CENE 476 – NAU Graduation Traffic Plan Capstone

7th May, 2019

Nate Reisner

ADOT NorthCentral District Development Engineer

Arizona Department of Transportation

Flagstaff, Arizona

Subject: Letter of Transmittal

Dear Mr. Reisner,

Contained within is the Northern Arizona University Graduation Traffic Team's Proposal. Per your instructions concerning the study bounds, we defined technical considerations, potential challenges, stakeholders, and exclusions.

Sincerely,

NAU Graduation Traffic Plan Capstone Team

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Northern Arizona University Traffic Study and Circulation Recommendations to Improve Traffic Flow During Graduation Events

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CENE 476 EGR Design: Capstone Prep – Spring 2019
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Technical Advisors: Nate Reisner and Edward Smaglik
Clients: Nate Reisner, NAU PD, and NAU Parking Services

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1.0 Project Understanding

1.1 Project Purpose

The traffic study collects traffic data and volumes for both baseline Northern Arizona University (NAU) Flagstaff campus traffic flow conditions and May 2019 Graduation event traffic conditions. Traffic volume data collected is to be analyzed to give circulation recommendations to the City of Flagstaff (CoF), Arizona Department of Transportation (ADOT), and Northern Arizona University Police Department (NAU PD), and Northern Arizona University Parking Services (Parking). The project objective is to reduce travel time, reduce traffic congestion, and maintain public safety on I-17, I-40, State Route 89A, and the local roadway network at NAU for graduation and other large special events.

1.2 Project Background

The main area of traffic congestion originates from McConnell and the I-17 off-ramp where the stop sign is located. In the hour leading up to the graduation ceremony, the traffic congestion winds its way along I-17 southbound toward the airport and down I-40 westbound toward East Flagstaff. Figure 1 shows the location within Arizona, and Figure 1 below shows the congested areas within the City of Flagstaff.

