NAU May 2019 Graduation Traffic Study and Circulation Recommendations Proposal

CENE 476-001 - Capstone Team
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Project Understanding

Purpose

- Improve roadway efficiency
- Reduce traffic congestion:
  - I-40
  - I-17
  - SR 89A
  - NAU and nearby Flagstaff surface streets

Client and Stakeholders

- Nate Reisner
- NAU Parking Services
- NAU PD
- City of Flagstaff

Project Location

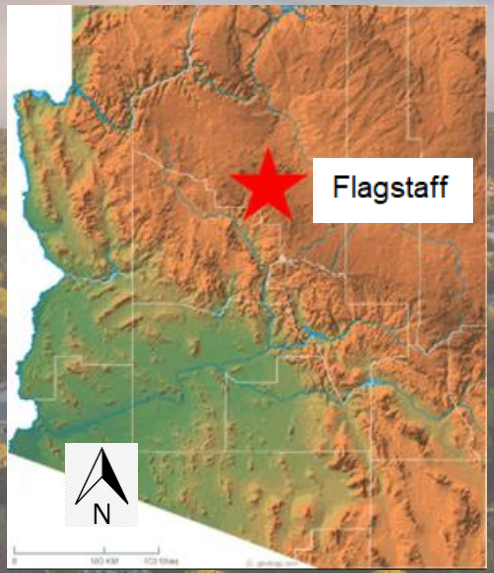


Figure 1: Flagstaff Location [3]

