

The Evolution of Roadway Geometric Design

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The Evolution of Roadway Geometric Design

- Era of Widespread Paving (1920s-1930s-1940s)
- Era of Big Roadbuilding (1950s-1960s-1970s)
- Era of System Preservation (1980s-1990s)
- Era of Incremental Enhancements (2000s-2010s-2020s)

Era of Incremental Enhancements

- We have built the system and preserved it...now what?
 - We aren't building a lot of new roads
 - Funding increasingly focused on maintenance
- Let's get the most out of the system we have!
 - Intelligent transportation systems
 - Asset management
 - What about design (or primarily re-design)...

Era of Incremental Enhancements ... in Design

Three key themes in the current era:

- **Design for the Setting**
- **Design with Innovation**
- **Design for Active Transportation**

Design for the Setting

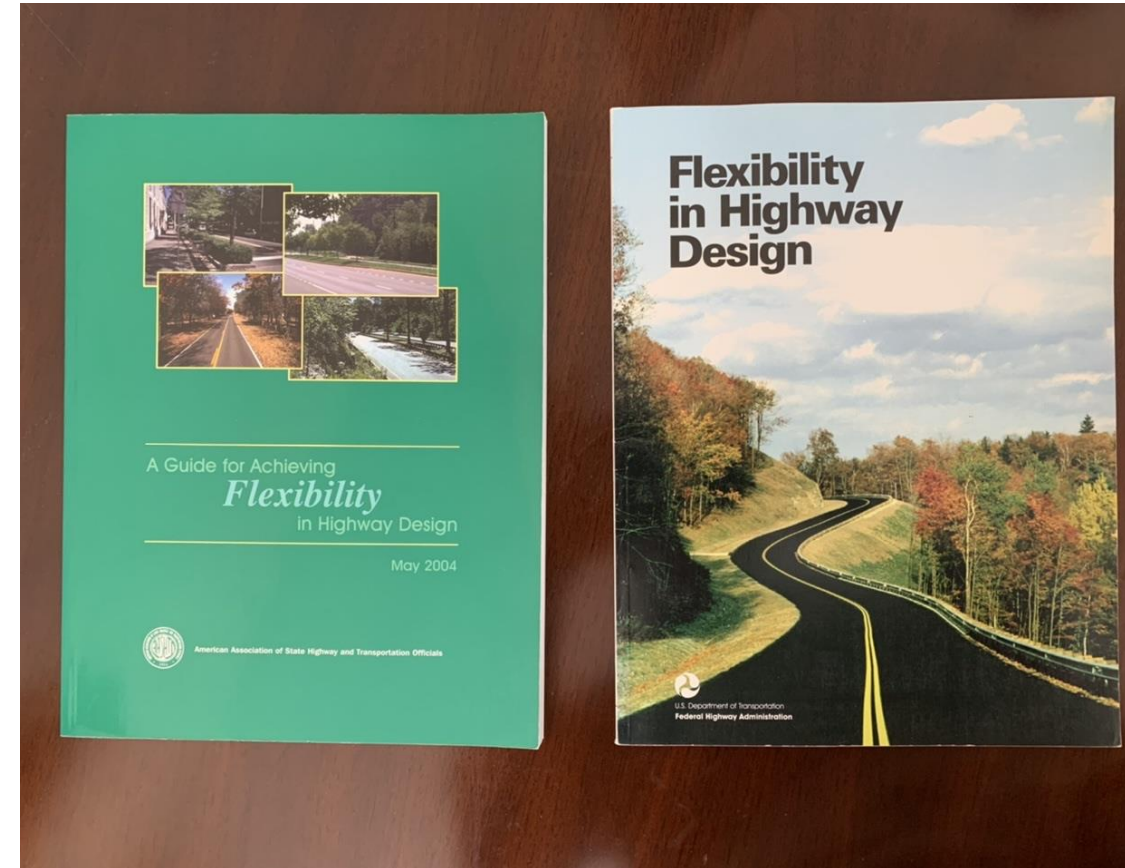
- Design approach that values the setting or context of the facility/project
 - Balance interests of the community with that of the greater system
 - “Context-Sensitive Design”