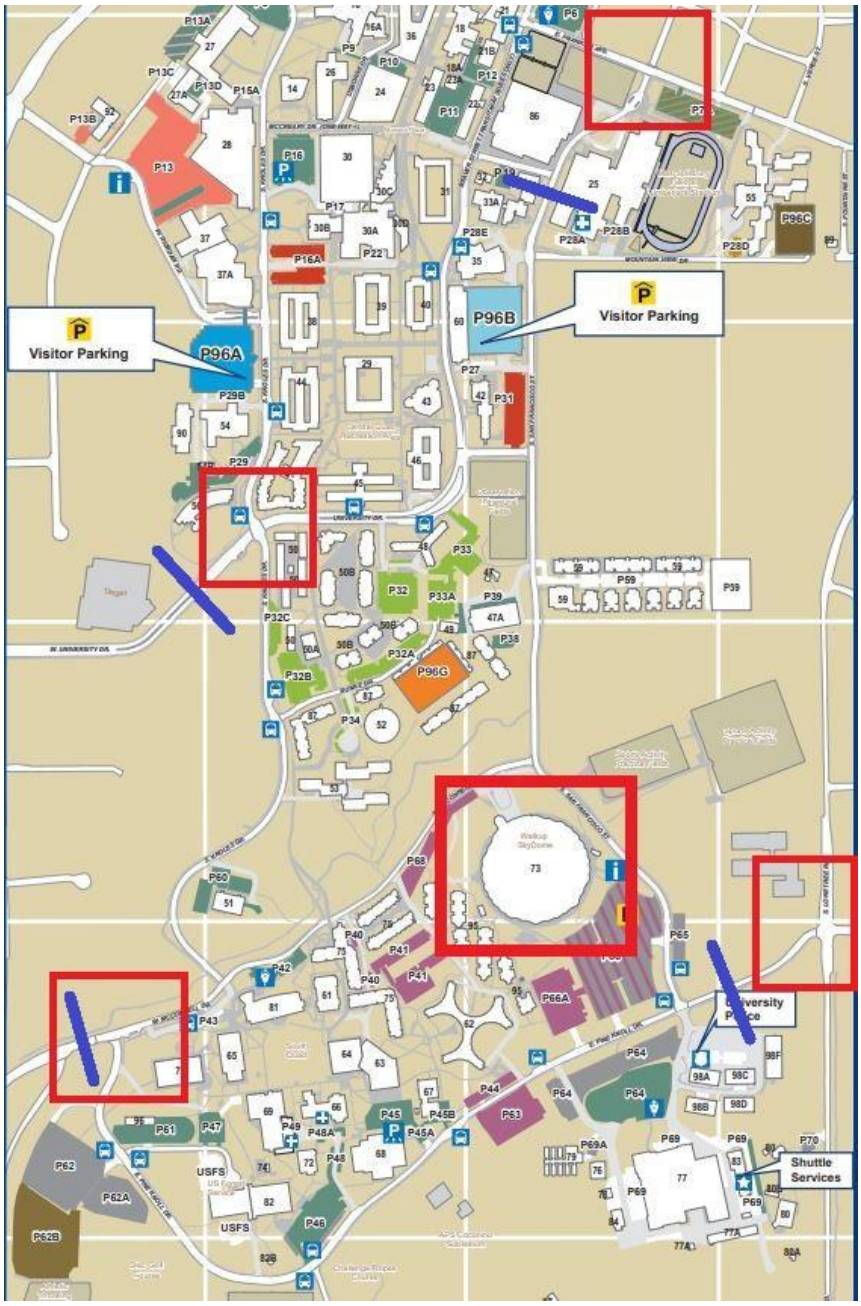

Figure 1: Project Site Locations [1].

The I-17 off-ramp contains one left-only and one right-only turn lane. Presently, the left turning traffic on the Interstates I-17 and I-40 off-ramp which backs up due to heavy cross-traffic on McConnell Drive. Additionally, all intersections on south campus are regulated by stop signs, which fail to handle large volumes of traffic in gridlock conditions. Figure 3 below shows the locations of the four study intersections on NAU

Central and South Campus. University Drive and Knoles Drive are Intersection 1, and Franklin Avenue and San Francisco Street are Intersection 2. Intersection 3 is Pine Knoll Drive and Lone Tree Road. Intersection 4 is McConnell Drive and Pine Knoll Drive. Figure 2 below shows the intersection geometry of the four study intersections as well as the I-17 off-ramp (in the bottom left) within NAU campus.

Figure 2: Clockwise from top left: Close-up of intersection geometry for Intersections 1, 2, 3, and 4 [2].

North Central District of ADOT, the NAU Police Department, the City of Flagstaff, and NAU Parking Services stated that NAU Graduation events cause traffic to congest on campus and slow traffic to a standstill on Interstates 40 & 17, and State Route 89A primarily in the two hours before commencement begins. NAU PD directs traffic, allocates officers and manual intersection traffic operators, and tickets offenders. NAU Parking Services designates lots and the San Francisco Parking Garage for "Park and Ride," Disabilities Parking, and General Event Parking for commencement. ADOT, NAU PD, and NAU Parking Services need an event traffic study for May 2019 Graduation at

the NAU SkyDome and data-backed traffic circulation recommendations for graduation events and other high traffic volume special events.

1.3 Technical Considerations

1.3.1 Study Parameters

The study parameters include analyzing the roadway levels of service (LOS) at Intersections 1, 2, 3, and 4. Traffic count devices, such as Jamar Boards and road tube counters, supplied by NAU and the City of Flagstaff, collect and plot traffic volume data at the above intersections within NAU campus. The traffic circulation study also includes calculating average vehicle delay. These three parameters will be measured on an average "control" traffic day on Friday, April 26th as well as on the Friday, May 10th, 2019 Commencement Ceremony.

1.3.2 Software

The collected traffic volume data, traffic flow simulations, and roadway maps will be created using software such as Vissim, Synchro, ArcGIS, Aries, and AutoCAD. Two intersections of the four have traffic lights: Pine Knoll Drive & Lone Tree Road, and Knoles Drive & University Drive. Traffic data will also be analyzed in an excel file in order to graphically compare the graduation traffic volume and baseline traffic volume data. In addition, a statistical graph will be utilized to demonstrate NAU's and the CoF's current and future population growth rate and how they will likely affect graduation volumes in the near future (10-20 years).