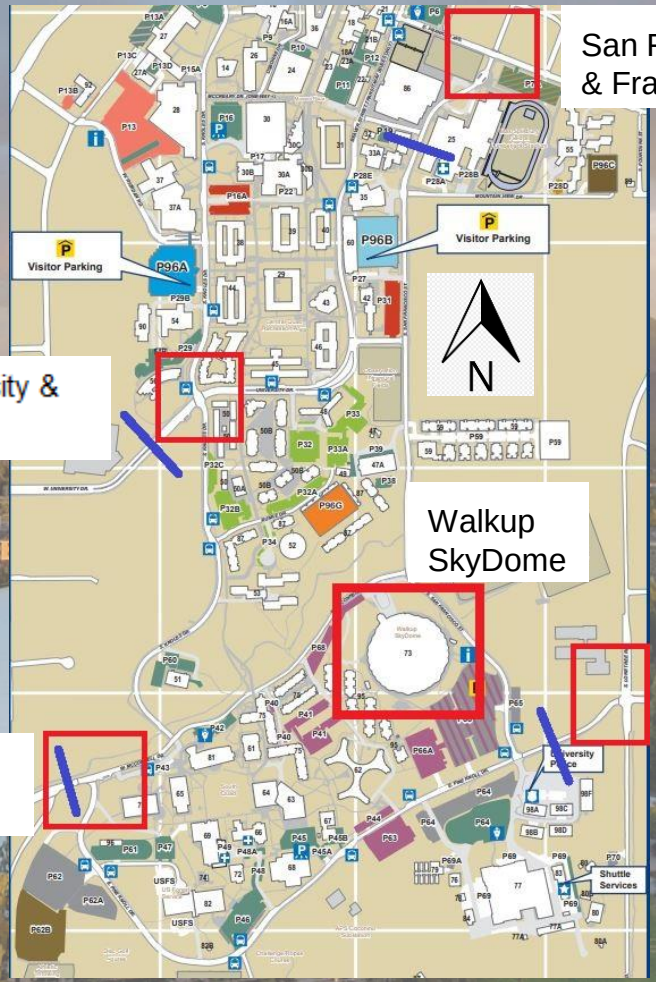
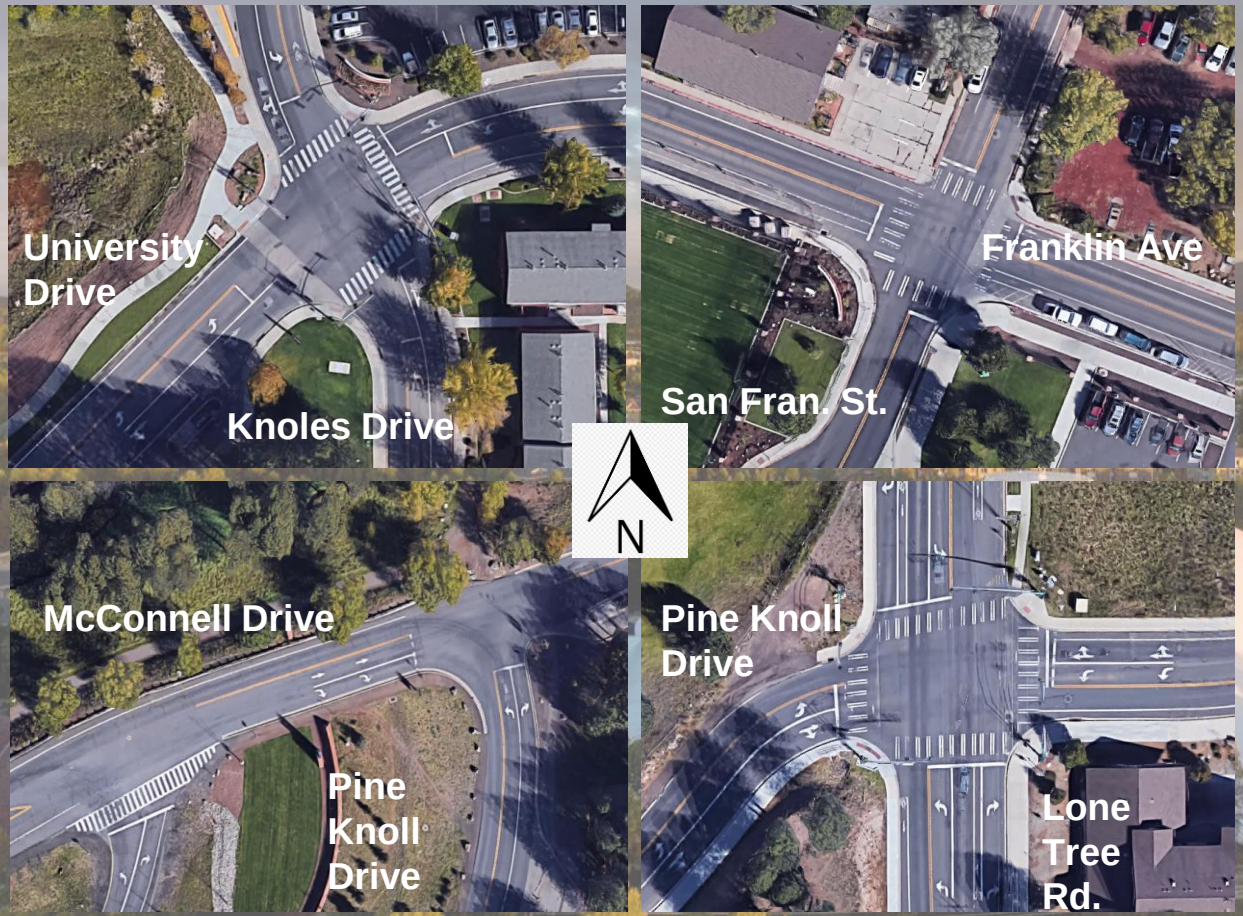


Figure 2: Project Site Locations [4]

Project Location & Background



- Focused on NAU Campus Access Roads
  - Skydome
  - Four Intersections
  - Improve Ingress Traffic

Figure 3: Close-up of intersection geometry for Intersections 1, 2, 3, and 4

Task 1: Site Investigation

1.1 Site Investigation and Work/Safety Plan

1.2 Virtual Data Collection and Finished Site Map

1.3 Equipment Acquisition

- ❑ **4 Jamar Boards**
- ❑ **4 Road Tube Counters**

Task 2: Traffic Study

2.1 Baseline Conditions and Baseline Flow Map

2.2 May 2019 Graduation Conditions and Event Flow Map

Task 3: Analysis

3.1 Average Delay Analysis

3.2 Traffic Volume Analysis

3.3 Level of Service (LOS) Analysis

3.4 Cost Analysis for Alternatives

Task 4: Impacts

4.1 Traffic Control

4.2 Environmental Impacts

4.3 Public Safety

Task 5: Traffic Management Recommendations

5.1 Management Alternatives

5.1.1 Short-term Recommendations

- Based off Collected and Analyzed Traffic Data

5.1.2 Long-term Recommendations

- NAU Master Plan
- Flagstaff Population Growth (Census)

