Proposal For Structural Design In Peach Springs

CENE 476
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1.0 Project Understanding

After research from various sources, Flag-Tech Engineering Inc. has complied an understanding of the proposed structure in the city of Peach Springs Arizona. This project will be divided by two respective teams which will be selected by the stakeholder, one to focus on the structural portion and one to focus on the grade separation. This proposal is to focus on the structural portion of the overall design.

1.1 Project Purpose

Peach Springs is currently divided by the railroad that passes through the city; this division separates the north and south side of the city. The north side of Peach Springs contained the fire station, hospital & for many there respective place of work. Due to this citizens and vehicles are crossing the tracks in a dangerous manner, Peach Springs as part of the long range transportation plan provided by the stakeholder is investing into a structure to allow not only pedestrians to cross the railroad but for vehicles to be able to cross safely as well. With the train in the crossing being known to stall or move through the section at a slow rate, many have to wait long periods of time (up to ten minutes). Another major issue is the accessibility of the south side of the track for emergency vehicles; this crossing is being requested to ensure the safety of those who live on the south side from fires or any other medical emergency that an ambulance would be requested upon.

1.2 Background Information

Peach Spring Arizona is located about 113 miles (2 Hours) west of Flagstaff Arizona; it is the capital of the Hualapai nation. A figure of the city is depicted below:

Figure 1. Peach Spring Arizona

The city falls in the Mojave County for Arizona, the location of the Mojave County in respect to the state is depicted below:

Figure 2. Mojave County in Respect to Arizona

Peach Springs Arizona is located in the eastern region of the Mojave County, this is depicted below:

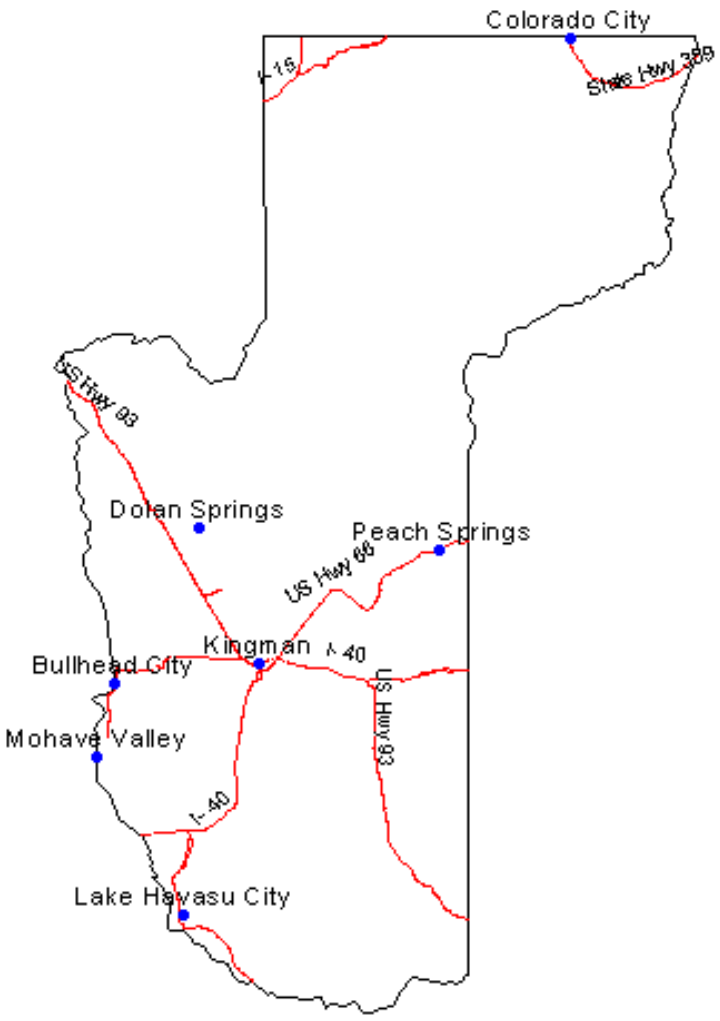

Figure 3. Peach Springs in Respect to the Mojave County

Currently the site is a hazard and has many paths in which locals choose to dangerously cross. The one legal crossing from the north to south side of the track is an at-grade crossing. Two images are shown below of the current crossing.

