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SR 260/SR 89A Intersection Analysis

CENE 476 Final Proposal Presentation

Depict Engineering Group

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DEPICT

NAU NORTHERN ARIZONA UNIVERSITY

ADOT

THE HEART OF ARIZONA WINE COUNTRY COTTONWOOD

Introduction

Purpose: Analysis of intersection for possible safety and mobility improvements

Client: Nate Reisner, PE, ADOT District Development Engineering Manager

Technical Advisor: Dr. Edward J. Smaglik, Ph.D., P.E., Professor

Location: Intersection of State Route 260 and State Route 89A in Cottonwood, Arizona

Background:

- Traffic has increased over the years to an unacceptable level
- ADOT has solicited proposals for traffic analysis and recommendation of alternatives

Location

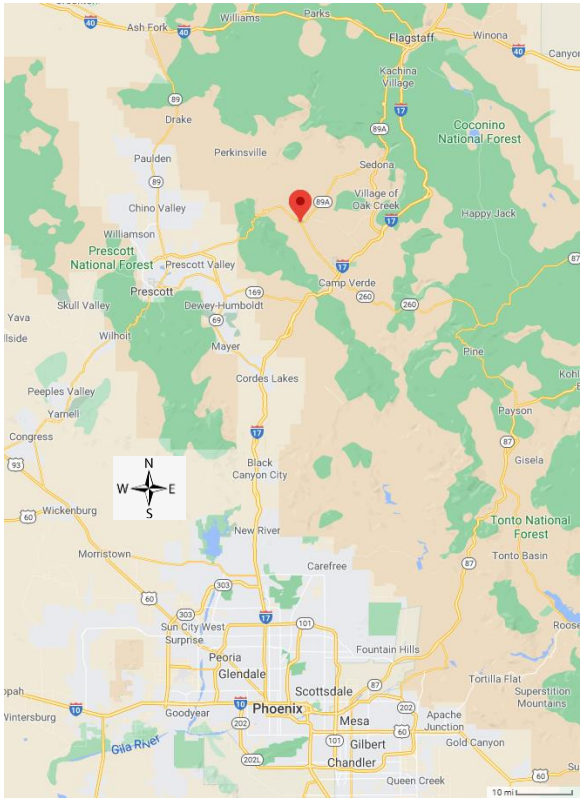


Figure 1: Cottonwood in relation to Phoenix and Flagstaff, Arizona © 2020 Google [2].

Figure 2: Close up of the intersection of SR260 and SR89A, Cottonwood, AZ © 2020 Google [3].

Constraints

- **Improve traffic mobility:**
  - Currently at LOS of C at peak hour conditions
  - Projected to be LOS E or F if no action is taken
  - Reduce delays over the existing design
  - Improve accessibility for non-vehicle traffic
- **Improve safety for the following:**
  - Vehicles
  - Pedestrians
  - Cyclists

Figure 3: Traffic Safety © 2020 Google [4].

Research and Site Investigation

Task 1.0 Research and Regulatory Considerations

- Task 1.1: Review Past Solutions
- Task 1.2: Regulatory Considerations
  - Task 1.2.1: Federal Highway Administration (FHWA)
  - Task 1.2.2: ADOT Roadway Design Guidelines

Task 2.0: Site Investigation

- Task 2.1: Surveying and Soil Data
- Task 2.2 Existing Geometry
- Task 2.3 Identify Contributing Intersections
- Task 2.4: Lane Configurations
- Task 2.5 Site Restrictions
- Task 2.6 Investigate Proposed Developments

Task 3.0: Collection of Field Data from ADOT

- Task 3.1 Existing Plan Set
- Task 3.2 Classification Of Vehicles
- Task 3.3 Five Year Crash Data
- Task 3.4 Signal Timing And Phasing

Figure 4: VISSIM Example Google [5].

Analysis and Design

Task 4.0: Traffic Counts

- Task 4.1 Field Safety Plan
- Task 4.2 Peak Hour Volume (PHF)
- Task 4.3 Upload Data

Task 5.0: Traffic Analysis

- Task 5.1: Base Model Creation and Calibration
- Task 5.2: VISSIM analysis of base conditions
- Task 5.3: 20-Year Projection

Task 6.0: Alternatives and Evaluation of Impacts

- Task 6.1: Scoring System
  - *Task 6.1.1: Design Criteria*
  - *Task 6.1.2: Construction Considerations*
  - *Task 6.1.3: Evaluation of Impacts*
- Task 6.2: Generate and Analyze Alternatives
- Task 6.3: Scoring, Selection of Final Alternative
- Task 6.4: Preliminary and Final Design Plan Sets

Figure 5: Overview of Cottonwood © 2020 Google [6].