Context-Sensitive Design

- What is “Context-Sensitive Design (CSD)”?
 - A movement beginning in the 1990s to promote incorporation of community interests in highway design (typically redesign of existing urban/suburban facilities)
 - Also known as context-sensitive solutions (CSS), flexibility in highway design
 - Intended to result in a design that retains (to some extent) the aesthetic and historical context of a facility

Key developments in Context-Sensitive Design

- **FHWA** support of this concept embodied in **1997** FHWA report “Flexibility in Highway Design”
- **AASHTO** support of this concept embodied in **2004** AASHTO report “A Guide for Achieving Flexibility in Highway Design”



Context-Sensitive Design: A definition

- CSD asks questions first about the need and purpose of the transportation project, and then equally addresses safety, mobility, and the preservation of scenic, aesthetic, historic, environmental, and other community values. CSD involves a collaborative, interdisciplinary approach in which citizens are a part of the design team.

From a national conference on this topic in 1998

CSD: What does it mean for us?

- **Greater public involvement, throughout project development,** particularly in the early phases when key design decisions (such as design speed, lane widths, alignment, etc.) are made
- **Resultant design that typically has strong community support,** addresses multiple modes of transportation more evenly, and retains more roadside and nearby features than traditional design

CSD: What does it mean for us in the design process?

- Selection of design elements, within established guidelines (e.g., the AASHTO Green Book), that may differ from values we might typically use
- Decisions on tradeoffs
 - For example: “Should we keep these trees in the clear zone?”
 - Possible increased use of design exceptions

Context-Sensitive Design Examples



Note that these examples also tie into the ideas of:
Design with Innovation
Design for Active Transportation

Design for Active Transportation

- Emphasis on providing for all modes of transportation
 - Walking and cycling predate the motor vehicle!
 - Era of big roadbuilding
 - Bicycle and pedestrian facilities were generally ignored
 - Modern era – increased interest in facilitating walking and cycling
 - Environmental benefits
 - Public health benefits
 - People walk and bike - it happens!



Fox Run Pkwy

Street sign

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Federal legislation (1991)

1991: ISTEA (Intermodal Surface Transportation Efficiency Act)

Phrases “due consideration” and “presumptive accommodation” first appeared

Created “Transportation Enhancements” funding program

Required state DOTs to identify a state pedestrian and bicycle coordinator

23 USC 217: Implementation of ISTEA requirements for transportation planning

“Bicyclists and pedestrians shall be given due consideration in the comprehensive transportation plans developed by each metropolitan planning organization and the States”

Federal policy (2009)

2009: FHWA Directive to State DOTs:

- “Bicycling and pedestrian facilities will be incorporated into all transportation projects unless exceptional circumstances exist”.
- Exceptional circumstances [verbatim]:
 - Bicyclists and pedestrians are prohibited by law from using the roadway
 - The cost of establishing bikeways or walkways would be excessively disproportionate to the need or probable use
 - Where a sparsity of population or other factors indicate an absence of existing and future need.