1.3.3 Safety Considerations

NAU safety protocol utilizes OSHA and ADOT safety standards for pedestrian protection from vehicular traffic during the graduation event and the traffic study. Any accident whether vehicle to vehicle, or vehicle to pedestrian will increase traffic congestion further by blocking the limited lanes of travel. Any plan put in place needs to be simple enough so that drivers can quickly obtain circulation direction information while driving and process it in time to respond in a safe, orderly manner. Electronic notification guide and warning signs need to be placed well in advance of the event for both vehicle and pedestrian traffic, and likely 2 miles away on I-17, I-40, South Milton Road, and AZ state route 89A in order to give drivers advanced warning of the event traffic and lane

rerouting. These signs need to be placed in regular intervals leading toward the graduation event and capable of changing messaging in real time.

Manual traffic operation officers, who currently direct traffic at intersections during high volume timeframes, will be provided a simple plan to minimize any potential confusion concerning the temporary rerouting of traffic lanes. The manual traffic officers are liable for any accidents caused by their explicit hand signaling. An overly-complex rerouting of traffic circulation lanes can confuse an officer, cause accidents, and potentially lead to lawsuits for NAU Police Department and ADOT.

1.3.4 Standards and Policies

The Manual for Uniform Traffic Control Devices (MUTCD) standard published by the Federal Highway Administration (FHWA) will be applied the project traffic study for. outlining special event traffic control planning and signage studies. Pedestrian safety, permissible vehicular movements, and roadway signage required for special, high traffic events is outlined by the MUTCD.

1.4 Potential Challenges

Collecting data during NAU graduation event limits the opportunities to collect the traffic data. If the equipment fails or data can't be accurately collected, the entire traffic study is useless. The baseline data collected for peak weekday traffic will need to be at least two weeks before graduation, and needs to be during the semester. Failure to collect baseline data before students start moving out at the end of the semester will skew the data.

The road geometry is fixed so the scope is limited to developing a traffic circulation recommendation. Although the stakeholders can be provided with better traffic data in order to implement a plan, there is currently no room for changes in infrastructure geometry. The only changes that can be made are potential changes in direction, and extra turning movement lanes for certain intersections.

1.5 Stakeholders

The City of Flagstaff, ADOT, NAU PD, NAU Parking Services, NAU faculty and students, CoF residents, graduation attendees, and interstate/highway travelers will be consulted during the study process. ADOT affirms that the traffic problem with the source of the traffic congestion on NAU campus causing vehicles to back up onto

Interstates 40 & 17, and AZ State Route 89A, and bring travel to a near stop on portions of the highways. NAU PD is responsible for enforcing any event traffic circulation plan in place, directing campus intersection traffic, and ticketing offenders for violating road and parking rules. These high traffic volumes during graduation events tend to strain campus police resources. NAU Parking Services is also responsible for implementing traffic circulation plans involving buses, shuttles, and parking schedules for parking lots including ADA parking. Parking Services' resources also become strained during these large graduation events.

2.0 Scope

2.1 Site Investigation

2.1.1 Site Investigation and Work/Safety Plan

The four intersections that are to be studied: Pine Knoll Drive & McConnell Drive, University Drive & San Francisco Street, and Pine Knoll Drive & Lone Tree Road, need to be visited and assessed prior to conducting the baseline and May 2019 traffic studies. The main issues surround ingress traffic on Northern Arizona University's (NAU) Flagstaff Campus. The campus entrance traffic movements need to be focused on to acquire traffic count data for ingress traffic.

A safe observation point needs to be determined for each of the three study intersections for both traveler and study worker safety. This singular point of observation or each intersection also needs to be established to ensure accurate data collection for study workers, and this observation point needs to have clear sightlines for all traffic movements entering campus.

2.1.2 Virtual Data Collection + Finished Site Map

Virtual data, such as AutoCAD roadway maps and ArcGIS traffic movement maps, needs to be acquired for traffic study planning, clearly communicating with the clients, traffic data analyzing, and traffic circulation recommendations.

