SECTION 2ARCHITECTURE

DESIGN BUILD-2013

DESIGN BUILD BOOKLET V.1

BLEACHER DESIGN
STATE COLLEGE HIGH SCHOOL- SOUTH
TRACK FIELD

ARCHITECTURE STUDIO II
SPRING 2013
THE PENNSYLVANIA STATE UNIVERSITY
DEPARTMENT OF ARCHITECTURE

Section 2:
Team Dynamics

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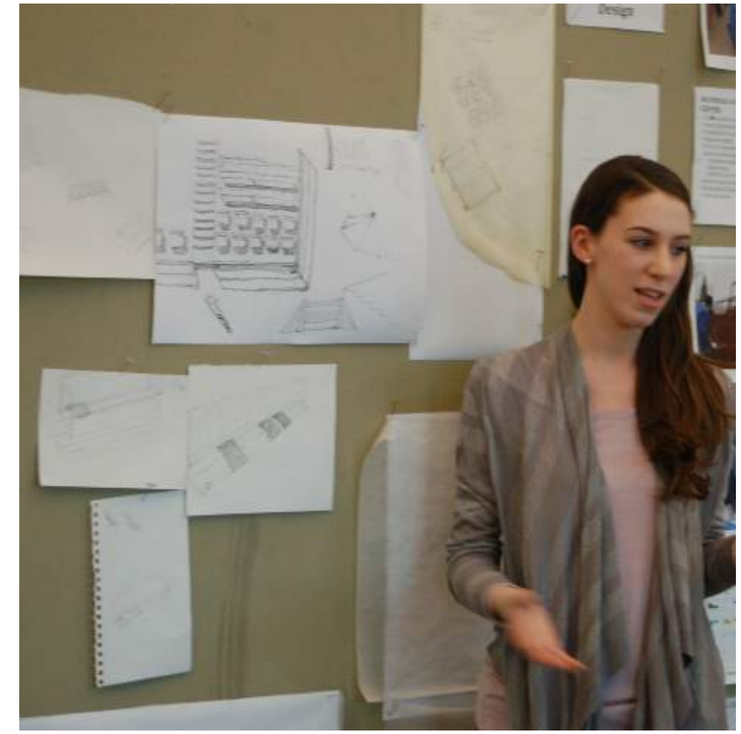
Contents



Introduction to Project

Background:

The Project is essentially a Design Build project, centered around Outdoor Sports seating. The Bleachers will be built for the Local High School-State College High- to serve as a form of outdoor seating for the School's track field.

Objectives and Strategy:

The Bleachers constructed will be a prototype, consisting of thirty seats. The Aim is to create Bleachers that will better serve the users the Track Field facilities than the existing bleachers.
The design strategy will try to solve the following problems:
1) How to Create Bleachers that will be both unique and aesthetically pleasing, whilst being structurally sound.
3)Constructing Bleachers, and supports that will be portable, and easy to assemble.

Focus:

The focus would be to build a set of prototype bleachers, making it a module. This would make it easier for the school to add more sets easily in the case that it works for them. The set of bleachers should also be durable and most of all, safe.




Above: Photographs of Sight Line taken at the site at various locations.

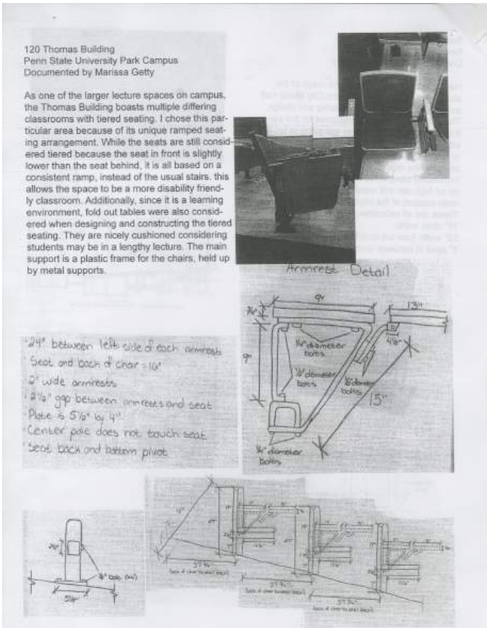
Existing Conditions

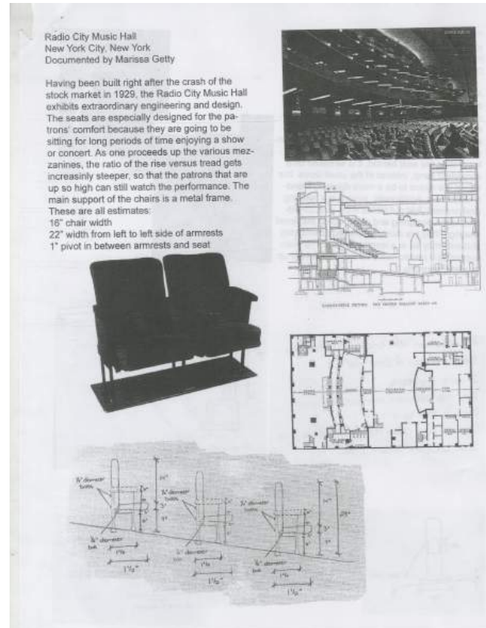


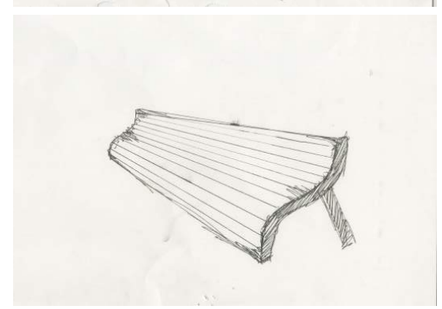
Clockwise (Starting Left): 1.Wooden Staircase situated halfway up the hill. 2. Wooden Bleachers. 3.Wooden Bleachers. 4. Aluminum Bleachers

The Bleachers currently used by state high are in terrible conditions. There is currently both a wooden and aluminum set of bleachers. The wooden bleachers are quite unsafe, bowed towards the center, and has aged badly. Although the aluminum bleachers are somewhat in better shape, they can be quite cold to sit in during the Fall and Winter, and heats up during the summer months. Yet the wooden ones have been known to be uncomfortable as well, causing the users to get splinters.

The existing bleachers are set on flattened ground on the hill, and could only be reached by climbing the steep hill, or the stairs situated on the far right of the bleachers. Although the latter would seem like an ideal choice, its location is pretty far off from the Bleachers, hence you wouldn't just be able to come down to the track and back up again quickly. Hence the 'steep hill climb' route is usually the one that is taken. This had the team very concerned as the hill is too steep to safely climb up and down. It would also pose a challenge for elderly relatives and younger children. It could also pose as a safety hazard when it is wet and muddy, causing it to be that much more difficult to climb. We also noticed the hill is used as a general seating area as many prefer the view from the hill. This could be uncomfortable as well, not to mention, the wet muddy hill could cause problems.



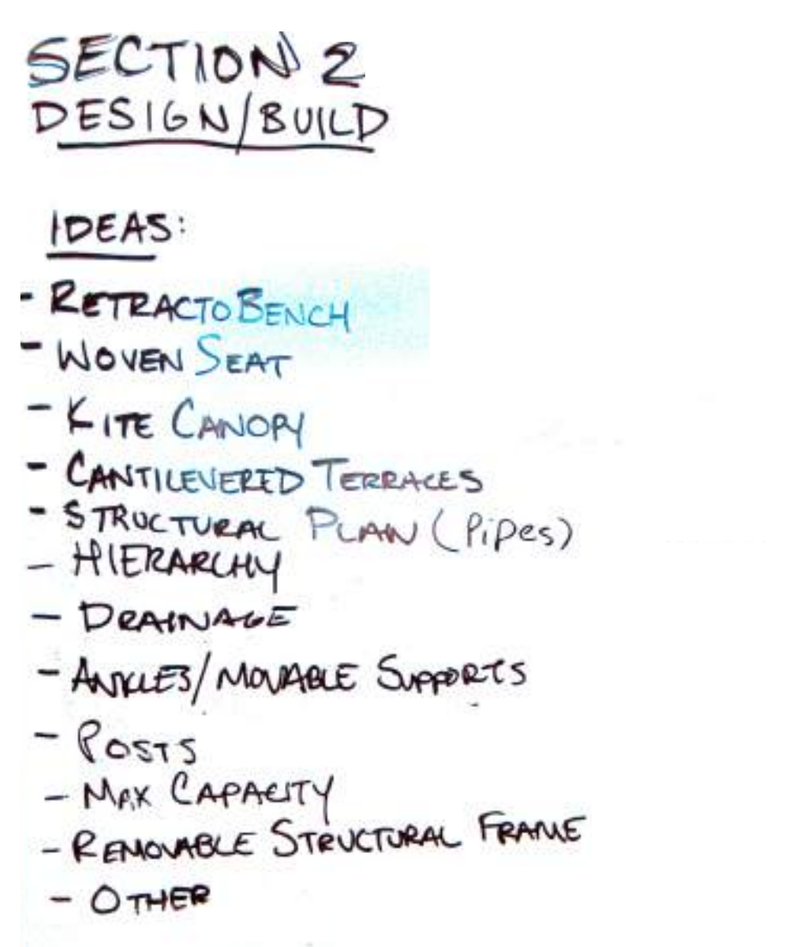


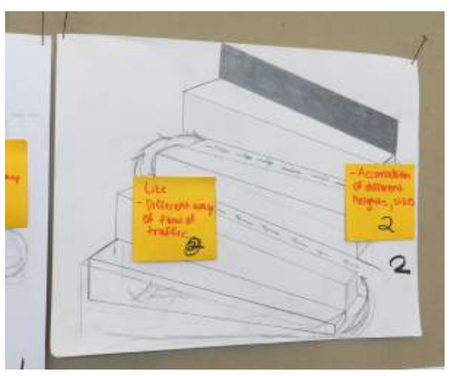


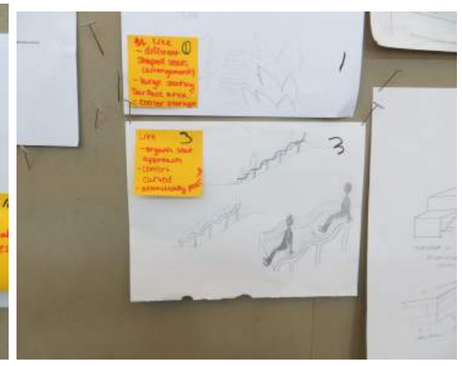
Above (L-R): Examples of precendent studies conducted by the team, 1. Study of Auditorium Seats at Thomas Building (PennState), by Marissa Getty, 2. Radio City Music Hall (NYC), by Marissa Getty. 3. Design Pitches :Continous Curves.

Precedents

Studying precedents is an important step in any type of design process, particularly at the start. In this case, bleachers, outdoor sports seating and public seating areas both on campus and off campus were studied. Each member of the team looked into two different precedents, and pitched the ideas and concepts they had learnt from them to the team as inpiration for the Bleachers design.
Some of the ideas derived included: Retracto benches, Woven seats, Kit canopies, Cantilevered terraces and Cantilevered terraces.







Seat and Structure Proposals

Continous Curves/
Individual

Adirondack Chair
Concept

Continuous Curves/
Bench

Structure Idea 1:
Adjustable Footing
(Angle Adjusted to Hill
Slope)

Removable Seats

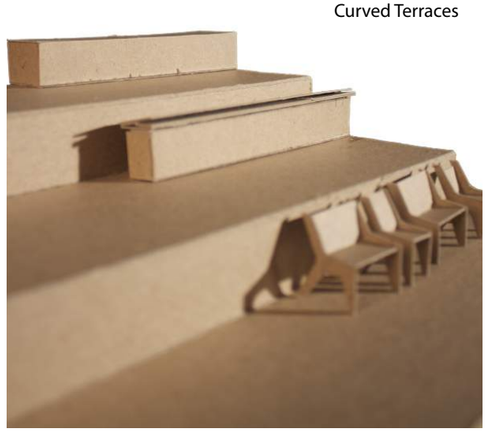
Structure Idea 2:
Metal Piping Lock
System

Hierarchy

Bench/Seatback
Variety

Woven Seat

Curved Terraces



Movable Seats

Re(movable) Seats

Section2 Architecture

What best describes you?

Faculty/ High School Student/ University Student/ Architecture Student

Bleachers/ Outdoor Sports seating Survey

	Yes	No
Do you feel the need to have storage space at a Public/Sports event?	☐	☐
Do you feel the need for seats at a Public/Sports event to have backs?	☐	☐
Would you prefer if seats at a Public/Sports event had armrests?	☐	☐
Would you prefer if seats at a Public/Sports event had footrests?	☐	☐

What would you find bothers you most when sitting on regular bleachers?

