# Roundabout Challenges: From Concept to Construction

TexITE Summer Meeting 2010

John Denholm III, P.E., PTOE

LEE ENGINEERING

# Outline

- Roundabout Development
- Concept Challenges
- Design Challenges
- Construction Challenges

LEE ENGINEERING

# Roundabout Development

- Roundabout Consideration
- Traffic Analysis
- Education
- Concept Design / Feasibility
- Detailed Schematic
- PS&E Development
- Construction

LEE ENGINEERING

# Roundabout Development

- Roundabout Consideration
- Traffic Analysis
- Education
- Concept Design / Feasibility

**Concept Stage**

- Detailed Schematic
- PS&E Development

**Design Stage**

- Construction

**Construction Stage**

LEE ENGINEERING

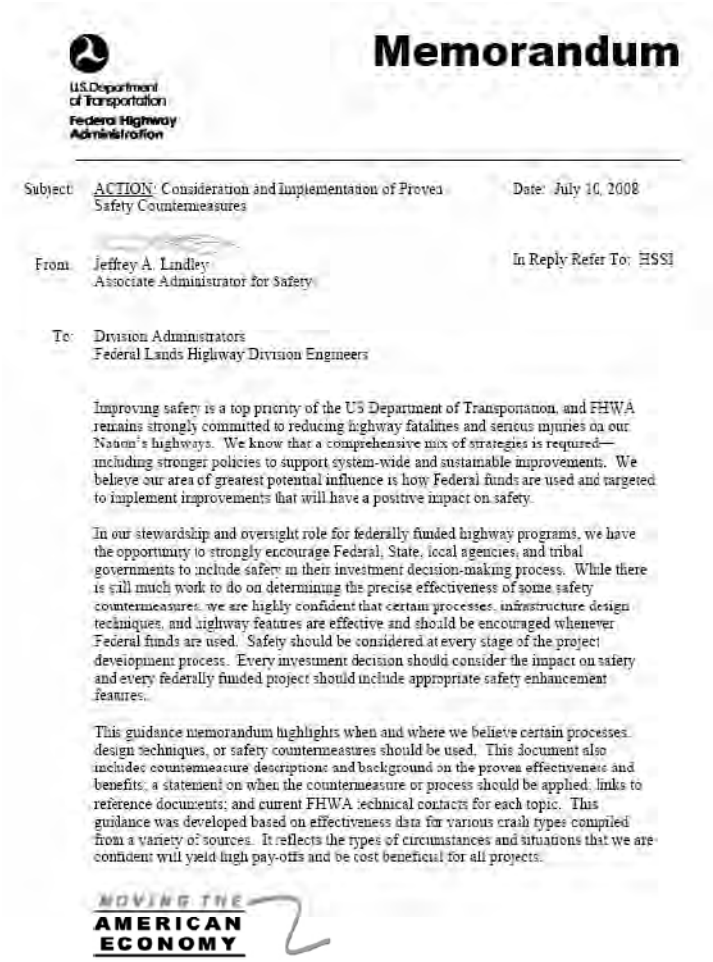
# Concept Challenge

- Is roundabout even an option?
- Often not part of "toolkit"
- Rdbt vs TWSC, AWSC, or Signal
- Introduce early in planning stages
  - TIA / Thoroughfare planning
- New vs Retrofit

LEE ENGINEERING

# FHWA Field Memo – July 10, 2008

## Consideration and Implementation of Proven Safety Countermeasures



U.S. Department of Transportation
Federal Highway Administration

**Memorandum**

Subject: ACTION: Consideration and Implementation of Proven Safety Countermeasures

Date: July 10, 2008

From: Jeffrey A. Lindley
Associate Administrator for Safety

In Reply Refer To: HSSI

To: Division Administrators
Federal Lands Highway Division Engineers

Improving safety is a top priority of the US Department of Transportation, and FHWA remains strongly committed to reducing highway fatalities and serious injuries on our Nation's highways. We know that a comprehensive mix of strategies is required—including stronger policies to support system-wide and sustainable improvements. We believe our area of greatest potential influence is how Federal funds are used and targeted to implement improvements that will have a positive impact on safety.

In our stewardship and oversight role for federally funded highway programs, we have the opportunity to strongly encourage Federal, State, local agencies, and tribal governments to include safety in their investment decision-making process. While there is still much work to do on determining the precise effectiveness of some safety countermeasures, we are highly confident that certain processes, infrastructure design techniques, and highway features are effective and should be encouraged whenever Federal funds are used. Safety should be considered at every stage of the project development process. Every investment decision should consider the impact on safety and every federally funded project should include appropriate safety enhancement features.

This guidance memorandum highlights when and where we believe certain processes, design techniques, or safety countermeasures should be used. This document also includes countermeasure descriptions and background on the proven effectiveness and benefits; a statement on when the countermeasure or process should be applied; links to reference documents; and current FHWA technical contacts for each topic. This guidance was developed based on effectiveness data for various crash types compiled from a variety of sources. It reflects the types of circumstances and situations that we are confident will yield high pay-offs and be cost beneficial for all projects.

MOVING THE AMERICAN ECONOMY

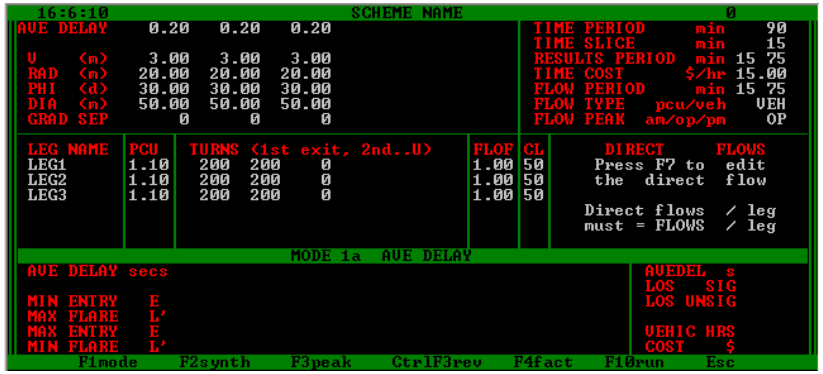
## GUIDANCE STATEMENT:

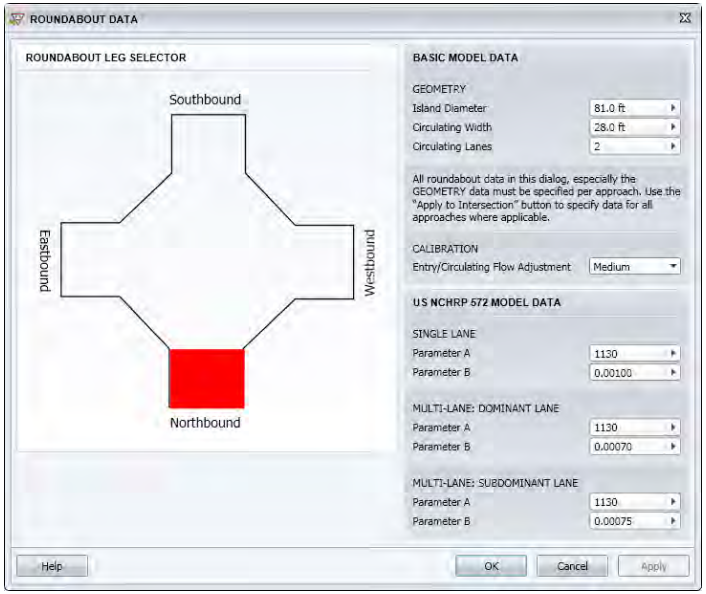
- **"Roundabouts are the preferred safety alternative for a wide range of intersections. Although they may not be appropriate in all circumstances, they should be considered as an alternative for all proposed new intersections on Federally-funded highway projects…"**

