ENGINEERING CHANGES VS. NEIGHBORHOOD IMPACT ASSESSMENT

PROJECT ID: CEEN 2016CPST 004

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A Capstone project submitted to:
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Brigham Young University

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EXECUTIVE SUMMARY

PROJECT TITLE: Engineering Changes vs. Neighborhood Impact Assessment
PROJECT ID: CEEN 2016CPST-004
PROJECT SPONSOR: City of Orem Department of Transportation
TEAM NAME: BMK Engineers

This report details the analysis of the 800 East corridor in Orem, Utah. Peak traffic flows were determined and traffic counts of intersections along the corridor were performed. Based on the data collected, a traffic model was created in Synchro. The existing two-way stop at 400 North 800 East was modeled as four-way stop, two way stop, signal, and roundabout. The effects of the different designs were recorded. The following tasks were also performed: consideration of past and current populations to predict future volumes and evaluation of current and future Levels of Service. BMK engineers completed data and cost-benefit analysis to finalize recommendations for a safe, effective design.

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INTRODUCTION

The purpose of this report is to analyze the 800 East Corridor in Orem, Utah, which has experienced increased vehicle delays in recent years, resulting in the potential decrease in level of service. Based on peak hour volumes, the intersections at Center Street and 800 North have been particularly problematic, obtaining levels of service (LOS) C and D, respectively.

The focal point of this analysis is the intersection at 400 North 800 East, which currently functions as a four-way stop along the corridor. BMK Engineers determined how changing the 400 N intersection would affect the peak-hour problems at 800 N and at Center Street. The following tasks have been completed for this report:

- Assessment of current LOS
- The effect of control systems on peak-hour problems at 800 North and at Center Street
- Roundabout, two-way and four-way stop, and signal analysis
- Modification of 400 North intersection to help Northbound flow
- Roundabout, two-way and four-way stop, and signal analysis for future growth
- Feasibility analysis of the different intersection types, including the economical and social costs of design implementation
- Recommendations to the changes necessary at the proposed intersection

SITE DESCRIPTION

The site analyzed was the intersection of 400 North and 800 East in Orem, Utah. The intersection is located south of the Harmon's grocery store and north of Cascade Elementary School as shown in Figure 1-1 below. The intersection described is controlled by a four-way stop. The intersections at 600 North and 200 North are controlled by a two-way stop, and the intersections at 800 North and Center Street are signalized controlled. The road conditions along the 800 East corridor are slightly fair with some transverse cracking along the road, also with some occasional potholes along the corridor. This could be due to the occasional bus and various single-axle with two tires and single-axle with four tires that are carrying heavier loads than most other common vehicles.

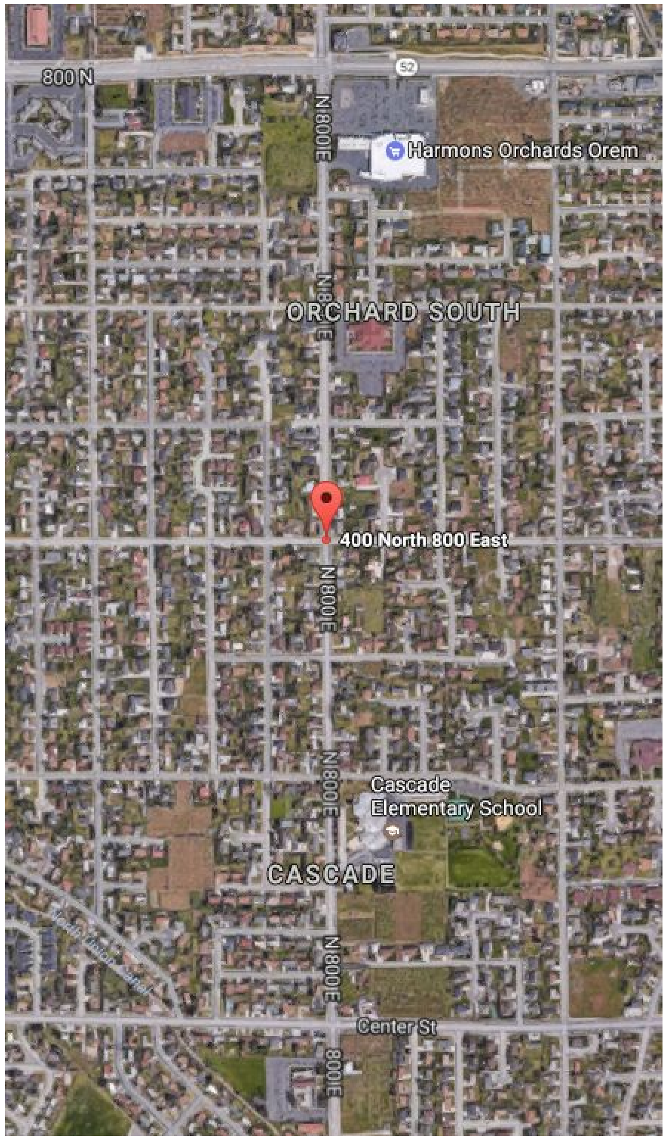

Figure 1-1. An aerial photo of the 800 East Corridor.

Figure 1-2. A current on-site photo of the 400 North 800 East Intersection.

METHODOLOGY

The site was simulated in four different models: two-way stop, four-way stop, signal, and roundabout. Traffic volume and turning counts were conducted at various peak hour times. A larger and more comprehensive volume count of the 400 N 800 E intersection is also referenced (See Appendix A). The intersections of Center St., 200 North, 400 North, 600 North, and 800 North were modeled along the 800 East corridor in Synchro. The Synchro model provided analysis of speeds and delays along the corridor. Once all simulations were complete, the levels of service were compared. The levels of service, vehicle speeds, and vehicle delays were analyzed together to determine the impact on local neighborhoods. Preliminary recommendations based solely on the data provided in this report are given.

DATA COLLECTION

Traffic Counts

In addition to traffic counts obtained by BMK engineers, previous recorded traffic counts were retrieved from the City of Orem's data collection. The City of Orem provided peak hour traffic counts at a few major intersections including 800 North 800 East and Center Street 800 East; this data was used during modeling. A study performed by Christopher Haskell, a graduate student in the Civil Engineering Transportation Department at Brigham Young University, provided peak hour volumes for the intersection of interest, 400 North 800 East (2016). The counts are included in Appendix A. Additional traffic counts were required for the minor intersections along the corridor. The counts were taken by BMK engineers at 200 North 800 East and 600 North 800 East during peak hours and are included in the appendix.

MODELING

The four intersection types were modeled in Synchro based on the actual dimensions and volume counts of the intersections on the 800 East corridor. The assumptions made to complete the model are conservative.

Assumptions

The following are key assumptions based upon site observations and standard roadway parameters:

- Percentage of volume that is heavy vehicles: 3%
- Design speeds are the posted speed limits; 25 mph or 35 mph based on the roadway
- Existing signalized intersections are already optimized and synchronized
- The volumes of existing intersections provided by the client are accurate
- Trip generation and distribution is representative of actual conditions
- The projected traffic volumes for the year 2040 are based on a conservative 1% population increase per year.

Four-Way Stop

The first model created was designed as the current operating intersection: a four-way stop. This model provided the basis for the following theoretical models. It provided a foundation of understanding to improve the LOS of the 400 North 800 East intersection and the other intersections along the corridor. The north and southbound directions have an exclusive left turn lane along with a shared right-thru lane. The east and westbound directions have a shared left, thru, and right turn lane. Figure 1-3 below depicts the current layout described.