What materials do you think the seats should be made out of? (Wood, Metal, Plastic..etc)

At a Sports event, would you rather sit on bench-style seating, or individual seats? Why?

Would you prefer that Outdoor Sports seating feature a shade to shelter you from weather?

Exhibit Questions:

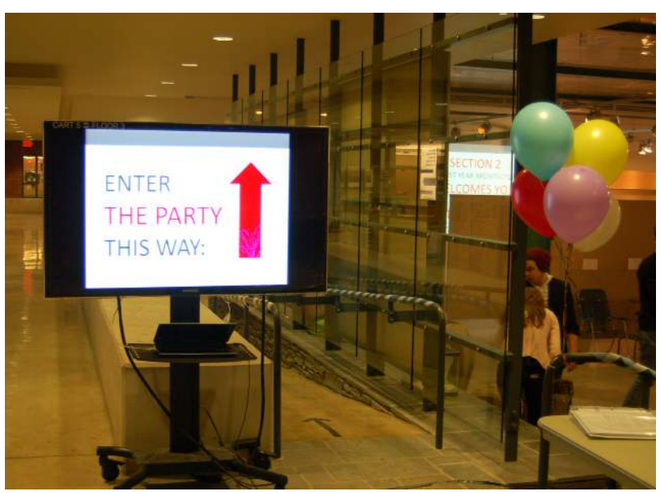
Which of our Bleacher Designs on display is your favorite?

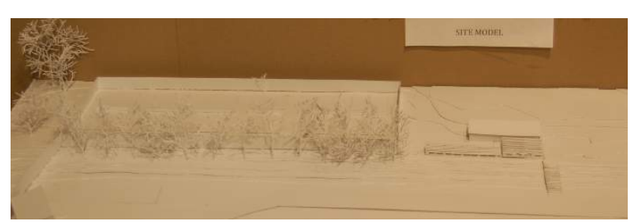
What were your favorite chair(s)?

Feedback:
Open House

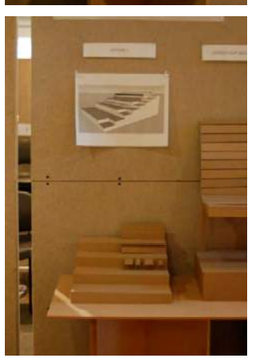
Feedback on a design is an essential part of the design process. At This point, there were various designs, and in order to narrow similar concepts down, and head towards working on a one final one rather than several, an 'Open House' exhibiting the designs, Models, Photographs of seats as well as actual seats was held.
The survey (On the left), was given out at the entrance, and collected towards the end, aiming at providing the team with suggestions, as well as finding out peopl'es certain preferences, e.g. Whether backrests and armrests are a must.

An introduction to the project was given at the start, where the guests were introduced to the site and aim of the project. After a visual prefrence survey, guests were asked to test some chairs out and later lead to view and comment on the various Bleacher designs on display.





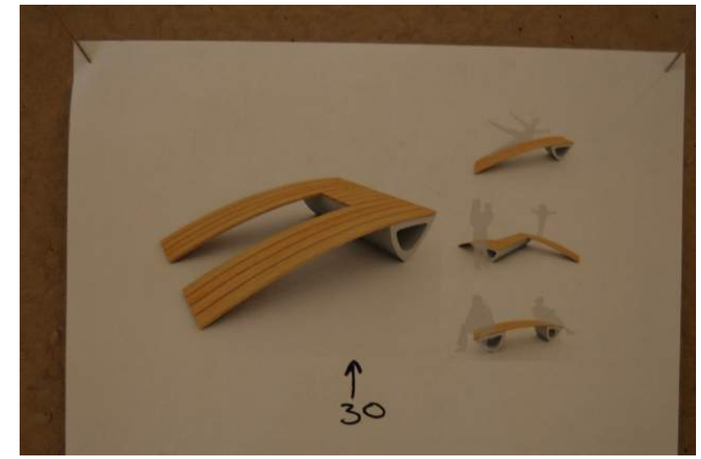
Bleacher Designs:

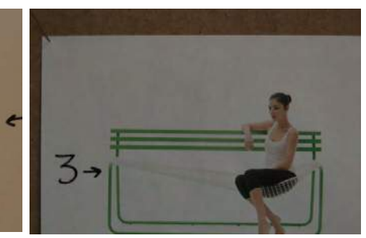


Far Left (Top to Bottom): Opt. Woven Seat,Opt. Curved Terraces, Opt. Variety.

Middle (L-R): Opt. Terraces with foldable benches, Opt. Continuous Curves.

Top (L-R): Opt. Anarondak, Close up of Continuous Curves.
Left: Opt. Rotating Chairs

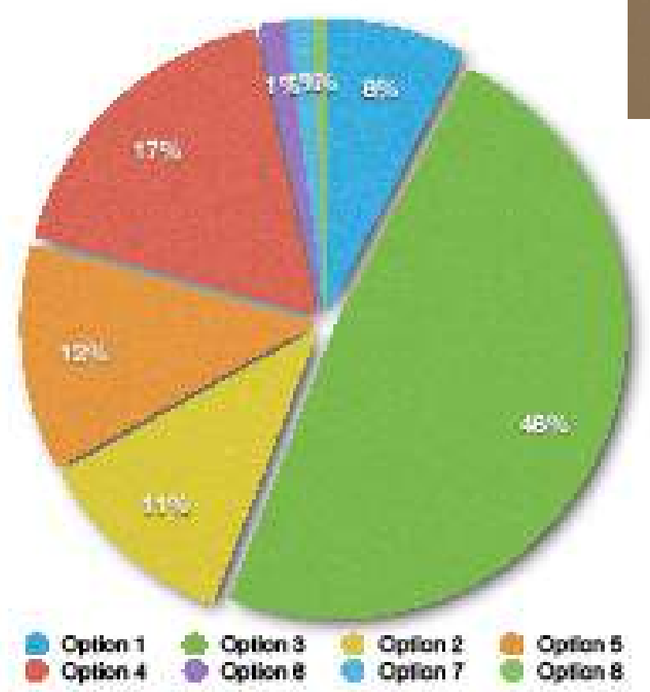


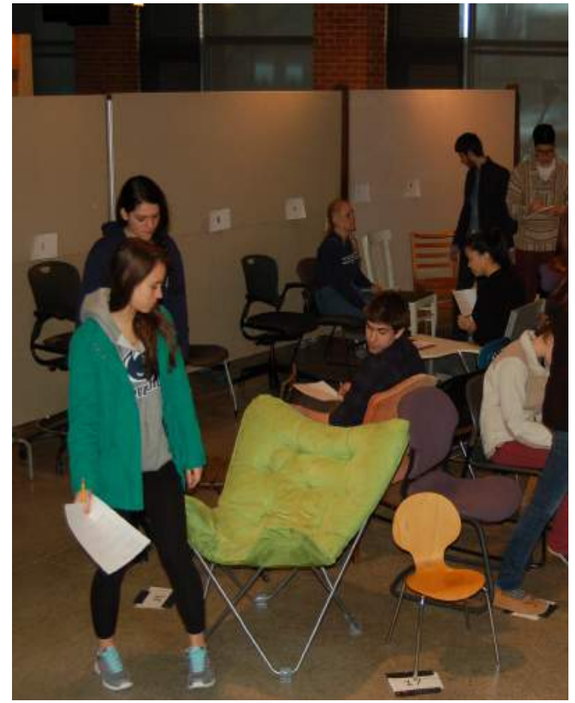


Option 1:, Option 2: Foldable Benches, Option 3: Continuous Curves, Option 4: Curved Terraces, Option 5: Rotating Chairs, Option 6: Woven Seats, Option 7: Variety, Option 8: Combination

Option 8 seems to be the most popular design by far. This design was comprimised of two designs, being teh Continuous Curves as well as the Terraces idea. This was quite important information considering that option did not exist and everyone seemed to prefer that choice unanimously.

Which of our Bleacher Designs were your favorite?





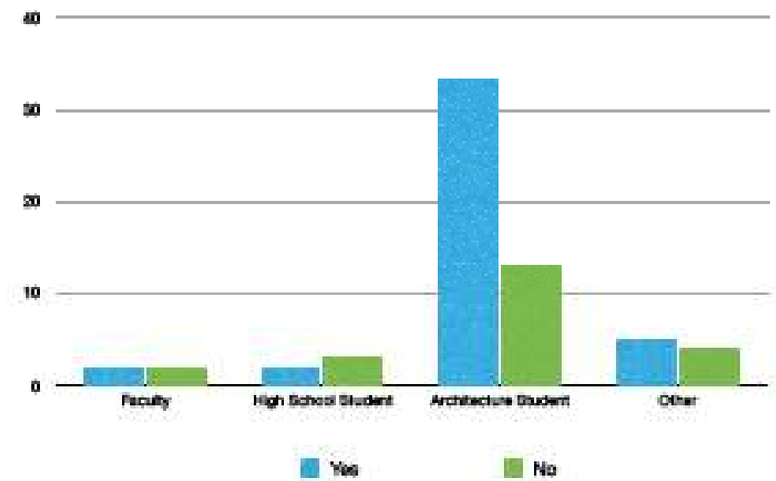
As a way to find out the people's personal preference when it comes to seating, in terms of aesthetics, comfort, height...etc, forty chairs were lined around a room for everyone to test out. They later filled out a section in the survey, where they simply mentioned their favourite chair(s).

The Graph to the Left has to do with there the audience preferred backs on seats, namely bleachers. The majority voted YES. This was later taken into consideration when the Bleacher designs were re-visited.

Chair Testing:

Would you prefer that the Bleachers feature backrests?

Would you prefer that Outdoor ports seating feature a shade, to shelter you from the weather?



A Visual Survey with different photographs of various benches were on display. The guests chose what they liked best based on aethetics, this information was also later to be used in thte design process.

Above: State High students participating in the Visual Survey Section

Cost Estimates & Budget

Composite Wood Options	Quantity	Unit Price	Total	
Home Depot				
Veranda ArmorGuard 1 in x 6 in x 12 ft Nantucket Gray Grooved	18	26.97	485.46	
Veranda 1 in x 6 in x 16 ft Brown Straight Edge	14	27.97	391.58	
Veranda 1 in x 6 in x 12 ft Brown Straight Edge	18	20.97	377.46	
Veranda 1 in x 6 in x 8 ft Brazilian Walnut Capped	27	17.97	485.19	
Trex 1 in x 6 in x 8 ft Grooved Beach Dune Composite	27	22.47	606.69	
Lowe's				
ChoiceDek Foundations 1 1/4 in x 6 in x 12 ft Beach House Gray	18	21.97	395.46	
Style Selections 1 1/4 in x 6 in x 8 ft Beechwood Brown	27	18.97	512.19	
Cedar Options	Quantity	Unit Price	Total	
Home Depot				
2 in x 4 in x 8 ft Select Deck Western Red Cedar	36	8.27	297.72	
1 1/4 in x 6 in x 12 ft Western Red Cedar Decking Board	24	13.79	330.96	96 ft
5/4 in x 6 in x 16 ft Select Deck Western Red Cedar	12	18.39	220.68	
2 in x 4 in x 12 ft Dimensional Cedar Lumber	36	12.47	448.92	144 ft
5/4 in x 6 in x 8 ft Western Red Cedar Kiln Dried Lumber Select	24	9.19	220.56	
1 in x 4 in x 12 ft Wester Red Cedar Select Tight Know Kiln Dried	36	7.74	278.64	144 ft
7/8 in x 4 in x 8 ft Kiln Dried STK Cedar Board	36	5.24	188.64	
Lowe's				
1 in x 8 in x 8 ft Kiln Dried Cedar Board	18	13.38	240.84	
1 in x 6 in x 12 ft Kiln Dried Cedar Board	24	17.98	431.52	96 ft
1 in x 6 in x 8 ft Kiln Dried Cedar Board	24	9.55	229.2	
1 in x 4 in x 8 ft Kiln Dried Cedar Board	36	5.78	208.08	
1 in x 4 in x 10 ft Kiln Dried Cedar Board	36	6.98	251.28	72 ft
1 in x 8 in x 12 ft Kiln Dried Board	18	18.98	341.64	72 ft
1 in x 6 in x 8 ft Kiln Dried Western Red Cedar	24	12.09	290.16	
1 in x 4 in x 12 ft Kiln Dried Cedar Board	36	8.78	316.08	144 ft
1 in x 6 in x 12 ft Kiln Dried Western Red Cedar Board	24	16.96	407.04	96 ft

Trailer Options (12 hours-full day price)	Initial Cost	Hourly Cost	Total	
Lowe's		19.00	20.00	259.00
Home Depot (special all day price)	19.00		69.00	
U-Haul (including insurance)			39.95	479.4

Rough Estimates (without the cost of Trex/student spending/ramp/trailer)	
1 set of stairs + 3 complete tiers	213.22
1 set of stairs + 3 complete tiers + 1 module of just structure	1198.88
1 set of stairs + 6 complete tiers	1343.96