Image 1. At-Grade Crossing In Peach Springs

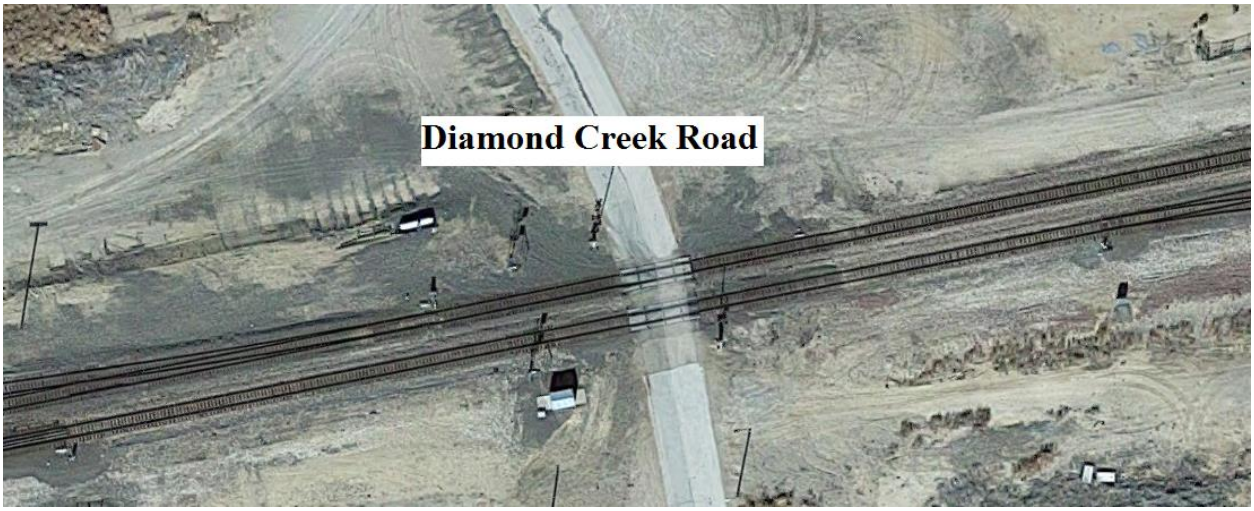

Image 2. Zoomed Out View of At-Grade Crossing

In the Long Range Transportation Plan provided by the client, it was shown that Peach Springs Arizona has four proposed alignment alternatives for a crossing, three overpasses and one underpass. Below is a figure that shows the four alignment alternatives:

Figure 4. Alignment Alternatives (Red is Overpasses & Blue is the Underpass)

Each Alignment Alternative is different and brings its own individual challenges, below are the images of each section:

Image 3. Overpass #4 Park (North)

Image 4. Overpass #3 Court House (North)

Image 5. Overpass #4 Park (South)

Image 6. Overpass #3 Court House (South)

Image 7. Overpass #2 Main Road (South)

Image 8. Overpass #2 Main Road (North)

Image 9. Underpass #1 West of City

1.3 Technical Considerations

For this project there are various different technical considerations that include the following: grading, channel design, structural design, retaining wall design, road design, concrete design and railroad boundary restrictions. Since this project is split between two teams the technical considerations will be more specific to each respective team. Thus, for the technical considerations of the structural portion of the overpass/underpass, Flag-Tech will focus on the structural design, concrete design and railroad boundaries. Any designs that are to be considered must abide the following: ACI Code, ADOT Standards, AASHTO Standards and FHWA Standards.