Administrative Tasks

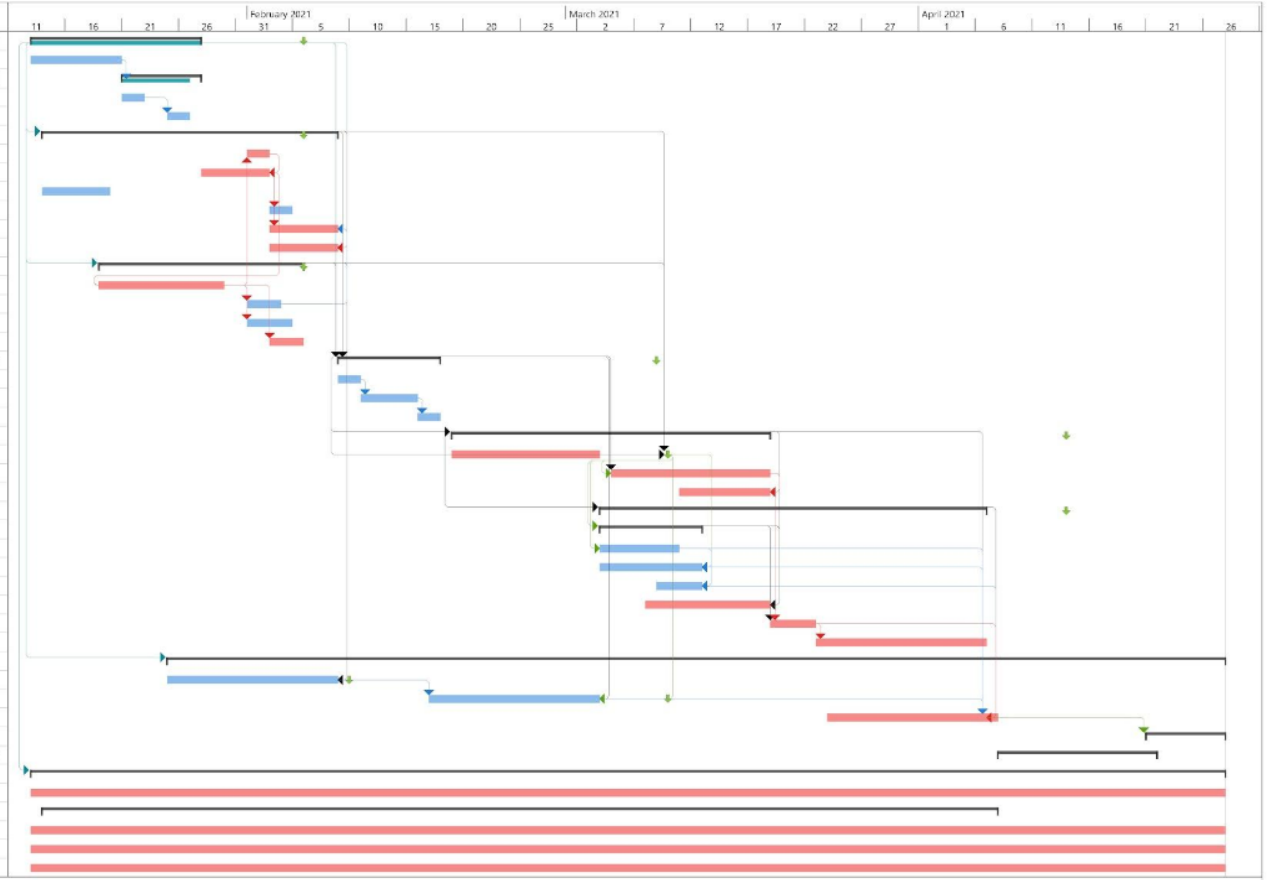
Task 7.0: Project Deliverables

- Task 7.1: 30% Report and Presentation
- Task 7.2: 60% Report and Presentation
- Task 7.3: 90% Report
- Task 7.4: Final Submittal
  - *Task 7.4.1: Final Report*
  - *Task 7.4.2: UGRADS Presentation*
- Task 7.5: Website
  - *Task 7.5.1: 90% Website*
  - *Task 7.5.2: Final Website*

