Lightyear Library

Project Information

Designer: Yusuf Morsi
Firm Name: Pixar Inc.
Address: 124 Conch Street
San Diego, CA 92000

Client: Buzz Lightyear
Address: 234 Elm Street
San Diego, CA 92120

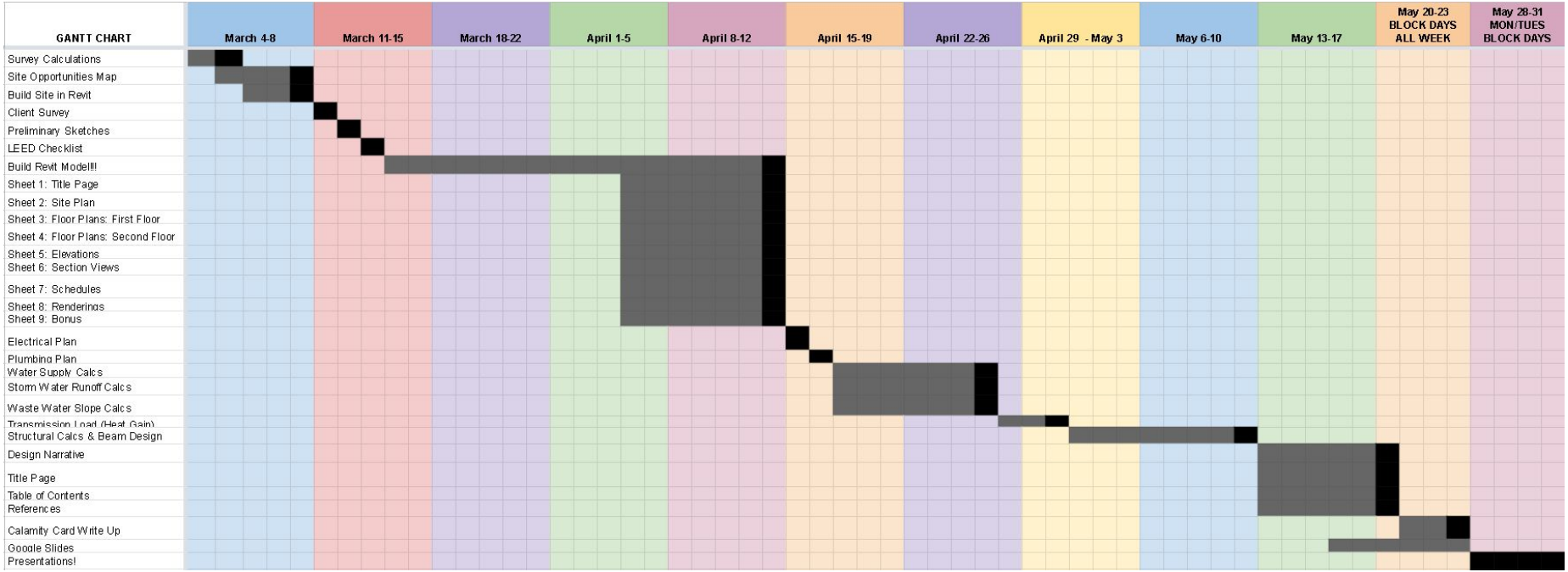
Problem Statement

- **I was given the task of building a library in the Quad to serve all community members including students. This building needed to be available both during and after school.**

Constraints

- **The building must be at least two stories**
- **We must include an elevator and two sets of stairs**
- **Building needs to be ADA compliant**
- **Must conform to city, state, and international building codes**
- **Must have enough LEED points**
- **Have a flat roof**
- **… and more!**

Gantt Chart


GANTT CHART
March 4-8
March 11-15
March 18-22
April 1-5
April 8-12
April 15-19
April 22-26
April 29 - May 3
May 6-10
May 13-17
May 20-23 BLOCK DAYS ALL WEEK
May 28-31 MON/TUES BLOCK DAYS
Survey Calculations
Site Opportunities Map
Build Site in Revit
Client Survey
Preliminary Sketches
LEED Checklist
Build Revit Model!!!
Sheet 1: Title Page
Sheet 2: Site Plan
Sheet 3: Floor Plans: First Floor
Sheet 4: Floor Plans: Second Floor
Sheet 5: Elevations
Sheet 6: Section Views
Sheet 7: Schedules
Sheet 8: Renderings
Sheet 9: Bonus
Electrical Plan
Plumbing Plan
Water Supply Calcs
Storm Water Runoff Calcs
Waste Water Slope Calcs
Transmission Load (Heat Gain)
Structural Calcs & Beam Design
Design Narrative
Title Page
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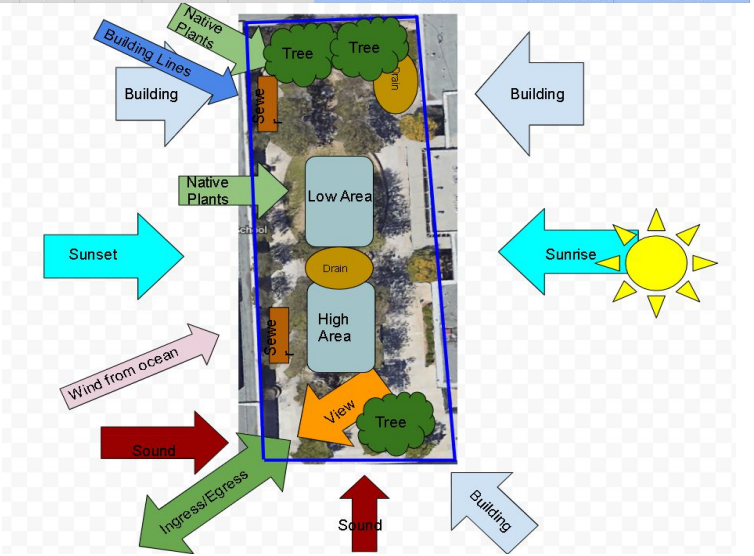
References
Calamity Card Write Up
Google Slides
Presentations!