1.4 Potential Challenges

The surrounding area around the track is owned by the railroad company, BNSF. This means that permission to build around the railroad must be approved by BNSF if the underpass is to be used or if any of the overpass structure will be within the property of BNSF. Below is an image that depicts an area with a fence, the top area (north) of the fence is what owned by BNSF and the bottom area (south) of the fence is what the reservation takes ownership of.

Image 10. Division Between BNSF and Hualapai Reservation

Another challenge this project faces is the open channel on the south side of the tracks, this is an issue for construction because a new structure may have to be constructed in order to properly manage the water flow. This channel causes a huge problem for the under pass since it will be built through the channel, a new way of routing the water has to be taken into consideration. Below is an image of the open channel on the side of the railroad:

Image 11. South Side of the Tracks Channel

1.5 Stakeholders

The stakeholders for this structure are BNSF, Mojave County & Hualapai Reservation. BNSF has an influence in this structure because they control the region around the railroad and it must be proposed and approved by BNSF standards in order for the overpass/underpass to be constructed. The Mojave county standards must also be met as well as any other demands that the county may have must be taken into consideration. Finally the Hualapai are stakeholders to this project since it directly affects the region they live in, any request will have to be considered and analyzed in the design.

2.0 Scope of Services

The project will demand two teams to work together to complete the final deliverable, thus both teams will each provide a respective proposal. The scope of this proposal will focus on the structural design services that will be provided by Flag-Tech Engineering. The exemptions section below will describe the work that the grade separation team will focus on. The structural team in this project will focus on the following major tasks: Decision of alignment alternative, review of all applicable codes for construction and design of overpass/underpass, design of structure and meeting all project management requirements stated.

2.1 Decision of Alignment Alternative

This will be the only major task that Flag-Tech Engineering will complete together with the grade separation team. This major task will be completed during the summer of 2015. It will require comparing an estimate of cost provided by the client in the Long Range Transportation Plan. The decision of the final alignment alternative will also be dependent on a public survey and the analysis of some general codes and requirements. After this information is compiled a decision matrix will be constructed by both teams to make the final decision. **Once this major task is completed the decision matrix with the final decision will be provided to the client.**

2.1.1 Estimate Cost

The cost estimate of each of the four alignment alternatives can be found in the Long Range Transportation Plan. These estimates will be used along with any other potential cost that need to be factored in, an example of other costs would be the closure of the at-grade crossing that is currently being used. **A final estimate of the cost of each alignment will be provided to the client upon competition.**

2.1.2 Public Opinion

A public opinion survey will be constructed by both teams to be sent out during the summer to the residents of Peach Spring Arizona during a city council meeting. The questions on the survey will be compiled by both teams. If the survey is not completed by mid-July, the survey will be dropped all together from the decision matrix and analysis of the alignment alternatives. **The results of the completed survey will be accessible on the team website.**

2.1.3 General Analysis of Permits and Codes Required

Both teams will research briefly some of the permits and codes that each of the four alignment alternatives will require. Though many of the permits and codes for these areas will be similar they may not be the exact same, an example is the permits for the underpass and overpasses.

2.1.4 Construction of the Decision Matrix

After the analysis of the four alignment alternatives, a decision matrix will be constructed based on a point system that will be created by the two teams. The matrix will be filled and a decision will be made, in the event that alternative alignments finish with the same amount of points, the two teams will discuss to make a final decision. **A copy of the decision matrix will be provided to the client upon completion.**

2.1.5 Final Decision

After the decision process is completed the two teams will conclude the decision process by signing a formal agreement stating that all members of both teams condone the final decision. **A copy of the formal document will be provided to the client upon completion.**

2.2 Permitting/Standards/Codes

The various codes that will be reviewed are dependent on the alignment alternative that is selected by both teams. Some of the standards and codes may not be utilized depending on the alignment alternative selected. **After all of the codes have been read and considered, a document summarizing the codes that will be specifically used in the design will be available to the client for viewing on the team website.**