2.1.3 Equipment Acquisition

Traffic count equipment enables the traffic study to capture more data as well as more movements within the NAU roadway network. Likely types of

equipment that will be used include the Jamar Board and road tubes. The Jamar Board requires at least one person to operate the traffic count and movement board. The road tubes are useful since they can be set up across the desired lane(s) of travel and automatically count cars. One limitation of the road tubes is they cannot count cars by type of movement. They only count the number of cars that pass over the device tubes.

2.2 Traffic Study

2.2.1 Baseline Conditions and Baseline Flow Map

The baseline map will be displayed to review the vehicular flow, and will be evaluated according to baseline traffic conditions in order to compare the baseline traffic conditions with NAU graduation event traffic conditions. In addition, to determine if the roadway improvement plans would improve the traffic circulation flow and the overall roadway safety, and reduce traffic congestion.

The team will be conducting a traffic count and movement study in order to accurately define peak morning traffic volumes and movements on NAU Central/South Campus. Collected baseline data will be compared with the May 2019 Graduation traffic count volumes to identify problem traffic areas and the dominant travel corridors with quantitative data.

The two study periods and related data collected will guide the development of base flow maps for NAU's Central and South Campus. These base flow maps act as a control for the event traffic flow map to be developed after the graduation traffic study is completed in May 2019.

2.2.2 May 2019 Graduation Conditions and Event Flow Map

The traffic volume data collected on May 10th and 11th, 2019, will be utilized for analysis and the NAU graduation traffic circulation plan. Collecting traffic volumes for the May 2019 graduation is the primary goal of this project and study so that it can be utilized to accurately gauge, improve traffic efficiency, and increase safety during NAU's graduation. Using the traffic flow data, traffic flow numbers will help develop an event traffic volume map for NAU South Campus.

2.3 Analysis

2.3.1 Average Delay Analysis

The average delay of the vehicles travelling through the four study intersections will be calculated to understand the flow conditions surrounding the analyzed intersections. The total delay (in seconds, minutes, hours) is divided by the number of cars in the intersection approach being analyzed [2].

2.3.2 Traffic Volume Analysis

The recorded traffic volume count of the two graduation event studies and three baseline studies will be analyzed and compared in order to account for the seasonal/ special event volume increase at the major intersections. The traffic volume is simply the number of cars traveling in a specific direction on a given roadway. The traffic count data will enable the creation of base flow and event flow traffic count maps for South Campus.

2.3.3 Level of Service (LOS) Analysis

Using the traffic count data and average delay equation, the level of service can be analyzed to measure and categorize the degree of the traffic congestion. Level of Service uses A, B, C, D, E, and F to categorize the efficiency of vehicle movement through an intersection, with A being the best level and F being the worst [3]. Vissim software will be utilized to display the traffic flow movement and traffic control type for each intersection. Vissim will simulate traffic flow movements based on queue length as well as light cycle time, depending on whether the intersection under analysis is controlled by stop signs or traffic lights. Analysis results for level of service as well as Vissim simulations for current and future growth traffic levels will be presented in a table for easy comparison and discussion.

2.3.4 Cost Analysis

Cost analysis will be performed on the three traffic circulation recommendations developed after the traffic data is processed and circulation plans are developed. Analysis includes cost of implementation, equipment required, personnel required, and cost of operation and management (O&M) for each of the three circulation plans. A comparison of the three plans based on the items mentioned immediately above will be carried out to determine which

circulation plan is the most cost effective for NAU, ADOT, the CoF, NAU PD, and NAU Parking.

2.4 Impacts

2.4.1 Traffic Control

The traffic control field will be extensively reviewed regarding the intersection conditions including lanes, speed limits, bus stops, signage, bike lanes, sidewalks, in addition to other possible concerns.

2.4.2 Environmental Impacts

The environmental impacts will be reviewed regarding the physical, natural, and geometric features in order to develop AutoCAD/ArcGIS maps of existing and graduation event conditions. Air pollution impacts from heavy traffic and increased runoff from any new roadways built on South Campus for congestion mitigation are of primary concern.

2.4.3 Public Safety

The public safety impacts will acquire awareness regarding the traffic maintenance, allowed pedestrian movements, changes to pedestrian routes, changes to traffic control devices at intersections, and management activities.

