800 South & 800 West Intersection

Civil Engineering Capstone Spring 2024

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Project Objectives

Figure 1. Intersection Location

The intersection of 800 South and 800 West in Orem, Utah experiences traffic congestion during peak morning and afternoon hours. The Orem master plan shows a bridge over I-15 and UVU has plans to develop the SW corner of the intersection into student housing. This will put an increased load on the current traffic control system at the intersection. Our objective is to redesign the intersection to be able to handle the existing conditions and projected growth.

Pre-Design and Planning

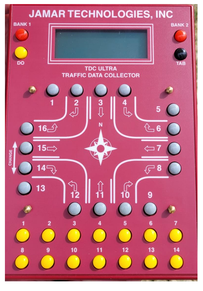

Figure 1. Traffic Count Board

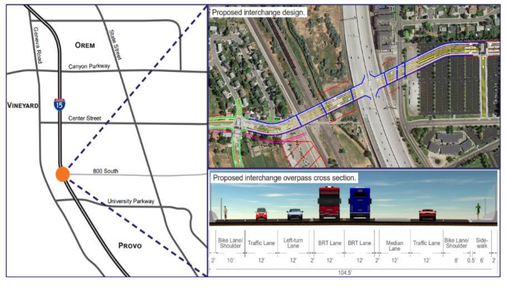

Figure 2. Orem Transportation Master Plan

Before the design process the project team prepared a Traffic Signal Warrant Analysis (TSWA) to report the traffic count data and the satisfied warrants. The warrant analysis reported that Warrants 1, 2, 3 and 8 were satisfied with existing conditions and future projected traffic data.

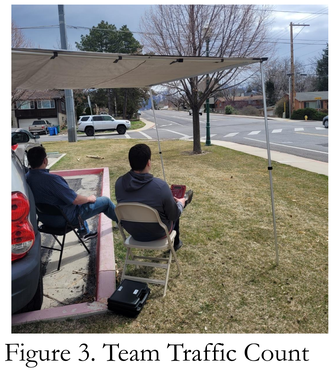

Figure 3. Team Traffic Count

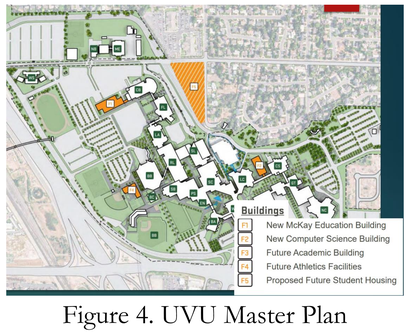

Figure 4. UVU Master Plan

Design Concept Development

During the Fall 2023 semester of the Capstone course the design team developed three alternative concept designs as possible traffic control solutions.

1) Vehicle-oriented traffic control signal
2) One lane compact urban roundabout
3) Pedestrian friendly traffic control signal

The technical team evaluated each design concept according to seven defined criteria. A weight was given to each metric by the City of Orem based on a 1-5 scale.

1. Maintenance Cost (5)
2. Safety of Pedestrian Crossings (5)
3. Conflict Issues (5)
4. Capital Cost (5)
5. ROW Cost (3)
6. Emergency Access and Response (3)
7. Maintenance Requirements (3)

Technical Design Alternatives

During the Spring 2024 semester of the Capstone course the technical team identified three areas of design that required alternative analysis. The design team then developed and evaluated alternatives for each identified area.

1) Signal Heads – Type IV, Type V, Type VI
2) Pedestrian Access Ramps – Parallel, Apex, Perpendicular, Directional
3) Signal Timing System – Fixed Time Coordination, Peer to Peer Communication, Central Control, Adaptive Control

Category	ID	Evaluation Criteria	Evaluation Criteria Definition	Importance 1 (least)-5(Most)	Quantitative Measures 1 (Low)	3 (Neutral)	5 (High)
Operations	AO.1	Maintenance requirements	Special requirement for maintenance	3	More than comparable alterantives	Same as comparable alternatives	Less than comparable alternatives
Safety	PS.1	Safety For Pedestrians	Considerations regarding pedestrians crossing the intersection with design option implemented	5	Unprotected pedestrian crossing with no uniform access	Same as comparable alternatives	Protected pedestrian crossings with uniform access
	PS.2	Safety for Vehicles	Considerations regarding passenger vehicle safety with design option implemented	5	Higher that comparable alternatives	Same as comparable alternatives	Lower that comparable alternatives
Cost	CT.1	Capital Cost	Capital cost to implement design option including materials and equipment	5	Higher cost than other alternatives	Same as comparable alternatives	Lower cost than other alternatives
	CT.3	Maintenance Cost	The annual costs to maintain the design option including repairs, landscaping, cosmetics	3	Higher cost than other alternatives	Same as comparable alternatives	Lower cost than other alternatives

Figure 5. Technical Design Metrics

Final Design Recommendations

Based on the defined metrics and the warrants satisfied, the project team determined that a vehicle-oriented traffic control signal that follows the existing turning movements and lane conditions with updated pedestrian access ramps, signing, striping, and crosswalks would be the best solution to improve future traffic conditions. The final traffic control signal design included directional pedestrian access ramps, peer to peer signal timing coordination, and Type V signal heads that provide protected left turn movements to create the safest and most efficient intersection for all road users, including pedestrians.

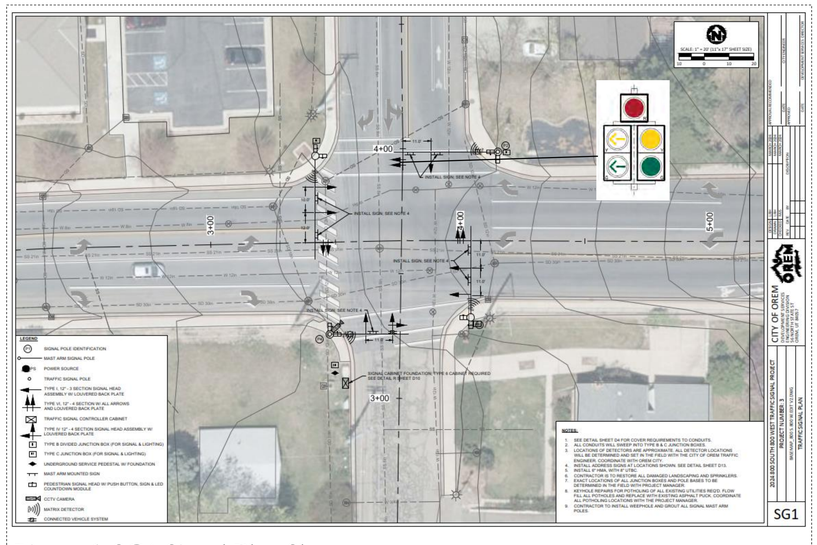

Figure 6. SG1 Signal Plan Sheet

Resources and Software

- Manual on Uniform Traffic Control Devices 2009 Edition
- 2024 UDOT Standard Drawings and Specifications
- City of Orem Construction Standards and Specifications
- Civil 3D and Bluebeam Studio Software