**Scope of Project and Project Schedule**
**Duncan, Arizona Floodplain Analysis- Highway and Levee Alignment Alternatives**
**CENE 476: Capstone-Prep**


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# 2 SCOPE OF SERVICES

2.1 Task 1: Field Investigation- Visiting Duncan, Arizona to complete the site investigation and traffic analysis.

2.1.1 Task 1.1: Site Investigation- Visually inspecting the site for any possible problems that may occur for the highways and intersections. This would include large trees, existing infrastructures, and other obstructions that may occur on the site. A walkthrough of the client's idea of the location of the proposed roadway will be conducted.

2.1.2 Task 1.2: Traffic Analysis- This will include determining what type of traffic analysis will performed, such as turn counts at the intersection to get an estimate of the traffic count to be expected on the roadway. Also, which equipment is necessary to perform traffic analysis and as a result, determine the type of design vehicle. The average annual daily volume (AADT) will be obtained from ADOT (Arizona Department of Transportation).

2.1.2.1 Task 1.2.1: Crash Data Analysis: Evaluation of crash data that will be obtained from ADOT to ensure that there is no significant data that will affect the alternatives. These will limit the possibilities of crashes on the new road by additions of preventive designs.

2.2 Task 2: Traffic Conditions- Assess the traffic analysis using highway analysis software. This will provide the team the geometric designs of the highway, intersection, and roadway width.

2.2.1 Task 2.1: Traffic Characteristics-Determine the speed and other dimensions required to meet ADOT, AASHTO, and Greenbook requirements. Other characteristics of the roadway will include traffic volume, number of lanes, level of service, sight distance, and grades. To determine all of the characteristics, Highway Capacity Software will be used.

2.2.2 Task 2.2: Highway Capacity Software (HCS)- Using HCS to determine the number of lanes and level of service for a 20-year span.

2.3 Task 3: Preliminary Data- Design will be based on the AASHTO Greebook, Arizona Design Standards, and the Highway Capacity Manual. This data will be used to outline the criteria of the new roadway.

2.3.1 Task 3.1: Horizontal Alignment Determination- Create an assembly in Civil-3D or AutoCAD to develop a 2-D version of highway design to create the alignment. The alignment must have a minimum turn radius which can be for speed or comfort.

2.3.2 Task 3.2: Elevation and LiDAR- Using the LiDAR the previous capstone team collected and in-putting it into Civil-3D to get current elevation in order to determine the possible elevation of the roadways.

2.3.3 Task 3.3: AASHTO Roadway Design Guidelines- Using the guidelines to insure the design is up to par and insuring that the side-slopes do not warrant guardrails.

2.4 Task 4: Alignment Design Alternatives- Multiple alternatives will need to be created to minimize cost, minimize conflict with the community, and satisfy the client.

2.4.1 Task 4.1: Alignment Design 1- Creating the first iteration of road realignment based on the client's request to utilize the new roadway as a levee. Creating an assembly and minimize the property interference.

2.4.1.1 Task 4.1.1: Horizontal Alignment- Having a brief idea where the road will be, adjustments can be made to minimize cost. This would require a surface in Civil-3D to input the roadway which does not interfere with existing infrastructures.

2.4.1.2 Task 4.1.2: Vertical Alignment- Elevate the roadway and create profile graph of roadway. Using Civil-3D to create the profile, and to meet the required height to double as a levee. This data such as sight distance will used to meet ADOT guidelines.

2.4.1.3 Task 4.1.3: Property Investigation- Use the AcreValue website find how much property will be interfered with and who they belong to. This will provide an idea of how much land we may need from each owner.

2.4.1.4 Task 4.1.4: Quantities Takeoff- Determine how much material is needed to fulfill design needs.

2.4.2 Task 4.2: Alignment Design 2-Developing second iteration of realignment.

2.4.3 Task 4.3: Alignment Design 3-Developing third iteration of realignment.

2.5 Task 5: Intersections-Developing the intersection requires the number of lanes and the locations where the client would like the intersections.

2.5.1 Task 5.1: Intersection Impact Analysis- HCS will be utilized again to find the best fit intersection and meets all criteria per ADOT, AASHTO Greenbook and AASHTO.

2.5.2 Task 5.2: Intersection Recommendations- Recommending the proper signage for the intersection and determine if the intersection warrants a stoplight.

