# MICHIGAN TECH KATSUD MARU

## ZOI3-ZOI4 CONCRETE CANDE DESIGN PAPER



#### **Table of Contents**

Table of Contents	i
Executive Summary	ii
Project Management	1
Organization Chart	2
Hull Design and Structural Analysis	3
Development and Testing	5
Construction	7
Project Schedule	9
Design Drawing	10
Appendix A – References	A-1
Appendix B – Mixture Proportions	B-1
Appendix C – Bill of Materials	C-1

#### List of Tables

Table 1	2014 Concrete properties	ii
Table 2	2014 Canoe properties	ii
Table 3	2014 Reinforcement properties	ii
Table 4	Principle stresses found from structural analysis	4
Table 5	Engineering properties 2013-2014	5
Table 6	Comparison of Secondary Reinforcement Used	5
Table 7	Initial woven, engineered grid testing results	6

#### **List of Figures**

Figure 1	Man-hour allocation chart	1
Figure 2	Breakdown of team costs	1
Figure 3	Block Coefficients comparison from 2008 to 2014	3
Figure 4	Testing of the constructed prototype, Kanu	3
Figure 5	Michigan Tech's final hull design	3
Figure 6	Developed cross sections of Katsuo Maru's V-bottom hull	4
Figure 7	Construction of the woven, engineering grid	6
Figure 8	Comparison of 2013 and 2014 QC depth gauges	7
Figure 9	Reinforcement arrangement within Katsuo Maru	8
Figure 10	Gunwale caps were cast following the completion of Katsuo Maru's hull	8

#### List of Appendices

Appendix A	References	A-1
Appendix B	Structural	B-1
	Finishing	B-2
	Inlay/Outlay	B-3
Appendix C	Bill of Materials	C-1





#### **Executive Summary**

In early Japan, samurai were fearsome warriors, selfless servants, and dedicated scholars who followed the Way of the Warrior, or bushido. This code of honor governed their lives and demanded from them loyalty, justice, and courage. Their way of life made the samurai not only the protectors of Japan, but leaders within their communities. A samurai was able to face the most formidable opponent, yet maintain a modest, creative, and intellectual life. Their lives consisted of a balance between honor and serenity. The culture surrounding the samurai livelihood is instilled today in icons such as swords, armor, poetry, art, and beliefs. Inspired by the culture of Japan that stemmed from the dedication and determination of these warriors, the Michigan Tech Concrete Canoe team chose this as its theme for the 2014 concrete canoe competition.

Michigan Technological University (Michigan Tech), established in 1885, is located in the western region of Michigan's Upper Peninsula. The Michigan Tech Concrete Canoe team is a member of the North Central Conference and has placed first overall for the past four years. The team has proudly represented the conference at the national level fourteen times, placing sixth, third, and seventh during 2011, 2012 and 2013, respectively. Striving to continue its success, the team optimized a hull design that reduced wave drag while retaining displacement and maneuverability. The turning ability of 2008's *Gambler* and the semi-displacement bulge introduced in 2012's *Genoa* were incorporated into an innovative V-bottom hull design. In addition to these design elements, a workable mix was developed, achieving the highest tensile strength in recent years while maintaining a low unit weight. Hayate, meaning "smooth," was chosen as the name of this final mix. The team also experimented with the possible implementation of recycled water into the mix design. Safety was emphasized throughout development and construction. With this in mind, duct work was added to dramatically improve the air filtration system that was installed last year.

Much like the samurai's loyalty and responsibilities are rewarded for a job well done, the team hopes its past experience and current innovations will be rewarded in this year's competition with its 2013-2014 canoe, *Katsuo Maru*. Properties for this year's canoe can be found in Tables 1, 2, and 3 below.

2014 Consuste Properties					
	2014 Concrete Properties				
	Unit Weight (pcf)	Compressive Strength (psi)	Tensile Strength (psi)		
Structural	54.4 Wet, 53.1 Dry	1700	400		
Finishing	89.6 Wet, 83.4 Dry	1417	235		
Inlay/Outlay	71.3 Wet, 65.5 Dry	890	261		

Table 1: 2014 Concrete properties.

#### Table 2: 2014 Canoe properties.

2014 Canoe Properties		
Weight	170 pounds	
Length	20 feet	
Width	31.9 inches	
Depth	15.4 inches	
Nominal Thickness	0.375 inches	
Main Color	White	
Complimentary Colors	Black, Blue, and Red	

#### Table 3: 2014 Reinforcement properties.

2014 Reinforcement Properties		
Continuous Reinforcement	Kevlar <sup>®</sup> Fabric 4009-1, 24K Carbon Tow, 0.014 Kevlar Thread	
Fiber Reinforcement	Nycon-PVA RF4000, Nycon-PVA RECS15, FORTA <sup>®</sup> ECONO-NET <sup>®</sup>	





#### **Project Management**

The Michigan Tech Concrete Canoe team prides itself on strong leadership, teamwork, and communication. The team is led by two captains. One captain is selected each year to serve a twoyear term beginning their third year on the team. This provides for a smooth transition and consistent leadership. A safety chairperson was selected to oversee and ensure proper safety practices during all construction tasks and paddling practices. Experienced members on the team held leadership positions and worked with new members to guarantee that knowledge would be passed along. Additionally, education sessions were conducted to expose new members to concrete canoe project objectives, methods, and concrete basics. The organization chart can be seen on page 2.

The team placed an emphasis on safety throughout the year. In October, a general safety course was held in conjunction with Michigan Tech's Civil and Environmental Engineering Department safety coordinator. This course familiarized all team members with safety procedures and equipment, material safety data sheets, fire extinguishers, exit routes, and emergency contact information. The team's safety chair also demonstrated proper power tool equipment use and care. The use of personal protective equipment was required when preforming any work within the team's facilities.

Milestones were selected from the previous year's project schedule and are indicated by the black dots on the project schedule on page 9. The critical path was based on any project objective that, if not completed by its scheduled date, would postpone completion of the entire project. These activities can be seen on the project schedule in red.

This year, final casting was set back over a month. The most significant delay resulted from minor hull design modifications, which were

implemented following prototype construction. Additional delays stemmed from procurement of the mold and reinforcement. Anticipating the possibility of project setbacks, the team incorporated a buffer of two weeks within the project schedule. Through hard work, the setbacks were overcome and all critical project objectives will be completed in time for the Regional Competition.

Figure 1 illustrates how the team members allocated their time throughout the year. In order to create *Katsuo Maru*, the team spent 370 manhours on hull design, 360 manhours on structural analysis, 145 manhours on construction, and expects to devote nearly 630 manhours to the final aesthetics of *Katsuo Maru*.



Figure 1: Man-hour allocation chart.

In order to construct *Katsuo Maru*, the team had to procure resources. The team received \$3,050 in donations and fundraised over \$800. The total cost to the team was about \$10400 for all project expenses and travel costs to attend the Regional Competition in Detroit. Figure 2 depicts the financial recourse allocation.



Figure 2: Breakdown of team costs.





**Organization Chart** 







#### Hull Design and Structural Analysis

Hull design has provided an opportunity for Michigan Tech to showcase its ingenuity in previous competitions. This year, the tradition continued by combining aspects of the 2008 canoe, *Gambler*, and the 2012 canoe, *Genoa*. *Gambler* was utilized for its semi-displacement hull design and excellent turning ability; *Genoa's* bulge was incorporated to optimize displacement and reduce total drag.

After analyzing the 2013 paddling performance, goals for the new canoe design were established: improve straight line tracking performance and decrease drag. Using PROLINES software for design and analysis, a canoe length of 20 feet was chosen to balance turning capability with straight line speed. From previous years' experience, it was apparent that ample freeboard is necessary for effective paddling. Freeboard was set at a minimum of 6 inches for all racing scenarios to increase paddler comfort, safety, and leaning ability in a buoy turn.

This year a V-bottom hull was developed to slice through the water, providing greater lift and lower drag. *Katsuo Maru* achieved the lowest total drag of any past Michigan Tech canoe, beating its predecessor, *Mesektet*, by 7%. Similarly, block coefficient decreased from 0.36 to 0.31. The progression of block coefficients over the last five Michigan Tech hulls are shown in Figure 3. Block coefficient is a strong indicator of a canoe's performance in the water, representing the ratio of the submerged volume of the canoe to the volume of the smallest box that still encases the wetted surface area of the canoe.

To increase turning ability with the V-bottom hull design, rocker was set at 6.1 inches in the bow and 2.15 inches in the stern. Combining this rocker and the bulge allows *Katsuo Maru* to pivot with both ends of the canoe out of the water, reducing waterplane area, thus improving maneuverability.



Figure 3: Block Coefficients comparison: 2008 to 2014

To practice with the design, a prototype was constructed of low-cost luan wood as shown in Figure 4. To better capture the complex hull geometry, luan strips were cut to a width of  $\frac{1}{2}$ inch rather than  $\frac{3}{4}$  inch as used in previous years. After testing paddler ergonomics, the final design was modified to decrease the severity of the Vbottom hull. This modification improved paddler comfort and stability.



Figure 4: Testing of the constructed prototype, Kanu

Achieving this year's goals optimized paddler efficiency, reduced drag, and ultimately increased maximum velocity. These accomplishments resulted in the finest design yet created by Michigan Tech displayed in Figure 5.



Figure 5: Michigan Tech's final hull design





In order to determine the survivability of *Katsuo Maru*, hand calculations, iterated in MATLAB and Excel, were performed to compare the maximum principal stresses during five different load cases. The principal stresses in each of the paddling load cases were found by combining the normal stresses from flexural bending and shear stresses from torsion developed during a buoy turn. Each race was modeled using four possible combinations of paddlers sitting and kneeling. Pure bending was also considered during transportation and display of *Katsuo Maru*. Allowable stress design was used to determine *Katsuo Maru*'s safety factor.

In order to perform these calculations, a few assumptions needed to be made. First, the bending stresses were calculated assuming straight-line dynamic loading conditions. Male and female paddlers' weights, 200 pounds and 170 pounds, respectively, were increased by 20% to account for additional loading during a paddle stroke. Each paddler was represented by two linear distributive loads. Seated paddlers were found to transfer 83% of their weight, whereas kneeling paddlers transferred 41% of their weight through the rear contact length. Katsuo Maru was modeled with a nominal thickness of 3/8 inch and a self-weight of 160 pounds. For this analysis, the canoe and the water were assumed to be in equilibrium.

Width and height dimensions were taken at one inch increments along the length of *Katsuo Maru* to develop shallow V-bottom cross-sections, see figure 6, at each of these locations.



Figure 6: Developed cross sections of *Katsuo Maru's* V-bottom hull

The volume of each one inch segment was calculated to accurately model the varying buoyancy force pushing upward on the canoe.

The maximum normal stress in the gunwales, chines, and keel of each cross-section was calculated and can be seen in Table 4. Shear stresses in the chines developed from torsional forces during a buoy turn were then calculated using shear flow analysis for open cross-sections (*Journal*.) The load case with two kneeling male paddlers yielded the maximum principal tensile stress of 270 psi, located in the gunwale, 7.5 feet from the stern of the canoe. This is located at the center of *Katsuo Maru's* bulge. The maximum compressive stress of 539 psi was located one foot from the stern along the keel during the coed race.

		Critical Stresses	
	Load Case	Compressive	Tensile
	(psi)	(psi)	
	2 Males	216	270
	2 Females	188	234

240

25

24

2 Males & 2 Females

**Stands** 

**Transport** 

258

35

31

Table 4: Principle stresses found from structural analysis.

The tensile and compressive strengths of Hayate are 400 psi and 1700 psi, respectively. This means that the gunwales of *Katsuo Maru* would have a factor of safety of 1.48 for tensile failure, and the keel has a factor of safety of 7.08 for compressive failure without reinforcement. However, the team chose to design for a safety factor of 3.0, which required one layer of reinforcement to increase the tensile strength of the canoe and ensure *Katsuo Maru* will survive the rigors of competition. With these concerns in mind, the team considered additional testing to determine an appropriate reinforcement scheme.