Site Details

- **After surveying the given site, my team and I plotted that elevation data, which came to show what we were given a sizeable piece of land to work on (we were given a .77 acre plot in the PHHS Quad)**

- **The image on the bottom right depicts the facts about the given site that must be taken into consideration before the library is built**

		Calculating Elevations				Calculating Distance		
Auto Level Location	Rod Location	Backsight	Height of Instrument (HI)	Foresight (FS)	ELEVATION	TOP STADIA	BOT STADIA	DISTANCE
		x	*(BS + ELEV)*	x	*(HI – FS)*	x	x	*(Top - bottom) * 100*
Point 1	Point 0	4.5625	x	x	700	4.67	4.45	22
Point 1	Point 2	x	704.5625	4.25	700.3125	4.55	3.95	60
Point 2	Point 1	5.625	x	x	x	5.91	5.33	58
Point 2	Point 3	x	705.9375	4.216667	701.720833	4.5	3.94	56
Point 3	Point 2	6.291667	x	x	x	6.56	6.12	44
Point 3	Point 4	x	708.0125	5.5625	702.45	5.97	5.18	79
Point 4	Point 3	4.81	x	x	x	5.18	4.43	75
Point 4	Point 5	x	707.26	5.0625	702.1975	5.34	4.73	61
Point 5	Point 4	5.25	x	x	x	5.55	4.97	58
Point 5	Point 6	x	707.4475	6.02	701.4275	6.34	5.52	82
Point 6	Point 5	5.14	x	x	x	5.33	4.95	38
Point 6	Point 7	x	706.5675	5.08	701.4875	5.7	4.47	123
Point 7	Point 6	4.5	x	x	x	5.11	3.89	122
Point 7	Point 8	x	705.9875	6.47	699.5175	7.23	5.72	151
Point 8	Point 7	2.97	x	x	x	3.7	2.18	152
Point 8	Point 9	x	702.4875	3.23	699.2575	4.29	2.18	211
Point 9	Point 8	N/A	x	x	x			0
Point 9	Point 10	x	#VALUE!	N/A	#VALUE!			0
Point 10	Point 9	N/A	x	x	x			0
Point 10	Point 11	x	#VALUE!	N/A	#VALUE!			0
Point 11	Point 10	N/A	x	x	x			0
Point 11	Point 12	x	#VALUE!	N/A	#VALUE!			0
Point 12	Point 11	N/A	x	x	x			0
Point 12	Point 0	x	#VALUE!	N/A	#VALUE!			0
x	x	x	x		^ ENDING ELEVATION ^		total distance	1392.00



Water Supply

- **The dynamic pressure must be calculated, so I can know if I should take measures such as replace pipe with something bigger, installing pipe, or replacing the pipe with one with a smaller diameter**

Step	Term	Calculations (A picture of your work on paper or written out here will suffice)
1	Static Head	(351 - 119) = 232 ft
2	Static Pressure	(232)/(2.31) = 100.43 psi
3	Hazen-Williams Constant	100
4	Miles-Feet Conversion	(8.7)(5280) = 45936 feet
5	Equivalent Lengths	(12)(7) = 84 feet
6	Head Loss	$\frac{10.44(46020ft)(100\ gal^{1.85})}{(100^{1.85})*(8^{4.8655})}$ = 19.394 feet
7	Dynamic Head	(232)-(19.394) = 212.606
8	Dynamic Pressure	(219.34)/(2.31) = 92.037 psi
9	What do you conclude about your pressure?	I believe that the pressure is too high, and it needs to be decreased.
10	What steps will you take, if any, to make sure pressure is appropriate?	To decrease the pressure, I will make the pipe diameter bigger.

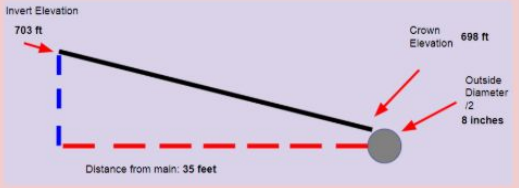
Storm Water Runoff

- **These calculations helped me determine if I will need to address the excess runoff storm water or not**

Step	Instructions	Answer, Drawing or Calculation (A picture of your work on paper or written out here will suffice)
1	What is the rainfall intensity? (assume a 50 year, 12 hour storm)	2.9
2	What is the Runoff Coefficient Adjustment Factor (C_f)?	1.2
3	What is the runoff coefficient for the site (C_1)? (Assume agricultural land, sandy soil, no crop)	.3
4	What is the area of your site (A_1) (see above: it's	.73 acres
5	Calculate pre-development runoff rate (Q) for your SITE ONLY. $Q = i \cdot C_f \cdot C_1 \cdot A_1$	(2.90)(1.2)(0.30)(0.73) = 0.762 CFS
5	Calculate the area of your house (A_2) (use Revit room schedule if you need help). Don't forget to convert to acres!	7500 + 7500 = 15,000 square feet = 0.34435262 acres
6	Calculate the area of your site MINUS the area of your house	0.73 acres - 0.34435262 acres = 0.38564738 acres
7	What is the runoff coefficient for the house (C_2)?	0.45
8	Calculate post-development runoff rate (Q) for SITE + HOUSE $Q = (i \cdot C_f \cdot C_1 \cdot (A_1-A_2)) + (i \cdot C_f \cdot C_2 \cdot A_2)$ Remember, the area of your site has now shrunk because you've built a house on it!	(2.16)(1.2)(0.30)(0.73-0.34435262)+((2.16)(1.2)(0.45)(0.34435262)) = 0.702 CFS
9	What is the difference between your pre and post runoff rates?	(0.762)-(0.702) = 0.06 CFS
10	Will you need to address the excess runoff? If so, what is your idea for enhancing drainage?	Since the post runoff is lower than the pre-runoff, we have to watch for potential blockage of our drains or if needed, redesign our entire sewer plan

Wastewater Slope

- **These calculations are important as they determine the slope for the library's wastewater**

Step	Instructions	Answer, Drawing or Calculation (A picture of your work on paper or written out here will suffice)
1	Convert inches to feet for pipe diameter	1.3333 ft
2	What is the minimum allowable slope for your wastewater?	12.5 %
3	Draw a diagram of your wastewater "triangle" and label each section. Include the numbers for your particular residence.	
4	Use the equation to calculate sewer lateral slope for your house.	100((703-698+.5(16))/(35)) = 37.143%
5	Does your slope exceed the minimum?	Yes, the slope dopes exceed the minimum
6	If not, what can you do to change it? Re-do your calculations and explain what number needs to change to make it work, and by how much.	I don't need to change anything because my percentage exceeds the minimum slope.

