

Introduction

The City of Angola expressed interest in redesigning a three-way intersection on East Harcourt Road and Williams Street. The intersection rests between the YMCA of Steuben County, Project Help Building, and a residential area to the intersection's southeast.

Over the past 3 years, there have been 10 car accidents and reckless driving complaints. The City of Angola is also planning to expand a residential neighborhood north of the intersection. The roundabout will provide a physical obstacle to slow traffic to safe speeds while giving pedestrians safe movement across the intersection.

The final roundabout is 150 ft in diameter with a pedestrian trail around the perimeter. The center island contains a garden with 3 types of native plants; Annabelle Hydrange, Marsh Milkweed, and Purple Cane Flower.

Our group did a Phase 1 design of the roundabout, which included a preliminary survey, geometric design, pavement design, maintenance of traffic, stormwater management, and cost estimate.



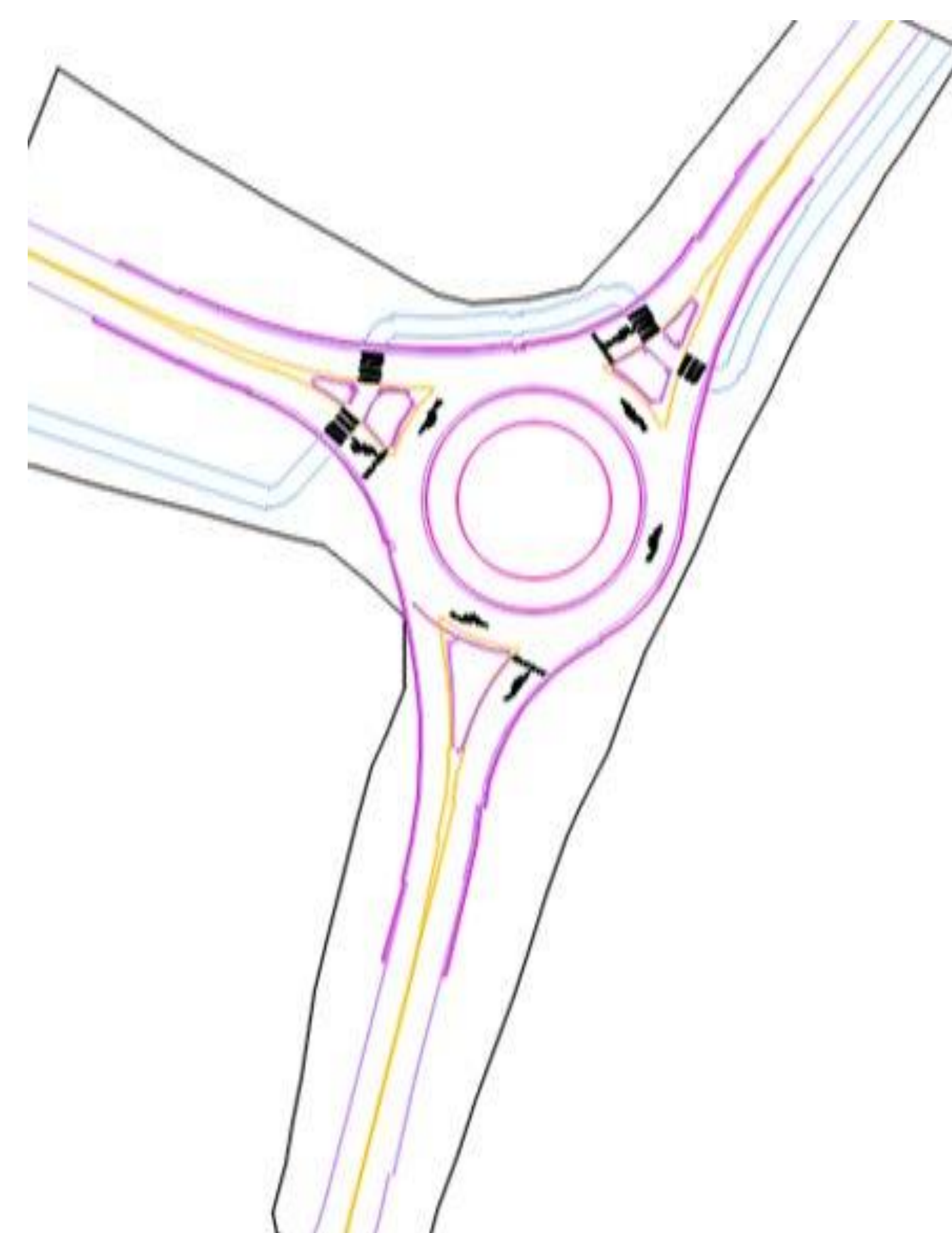
Preliminary Survey

For the preliminary survey, took elevations at points of interest using a TOPCON GPS rover. Points of interest included a fire hydrant, manhole, and light pole. There were also two swales and a constructed wetland near the site. With plans provided by Amanda Cope, Angola's City Engineer, there was also a water main line and sewage line running along Williams Street.

Roundabout Design