#### **Development and Testing**

The team had several goals in mind throughout the mix development process. A structural mix with high tensile strength and low unit weight was crucial. Aesthetics were also a priority, as an all-white mix was needed to complement *Katsuo Maru*'s design. Last year's structural mix, Musa, was used as a baseline because it met initial strength, weight, and color criteria. However, it was difficult to cast due to low workability. Data comparing Hayate to last year's mix is shown in Table 5 below.

The team conducted three tiers of testing to examine the effects of binders, aggregates, and fibers. The water-to-cementitious material ratio (w/cm ratio) decreased from 0.40, as seen in Musa, to 0.38. In addition, the aggregate-to-binder ratio decreased from 4.5 to 4.25. Both of these adjustments contributed to an overall increase in strength.

This year, white Portland cement, ground granulated blast furnace slag (GGBFS), and VCAS 160 were all re-examined from last year's mix design. After discussion with the supplier, VCAS 140 was incorporated into testing. Two mechanically ground pumice pozzolans, Hess Pozz and Hess Ultra Pozz, were also tested for the first time.

Poraver glass microspheres of 1-2 mm, 0.5-1 mm, and 0.25-0.5 mm, the same grades used in Musa, were utilized during testing. Similarly,  $3M^{TM}$  K1 glass microspheres were carried over as an aggregate. A new material, Elemix, composed of lightweight, synthetic particles, was included in the aggregate tier. Poraver 0.1-0.3 mm spheres were also used in the finishing mix to produce a finer gradation.

During *Mesektet*'s casting, many trowelers found it difficult to create 1/8 inch layers with Musa. One of these reasons was believed to be the blend of secondary fibers used in the mix as shown in Table 6. In order to determine if this truly was the case, mixes from the fiber tier were used for troweling practices prior to casting. It was found that by limiting the amount of FORTA<sup>®</sup> PE-2 and GRT Polymesh, workability would increase without having a substantial impact on strength. In addition, FORTA<sup>®</sup> ECONO-NET<sup>®</sup>, a fibrillated polypropylene fiber, was utilized.

Table 6: Comparison of Secondary Reinforcement Used

Fiber Type	Composition	Musa	Hayate
(PVA) Fibers	Polyvinyl ✓ Alcohol		✓
PE-2	Polyethylene	$\checkmark$	
Polymesh	Polypropylene	$\checkmark$	
ECONO-NET	Polypropylene		$\checkmark$

The final structural mix incorporates the best qualities of the previously tested batches. Hayate's binders include white Portland cement, GGBFS, and VCAS 140 and160. Aggregates included Poraver 1-2 mm, 0.5-1 mm, and 0.25-0.5 mm, 3M K1, and Elemix. A finishing mix and inlay/outlay mix were adapted from Hayate using the same binders, while omitting the fibers and incorporating a blend of aggregates suitable for each mixes intended purpose. While there was a slight increase in unit weight and a decrease in compressive strength, the team was satisfied with the 27% increase in tensile strength from Musa. Final mix components have been included in Appendix B.

Tensile and compression testing were performed at 7 and 14 days in accordance with ASTM standards. For each batch, four 3" by 6" cylinders were cast for split tensile tests, while only two 3" by 6" cylinders were cast for uniaxial compression tests.

Table 5: Engineering properties 2013-2014

Year	Mix Name	Unit Weight (pcf)	14-Day Compressive Strength (psi)	14- Day Tensile Strength (psi)
2013	Musa	53.5	1915	314
2014	Hayate	53.9	1700	400





In addition to efforts concerning strength, weight, and workability, the team investigated ways to increase the sustainability of this year's mix. Previously, a water filtration system was installed in the team's facility with the intent of recycling water for use in mixing. Prior to this year, it had only been used to wash equipment. To determine if this water was adequate for use in the mix, two batches of the same mix were made, one with control water and one with recycled water. However, the batch containing recycled water failed to meet the 90% minimum compressive strength of the control water required by ASTM C1602. Therefore, the recycled water could not be used and the water filtration system must be refined before the water can be implemented in mixes.

Previously used reinforcements, Chromarat C-Grid® CT275 Carbon Fiber Grid and Kevlar® 4009-1, were used as baselines for researching new materials. This year, reinforcement with larger grid spacing and no epoxy coating was desired to promote bonding between the layers of concrete. However, prefabricated reinforcements which featured large grids were typically epoxy coated during production. The team decided to engineer a reinforcement when research failed to find a manufactured material that met the set requirements.

To begin the development of a woven, engineered grid, 24K Carbon Tow was procured for testing. Percent open area (POA) calculations were generated to determine the spacing for grids of forty, fifty, sixty, and seventy POA. A square foot grid was woven by interlacing 24K Carbon Tow with 0.014 inch diameter Kevlar<sup>®</sup> thread for each potential POA. Plates were then cast using Musa to provide comparable results for previous punching shear tests.

Punching shear tests were conducted assuming an isotropic composite, where both in-plane and out-of-plane yield stress values were the same. Plates were supported by a wooden frame as a uniform 1.5 inch diameter force was applied at a steady rate of 2.5 pound-mass per second. The data was used to develop stress-strain curves for analysis. The smaller POA obtained a higher yield strength, as shown in Table 7. However, 50% open area was chosen to provide a balance between material cost, yield strength, and bonding properties between concrete layers.

TT 1 1 TT 1.1 1		• •	• •		1.
Table / Initial	woven	engineered	orid	testing i	results
raole /. minuar	woven,	ungineereu	Silu	to sung i	courto

Percent Open Area	Yield Stress (ksi)
40	5063
50	4425
60	3781
70	2625

To create the reinforcement grids used in *Katsuo Maru*, the construction process was modified to increase efficiency and ensure proper POA. Instead of weaving Kevlar<sup>®</sup> thread throughout the grid, knots were tied along the border and at alternating intersections between the carbon fiber strands as shown in Figure 7. The reinforcement scheme in the canoe consists of a single woven sheet in the bottom of the canoe and eleven panels in the side walls. In the bottom of the canoe, a second layer of reinforcement was added to account for punching shear. However, due to time and space constraints, a sheet of Kevlar® 4009-1 was used for this second layer instead of the woven, engineered grid.



Figure 7: Construction of the woven, engineering grid

The Rule of Mixtures was used to find the maximum tensile strength, which occurs at the top of the gunwales. A 3/8 inch layer of Hayate containing one layer of the woven, engineered grid was used to simulate this composite and yielded a composite flexural strength of 1390 psi. This allowed *Katsuo Maru*'s safety factor to be increased from 1.48 to 11.0.





#### Construction

This year, the team aimed to trowel *Katsuo Maru* to a nominal thickness of 3/8 inch. A female mold was necessary to accurately capture the complex geometry of the hull.

The team ordered a CNC-milled mold made from 10% pre-consumer recycled high-density polystyrene foam. The mold was received in six sections, cut in half through the keel and into thirds along the length of the canoe. The sections were put together and fastened by aligning the edges and attaching the mold to a rigid frame. This can be seen in the design drawing located on page 10.

Two layers of epoxy were applied to the mold to provide a stiff surface for concrete placement and a barrier to prevent water loss through the foam. Thirty minutes prior to casting, Huron Technologies Release Coating 7572 was applied to the mold; manufacturer specifications state that the release agent is designed for use between concrete and epoxy surfaces for an aestheticallyappealing result.

On casting day, the team was divided into specific assignments. Eight trowelers and four quality control (QC) monitors were selected to construct the canoe and ensure proper thickness. The remaining members were assigned either to the reinforcement team, which guaranteed proper placement of the reinforcement, or the mix crew, which ensured consistent concrete throughout the casting process. The team captains served as runners between two separate rooms for casting and mixing to facilitate communication throughout the day.

Fewer QC monitors were utilized compared to previous years to reduce the number of personnel within the casting area. As a result, casting was completed using a section approach, where each troweler was assigned a specific section to cast, rather than casting each layer through an assembly line style.

OC Team members assigned to used premeasured depth gauges to determine the thickness of the canoe throughout construction. The team has had problems with QC in the past, so a new style of depth gauge was created this year. The new gauges were designed using Unigraphics software and then 3D printed. Each gauge consisted of a measured cylinder extending from a circular disk. A longer handle was also added to ease grip when wearing gloves. Gauge depths of 1/8 inch, 1/4 inch, and 3/8 inch were made for successive concrete layers. The gauge diameter was also modified to ensure that the gauge could pass through the concrete without compromising the surface of the mold or the Kevlar<sup>®</sup> reinforcement. Figure 7 shows the depth gauges used this year compared to those used in construction of Mesektet.



Figure 8: Comparison of 2013 and 2014 QC depth gauges

*Katsuo Maru* was cast with three 1/8 inch layers of structural concrete, two layers of reinforcement, and one layer of finishing mix.

According to analysis and previous years' experience, the team was able to determine that one layer of reinforcement throughout the walls





would be sufficient. Eleven panels of the woven, engineered grid were placed within the walls. Previous testing has shown that two layers of reinforcement are necessary along the bottom of the canoe to prevent failure from punching sheer. The bottom consisted of one layer of the custom grid reinforcement and one layer of Kevlar<sup>®</sup> reinforcement. The final reinforcement scheme is shown in Figure 9.



Figure 9: Reinforcement arrangement within Katsuo Maru

Having successfully cast a gunwale cap with a female mold in years past, the team implemented the same process for Katsuo Maru. Extruded polystyrene foam was used as a placement guide for the gunwale caps on casting day. One layer of epoxy and one layer of release aid were applied to the polystyrene form. This prevented the concrete from sticking while still allowing the foam to shape to the curves of the gunwale. On casting day, these forms were clamped to the mold after the main body of the canoe was completed. The foam molds were filled partially with a concrete layer. After a strip of Kevlar reinforcement was placed throughout the cap, the molds were filled and leveled. The completed gunwale caps are shown in Figure 10.



Figure 10: Gunwale caps were cast following the completion of *Katsuo Maru's* hull

The final thickness of the canoe was measured to be 3/8 inch, which met the team's casting goal for *Katsuo Maru*.

After two weeks of curing, the mold was removed from the canoe. A week of initial sanding commenced. Finishing mix was then applied, followed by five weeks of extensive sanding. This year, the air filtration system in the finishing area was improved to provide safer conditions for team members during sanding. Duct work was extended to provide more efficient dust removal. Flexible hoses were also added to deliver spot-specific vacuuming as needed.

The air compressor within the facilities will be utilized for airbrush staining. The team has found that this method guarantees uniform covering for base coats and large details. Compared to previous methods which required the use of aerosol cans, the air compressor reduces material consumption and costs. Remaining intricate details will be painted by hand in order to express the character of *Katsuo Maru*.

After staining is completed, two layers of ChemMasters<sup>®</sup> Crystal Clear-A will be applied. This sealant is used to protect and enhance the finished aesthetics. One week is required for the sealant to set.

*Katsuo Maru's* innovative hull design combined with Hayate's impressive tensile strength result in the greatest concrete canoe designed by Michigan Tech. The team is excited to demonstrate what it has learned this year and hopes that *Katsuo Maru* will bring another honorable and rewarding year.