Task 8.0: Project Management

- Task 8.1: Resource Management
- Task 8.2: Client and TA Meetings
- Task 8.3: GI Meetings
- Task 8.4: Team Meetings
- Task 8.5: Schedule Management

ID	Task Name	Duration	Start	Finish
1	**Task 1.0: Research and Regulatory Considerations**	**10 days**	**Wed 1/13/21**	**Wed 1/27/21**
2	Task 1.1: Review Past Solutions	5 days	Wed 1/13/21	Wed 1/20/21
3	**Task 1.2: Regulatory Considerations**	**5 days**	**Thu 1/21/21**	**Wed 1/27/21**
4	Task 1.2.1: FHWA	2 days	Thu 1/21/21	Fri 1/22/21
5	Task 1.2.2: ADOT	2 days	Mon 1/25/21	Tue 1/26/21
6	**Task 2.0: Site Investigation**	**17 days**	**Thu 1/14/21**	**Mon 2/8/21**
7	Task 2.1: Surveying and Soil Data	2 days	Mon 2/1/21	Tue 2/2/21
8	Task 2.2: Existing Geometry	4 days	Thu 1/28/21	Tue 2/2/21
9	Task 2.3: Identify Contributing Intersections	3 days	Thu 1/14/21	Tue 1/19/21
10	Task 2.4: Lane Configurations	2 days	Wed 2/3/21	Thu 2/4/21
11	Task 2.5: Site Restrictions	4 days	Wed 2/3/21	Mon 2/8/21
12	Task 2.6: Investigate Proposed Developments	4 days	Wed 2/3/21	Mon 2/8/21
13	**Task 3.0: Collection of Traffic Data from ADOT**	**14 days**	**Tue 1/19/21**	**Fri 2/5/21**
14	Task 3.1: Existing Plan Set	9 days	Tue 1/19/21	Fri 1/29/21
15	Task 3.2: Classification of Vehicles	3 days	Mon 2/1/21	Wed 2/3/21
16	Task 3.3: Five-Year Crash Data	4 days	Mon 2/1/21	Thu 2/4/21
17	Task 3.4: Signal Timing and Phasing	3 days	Wed 2/3/21	Fri 2/5/21
18	**Task 4.0: Traffic Counts**	**7 days**	**Tue 2/9/21**	**Wed 2/17/21**
19	Task 4.1: Field Safety Plan	2 days	Tue 2/9/21	Wed 2/10/21
20	Task 4.2: Peak Hour Volumes	3 days	Thu 2/11/21	Mon 2/15/21
21	Task 4.3: Upload Data	2 days	Tue 2/16/21	Wed 2/17/21
22	**Task 5.0: Traffic Analysis**	**20 days**	**Fri 2/19/21**	**Thu 3/18/21**
23	Task 5.1: Base Model Creation and Calibration	9 days	Fri 2/19/21	Thu 3/4/21
24	Task 5.2: VISSIM Analysis of Base Conditions	10 days	Fri 3/5/21	Thu 3/18/21
25	Task 5.3: 20-Year Projection	6 days	Thu 3/11/21	Thu 3/18/21
26	**Task 6.0: Alternatives and Evaluation of Impacts**	**24 days**	**Thu 3/4/21**	**Tue 4/6/21**
27	**Task 6.1: Scoring System**	**7 days**	**Thu 3/4/21**	**Fri 3/12/21**
28	Task 6.1.1: Design Criteria	5 days	Thu 3/4/21	Wed 3/10/21
29	Task 6.1.2: Construction Considerations	7 days	Thu 3/4/21	Fri 3/12/21
30	Task 6.1.3: Evaluation of Impacts	4 days	Tue 3/9/21	Fri 3/12/21
31	Task 6.2: Generate and Analyze Alternatives	9 days	Mon 3/8/21	Thu 3/18/21
32	Task 6.3: Scoring, Selection of Final Alternative	2 days	Fri 3/19/21	Mon 3/22/21
33	Task 6.4: Preliminary and Final Design Plan Sets	11 days	Tue 3/23/21	Tue 4/6/21
34	**Task 7.0: Project Deliverables**	**67 days**	**Mon 1/25/21**	**Tue 4/27/21**
35	Task 7.1: 30% Report and Presentation	11 days	Mon 1/25/21	Mon 2/8/21
36	Task 7.2: 60% Report and Presentation	11 days	Wed 2/17/21	Thu 3/4/21
37	Task 7.3: 90% Report	11 days	Wed 3/24/21	Thu 4/8/21
38	**Task 7.4: Final Report and Presentation**	**5 days**	**Wed 4/21/21**	**Tue 4/27/21**
41	**Task 7.5: Website**	**10 days**	**Thu 4/8/21**	**Wed 4/21/21**
44	**Task 8.0: Project Management**	**74 days**	**Wed 1/13/21**	**Tue 4/27/21**
45	Task 8.1: Resource Management	74 days	Wed 1/13/21	Tue 4/27/21
46	**Task 8.2: Client and TA Meetings**	**59 days**	**Thu 1/14/21**	**Thu 4/8/21**
54	Task 8.3: GI Meetings	74 days	Wed 1/13/21	Tue 4/27/21
55	Task 8.4: Team Meetings	74 days	Wed 1/13/21	Tue 4/27/21
56	Task 8.5: Schedule Management	74 days	Wed 1/13/21	Tue 4/27/21



