LIGHT RAIL AND ROUNDABOUTS:
A TRUE COMPLETE STREET ON MAIN STREET

Joseph Perrin, PhD, PE, PTOE
The Gilbert Road Light Rail Transit (LRT) Project consists of approximately 1.9 miles double track alignment extending from near Main Street and Hobson to an end of line station on Main Street and Gilbert Road.
Goal

- Provide two Roundabout / Light Rail designs
- Accessible to all travel modes
  - Horne and Main Street
  - Harris and Main Street
Immediate Concerns

- Are Signals safer than Roundabouts
  - (No Brainer, NO)
  - At Rail crossings??
- Horne is already Signalized, does changing to a roundabout make it less safe and therefore open to liability
- How can ADA, Pedestrians, Bicyclists, “Scooters” be accommodated
- Concern of blocking of intersections when LR passes
Design Factors

**User**
- Vehicle
- Pedestrians
- Bicyclists
- Light Rail
- Heavy vehicles
- Emergency vehicles

**Elements**
- ROW Constraints
- Curb Geometry
- Directional fencing
- Rail gates
- Signs
- Striping
AASHTO
MUTCD
Valley Metro (Transit Agency)
City of Mesa
ADOT
NCHRP: 672, 488, 674
Figure 2B-22. Example of Regulatory and Warning Signs for a One-Lane Roundabout

Figure 3C-3. Example of Markings for a One-Lane Roundabout

Legend

- Optional

Splitter island mountable or painted yellow

Central island might also be mountable or painted yellow

Splitter island formed by two sets of double yellow lines
Figure 8B-6. Example of Placement of Warning Signs and Pavement Markings at Grade Crossings

A three-lane roadway should be marked with the centerline for two-lane approach operation on the approach to a grade crossing.

If transverse lines are used at the grade crossing, yield lines may be used instead of stop lines if YIELD signs are used at the grade crossing.

On multi-lane roads, the transverse bands should extend across all approach lanes, and individual RPO symbols should be used in each approach lane.

When used, a portion of the pavement marking symbol should be directly opposite the Advance Warning Sign (W-10-1). If needed, supplemental pavement marking symbol(s) may be placed between the Advance Warning Sign and the grade crossing, but should be at least 50 feet from the stop or yield line.

Note: In an effort to simplify the figure to show warning sign and pavement marking placement, not all required traffic control devices are shown.
Starting Point

- Heavy Rail Roundabouts –
  - Tavares, FL (90’s)
  - Napa Valley (coming soon)
- Examples from Europe, Asia, Australia
Salt Lake City, UT
Scanning Tour Goals

- Investigate Crossing Treatments at Transit / Roundabout Intersections
- (And I wanted to go to Europe and write it off)
Design Roundabout with a Rail Crossing and pedestrian/non-motorized usage

Scanning tour in March 2017
Nantes, France
Factors that would change design
Nantes, France
Nantes Tram Ways – 30+ Rail / Roundabouts

Tramway lines in Nantes and roundabouts
Yellow line BRT with 7 Roundabouts
BRT Left-turn at Mini Roundabout
Amsterdam LRT Rbt
LRT / Roundabout Recommendations

Legend:
- Finishing of the tracks with different material, color or texture than the surrounding areas
- Marking stop lines before the crossings of the LRT tracks
- Traffic lights before the crossing of the tracks by the circular road
- LRT warning signs before the crossings of the LRT tracks by the circular road (on the pole of the traffic light)
- LRT warning signs before the entrances of the roundabout (advanced signs)
Roundabout Design Considerations

1. Good Speed Control
2. Proper Deflection
3. Intuitive User Path
Pedestrian Crossing Options

TABLE X
How Much Protection Do we Need?

Figure 123. Example of a pedestrian automatic gate with an exit gate.

Source: Fitzpatrick

Figure 118. Example of an audible warning device.
Outside Truck Apron
Rail Crossing Markings
Other Considerations

- School Bus Stop
- Sight Distance
- Distance to view Gate Lights
SIGHT DISTANCE

STOPPING SIGHT DISTANCE CALCULATIONS:

\[ SD_s = 1.47 \times Y_0 \times t + \frac{V_0^2}{2g(1 + G \pm G)} \]

- \( SD_s \) = Stopping Sight Distance, m
- \( Y_0 \) = Average Vehicle Length, m
- \( t \) = Vehicle Reaction Time, sec
- \( V_0 \) = Design Speed, m/s
- \( g \) = Assumed Deceleration, m/s²
- \( G \) = 0.5 

NOTE: 22 MPH IS THE FASTEST PATH AT THE ROUNDABOUT.

HORNE SIGHT VISIBILITY ANALYSYS
FOR EASTBOUND TO SOUTHBOUND TURN
02/13/2019
Not Everything is Perfect