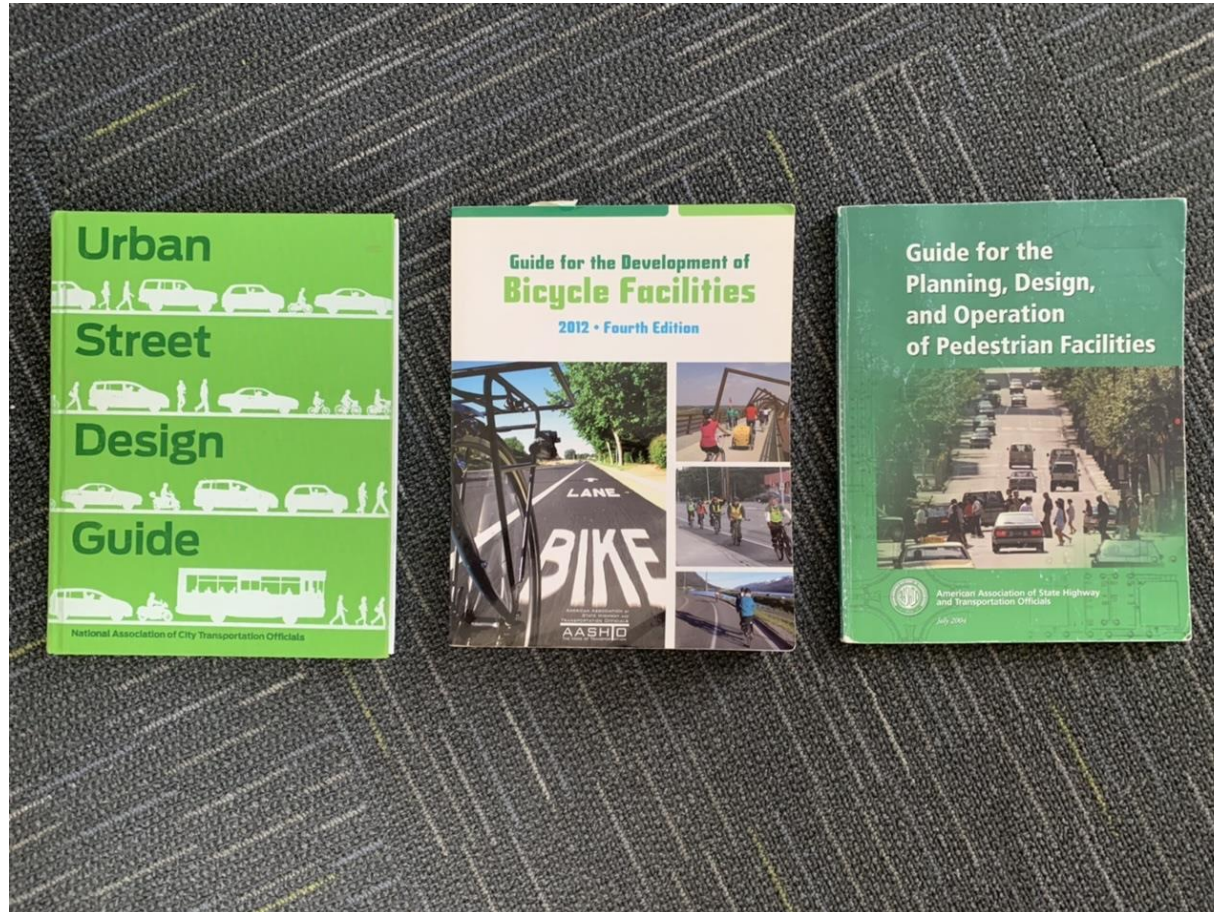
FHWA support through Every Day Counts (2017-2020)

2017: “Safe Transportation for Every Pedestrian” (STEP):

Encourage use of several safety countermeasures:

- Rectangular Rapid Flashing Beacons
- Pedestrian Refuge Island
- Crosswalk Visibility Enhancements
- Pedestrian Hybrid Beacons
- Leading Pedestrian Interval
- Raised Crosswalk
- Road Diet / Roadway Reconfiguration

Key resources for bicycle and pedestrian facility design



AASHTO Green Book (2018)

Chapter 4, Cross-Section Elements

Sidewalks are an integral part of city streets and are sometimes also provided in rural areas. However, the potential for collisions with pedestrians is higher in many rural areas due to the higher speeds and general absence of lighting. The limited data available suggest that sidewalks in rural areas are effective in reducing pedestrian collisions.

