

Bamboo Bridge Design



Abdulaziz Almansur, Dominic Good, Steven Kohr, Mike Malisa

Purpose

Design a Bamboo replacement bridge for Flagstaff Urban Trail System to improve aesthetic of site area

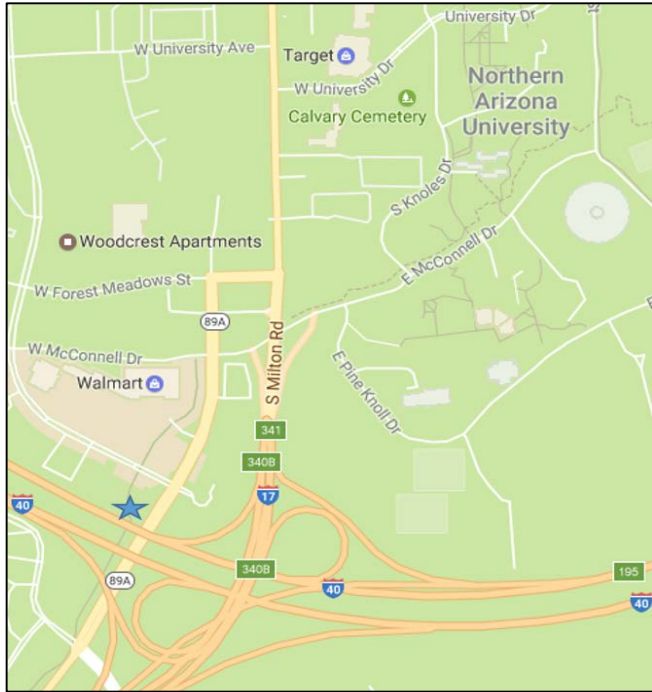
Construct a physical scale model that reflects design and architecture (not for loading)

Promote the feasibility and practicality of utilizing bamboo as a structural material



Existing Structure Facing South

Background



Vicinity Map of Project Site



Dimensions of Existing Structure

- The existing structure is a standard pedestrian bridge made of treated lumber
- The bridge spans across a floodplain detention basin and joins two segments of the FUTS

Stakeholders

- Client: Dr. Bridget Bero
- Technical Advisor: Dr. Joshua Hewes
- Flagstaff Urban Trail System Users
- Bamboo Industry
- Civil Engineering Profession



FUTS Logo [2]



City of Flagstaff Signage [3]

Scope - Task 1

Phase	Code	Task
1	1.0	Literature Review
	1.1	Existing Plans
	1.1.1	Current Bamboo Architecture
	1.1.2	Bamboo Properties
	1.2	Current Bamboo Structures in U.S.
	1.3	Team Meeting

- Acquire existing lumber bridge designs from the city of Flagstaff
- Research bamboo structures in both the U.S. and around the world
- Verify bamboo properties through reliable online sources
- Set meeting with the team to discuss how the obtained information will help influence the alternatives

Scope - Task 2

Phase	Code	Task
2	2.0	Develop Preliminary Designs
	2.1	Develop Three Alternatives
	2.2	Survey Public
	2.3	Analysis for Selected Designs
	2.3.1	Design Selection
	2.3.2	Team Meeting
	2.3.3	Client Meeting

Design Criteria

Material Strength/Stress Properties

Material Stiffness Properties

Durability

Aesthetics

Cost

Scope - Task 3

Phase	Code	Task
3	3.0	Detailed Analysis
	3.1	AutoCAD Analysis
	3.1.1	Plan and Profile View of Design Soutlion
	3.2	RISA Analysis of Design
	3.2.1	Technical Advisor Meeting

- Provide an AutoCAD design by profile view of the design solution.
- Analyze the the selected design by RISA software.
- Meeting with technical advisor.