2.6 Task 6: Cost Analysis- Determine the overall cost of the new alignment designs.

2.6.1 Task 6.1: Land Value Assessment- Determine how much property will cost based on land value.

2.6.2 Task 6.2: Alternatives Total Cost- Overall costing including labor and materials.

2.7 Task 7: Deliverables- CENE 486 Deliverables were chosen by the Graders and Creators of the class.

2.7.1 Task 7.1: 30% Report- This report will be completed by the due date, with the proper information including to the Grader.

2.7.2 Task 7.2: 60% Report- This report will be completed by the due date, with the proper information included to the Grader.

2.7.3 Task 7.3: Final Report- This report will include all tasks listed above and presented to the client.

2.7.4 Task 7.4: Website- Create and maintain a website that includes all major deliverables and pictures of the project from the beginning to completion.

2.7.5 Task 7.5: Impacts Report- A report on how the project impacts the town, environment, and more.

2.7.6 Task 7.6: Status Updates- Updating the Grader and client about the project's current standing throughout the semester.

2.7.7 Task 7.7: Final Presentation- This will be given at NAU UGrads Symposium and will be based on the proposed alternatives.

2.8 Task 8: Project Management- This includes weekly team meetings and extra meetings as necessary. Phone meetings with our client, Phil Ronnerud, monthly and on an as needed basis.

Technical advisor, Brendan Russo, meeting once a month and as needed to insure the team is performing all technical work correctly. As needed meetings with the Grader, Mark Lamer.

2.9 Project Limitations: The proposed flood mitigation measures will help reduce impact of floods on Duncan's urban structures. However, limitations such as cost-height of levees may hinder the effectiveness of controlling floods on other parts especially the lowest parts of the town. Maintenance costs, especially during low rainfall seasons due to material exposure, may limit effectiveness of selected method. Also, material for structural sections of such levees, may be insufficient. Finally, the terrain of sections of the town and general slope of Duncan town is a limitation to intersections proposed. The Federal Emergency Management Agency sets guidelines to design and build a levee. One of the guidelines listed as having a minimum seepage to prevent any damage to the levee stability. This will limit the design of the proposed solution. Moreover, the Greenlee County Engineer requires a permit to build a levee. Having such guidelines and permits required will cause challenges to the team.

2.9.1 Challenges: Challenges with this project would include travel and scheduling. Duncan, Arizona is located about five hours South East of Flagstaff and could cause complications with finding a time that works with the team's schedule as well as a time that works with the client. Another challenge would be funding for the project. In order for this project to be successful, the project would need federal funding for the highway portion of the levee. Other challenges with this project would include meeting the allowable grade for pedestrians, bicycles, and ADA requirements. The introduction of an elevated highway could cause complications with meeting the maximum allowable grade. Along with this, Duncan High School is located near the floodplain, so the team would have to take into consideration whether the students would need a route for walking to school. Currently there is also a railroad that runs through the town, this will not be designed for reroute, but it will need to be taken into consideration for our final design.

2.9.2 Exclusions: For the project, the team will only be designing an elevated highway. The team's task is to determine the height for a highway where a levee could be placed. The final alternatives will not include a cost analysis based on the amount of land that will be acquired. A geotechnical analysis of the soils and materials under the highway and surrounding will be excluded from the project. Other components that will be excluded are a formal EPA Environmental Impacts report and development permits for re-zoning of the new acquired land.

# 3 PROJECT SCHEDULE

3.1 Total Duration of Project: The total duration of the project will be roughly 81 days.

3.2 Major Tasks: The major tasks of the project schedule include a field investigation. Also, traffic conditions, preliminary data, alignment design alternatives, and intersections. Lastly, the major tasks will also include cost assessment, deliverables, and project management. All eight of these major tasks will have sub tasks.

3.3 Deliverables: The deliverables in the schedule include 30% report, 60% report, final report, status update, impacts report, website, and final presentation. These deliverables are due at various times and are major reports that will be done.

3.4 Critical Path: The critical path was determined by identifying what tasks needed to be completed in order to have a final product. This showed that the major tasks must be completed in order to have a final product. The timing will be maintained by the team leader who will help to keep everyone on task. The duration of the tasks will be based on what the individual team members who has been assigned this task. It will be up to their discretion on whether to finish it ahead of time or when it needs to be completed by.

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