2.5 Traffic Management Recommendations

2.5.1 Management Alternatives

2.5.1.1 Short-term Recommendations

Based on the previous traffic management plans designed by Arizona Department of Transportation (ADOT), City of Flagstaff, and the Northern Arizona University Police Department, the short term recommendations for the graduation traffic circulation are centered primarily around utilizing designated inlets and outlets for traffic, shuttle services from local parking garages, and utilizing police or trained individuals to manage traffic at each of the three high volume intersections.

2.5.1.2 Long-term Recommendations

After the completion of the traffic study, the team will analyze which intersections are experiencing the largest amount of traffic volume, the longest delays, the lowest levels of service (LOS), and which main arteries of traffic need improvement. These traffic volumes will also help identify which contra-flow regimes of traffic are most efficient to relieve congestion as quickly as possible.

2.6 Deliverables

2.6.1 Traffic Study and Analysis (30% Submittal)

Concluding the May 2019 graduation traffic study, a 30% completion report will be created. It identifies which aspects of the project will have been completed as well as the analysis of the previous transportation plan provided by ADOT and where it can be improved.

2.6.1.1 30% Report

A 30% report will be developed and provided to the GI and TAs after obtaining and analyzing the existing local roadway plans and studies.

2.6.1.2 30% Presentation

A 30% presentation will prepared to list all the data acquired from the traffic analysis as well as traffic count data for both the baseline traffic studies and graduation traffic study.

2.6.2 Traffic Recommendation (60% Submittal)

Based on the collected graduation volume data from May of 2019 and the baseline traffic volume data, software analysis including excel, Synchro, Vissim, and Aries will be utilized to simulate the traffic conditions and inform potential problem areas in the roadway network. The simulations will also inform potential circulation improvements.

2.6.2.1 60% Report

A 60% report will be developed and provided to the GI and TAs after developing proposed short-term and long-term traffic circulation recommendations on the two-peak periods of the graduation event for the

Friday and Saturday commencement ceremonies. Three circulation plans will be included in the 60% report based on the analyzed data from the 30% submittal.

2.6.2.2 60% Presentation

A 60% presentation includes the completed software analysis for vehicle volume flow modeling as well as the project's impacts concerning public safety, the environment, and traffic flow.

2.6.3 Refined Compilation (90% Submittal)

With the aid of outside agencies such as ADOT, NAU PD, and NAU Parking Services, a traffic circulation plan will be established to present intersections and roadways improvement plans. In addition to bicycle, shuttles, buses, and pedestrian facilities traffic improvement plan during NAU graduation event.

Projected NAU population growth data will be obtained from NAU and the City of Flagstaff population growth will come from Blueprint 2040 as well as the U.S. Census. Population growth data informs the area's likely growth rate over the next 10 to 20 years, which will also allow for more accurate traffic circulation recommendations by the team.

2.6.3.1 90% Report

A 90% report will written and provided based on the GI, client, stakeholder, and TA's feedback.

2.6.3.2 90% Website

A 90% website will be developed based on the final results, then presented to the GI, TA, clients, stakeholders, Industrial Advisory Board (IAB), as well as the public.

2.6.4 Final Report

A completed final report will include a complete baseline and event traffic circulation site map. Three alternative circulation plans and accompanying circulation maps for campus will be provided to demonstrate vehicles, bicycle, and pedestrian flow as well as traffic congestion based on the analyzed data. Final

cost of implementing the three circulation plans will be provided to the client, GI, and TA in the final report.

2.6.5 Final Website

A final website will be compiled, edited, and refined based on GI and TA feedback. This hard-copy report and presentation will be provided and presented to the clients, stakeholders, interested public, CENE 486C Instructors, and Industrial Advisory Board (IAB).

2.7 Project Management

2.7.1 Coordination

A stakeholders, technical advisors, clients, grading instructor, and team meeting schedule will be provided including date, time, location, and the meeting's discussion summary/agenda for identifying/analyzing solutions and seeking input. Meetings with the above individuals will take place every 2 to 3 weeks to ensure timely project feedback and to give the capstone team ample time to incorporate feedback into the project.