The Final Design

- **These pictures are renderings of one of the area that surrounds the elevator on the first floor**

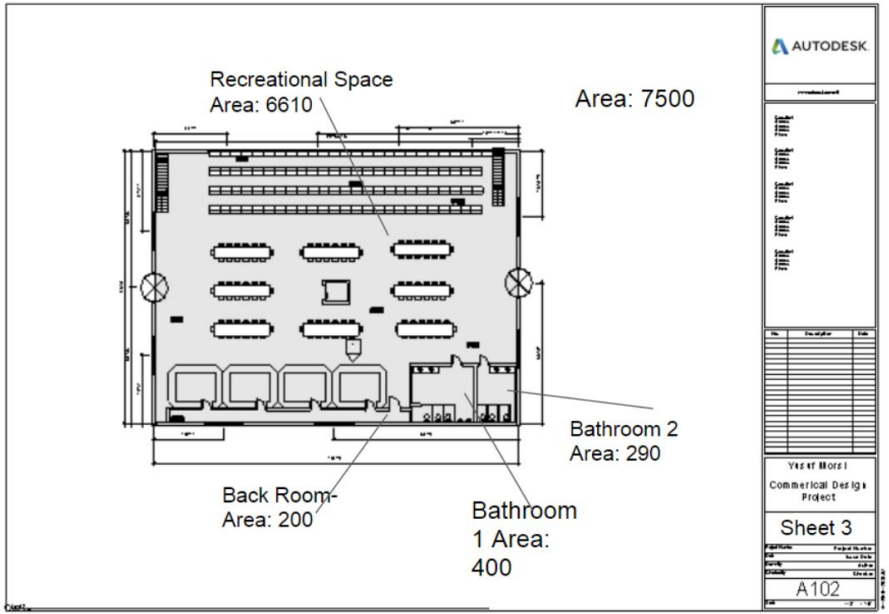
The Final Design

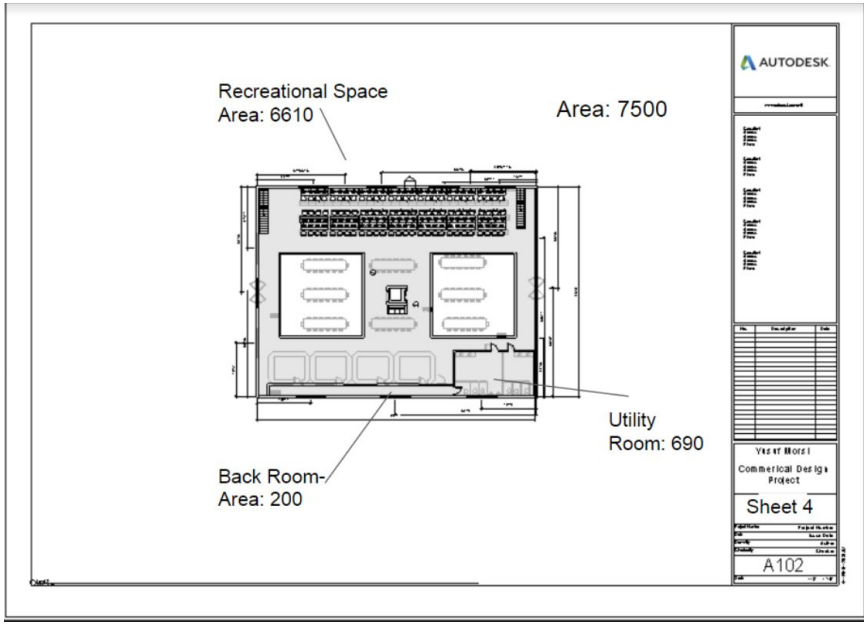
- **Below are renderings of the checkout counter on the first floor, and the area that surrounds the elevator on the second floor**

The Final Design

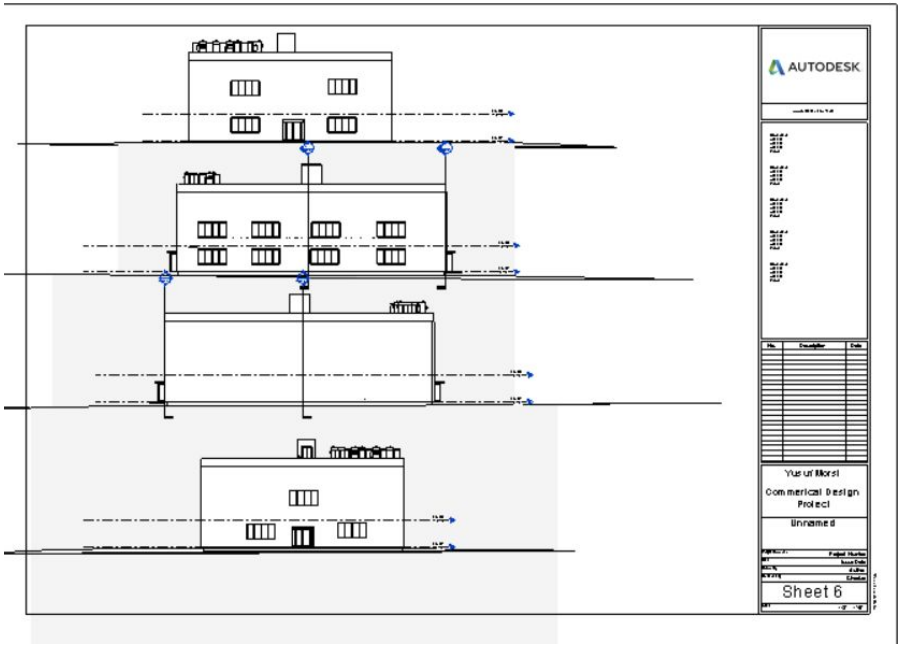
- **These pictures are renderings of one of the stairwells and one of the entrances of the first floor**

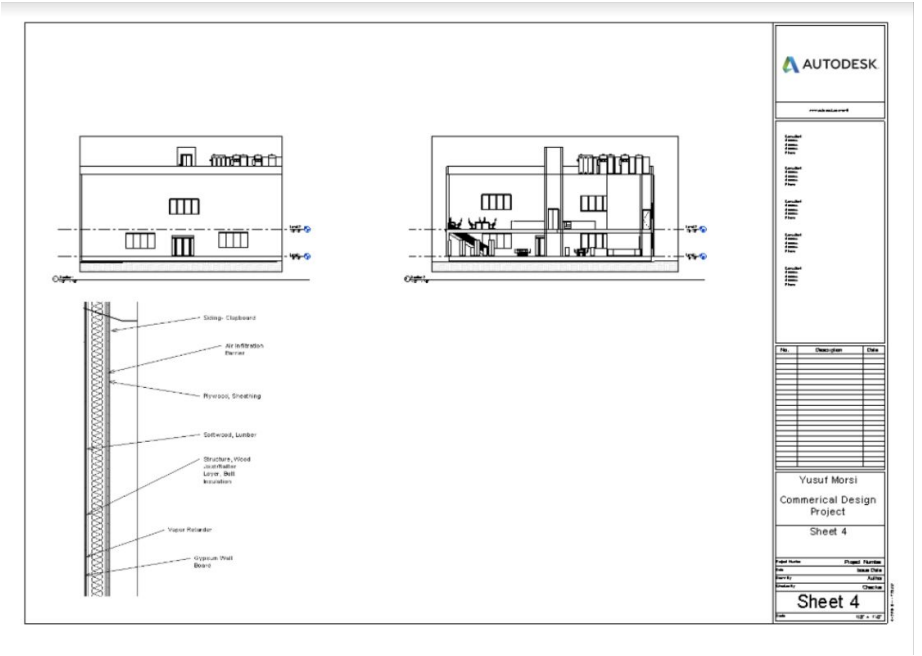
Floor Plans


Recreational Space
Area: 6610
Area: 7500
Bathroom 2
Area: 290
Back Room-
Area: 200
Bathroom
1 Area:
400
AUTODESK.
Commerical Design
Project
Sheet 3
A102