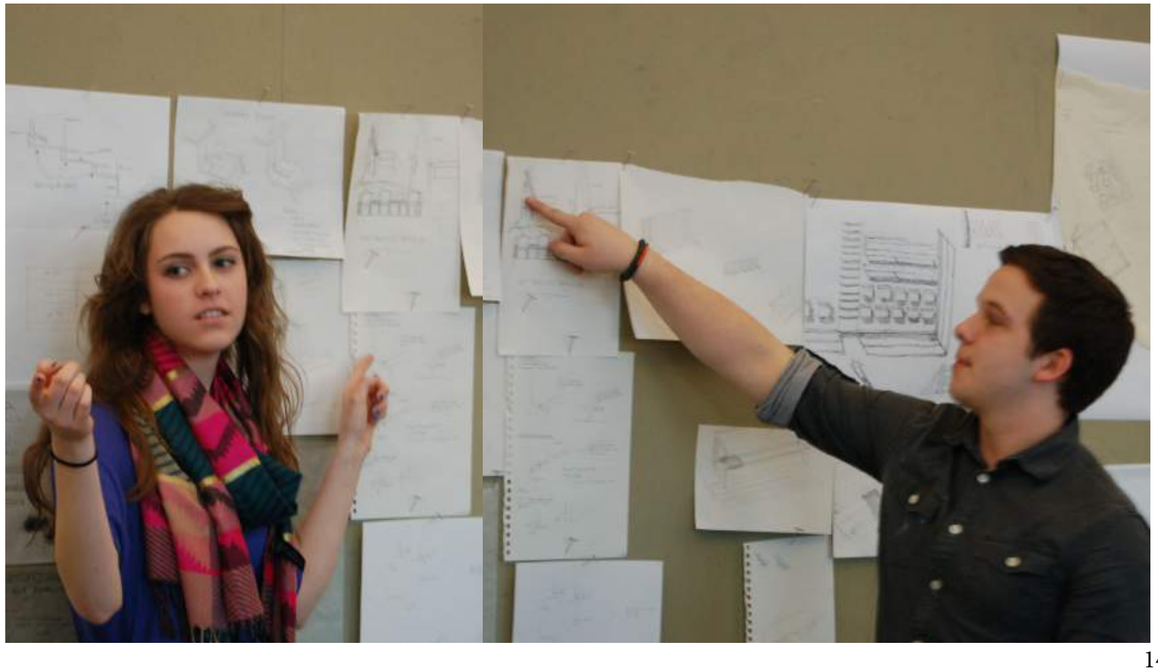
We found as we had to order more and more materials we were becoming extemely over budget. There would need to be a sizeable donation from each student to make up for the over-drafts. Getting the grants from the school did help our plight but, the cost of wood, fittingss, pipings, and as-sorted materials began to add up.

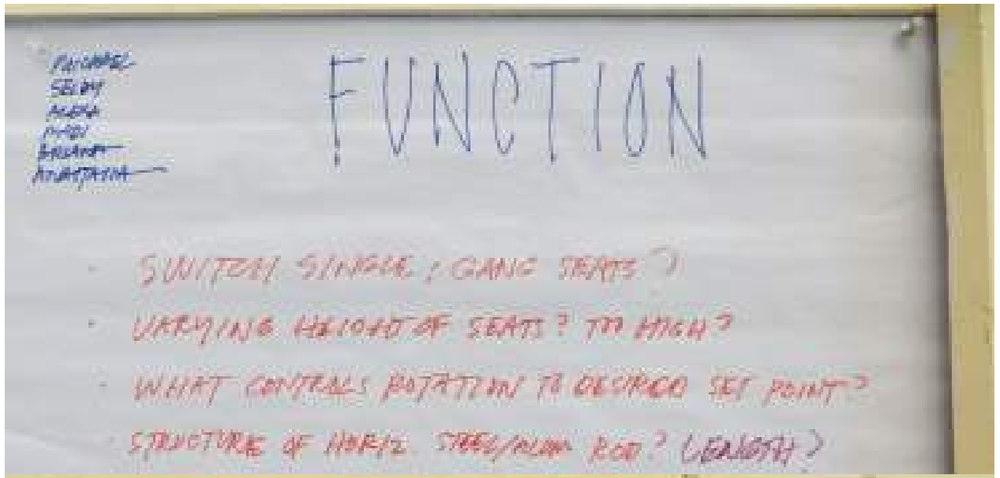
	Quantity	Unit Price	Total
Grainger			
Side-Outlet Tee Nom Pipe Size 1 1/	22	13.01	286.22
Clamp-On Crossover Pipe Size 1 1/4	10	9.15	91.5
Slip-On Plug Nom Pipe Size 1 1	24	2.03	48.72
			426.44
Lowe's			
#7 Pipe 1 1/4 Gal. Steel, 10'	25	26.15	653.50
84 Lumber			
Cedar	256	2.45	627.20
Peachey's			
5/4 in x 6 in x 8 ft White Oak	170	2.40	408.00
Lindsay Krause			
30 in x 40 in 1 Ply Chipboard	1	2.29	2.29
30 in x 40 in 3 Ply Chipboard	1	4.99	4.99
Tax			0.44
Phillips Head Screws 8 x 1 1/2 in	1	5.58	5.58
Tax			0.33
1/2 in x 10 ft PVC Pipe	4	3.55	14.20
3/4 in x 10 ft PVC Pipe	1	6.07	6.07
Tax			1.21
Chipboard	4	2.00	8.00
			43.11
Mike Lindenmayer			
Easel	1	10.79	10.79
Tax		0.65	
Dry Erase Board	1	31.99	31.99
Tax			0.30
			43.73
Marissa Getty			
Binder Envelope	1	3.99	3.99
Multi-page Sheet Protector	1	6.99	6.99
Tax			0.66
3/8 in Square Dowels	48	0.44	21.00
			32.64
Andrew Hoffmann			
Chipboard			5.00
Lauren Pelletier			
Dry Erase Accessory Pack	1	10.29	0.29
Tax			0.62
			10.91
Aiman Alalousi			
Chipboard	1	2.00	2.00
Briana Keyes			
Chipboard	1	2.00	2.00
Giselle Perry			
3/8 in x 36 in Dowels	24	0.59	14.16
Tax			0.85
			15.01
Justin Femiano			
Chipboard	6	2.00	12.00
			12.00
		Total	2281.54
College of A + A Opportunity Fund			300.00
Department of Architecture			300.00
Grant			1000.00
Students	18	50.00	900
Amount left			-$218.46

Design Development: schematic

To further develop the design using the data accumulated at the 'Open House', a new direction needed to be taken. So the groups were divided into subgroups, to focus on three important aspects of the Bleacher designs. The decision to divide the team between the three subgroups was to make sure that some of us were not attached to the ideas that we had come up with and try and look at the design in a different light.

What we learned from the 'Open House' was that people liked the idea of the Bleachers being more than just Bleachers, but serving various different purposes such as providing storage. Another focal point was finding a way to make the Bleachers more comfortable, and our designs had not achieved that yet. Finally, the construction of the Bleachers had not been thought out yet and in order to move on, we needed to find a way to support the structure to find out what materials could be used to build it as well.





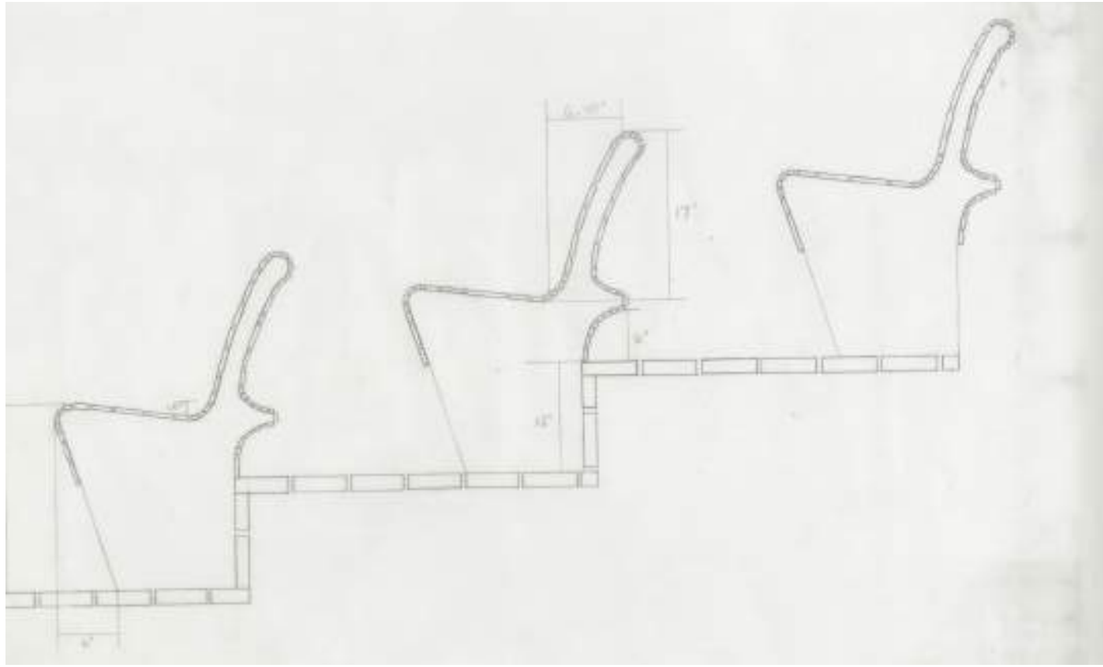
Group 1: Comfort

The Comfort group focused on making the design ergonomic. This was done by adapting the Continuous Curves design to their findings of what made a comfortable. In order to do that, the average seat height needed to be calculated, as well as how to make the back comfortable by finding the most comfortable angle.

What we found was that a harsh ninety degree angle -although the easiest and most practical to build- was far from comfortable. Hard surfaces like wood could be made comfortable be gently curving the back backwards. The edge of the seat on which the back of your legs sit on is also important, which is why the seat curves towards the edge.

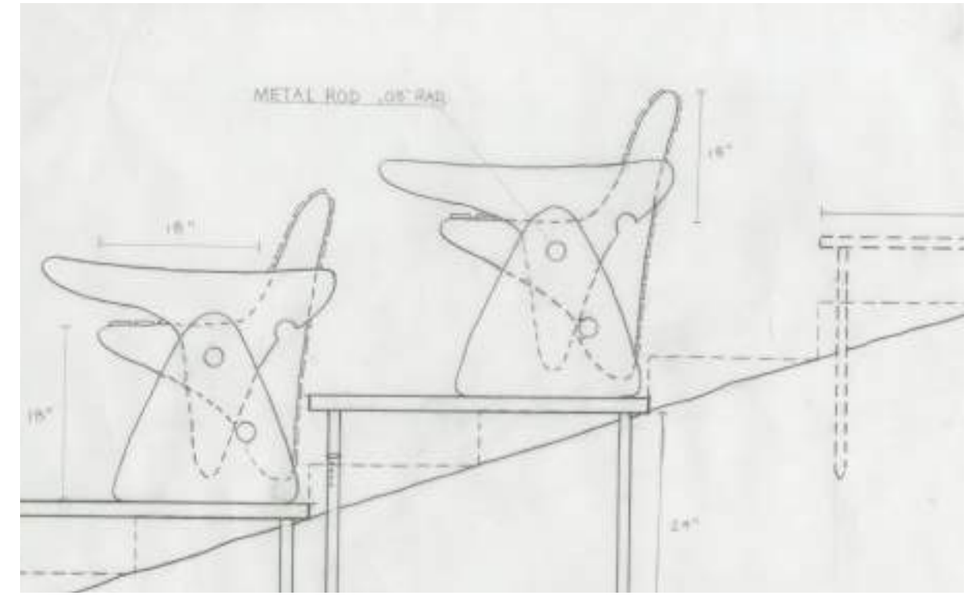
The slats were also cut at different widths as it was easier to use thinner pieces on the sharper curves, as well as the fact that wide slats are more comfortable to sit on.

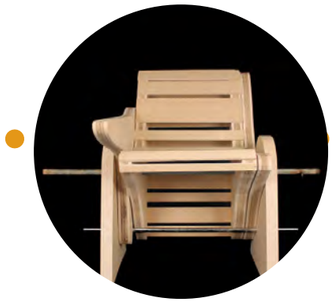
In order to make the design that much more functional, a footrest was integrated into the design at the back.