Priority rules apply to the four-way stop intersection. For example, if vehicle A approaches the intersection going northbound and vehicle B arrives going eastbound directly after vehicle A, then vehicle B is designed to stop and wait until vehicle A passes through the intersection.

In the model, there is no design for pedestrian traffic at the intersection. This was decided because the focus is how the traffic flow is influencing the other intersections along the corridor and in the surrounding neighborhoods.

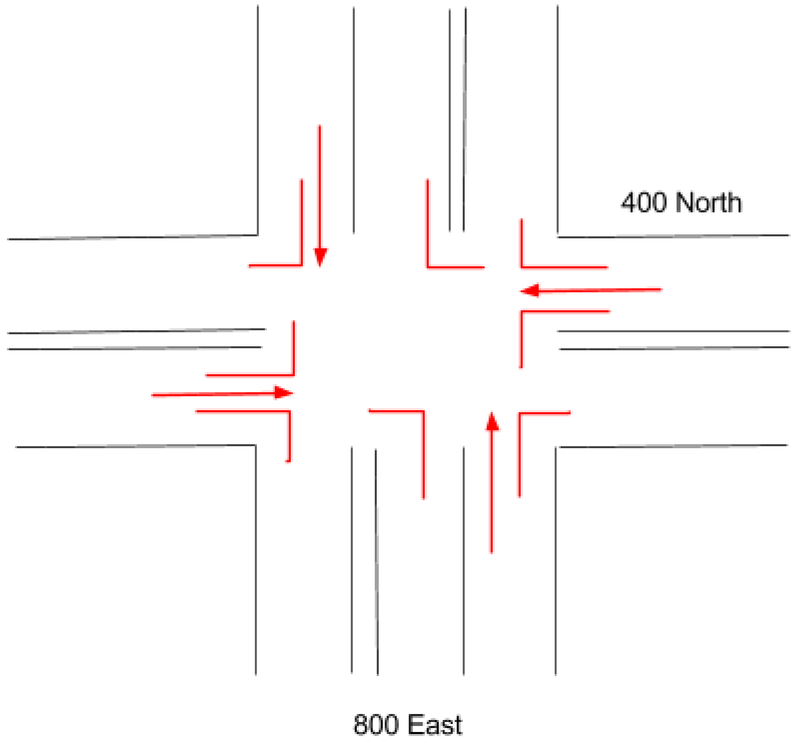

Figure 1-3. Four-way stop control diagram of the 400 North 800 East Intersection.

Two-way Stop

The second model created was the two-way stop intersection. This layout was designed to depict the projections of traffic flow, delays of vehicles, and average speeds of the vehicles. The purpose of the two-way stop control was to analyze how the 400 North intersection would behave if it was similar to the 200 North and 600 North intersections along the corridor.

Priority was given to the north and southbound flow of traffic. This would mean that the only change to be made would be to remove the stop signs for the North and Southbound traffic, which would allow free-flow for those directions. The east and westbound traffic would be required to perform a complete stop and give priority to the oncoming north and southbound traffic until the intersection had cleared.

Signalized Intersection

The intersection was modeled once for each signal timing mechanism: actuated coordinated, actuated uncoordinated, semi-actuated uncoordinated. The actuated coordinated signal model timing was based on the pre-existing signal timings of the other intersections in the 800 East zone. For all three signalized intersection models, the intersection timing was optimized based on traffic counts and volumes for each direction. The optimization is completed automatically by the Synchro program.

Roundabout Intersection

The fourth model created for the project was the intersection model. The lane configuration functioned in a similar manner to the other models. Each approaching roadway consisted of one entry and exit lane and the roundabout had one circulation lane. Priority was given to the circulating flow. Approaching traffic yielded to vehicles in the roundabout. If vehicles in circulation were not within range of interference for approaching vehicles, the approaching vehicles would not yield to vehicles in circulation. All traffic yielded to pedestrians crossing the intersection.

2040 Projected Volumes

The projected volumes for the year 2040 were calculated using a 1% volume increase per year. This resulted in roughly 26% increase of the current traffic volumes. This increase was directly input into each intersection control scenario to achieve a new analysis of the 800 E 400 N intersection. All other parameters such as speed limit, number of lanes, and percentage of heavy vehicles were left the same.

SIMULATION RESULTS

Upon completion of the models, simulations were performed on the four-way stop, two-way stop, signalized intersection, and roundabout for both current 2017 volumes and future 2040 volumes. The simulations resulted in reports measuring the average vehicle speeds through the intersections and average vehicle delays at the intersections.

Average Vehicle Speed

The actuated signal intersection at 400 North provides slightly faster speeds at the 200 North, 400 North, and 600 North intersections. However, the speed for this option is slower at the 800 North intersection. The speed at the 800 North intersection may be reduced because vehicles pass quickly through the other intersections and then wait. For the two- and four-way stop intersections, the speeds were slower at the 200 North, 400 North, and 600 North intersections, but faster at the 800 North intersections. This effect happens because less cars get congested at the 800 North intersection and are more spread out over the 800 East corridor. These results show that each option has faster and slower speeds relative to the others as shown in Table 1. A major difference is the location of the higher and lower speeds. These results can be shown in Figure 2.

Table 1. Average Vehicle Speed Results

	Center St 800 E	200 N 800 E	400 N 800 E	600 N 800 E	800 N 800 E
Two-Way Stop (mph)	25	31	20	26	25
Four-Way Stop (mph)	25	30	19	25	25
Signal (mph)	24	30	32	34	22
Roundabout (mph)	19	26	24	29	22

Figure 2. Average vehicle speed comparison.

Average Vehicle Delay

The results in Table 2 and Figure 3 show that the average delay when the 400 North intersection is signalized is greater than the other options. The exceptions are the four-way stop sign option at 400 North and the roundabout option at 800 North. The two way stop offers the least amount of delay along the 800 East corridor. The side traffic may be back up more with the two-way stop option.

Table 2. Average Vehicle Delay Results

	Center St 800 E	200 N 800 E	400 N 800 E	600 N 800 E	800 N 800 E
Two-Way Stop (s/veh)	20.1	0.8	1.0	0.7	42.2
Four-Way Stop (s/veh)	20.2	0.7	10.0	1.8	40.0
Signal (s/veh)	24.0	9.0	9.0	7.0	42.0
Roundabout (s/veh)	23.0	1.8	4.4	0.4	66.8

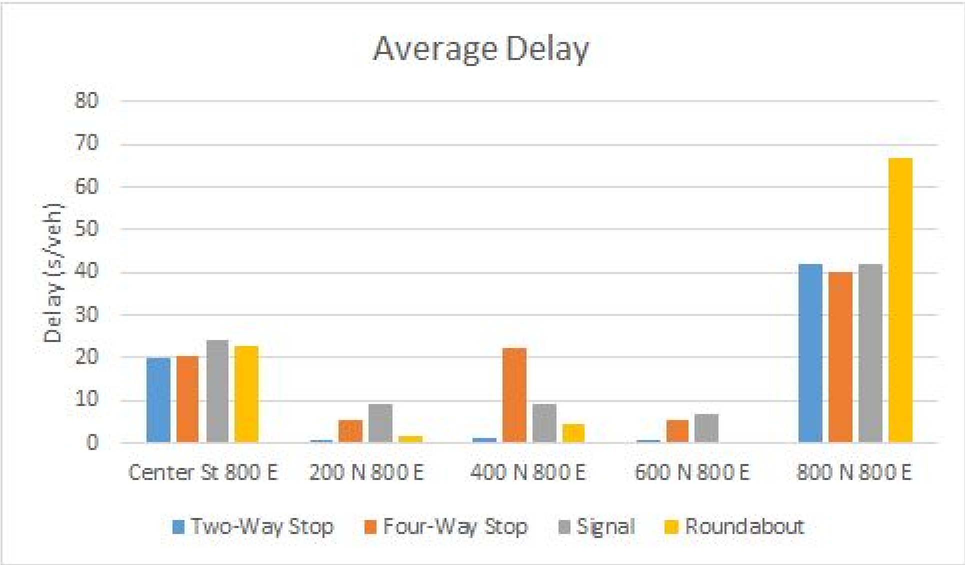

Figure 3. Average vehicle delay comparison.