For the geometric design of the roundabout, we first drew a preliminary sketch with a diameter of 150 feet, a circulatory roadway width of 18 feet, and 50 feet long splitter islands. This design was used to run calculations through the roundabout to ensure that the differential speeds of all three approaches were within safe limits. Additionally, we made sure that our design vehicle could safely navigate through the intersection. After some iterations with deflection entering the intersection, the final design resulted in the same dimensions listed above. We also added pavement markings to this design using standard markings for the State of Indiana, including direction arrows, yield bars, and crosswalks.

We placed a pedestrian trail through the intersection to connect an existing trail to future development. To ensure a safe pedestrian refuge in the splitter islands, they needed to be 50 feet long. This is essential so pedestrians are only required to cross one lane of traffic at a time. The placement of the trail was chosen due to the limited Right of Way in the southwest corner and along the east side of the intersection. The final design of the intersection and pedestrian trail fits in the existing Right of Way and does not require the demolition of any nearby structures.



Pavement Design

JP&C conducted standard pavement design operations through the Mechanistic-Empirical Pavement Design (MEPD) software. MEPD analyzes multiple variables the intersection will undergo in a 20-year period. These variables include weather, Average Annual Daily Traffic (AADT), and Average Annual Daily Truck Traffic (AADTT). The resulting pavement design can be seen below.

Layer	Depth
QC/QA-HMA, 3, 70, Surface, 12.5mm	2 inches
QC/QA-HMA, 3, 70, Intermediate, 19.0mm	6 inches
QC/QA-HMA, 2, 64, Aggregate Base, 19.0mm	9 inches
Subgrade Treatment	