Group 2: Function

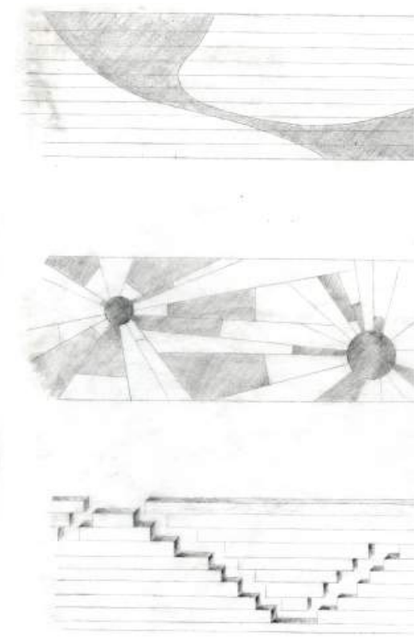
The Function group focused on making the Bleachers as functional and useful as possible. The 'Rotating Triangles' Concept introduced at the open-house (Shown Below) best suited that idea. Just like a Swiss knife, different parts of the bleachers can flip out and serve various purposes. In this particular design, instead of using several triangular panels strung through a metal rod, a system of module is used where two triangular panels make up a seat by placing wooden slats to connect them. That way an entire seat would be able to flip down and also serve as a bench for one person. However, due to time constraints it would be difficult to construct a whole set of Bleachers in this manner, so a system of hierarchy was created, where singular seats are set above, and long benches -built in the same way- with the triangular panels set on either side. This means that the whole bench would be able to flip down to form a long bench. In addition to all that, the seats above would have armrests that would also be able to flip down.

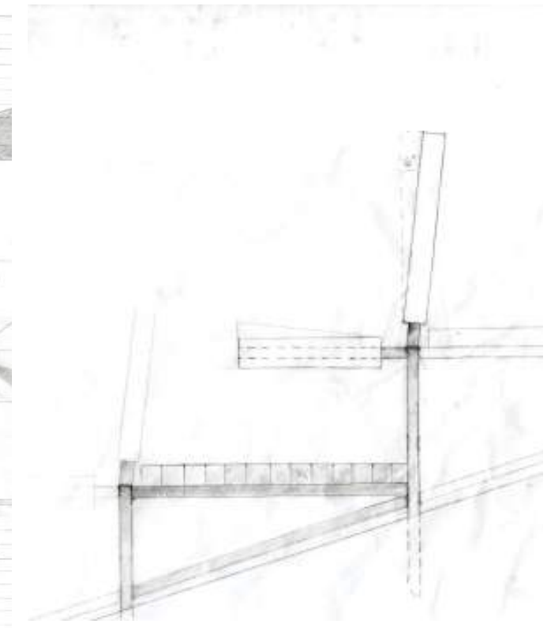


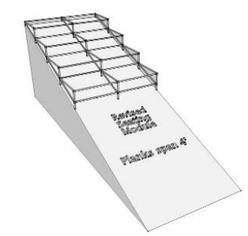


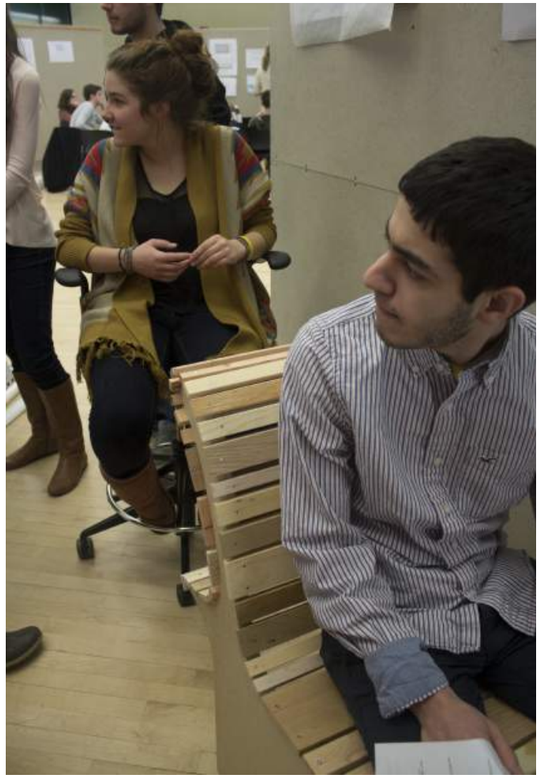
Group 3: Construction

The Comfort group was tasked with designing a seat that would be the most simple to make and most durable over time. The idea of the design was having both vertical and horizontal pipes that a seat and bottom would slide on to. This idea would use the least amount of materials and called for a CNC routed design on the chair itself. Though it was not chosen completely as the final design, the spirt of the vertical and horizontal is evident in the continuous curve supports. The down side to this design was though it would be fairly simple to make, it wouldn't be the most comfortable and functional of the three. These three teams were really just created to contribute to one final design instead of picking a single durable, comfortable, or functional idea. We learned that the 6 degree slant on the back of the seat was not enough to make the flat plans a comfortable sitting surface, and that the height of the seat was a little too low for an average height person.









A Review of the Mock-Ups

[redacted]

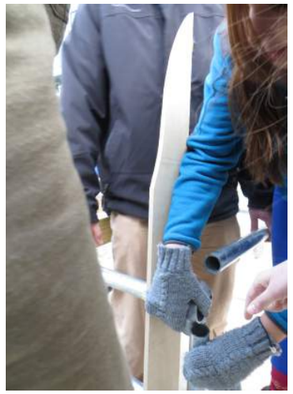
A Review of the Prototype





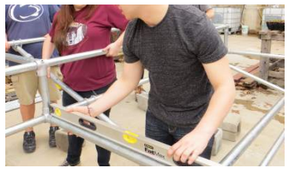



Both constructing and moving the structure required as many people as possible. As each student added a series of steel pipes to the fittings their respect places were makered and recorded. Once the structure was finalized, leveling it became the biggest concern. To compelete the task, every student was required to move the structure off of the hill. It was then possible, on flat ground the level the pipe structure. This was a very large team building activity that required constant communication from everyone involved. The process of leveling that had originally taken days was accomplished in mere minutes.Upon realizing that the current seat design lost the integrity of the orginal "Continuous Curves" desgn, the group re-finalized the seat design.

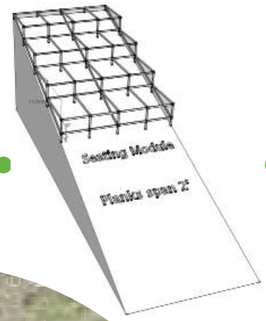


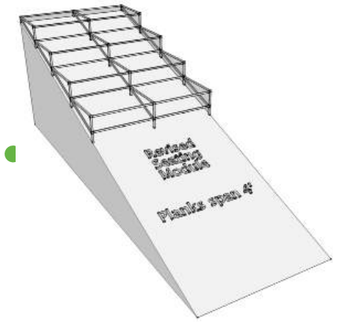


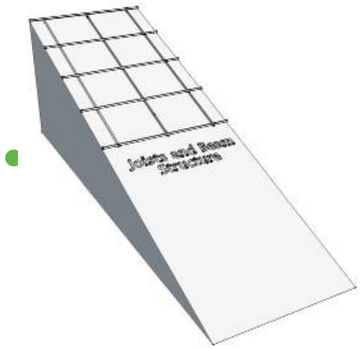


THE STRUCTURE

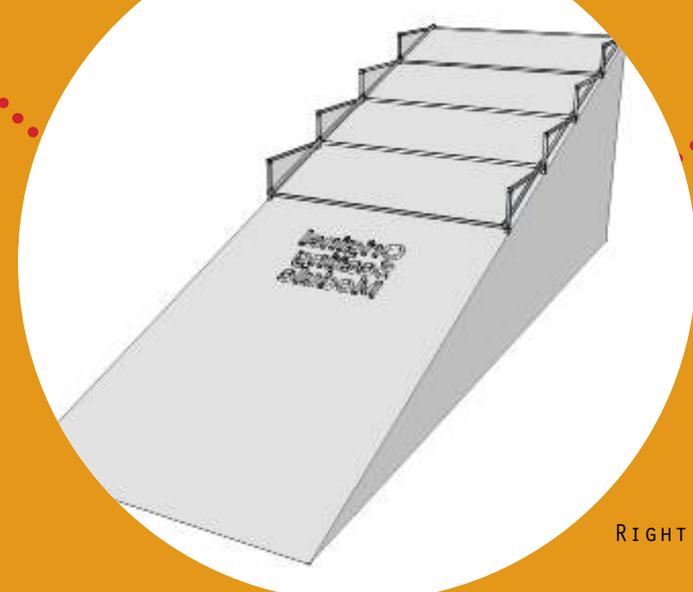




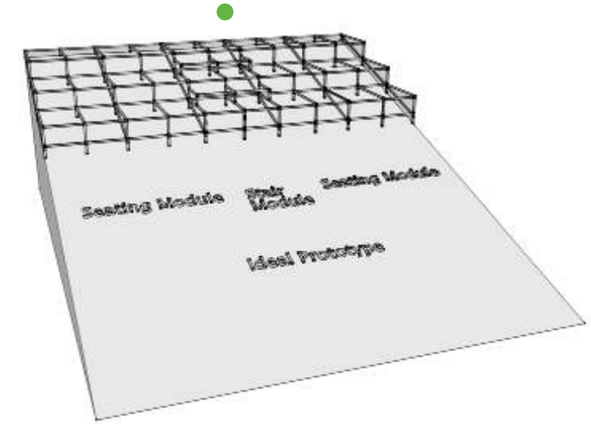


Above: Square Steel Beams of different sizes that were found, helped to fruther improve the structure as it gave an idea of what we could be working with.

Design Pitch: Spikes pushed into the ground, as well as being used to hold seats in place.
- Easy to Assemble/Dissasemble



Right: Original Seat Mod-



MATERIALS

The transformation of stiff, sharp bleachers to inviting, whimsical seating

The existing conditions at our site consist of the typical metal and wood bleachers. The planks of metal and wood are laid effortlessly across the structure to provide the most simple form of seating for the public. We wanted to change that. For our design, we chose the idea of continuous curves, which are more pleasing physically and aesthetically. To accomplish this idea of a seat being one continuous curve, we needed the right materials.

Galvanized Steel- For the structure of our seating, we needed something that could hold about thirty people on a hillside. We wanted not only something strong, but also a material that is the right cost. Galvanized steel is almost invariably cheapest in the long term because it lasts longer and doesn't require much maintenance. It is also very strong and reliable, a galvanized coating has a unique metallurgical structure which gives outstanding resistance to mechanical damage in transport, erection and service. Galvanized key clamps are used to connect the steel pipes.

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GALVANIZED STEEL

White Oak Wood- For the decking that is laid across the steel structure, our section decided on using White Oak. White Oak is strong, hard and very resistant to the elements and decay. These characteristics are needed because the seating will be placed outdoors where it will endure weather from snow to sun. Also, White Oak's own distinct grain and texture make it very pleasing to look at.

Trex- Trex is a composite material made of wood fiber/wood flour and thermoplastic(s). We decided trex would be good to use for the profiles of the seats, vertical supports for the white oak joists (decking), and for the stairs decking. We picked trex because, like the White Oak, it is also resistant to rot and decay. Also, trex has good workability and can be easily shaped by conventional woodworking tools. This is why it was used for the seat profiles, we were able to shape the wood to the continuous curve design of our seating. For the stairs, we decided to use gray trex simply for aesthetic reasons. Since we're building for State High and they're school colors and gray and maroon, gray trex on the stairs will represent the school as well as add to the diversity of our seating.

Cedar- Our section decided on using Cedar wood for the horizontal planking across the seat profiles for multiple reasons. First, Cedar fibers contain oils that are natural preservatives. This quality of cedar wood makes it, like the Trex and White Oak, resistant to rot and decay. Also, its low rate of heat absorption means the even on hot days, the seats won't be hot. Also beneficial for seating, Cedar is softer to the touch than many other woods.

TREX

CEDAR

WHITE OAK

CODES

What's allowable and restricted when it comes to bleacher seating

Live Load

-It should be assumed that the live load being applied on the bleachers is 100 pounds per square foot to assure safety for every one.

Aisle Stairs

-The stairs must be at least 48" wide to allow enough room for people walking up the stairs as well as for people walking down the stairs.
-There must be at least 23" between the aisle and the handrail.

Aisle in Seats

-If the aisle is over 30" above the ground, there are no openings greater than 4" in diameter allowed.
-There should be at least 12" available for walking space between the seats.
-The seats must have a depth of at least 9".

Handrail Requirements

-There should be 22"-36" between two verticals of the handrail.
-The handrail should be between 34"-38" tall.
-The diameter of the handrail should be between 1.25"-2".
-There are no projections of the handrail allowed.
-If there are two horizontal rails, the lower rail must be placed at most 12" from the top rail.

Handicap Requirements

-There should be 1-2 spaces for wheel chairs.
-The highest allowable slope for wheel chairs is a 20" run for every 1" rise.