As a general practice, sidewalks should be constructed along any street or highway not provided with shoulders, even though pedestrian traffic may be light. Where sidewalks are built along a high-speed highway, buffer areas should be established so as to separate them from the traveled way.

AASHTO Green Book (2018)

Chapter 7, Arterials

As a general practice, sidewalks should be provided along arterial streets in urban areas, even though pedestrian traffic may be light. On some sections of arterial streets that traverse relatively undeveloped areas, no initial pedestrian demand may be present, and, therefore, sidewalks may not be needed initially. Because these areas will usually be developed in the future, the design should allow for the ultimate installation of sidewalks.

Bicycle usage can be expected on most arterials in urban areas and should be considered in arterial street design. In the absence of dedicated bicycle facilities, bicycle travel in the motor-vehicle travel lanes should be expected. Separate facilities, such as bike lanes, separated bike lanes, and shared-use paths help preserve capacity for motor vehicles while reducing potential conflicts with bicyclists. The *AASHTO Guide for the Development of Bicycle Facilities* (7) should be referenced for appropriate facility selection and design guidance.

Birmingham →

Atlanta →





Design with Innovation

- Innovative approaches to intersections/interchanges
 - Typically for safety and/or operational benefits...
 - Safety
 - Reduce conflict points
 - Reduce crash frequency
 - Redistribute crash types to reduce severity
 - Operations
 - Reduce signal phases and cycle length
 - Reduce travel time/delay

FHWA research program on alternative intersections/interchanges: 2009 report

- Roundabouts
- Displaced left-turn (DLT) intersections
- Restricted crossing U-turn (RCUT) intersections
- Median U-turn (MUT) intersections
- Quadrant roadway (QR) intersections
- Continuous green-T intersections,
- Double crossover diamond (DCD) interchanges (a.k.a. Diverging diamond)

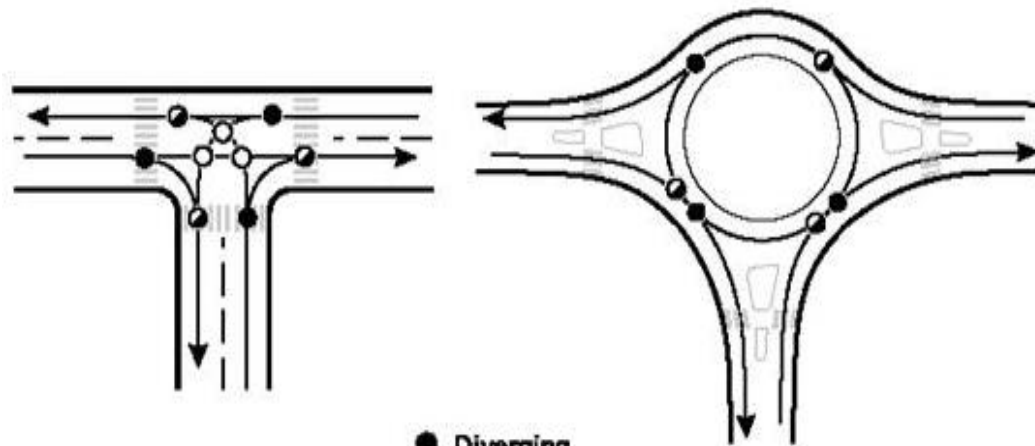


Roundabouts: Timeline

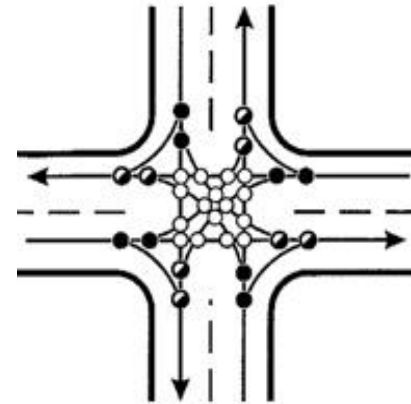
- First “modern” roundabout developed in United Kingdom in **1966**
- First modern roundabout in the US in **early 1990s** in Nevada and Colorado
- *Roundabouts: An Informational Guide*
 - Published by FHWA in **2000** (FHWA-RD-00-067)
 - Comprehensive source of information regarding the planning, design, and operations of roundabouts and how they apply to the U.S. road system
- *Roundabouts: An Informational Guide: Second Edition*
 - Published by NCHRP in **2010** (NCHRP Report 672)