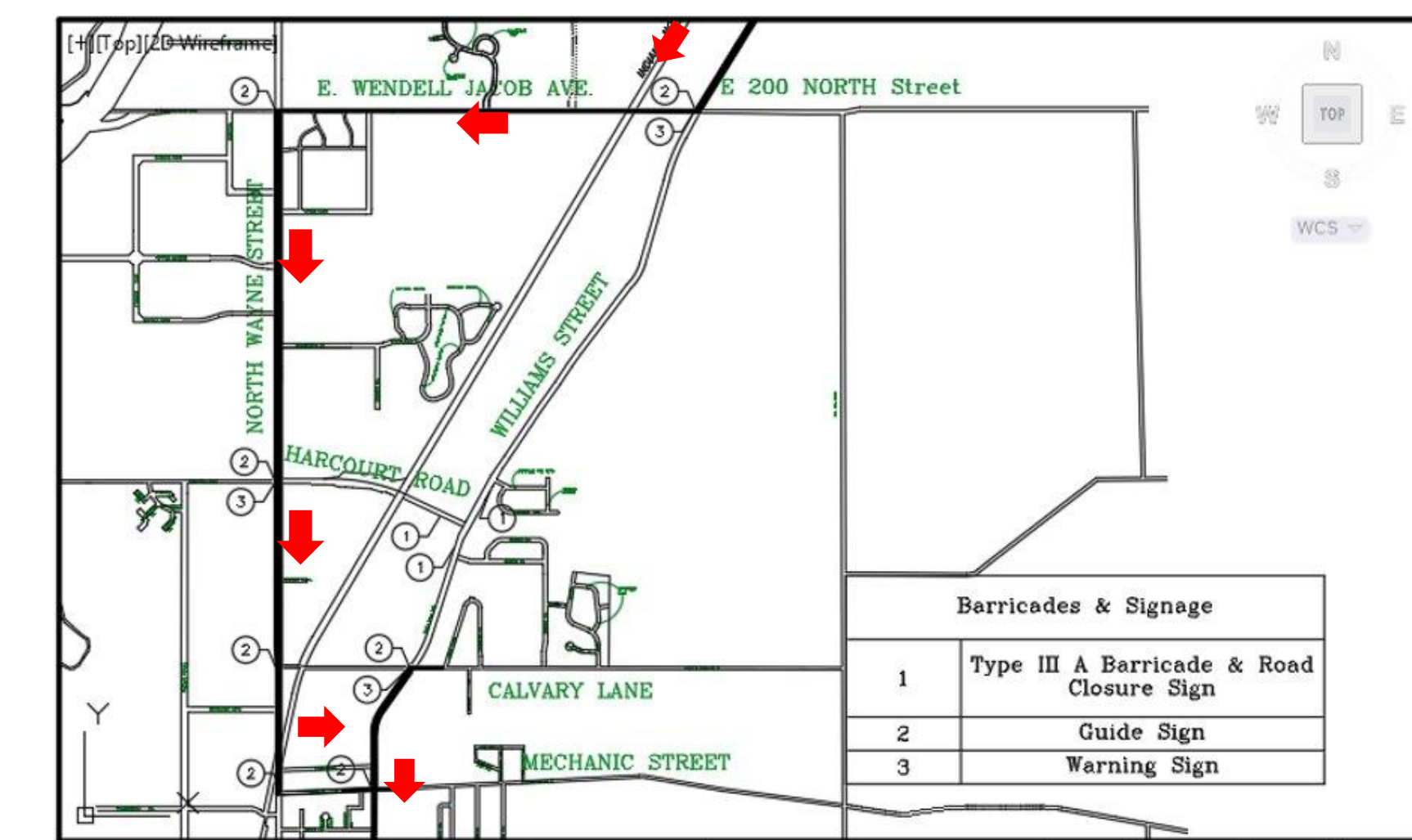
Stormwater Management



The Angola Stormwater Ordinance and the City of Indianapolis Stormwater Specifications Manual were used for determining stormwater volume and storage. Although the roundabout is expected to decrease the expected stormwater runoff, it will cover pre-existing stormwater controls. The water will be controlled with curb cuts every 50 feet along East Harcourt Road and Williams Street. The Rational Method was used to determine peak water flow on the roundabout. Our team then used the water flows to calculate curb cut sizes. We estimate needing 16, 2-foot curb cuts along the roads leading into the roundabout and 3, 4-foot curb cuts along the roundabout. The stormwater will then be stored in 6 swales placed along the roundabout.

Maintenance of Traffic

A maintenance of traffic plan was established by JP&C to facilitate the transportation of the public during construction. Standards for maintaining traffic were selected from INDOT Chapter 503: MOT. During construction, JP&C, will initiate a full closure of the intersection. Traffic will be routed through E 200 N Street, E Wendell Jacob Avenue, N Wayne Street, and Mechanic Street.



Cost Estimate

Our group used the INDOT Standard Price Index to calculate the material and equipment costs. Mobilizing construction equipment and demolition is expected to be \$146,140. The cost of asphalt and concrete for the roundabout, sidewalk, and truck apron is projected to be \$430,150. Proper signage for the detour route during construction was \$5,222. Based on the Maintenance of Traffic, expenses incurred to drivers detouring around the construction site are \$2,764.00. In addition to material costs, a 10% contingency was added for problems during construction, making the total cost \$930,450.

Cost Estimate	
Item	Cost
Construction Engineering	\$37,848.67
Mobilization and Demolition	\$369,879.52
Construction Materials	\$435,371.86
Subtotal	\$845,864.05
Contingency	\$84,586.41
Total	\$930,500