Project: CENE 476 Schedule
Date: Thu 11/12/20

Task
Split
Milestone
Summary
Project Summary
Inactive Task
Inactive Milestone
Inactive Summary
Manual Task
Duration-only
Manual Summary Rollup
Manual Summary
Start-only
Finish-only
External Tasks
External Milestone
Deadline
Critical
Critical Split
Progress
Manual Progress

Staffing Matrix

Table 1: Staffing Matrix by Position

Task	Senior Egr.	Project Egr.	Proj. Manager	Drafter	Total
Task 1.0: Research and Regulatory Considerations	**11**	**22**	**24**	**17**	**74**
Task 1.1: Review Past Solutions	5	6	8	4	23
Task 1.2: Regulatory Considerations	6	16	16	13	51
Task 1.2.1: Federal Highway Administration (FHWA)					
Task 1.2.2 ADOT Roadway Design Guidelines					
Task 2.0: Site Investigation	**7**	**19**	**22**	**37**	**85**
Task 2.1: Surveying and Soil Data	1	2	2	4	9
Task 2.2: Existing Geometry	2	4	4	8	18
Task 2.3: Identify Contributing Intersections	1	3	2	3	9
Task 2.4: Lane Configurations	0	2	2	4	8
Task 2.5: Site Restrictions	2	6	6	12	26
Task 2.6: Investigate Proposed Developments	1	2	6	6	15
Task 3.0: Collection of Traffic Data from ADOT	**8**	**16**	**16**	**28**	**68**
Task 3.1: Existing Plan Set	3	6	6	14	29
Task 3.2: Classification of Vehicles	2	4	4	4	14
Task 3.3: Five-Year Crash Data	1	2	2	4	9
Task 3.4: Signal Timing and Phasing	2	4	4	6	16

Table 2: Continuation of Staffing Matrix by Position

Task	Senior Egr.	Project Egr.	Proj. Manager	Drafter	Total
Task 4.0: Traffic Counts	**4.5**	**13**	**13**	**13**	**43.5**
Task 4.1: Field Safety Plan	2	4	4	4	14
Task 4.2: Peak Hour Volumes	2	6	6	6	20
Task 4.3: Upload Data	0.5	3	3	3	9.5
Task 5.0: Traffic Analysis	**23.5**	**47.5**	**47.5**	**47.5**	**166**
Task 5.1: Base Model Creation and Calibration	14	28	28	28	98
Task 5.2: VISSIM analysis of base conditions	5.0	10.5	10.5	10.5	36.5
Task 5.3: 20-Year Projection	4.5	9.0	9.0	9.0	31.5
Task 6.0: Alternatives and Evaluation of Impacts	**28**	**74**	**72**	**80**	**254**
Task 6.1: Scoring System	8	16	16	16	56
Task 6.1.1: Design Criteria					
Task 6.1.2: Construction Considerations					
Task 6.1.3: Evaluation of Impacts					
Task 6.2: Generate and Analyze Alternatives	10	20	20	20	70
Task 6.3: Scoring, Selection of Final Alternative	2	6	4	4	16
Task 6.4: Preliminary and Final Design Plan Sets	8	32	32	40	112
Task 7.0: Project Deliverables	**19**	**34**	**34**	**34**	**121**
Task 8.0: Project Management	**28**	**33**	**43**	**23**	**127**
Total Of All Tasks	**129**	**258.5**	**271.5**	**279.5**	**938.5**

Staffing Matrix (cont.)