2.7.2 Scheduling Meetings

Meetings with stakeholders, technical advisors, the grading instructor, clients, and the capstone team will be recorded in the teambinder to document input and maintain accountability for each team member. The meetings must include four meetings with the GI and four meetings with the TAs at a minimum. Monthly progress reports; 30%, 60%, and 90% will be developed and refined throughout work study plan. A Gantt chart will be developed in order to illustrate the project schedule plan to point out the milestones and the interrelationships between the tasks and sub-tasks.

2.7.3 Team Meetings

The meetings will be conducted to ensure that the team members work closely, efficiently, and on-time for a successful development of NAU graduation circulation plan. The baseline and future traffic conditions will be reviewed thoroughly in order to keep on-track and identify 3 traffic calming solutions.

2.7.4 Resource Management

Email correspondence and excel will maintain resource management regarding the project's equipment utilization. The Jamar boards are available from NAU's Traffic Laboratory and road tube counters are available from the CoF via Ms. Stephanie Sarty.

2.7.5 Project Tracking

Microsoft Project will maintain project tracking. The critical path and task scheduling is outlined in the project Gantt Chart, and related due dates for all tasks and critical tasks are shown in the Gantt Chart as well.

Exclusions

The study is limited/constrained by only two major events and the recommendation cannot include roadway geometry changes. The final report and deliverables are limited solely to a traffic study and recommendations based on quantified data to NAU PD, ADOT, NAU Parking, and the City of Flagstaff. The agencies will use the data to minimize traffic delay, improve roadway and parking efficiency, and maintain vehicular and pedestrian safety on NAU campus during the graduation event. During the data collection process, ADOT, NAU PD, and NAU Parking Services will set guidance and manage the traffic control by implementing its necessary traffic operations within NAU's geometric infrastructure.

Specific Exclusions

a. Special Event Traffic Management
b. Notification to the Public
c. Site Survey

3.0 Project Schedule

A work task plan (Gantt Chart) has been developed and displayed below illustrating the project schedule, interrelationships between tasks, as well as the critical path in figures 3 and 4 below. Some of the work tasks will be completed before Fall 2019 such as the equipment acquisition, as well as the baseline data and graduation event vehicular count data. The established schedule is subjected to modification based on the technical advisors and the grading

instructor feedback. The following table provides and overview of the project tasks and standards activities for which the traffic circulation study would be accomplished.

1: Preliminary Site Visit and Assessment	**5 days**	**Mon 8/26/19**	**Fri 8/30/19**	
1.1 Safety Plan	3 days	Mon 8/26/19	Wed 8/28/19	
1.2 Equipment Acquisition	4 days	Mon 8/26/19	Thu 8/29/19	
1.3 Virtual Data Collection	5 days	Mon 8/26/19	Fri 8/30/19	
2: Traffic Study	**5 days**	**Mon 9/2/19**	**Fri 9/6/19**	
2.1 Baseline Condtions Study	2 days	Tue 9/3/19	Wed 9/4/19	2,3,4
2.2 Baseline Flow Map	2 days	Thu 9/5/19	Fri 9/6/19	6
2.3 Graduation Traffic Study	2 days	Mon 9/2/19	Tue 9/3/19	3,4,2
2.4 Graduation Flow Map	3 days	Wed 9/4/19	Fri 9/6/19	8
3: Data Analysis	**11 days**	**Sat 9/7/19**	**Fri 9/20/19**	
3.1 Data Analysis	**11 days**	**Sat 9/7/19**	**Fri 9/20/19**	
3.1.1 Average Delay Analysis	10 days	Sat 9/7/19	Thu 9/19/19	6,8,7,9
3.1.2 Traffic Volume Analysis	10 days	Sat 9/7/19	Thu 9/19/19	6,8,7,9
3.1.3 Level of Service Analysis	10 days	Sat 9/7/19	Thu 9/19/19	6,8,7,9
3.1.4 Cost Analysis	10 days	Mon 9/9/19	Fri 9/20/19	2,3,4,6,7,8,9
4: Impacts	**20 days**	**Sat 9/7/19**	**Thu 10/3/19**	
4.1 Traffic Control	10 days	Fri 9/20/19	Thu 10/3/19	6,7,8,9,12,13,14
4.2 Environmental Impacts	10 days	Sat 9/7/19	Thu 9/19/19	8,6,7,9
4.3 Public Safety	10 days	Mon 9/16/19	Fri 9/27/19	6,8,7,9
5: Traffic Management Recommen	**6 days**	**Fri 10/4/19**	**Fri 10/11/19**	
5.1 Management Alternatives	**6 days**	**Fri 10/4/19**	**Fri 10/11/19**	
5.1.1 Short Term Recommenda	6 days	Fri 10/4/19	Fri 10/11/19	12,13,14,15,17,18,19
5.1.2 Long Term Recommendat	6 days	Fri 10/4/19	Fri 10/11/19	12,13,14,15,17,18,19
~~6: Deliverables~~	~~79 days~~	~~Mon 8/26/19~~	~~Wed 12/11/1~~	
~~7: Project Management~~	~~78 days~~	~~Mon 8/26/19~~	~~Tue 12/10/19~~	