Roundabout Safety: Conflict Comparison

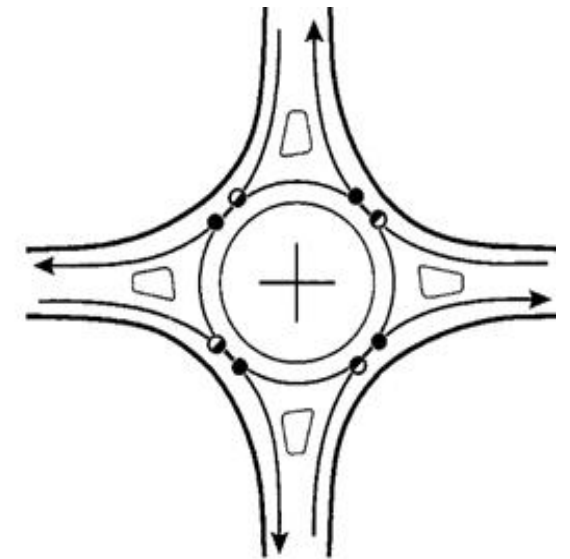
Conflict Points: 3-way intersection



- Diverging
- ◐ Merging
- Crossing

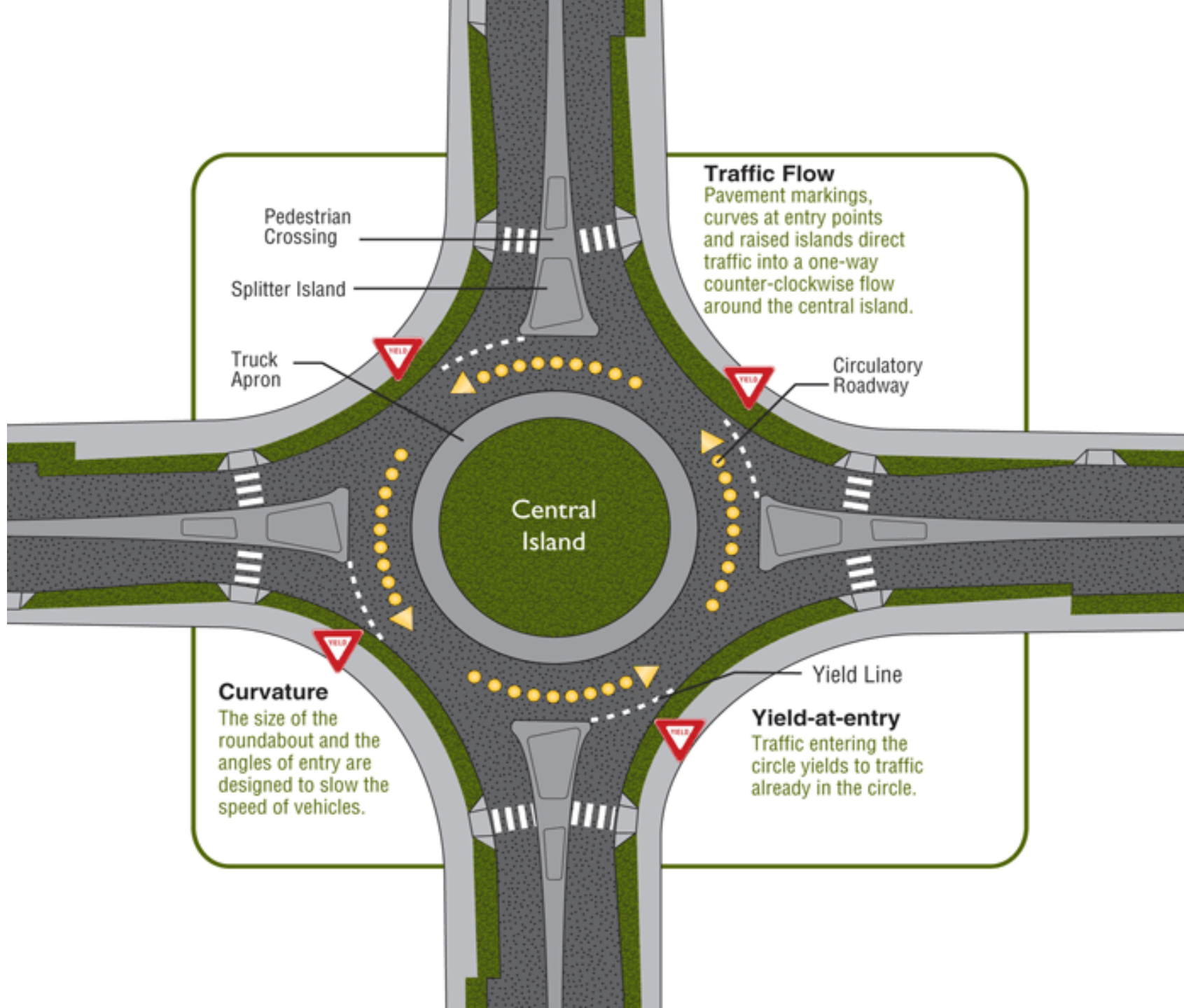


- | | |
|-------------|----|
| ● Diverging | 8 |
| ◐ Merging | 8 |
| ○ Crossing | 16 |
| | 32 |



- | | |
|-------------|---|
| ● Diverging | 4 |
| ◐ Merging | 4 |
| ○ Crossing | 0 |
| | 8 |