Projected 2040 Average Vehicle Speeds

After adjusting the volumes for the year 2040, the results of the average speeds through the intersections is much different than the results for the current year. The signalized intersection options offers much greater vehicle speeds at the 800 North intersection. This intersection is particularly important because it is a major arterial for the east and west directions. Better access to this road allows vehicles to move smoothly along the 800 East corridor. The other options offer about the same speeds through the middle intersections, but much slower speeds at the 800 North intersection as shown in Table 3 and Figure 4.

Table 3. Average Vehicle Speed Results 2040

	Center St 800 E	200 N 800 E	400 N 800 E	600 N 800 E	800 N 800 E
Two-Way Stop (mph)	23	27	32	32	8
Four-Way Stop (mph)	14	30	30	25	11
Signal/ Act-coord. (mph)	22	24	22	25	20
Roundabout (mph)	18	27	24	27	8

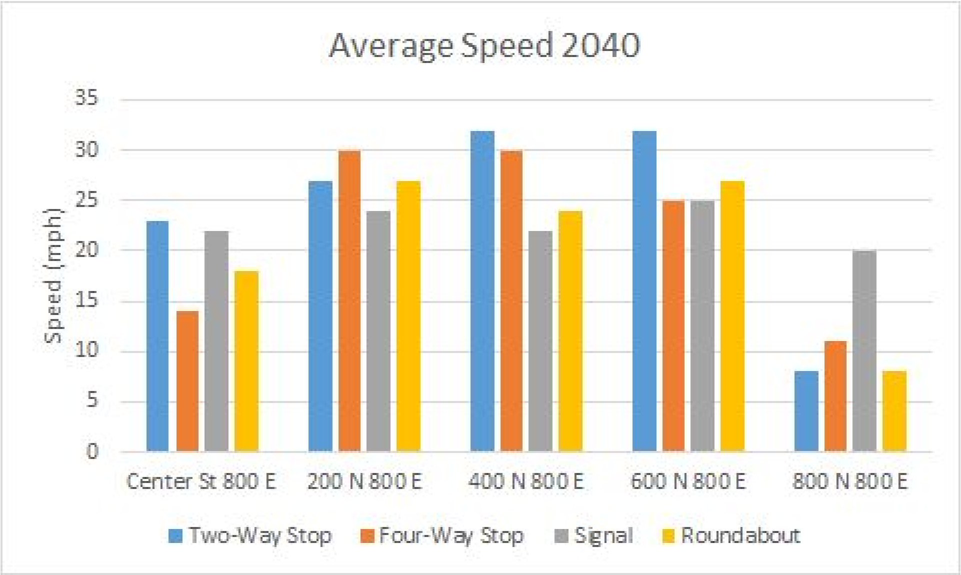

Figure 4. 2040 average vehicle speed comparison.

Projected 2040 Average Vehicle Delay

The average vehicle delay results closely match the average vehicle speed results for the year 2040. The signalized intersection offers reduced delays at the 800 North intersection. However, the intersection at Center Street is actually increased with a signalized intersection. Center Street is also an important road for the east and west movement of vehicles. The data in Table 4 and Figure 5 shows that the two-way stop has the least delay at Center Street, 200 North, and 400 North. The roundabout causes the least delay at the 600 North intersection.

Table 4. Average Vehicle Delay Results 2040

	Center St 800 E	200 N 800 E	400 N 800 E	600 N 800 E	800 N 800 E
Two-Way Stop (s/veh)	24.0	0.9	0.6	0.4	58.7
Four-Way Stop (s/veh)	24.2	1.6	10.2	0.5	59.1
Signal (s/veh)	33.0	11.0	12.0	7.0	49.0
Roundabout (s/veh)	28.0	1.1	5.6	0.7	74.6

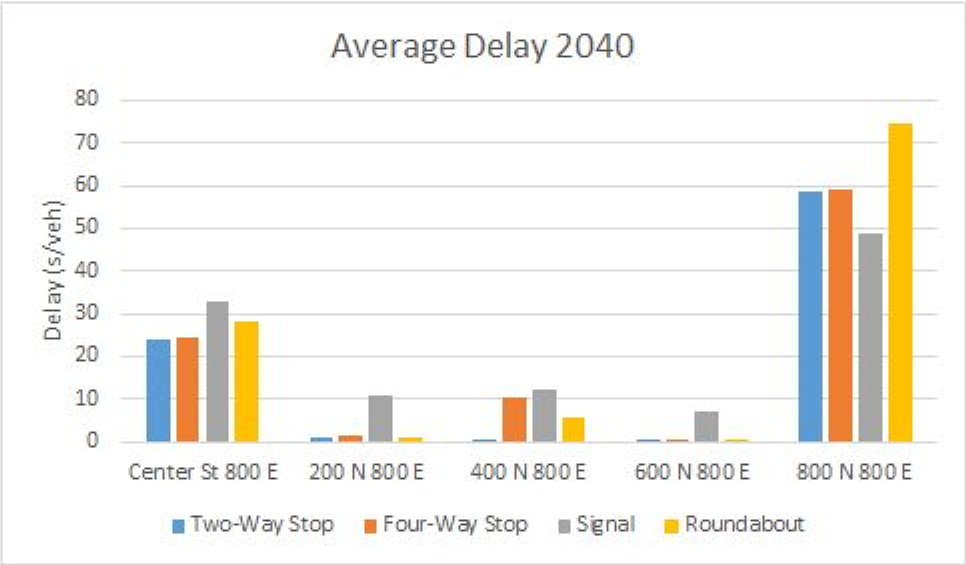

Figure 5. 2040 average vehicle delay comparison.

Interpretation of Results

Upon comparison of the results, it was determined that a four-way stop control and a two-way stop control would perform in a similar manner as it stands currently for the 400 North and 800 East intersection. The East and Westbound directions would continue to perform well, but the performance of the North and Southbound directions would decline. This is because there would not be much change in the traffic volume east and westbound, but the north and southbound traffic would greatly increase. The results reveal that the conversion of the four-way stop control intersection into a two-way stop or signal would produce better results. The average vehicle delay would decrease and the average speed would increase, thus, causing the intersection to perform at a more acceptable level of service.

Average speeds are higher for the signalized intersection than the other intersection types. This is because the vehicles have right of way based on the green light timing. This allows them to move faster on average. The two-way stop would provide the highest speeds for the vehicles moving the north/south direction, but this average speed is reduced when the east/west directions are added.