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2	Beginning of 2013-2014 Academic Year	Tue 9/3/13	Tue 9/3/13 Tue 9	/3/13 Tue 9/	13 ABeginning of 2013	3-2014 Academic Year	1	1		1		1	1				
3	Receipt of Rules	Fri 9/6/13	Fri 9/6/13 Fri 9	6/13 Fri 9/6	13 Requipt of F	Rules	1	1		1		1	1				
4	Theme Decision	Wed 9/18/13	Wed 9/25/13 Wed 9	/18/13 Wed 9/	/13		Thome Decision	1				1	1			<b>_</b> '	
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9	Pre-Regional Competition Paddling Trip	Sat 3/22/14	Sun 3/23/14 Sat 3/	22/14 Sun 3/2	/14		1			1		1	1				
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11	Hull Design Research	Tue 9/3/13	Sat 9/21/13 Tue 9	/3/13 Sat 10/	/13		-	Hull Design Research					1				- i
12	Prototype Construction	Sat 9/21/13	Sat 10/19/13 Sun 1	0/6/13 Sun 10/	7/13				-Prototype Construction	i i		1	1				i i
13	Prototype Testing	Sun 10/20/13	Mon 11/4/13 Mon 10	0/28/13 Fri 11/1	/13	1	1	1		Proto	type Testing		1				
14	Final Hull Design Selection	Tue 11/5/13	Tue 11/5/13 Sat 11	/16/13 Sat 11/	/13	1	1	1		Fin	al Hull Design Selection		1				1
15	Analysis	Wed 11/6/13	Sun 11/10/13 Sat 11	/16/13 Wed 11	0/13	l	1	l.			Analysis	l i	1				
16	Analysis	Wed 11/6/13	Sat 11/9/13 Sat 11	/16/13 Tue 11/	9/13		1	1	ICC2222		Analysis						
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19	Release Dimensions of Hull	Wed 11/6/13	Wed 11/6/13 Sat 11	/16/13 Sat 11/	/13	1	1	1	<b>5</b>	Rei Rei	hase Dimensions of Hull						
20	Foam Sized and CNC Milled	Wed 11/20/13	Wed 11/27/13 Wed 1	1/20/13 Fri 12/	13	1	I.	I.		1		Foam Sized and CNC N	filled	!			1
21	Mold Pick-up and Delivery	Wed 11/27/13	Mon 12/2/13 Fri 1/	10/14 Sat 1/1	/14		1	1	1 	1		1	1	<b>*</b>	Mold Pick-u	p and Delivery	l
22 N	lix Design	Mon 9/9/13	Fri 11/8/13 Mon 9	9/9/13 Wed 11	0/13		1	1	II	1	Mix Design			L C			
23	Material Procurement	Mon 9/9/13	Fri 9/20/13 Mon 9	9/9/13 Fri 9/2	13		Material Procureme	ent		1		1	1	1			- i
24	Structural Concrete Mix Design	Mon 9/16/13	Fri 11/8/13 Mon 9	/16/13 Wed 11	0/13			:			Structural Concrete Mix Design	1	1	1			
25	Binder, Aggregate, and Fiber Testing	Mon 9/16/13	Fri 10/18/13 Mon 9	/16/13 Fri 10/1	/13				Binder, Aggregate, and Fiber Testing	l I							1
26	Proposed Final Mix Testing	Mon 10/21/13	Fri 10/25/13 Mon 10	0/21/13 Fri 10/2	/13	1	1	1	Proposed Final Mix Testing	1			1				
27	Final Structural Mix Design Selection	Sun 11/10/13	Sun 11/10/13 Wed 1	1/20/13 Wed 11/	0/13		1	1		1	Final Structural Mix Design Sele	tion	1	1			
28	Finishing and Inlav/Quitlay Concrete Mix Design	Tue 9/10/13	Wed 10/9/13 Mon 9	/16/13 Tue 10/	5/13		1	Finishi	a and Inlav/Outlay Concrete/Mix Design	1	·		1	1			
29	Einishing and Islav/Outlay Mix Testing	Mon 9/16/13	Tue 10/8/13 Mon 9	/16/13 Mon 10/	1/13		I	Finishi	and Inlav/Qutlay Mix Testing	1							
30	Final Einishing and Jalay/Outlay Constants Mix	Wod 10/0/12	Wed 10/0/12 Tup 10	(15/13 Tup 10/				Final	alishing and Jolay/Outlay Concrete Mix Selection	1			1	1			 
21	Selection	Mar 0/0/42	Fri 40/6/42		M 4		1	1					1	1		Reinforcement	
		MOI 3/3/13	FIT 12/0/13 MION :		/14	1	1	I	I I					1		I	
32	Material Procurement and Testing	Mon 9/9/13	Fri 11/1/13 Mon 9	9/9/13 Fn 11/1	/13	1	1		I I	Mater			1	1			l l
33	Final Reinforcement Selection	Wed 11/6/13	Wed 11/6/13 Wed 1	1/20/13 Wed 11/	0/13		1	1					1	1			
24			Marc 44/06/40 Thu 44	/01/10 Tuo 1/2	/14						Construction of the Constr					Procurement of Final Rei	forcement
34	Procurement of Final Reinforcement	Thu 11/21/13	Mon 11/25/13 Thu 11	/21/13 Tue 1/2			1	1		1							1
35	Procurement of Final Reinforcement Fabrication of Reinforcement	Thu 11/21/13 Mon 12/2/13	Fri 12/6/13 Wed 1	2/4/13 Tue 1/2	/14		   	1 1 1	       	- - -					++-	Flabrication of Reinforcer	vent
35 36 <b>(</b>	Procurement of Final Reinforcement Fabrication of Reinforcement Construction and Casting	Thu 11/21/13 Mon 12/2/13 Mon 10/7/13	Mini 11/25/13         Mini 11           Fri 12/6/13         Wed 1           Sun 3/16/14         Mon 1	2/4/13 Tue 1/2 0/7/13 Sun 3/	/14		1     	     		     	<b>3</b> 8					Fabrication of Reinforce	hent
35 36 37	Procurement of Final Reinforcement Fabrication of Reinforcement Construction and Casting Casting Practices	Thu 11/21/13 Mon 12/2/13 Mon 10/7/13 Mon 10/7/13	Mon 11/23/13         Thu 11           Fri 12/6/13         Wed 1           Sun 3/16/14         Mon 1           Fri 12/6/13         Mon 1	2/4/13         Tue 1/2           0/7/13         Sun 3/2           0/7/13         Thu 1/2	/14 /14			   			<b></b>					Casting Practices	nent
35 36 37 38	Procurement of Final Reinforcement Fabrication of Reinforcement Construction and Casting Casting Practices Mold Assembly and Release Application	Thu 11/21/13 Mon 12/2/13 Mon 10/7/13 Mon 10/7/13 Wed 12/4/13	Mon         11/29/13         Find           Fri         12/6/13         Wed 1           Sun         3/16/14         Mon 1           Fri         12/6/13         Mon 1           Fri         12/6/13         Sat 1/	2/4/13         Tue 1/2           2/4/13         Tue 1/2           0/7/13         Sun 3/           0/7/13         Thu 1/2           11/14         Sat 1/2	/14 /14 /14		1 1 1 1 1	     								Fabrication of Reinforce	Ind Release Ap
35 36 37 38 39	Procurement of Final Reinforcement Fabrication of Reinforcement Construction and Casting Casting Practices Mold Assembly and Release Application Pre-batching Final Structural Mix	Thu 11/21/13 Mon 12/2/13 Mon 10/7/13 Mon 10/7/13 Wed 12/4/13 Mon 12/2/13	With 11/23/13         Hu 11           Fri 12/6/13         Wed 1           Sun 3/16/14         Mon 1           Fri 12/6/13         Mon 1           Fri 12/6/13         Sat 1/           Mon 12/2/13         Tue 12	2/4/13         Tue 1/2           0/7/13         Sun 3/           0/7/13         Thu 1/2           11/14         Sat 1/2           /17/13         Tue 12/	/14 /14 /14 /14 /14						****** *******************************		Pre-batching-Final-Structu	iał Mix		Fabrication of Reinforce	and Release Ap
35 36 37 38 39 40	Procurement of Final Reinforcement Fabrication of Reinforcement Construction and Casting Casting Practices Mold Assembly and Release Application Pre-batching Final Structural Mix Pre-cutting Reinforcement	Thu 11/21/13 Mon 12/2/13 Mon 10/7/13 Mon 10/7/13 Wed 12/4/13 Mon 12/2/13 Thu 12/5/13	With         11/25/13         Hut           Fri         12/6/13         Wed         1           Sun         3/16/14         Mon 1         1           Fri         12/6/13         Mon 1         1           Fri         12/6/13         Mon 1         1           Fri         12/6/13         Sat 1/           Mon         12/2/13         Tue 12           Fri         12/6/13         Tue 12	Z/4/13         Tue 1/2           2/4/13         Tue 1/2           0/7/13         Sun 3/           0/7/13         Thu 1/2           11/14         Sat 1/2           /17/13         Tue 12/           23/14         Sat 1/2	//4 //4 //4 //4 //13 //13					 	2000 2000 2000 2000		Pre-batching-Final-Structu	tal Mix		Casting Practices	and Release Ap
34 35 36 C 37 38 39 40 41	Procurement of Final Reinforcement Fabrication of Reinforcement Construction and Casting Casting Practices Mold Assembly and Release Application Pre-batching Final Structural Mix Pre-cutting Reinforcement Preparing Aesthetic Components	Thu 11/21/13 Mon 12/2/13 Mon 10/7/13 Wed 12/4/13 Mon 12/2/13 Thu 12/2/13 Wed 12/4/13	With         11/25/13         Hu 11           Fri 12/6/13         Wed 1           Sun 3/16/14         Mon 1           Fri 12/6/13         Mon 1           Fri 12/6/13         Mon 1           Fri 12/6/13         Sat 1/           Mon 12/2/13         Tue 12           Fri 12/6/13         Thu 1.           Fri 12/6/13         Sat 1/           Fri 12/6/13         Sat 1/	Z/4/13         Tue 1/2           2/4/13         Tue 1/2           0/7/13         Sun 3/           0/7/13         Thu 1/2           11/14         Sat 1/2           /17/13         Tue 12/           23/14         Sat 1/2           18/14         Fri 1/2	//14 /14 /14 /14 /13 /14 /14					 			Pre-batching Final Structu	at Mix		Casting Practices	Ind Release Ap
34 35 36 37 38 39 40 41 42	Procurement of Final Reinforcement Fabrication of Reinforcement Construction and Casting Casting Practices Mold Assembly and Release Application Pre-batching Final Structural Mix Pre-cutting Reinforcement Preparing Aesthetic Components Concrete Placement	Thu 11/21/13 Mon 12/2/13 Mon 10/7/13 Mon 10/7/13 Wed 12/4/13 Thu 12/5/13 Wed 12/4/13 Sat 12/7/13	With         11/25/13         Hu 11           Fri 12/6/13         Wed 1           Sun 3/16/14         Mon 1           Fri 12/6/13         Mon 1           Fri 12/6/13         Mon 1           Fri 12/6/13         Sat 1/           Mon 12/2/13         Tue 12           Fri 12/6/13         Thu 1.           Fri 12/6/13         Sat 1/           Sat 12/6/13         Sat 1/	2///13 Tue 1/2 2///13 Tue 1/2 0/7/13 Sun 3/ 0/7/13 Thu 1/2 11/14 Sat 1/2 23/14 Sat 1/2 18/14 Fri 1/2 25/14 Sat 1/2	//4 //4 //4 //13 //4 14								Pre-batching Final Structu	iot Mix		Casting Practices Mold Assembly Pre-cutting Rein Pre-cutting Rein Preparing Aestheti Concrete Placem	and Release Ap
34 35 36 37 38 39 40 41 41 42 43	Procurement of Final Reinforcement Fabrication of Reinforcement Construction and Casting Casting Practices Mold Assembly and Release Application Pre-batching Final Structural Mix Pre-cutting Reinforcement Preparing Aesthetic Components Concrete Placement Initial Cure with Mold	Thu 11/21/13 Mon 12/2/13 Mon 10/7/13 Mon 10/7/13 Wed 12/4/13 Mon 12/2/13 Thu 12/5/13 Wed 12/4/13 Sat 12/7/13 Sat 12/7/13	Mini 11/25/13         Hu 11           Fri 12/6/13         Wed 1           Sun 3/16/14         Mon 1           Fri 12/6/13         Mon 1           Fri 12/6/13         Mon 1           Fri 12/6/13         Sat 1/           Mon 12/2/13         Tue 12           Fri 12/6/13         Sat 1/           Mon 12/2/13         Tue 12           Fri 12/6/13         Sat 1/           Sat 12/7/13         Sat 1/           Sat 12/7/13         Sat 1/	22/1/3 102 1/2 2/4/13 Tue 1/2 2/4/13 Tue 1/2 2/7/13 Sun 3/ 07/713 Thu 1/2 11/14 Sat 1/2 11/14 Sat 1/2 22/14 Sat 1/2 22/14 Sat 1/2 25/14 Sat 2/2	//4 //4 //4 //13 //14 /14 /14								Pre-batching-Final-Structu	i of Mix		Casting Practices Casting Practices Casting Practices Casting Practices Pre-cutting Reir Preparing Aesthet Concrete Placem	and Release Ap
34           35           36           37           38           39           40           41           42           43           44	Procurement of Final Reinforcement Fabrication of Reinforcement Construction and Casting Casting Practices Mold Assembly and Release Application Pre-batching Final Structural Mix Pre-cutting Reinforcement Preparing Aesthetic Components Concrete Placement Initial Cure with Mold Mold Removal	Thu 11/21/13 Mon 12/2/13 Mon 10/7/13 Mon 10/7/13 Wed 12/4/13 Mon 12/2/13 Thu 12/5/13 Wed 12/4/13 Sat 12/2/13 Sat 12/2/13 Sat 12/21/13	With         Fri 12/6/13         Wed 1           Sun 3/16/14         Mon 1           Fri 12/6/13         Mon 1           Fri 12/6/13         Sat 1/           Mon 12/2/13         Tue 1/2           Fri 12/6/13         Sat 1/           Mon 12/2/13         Tue 1/2           Fri 12/6/13         Sat 1/           Sat 12/7/13         Sat 1/           Sat 12/7/13         Sat 1/           Sat 12/21/13         Sat 1/           Sat 12/21/13         Sat 1/	22/1/3 102 /2 22/4/13 Tue 1/2 22/4/13 Tue 1/2 077/13 Tu 1/2 11/14 Sat 1/2 22/14 Sat 1/2 22/14 Sat 1/2 22/14 Sat 1/2 22/14 Sat 2/ 18/14 Sat 2/	7/14 <b>//14</b> 7/14 7/13 7/14 1/14 1/14 1/14 1/14 1/14								Pre-batehing Final Structu	at Mix		Casting Practices Casting Practices Casting Practices Casting Practices Pre-cutting Reir Preparing Aesthet Concrete Placem	and Release Ap