Cost of Engineering Services

Table 3: Cost of Engineering Services

1.0 Personnel	**Classification**	**Unit**	**Rate per Unit**	**Quantity**	**Cost**
	SE	Hours	$ 152.59	129.0	$ 19,685
	E	Hours	$ 105.98	258.5	$ 27,395
	PM	Hours	$ 89.62	271.5	$ 24,331
	DR	Hours	$ 56.32	279.5	$ 15,742
	Total personnel				**$ 87,154**
2.0 Travel	**Classification**		**Rate per Mile**	**Miles**	**Cost**
	Travel to site				
	3 vehicles, 2 round trips, 130 miles R/T, @ $0.445/mile		$ 0.445	780	$ 347
	Total travel				**$ 347**
3.0 Supplies	**Classification**		**Rate per Day**	**Days**	**Cost**
	Traffic Lab access				
	20 days @ $100/day		$ 100.00	20	$ 2,000
	Total supplies				**$ 2,000**
4.0 Total Cost of Engineering Services					**$ 89,501**

- Largest expense is Personnel
- Mileage rates come from the AZ General Accounting Office [7]
- First trip to site is for the site investigation
- Second trip is for the traffic counts
- Traffic lab time is based on the amount of time needed to complete the traffic analysis

References

[1] Google. “Cottonwood AZ” Accessed November. 9th 2020 [online] https://www.google.com/url?sa=i&url=https%3A%2F%2Fcottonwoodaz.gov%2F&psig=AOvVaw2SuunYMiN5Ti9XX-bGD1ii&ust=1605204789345000&source=images&cd=vfe&ved=0CAIQjRxqFwoTCLiJvvyL--wCFQAAAAAdAAAAABAD

[2] Google. “Cottonwood Arizona US 260 US 89A” Accessed September. 10, 2020. [Online]. Available:https://www.google.com/maps/place/AZ-89A+%26+AZ-260,+Cottonwood,+AZ+86326/@34.721637,-112.0045955,17z/data=!3m1!4b1!4m5!3m4!1s0x872d0578dc66da37:0xa517b2a69b4584d8!8m2!3d34.721637!4d-112.0024068

[3] Google. “Cottonwood Arizona US 260 US 89A” Accessed September. 10, 2020. [Online]. Available: https://www.google.com/maps/place/AZ-89A+%26+AZ-260,+Cottonwood,+AZ+86326/@34.721637,-112.0045955,17z/data=!3m1!4b1!4m5!3m4!1s0x872d0578dc66da37:0xa517b2a69b4584d8!8m2!3d34.721637!4d-112.0024068

[4] Google. “Traffic Safety” Accessed November. 9th 2020 [Online] https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.sibfl.net%2Ftrafficsafety%2F&psig=AOvVaw1mZeEjFgA_aCkmsdmDN8xV&ust=1605118037561000&source=images&cd=vfe&ved=0CAIQjRxqFwoTCKD41ObI-OwCFQAAAAAdAAAAABAD

[5] Google. “VISSIM” Accessed November 9, 2020 [online] https://www.researchgate.net/profile/Ziran_Wang3/publication/332814708/figure/fig5/AS:754521768726528@1556903416032/Simulation-is-running-in-VISSIM-with-3D-mode.png

[6] J. Glass, “Dunkin' Donuts | Outparcel to Home Depot | 1006 S Main St.” LoopNet. Accessed November 11, 2020 [online]. Available: https://www.loopnet.com/Listing/1006-S-Main-St-Cottonwood-AZ/19597217/

[7] "State of Arizona Accounting Manual", In.nau.edu, 2020. [Online]. Available: https://in.nau.edu/wp-content/uploads/sites/206/Reimbursement-Rates-_10-2018.pdf. [Accessed: November 9, 2020]

Questions?