FEASIBILITY

2-way and 4-way Stop Intersections

The intersection of 400 North and 800 East currently exists as a 4-way stop intersection. The city of Orem would need to maintain the basic upkeep of the stop signs every year in order to ensure driver safety. Currently, the four-way stop intersection proved to be one of the more ineffective forms of traffic control for that intersection. As it pertains to average vehicle delay and average vehicle speed, the intersection does not provide level of service required for more appropriate traffic conditions along the 800 East corridor. For 2040 projection, the results of the model exhibited signs of drastic increase of average vehicle delay at the various intersections along the corridor , and it also decreased the average vehicle speed at each intersection. however, there would not be much of a monetary risk in keeping the intersection as a four way stop.

Similar to the 4-way stop intersection, the 2-way stop intersection also shows signs of increased average vehicle delay and decreased average vehicle speed along the corridor. The 2040 projections are also similar in average vehicle delay increasing and average vehicle speed decreasing. The one exception is that as the the 400 North 800 East intersection, there would be a slight decrease and increase in vehicle delay and average speed, respectively. The cost of removal of two of the stop signs would be the only monetary value applied to this option of traffic control.

Signalized Intersection

The Utah Department of Transportation Division of Traffic and Safety has guidelines regarding the cost of hardware and installation of a traffic signal (Utah Department of Transportation, 2017). The cost of signalizing the intersection is based on the estimates of this document. An estimate of the cost to install the signals at the intersection is roughly $60,000. The annual cost of electricity and maintenance for a signalized intersection is about $8,000 (Washington Department of Transportation, 2017). Traffic lights have a 15-year warranty. The replacement cost of the traffic lights after 15 years will cost about $10,000 (Utah Department of Transportation, 2017). It is estimated that this signalized intersection will have to be re-timed twice in the period between the current period and the year 2040. This retiming will cost $4,000. The estimated cost of the traffic signal from the current period until the year 2040 will cost about $258,000.

At the year 2040, the roadway will potentially be expanded and a new traffic signal configuration will need to be designed and installed. New hardware will most likely need to be procured to replace the older hardware. The signals at the intersection will need to be re-timed. The old footings and curbs from the previous intersection will need to be replaced after the roadway is widened. The cost of removal of the signalized intersection prior to the widening of the road in the year 2040 is roughly $8,000 (Utah Department of Transportation, 2017). This cost is added to the previous total to result in a cost of $266,000 for the signalized intersection from the 2017 to 2040. This amount equates to $11,565 per year.

Roundabout

At the 400 N 800 E intersection, it was decided a single-lane roundabout will be used in design to accommodate for the daily traffic volume and 35-mph speed along the corridor. The inscribed circle diameter will be 100 feet (AASHTO, 2011). A design study performed by Kinney Engineering Company compared the cost of a signalized intersection and roundabout. It was estimated a roundabout costs nearly 10% more than a signalized intersection (2012). Based on this relationship, the approximate costs of installation of the roundabout will be $284,000. In order to reduce the amount of land that must be purchased, it was decided the design roundabout will have an intersection diameter of 90 feet (AASHTO, 2012). The existing intersection has sufficient land to provide a 90 foot diameter for the roundabout. No additional land will need to be purchased. Compared to a signalized intersection which requires constant power, light bulb and detection maintenance, and signal timing updates, a roundabout will have lower maintenance costs. However, the roundabout will have higher landscape maintenance costs, depending on the size and aesthetics of the central island. The typical annual maintenance cost for roundabout landscaping is $2,000 (Virginia Department of Transportation, 2014). The estimated cost of the roundabout from the current period until the year 2040 will cost about $330,000.

As previously mentioned, at the year 2040, the roadway will potentially be expanded and a new roundabout will need to be designed and installed. The landscaping of the central island will be removed. The old footings and curbs from the previous roundabout will need to be replaced after a roadway is widened. The cost of removal of the roundabout prior to the widening of the road in the year 2040 is roughly $7,000 (Utah Department of Transportation, 2017). This cost is added to the previous total to result in a cost of $337,000 for the roundabout from the 2017 to 2040. This amount equates to $14,652 per year.

NEIGHBORHOOD IMPACT ANALYSIS

Currently, the 800 East corridor experiences an increase in traffic congestion at peak hours during an average 24-hour period. The Center Street and 800 North intersections along the corridor experience an overload of traffic. These concerns cause delays in vehicles' travel time, which can cause the local population to be tardy to their respective destinations. There is also an elementary school in between the intersections of 200 North and 400 North that has also experienced traffic congestion due to the lack of a correctly controlled intersection at 400 North.

The level of service of the neighborhood intersections may increase with a two-way stop and roundabout. With these traffic control options, the residents may have better access to 800 East. However, these options decrease the levels of service of the 800 North and Center street intersections. Most trips generated by these neighborhoods lead to these two roads. Therefore, the actual neighborhood impact of a signalized intersection may be less than stop signs or a roundabout because traffic can flow faster to 800 North and Center street. As traffic continues to increase year to year, this effect will also increase.

RECOMMENDATIONS

The following recommendations are based solely upon the analysis that has been completed and described in this report. There are no recommendations based on future volume or feasibility. These recommendations address the impact of the intersection types on the neighborhoods.

Average delay times per vehicle are a major factor in determining the suitability of an intersection type for the neighborhoods along the 800 East corridor. The two- and four-way stop signs offer reduced delay times. The signalized intersection also offers relatively low delay time. Since the signal can be coordinated with 800 N and Center street, there should be less delay at those intersections in general.

The roundabout option has mixed results and could benefit the neighborhood wait times. The conflict with the roundabout is that the vehicles can move along the 800 corridor relatively quick, but end up waiting at the 800 N 800 E intersection for longer periods of time. This situation is undesirable because this intersection has the lowest level of service.

Based on analysis of the current and projected volumes, it is recommended that the actuated-coordinated signal is used at the intersection of 400 N 800 E.

CONCLUSION

The intersections along the 800 East Corridor in Orem, Utah were studied to determine the best approach to resolving issues with traffic flow. Data was collected from the City of Orem and a Civil Engineering graduate student, and new counts were taken by BMK Engineering. Four different models were created: a four-way stop, two-way stop, signal, and roundabout. Simulations were run and results reported the measure the effectiveness at the major intersections along the corridor including Center St. 800 E, 200 N 800 E, 400 N 800 E, 600 N 800 E, and 800 N 800 E. The two measurements used for analysis were the average vehicle speed and delay time. The results verified a two-way stop, signal, or roundabout would decrease the average vehicle delay and increase the average speed in most cases. The signal offers minimal delay time to the cars at all four approaches at the 400 N 800 E intersection, as well as other intersections on the corridor and is recommended to be used.

REFERENCES

AASHTO. 2011. *A Policy on Geometric Design of Highways and Streets (Greenbook).*

Haskell, Christopher K. 2016. *800 East 400 North Simulations* (Master's Research Project). Retrieved from City of Orem Transportation Department.