INVENTORY

Side Outlet Tee Nom Pipe Size 1-1/4”	22
Clamp-On Crossover Pipe Size 1-1/4”	10
Slip-On Plug Nominal Pipe Size	24
Flat Washers 3/8”	106
Hex Bolts 3/8x3-1/2”	63
Hex Nuts 3/8”	29
Galvinized Cupping 1-1/4”	6

INVENTORY

FITTINGS

CORNER:
NEW – 22
JAMIE'S – 6

CROSSOVER:
NEW – 10
JAMIE'S – 2

SLIP ON PLUGS:
NEW - 24

COUPLINGS:
NEW-

HARDWARE

3/8" x 3½ BOLTS:
NEW- 63

3/8" WASHERS:
NEW – 106

3/8" NUTS:
NEW – 63

2" EXT. SCREW
1 BOX

2.5" EXT SCREW
1 BOX

PIPES

1 1/4" #7
GALVANIZED STEEL:
10 — 3|23|13
10 - 4|1|13

Prime
2x4x96 - 16
2x4x43 - 14

Trex
Red
2x6x29 - 2
2x6x32 - 9
2x6x31 - 2
2x6x48 - 2
2x6x36 - 1

Chocolate
1x6x39 - 1
1x6x49½ - 3
1x6x67½ - 1

Light Brown
2x6x48 - 6
2x6x44 - 1
2x6x47 - 1
2x6x49 - 1
2x6x50½ - 1

Dust
1x3½x34½ - 1
1x2½x23 - 24
1x2½x80 - 3
1x2½x45 - 1
1x2½x23½ - 4
1x2½x79 - 1
1x2½x37 - 2
1x2½x31½ - 1
1x2½x44½ - 1
1x2½x128 - 1
1x2½x33 - 3
1x2½x26 - 1
1x2½x32 - 3
1x2x51 - 1

INVENTORY (JAMIE'S STEEL)

UPDATED

#7 PIPES (27)

0'10.5"	II
5'1"	II
5'2"	II
5'9"	II
6'0"	I
6'2"	I
6'3"	I
6'2.5"	I
6'3.5"	I
6'8"	III
7'6"	I
7'7"	II
8'0"	II
8'2"	I
10'1"	IIII

SKINNY PIPES (1)

4'7"	I

ASST. WOOD PLANKS

~~IIII~~ I

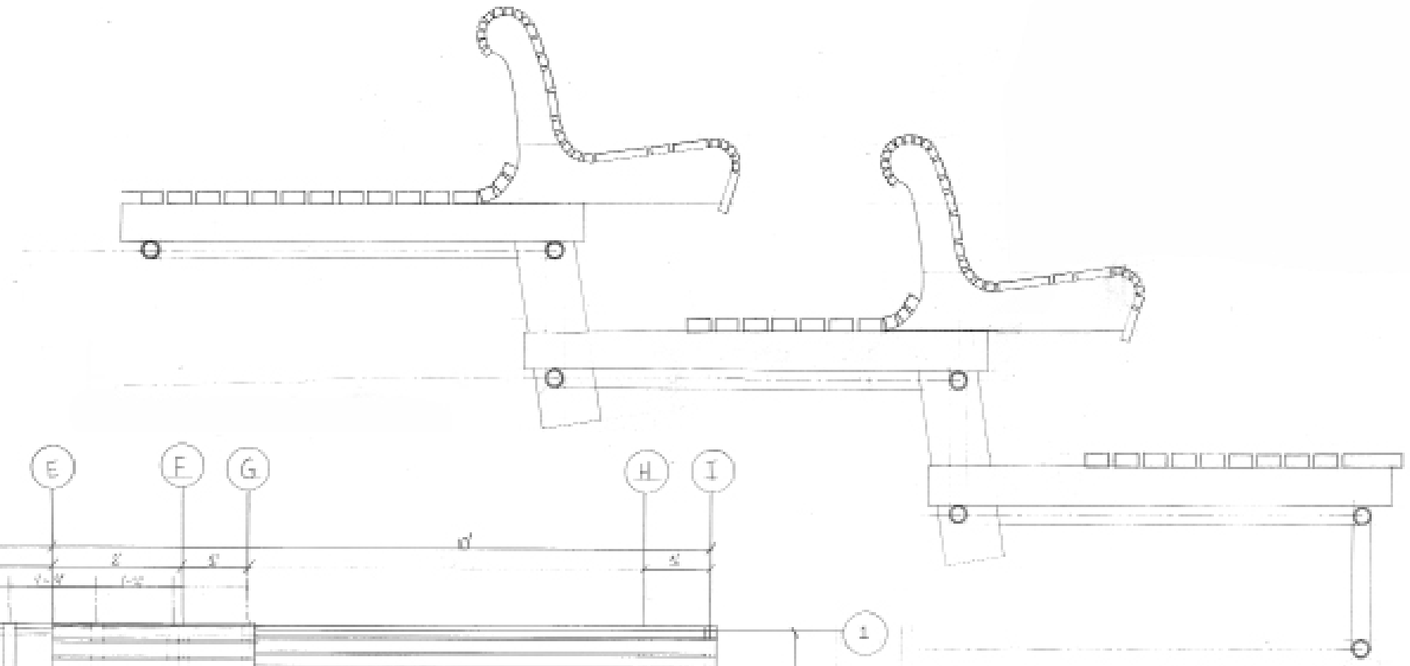
SMALL FITTINGS

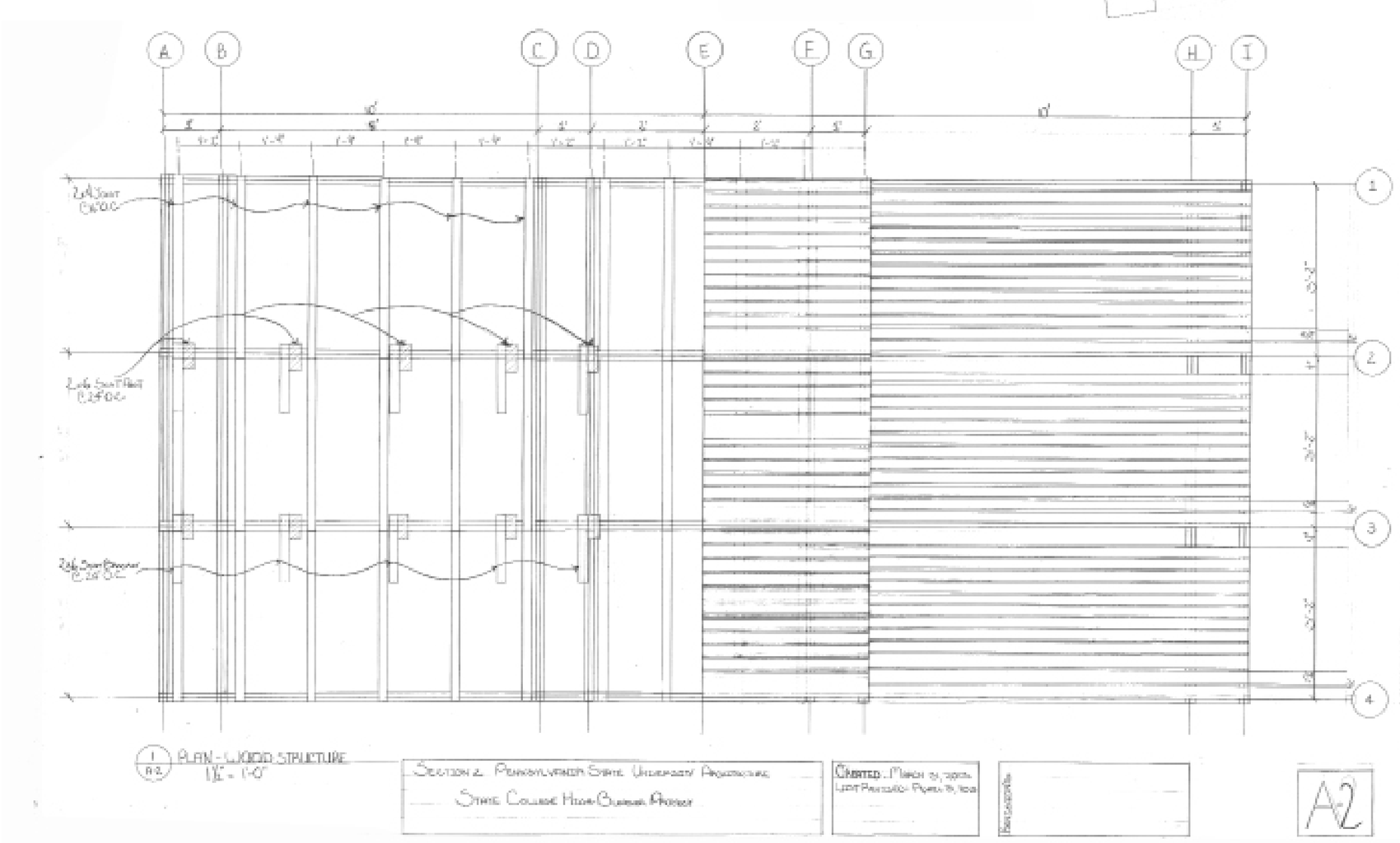
# 2	I
# 1ME	I

KEE-CLAMPS #7 (## -

10	III
15	III
19	II
21	~~IIII~~ I
45	IIII
61	III
70	~~IIII~~ III
A10	IIII
A45	II
F50	IIII
M52	~~IIII~~ ~~IIII~~ I
M50	IIII
~~[illegible]~~	II