34           35           36           37           38           39           40           41           42           43           44           45	Procurement of Final Reinforcement Fabrication of Reinforcement Construction and Casting Casting Practices Mold Assembly and Release Application Pre-batching Final Structural Mix Pre-cutting Reinforcement Preparing Aesthetic Components Concrete Placement Initial Cure with Mold Mold Removal Final Curing	Thu 11/21/13 Mon 12/2/13 Mon 10/7/13 Mon 10/7/13 Wed 12/4/13 Mon 12/2/13 Thu 12/5/13 Wed 12/4/13 Sat 12/7/13 Sat 12/7/13 Sat 12/2/13 Sun 12/22/13	With         11/25/13         Hut           Fri         12/6/13         Wed 1           Sun 3/16/14         Mon 1           Fri         12/6/13         Mon 1           Fri         12/6/13         Sat 1/           Mon 12/2/13         Sat 1/           Mon 12/2/13         Tute 12           Fri         12/6/13         Sat 1/           Fri         12/6/13         Sat 1/           Sat         12/6/13         Sat 1/           Sat         12/7/13         Sat 1/           Sat         12/21/13         Sat 2/	22/1/3 102 /2 22/4/13 Tue 1/2 22/4/13 Tue 1/2 07/7/13 Thu 1/2 11/14 Sat 1/2 11/14 Sat 1/2 21/17/13 Tue 1/2 11/1/14 Sat 1/2 22/14 Sat 1/2 22/14 Sat 1/2 22/14 Sat 2/2 /8/14 Sat 2/2 /8/14 Sat 2/2	7/14 <b>7/14</b> 7/14 7/13 7/14 114 114 114 114 114								Pre-batehing-Final-Structu	al Mix		Casting Practices Casting Practices Casting Practices Casting Practices Pre-cutting Reir Preparing Aesthet Proparing Aesthet Concrete Placem	and Release Ap
34           35           36           37           38           39           40           41           42           43           44           45           46           46	Procurement of Final Reinforcement Fabrication of Reinforcement Construction and Casting Casting Practices Mold Assembly and Release Application Pre-batching Final Structural Mix Pre-cutting Reinforcement Preparing Aesthetic Components Concrete Placement Initial Cure with Mold Mold Removal Final Curing inishes and Aesthetics	Thu 11/21/13 Mon 12/2/13 Mon 10/7/13 Mon 10/7/13 Wed 12/4/13 Mon 12/2/13 Thu 12/2/13 Wed 12/4/13 Sat 12/7/13 Sat 12/21/13 Sat 12/21/13 Sun 12/22/13 Mon 1/13/14	With         11/25/13         Hut 1           Fri         12/6/13         Wed 1           Sun 3/16/14         Mon 1           Fri         12/6/13         Mon 1           Fri         12/6/13         Mon 1           Fri         12/6/13         Sat 1/           Mon 12/2/13         Tue 12           Fri         12/6/13         Sat 1/           Fri         12/6/13         Sat 1/           Sat 12/7/13         Sat 1/           Sat 12/7/13         Sat 1/           Sat 12/21/13         Sat 1/           Sun 2/2/14         Sun 2/2/14           Wed 3/26/14         Sun 2/2/14	22/1/3 Tue 1/2 22/4/13 Tue 1/2 22/4/13 Tue 1/2 10/7/13 Tue 1/2 11/14 Sat 1/2 11/14 Sat 1/2 21/17/13 Tue 1/2 11/1/14 Sat 1/2 22/14 Sat 1/2 22/14 Sat 1/2 22/14 Sat 2/1 22/14 Sat 2/1 2/14 Sat 2/14 Sat 2	7/4 <b>7/4</b> 7/4 7/4 7/4 7/4 14 14 14 14 14 14 14 14 14								Pre-batching-Final-Structu	ał Mis		Casting Practices Casting Practices Mold Assembly Pre-cutting Reir Preparing Aesthet Proparing Aesthet I Proparing Aesthet I	and Release Ap
34         35           35         36         C           37         38         39           40         41         42           43         44         45           46         F         47	Procurement of Final Reinforcement Fabrication of Reinforcement Construction and Casting Casting Practices Mold Assembly and Release Application Pre-batching Final Structural Mix Pre-cutting Reinforcement Preparing Aesthetic Components Concrete Placement Initial Cure with Mold Mold Removal Final Curing inishes and Aesthetics Sanding and Honing	Thu 11/21/13 Mon 12/2/13 Mon 10/7/13 Mon 10/7/13 Wed 12/4/13 Mon 12/2/13 Thu 12/2/13 Wed 12/4/13 Sat 12/7/13 Sat 12/7/13 Sat 12/21/13 Sun 12/22/13 Mon 1/13/14 Mon 1/13/14	With         11/25/13         Hut 1           Fri         12/6/13         Wed 1           Sun 3/16/14         Mon 1           Fri         12/6/13         Sat 1/           Fri         12/6/13         Sat 1/           Mon 12/2/13         Tue 12         Fri           Fri         12/6/13         Thu 1.           Fri         12/6/13         Thu 1.           Fri         12/6/13         Thu 1.           Fri         12/6/13         Sat 1/           Sat         12/6/13         Sat 1/           Sat         12/1/13         Sat 1/           Sat         12/2/1/3         Sat 2/2           Wed         3/26/14         Sun 2           Wed         3/26/14         Sun 2	22/1/3         Tue 1/2           22/1/3         Tue 1/2           22/1/13         Tue 1/2           007/13         Sun 3/2           007/13         Thu 1/2           11/14         Sat 1/2           11/14         Sat 1/2           23/14         Sat 1/2           23/14         Sat 1/2           23/14         Sat 1/2           25/14         Sat 2/2           25/14         Sat 2/2           1/8/14         Sat 2/2           1/9/14         Sun 3/2           1/9/14         Sun 2/2	7/14 7/14 7/14 7/13 7/13 7/14 114 114 114 114 114 114 114								Pre-batching-Final-Structu	al Mis		Casting Practices Casting Practices Casting Practices Mold Assembly Pre-cutting Reir Preparing Aesthet Proparing Aesthet I I I I I I I I I I I I I I I I I I I	and Release Ap
35           35           36           37           38           39           40           41           42           43           44           45           46           47           48	Procurement of Final Reinforcement Fabrication of Reinforcement Construction and Casting Casting Practices Mold Assembly and Release Application Pre-batching Final Structural Mix Pre-cutting Reinforcement Preparing Aesthetic Components Concrete Placement Initial Cure with Mold Mold Removal Final Curing infahses and Aesthetics Sanding and Honing Inlays, Outlays, and Staining	Thu 11/21/13 Mon 12/2/13 Mon 10/7/13 Wed 12/4/13 Mon 12/2/13 Thu 12/2/13 Wed 12/4/13 Sat 12/2/13 Sat 12/27/13 Sat 12/27/13 Sat 12/27/13 Sat 12/27/13 Mon 1/13/14 Mon 1/13/14 Sun 2/9/14	With         11/25/13         Hut 11           Fri         12/6/13         Wed 1           Sun 3/16/14         Mon 1           Fri         12/6/13         Sat 1/           Fri         12/6/13         Sat 1/           Mon 12/2/13         Tue 12         Fri           Fri         12/6/13         Sat 1/           Fri         12/6/13         Thu 1.           Fri         12/6/13         Sat 1/           Sat 12/21/13         Sat 1/           Sat 12/21/13         Sat 2/           Ved 3/26/14         Sun 2           Wed 3/26/14         Sun 2           Sat 2/8/14         Sun 2           Sat 3/15/14         Mon 2	22/1/3         Tue 1/2           22/1/3         Tue 1/2           22/1/3         Tue 1/2           007/1/3         Sun 3/2           007/1/3         Thu 1/2           11/14         Sat 1/2           11/14         Sat 1/2           23/14         Sat 1/2           23/14         Sat 1/2           23/14         Sat 1/2           25/14         Sat 2/2           25/14         Sat 2/2           29/14         Sun 3/2           29/14         Thu 3/2           29/14         Sun 3/2           29/14         Sun 3/2           29/14         Sun 3/2	7/4 7/4 7/4 7/4 7/4 7/4 14 14 14 14 14 14 14 14 14 1								Pre-batching-Final-Structu	al Mis		Casting Practices Casting Practices Casting Practices Casting Practices Casting Practices Casting Pre-cutting Reir Preparing Aesthet Preparing Aesthet Concrete Placem	nent
33         35         36         C           37         38         39         40           41         42         43         44           45         46         F         47           48         49         9         1         1	Procurement of Final Reinforcement Fabrication of Reinforcement Construction and Casting Casting Practices Mold Assembly and Release Application Pre-batching Final Structural Mix Pre-cutting Reinforcement Preparing Aesthetic Components Concrete Placement Initial Cure with Mold Mold Removal Final Curing Final Curing Final Curing Inlashes and Aesthetics Sanding and Honing Inlays, Outlays, and Staining Sealing	Thu 11/21/13 Mon 12/2/13 Mon 10/7/13 Wed 12/4/13 Mon 12/2/13 Thu 12/2/13 Thu 12/2/13 Sat 12/2/13 Sat 12/21/13 Sat 12/21/13 Sun 12/22/13 Sun 12/22/13 Sun 12/22/13 Sun 2/22/13 Sun 2/22/13	With         Thu 11           Fri         12/6/13         Wed 1           Sun 3/16/14         Mon 1           Fri         12/6/13         Mon 1           Fri         12/6/13         Sat 1/           Mon 12/2/13         Tue 12           Fri         12/6/13         Sat 1/           Mon 12/2/13         Tue 12           Fri         12/6/13         Sat 1/           Fri         12/6/13         Sat 1/           Sat 12/21/13         Sat 1/         Sat 2/           Sat 12/21/13         Sat 2/         Sat 2/           Sun 2/2/14         Sun 2         Sun 3/26/14         Sun 2           Sat 2/8/14         Sun 2         Sat 3/15/14         Mon 2           Thu 3/20/14         Sun 3/20/14         Sun 3/20/14         Sun 3/20/14	22/1/3         Tue 1/2           22/1/13         Tue 1/2           22/1/13         Tue 1/2           007/13         Sun 3/2           007/13         Thu 1/2           11/14         Sat 1/2           11/14         Sat 1/2           23/14         Sat 1/2           23/14         Sat 1/2           23/14         Sat 1/2           23/14         Sat 1/2           25/14         Sat 2/2           25/14         Sat 2/2           2/9/14         Sun 3/2           2/9/14         Sun 3/2           2/9/14         Sun 2/2           2/2/14         Sat 3/1           116/14         Thu 3/2	7/14 7/14 7/14 7/14 7/13 7/13 7/13 7/14 7/14 7/14 7/14 7/14 7/14 7/14 7/14 7/14 7/14 7/14 7/14 7/14 7/15								Pre-batching-Final-Structu	al Mis		Casting Practices Casting Practices Casting Practices Casting Practices Casting Precuting Reir Preparing Aesthet Concrete Placem	and Release Ap