2.2.1 Mojave County Codes

The team will perform extensive research to conclude what codes the Mojave County uses for overpass/underpass construction. These codes will all be reviewed and summarized prior to the beginning of construction. **The final document provided to the client will include a summary of these codes.**

2.2.2 Permissions from BNSF

Permission to construct within the boundaries of the railroad that is owned by BNSF could apply for the overpass alignment alternatives but more than likely will only apply to the underpass alignment alternative. If the underpass is selected or if the overpass falls within the boundaries of the railroad, then BNSF will be contacted to confirm that the design will be permitted, in the circumstance that the design is denied the projects second option based on the document formed during the decision matrix task will be utilized. During this task the team will review the standards set in the area by BNSF in detail to ensure that no standards are broken in the general design of the structure. **Any permission provided by BNSF will be documented and included in the final document provided to the client.**

2.2.3 AASHTO Requirements

Flag-Tech Engineering Inc. will review the American Association of State Highway and Transportation Officials requirements, in this research the team will find height and width requirements for the sections of the overpass/underpass as well as the vehicle load that will be considered during construction. **A section of the AASHTO requirements summarized will be included in the final document and provide to the client.**

2.2.4 ADOT Overpass/Underpass Requirements

The Arizona Department of Transportation requirements for overpass/underpass will dictate the width of the overpass/underpass. The research in this code will be able to provide the overall dimensions of the structure as a whole along with the grade requirements to meet the length which the structure will have to meet; this length will be provided by Peach Springs Railroad Grade Separation Team after the competition of their field surveying. **A section in the final document will be provided to the client to show the results of the subtask.**

2.2.5 Structural Requirements

Post completion of determining the general load considerations that will be applied to the structure, Flag-Tech Engineering Inc. will review the most updated version of the ACI code in order to determine the proper concrete and rebar that the structure will require. This research will help to provide a general design for the proper reinforced concrete required to withstand all of the loads to be considered in the project. **A section in the final document will be provided to the client to show the results of the subtask.**

2.2.6 FHWA Standards

Flag-Tech Engineering Inc. will review the Federal Highway Administration standards to ensure that no codes and requirements are broken. This task will be used as a precaution to prevent any legal conflicts from arising. **Any requirements that may be applicable will be summarized and provided to the client in the final document.**

2.3 Design of Structure

This task will be the bulk of the work provided by Flag-Tech Engineering Inc., it will include drawings, computations, analysis and more finalized plans to the structure. **Throughout this task, various different documents will be provided to the client and available on the team website.**

2.3.1 Selecting Structure Type

Utilizing overpass/underpass design manuals from various sources the team will select a template for the bridge based on pervious similar projects. The group will focus on using Arizona overpass/underpass manuals but will not ignore manuals from other states. The decision of the structure will be made during this time frame and will be made with the consideration of Peach Springs Railroad Grade Separation Team. After a decision is confirmed, Flag-Tech Engineering Inc. will construct general AutoCAD drawings of the overpass/underpass. **A general print of the dimensions will be created, which will be available to the client upon completion on the team website.**

2.3.2 Structural Support

During this subtask Flag-Tech will design the proper reinforced concrete for the overpass/underpass. All calculations for the proper concrete will be completed during this subtask. Utilizing the ACI codes the concrete and rebar will be designed to meet the code. **These drawings will be provided to the clients for viewing upon completion.**

2.3.3 Super Structure

Beams will be proper constructed based on the prints and the external forces of the structure, the deck will also be finalized and properly constructed to meet all notable forces and weight that it is required to withstand. The internal features of the structure will be calculated and accommodate all the standards and codes, this portion will provide proper bolt sizes as well as proper diameters to ensure stability and that all safety factors are met. **A document of the design analysis can be provided to the client upon request.**

