go back over with de-icer -OR-
    - Use stamped concrete or asphalt instead of brick pavers – not as aesthetically pleasing after several years of wear



# clay terrace