LEE ENGINEERING

# Traffic Analysis

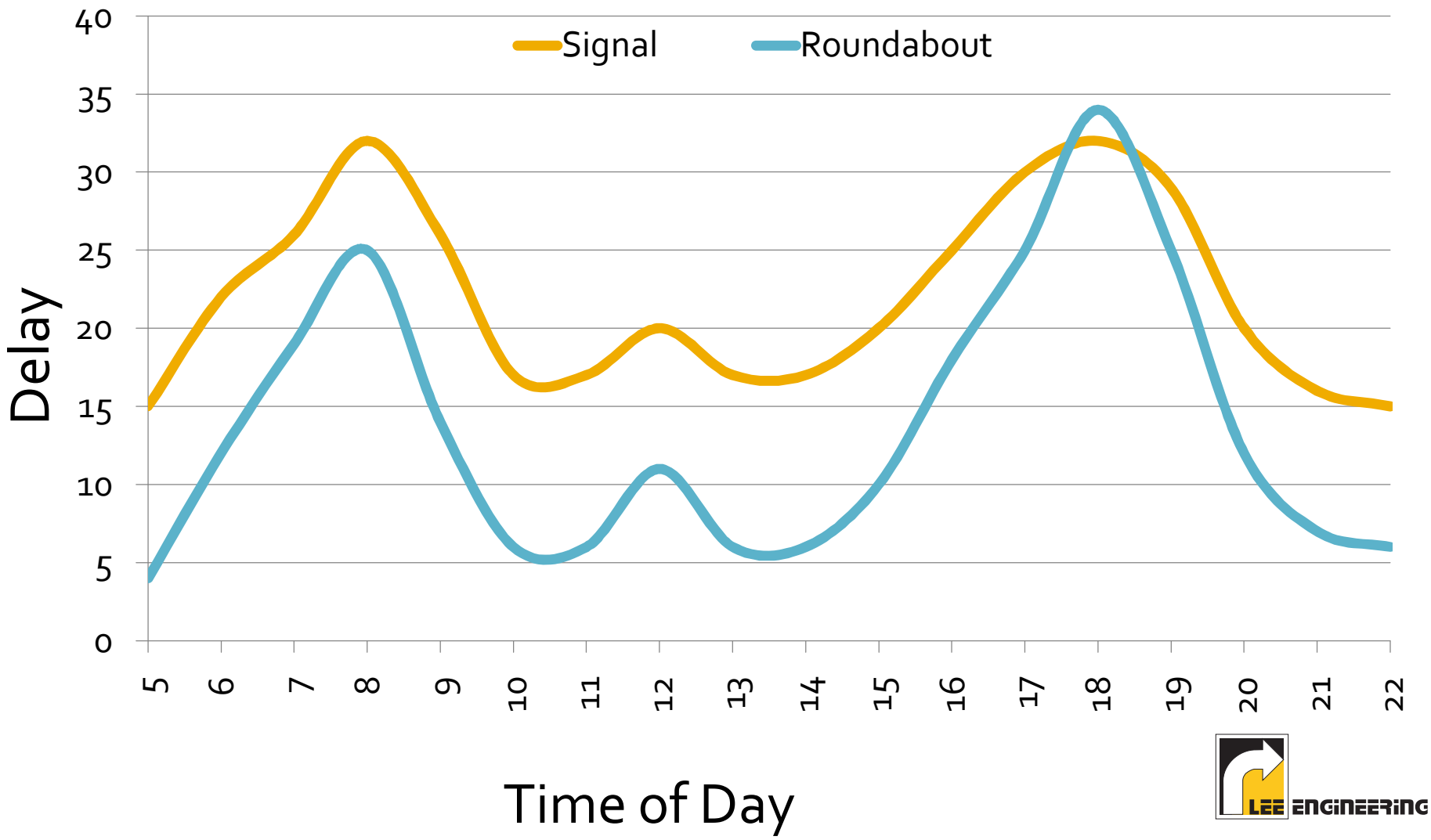
- Which Software?
  - RODEL
  - SIDRA
  - VISSIM
  - ~~Synchro~~




LEE ENGINEERING

# Traffic Analysis



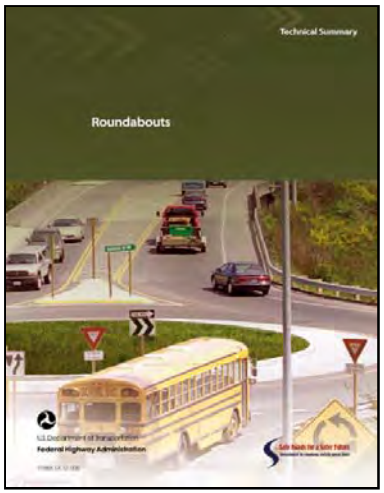

LEE ENGINEERING

# Concept Acceptance

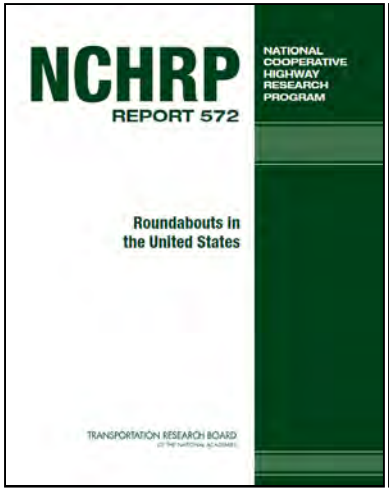
- Staff
- Council
- Public
- Funding source