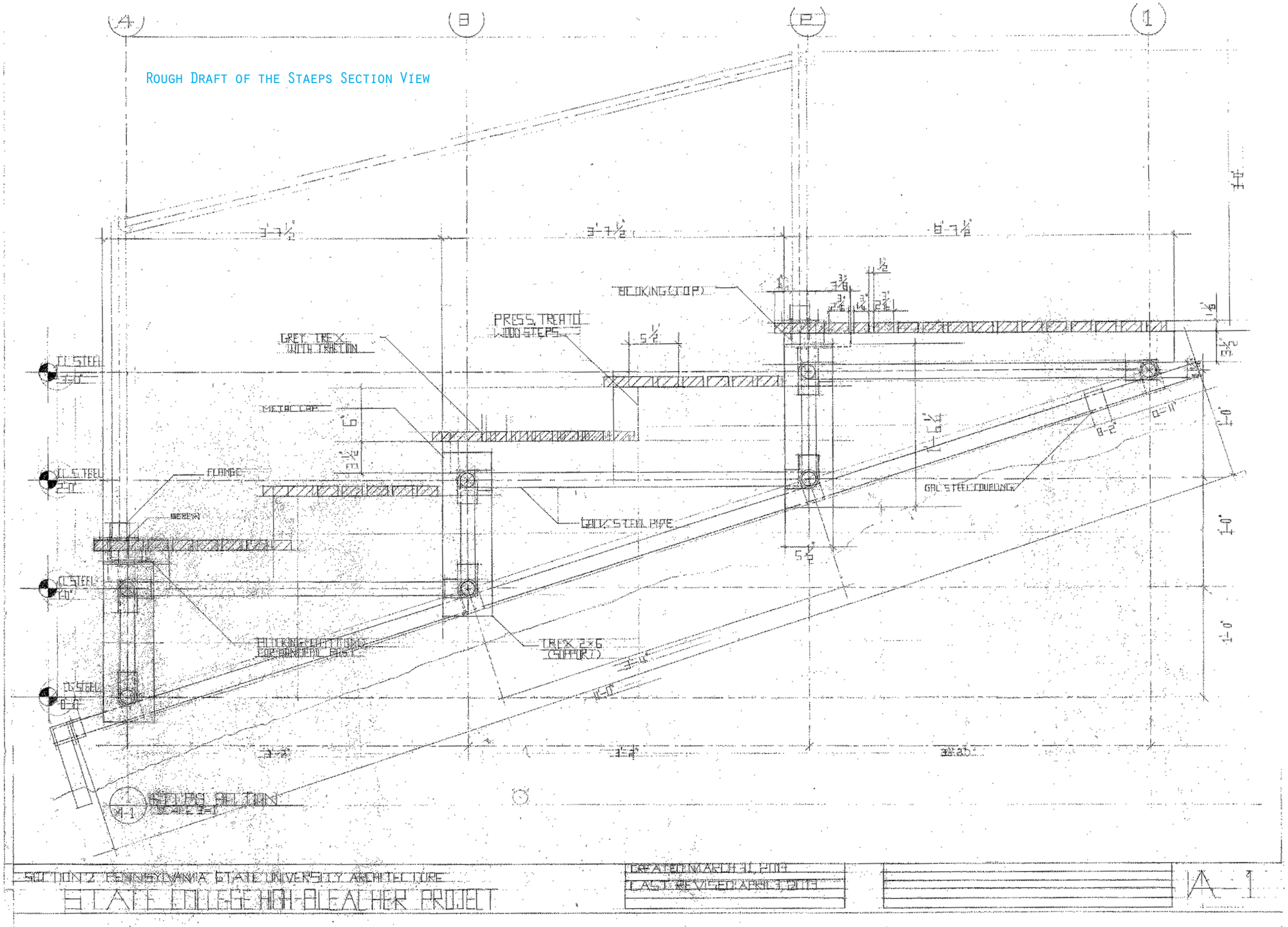
DRAWINGS





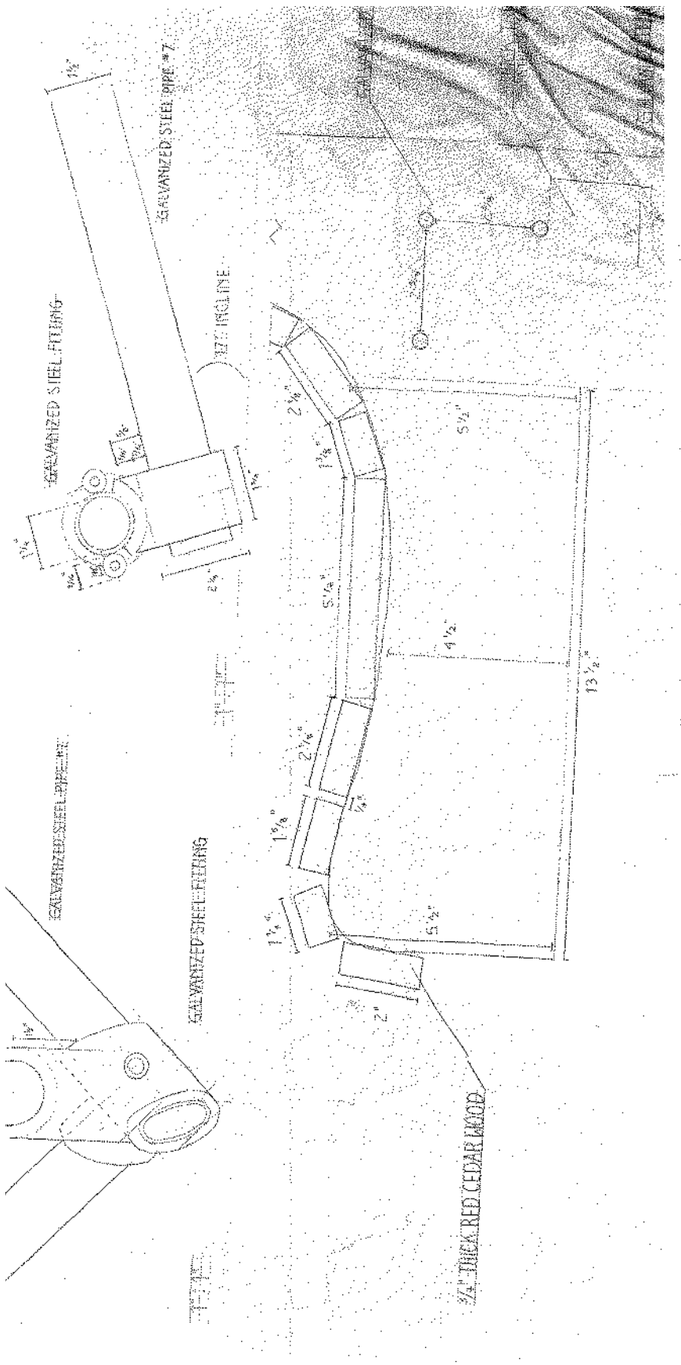
Top: Section Cut View

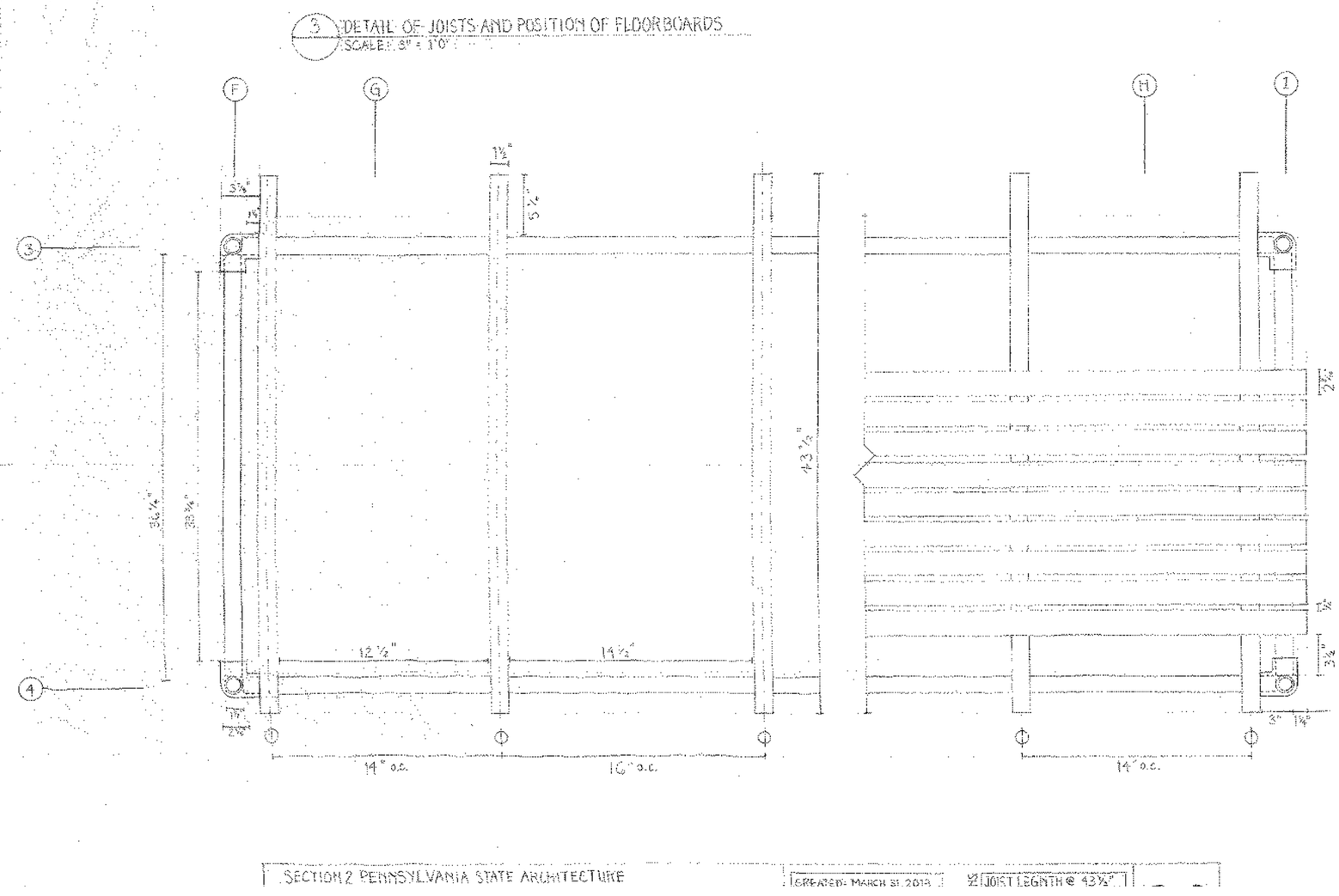
Left: Plan View


Rough Draft of the Staeps Section View
BLOCKING (TOP)
PRESS TREATED WOOD STEPS
GREY TREX WITH TRACTION
METAL CAP
FLANGE
BEAM
GALV STEEL PIPE
GALV STEEL DOWELING
TREX 2x6 (GUARD)
STEPS SECTION
SECTION 2 PENNSYLVANIA STATE UNIVERSITY ARCHITECTURE
STATE COLLEGE HIGH-BLEACHER PROJECT
CREATED MARCH 31, 2009
LAST REVISED APRIL 3, 2009
A-1

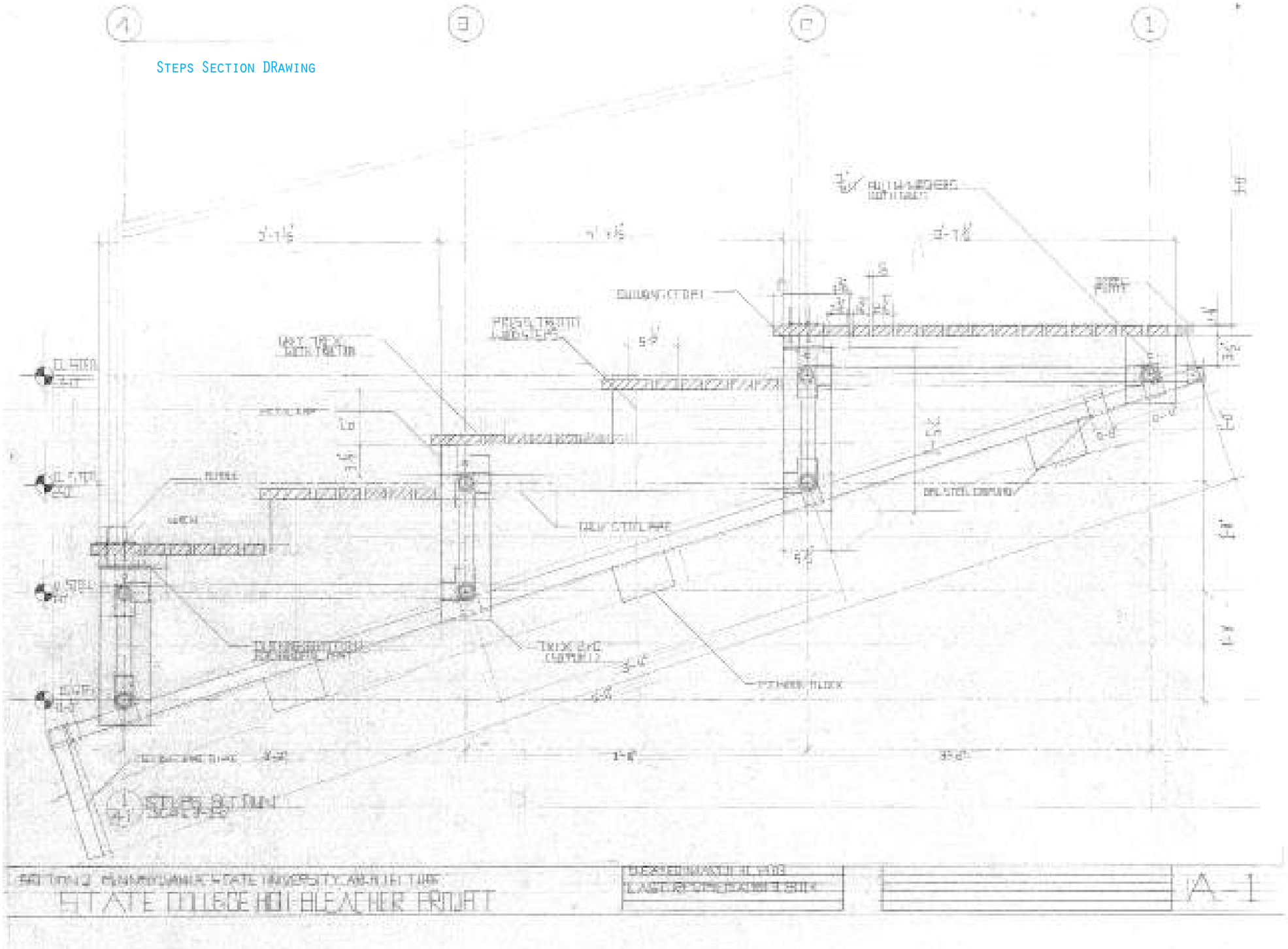
Bottom: Detail of Joists and Position of Floorboards