Kinney Engineering. 2012. *McCarrey Street Intersection and Safety Upgrades.* Retrieved from http://www.crweng.com/assets/images/uploads/projectsites/MVM_DSR_CostEstimate_Schedule.pdf

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Virginia Department of Transportation. *Intersection Cost Comparisons Spreadsheet Manual*. 2014. Retrieved from http://www.virginiadot.org/business/resources/2-Roundabout_Cost_Comparison_Tool_Manual_v2.5.pdf

Washington Department of Transportation. *Traffic Signals*. 2017. Retrieved from https://wsdot.wa.gov/Operations/Traffic/signals.htm

Appendix A: Traffic Counts

INTERSECTION TURNING MOVEMENTS

OREM

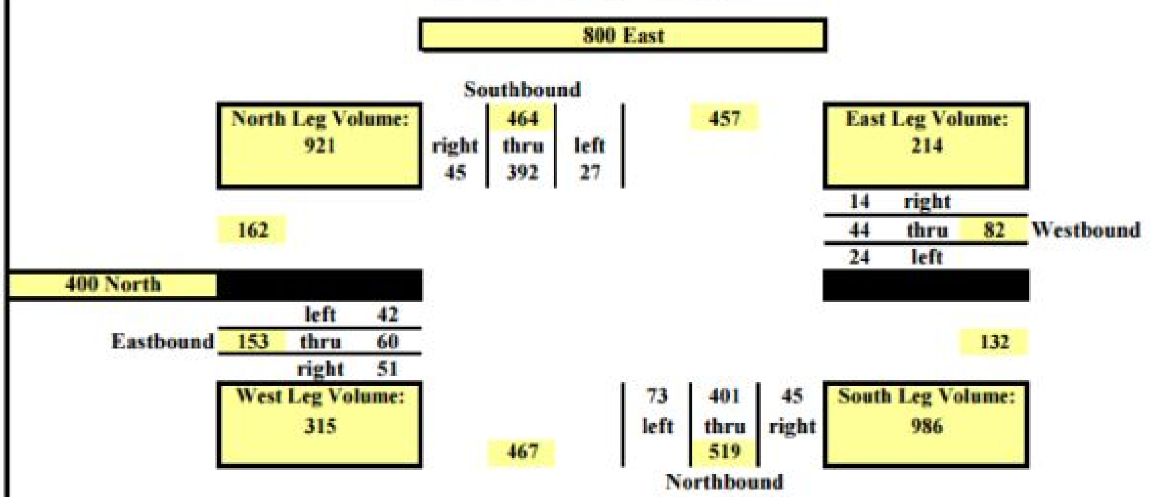
400 North & 800 East
Vehicle Page
Wednesday, June 18, 2014

4:30 - 6:00: PM Count

TIME PERIOD		EASTBOUND			SOUTHBOUND			WESTBOUND			NORTHBOUND			TOTAL	
BEGIN	END	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	15 MIN	SUM
4:30	4:45	6	11	5	3	76	12	7	13	3	9	76	6	227	227
4:45	5:00	12	13	18	7	89	9	3	10	4	16	85	11	277	504
5:00	5:15	8	13	9	4	95	15	5	10	4	21	103	14	301	805
5:15	5:30	5	13	12	6	100	10	10	12	5	21	112	11	317	1122
5:30	5:45	17	21	12	10	108	11	6	12	1	15	101	9	323	1445
5:45	6:00	5	9	15	2	101	12	9	14	3	9	81	14	274	1719

SUM	53	80	71	32	569	69	40	71	20	91	558	65
PERCENT	26%	39%	35%	5%	85%	10%	31%	54%	15%	13%	78%	9%
TOTAL	204			670			131			714		

Peak Hour Volume Statistics



PEAK TRAFFIC VOLUME											
EASTBOUND			SOUTHBOUND			WESTBOUND			NORTHBOUND		
LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT
42	60	51	27	392	45	24	44	14	73	401	45
153			464			82			519		
Peak Hour:	4:45 - 5:45		Peak Volume:		1218		Peak Hour Factor:			0.94	

Figure A-1. Intersection turning movements at 400 North 800 East (Haskell, 2016).

Table A-2. Intersection turning movements at 200 N 800 East

200 N & 800 E

Thursday, February 23, 2017

5:40 - 6:40: PM Count

TIME PERIOD		NORTHBOUND	SOUTHBOUND	EASTBOUND	WESTBOUND	TOTAL
BEGIN	END	THRU	THRU	RIGHT	LEFT	SUM
5:40	6:40	216	180	22	3	421

Table A-3. Intersection turning movements at 600 N 800 East

600 N & 800 E

Thursday, February 23, 2017

4:00 - 5:00: PM Count

TIME PERIOD		NORTH-BOUND			SOUTH-BOUND			EAST-BOUND			WEST-BOUND			TOTAL
BEGIN	END	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	SUM
4:00	5:00	16	74	12	8	96	24	4	4	20	8	4	28	298