Task 6: Deliverables

6.1 Traffic Study and Analysis (30% Submittal)

- **6.1.1 30% Report**
- **6.1.2 30% Presentation**

6.2 Traffic Recommendation (60% Submittal)

- **6.2.1 60% Report**
- **6.2.2 60% Presentation**

6.3 Refined Compilation (90% Submittal)

- **6.3.1 90% Report**
- **6.3.2 90% Website**

6.4 Final Report

6.5 Final Website

6.6 Final Presentation

Task 7: Project Management

7.1 Coordination

7.2 Scheduling Meetings

7.3 Team Meetings

7.4 Resource Management

7.5 Project Tracking

Figure 4: Road Tube Counter [5].

Project Limitations

Challenges

- Time-sensitive data collection
- Equipment Failure
- Weather
  - Rain
  - Snow
  - Lightning

Exclusions

- Special Event Traffic Management
- Notification to the Public
- Site Survey

Project Schedule

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	

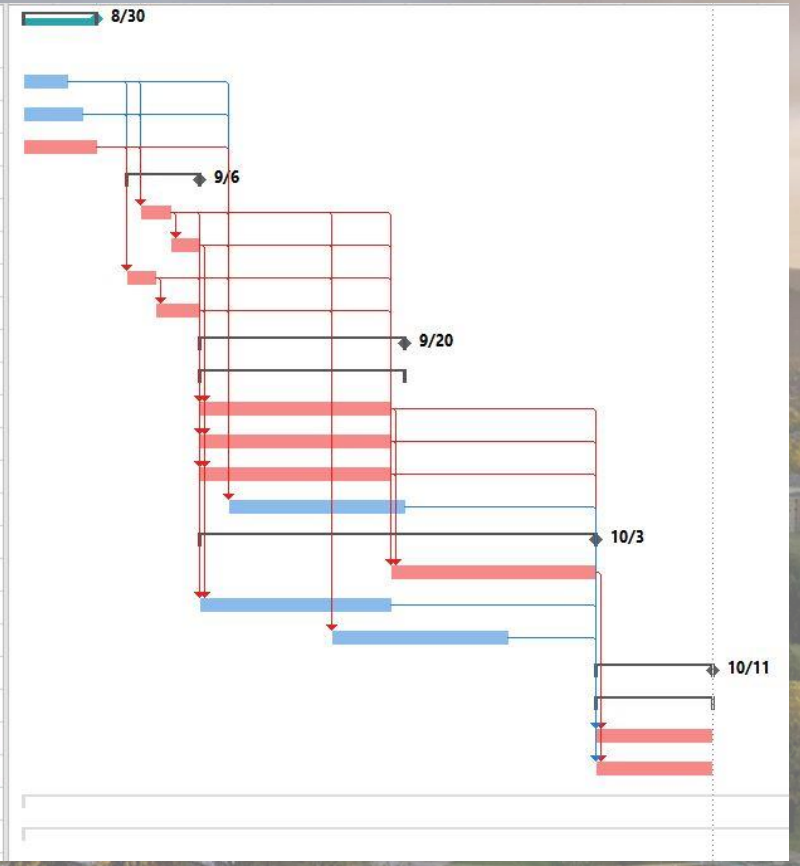


Figure 5: Gantt Chart and Critical Path

Critical Path