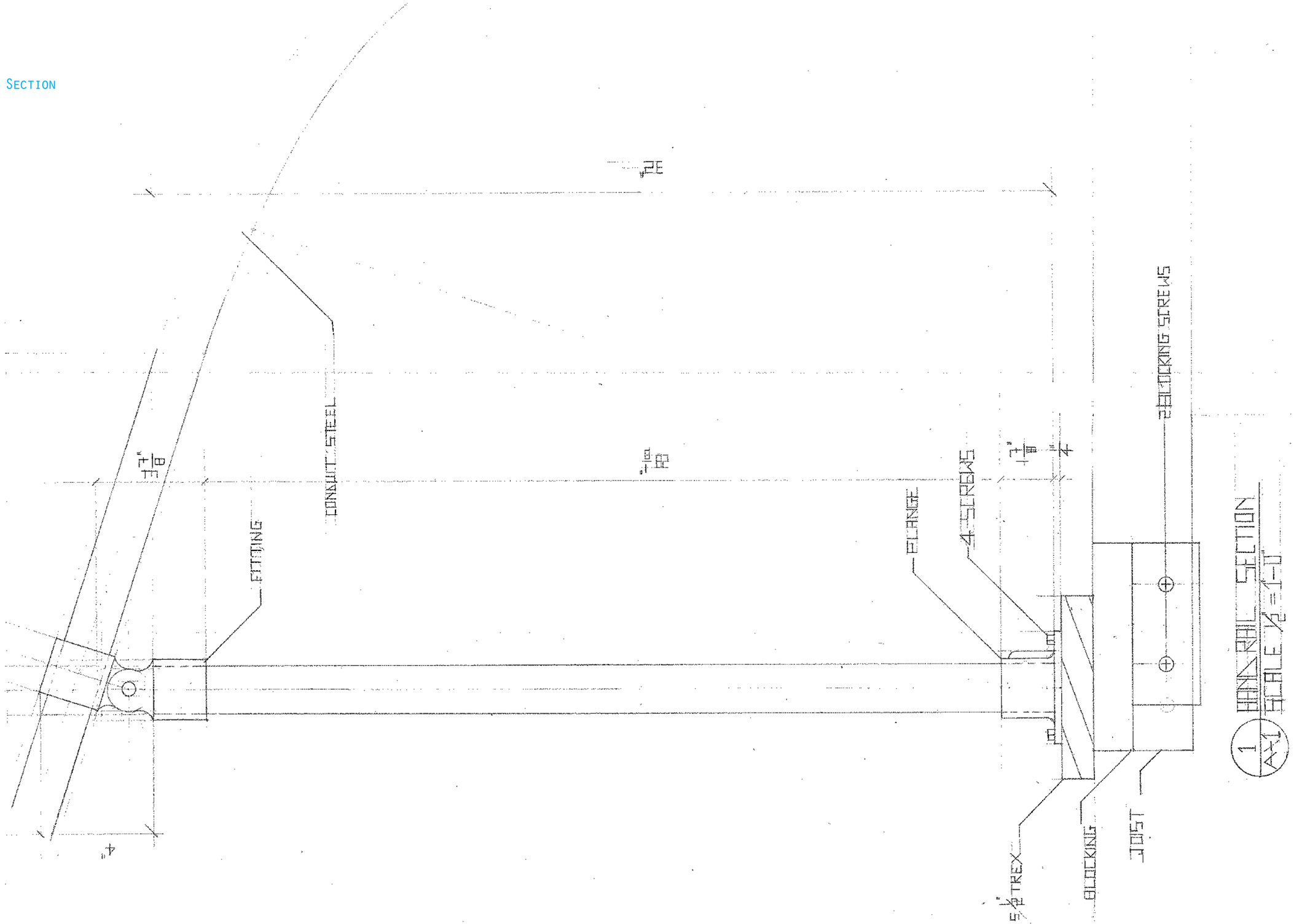
Left: Detail Drawings



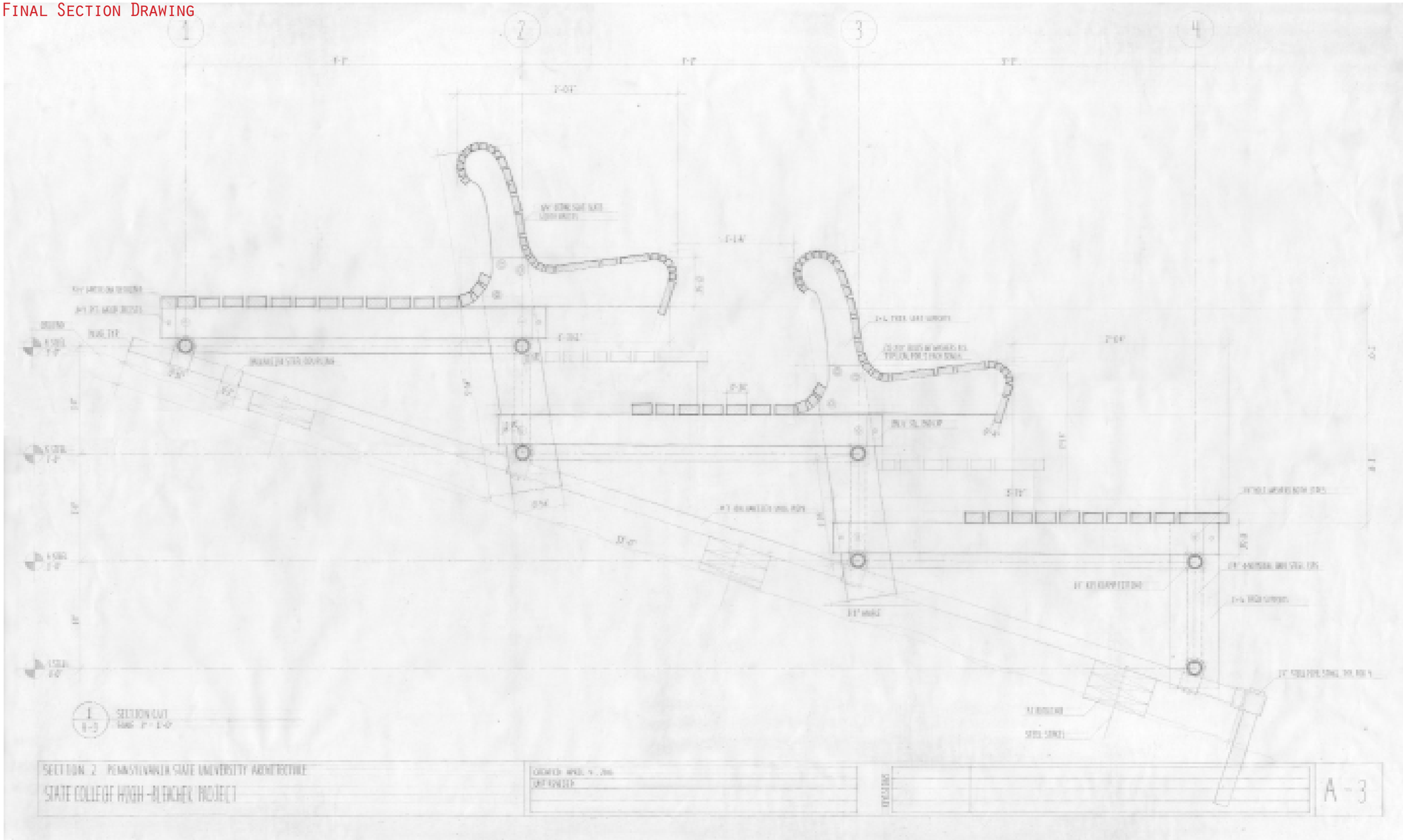


Steps Section DRawing




2 BLOCKING SCREWS
4"
1 7/8"
4 SCREWS
FLANGE
5/4 TREX
BLOCKING
JOIST
1 1/2"
CONDUIT STEEL
FITTING
7 7/8"
4"
1 HAND RAIL SECTION
A-1 SCALE 1/2=1'-0"

Final Section Drawing



Construction Process

- Structure
- Hill Installation
- Profiles
- Curves
- Seats
- Footrests
- Decking
- Stairs
- Handrail
- Mesh
- ADA Platform

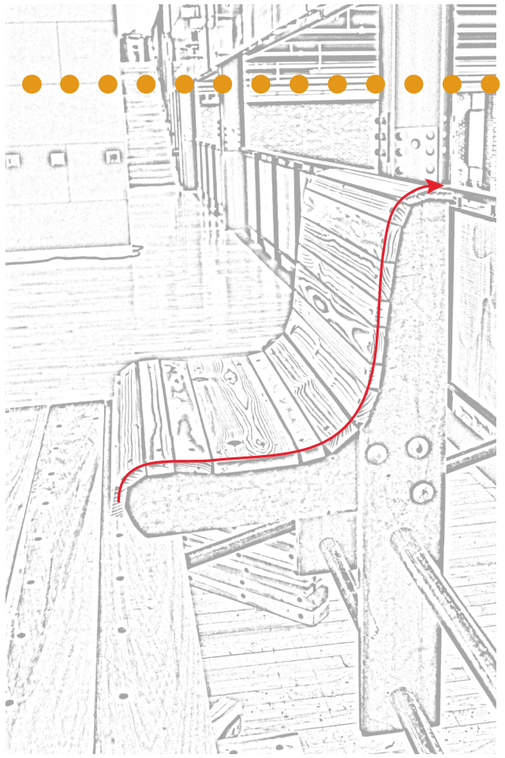
The construction process was not quite a lOong one but did involve many different operations being taken at the same time. Most of these are mentioned above and were all essential parts of completing the Bleachers. The structure was the first thing to be built, since everything had to be built around the frame. Followed by installing it on the hill to level it out and from there attach the seat profiles, decking, stairs and handrail. The whole process took about two weeks with almost all team members involved int he construction of the Bleachers at this point.





The Steel Structure

The steel structure was the most important part of the design. After receiving the steel pipes, they were cut down to size and assembled together using key clamps which made the process much easier, and go by faster. The structure was built first since all the other parts of the Bleachers were to be assembled on the structure. Hence it was very important to ensure that the structure was level both on the hill and on the ground. Using a Level, bricks were placed under parts of the structure to make sure it was level all-around. Key clamps were also added to the edges to make it easier to add more modules of the Bleachers on to the structure if an expansion of the seating area at the track was required.



Profiles and Curve Changes over Time

The Profile of the Seats changed a few times as the project developed, adapting to different designs and constraints placed upon them by Codes and limited Materials. The three photographs above illustrate the main changes the Profile of the Curve went through over time. The first Curve is that of the Prototype, which was slightly modified from the curves found in our Initial Continuous Curves Model. The back as well as bottom f the seat were both cut shorter to accommodate the Trex now being used for the Profiles. The seat had also been brought down lower by approx. 2 inches. The Chair however had now lost the very essence of what the Continuous Curves Model embodied. Hence, as seen on the template of the Profile in the Second Photo, the bottom of the seat now went up higher, allowing for your legs to curve back. The Vertical Joists were drilled into different so that it no longer rested at a 90 degree angle but at a ()angle. This allows room to lean back; more comfortable. The last Photo simply shows the Trex Profile installed on the Steel structure.

the Seats

Now that the Profiles were being installed, the seats were slowly starting to take shape. Eight foot long planks of Cedar had to be cut to size, drilled, sanded, then sealed twice before they could be fixed onto the profiles.

Cutting Cedar To Size:

Since the Profiles were now a lot more like the original Continuous Curves Design, We decided to go back to the plan of cutting the planks of wood/lumber to varying widths to accommodate the degrees of curves along the Profile.
Therefore, the pieces that went on the flatter parts of the profile were wider, and smaller pieces used where the profiles curved, and the angles were sharper.
This way, we were able to replicate the curve, and truly giving it the appearance of a Continuous Curve.

Drilling:

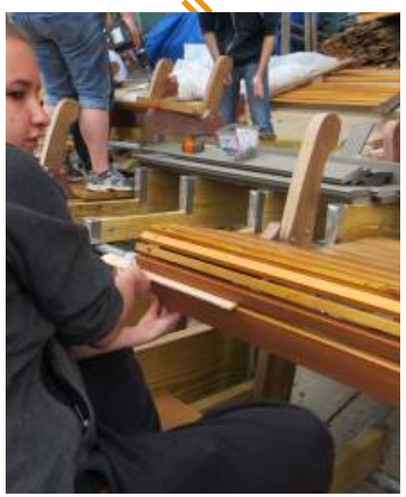
The pieces that would go on the seats were divided into two groups. A group that would go on the bottom of the seat, and the other on the back. The reason behind this can clearly be seen in the photographs featured. The bottom part of the seat is separate from the back, and they were drilled together. Therefore the pre-drilled holes' positioning differed per group as we had to make sure they meet the surface of the trex.
The holes in the cedar were pre-drilled as mentioned. Using a spacer, holes were drilled into the trex one by one by assessing where they would go using the pre drilled holes in the cedar as a guide. We finally used a 2-1/2" screw to screw the cedar to the trex.

Sanding:

The pieces of cedar were sanded twice to ensure they were smooth, and free of splinters. This made the seats that much more comfortable and served as a smooth surface for the sealant to go on.