2.3.4 Estimate Potential Costs

Cost can be estimated by the team using the overpass/underpass practice guidelines available on the Arizona Department of Transportation website or upon request of ADOT. Other sources will be utilized to create a more precise cost estimate. **This cost will be the final proposed cost of the structure and will be presented in a detailed document explaining each individual aspect to the client.**

2.4 Exemptions

2.4.1 Surveying of Land

The surveying study of the region selected will be provided by the Peach Springs Railroad Grade Separation Team. This document will be utilized by Flag-Tech Engineering Inc. to a better understanding of the region around the alignment alternative chosen. **A copy of the document will be provided to the clients.**

2.4.2 Soil Testing

Peach Springs Railroad Grade Separation Team will conduct various soil tests in the regions of their choosing and presenting the soil reports to the Flag-Tech Engineering Inc. Team to properly design the foundation and retaining structure. **A copy of the document will be provided to the clients.**

2.4.3 Hydrology

Any hydrologic studies and calculations will be performed by Peach Springs Railroad Grade Separation Team and will include the current rainfall averages as well as the flow rates in the region around the alignment alternative that is selected as well as the intervals at which they occur. These factors will be considered by the Flag-Tech Engineering Inc. Team in all cases but particularly more in the case that the underpass design is selected for this project. **This information will be provided to the client in the form of a document summarized by the Peach Springs Railroad Grade Separation Team.**

2.5 Project Management

2.5.1 Project Schedule

A project schedule will be provided by Flag-Tech Engineering Inc. on a biweekly basis in order to keep the client up-to-date on any changes or additions to the project if required. **The project schedule will be available on a weekly basis on the team website as well upon request of the client & stakeholders.**

2.5.2 50% Design Report

This report will be submitted with all of the field work and standards review completed. It will encompass a rough AutoCAD drawing of the proposed structure. With some dimensions of internal features provided. This report will be an update on the progression of the project.

2.5.3 Final Design Report

Flag-Tech will have successfully completed the entire list of tasks described above and will have double checked them to ensure accuracy. **The team will be producing a 95% design report and will be reviewing within ourselves, upon request this document could also be turned in if requested by the project manager and/or stakeholders involved.**

2.5.4 Final Presentation

A presentation summarizing the project will be provided, and this time it will be utilized to answer any questions and evaluate on potential unclear topics. This presentation will provide all the aspects that were considered during the design of the structure as well as the methods that were used in each portion.

2.5.5 Website

Any documents and drawings that are completed and to be submitted to the client will also be available on the website. The entire teams contact information will also be shown on the home page, updates will occur weekly for the website to ensure the clients are informed as much as possible.

3.0 Project Schedule

At the end of this document (not attached but provided) is a Gantt chart that shows the time periods we have for all the tasks and subtasks that are planned for the project. The tan section is the expected dates for the grade separation team to provide the deliverables that are required in order for the structural design to properly begin. This Gantt chart does not show a critical path. There is a separate Gantt chart (not attached but provided) that does show the critical path on it, it is clearly defined by the red on the chart.

In the following two pages a more detailed representation of project schedule with duration and dates will be included. The following two figures depict all the tasks and subtasks of the project as well as the start and end dates of each respective task. The orange and tan tasks will be completed by the grade separation team.