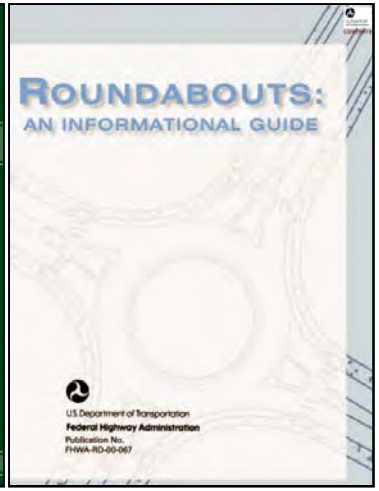

LEE ENGINEERING

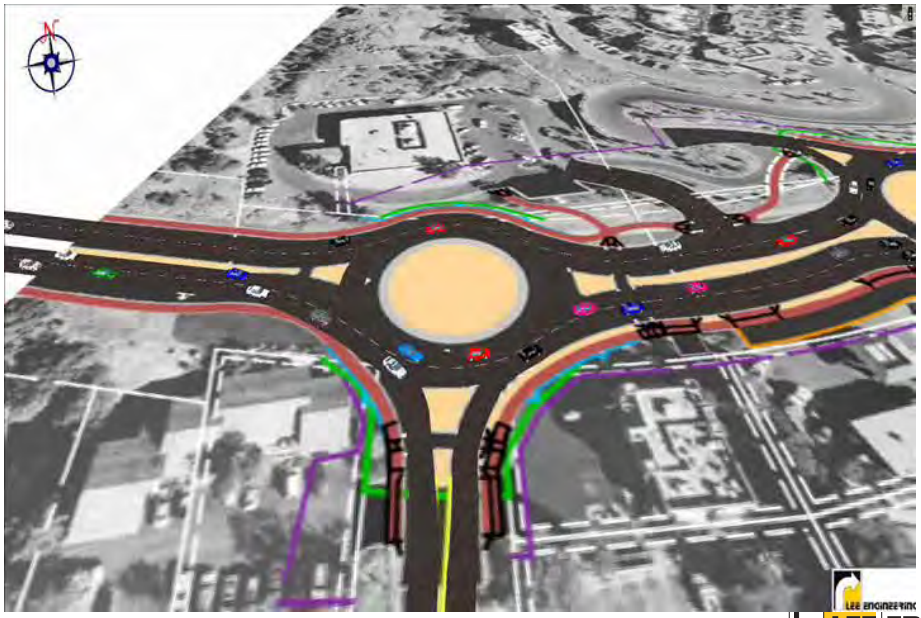
# Education Examples





LEE ENGINEERING

# Education Examples


LEE ENGINEERING

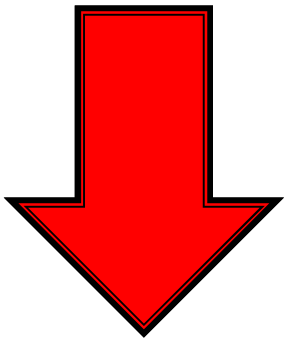
# Educate – Build Support

- Education
  - Create a believer at every level
  - Gain an advocate / champion


LEE ENGINEERING

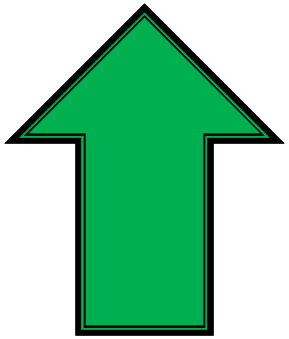
# Public Acceptance

NCHRP Synthesis 264



**Prior to Construction**

**68%** of the responses negative or very negative



**After Construction**

**73%** of the responses positive or very positive

LEE ENGINEERING

# Design Challenge

- Design Vehicles
- "Minor" Changes
- Cost Variability
- Curbing
- Grades

LEE ENGINEERING

# Design Vehicles

- Design Vehicle Tradeoffs
  - ICD Size
  - Circulating Roadway Size
  - Vehicle Speeds
  - Aesthetics

LEE ENGINEERING

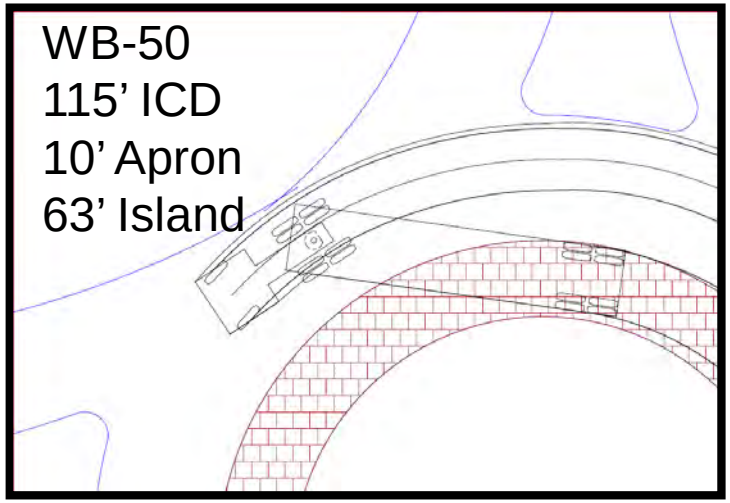
# Design Vehicles

- Decisions
  - Fire Truck / School Bus - Where?
  - Type of Truck (if any)
    - Truck apron