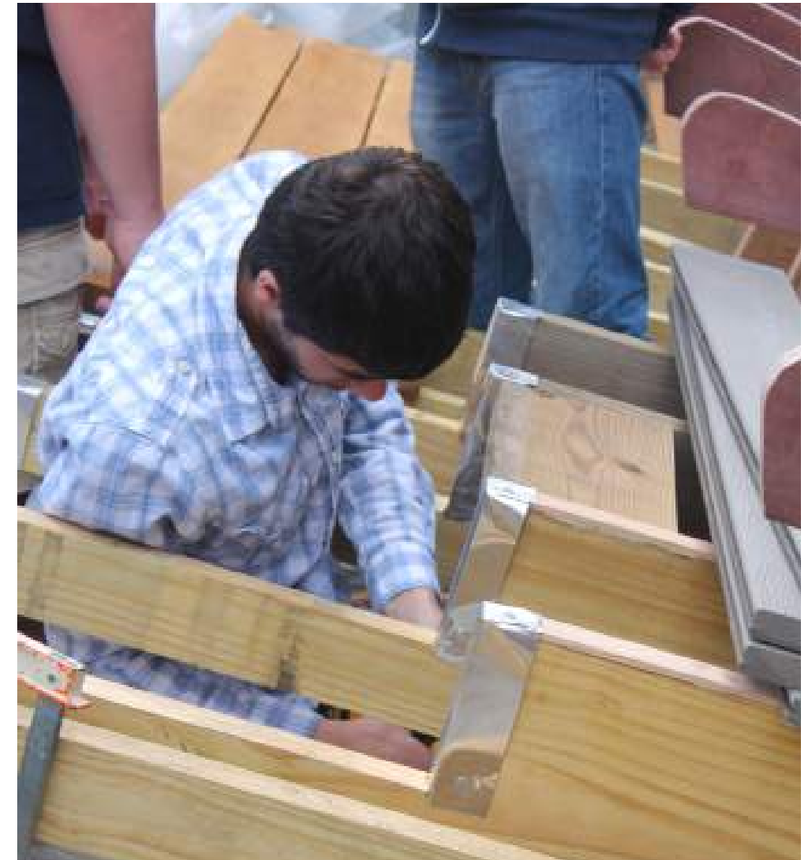
Sealing:

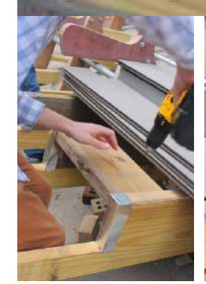
The cedar was sealed twice, this was to ensure it would last a considerable amount of years and be able to withstand the weather here in State College.



DECKING

The decking was to be made out of 8 foot long planks of white oak. The white oak had to be jointed, then planed since they were almost all bowed. The white oak was then sealed, pre drilled, and screwed down to the wooden joists along the structure that also happened to be supporting the seat bottoms in most cases. White oak was chosen for its durability since the Bleachers were to be laced outside and had to withstand the changes in weather like rain and snow. It is also tough and doesn't bow easily.

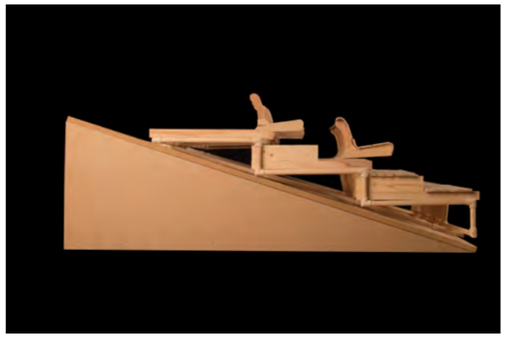


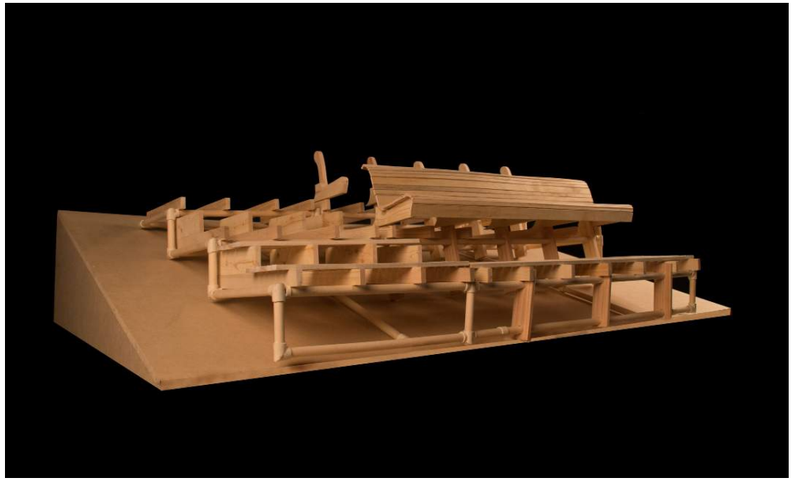


STAIRS

The Stairs were done using trex, alternating the colors between maroon and grey -the high school's colors As shown Above. The top picture show the wooden stop that had been placed on the lower and upper steps to support the handrail which was to be added later. (The technical drawings of both the stairs and handrail can be found in the Drawing Section on Pages 29 and 30.)

THE FINAL MODEL





Much like the assembly of the bench the assembly of the final model took a lot of time.

Making the fittings:

A group of about three students made it their mission to create believable fittings for the model. After experimenting with different types of material, they settled on PVC pipe. The pipe could easily be cut and fashioned to look like a fitting. It also held the wooden dowel that was necessary to connect each piece.

The Structure:

After each fitting was created, fitting each dowel to form a structure became very easy. The necessary shape was simple to create.

the Verticle Supports and Joists:

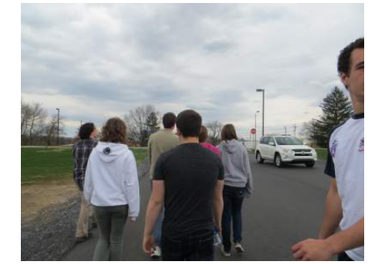
As one of the final things added to model the verticles were made to slide onto the dowels. After being attached with glue, they were connected to the joists.

Seating:

The final touch to the model was the seating itself. After each slat was measured perfectly to size they were glued to model and it was complete.













TOURS
Centre Furnace Mansion



YBC
Your Building Center

YBC
Your Building Center

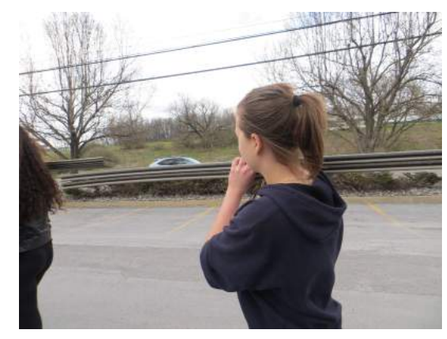












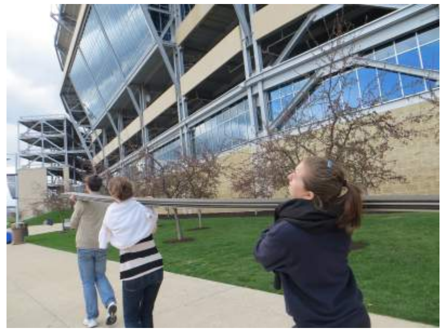
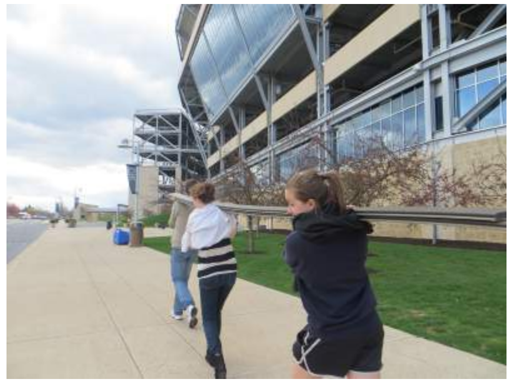


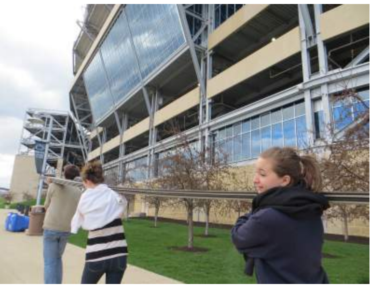






CENTER LANE ONLY





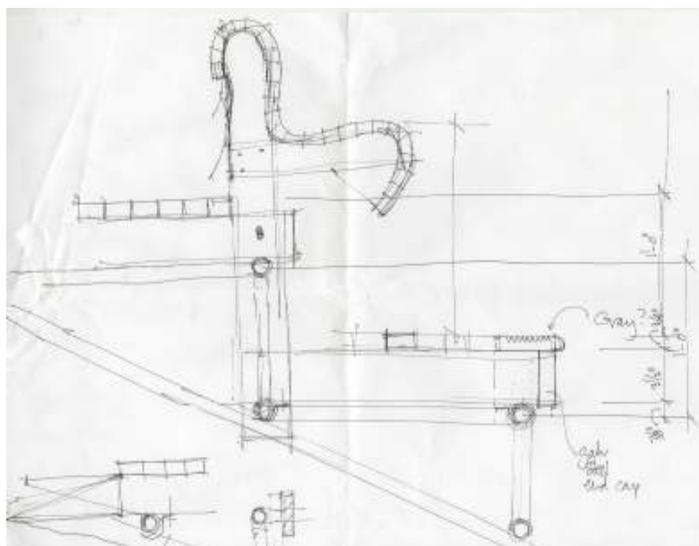


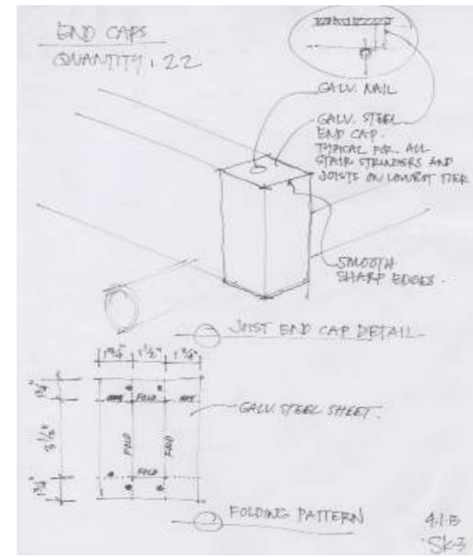


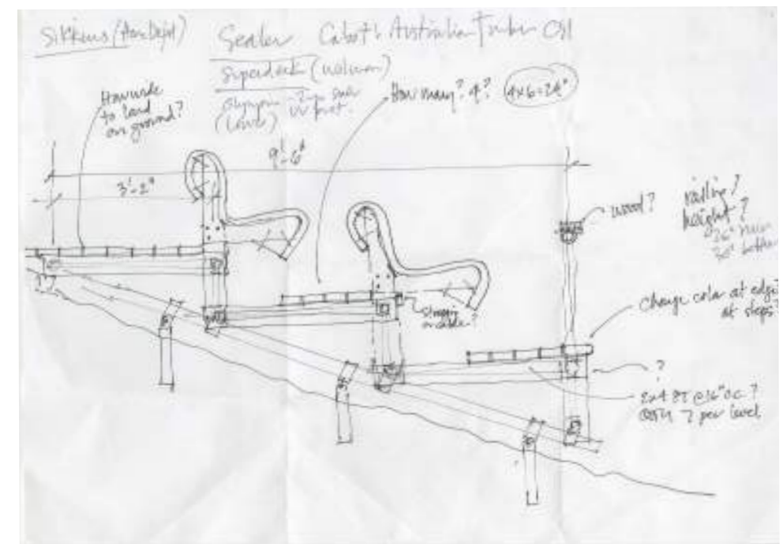


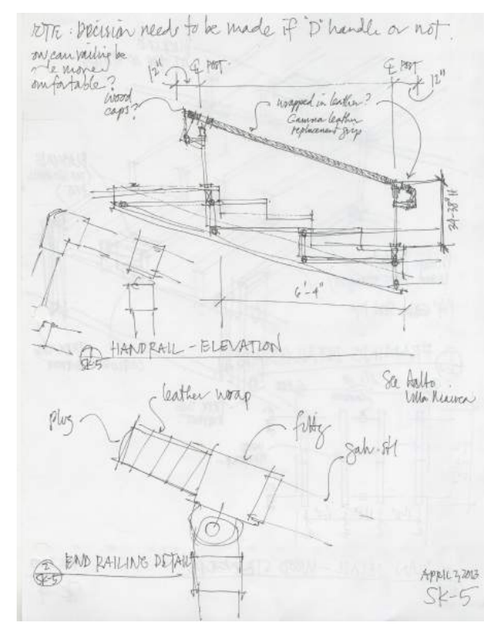


THE FUTURE.....


Gray?
Galv
End cap


END CAPS
QUANTITY: 22
GALV. NAIL
GALV. STEEL END CAP. TYPICAL FOR ALL STAIR STRINGERS AND JOISTS ON LOWEST TIER
SMOOTH SHARP EDGES.
JOIST END CAP DETAIL
GALV. STEEL SHEET.
FOLDING PATTERN
4.1.B
SK-3


Sealer Cabot's Australian Timber Oil
Superdeck (walnut)
How many? 4? (4x6=24")
How wide to land on ground?
3'-2"
9'-6"
wood?
railing height?
change color at edge at steps
?
2x4 @ 16" o.c. ? 2 per level


NOTE: Decision needs to be made if 'D' handle or not.
wood caps?
wrapped in leather? Canvas leather replacement grip
6'-4"
HANDRAIL - ELEVATION
See Detail Villa Kaiser
leather wrap
plug
felt
galv. st.
END RAILING DETAIL
APRIL 7, 2013
SK-5