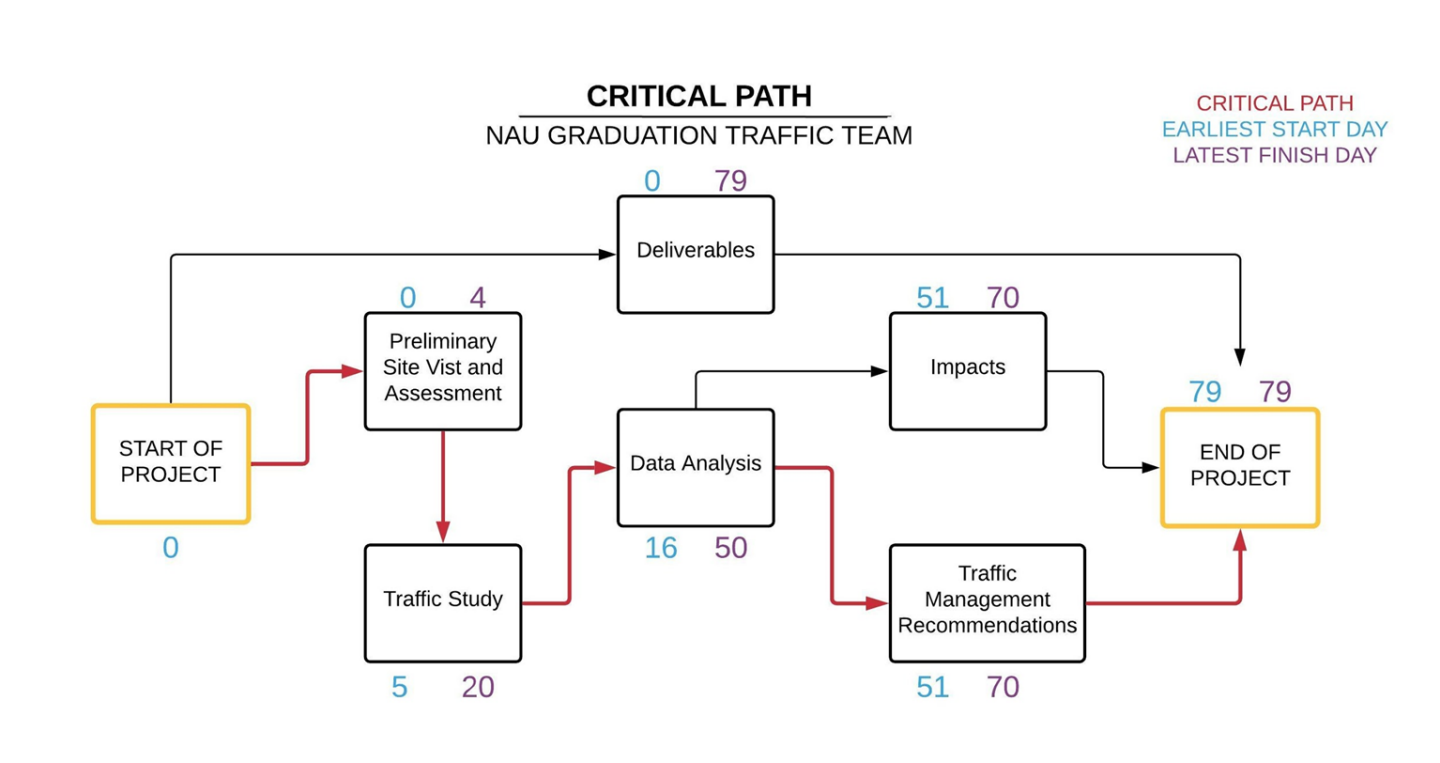


Figure 6: Critical Path Network

Staffing

Table 1: 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

Cost of Engineering Services

Table 2: Cost of 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

[1] Hardisondowney.com. (2019). NAU Honors College. [online] Available at: https://hardisondowney.com/portfolio-view/nau-honors-college/ [Accessed 18 Apr. 2019].

[2] https://nau.edu/sbs/2018-community-partners/

[3] Printable Map - New. (2019). Arizona Topo Map. [online] Available at: http://bartosandrini.com/arizona-topo-map.asp [Accessed 18 Apr. 2019].

[4] In.nau.edu. (2019). [online] Available at: https://in.nau.edu/wp-content/uploads/sites/119/2019/02/Campus-Map-FY19-Y-P62-change.pdf [Accessed 16 Apr. 2019].

[5] Jamartech.com. (2019). *Making Traffic Data Collection Easier*. [online] Available at: https://www.jamartech.com/ [Accessed 24 Apr. 2019].

Questions?