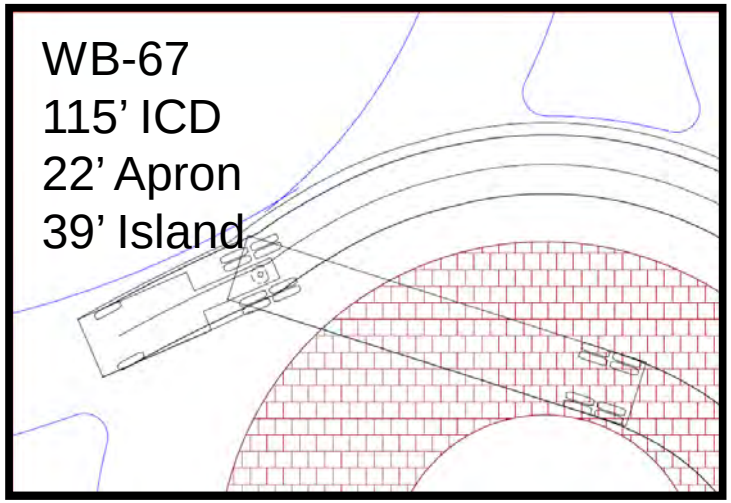
LEE ENGINEERING

# Design Vehicles

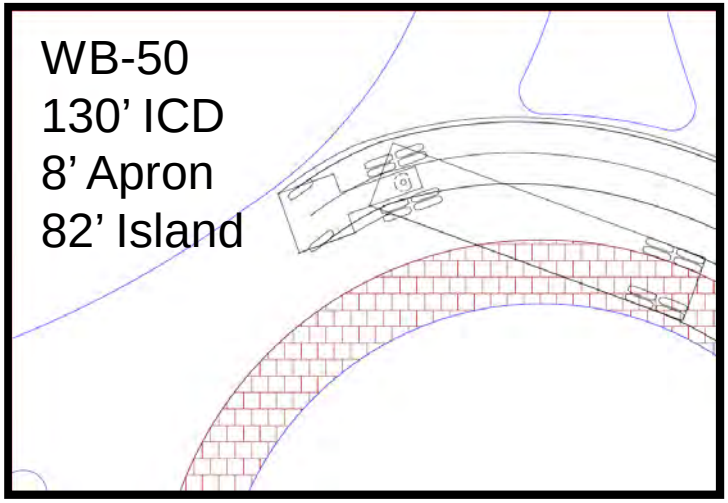
WB-50
115’ ICD
10’ Apron
63’ Island



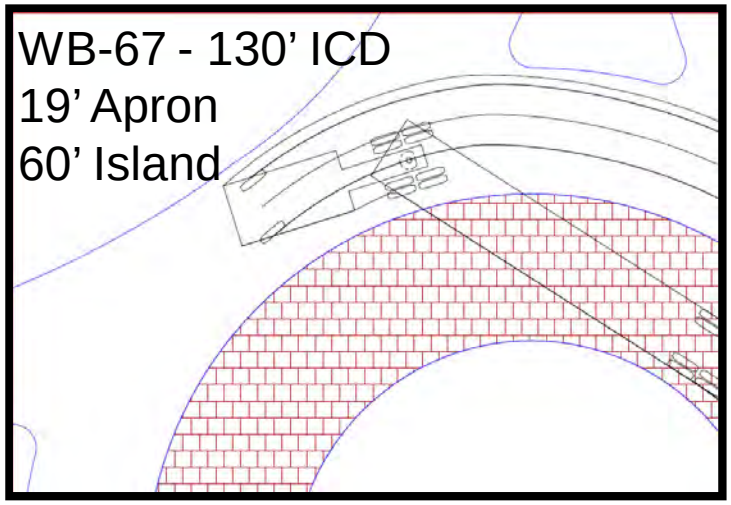
WB-67
115’ ICD
22’ Apron
39’ Island



WB-50
130’ ICD
8’ Apron
82’ Island



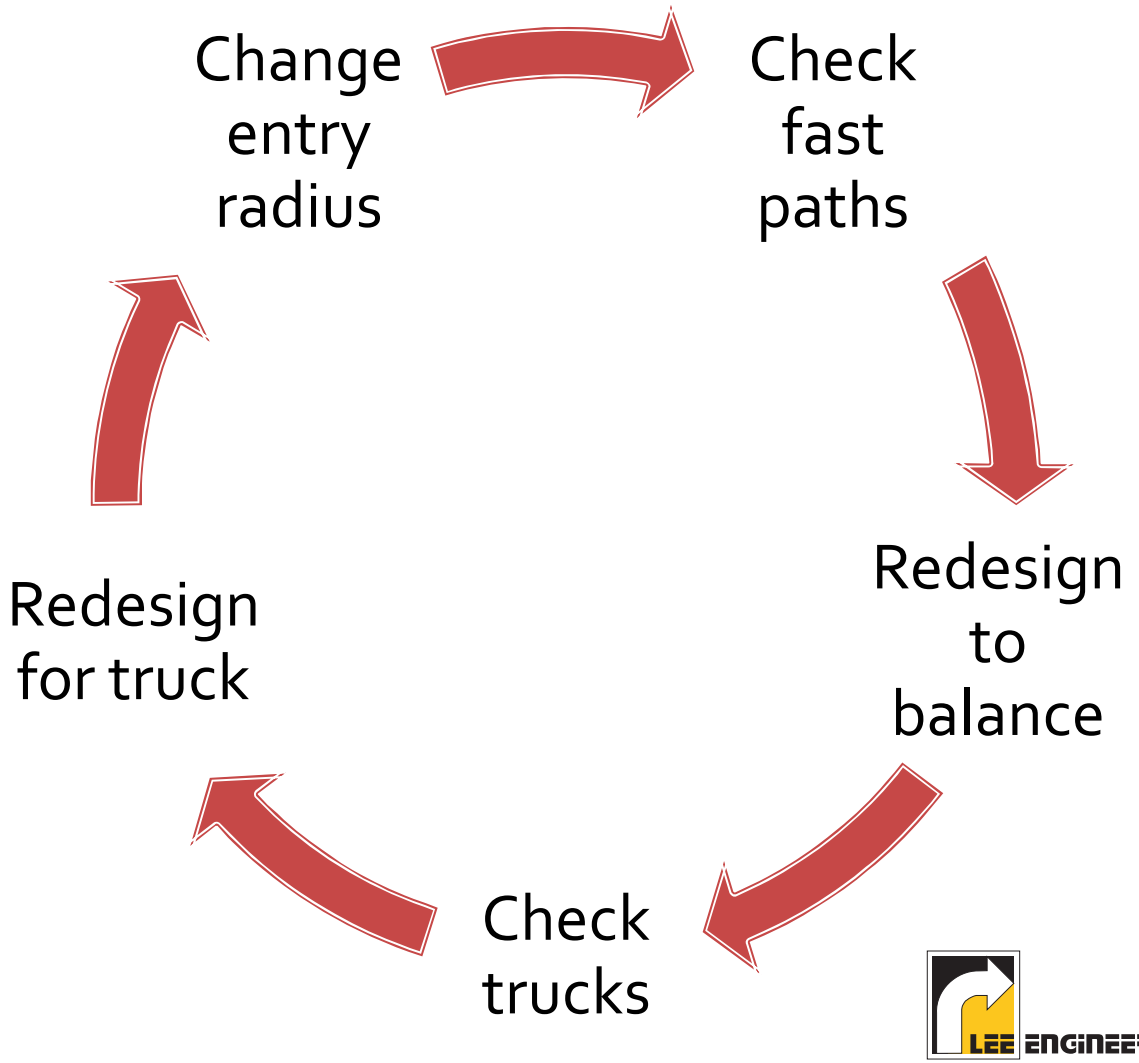
WB-67 - 130’ ICD
19’ Apron
60’ Island



LEE ENGINEERING

# "Minor" Changes

- Layout is iterative
- Snowball
- effect




LEE ENGINEERING

# Cost Variability - Signal

- Low
  - Span Wire, No Turn Lanes
- Medium
  - Standard Poles, No Turn lanes
- High
  - Realign Intersection, LMA, ITS Decorative Poles, Pavement, Drainage, Dual Turn Lanes

LEE ENGINEERING

# Cost Variability - Roundabout

- Low - < $20k
  - Rubber curbing
- Medium - < $150k
  - Fill outsides, build islands, overlay
- High - > $1 million
  - Approach Work, Pavement, Major Drainage, Landscaping, Art

LEE ENGINEERING

# "Low" < $20,000


LEE ENGINEERING

# "Medium" < $150,000

LEE ENGINEERING

# "High" - $525,000 +

# “High” - $525,000 +

# Public Art


LEE ENGINEERING

# Curbing

- Curb selection affects operation
- Laydown/Mountable
- Barrier
- Height
  - Splitter
  - Apron
  - Outside edges

LEE ENGINEERING

# Curbing

LEE ENGINEERING

# Curbing

LEE ENGINEERING

# Curbing

LEE ENGINEERING

# Grades

- More restrictive
- May lead to more earth work
- Truck concerns

LEE ENGINEERING

# Construction Challenges

- Accommodating all users
- Complete Closure
- Build Under Traffic
  - Partial Closures
  - Temporary Detours

LEE ENGINEERING

# All users

- Pedestrians
- Trucks present without apron


# Apron is part of the traveled way

LEE ENGINEERING

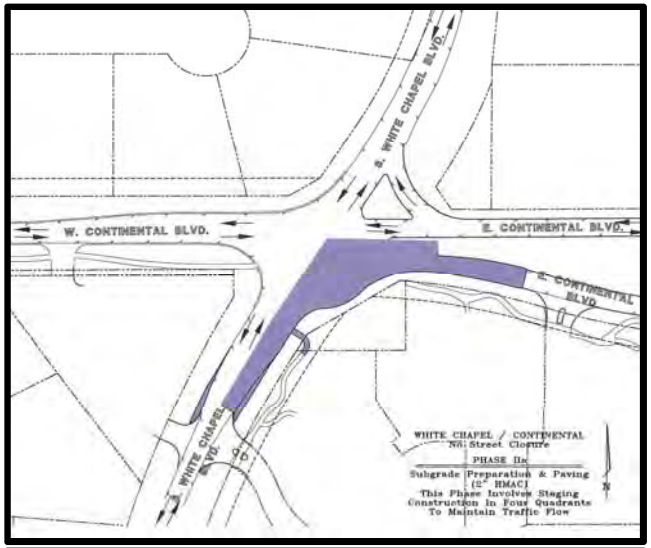
# Construction Sequencing

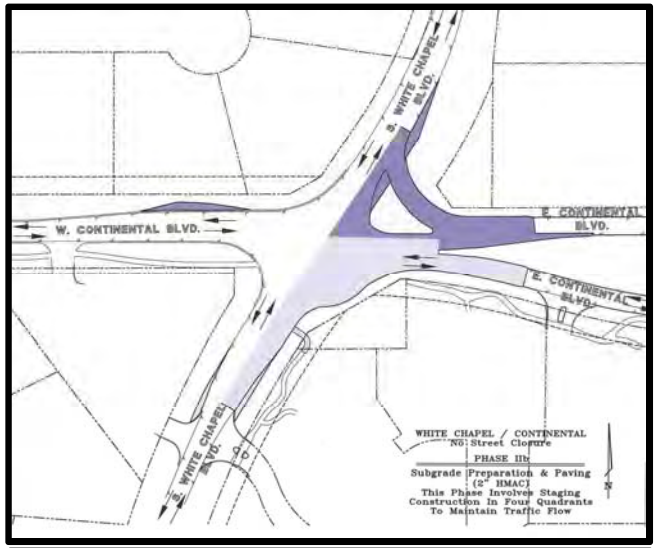
- Complete Closure
  - Fastest construction
    - 30 – 60 Days
  - Less $$$
  - Requires alternate routes
  - Politically unpopular
- Build Under Traffic
  - Slower construction
    - 3 – 9 months
  - More $$$
  - May still require alternate routes
  - Politically unpopular