35         36         C           37         38         39           40         41         42           43         44         45           46         F         47           48         49         50	Procurement of Final Reinforcement Fabrication of Reinforcement Construction and Casting Casting Practices Mold Assembly and Release Application Pre-batching Final Structural Mix Pre-cutting Reinforcement Preparing Aesthetic Components Concrete Placement Initial Cure with Mold Mold Removal Final Curing Initshes and Aesthetics Sanding and Honing Inlays, Outlays, and Staining Sealing Sealing Cure	Thu 11/21/13 Mon 12/2/13 Mon 10/7/13 Mon 10/7/13 Wed 12/4/13 Mon 12/2/13 Thu 12/2/13 Sat 12/2/13 Sat 12/2/13 Sat 12/21/13 Sat 12/21/13 Sun 12/22/13 Mon 1/13/14 Mon 1/13/14 Sun 2/9/14 Sun 3/16/14 Mon 3/17/14	With         11/25/13         Hut 11           Fri         12/6/13         Wed 1           Sun 3/16/14         Mon 1           Fri         12/6/13         Mon 1           Fri         12/6/13         Sat 1/           Mon 12/2/13         Tue 12           Fri         12/6/13         Sat 1/           Mon 12/2/13         Tue 12           Fri         12/6/13         Sat 1/           Sat 12/21/13         Sat 1/           Sat 12/21/13         Sat 2/           Sun 2/21/4         Sun 2           Sun 2/21/4         Sun 2/2           Sat 3/15/14         Mon 2           Sat 3/15/14         Mon 3           Wed 3/26/14         Sun 3/	22/1/3         Tue 1/2           22/1/13         Tue 1/2           22/1/13         Tue 1/2           22/1/13         Tue 1/2           007/13         Sun 3/7           007/13         Thu 1/2           11/14         Sat 1/2           11/14         Sat 1/2           23/14         Sat 1/2           22/14         Sat 1/2           25/14         Sat 1/2           25/14         Sat 2/1           25/14         Sat 2/1           25/14         Sat 2/1           29/914         Sun 2/2           2/2/14         Sat 3/1           2/2/14         Sat 3/1           1/6/14         Thu 3/2           2/2/14         Sat 3/1           1/16/14         Thu 3/2	114 114 114 114 114 114 114 114								Pre-batching-Final-Structu	al Mis		Casting Practices Casting Practices Casting Practices Casting Practices Casting Practices Casting Precuting Reir Preparing Asstret Concrete Placem	and Release Ap
35         36         C           37         38         39           40         41         42           43         44         45           46         F         44           45         46         F           48         49         50         51	Procurement of Final Reinforcement Fabrication of Reinforcement Construction and Casting Casting Practices Mold Assembly and Release Application Pre-batching Final Structural Mix Pre-cutting Reinforcement Preparing Aesthetic Components Concrete Placement Initial Cure with Mold Mold Removal Final Curing Initishes and Aesthetics Sanding and Honing Inlays, Outlays, and Staining Sealing Finals Cure Finishes Complete	Thu 11/21/13 Mon 12/2/13 Mon 10/7/13 Mon 10/7/13 Wed 12/4/13 Mon 12/2/13 Thu 12/2/13 Sat 12/7/13 Sat 12/7/13 Sat 12/21/13 Sat 12/21/13 Sun 12/22/13 Mon 1/13/14 Mon 1/13/14 Sun 2/9/14 Sun 3/16/14 Mon 3/17/14 Wed 3/26/14	With         11/25/13         Hut 11           Fri         12/6/13         Wed 1           Sun 3/16/14         Mon 1           Fri         12/6/13         Mon 1           Fri         12/6/13         Sat 1/           Mon 12/2/13         Tue 12           Fri         12/6/13         Sat 1/           Mon 12/2/13         Tue 12           Fri         12/6/13         Sat 1/           Sat 12/21/13         Sat 1/           Sat 12/21/13         Sat 2/           Wed 3/26/14         Sun 2           Sat 2/8/14         Sun 2           Sat 3/5/14         Mon 3           Wed 3/26/14         Sun 3           Wed 3/26/14         Mon 3           Wed 3/26/14         Mon 3	22/1/3         Tue 1/2           22/1/13         Tue 1/2           22/1/13         Tue 1/2           22/1/13         Tue 1/2           20/7/13         Sun 3/7           007/13         Thu 1/2           11/14         Sat 1/2           11/14         Sat 1/2           23/14         Sat 1/2           22/1/1         Sat 1/2           25/14         Sat 1/2           25/14         Sat 2/2           25/14         Sat 3/1           11/1/14         Wed 3/2           22/1/1         Thu 3/2	1/14       1/14									al Mis		Casting Practices Casting Practices Casting Practices Casting Practices Casting Practices Casting Precuting Reif Preparing Aesthet Concrete Placem	and Release Ap
35         36         C           37         38         39         40           41         42         43         44           45         46         F         47           48         49         50         51           52         F         52         F	Procurement of Final Reinforcement Fabrication of Reinforcement Casting Practices Mold Assembly and Release Application Pre-batching Final Structural Mix Pre-cutting Reinforcement Preparing Aesthetic Components Concrete Placement Initial Cure with Mold Mold Removal Final Cuting Sanding and Honing Inlays, Outlays, and Staining Sealing Sealing Cure Finishes Complete Product Display	Thu 11/21/13 Mon 12/2/13 Mon 10/7/13 Mon 10/7/13 Wed 12/4/13 Mon 10/7/13 Thu 12/2/13 Thu 12/2/13 Sat 12/2/13 Sat 12/21/13 Sat 12/21/13 Sat 12/21/13 Sat 12/21/13 Mon 1/13/14 Mon 1/13/14 Sun 2/9/14 Sun 3/16/14 Mon 3/17/14 Wed 3/26/14	With         11/25/13         Hut it           Fri         12/6/13         Wed 1           Sun 3/16/14         Mon 1           Fri         12/6/13         Mon 1           Fri         12/6/13         Sat 1/           Mon 12/2/13         Tue 12           Fri         12/6/13         Sat 1/           Mon 12/2/13         Tue 12           Fri         12/6/13         Sat 1/           Sat 12/21/13         Sat 1/           Sat 12/21/13         Sat 2           Sun 2/2/14         Sun 2           Sat 3/26/14         Sun 2           Sat 3/15/14         Sun 3           Wed 3/26/14         Mon 3           Wed 3/26/14         Thu 3           Sun 3/16/14         Sun 3	22/1/3 Tue 1/2 22/1/3 Tue 1/2 22/1/13 Tue 1/2 22/1/13 Tue 1/2 11/14 Sat 1/2 22/1/1 Sat 1/2 22/14 Sat 1/2 22/14 Sat 1/2 25/14 Sat 1/2 25/14 Sat 1/2 25/14 Sat 2/2 18/14 Sat 2/2 18/14 Sat 2/2 19/14 Sue 3/2 12/2/14 Sat 3/1 18/14 Thu 3/2 27/14 Thu 3/2 27/14 Thu 3/2	ли ли ли ли ли ли ли ли ли ли											Casting Practices Casting Practices Casting Practices Casting Practices Concrete Placem Concre	and Release Ap
35         36         C           37         38         39         40           41         42         43         44           45         46         F         47           48         49         50         51         52         F           53         53         53         53         53         53	Procurement of Final Reinforcement Fabrication of Reinforcement Casting Practices Mold Assembly and Release Application Pre-batching Final Structural Mix Pre-cutting Reinforcement Preparing Aesthetic Components Concrete Placement Initial Cure with Mold Mold Removal Final Curing Sealing Sealing Sealing Sealing Cure Finishes Complete Product Display Cross Section Construction	Thu 11/21/13 Mon 12/2/13 Mon 10/7/13 Mon 10/7/13 Wed 12/4/13 Mon 12/2/13 Thu 12/5/13 Wed 12/4/13 Sat 12/2/13 Sat 12/21/13 Sat 12/21/13 Sat 12/21/13 Sat 12/21/13 Mon 1/13/14 Sun 2/9/14 Sun 3/16/14 Mon 3/17/14 Wed 3/26/14 Sat 12/14/13 Sat 12/14/13	With         IT22/13         IT10 11           Fri         12/6/13         Wed 1           Sun 3/16/14         Mon 1           Fri         12/6/13         Mon 1           Fri         12/6/13         Sat 1/           Mon         12/2/13         Tue 12           Fri         12/6/13         Sat 1/           Mon         12/2/13         Tue 12           Fri         12/6/13         Sat 1/           Sat         12/7/13         Sat 1/           Sat         12/7/13         Sat 1/           Sat         12/21/13         Sat 2           Sun 2/2/14         Sun 2           Wed 3/26/14         Sun 2           Sat 3/15/14         Mon 3           Wed 3/26/14         Mon 3           Wed 3/26/14         Thu 3           Sun 3/16/14         Sat 4	22/1/3         Tue 1/2           1/2/1/3         Tue 1/2           2/2/1/3         Tue 1/2           2/2/1/3         Tue 1/2           2/2/1/3         Tue 1/2           0/7/1/3         Tue 1/2           1/1/4         Sat 1/2           1/1/1/4         Sat 1/2           2/3/1/4         Sat 2/2           2/3/1/4         Sat 3/2           2/3/1/4         Sat 3/2           2/3/1/4         Sat 3/2           2/3/1/4         Thu 3/2           2/3/1/4         Thu 3/2           2/3/1/4         Thu 3/2           2/3/1/4/1/3         Sat 3/2	ли ли ли ли ли ли ли ли ли ли											Casting Practices Used Assembly Pre-cutting Rein Preparing Assthet	and Release Ap
35         36         C           37         38         39           40         41         42           43         44         45           46         F         47           48         49         50           51         52         F           53         53         54	Procurement of Final Reinforcement Fabrication of Reinforcement Construction and Casting Casting Practices Mold Assembly and Release Application Pre-batching Final Structural Mix Pre-cutting Reinforcement Preparing Aesthetic Components Concrete Placement Initial Cure with Mold Mold Removal Final Curing Inishes and Aesthetics Sanding and Honing Inlays, Outlays, and Staining Sealing Sealing Cure Finishes Complete Product Display Cross Section Construction	Thu 11/21/13 Mon 12/2/13 Mon 10/7/13 Mon 10/7/13 Wed 12/4/13 Mon 12/2/13 Thu 12/5/13 Wed 12/4/13 Sat 12/2/13 Sat 12/21/13 Sat 12/21/13 Sat 12/21/13 Sat 12/21/13 Sat 12/21/13 Mon 1/13/14 Mon 1/13/14 Sun 2/9/14 Sun 3/16/14 Mon 3/17/14 Wed 3/26/14 Sat 1/18/14 Sat 1/18/14	With         IT22/13         IT10 11           Fri         12/6/13         Wed 1           Sun 3/16/14         Mon 1           Fri         12/6/13         Mon 1           Fri         12/6/13         Sat 1/1           Mon 12/2/13         Tue 12           Fri         12/6/13         Sat 1/1           Mon 12/2/13         Tue 12           Fri         12/6/13         Sat 1/1           Sat 12/2/1/13         Sat 1/1           Sat 12/2/1/13         Sat 2/2           Sun 2/2/14         Sun 2           Wed 3/26/14         Sun 3           Wed 3/26/14         Sun 3           Wed 3/26/14         Mon 3           Wed 3/26/14         Thu 3           Sun 3/16/14         Sat 2/1           Sat 3/15/14         Mon 3           Wed 3/26/14         Thu 3           Sun 3/16/14         Sat 3/15/14	22/1/3         Tue 1/2           1/2/1/3         Tue 1/2           2/2/1/3         Tue 1/2           2/2/1/3         Tue 1/2           0/7/1/3         Tue 1/2           0/7/1/3         Thu 1/2           11/1/4         Sat 1/2           11/1/4         Sat 1/2           2/3/1/4         Sat 1/2           2/3/1/4         Sat 1/2           2/3/1/4         Sat 2/2           2/3/1/4         Sat 3/4           2/3/1/4         Sat 3/4           2/3/1/4         Sat 3/4           2/3/1/4         Sat 3/4           1/3/1/4         Sat 3/4           1/3/1/4         Sat 3/4	114 114 114 114 114 114 114 114								Pre-batching-Final-Structu	al Mix		Casting Practices Casting Practices Wold Assembly Pre-cutting Reir Concrete Placem	and Release Ap