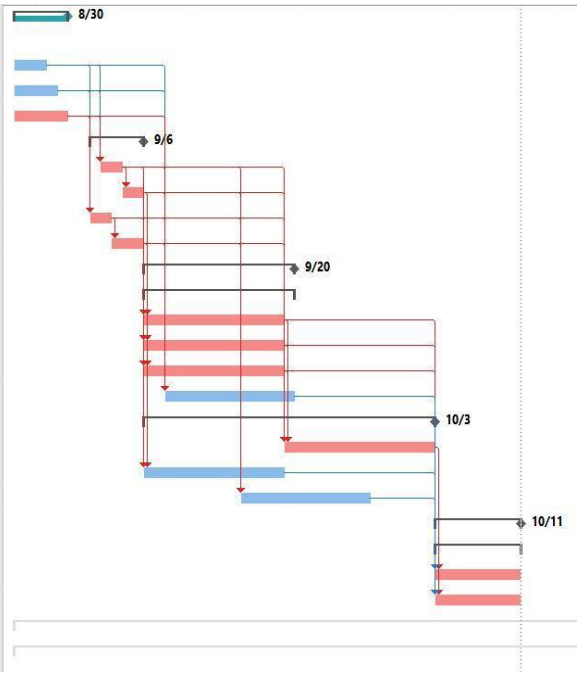

Figure 3: Gantt Chart

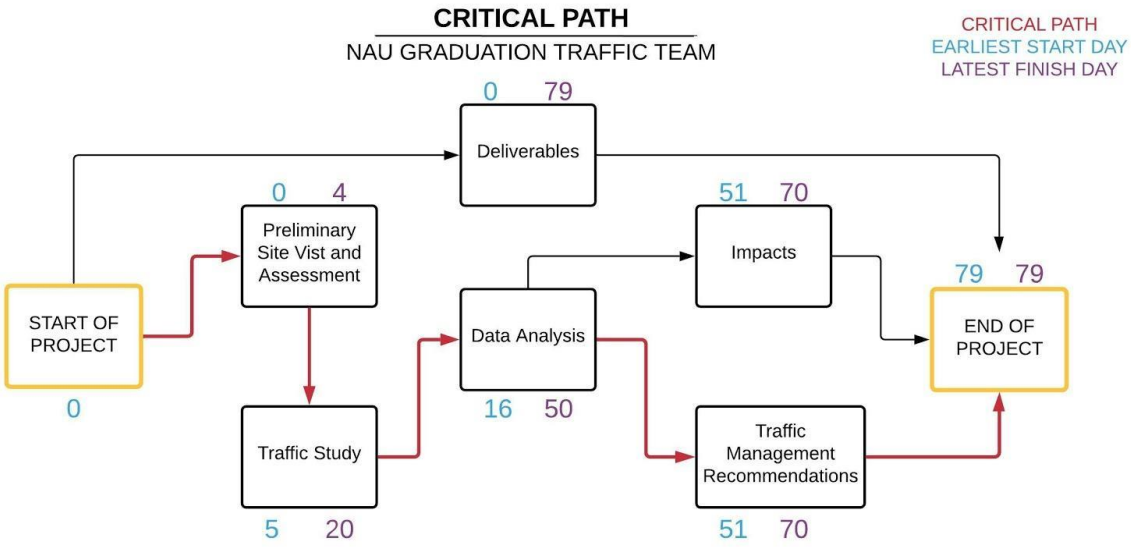

Figure 4: Critical Path Network

4.0 Staffing Plan

The project's team staffing plan and roles are outlined in Table 2 below. The roles for this project study are senior engineer, engineer, and intern with traffic study experience. Capstone work will begin on April 1st with equipment acquisition and site assessment. The baseline study will take place on Friday, April 26th, and the event traffic study will take place on Friday, May 10th. The roles are evenly distributed to each member of the team followed with some backup from a couple of classmates for the baseline and event traffic studies.

No lab work is required for the project. Traffic data will be collected in the field by the engineer and intern, and analyzed by the engineer and intern. Oversight on the project will be provided by the senior engineer role, which will mostly take place in the later tasks and briefly during the project to make sure that it remains on track and completes the intended objectives.

No administrative assistant role is needed for this capstone either. The intern will compile the reports concerning the analysis and traffic flow maps. The engineer and senior engineer will compile the 30%, 60%, and Final Reports.

Table 2: Staffing Plan

Task	Staff (hrs)			Total Task (hrs)
	Senior Engineer	Engineer	Intern	
1.0 Preliminary Site Visit and Assessment				0
1.1 Safety Plan	0	15	0	15
1.2 Virtual Data Collection	0	0	21	21
1.3 Equipment Acquisition	0	0	9	9
2.0 Traffic Study				0
2.1 Baseline Conditions Study	0	15	0	15
2.2 Baseline Flow Map	0	0	15	15
2.3 Graduation Traffic Study	0	0	0	0
2.3.1 Friday Traffic Data Collection	0	15	0	15
2.3.2 Saturday Traffic Data Collection	0	15	0	15
2.4 Graduation Flow Map	0	3	12	15