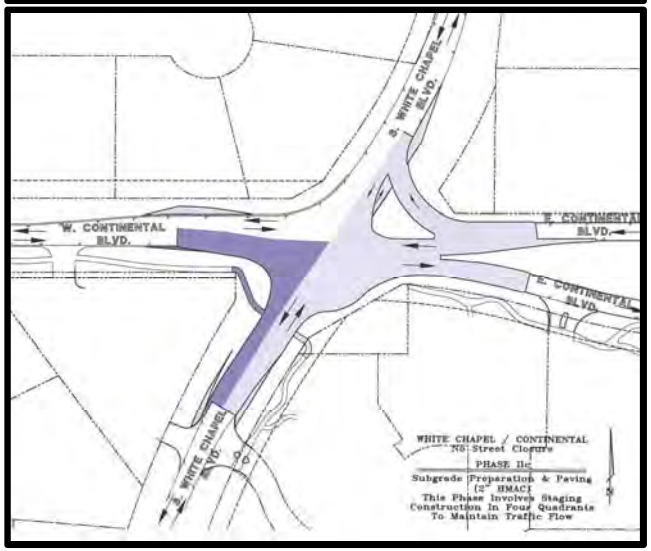
# Construction Sequencing

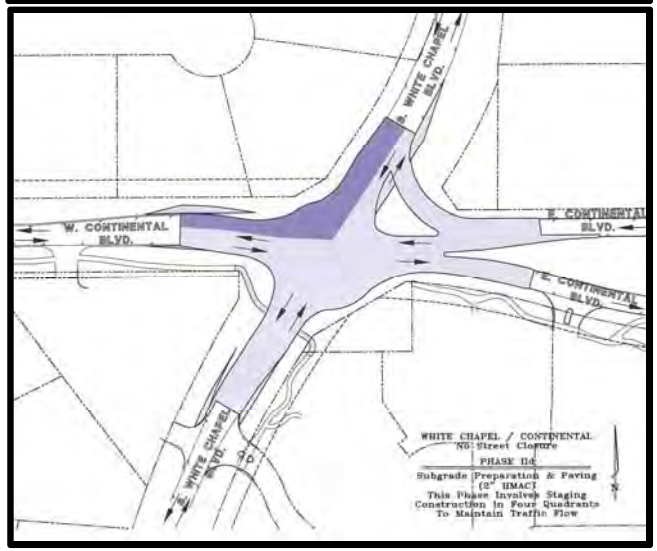
- Complete Closure

# Construction Sequencing

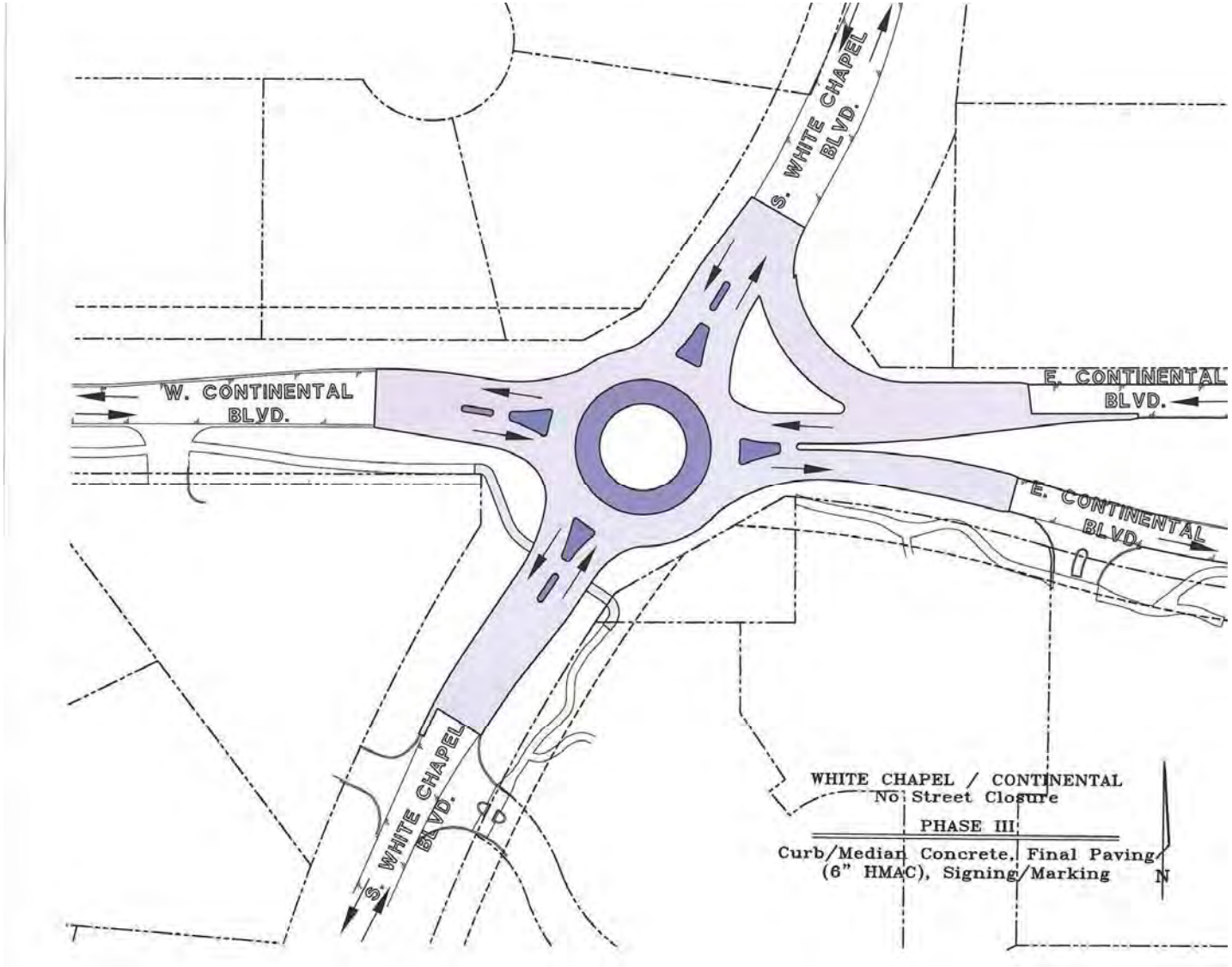


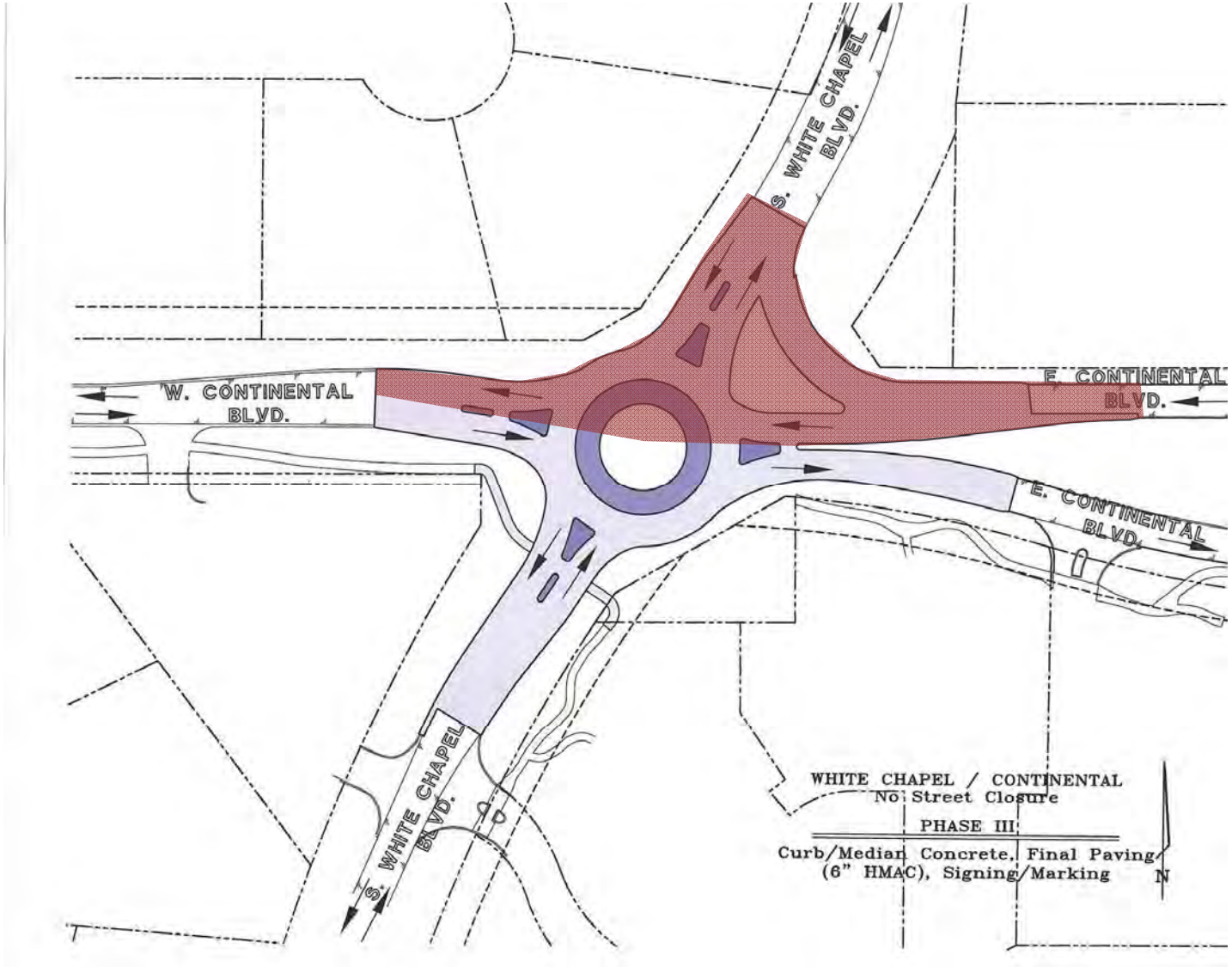



# Construction Sequencing

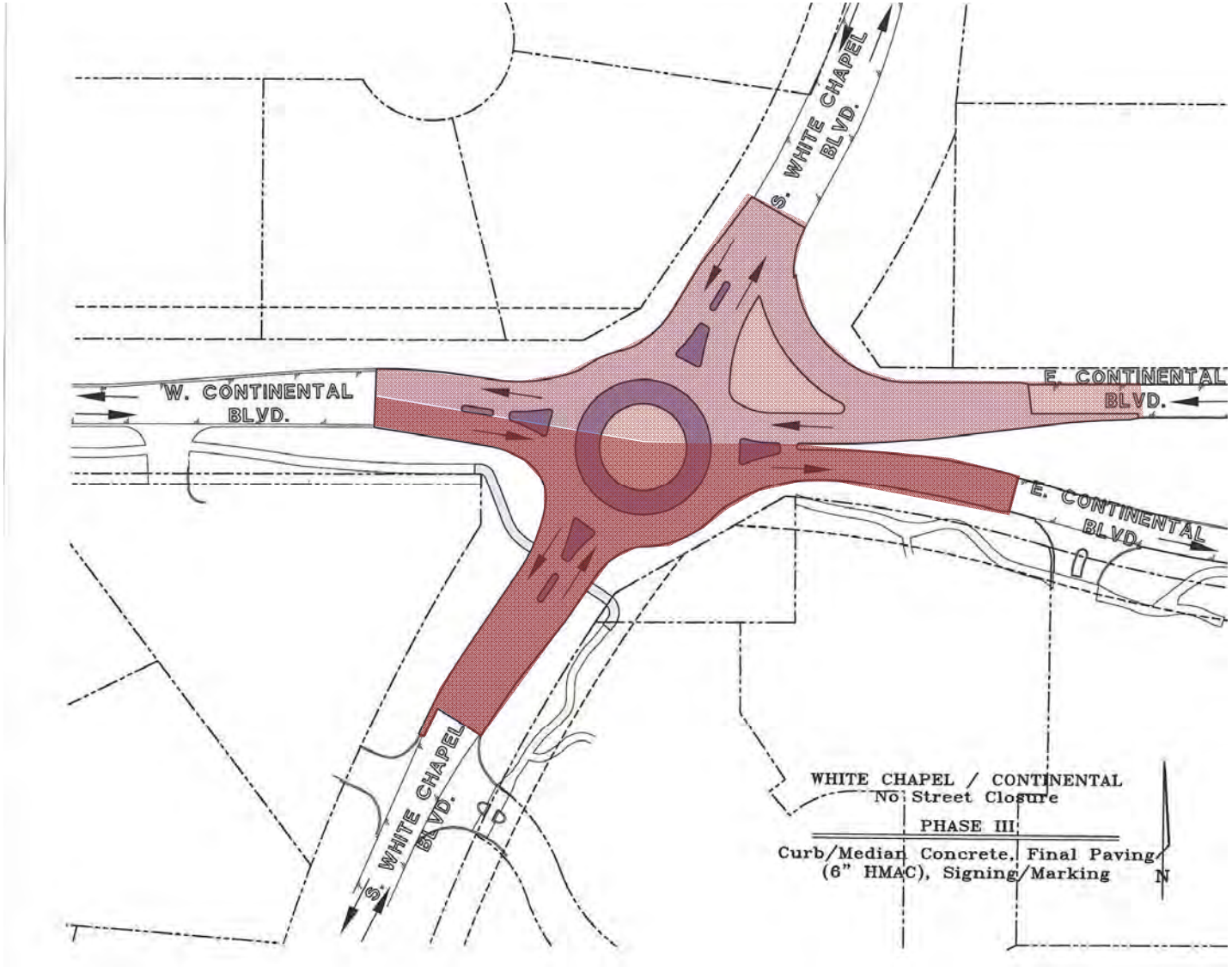