35         36           36         37           38         39           40         41           42         43           44         45           46 <b>F</b> 47         48           49         50           51         52           53         53           54         54	Procurement of Final Reinforcement Fabrication of Reinforcement Construction and Casting Casting Practices Mold Assembly and Release Application Pre-batching Final Structural Mix Pre-cutting Reinforcement Preparing Aesthetic Components Concrete Placement Initial Cure with Mold Mold Removal Final Curing Finalses and Aesthetics Sanding and Honing Inlays, Outlays, and Stainling Sealing Sealing Sealing Cure Finishes Complete Product Display Cross Section Construction Tabletop Display Construction	Thu 11/21/13 Mon 12/2/13 Mon 10/7/13 Mon 10/7/13 Wed 12/4/13 Mon 12/2/13 Thu 12/5/13 Wed 12/4/13 Sat 12/2/13 Sat 12/21/13 Sat 12/21/13 Sat 12/21/13 Sat 12/21/13 Sun 2/9/14 Sun 2/9/14 Sun 3/16/14 Mon 3/17/14 Wed 3/26/14 Sat 12/14/13 Sat 1/18/14	With         Th220/13         Fit 12/6/13         Wed 1           Fri         12/6/13         Wed 1           Fri         12/6/13         Mon 1           Fri         12/6/13         Mon 1           Fri         12/6/13         Sat 1/           Mon 12/2/13         Tue 12           Fri         12/6/13         Tue 12           Fri         12/6/13         Sat 1/           Sat         12/6/13         Sat 1/           Sat         12/6/13         Sat 1/           Sat         12/21/13         Sat 1/           Sat         12/21/13         Sat 2/           Sun 2/2/14         Sun 2/         Sun 2/2/14           Sat 2/8/14         Sun 2/         Sun 2/2/14           Sat 3/15/14         Mon 2         Sat 3/15/14           Wed 3/26/14         Sun 3         Wed 3/26/14           Sun 3/16/14         Sat 1/2         Sat 1/2           Sat 3/15/14         Sat 1/2         Sat 1/2           Sat 3/15/14         Sat 1/2         Sat 1/2           Sat 3/15/14         Sat 1/2         Sat 1/2	22/1/3         108 / //           22/1/13         Tue 1//           22/1/13         Tue 1//           22/1/13         Tue 1//           07/713         Tue 1//           07/713         Thu 1//           11/1/14         Sat 1//           223/14         Sat 1//           223/14         Sat 1//           225/14         Sat 1//           225/14         Sat 2//           //8/14         Sat 2//           //9/14         Sat 2//           //9/14         Sut 2//           //9/14         Sut 2//           //2/2/14         Sat 3//           //2/2/14         Thu 3//           //2/2/14         Thu 3//           //2/2/14         Thu 3//           //2/2/14         Sat 3//           //13/14         Sat 3//	7/14 7/14 7/14 7/13 7/14 1/14								Pre-batching-Final-Structu			Casting Practices Casting Practices Casting Practices Concrete Placem Concrete	and Release Ap
35         3           36         0           37         3           38         3           40         4           41         4           42         4           43         4           44         4           45         6           47         1           48         1           49         1           50         5           51         5           54         55	Procurement of Final Reinforcement Fabrication of Reinforcement Construction and Casting Casting Practices Mold Assembly and Release Application Pre-batching Final Structural Mix Pre-cutting Reinforcement Preparing Aesthetic Components Concrete Placement Initial Cure with Mold Mold Removal Final Curing Inlays, Outlays, and Staining Sealing Sealing Sealing Cure Finishes Complete Product Display Cross Section Construction Tabletop Display Construction Stands Construction	Thu 11/21/13 Mon 12/2/13 Mon 10/7/13 Wed 12/4/13 Mon 10/7/13 Wed 12/4/13 Thu 12/5/13 Wed 12/4/13 Sat 12/7/13 Sat 12/7/13 Sat 12/7/13 Sat 12/21/13 Sat 12/21/13 Mon 1/13/14 Sun 2/9/14 Sun 3/16/14 Mon 3/17/14 Wed 3/26/14 Sat 12/14/13 Sat 1/18/14 Sat 12/14/13	With         11/25/13         Wed 1           Fri         12/6/13         Wed 1           Sun 3/16/14         Mon 1           Fri         12/6/13         Mon 1           Fri         12/6/13         Sat 1/           Mon 12/2/13         Sat 1/           Mon 12/2/13         Tute 12           Fri         12/6/13         Sat 1/           Fri         12/6/13         Sat 1/           Fri         12/6/13         Sat 1/           Sat 12/21/13         Sat 1/           Sat 12/21/13         Sat 2/           Wed 3/26/14         Sun 2           Wed 3/26/14         Sun 2           Sat 2/8/14         Sun 3           Wed 3/26/14         Mon 3           Wed 3/26/14         Thu 3           Sat 3/15/14         Sat 2           Sat 3/15/14         Sat 1	22/4/13         Tue 1/2           20/7/13         Tue 1/2           11/14         Sat 1/2           11/14         Sat 1/2           11/14         Sat 1/2           22/14         Sat 1/2           22/14         Sat 1/2           22/14         Sat 2/2           18/14         Sat 2/2           1/8/14         Sat 3/1           1/8/14         Sat 3/1           1/8/14         Sat 3/1           1/13/14         Sat 3/1	7/14 7/14 7/14 7/13 7/14 7/13 7/14 7/14 114 114 114 114 114 114 114								Pre-batching-Final-Structu			Casting Practices Casting Practices Casting Practices Concrete Placem Concrete	and Release Ap
35         36           36         6           37         38           38         39           40         41           42         43           44         44           45         6           47         48           48         1           49         50           51         52           53         54           55         56	Procurement of Final Reinforcement Fabrication of Reinforcement Construction and Casting Casting Practices Mold Assembly and Release Application Pre-batching Final Structural Mix Pre-cutting Reinforcement Preparing Aesthetic Components Concrete Placement Initial Curre with Mold Mold Removal Final Curing Inlays, Outlays, and Staining Sealing Sealing Sealing Cure Finishes Complete Product Display Cross Section Construction Tabletop Display Construction Stands Construction Display Components Complete	Thu 11/21/13 Mon 12/2/13 Mon 10/7/13 Wed 12/4/13 Mon 12/2/13 Thu 12/2/13 Thu 12/2/13 Sud 12/2/13 Sat 12/2/13 Sat 12/21/13 Sat 12/21/13 Sun 12/22/13 Mon 1/13/14 Mon 1/13/14 Sun 2/9/14 Sun 3/16/14 Sat 12/14/13 Sat 1/18/14 Sat 12/14/13 Sun 3/16/14	With         11/25/13         Wed 1           Fri         12/6/13         Wed 1           Sun 3/16/14         Mon 1           Fri         12/6/13         Mon 1           Fri         12/6/13         Sat 1/           Mon 12/2/13         Tut 12           Fri         12/6/13         Sat 1/           Mon 12/2/13         Tut 12           Fri         12/6/13         Sat 1/           Fri         12/6/13         Sat 1/           Fri         12/6/13         Sat 1/           Sat 12/7/13         Sat 1/         Sat 1/           Sat 12/21/13         Sat 1/         Sat 2/2/14           Sun 2/2/14         Sun 2         Sun 2/2/14           Wed 3/26/14         Sun 3/         Sun 3/15/14           Wed 3/26/14         Sun 3/         Wed 3/26/14           Sun 3/16/14         Sat 1/2         Sat 3/15/14           Sat 3/15/14         Mon 1         Sat 3/15/14           Sat 3/15/14         Sat 1/2         Sat 3/15/14	22/4/13         Tue 1/2           20/7/13         Tue 1/2           11/14         Sat 1/2           11/14         Sat 1/2           11/14         Sat 1/2           22/14         Sat 1/2           22/14         Sat 2/2           1/8/14         Sat 2/2           1/8/14         Sat 2/2           1/8/14         Sat 2/2           1/9/14         Sun 2/2           1/16/14         Sat 3/1           1/16/14         Sat 3/1           1/12/14         Sat 3/1           1/12/14         Sat 3/1           1/13/14         Sat 3/1           1/14/13         Sat 3/1           1/16/14         Sun 3/1	1/14       1/14 <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th>Pre-batching Final Structur</th> <th></th> <th></th> <th>Casting Practices Casting Practices Casting Practices Concrete Placem Concrete</th> <th>and Release Ap</th>								Pre-batching Final Structur			Casting Practices Casting Practices Casting Practices Concrete Placem Concrete	and Release Ap
35         6         C           35         6         C         37           38         39         39         40           40         41         42         43           44         45         46         F           47         48         49         50           51         52         F         53           54         55         55           56         57         C	Procurement of Final Reinforcement Fabrication of Reinforcement Construction and Casting Casting Practices Mold Assembly and Release Application Pre-batching Final Structural Mix Pre-cutting Reinforcement Preparing Aesthetic Components Concrete Placement Initial Cure with Mold Mold Removal Final Curing Inlays, Outlays, and Staining Sealing Sealing Sealing Cure Finishes Complete Product Display Cross Section Construction Tabletop Display Construction Stands Construction Display Components Complete Pesign Paper	Thu 11/21/13 Mon 12/2/13 Mon 10/7/13 Wed 12/4/13 Mon 10/7/13 Wed 12/4/13 Thu 12/2/13 Thu 12/2/13 Sat 12/1/13 Sat 12/21/13 Sat 12/21/13 Sat 12/21/13 Sat 12/21/14 Mon 1/13/14 Sat 12/14/13 Sat 1/18/14 Sat 12/14/13 Sun 3/16/14 Mon 1/13/14	With         11/25/13         Wed 1           Fri         12/6/13         Wed 1           Sun 3/16/14         Mon 1           Fri         12/6/13         Mon 1           Fri         12/6/13         Sat 1/           Mon 12/2/13         Tue 12           Fri         12/6/13         Sat 1/           Mon 12/2/13         Tue 12           Fri         12/6/13         Sat 1/           Sat 12/21/13         Sat 1/           Sat 12/21/13         Sat 1/           Sat 12/21/13         Sat 1/           Sat 12/21/13         Sat 2           Wed 3/26/14         Sun 2           Wed 3/26/14         Sun 2           Wed 3/26/14         Sun 3           Wed 3/26/14         Sun 3           Sun 3/16/14         Sat 1/           Sat 3/15/14         Mon 1           Sat 3/15/14         Sat 1/	21/13         Tue 1/2           22/4/13         Tue 1/2           22/4/13         Tue 1/2           22/4/13         Tue 1/2           07/713         Tue 1/2           11/14         Sat 1/2           11/14         Sat 1/2           11/14         Sat 1/2           22/14         Sat 1/2           22/14         Sat 1/2           22/14         Sat 2/2           18/14         Fri 1/2           25/14         Sat 2/2           20/14         Sat 3/2           21/17/14         Wed 3/2           22/14         Sat 3/2           21/14/13         Sat 3/2           21/14/13         Sat 3/2           21/14/14         Sat 3/2	7/14       7/14       7/14       7/14       7/13       7/14       7/14       7/14       114								Pre-batching Final Structu			Casting Practices Casting Practices Casting Practices Concrete Placem Concrete Placem I I I I I I I I I I I I I I I I I I I	and Release Ap