Assignment	Start Date	Duration (Days)	End Date
Project Total	6/14/2015	186	12/17/2015
Decision On Region	6/14/2015	1	6/15/2015
· Pro/Con Sections for Each	6/14/2015	1	6/15/2015
· Decision Matrix	6/14/2015	1	6/15/2015
· Email Decision Matrix to Stakeholders	6/14/2015	1	6/15/2015
· Final Region Selection	6/14/2015	1	6/15/2015
Website	7/1/2015	158	12/6/2015
· Update Website	7/1/2015	3	7/4/2015
· Update Website	8/31/2015	3	9/3/2015
· Update Website	9/9/2015	3	9/12/2015
· Update Website	9/18/2015	3	9/21/2015
· Update Website	9/27/2015	3	9/30/2015
· Update Website	10/6/2015	3	10/9/2015
· Update Website	10/15/2015	3	10/18/2015
· Update Website	10/24/2015	7	10/31/2015
· Update Website	11/7/2015	3	11/10/2015
· Update Website	11/16/2015	3	11/19/2015
· Update Website	11/25/2015	3	11/28/2015
· Update Website	12/3/2015	3	12/6/2015
Field Evaluation	8/31/2015	11	9/11/2015
· Request for Surveying	8/31/2015	5	9/5/2015
· Request for Soil Testing	8/31/2015	5	9/5/2015
· Request for Hydrology Info	8/31/2015	5	9/5/2015
· Perform Survey	9/6/2015	1	9/7/2015
· Perform Soil Testing	9/6/2015	1	9/7/2015
· Measure Area for Hydraulic Analysis	9/6/2015	1	9/7/2015

Table 1. Start and End Dates for All Tasks

Assignment	Start Date	Duration (Days)	End Date
Project Total	6/14/2015	186	12/17/2015
Permitting/Standards/Codes	9/8/2015	22	9/30/2015
· Reviewing Current ACI Codes	9/8/2015	9	9/17/2015
· Document to Client Summarizing Codes	9/17/2015	3	9/20/2015
· Permission from BNSF	9/16/2015	6	9/22/2015
· AASHTO Requirements	9/22/2015	2	9/24/2015
· ADOT Overpass/Underpass	9/24/2015	2	9/26/2015
· Document Summarizing ADOT/AASHTO	9/26/2015	3	9/29/2015
· Structural/FHWA	9/29/2015	1	9/30/2015
Design of Structure	9/30/2015	58	11/27/2015
· Selecting Structure Type	9/30/2015	5	10/5/2015
· Finalize AutoCAD drawing to Client	10/5/2015	3	10/8/2015
· Construct 50% Report	10/5/2015	6	10/11/2015
· 50% Due Date	10/11/2015	1	10/12/2015
· Structural Support	10/12/2015	20	11/1/2015
· AutoCAD Drawing to Client	10/31/2015	4	11/4/2015
· Due Date for AutoCAD	11/4/2015	1	11/5/2015
· Super Structure	11/5/2015	22	11/27/2015
· Estimation of Costs of Materials	11/27/2015	7	12/4/2015
· Due Date for Cost report	12/4/2015	1	12/5/2015
· Construction of 95% Report	12/2/2015	6	12/8/2015
· Due Date of 95%	12/8/2015	1	12/9/2015
· Clean up 100% and Present	12/5/2015	6	12/11/2015
· 100% Due Date	12/11/2015	1	12/12/2015
· Clean up Presentation	12/12/2015	4	12/16/2015
· Final Presentation Due	12/16/2015	1	12/17/2015

Table 2. Start and End Dates for All Tasks

4.0 Staffing and Cost of Engineering Services

Flag-Tech Engineering Inc. will provide four personnel for the design of the overpass/underpass in Peach Springs, AZ. These personnel, description of their respective role and qualifications are shown in *Table 3*. The abbreviations in *Table 3* will be utilized in the proceeding tables.

Classification (Abbreviation)	Role and Qualifications
Senior Engineer (SENG)	Must oversee the project, ensure tasks are completed according to schedule, review all submittals & ensure efficiency in the office. Qualifications include: Graduation from a major college with coursework in Engineering, five years of professional engineering experience with two of those years involving project management.
Project Engineer (ENG)	In charge of completing deliverables presented in project schedule by organizing and controlling project elements. Qualification Include: Knowledge of proper analysis techniques, design skills, technical understanding, documentation skills, safety management & knowledge in manufacturing methods and procedures.
Engineering Intern (INT)	Perform engineering tasks under close supervision, Perform simple calculations and construct proper documents. Qualifications Include: Basic engineering principles and techniques, engineer planning & knowledge of equipment used in engineering operations.
Administrative Assistant (AA)	Oversee all administrative activities and schedule meetings. Qualifications: Basic understanding of engineering and sciences involved in engineering.