# Construction Sequencing

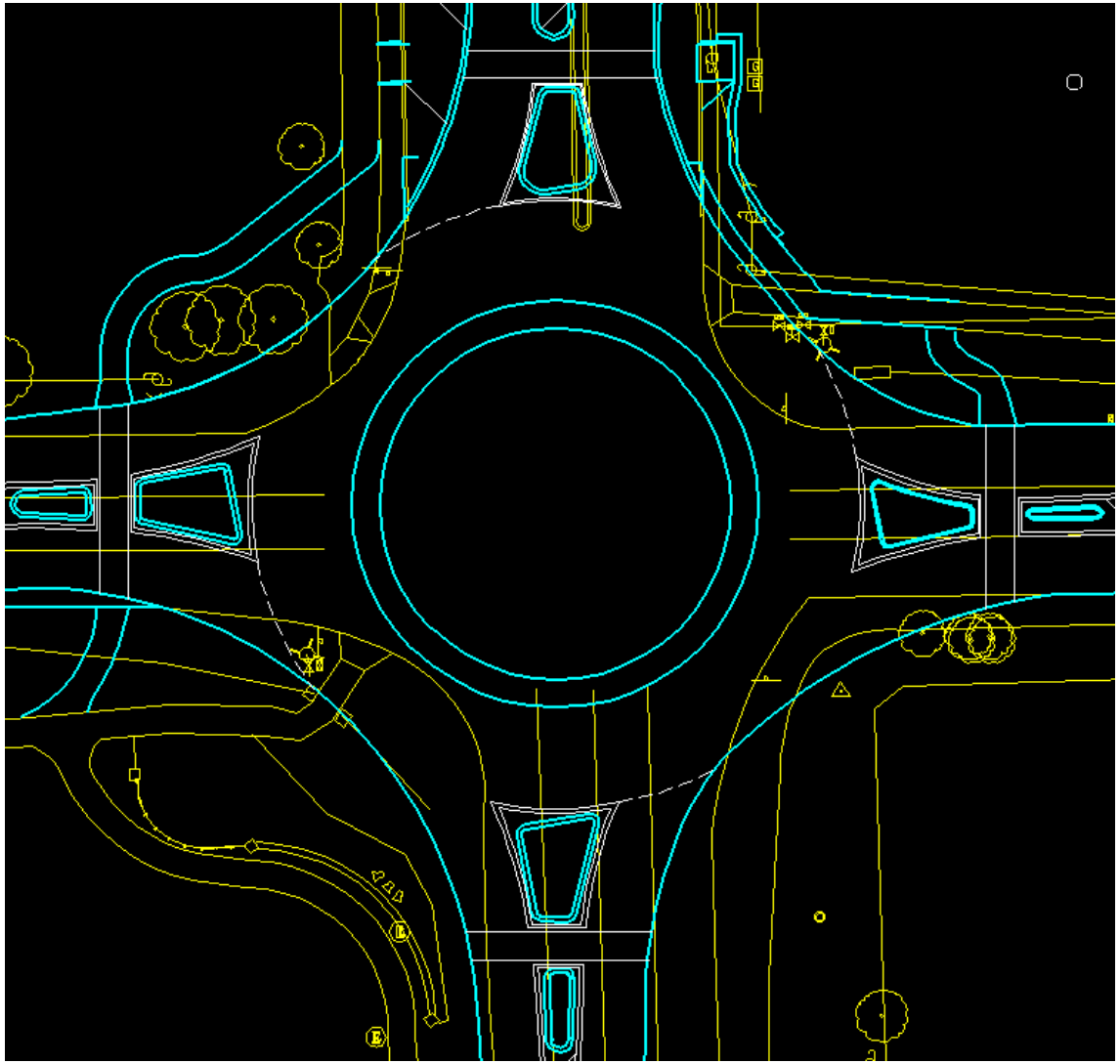
# Construction Sequencing



# Construction Sequencing

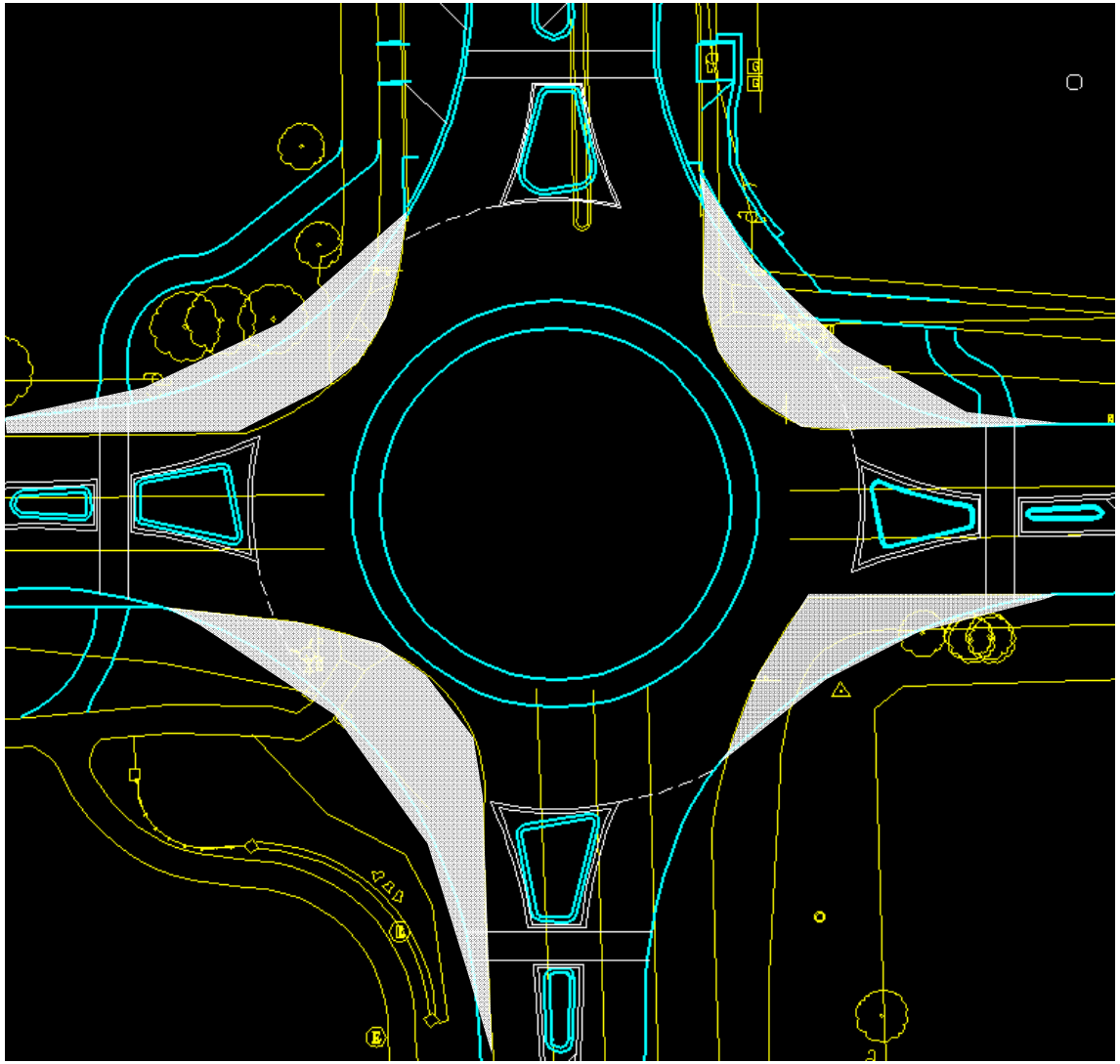


# Construction Sequencing



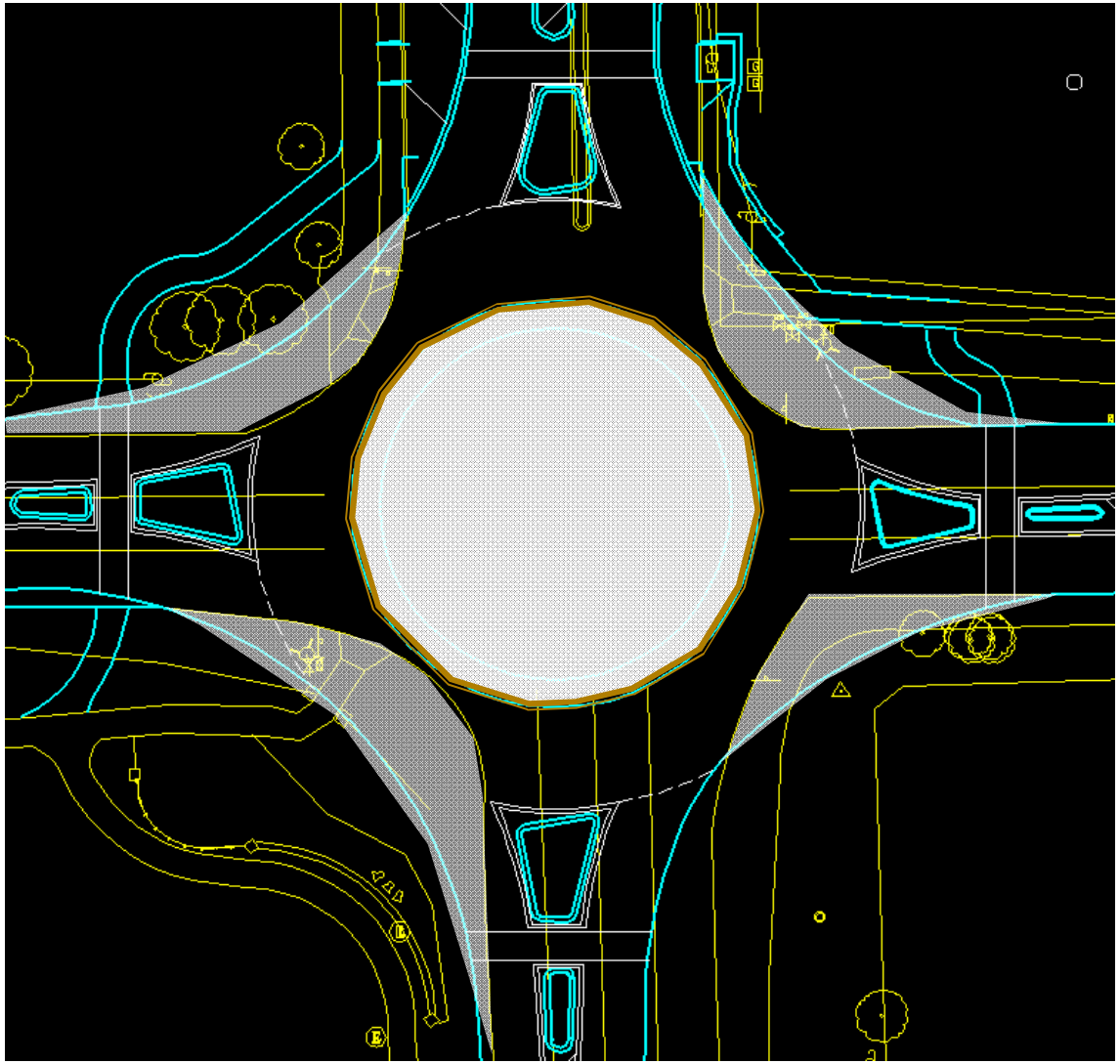
LEE ENGINEERING