35         6         C           35         6         C         37           38         38         38         38           40         4         45           46         4         45           46         4         45           46         5         55           56         56         56           57         1         58	Procurement of Final Reinforcement Fabrication of Reinforcement Construction and Casting Casting Practices Mold Assembly and Release Application Pre-batching Final Structural Mix Pre-cutting Reinforcement Preparing Aesthetic Components Concrete Placement Initial Cure with Mold Mold Removal Final Curing Inlays, Outlays, and Staining Sealing Sealing Cure Finalse Complete Product Display Construction Tabletop Display Construction Stands Construction Display Components Complete Pager Qutine and Draft Pager Qutine and Draft	Thu 11/21/13 Mon 12/2/13 Mon 10/7/13 Wed 12/4/13 Mon 12/2/13 Thu 12/2/13 Thu 12/2/13 Sat 12/2/13 Sat 12/2/13 Sat 12/21/13 Sat 12/21/13 Sat 12/21/13 Sat 12/1/13 Sat 12/14/13 Sat 12/14/13 Sat 12/14/13 Sun 3/16/14 Mon 1/13/14 Tue 1/14/14	With         11/20/13         Hut if           Fri         12/6/13         Wed 1           Sun 3/16/14         Mon 1           Fri         12/6/13         Sat 1/           Mon 12/2/13         Tue 12           Fri         12/6/13         Sat 1/           Mon 12/2/13         Tue 12           Fri         12/6/13         Sat 1/           Fri         12/6/13         Sat 1/           Sat         12/21/13         Sat 2/           Wed         3/26/14         Sun 2/           Wed         3/26/14         Sun 3/           Wed         3/26/14         Mon 3           Wed         3/26/14         Mon 1           Sat         3/15/14         Sat 1/           Sat         3/15/14         Sat 1/           Sat         3/15/14         Sat 1/           Sat 3/15/14         Sat 1/         Sat 1/      Sat 3/15/14         Sat 1	22/1/3         Tue 1/2           22/1/3         Tue 1/2           22/1/13         Tue 1/2           22/1/13         Tue 1/2           11/14         San 3/F           07/1/13         Thu 1/2           11/14         Sat 1/2           11/14         Sat 1/2           11/14         Sat 1/2           22/14         Sat 1/2           22/14         Sat 1/2           25/14         Sat 2/1           25/14         Sat 3/1           118/14         Sat 3/1	1/14       1/14											Casing Practices Casing	and Release Ap
35         6         C           35         6         C         37           38         39         40         41           42         43         44           45         46         F           44         45         55           56         57         C           55         56         57           58         59         59	Procurement of Final Reinforcement Fabrication of Reinforcement Construction and Casting Casting Practices Mold Assembly and Release Application Pre-batching Final Structural Mix Pre-cutting Reinforcement Preparing Aesthetic Components Concrete Placement Initial Cure with Mold Mold Removal Final Curing Inlays, Outlays, and Staining Sealing Sealing Cure Finishes Complete Product Display Cross Section Construction Tabletop Display Construction Stands Construction Display Components Complete Pager Qurline and Draft Professional Reviews	Thu 11/21/13 Mon 12/2/13 Mon 10/7/13 Wed 12/4/13 Mon 12/2/13 Thu 12/2/13 Thu 12/2/13 Sat 12/2/13 Sat 12/2/13 Sat 12/21/13 Sat 12/21/13 Sat 12/21/13 Sat 12/21/13 Sat 12/21/13 Sat 12/14/13 Sat 12/14/13 Sat 12/14/13 Sun 3/16/14 Mon 1/13/14 Tue 1/14/14 Tue 1/14/14 Tue 1/14/14	With         11/20/13         Hut if           Fri         12/6/13         Wed 1           Sun 3/16/14         Mon 1           Fri         12/6/13         Sat 1/           Mon 12/2/13         Tue 12           Fri         12/6/13         Sat 1/           Mon 12/2/13         Tue 12           Fri         12/6/13         Sat 1/           Fri         12/6/13         Sat 1/           Sat         12/21/13         Sat 2/           Wed         3/26/14         Sun 2/2           Wed         3/26/14         Sun 3/           Wed         3/26/14         Sun 3/           Wed         3/26/14         Mon 3           Wed         3/26/14         Sat 1/           Sat         3/15/14         Sat 1/           Sat 3/15/14         Sat 1/           Sat 3/15/14         Sat 1/           Sat 3/15/14         Sat 1/      S	22/4/13         Tue 1/2           22/4/13         Tue 1/2           22/4/13         Tue 1/2           22/4/13         Tue 1/2           07/13         Tue 1/2           11/14         Sat 1/2           11/14         Sat 1/2           11/14         Sat 1/2           11/14         Sat 1/2           22/14         Sat 1/2           22/14         Sat 1/2           25/14         Sat 2/2           25/14         Sat 3/2           27/14         Thu 3/2           27/14         Thu 3/2           27/14         Sat 3/1           18/14         Sat 3/1           11/14/13         Sat 3/1           11/14/14         Sat 3/1           11/14/14         Mon 2/2           11/14/14         Thu 2/2	1/14       1/14											Casing Practices Casing	and Release Ap
35         6           35         6           37         38           38         39           40         4           42         4           43         44           45         46           47         48           49         50           51         52           52         5           55         55           56         57           58         59           60         57	Procurement of Final Reinforcement Fabrication of Reinforcement Casting Practices Mold Assembly and Release Application Pre-batching Final Structural Mix Pre-cutting Reinforcement Preparing Aesthetic Components Concrete Placement Initial Cure with Mold Mold Removal Final Curing Initishes and Aesthetics Sanding and Honing Inlays, Outlays, and Staining Sealing Sealing Cure Finishes Complete Product Display Cross Section Construction Tabletop Display Construction Stands Construction Display Components Complete Paper Outline and Draft Professional Reviews Final Reviews Fina	Thu 11/21/13 Mon 12/2/13 Mon 10/7/13 Wed 12/4/13 Mon 10/7/13 Wed 12/4/13 Thu 12/5/13 Wed 12/4/13 Sat 12/7/13 Sat 12/27/13 Sat 12/21/13 Sat 12/21/13 Sat 12/21/13 Sun 2/29/14 Sun 3/16/14 Mon 1/13/14 Sat 12/14/13 Sat 12/14/13 Sat 12/14/13 Sun 3/16/14 Mon 1/13/14 Tue 1/14/14 Tue 1/14/14 Tue 2/18/14	With         11/20/13         Hut 11           Fri         12/6/13         Wed 1           Sun 3/16/14         Mon 1           Fri         12/6/13         Sat 1/           Mon 12/2/13         Sat 1/           Mon 12/2/13         Tue 12           Fri         12/6/13         Sat 1/           Mon 12/2/13         Tue 12           Fri         12/6/13         Sat 1/           Sat 12/2/13         Sat 1/           Sat 12/2/13         Sat 1/           Sat 12/2/13         Sat 2/           Wed 3/26/14         Sun 2/           Wed 3/26/14         Sun 2/           Wed 3/26/14         Sun 3/           Wed 3/26/14         Mon 3           Wed 3/26/14         Thu 3/           Sat 3/15/14         Sat 1/	22/1/3         Tue 1/2           22/1/3         Tue 1/2           22/1/13         Tue 1/2           22/1/13         Tue 1/2           11/14         Sun 1/2           11/14         Sat 1/2           11/14         Sat 1/2           22/1/13         Tue 1/2           11/14         Sat 1/2           22/1/13         Tue 1/2           11/14         Sat 1/2           22/1/14         Sat 1/2           22/1/14         Sat 2/2           25/14         Sat 3/1           26/14         Thu 3/2           27/14         Thu 3/2           27/14         Thu 3/2           27/14         Sat 3/1           11/13         Sat 3/1           11/14         Sat 3/1           11/14         Sat 3/1           11/14         Sat 3/1           11/14         Sat 3/1           11/14/14         Mon 2/1	1/14       1/14											Casing Practices Casing	and Release Ap
35         36         C           37         38         39           40         4         4           42         4         4           44         45         4           45         6         6           57         1         55           56         57         1           58         59         60           61         1         1	Procurement of Final Reinforcement Fabrication of Reinforcement Construction and Casting Casting Practices Mold Assembly and Release Application Pre-batching Final Structural Mix Pre-cutting Reinforcement Preparing Aesthetic Components Concrete Placement Initial Cure with Mold Mold Removal Final Curing Final Structural Mix Sealing Sealing Sealing Sealing Sealing Cure Finishes Complete Product Display Construction Stands Construction Stands Construction Stands Construction Stands Construction Display Components Complete Pager Outline and Draft Professional Reviews Final Reviews Final Reviews Design Paper Submittal	Thu 11/21/13 Mon 12/2/13 Mon 10/7/13 Wed 12/4/13 Mon 10/7/13 Wed 12/4/13 Thu 12/2/13 Thu 12/5/13 Sat 12/4/13 Sat 12/2/13 Sat 12/21/13 Sat 12/21/13 Sat 12/21/13 Mon 1/13/14 Mon 1/13/14 Sat 12/14/13 Sat 12/14/13 Sat 12/14/13 Sat 12/14/13 Sat 12/14/13 Tue 1/14/14 Tue 2/18/14 Fri 2/21/14 Sat 3/1/14	With         11/20/13         Hith           Fri         12/6/13         Wed 1           Sun 3/16/14         Mon 1           Fri         12/6/13         Sat 1/           Mon 12/2/13         Sat 1/           Mon 12/2/13         Sat 1/           Mon 12/2/13         Sat 1/           Fri         12/6/13         Sat 1/           Fri         12/6/13         Sat 1/           Fri         12/6/13         Sat 1/           Sat 12/21/13         Sat 1/         Sat 1/           Sat 12/21/13         Sat 2/         Sat 2/2//13         Sat 2/           Wed 3/26/14         Sun 2/         Sun 2/2/14         Sun 2/           Sat 2/8/14         Sun 3/         Wed 3/26/14         Mon 2           Thu 3/20/14         Sun 3/16/14         Sat 1/         Sat 1/           Sat 3/15/14         Mon 1         Sat 3/15/14         Sat 1/           Sat 3/15/14         Sat 1/         Sat 1/         Sat 1/           Sat 3/15/14         Sat 1/         Sat 1/         Sat 3/           Wed 3/26/14         Thu 3/         Sat 2/         Sat 3/           Sat 3/15/14         Sat 1/         Sat 1/         Sat 1/           Sat	Yaziris         Tue 1/2           Yaziris         Tue 1/2           Yaziris         Tue 1/2           Yaziris         Tue 1/2           Yini Sun 3/F         Sun 3/F           Yini Yini Sun 1/2         Yini Yini Sun 1/2           Yini Yini Sun Yini	1/14       1/14											Casting Practices Casting Practices Casting Practices Casting Practices Casting Practices Casting Precuting Reife Concrete Placem Concrete Pla	and Release Ap