Scope - Task 4



Bamboo Bridge being Assembled [1]

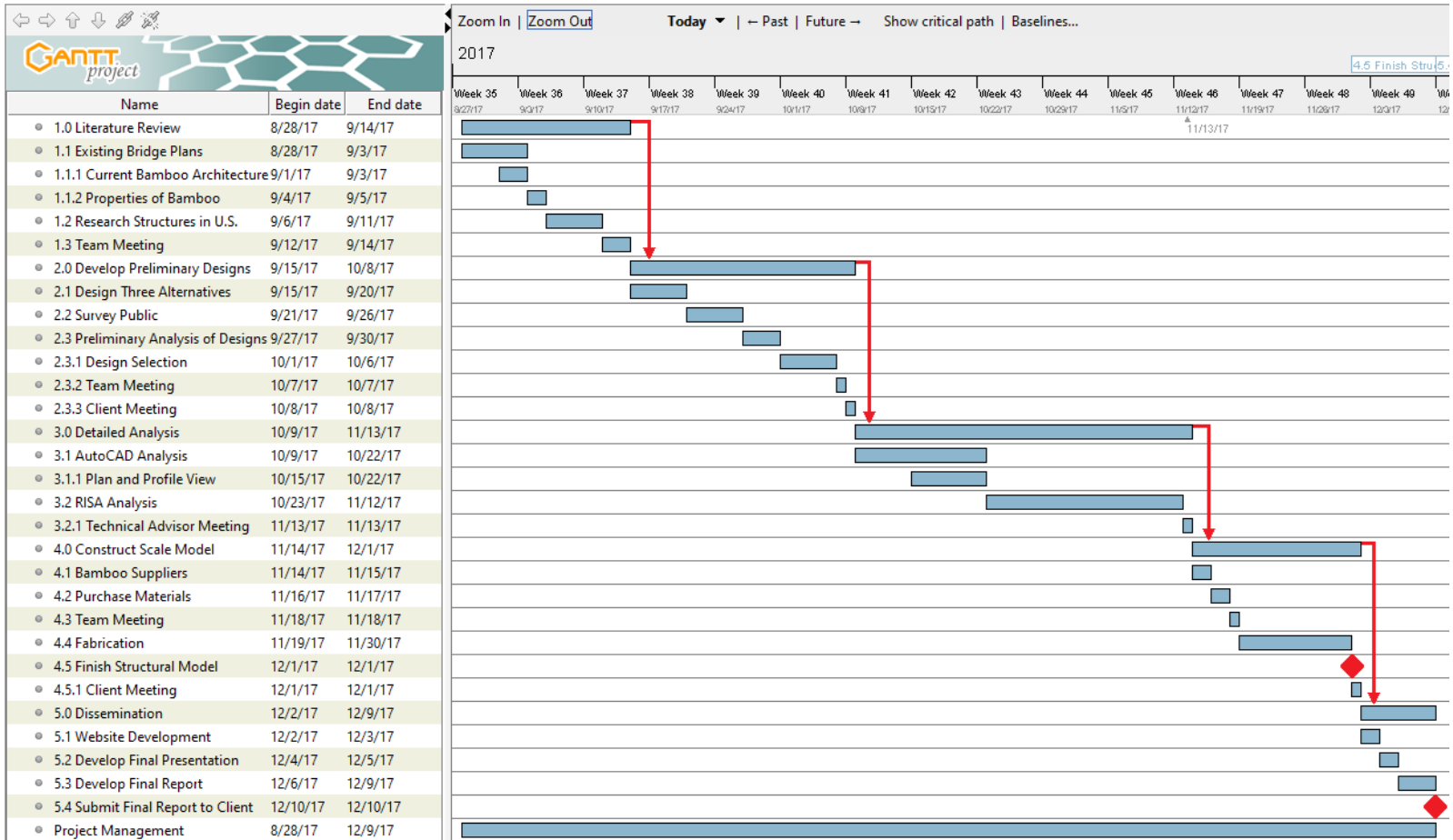
Phase	Code	Task
4	4.0	Construct Scale Model
	4.1	Purchase Materials
	4.2	Bamboo Suppliers
	4.3	Place Orders
	4.3.1	Team Meeting
	4.4	Fabrication
	4.5	Finish Structural Work of Model
	4.5.1	Client Meeting

Scope - Task 5

Phase	Code	Task
5	5.0	Dissemination
	5.1	Website Development
	5.2	Develop Final Presentation
	5.3	Develop Final Report
	5.4	Submit Final Report to Client