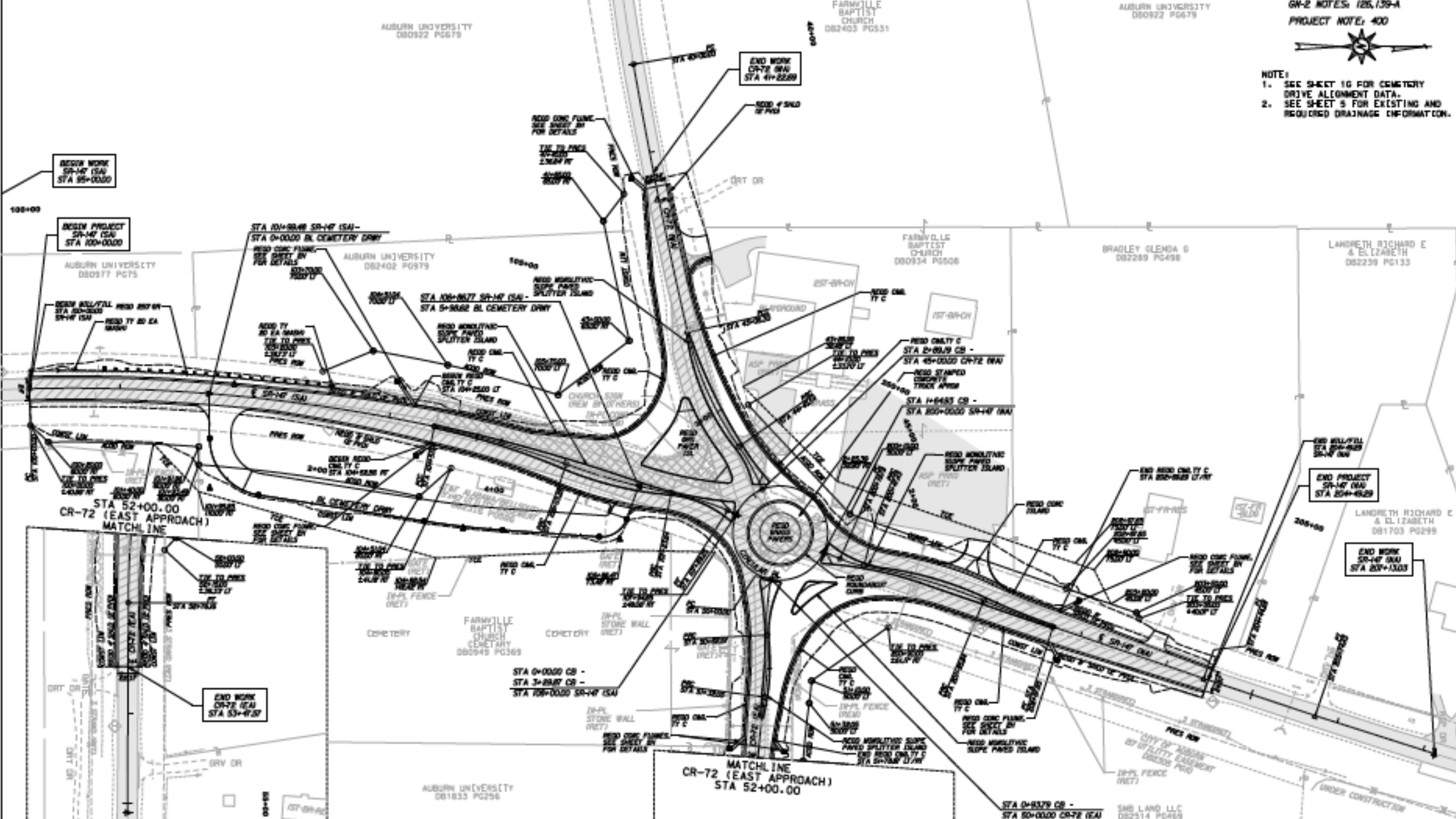
Conflict Points: 4-way intersection







- NOTE:
1. SEE SHEET 1G FOR CEMETERY DRIVE ALIGNMENT DATA.
 2. SEE SHEET 5 FOR EXISTING AND REQUIRED DRAINAGE INFORMATION.



BEGIN WORK
SR-147 (ISU)
STA 95+00.00

BEGIN PROJECT
SR-147 (ISU)
STA 100+00.00

BEGIN MILL/FILL
SR-147 (ISU)
STA 200+00.00

STA 52+00.00
CR-72 (EAST APPROACH)
MATCHLINE

END WORK
CR-72 (EA)
STA 53+47.50

END WORK
CR-72 (EA)
STA 4+22.69

END PROJECT
SR-147 (ISU)
STA 204+62.29

END WORK
SR-147 (ISU)
STA 204+130.00

MATCHLINE
CR-72 (EAST APPROACH)
STA 52+00.00

STA 0+00.00 CB -
STA 50+00.00 CR-72 (EA)

SHO LAND LLC
DB2514 PG493

UNDER CONSTRUCTION





Eastern Shore Toyota
Toyota dealer

ATAP Resources

- Safety Video Series
 - YouTube channel: search “atap auburn”
 - Videos on Roundabouts
 - Videos on Pedestrian Safety

- Recent training opportunities
 - Roundabout Workshop
 - Safe Transportation for Every Pedestrian



Takeaways for today!

- **Design for the Setting**

- Our design practices must balance the transportation need with the interests of the community

- **Design with Innovation**

- Our design practices must consider innovative approaches that provide safety and/or operational benefits

- **Design for Active Transportation**

- Our design and maintenance practices must consider all modes of transportation