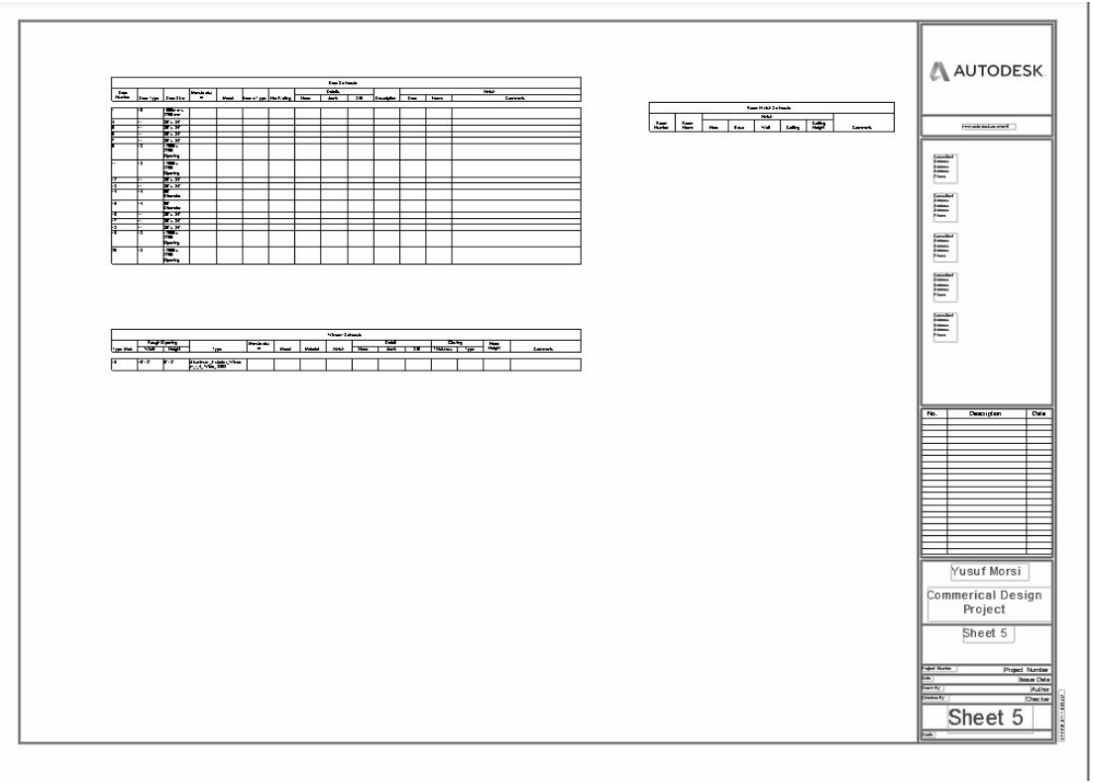

Recreational Space
Area: 6610
Area: 7500
Utility
Room: 690
Back Room-
Area: 200
AUTODESK.
Commerical Design
Project
Sheet 4
A102