- Develop final report and final presentation
- Disseminate final design with stakeholders
- Deliver final report to client

Schedule



Staffing

	Staffing and Budget							
	Task 1	Task 2	Task 3	Task 4	Task 5			
Position	Duration (Hour)	Duration (Hour)	Duration (Hour)	Duration (Hour)	Duration (Hour)	Total Hours	Rate (USD)	Costs (USD)
Senior Engineer	10	20	80	10	30	150	194	29100
Project Engineer	16	30	100	15	30	191	67	12797
Project Manager	10	30	80	15	30	165	90	14850
EIT	16	35	110	20	30	211	50	10550
						717		\$67,297.00

Materials Cost Analysis				
Material Code	Material Description	Material Rate (ft)	Quantity	Material Cost (USD)
1.0	Bamboo (30 X 1')	110.95	1	110.95
2.0	Fabrication Costs (Machine Shop)	30	30	900
			Total Cost	\$1,010.95

Exclusions

Footings Design

Geotechnical engineering analysis or earthwork associated with manipulating the pre-existing concrete footings

Material Testing

Due to availability of reliable theoretical values, mechanics of materials testing will be excluded

Fasteners

The design will allow for steel fasteners

General Exclusion

Anything not explicitly stated in the scope is excluded



Pre-existing Footing at Project Site

References

- [1] ("Pins From Bambooroo.Net On Pinterest")
- [2] "City Of Flagstaff Official Website - Flagstaff Urban Trails System (FUTS)". *Flagstaff.az.gov*. N.p., 2017. Web. 26 Apr. 2017.
- [3] "About Flagstaff", *Flagstaffplaces.com*, 2017. [Online]. Available: <http://www.flagstaffplaces.com/welcome/about-flagstaff/>. [Accessed: 24- Apr- 2017]
- [4] "RISA-3D - Structural Engineering Software for Analysis & Design", Risa.com, 2017. [Online]. Available: https://risa.com/p_risa3d.html. [Accessed: 05- Feb- 2017]
- [5] "Beam Bridges", Design-technology.org, 2017. [Online]. Available: <http://www.design-technology.org/beambridges.htm>. [Accessed: 29- Jan- 2017]
- [6] "Pros And Cons Of Arch Bridges | APECSEC.org", Apecsec.org, 2017. [Online]. Available: <http://apecsec.org/pros-and-cons-of-arch-bridges/>. [Accessed: 29- Jan- 2017]
- [7] 2017. [Online]. Available: <https://www.ncdot.gov/projects/ncbridges/historic/types/?p=17>. [Accessed: 29- Jan- 2017]
- [8] "Truss Bridge Pros And Cons | APECSEC.org", Apecsec.org, 2017. [Online]. Available: <http://apecsec.org/truss-bridge-pros-and-cons/>. [Accessed: 29- Jan- 2017]
- [9] Bamboo Facts. (n.d.). Retrieved February 20, 2017, from http://www.softschools.com/facts/plants/bamboo_facts/563/
- [10] "Connections in bridges", Steelconstruction.info, 2017. [Online]. Available: http://www.steelconstruction.info/Connections_in_bridges#Bolted_connections. [Accessed: 29- Jan- 2017]
- [11] "RISA Technologies - Structural Engineering Software for Analysis & Design", Risa.com, 2017. [Online]. Available: <https://risa.com/products.html>. [Accessed: 29- Jan- 2017]
- [12] "What is AutoCAD?", Study.com, 2017. [Online]. Available: http://study.com/what_is_auto_cad.html. [Accessed: 29- Jan- 2017]
- [13] "What is Civil 3D?", Edulearn.com, 2017. [Online]. Available: http://www.edulearn.com/article/what_is_civil_3d.html. [Accessed: 29- Jan- 2017]
- [14] "Structural Software for Analysis and Design | SAP2000", Csiamerica.com, 2017. [Online]. Available: <https://www.csiamerica.com/products/sap2000>. [Accessed: 29- Jan- 2017]

Questions ?



Abdulaziz
Almansur



Dominic Good



Steven Kohr



Mike Malisa