Table 3. Staff Classification and Qualifications

The following tables were constructed to provide a representation of the work time and how it will be dispersed among the three members. The total number of hours and days that each task will require is shown below in *Tables 4 & 5.*The yellow section depicts the total amount of days and hours that are estimated to be required in order to complete all of the tasks depicted in both tables. The blue sections depict larger tasks within the project and finally the white sections are the subtasks that are directly correlated with the larger task above it.

Assignment	Duration (Days)	Hours Per Day	Hours
Project Total	186		507
Decision On Region	1		7.05
· Pro/Con Sections for Each	1	1.5	1.5
· Decision Matrix	1	4	4
· Email Decision Matrix to Stakeholders	1	0.55	0.55
· Final Region Selection	1	1	1
Website	158		10.45
· Update Website	3	0.25	0.75
· Update Website	3	0.25	0.75
· Update Website	3	0.25	0.75
· Update Website	3	0.25	0.75
· Update Website	3	0.25	0.75
· Update Website	3	0.25	0.75
· Update Website	3	0.25	0.75
· Update Website	7	0.25	1.75
· Update Website	3	0.25	0.75
· Update Website	3	0.25	0.75
· Update Website	3	0.25	0.75
· Update Website	3	0.4	1.2

Table 4. Hours For Project

Assignment	Duration (Days)	Hours Per Day	Hours
Project Total	186		507
Permitting/Standards/Codes	22		80
· Reviewing Current ACI Codes	9	3	27
· Document to Client Summarizing Codes	3	4	12
· Permission from BNSF	6	2	12
· AASHTO Requirements	2	4	8
· ADOT Overpass/Underpass	2	4	8
· Document Summarizing ADOT/AASHTO	3	3	9
· Structural/FHWA	1	4	4
Design of Structure	58		409.5
· Selecting Structure Type	5	3	15
· Finalize AutoCAD drawing to Client	3	4	12
· Construct 50% Report	6	4	24
· 50% Due Date	1	1	1
· Structural Support	20	6	120
· AutoCAD Drawing to Client	4	3	12
· Due Date for AutoCAD	1	1	1
· Super Structure	22	6	132
· Estimation of Costs of Materials	7	2.5	17.5
· Due Date for Cost report	1	1	1
· Construction of 95% Report	6	5	30
· Due Date of 95%	1	2	2
· Clean up 100% and Present	6	3	18
· 100% Due Date	1	3	3
· Clean up Presentation	4	4	16
· Final Presentation Due	1	5	5

Table 5. Hours For Project

After the hours for each task were estimated Flag-Tech Engineering determined how many hours every individual position would be responsible for each task. This is shown below on *Table 6 & Table 7*, this will also provide a total on how many hours each position will be contributing to the project which is shown in yellow. As in the previous tables, the blue sections are the amounts of hours that the larger task will demand of each position. Each row can be compared to *Table 4 & Table 5*, the maximum amount of hours that any position can contribute to any given task is shown in *Table 4 & Table 5* in the final column on the far right.

Classification	SENG	ENG	INT	AA
Project Total	62	208	215	22
Decision On Region	0.75	2.5	3.7	0.1
· Pro/Con Sections for Each	0	1.5	0	0
· Decision Matrix	0.5	0.5	3	0
· Email Decision Matrix	0	0	0.45	0.1
· Final Region Selection	0.25	0.5	0.25	0
Website	0	0	10.45	0
· Update Website	0	0	0.75	0
· Update Website	0	0	0.75	0
· Update Website	0	0	0.75	0
· Update Website	0	0	0.75	0
· Update Website	0	0	0.75	0
· Update Website	0	0	0.75	0
· Update Website	0	0	0.75	0
· Update Website	0	0	1.75	0
· Update Website	0	0	0.75	0
· Update Website	0	0	0.75	0
· Update Website	0	0	0.75	0
· Update Website	0	0	1.2	0