Elevation and Section Plans

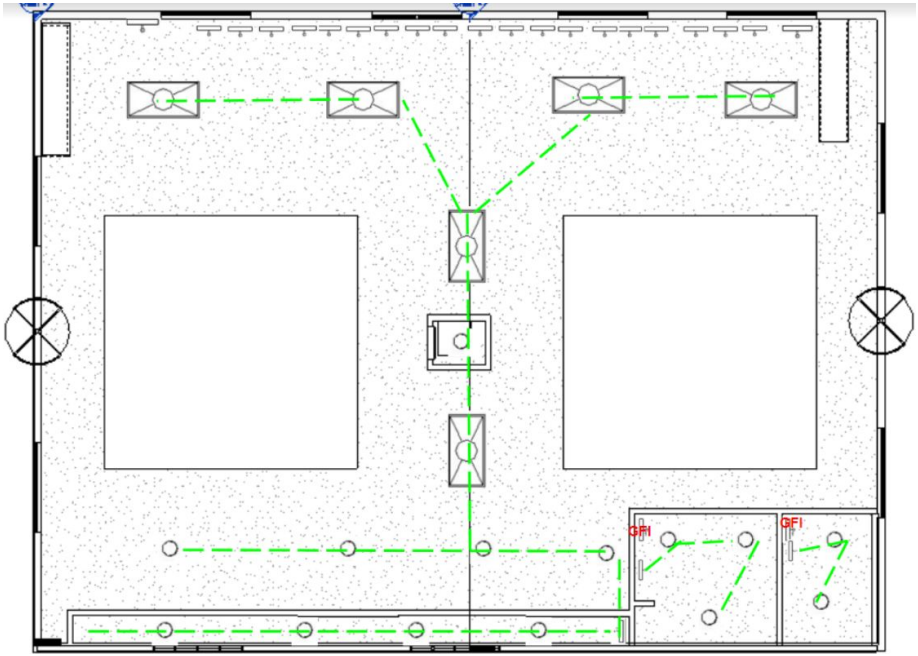


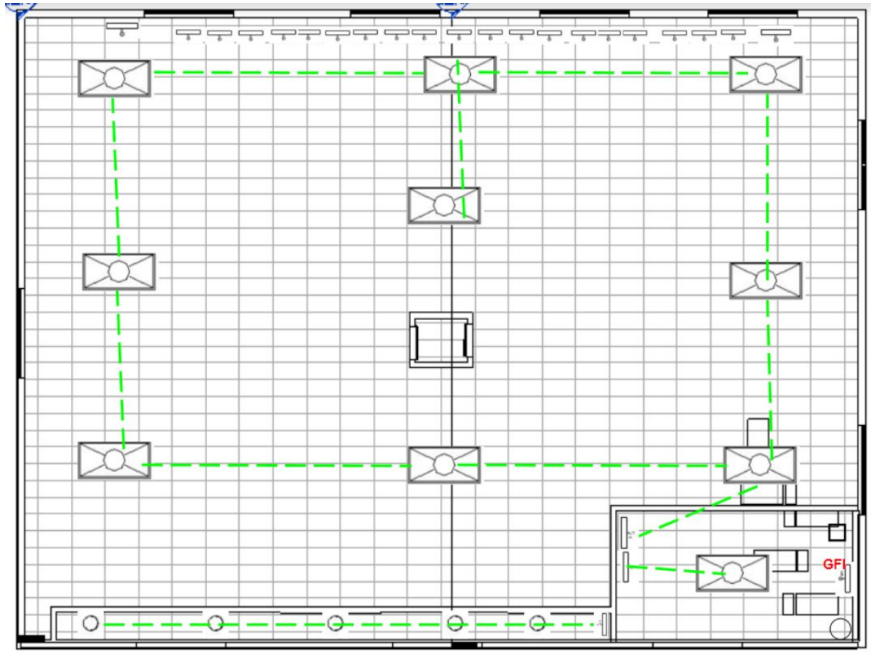


Schedule Plan

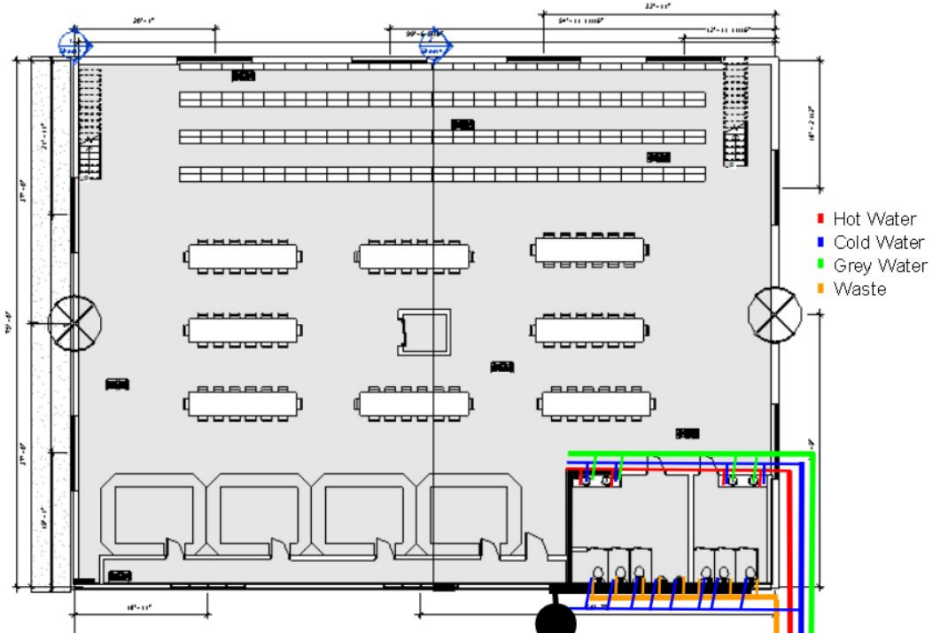


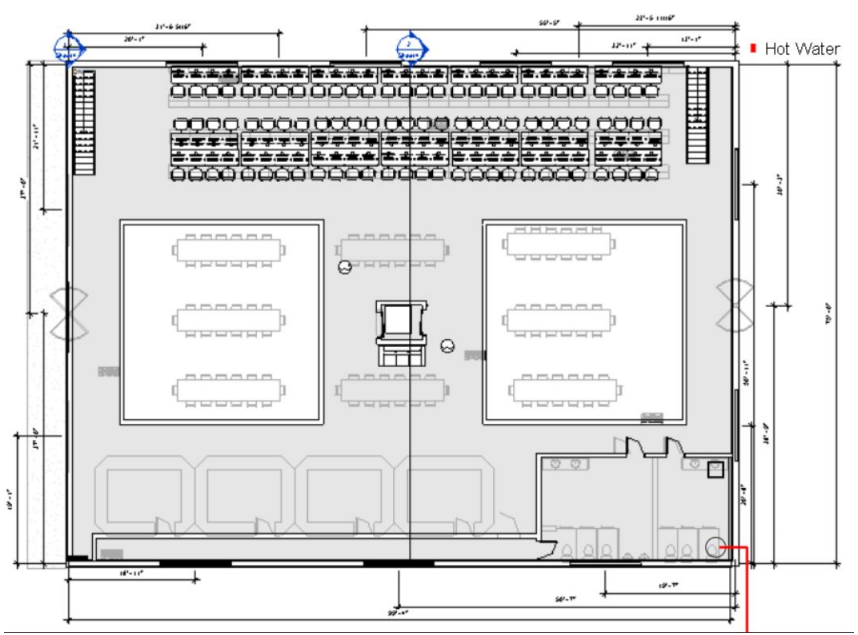
Electrical Plans





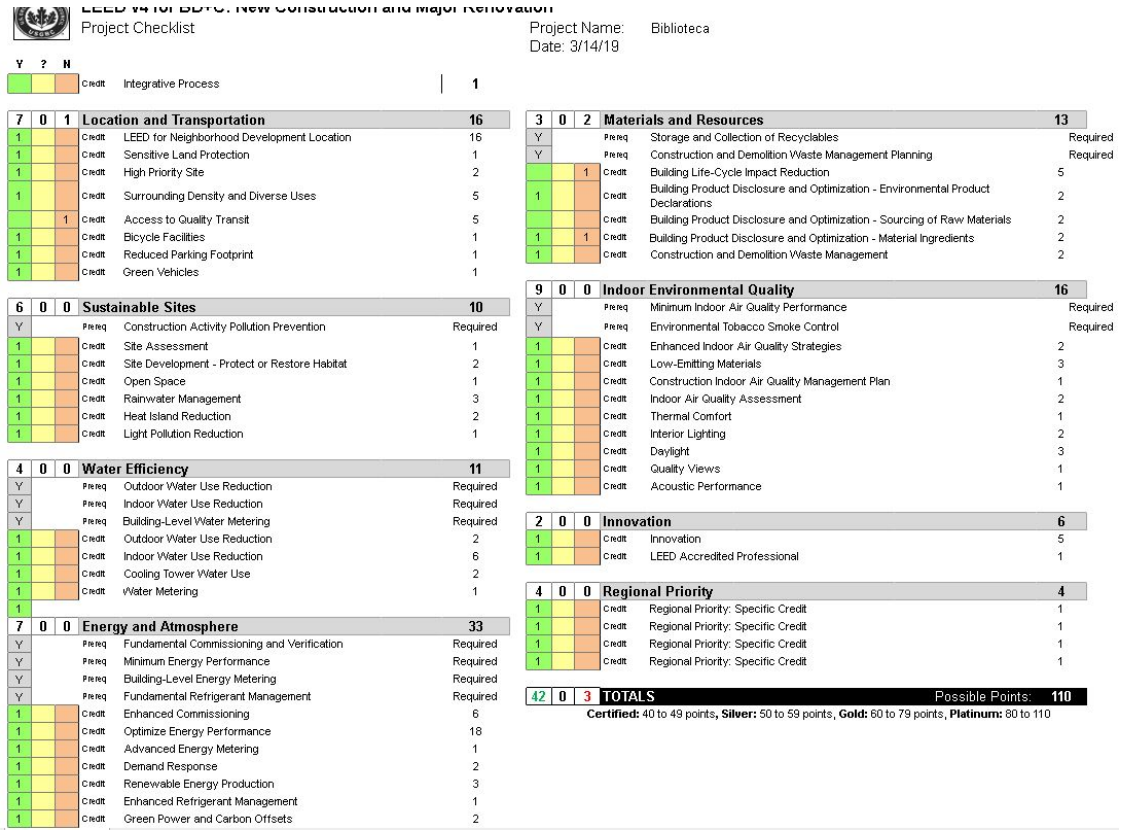
Plumbing Plans





LEED Checklist

- **I needed to ensure that the library got the necessary amount of points to be a certified building (40 points), and on the right is a list of individual things that helped attain those points**