Appendix B: Modeling

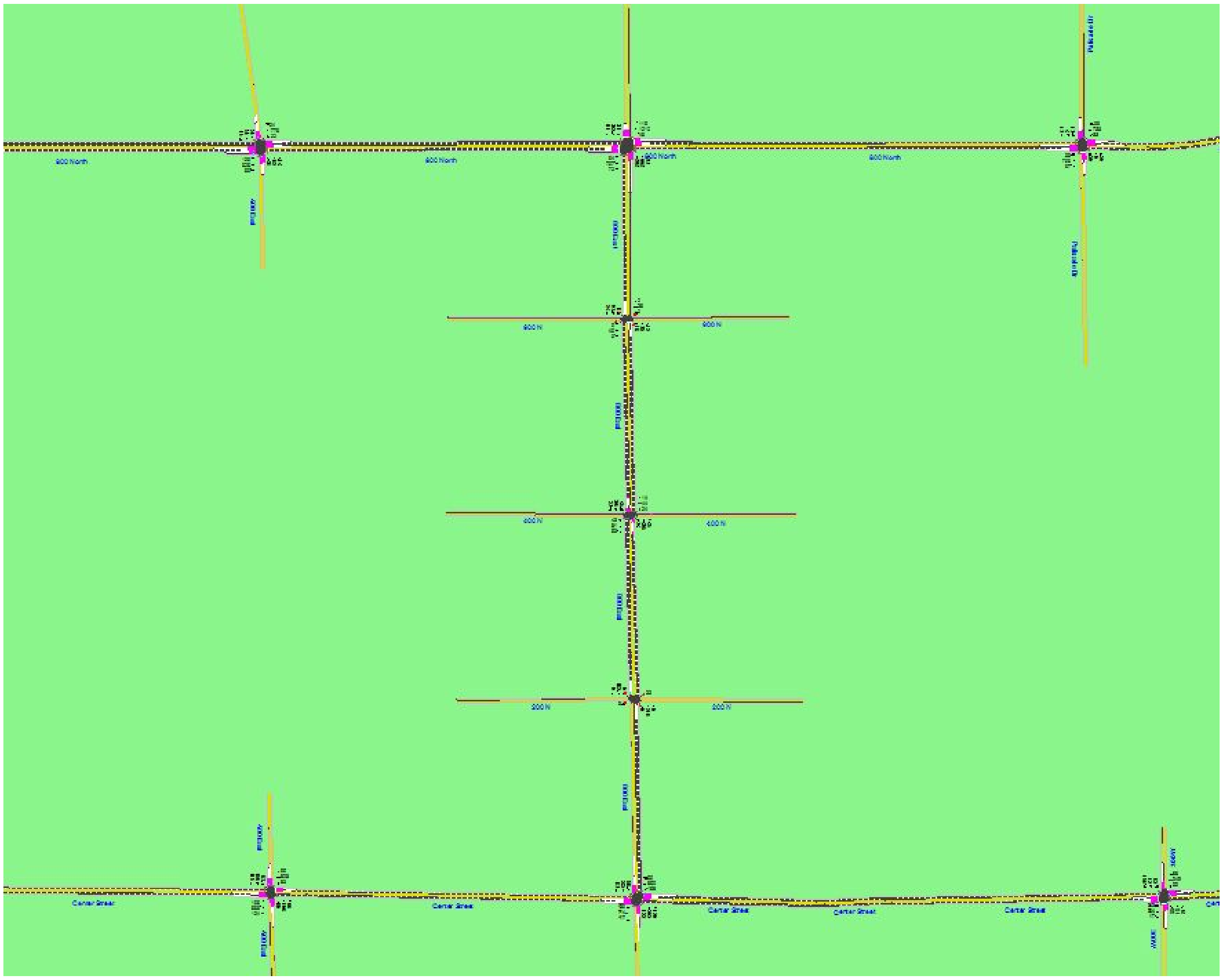


Figure B-1. Model of 800 East Corridor.

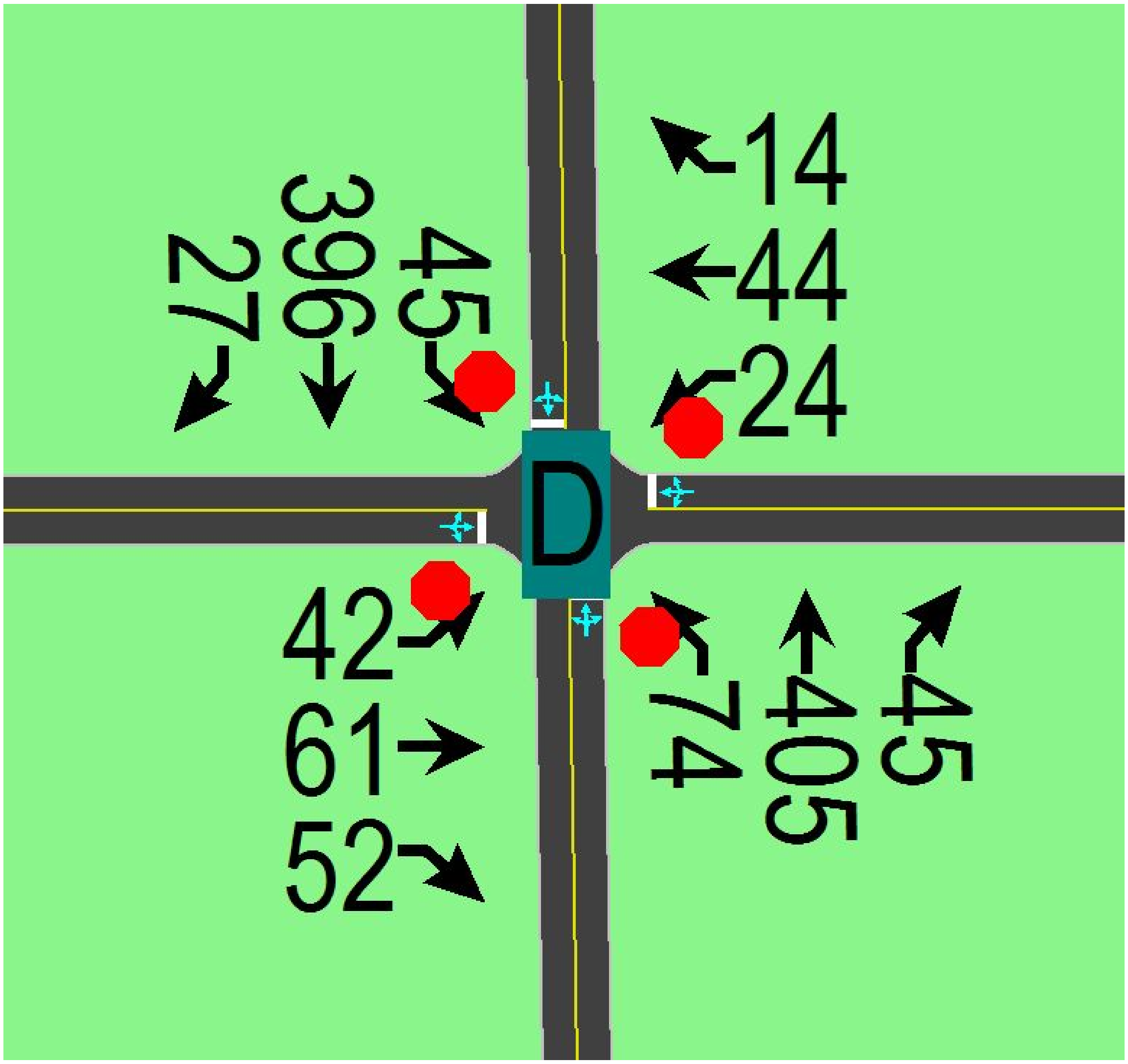


Figure B-2. Model of Four-Way Stop.