3.0 Traffic Analysis				0
3.1 Average Delay Analysis	0	12	30	42
3.2 Traffic Volume Analysis	0	12	30	42
3.3 Level of Service Analysis	0	12	30	42
3.4 Cost Analysis	0	27	15	42
4.0 Impacts				0
4.1 Traffic Control	0	0	6	6
4.2 Environmental Impacts	0	0	6	6
4.3 Public Safety	0	0	6	6
5.0 Traffic Management Recommendations				0
5.1 Management Alternatives	0	0	0	0
5.1.1 Short-term Recommendations	12	12	0	24
5.1.2 Long-term Recommendations	12	12	0	24
6.0 Deliverables				0
6.1 Traffic Study Analysis	0	0	0	0
6.1.1 30% Design Report	3	9	0	12
6.1.2 30% Design Presentation	3	9	0	12
6.2 Traffic Circulation Recommendations				0
6.2.1 60% Design Report	6	9	0	15
6.2.2 60% Design Presentation	6	9	0	15
6.3 Report Compilation				0
6.3.1 90% Design Report	3	12	0	15
6.3.2 90% Website	3	12	0	15
6.4 Final Report and Presentation	3	12	0	15
7.0 Project Management				0
7.1 Coordination	18	18	0	36
7.2 Scheduling Meetings	0	9	0	9
7.3 Team Meetings	33	33	33	99
7.4 Resource Management	0	9	6	15
7.5 Project Tracking	12	0	0	12
			Total Project Hours	624

5.0 Cost of Engineering Services

The following table provides the cost estimates for the traffic study, analysis, and traffic circulation recommendations. Table 3 outlines the engineering services to be incurred and the cost planning estimation for each service. These cost estimations should be used for study planning and project budgeting only. Estimates in this table does not include project risk costs.

Table 3: Cost of Engineering Services

1.0 Personnel	Classification	Rate, $/hr	Hours	Cost
	Senior Engineer	200	114	$22,800
	Engineer	70	291	$20,370
	Intern	25	219	$5,475
	Total Personnel			$48,645
2.0 Travel	N/A	N/A	N/A	0
3.0 Supplies	4 Jamar Boards and 3 Road Tubes	$45/hr	20	$900
4.0 Total				$49,545

References

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