LEED v4 for BD+C: New Construction and Major Renovation
Project Checklist

Project Name: Biblioteca
Date: 3/14/19

Y	?	N			
			Credit	Integrative Process	1

7	0	1	Location and Transportation		16
1			Credit	LEED for Neighborhood Development Location	16
1			Credit	Sensitive Land Protection	1
1			Credit	High Priority Site	2
1			Credit	Surrounding Density and Diverse Uses	5
		1	Credit	Access to Quality Transit	5
1			Credit	Bicycle Facilities	1
1			Credit	Reduced Parking Footprint	1
1			Credit	Green Vehicles	1

6	0	0	Sustainable Sites		10
Y			Prereq	Construction Activity Pollution Prevention	Required
1			Credit	Site Assessment	1
1			Credit	Site Development - Protect or Restore Habitat	2
1			Credit	Open Space	1
1			Credit	Rainwater Management	3
1			Credit	Heat Island Reduction	2
1			Credit	Light Pollution Reduction	1

4	0	0	Water Efficiency		11
Y			Prereq	Outdoor Water Use Reduction	Required
Y			Prereq	Indoor Water Use Reduction	Required
Y			Prereq	Building-Level Water Metering	Required
1			Credit	Outdoor Water Use Reduction	2
1			Credit	Indoor Water Use Reduction	6
1			Credit	Cooling Tower Water Use	2
1			Credit	Water Metering	1
1					

7	0	0	Energy and Atmosphere		33
Y			Prereq	Fundamental Commissioning and Verification	Required
Y			Prereq	Minimum Energy Performance	Required
Y			Prereq	Building-Level Energy Metering	Required
Y			Prereq	Fundamental Refrigerant Management	Required
1			Credit	Enhanced Commissioning	6
1			Credit	Optimize Energy Performance	18
1			Credit	Advanced Energy Metering	1
1			Credit	Demand Response	2
1			Credit	Renewable Energy Production	3
1			Credit	Enhanced Refrigerant Management	1
1			Credit	Green Power and Carbon Offsets	2

3	0	2	Materials and Resources		13
Y			Prereq	Storage and Collection of Recyclables	Required
Y			Prereq	Construction and Demolition Waste Management Planning	Required
		1	Credit	Building Life-Cycle Impact Reduction	5
1			Credit	Building Product Disclosure and Optimization - Environmental Product Declarations	2
			Credit	Building Product Disclosure and Optimization - Sourcing of Raw Materials	2
1		1	Credit	Building Product Disclosure and Optimization - Material Ingredients	2
1			Credit	Construction and Demolition Waste Management	2

9	0	0	Indoor Environmental Quality		16
Y			Prereq	Minimum Indoor Air Quality Performance	Required
Y			Prereq	Environmental Tobacco Smoke Control	Required
1			Credit	Enhanced Indoor Air Quality Strategies	2
1			Credit	Low-Emitting Materials	3
1			Credit	Construction Indoor Air Quality Management Plan	1
1			Credit	Indoor Air Quality Assessment	2
1			Credit	Thermal Comfort	1
1			Credit	Interior Lighting	2
1			Credit	Daylight	3
1			Credit	Quality Views	1
1			Credit	Acoustic Performance	1

2	0	0	Innovation		6
1			Credit	Innovation	5
1			Credit	LEED Accredited Professional	1

4	0	0	Regional Priority		4
1			Credit	Regional Priority: Specific Credit	1
1			Credit	Regional Priority: Specific Credit	1
1			Credit	Regional Priority: Specific Credit	1
1			Credit	Regional Priority: Specific Credit	1

42	0	3	TOTALS	Possible Points:	110

Certified: 40 to 49 points, **Silver:** 50 to 59 points, **Gold:** 60 to 79 points, **Platinum:** 80 to 110

Heat Gain/Loss

- **The calculations for heat gain/loss are on the right**

R-Value Calculations

Component	Material Name / Description	R-Value	Total R-Value
DOOR Material 1	Aluminum	0.61	
DOOR Material 2	Glass	2.56	
DOOR Material 3	Single Panel Door	1.85	5.02
WINDOW Material 1	Double Insulating Glass	2.04	
WINDOW Material 2	Interior Trim	0.94	
WINDOW Material 3	Exterior Trim	0.63	3.61
WALL Material 1	Siding, Clapboard	0.44	
WALL Material 2	Air Infiltration Barrier	0.25	
WALL Material 3	Plywood, Sheathing	1.26	
WALL Material 4	Softwood, Lumber	1.25	
WALL Material 5	Metal Stud	45	
WALL Material 6	Vapor Retarder	0.25	
WALL Material 7	Gypsum Wall Board	0.45	48.90
FLOOR Material 1	Oak Flooring	0.91	
FLOOR Material 2	Plywood, Sheathing	0.93	
FLOOR Material 3	Structure, Wood Joist/Rater Layer	0.63	2.47
ROOF Material 1	Asphalt Shingles	0.44	
ROOF Material 2	Plywood, Sheathing	0.77	
ROOF Material 3	Structure Vapor Barrier	0.25	
ROOF Material 4	Structure Batt Insulation	13	14.46

Area Calculations

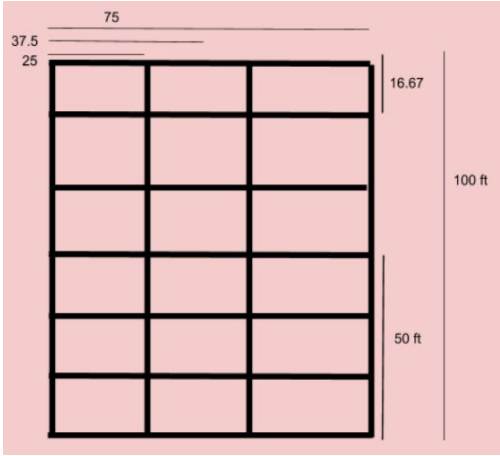
Component	Total # In Library	Area of Each	Total Area
Wall 1	1.00	1941.68	1941.68
Wall 2	1.00	2547.07	2547.07
Wall 3	1.00	1976.71	1976.71
Wall 4	1.00	3000	3000
Windows	15.00	60.4573559	906.8603385
Doors	2.00	61.333336	122.666672
Roof	1.00	7467.69	7467.69
First Floor	1.00	7350.23	7350.23
Second Floor	1.00	5434.17	5434.17