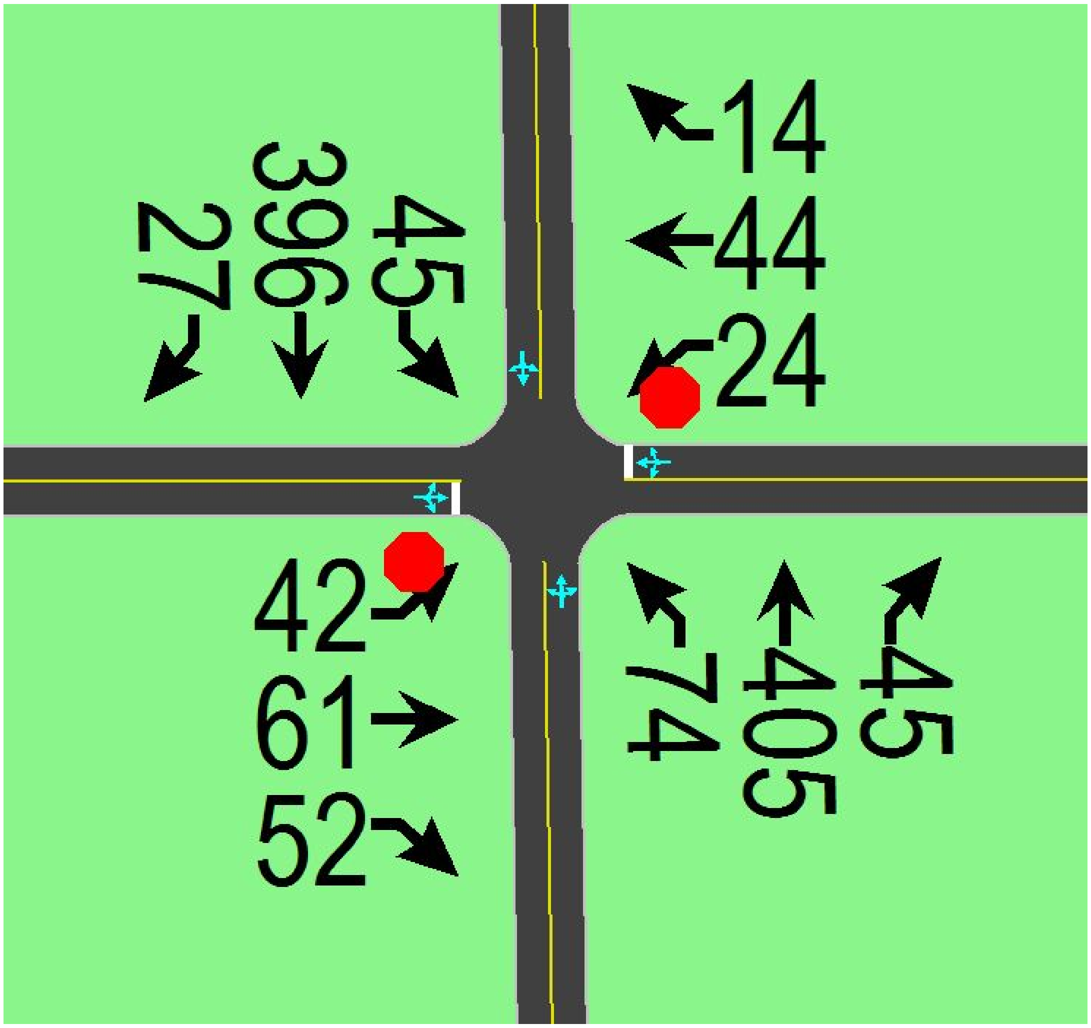


Figure B-3. Model of Two-Way Stop.

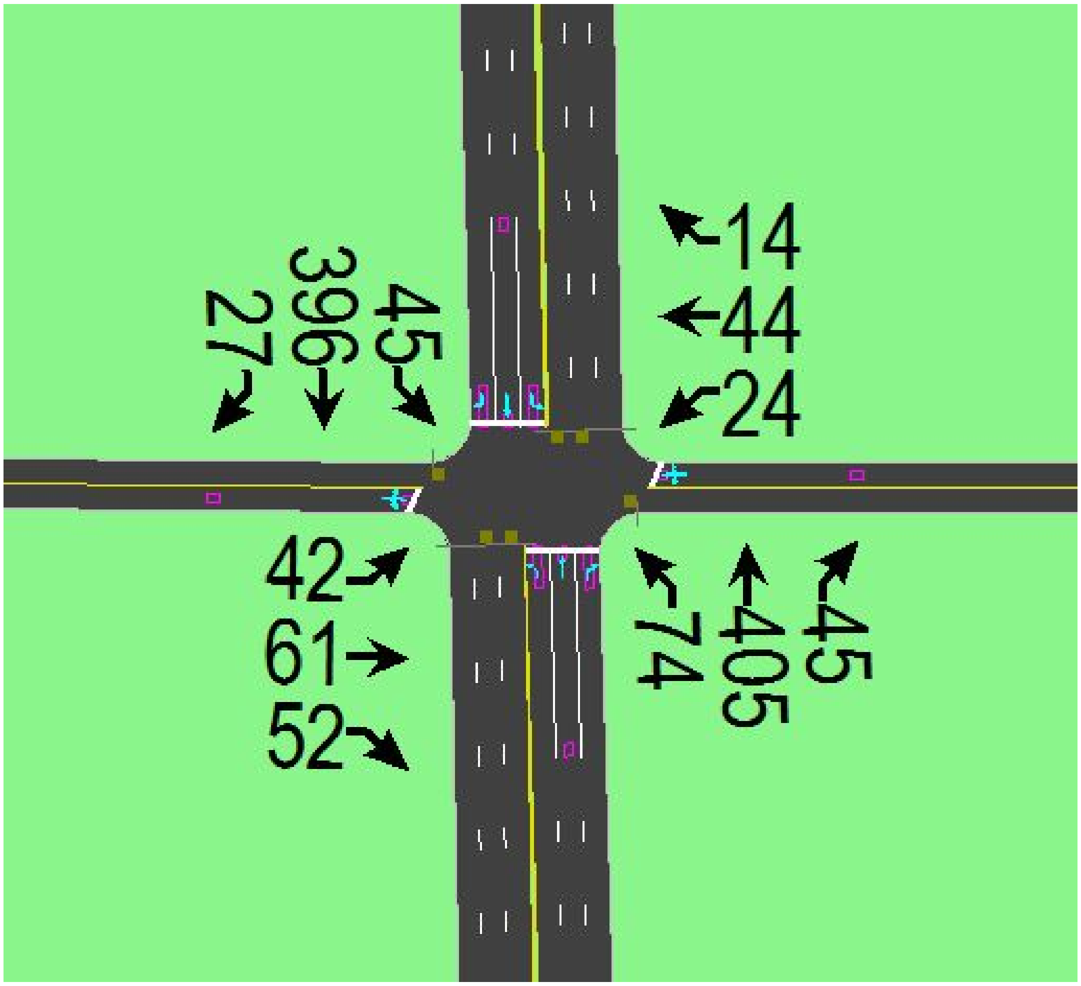


Figure B-4. Model of Signalized Intersection.