Table 6. Hours Per Position and Task

Classification	SENG	ENG	INT	AA
Project Total	62	208	215	22
Permitting/Standards/Codes	2.5	24.5	32.85	20.15
· Reviewing Current ACI Codes	0	12	9.85	5.15
· Document to Client Summarizing Codes	1.5	6	4	0.5
· Permission from BNSF	0	0	6	6
· AASHTO Requirements	0	1.5	2.5	4
· ADOT Overpass/Underpass	0	1.5	2.5	4
· Document Summarizing ADOT/AASHTO	1	2.5	5	0.5
· Structural/FHWA	0	1	3	0
Design of Structure	58.75	181	168	1.75
· Selecting Structure Type	5	7.5	2.5	0
· Finalize AutoCAD drawing to Client	2	6	4	0
· Construct 50% Report	3	12	9	0
· 50% Due Date	0	0.25	0	0.75
· Structural Support	10	45	65	0
· AutoCAD Drawing to Client	3	6	3	0
· Due Date for AutoCAD	0	0.75	0	0.25
· Super Structure	18	56.5	57.5	0
· Estimation of Costs of Materials	0	10	7.5	0
· Due Date for Cost report	0.25	0.5	0	0.25
· Construction of 95% Report	8	12	10	0
· Due Date of 95%	0.75	1	0	0.25
· Clean up 100% and Present	2	10	6	0
· 100% Due Date	1.25	1.5	0	0.25
· Clean up Presentation	4	10	2	0
· Final Presentation Due	1.5	2	1.5	0

Table 7. Hours Per Position and Task

With the hours that each given position will be contributing to the project, Flag-Tech Engineering composed a table to show how much each position will be charged. This is show on the next page in *Table 8.* The final billing rate for each respective position is shown in the peach colored column.

Classification	Base Pay ($/hr)	Benefits % of Base Pay	Actual Pay ($/hr)	OH % of Base Pay	Actual Pay + OH ($/hr)	Profit, % of Actual Pay + OH	Billing Rate ($/hr)
SENG	55	30	71.5	70	121.55	12	136.14
ENG	45	60	72	15	82.8	12	92.74
LAB	35	80	63	10	69.3	12	77.62
INT	30	20	36	5	37.8	12	42.34
AA	12	90	22.8	50	34.2	12	38.30

Table 8. Calculated Billing Rate for Each Position

With the proper billing rate and the base pay determined a multiplier was found for the client to review and approve. This is shown below in *Table 9* in the cyan colored column; it depicts the multiplier in respect to the position.

Classification	Base Pay ($/hr)	Billing Rate ($/hr)	Multiplier
SENG	55	136.14	2.48
ENG	45	92.74	2.06
LAB	35	77.62	2.22
INT	25	42.34	1.69
AA	15	38.3	2.55

Table 9. Multiplier For Each Respective Position

Given the billing rate and hours for each position, calculations were determined on how much each position would demand. This is described in *Table 10* below, each calculation was rounded down to the nearest cent and the final total was found by rounding up to the nearest dollar for personnel. The travel portion of the cost estimation was found by researching the average cost of gas per mile and the distance from the office to Peach Springs, AZ. The total for the entire analysis of the structural portion of the Peach Spring crossing is highlighted in purple at the bottom right corner. Any details on how values were determined can be proved upon request.

1.0 Personnel	Classification	Hours	Rate $/hr	Cost ($ Dollars)
	SENG	62	136	8,432.00
	ENG	208	93	19,344.00
	INT	215	43	9,245.00
	AA	22	38	836.00
	Total Personnel	507		37,857.00
2.0 Travel	3 meetings at 224 mi/meeting	$.56/mi		376.32
	Car Rental	5 Days	55/Day	275.00
3.0 TOTAL				38,508.32

Table 10. Cost Estimate For Engineering Services

5.0 Resources

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