Transmission Load Calculations

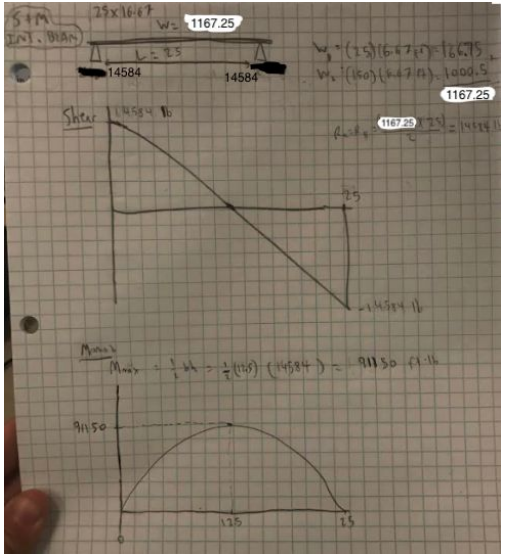
Component	Total Area of Component (added together)	R-Value (Chart)	U Factor (1/R)	Change in Temp	Transmission Load Q = U*A*(deltaT)	
WALLS	9,465.46	48.90	0.02	61	11,807.63	
WINDOWS	906.86	3.61	0.28	61	15,323.68	
DOORS	122.67	5.02	0.20	61	1,490.57	
ROOF	7,467.69	14.46	0.07	61	31,502.70	
FLOOR	12,784.40	2.47	0.40	61	315,728.10	
TOTALS	30,747.08	TOTAL TRANSMISSION LOAD --->			**375,852.68**	BTU/Hr

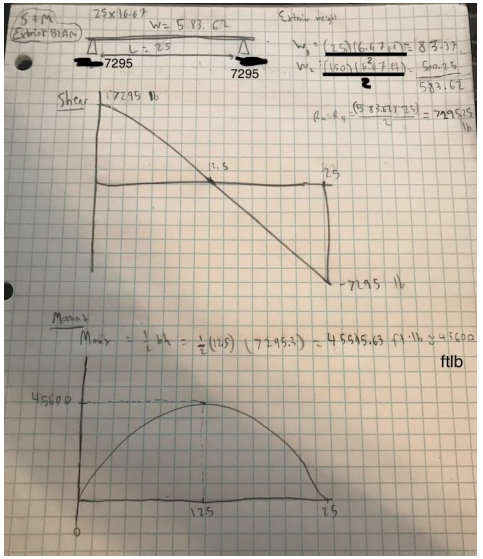
Beam Design

- **Beams are designed for shear (force that acts perpendicular to beam) and moment (combination of tension & deflection that occurs when the beam is loaded) forces**
- **Beam deflection must be checked, and the process can be seen on the right and on the next slide**

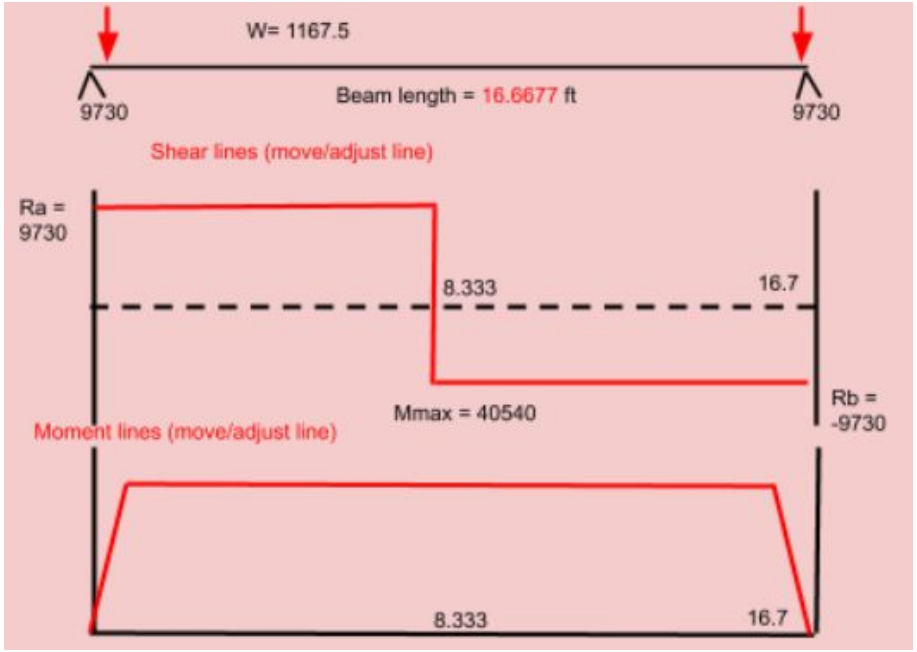


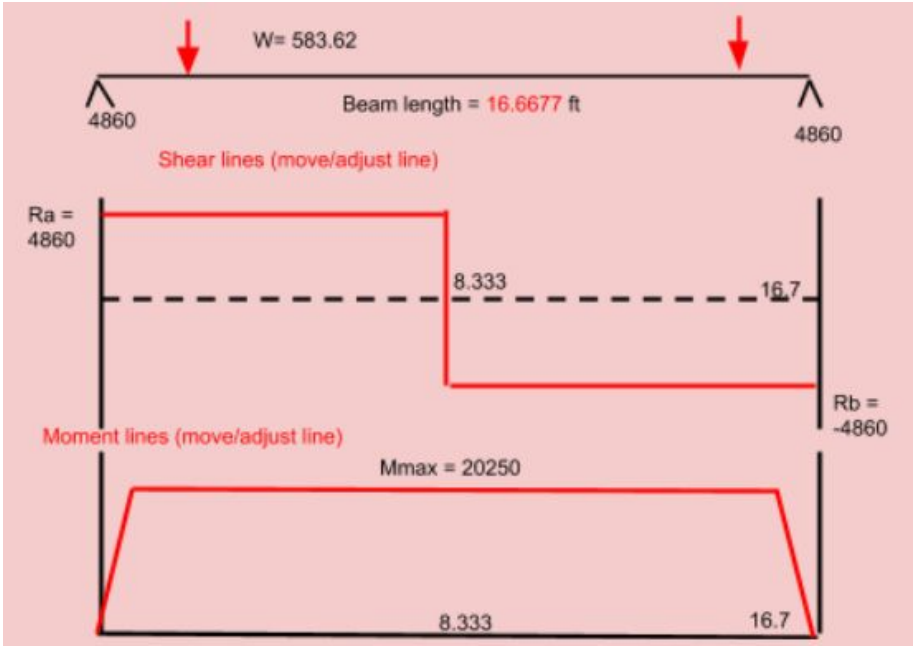
Roof Dead Loading: (The roof will support the weight of the low-slope roof in addition to mechanical, electrical, and plumbing equipment (MEP). Assume 10 psf for the equipment and reference the Loads & Load Path slides for an example)	Roof Dead Loading: 25
Roof Live Loading (from code, varies based on what kind of structure you are building):	150 psf
Total Roof Total Loading (LL + DL):	25 psf + 150 psf = 175 psf