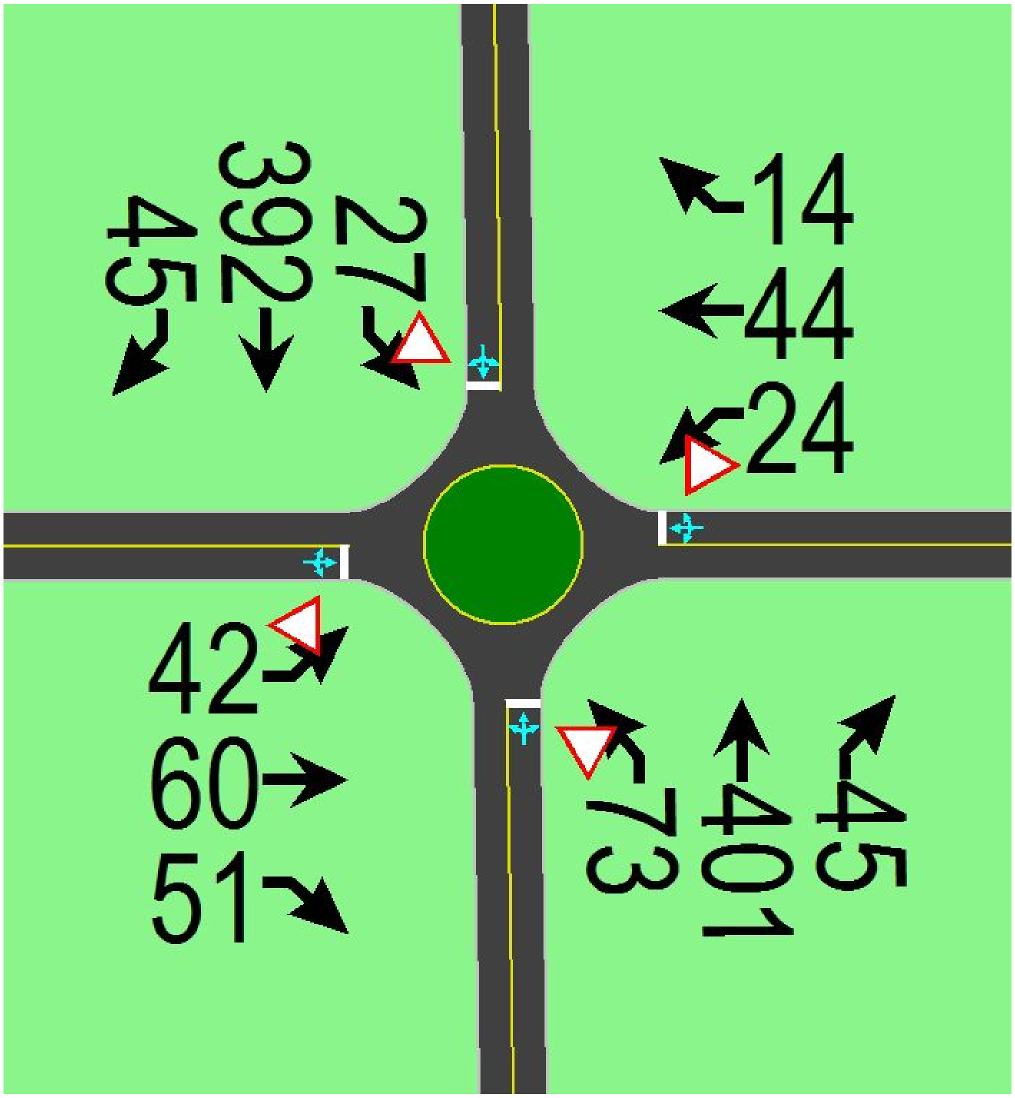


Figure B-5. Model of Roundabout.

Appendix C: Resumes

MARTIN T. SENECA

1937 N Canyon Rd. #201 Provo, UT 84604 | (571) 244-7008 | mtseneca@gmail.com

EXPERIENCE

Engineer in Training May/2016 – Present
Acute Engineering, Orem, UT

- Conducted independent research and design of post-tensioned concrete slabs according to ACI, PTI, IRC, ASCE-7 codes and standards
- Used Forte, StrucCalc, AutoCad, and other project specific software to complete accurate and efficient design of wood frame structures
- Engineered custom and production homes according to LFRD and ASD specifications

West Point Cadet Platoon Sergeant May/2012 – Jun/2012
United States Military Academy, West Point, NY

- Led a platoon of cavalry scouts from the 10^{th} Mountain Division to provide counter-terror training for 300+ cadets
- Solved logistical and equipment issues between training site managers and training teams for 15+ sessions

Sales Representative Apr/2015 – Aug/2015
Moxie Pest Control, Centreville, VA

- Generated $88,000+ in company revenue in sales in a four month period
- Managed 30+ sales areas throughout Northern Virginia
- Participated in daily sales training and assessed junior sales representatives

Volunteer Missionary Jul/2012 – Aug/2014
The Church of Jesus Christ of Latter Day Saints, Taipei, Taiwan

- Presented 20+ training sessions to groups of missionaries ranging from 24-120 to help them teach more effectively
- Conducted 20+ personal assessments of individual missionaries' proselyting and performance
- Organized two separate meetings involving global level church leaders and 180 missionaries
- Worked 85+ hours per week

EDUCATION

Major: Civil and Environmental Engineering, Brigham Young University, Provo, UT
GPA: 3.80
Graduation Date: June 2017
Member of American Society of Civil Engineers
Member of Tau Beta Pi

SKILLS/ ACCOMPLISHMENTS

- Chinese Fluency
- First place in BYU Global Management Student Association case competition
- Microsoft Office proficiency
- Eagle Scout

Brad T. Fellows

(713) 562-1825 * bradtfellows@gmail.com * 9410 Floral Park Ct. Houston, TX 77095

Education

Bachelor of Science in Civil & Environmental Engineering
Brigham Young University, Provo, UT
Relevant Course Work: Chemical Engineering, Surveying, Computer Programming

Professional Experience

Metals, Woods, & Composites Teaching Assistant Provo,UT
Brigham Young University *Aug. 2016 – present*

- Conducted several lab sections throughout the week for approximately 20 students
- Responsible for grading of approximately 450 lab and homework assignments

E.I.T. (Internship) Provo, UT
Acute Engineering *Dec. 2015 – Aug. 2016*

- Perform detailed structural analysis for residential engineering projects
- Prepare Engineering Addendums & B.O. Letters for clients to assist with engineering projects
- Collaborate with drafters to prepare engineering drawings/blueprints for clients

Surveying Teaching Assistant Provo, UT
Brigham Young University *Aug. 2015 – Dec. 2015*

- Conducted several lab sections throughout the week for approximately 50 students
- Responsible for grading of approximately 1400 lab and homework assignments

Chemical Engineering Teaching Assistant Provo, UT
Brigham Young University *Dec. 2013 – May 2015*

- Instructed all labs for 200-300 students
- Directed the grading of approximately a range of 4000-5000 lab and homework assignments

Sales Manager Houston, TX
Stampede Pest Control *Jul. 2012 – Aug. 2013*

- Managed sales representative team of ten for five months
- Coordinated the production of all sales representatives which increased company sales accounts by 20%
- Provided technical pest control services to clients for the exterior and interior of homes and businesses

Volunteer Experience

- Served as a volunteer representative for 2 years
    - Lead and instructed groups ranging from 10 to 200 people to properly plan and schedule their work
- Orchestrated the work of 20-25 men at 3 different locations for food donations for a local Houston food pantry
- Taught 25-30 children between ages 3-4 years-old for one year

Skills & Accomplishments

- Proficiency in Microsoft Office, Visual Basic, ArcGIS software, AutoCAD, MathCAD, HTML, Autodesk Revit
- Skilled in the proper use and safety of surveying equipment (e.g. Total Stations, GPS, Levels, etc.)
- Eagle Scout in the Boy Scout of America, Troop 1830 Cypress, Texas.
- Member of ASCE BYU Provo Chapter

KAYLEE BATEMAN

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EDUCATION

Bachelors of Science, Civil Engineering — **Jan. 2014-Present**
Brigham Young University — *Provo, UT*

- GPA: 3.45
- Member of national and student chapter of American Society of Civil Engineers

RELATED WORK EXPERIENCE

Undergraduate Researcher — **Oct.- Dec. 2016**
Brigham Young University — *Provo, UT*

- Tested and developed grout mixtures with specified compressive strengths
- Reviewed calculations and analytical data to maintain accuracy during testing
- Worked closely among peers and the research professor to define problems, collect data, establish facts, and draw conclusions

Civil Engineering Intern — **Apr.-Aug. 2016**
Engineering Systems Solutions (ES^2) — *Idaho Falls, ID*

- Created concrete design spreadsheets for concrete shear, column interaction diagrams/ loadings and beam moment analysis
- Utilized proprietary software from ES^2 to check company designs with reinforced concrete
- Worked and coordinated with other project engineers to review projects for construction

ACTIVITIES AND INVOLVEMENT

Mentor — **Sep. 2016-Present**
Brigham Young University — *Provo, UT*

- Helped incoming female freshman in engineering navigate their first semester
- Assisted coordinating schedules and finding resources to lead mentees to success

Analyst — **Sep. 2016-Present**
City of Orem Transportation — *Orem, UT*

- Analyzed the affect of changing an intersection control system through a corridor in Orem
- Worked and coordinated with city engineers and capstone team members

Leadership Study — **May-June 2015**
Brigham Young University — *Guangzhou, China*

- Participated in engineering leadership studies with American and Chinese students at Sun Yat Sen University

Student Volunteer — **Aug.-Dec. 2013**
Westerstede Elementary — *Westerstede, Germany*

- Volunteered 15 hours a week at Westerstede elementary assisting German students with English