# Construction Sequencing



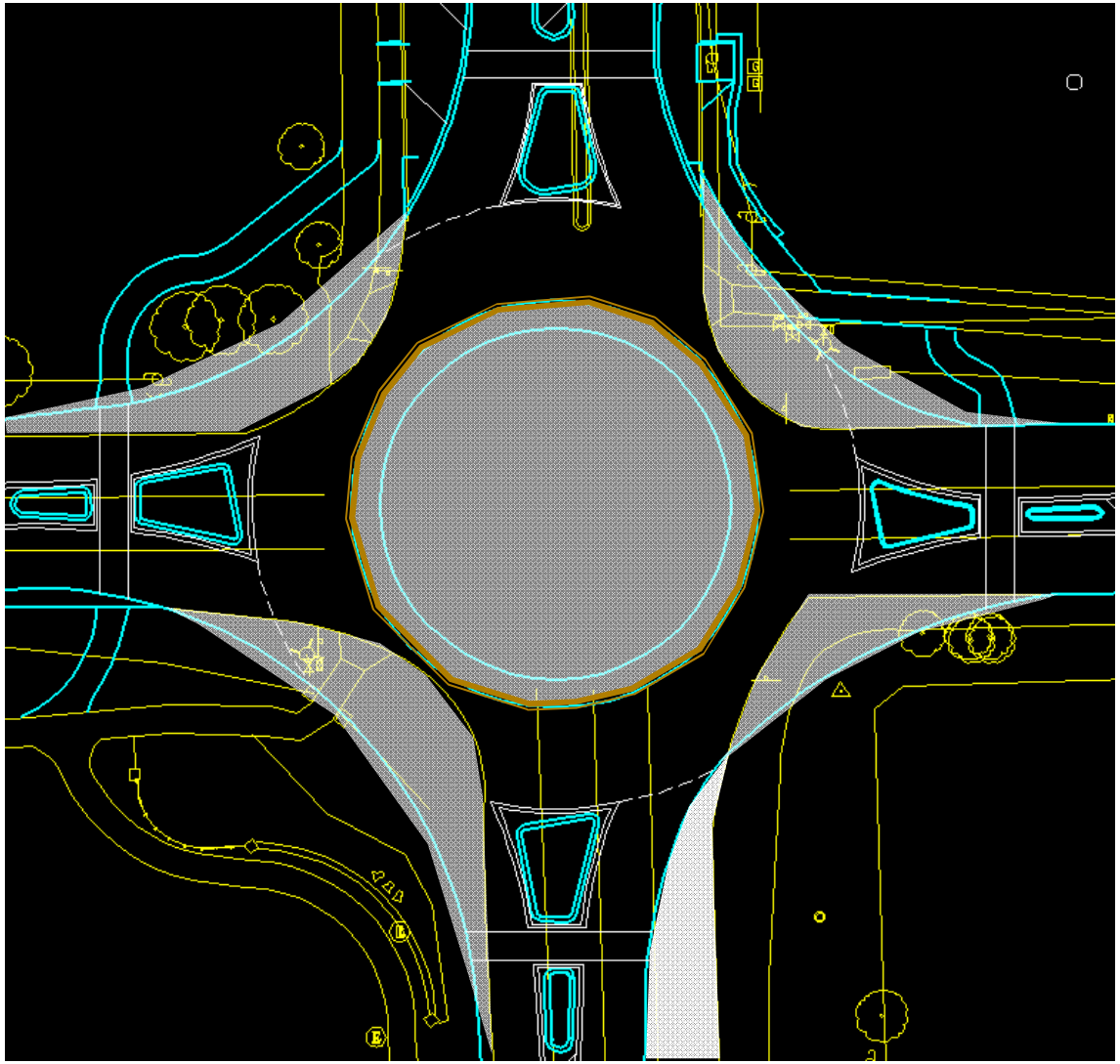
LEE ENGINEERING

# Construction Sequencing



LEE ENGINEERING

# Construction Sequencing



LEE ENGINEERING

# Construction Sequencing



LEE ENGINEERING

# Construction Sequencing



LEE ENGINEERING

# Construction Sequencing

# Conclusion

- Wide variety of challenges at every stage
- Key challenges
  - Stakeholder buy in
  - Iterative principle based design
  - Design vehicle tradeoffs
  - Construction

LEE ENGINEERING

John Denholm, P.E., PTOE

jdenholm@lee-eng.com

972.248.3006

www.lee-eng.com/roundabouts



LEE ENGINEERING