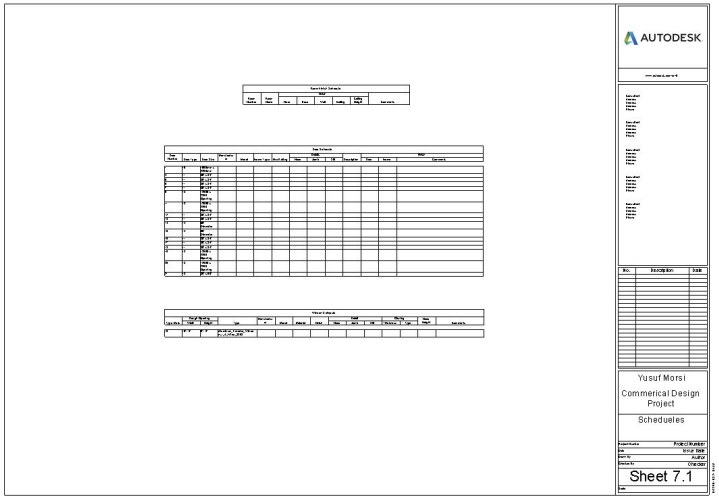
Beam Design Cont'd





Calamity Card

After the library project was finished, the fire marshall informed me that we needed to add an additional emergency exit to our building. As a result, I needed to redo a few documents. Here are just a couple of the sheets/documents that had to be edited:



R-Value Calculations

Component	Material Name / Description	R-Value	Total R-Value
DOOR Material 1	Aluminum	0.61	
DOOR Material 2	Glass	2.56	
DOOR Material 3	Single Panel Door	1.85	5.02
WINDOW Material 1	Double Insulating Glass	2.04	
WINDOW Material 2	Interior Trim	0.94	
WINDOW Material 3	Exterior Trim	0.63	3.61
WALL Material 1	Siding, Clapboard	0.44	
WALL Material 2	Air Infiltration Barrier	0.25	
WALL Material 3	Plywood, Sheathing	1.26	
WALL Material 4	Softwood, Lumber	1.25	
WALL Material 5	Metal Stud	45	
WALL Material 6	Vapor Retarder	0.25	
WALL Material 7	Gypsum Wall Board	0.45	48.90
FLOOR Material 1	Oak Flooring	0.91	
FLOOR Material 2	Plywood, Sheathing	0.93	
FLOOR Material 3	Structure, Wood Joist/Rafter Layer	0.63	2.47
ROOF Material 1	Asphalt Shingles	0.44	
ROOF Material 2	Plywood, Sheathing	0.77	
ROOF Material 3	Structure Vapor Barrier	0.25	
ROOF Material 4	Structure Batt Insulation	13	14.46
DOOR 2 Material 1	Single Panel Door	1.85	1.85

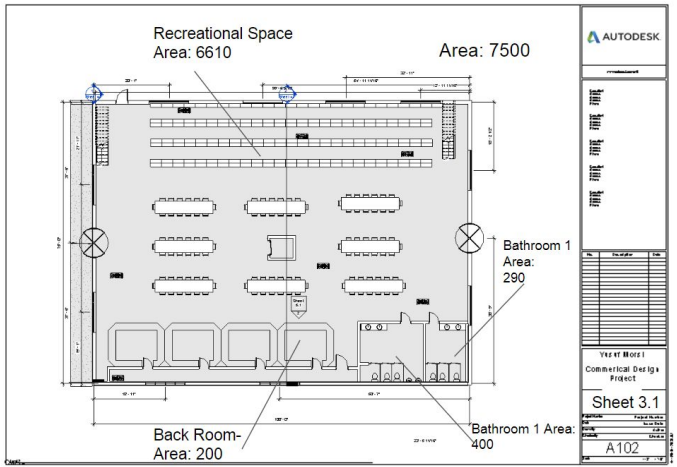
Area Calculations

Component	Total # In Library	Area of Each	Total Area
Wall 1	1.00	1941.68	1941.68
Wall 2	1.00	2547.07	2547.07
Wall 3	1.00	1976.71	1976.71
Wall 4	1.00	3000	3000
Windows	15.00	60.4573559	906.8603385
Doors	2.00	61.333336	122.666672
Roof	1.00	7467.69	7467.69
Second Floo	1.00	7350.23	7350.23
	1.00	5434.17	5434.17
DOOR 2	1	24	24

Transmission Load Calculations

Component	Total Area of Component (added together)	R-Value (Chart)	U Factor (1/R)	Change in Temp	Transmission Load Q = U*A*(deltaT)
WALLS	9,465.46	48.90	0.02	61	11,807.63
WINDOWS	906.86	3.61	0.28	61	15,323.68
DOORS	122.67	5.02	0.20	61	1,490.57
ROOF	7,467.69	14.46	0.07	61	31,502.70
FLOOR	12,784.40	2.47	0.40	61	315,728.10
DOOR 2	24	1.85	0.54	61	790.56
TOTALS	30,771.08	TOTAL TRANSMISSION LOAD ---->			376,643.24 BTU/Hr

Client Information	City of San Diego
Architectural Details	
Building Type	Public Library
Function of Building	To store books so students can use
Projected Square Footage	1392 square feet
Projected Occupancy	2
Number of Bathrooms	2
Number of Exits	4
Number of Elevators	1
Number of Stairwells	2
Architectural Style	Modern
ADA Compliance	
Any notes for ADA compliance regarding second story	We have an elevator going up to it
Energy Saving/ LEED Concepts and Ideas	Use windows to have natural light.
Site Development	Save water by using high efficient sinks and toile
Water Savings	
Energy Efficiency	Use efficient LED lights to save energy.
Materials Selection	Use paper back books for cheaper costs.
Indoor Environmental Quality	Use steel to create a modern building.
	Use indoor plants to make the place look better a natural
Other Ideas	None



Questions?