35         36         C           37         38         39         40           38         39         44         44           44         44         44         45           46         F         50         51           50         51         52         F           53         54         55         56           57         C         58         59           60         61         62         F	Procurement of Final Reinforcement Fabrication of Reinforcement Construction and Casting Casting Practices Mold Assembly and Release Application Pre-batching Final Structural Mix Pre-cutting Reinforcement Pre-arting Reinforcement Pre-arting Reinforcement Concrete Placement Initial Cure with Mold Mold Removal Final Curing Finalses and Aesthetics Sealing Sealing Sealing Sealing Finishes Complete Finishes Complete Product Display Construction Stands Construction Stands Construction Stands Construction Display Components Complete Paper Outline and Draft Professional Reviews Final Revision and Refinements Design Paper Submittal Prosentation	Thu 11/21/13 Mon 12/2/13 Mon 10/7/13 Wed 12/4/13 Mon 10/7/13 Wed 12/4/13 Thu 12/2/13 Thu 12/5/13 Wed 12/4/13 Sat 12/2/13 Sat 12/2/13 Sat 12/21/13 Sat 12/21/13 Sat 12/21/14 Mon 1/13/14 Mon 1/13/14 Mon 3/16/14 Wed 3/26/14 Sat 12/14/13 Sat 12/14/13 Sat 12/14/13 Sat 12/14/13 Sat 12/14/14 Tue 1/14/14 Tue 2/18/14 Fri 2/21/14 Sat 3/1/14	With         High         High           Fri         12/6/13         Wed 1           Sun 3/16/14         Mon 1           Fri         12/6/13         Sat 1/           Fri         12/6/13         Sat 1/           Mon 12/2/13         Tue 12           Fri         12/6/13         Sat 1/           Mon 12/2/13         Tue 12           Fri         12/6/13         Sat 1/           Sat 12/2/13         Sat 1/           Sat 12/2/13         Sat 2/           Sun 2/2/14         Sun 2           Sun 2/2/14         Sun 2           Sun 2/2/14         Sun 2           Sat 3/15/14         Mon 3           Wed 3/26/14         Mon 3           Wed 3/26/14         Mon 3           Wed 3/26/14         Mon 3           Wed 3/26/14         Mon 1           Sat 3/15/14         Sat 11           Sat 3/15/14         Sat 12           Sun 3/16/14         Sat 3/15/14           Sat 3/15/14         Sat 12           Sun 3/16/14         Sun 3           Sat 3/15/14         Tue 1           Mon 2/17/14         Tue 2           Sat 3/11/14         Fri 2/	22/1/3         Tue 1/2           22/1/13         Tue 1/2           22/1/13         Tue 1/2           22/1/13         Tue 1/2           07/1/13         Sun 3/1           07/1/13         Thu 1/2           11/14         Sat 1/2           11/14         Sat 1/2           23/14         Sat 1/2           23/14         Sat 1/2           23/14         Sat 1/2           25/14         Sat 1/2           25/14         Sat 1/2           25/14         Sat 2/2           26/14         Thu 3/2           27/14         Thu 3/2           27/14         Thu 3/2           27/14         Thu 3/2           11/15/14         Sat 3/1           11/14         Sat 3/1	1/14       1/14								Pre-batching Final Structure 			Casing Practices Casing	and Release Ap
35         6         C           35         36         C         37           38         39         40         41           42         43         44           45         4         45           46         F         6           47         48         49           50         51         52           53         54         55           56         56         59           59         60         61           62         F         69           63         59         59	Procurement of Final Reinforcement         Fabrication of Reinforcement         Casting Practices         Mold Assembly and Release Application         Pre-batching Final Structural Mix         Pre-outing Reinforcement         Pre-outing Reinforcement         Pre-outing Reinforcement         Pre-outing Reinforcement         Pre-outing Reinforcement         Pre-outing Reinforcement         Initial Cure with Mold         Mold Removal         Final Curing         Final Curing         Sanding and Honing         Inlays, Outlays, and Staining         Sealing         Cross Section Construction         Tabletop Display Construction         Stands Construction         Display Components Complete         Preper Outline and Draft         Professional Reviews         Final Revision and Refinements         Design Paper Submittal         Presentation	Thu 11/21/13 Mon 12/2/13 Mon 12/2/13 Mon 10/7/13 Wed 12/4/13 Mon 10/7/13 Wed 12/4/13 Thu 12/2/13 Sat 12/2/13 Sat 12/2/13 Sat 12/21/13 Sat 12/21/13 Sat 12/21/13 Mon 1/13/14 Mon 1/13/14 Sun 3/16/14 Mon 3/17/14 Wed 3/26/14 Sat 12/14/13 Sat 12/14/13 Sat 12/14/13 Sat 12/14/13 Sat 12/14/14 Tue 1/14/14 Tue 1/14/14 Tue 2/18/14 Fri 2/21/14 Sat 3/1/14 Tue 1/28/14	With         The T           Fri         12/6/13         Wed 1           Sun 3/16/14         Mon 1           Fri         12/6/13         Mon 1           Fri         12/6/13         Mon 1           Fri         12/6/13         Sat 1/           Mon 12/2/13         Tue 12           Fri         12/6/13         Tue 12           Fri         12/6/13         Sat 1/           Mon 12/2/13         Sat 1/           Sat 12/2/13         Sat 1/           Sat 12/21/13         Sat 1/           Sat 12/21/13         Sat 2/           Wed 3/26/14         Sun 2/           Wed 3/26/14         Sun 2/           Sat 3/15/14         Mon 2           Thu 3/20/14         Sun 3           Wed 3/26/14         Thu 3           Sun 3/15/14         Sat 1/           Sat 3/15/14         Sat 1           Sat 3/15/14         Sat 1           Sat 3/15/14         Sat 3/           Sat 3/15/14         Sun 3           Sat 3/15/14         Sun 3           Sat 3/15/14         Tue 1           Mon 2/17/14         Tue 1           Mon 2/17/14         Tue 1           <	22/1/3         100 // 2           22/1/3         Tue 1/2           22/1/3         Tue 1/2           22/1/3         Tue 1/2           2/1/13         Sun 3/2           0/7/13         Thu 1/2           1/14         Sat 1/2           22/1/13         Tue 1/2           1/1/14         Sat 1/2           22/14         Sat 1/2           22/14         Sat 1/2           22/14         Sat 1/2           25/14         Sat 2/2           /25/14         Sat 2/2           /26/14         Sat 2/2           /26/14         Sat 2/2           /26/14         Sat 2/2           /26/14         Sat 2/2           /27/14         Thu 3/2           /27/14         Thu 3/2           /13/14         Sat 3/1           /13/14         Sat 3/2           /14/14         Sat 3/2	1/14       1/14								Pre-batching-Final-Structu			Cassing Practices Like Cassin	and Release Ap
35         6         C           35         36         C         37           38         39         40         41           42         43         44           45         6         F           44         45         5           46         F         50           51         52         F           53         54         55           56         56         56           59         60         60           61         62         F           63         64         53	Procurement of Final Reinforcement       Fabrication of Reinforcement       Casting Practices       Mold Assembly and Release Application       Pre-batching Final Structural Mix       Pre-outting Reinforcement       Pre-outting Reinforcement       Pre-outting Reinforcement       Pre-outting Reinforcement       Pre-outting Reinforcement       Initial Cure with Mold       Mold Removal       Final Curing       Standing and Honing       Inlays, Outlays, and Stainling       Sealing       Sealing Cure       Finishes Complete       Product Display       Construction       Display Construction       Stands Construction       Display Construction       Preper Outline and Draft       Professional Reviews       Final Revision and Refinements       Design Paper Submittal       Prosentation       Selection of Presentarion and Review Potential	Thu 11/21/13 Mon 12/2/13 Mon 10/7/13 Wed 12/4/13 Mon 10/7/13 Wed 12/4/13 Thu 12/2/13 Thu 12/2/13 Sat 12/2/13 Sat 12/21/13 Sat 12/21/13 Sat 12/21/13 Sat 12/21/13 Mon 1/13/14 Mon 3/16/14 Mon 3/16/14 Mon 3/16/14 Sat 12/14/13 Sat 12/21/14 Sat 12/21/14 Sat 12/21/14 Tue 1/14/14 Tue 2/18/14 Fri 2/21/14 Sat 3/1/14 Tue 1/28/14 Wed 2/26/14 Wed 2/26/14 Wed 2/26/14	With         The T           Fri         12/6/13         Wed 1           Sun 3/16/14         Mon 1           Fri         12/6/13         Mon 1           Fri         12/6/13         Sat 1/           Mon 12/2/13         Tue 12           Fri         12/6/13         Sat 1/           Mon 12/2/13         Tue 12           Fri         12/6/13         Sat 1/           Sat 12/21/13         Sat 1/           Sat 12/21/13         Sat 1/           Sat 12/21/13         Sat 12/           Sat 12/21/13         Sat 2/           Wed 3/26/14         Sun 2/           Wed 3/26/14         Sun 2/           Sat 2/8/14         Sun 2/           Wed 3/26/14         Sun 3/           Wed 3/26/14         Sun 3/           Wed 3/26/14         Sun 3/           Sun 3/15/14         Sat 12           Sun 3/15/14         Sat 12           Sun 3/15/14         Sat 3/           Sun 3/15/14         Sun 3           Sat 3/	Tue         Tue <thtue< th=""> <thtue< th=""> <thtue< th=""></thtue<></thtue<></thtue<>	1/14       1/14								Pre-batching-Final-Structu			Cassing Practices Like Cassin	and Release Ap
35         6         C           35         36         C           37         38         39           40         41           42         43           44         45           46         F           47         46           48         50           51         F           52         F           53         54           55         56           57         C           58         59           60         61           62         F           63         64           64         65	Procurement of Final Reinforcement         Fabrication of Reinforcement         Construction and Casting         Casting Practices         Mold Assembly and Release Application         Pre-batching Final Structural Mx         Pre-batching Reinforcement         Pre-outing Reinforcement         Preparing Aesthetic Components         Concrete Placement         Initial Curing         Seating         Seating         Corse Section Construction         Tabletop Display Construction         Stands Construction         Stands Construction         Stands Construction         Stands Construction	Thu 11/21/13 Mon 12/2/13 Mon 10/7/13 Wed 12/4/13 Mon 10/7/13 Wed 12/4/13 Subsect of the second	With         11/20/13         Hith           Fri         12/6/13         Wed 1           Sun 3/16/14         Mon 1           Fri         12/6/13         Mon 1           Fri         12/6/13         Sat 1/           Mon 12/2/13         Tue 12           Fri         12/6/13         Sat 1/           Mon 12/2/13         Tue 12           Fri         12/6/13         Sat 1/           Sat 12/2/1/13         Sat 1/           Sat 12/2/1/13         Sat 1/           Sat 12/2/1/13         Sat 2/           Wed 3/26/14         Sun 2/           Wed 3/26/14         Sun 2/           Wed 3/26/14         Mon 3           Wed 3/26/14         Mon 3           Wed 3/26/14         Mon 3           Wed 3/26/14         Mon 3           Wed 3/26/14         Mon 1           Sat 3/15/14         Sat 12           Sun 3/16/14         Sat 3/           Sat 3/15/14         Sat 3/           Sat 3/15/14         Sat 3/           Mon 2/17/14         Tue 1           Mon 2/17/14         Tue 2           Sat 3/15/14         Sat 3/           Sat 3/1/14         Fri 2/	Tue         Tue <thtue< th=""> <thtue< th=""> <thtue< th=""></thtue<></thtue<></thtue<>	1/14       1/14 <th></th> <th>Cassing Practices Cassing Practices Used Assembly Pre-cutting Rein Pre-cutting Rein Concrete Placem Concrete Placem Co</th> <th>and Release Ap</th>											Cassing Practices Cassing Practices Used Assembly Pre-cutting Rein Pre-cutting Rein Concrete Placem Concrete Placem Co	and Release Ap
35         6         C           35         36         C           37         38         39           40         41           42         43           44         45           46         F           47         6           48         50           51         55           55         55           56         57           58         59           60         64           64         65           66         66	Procurement of Final Reinforcement         Fabrication of Reinforcement         Construction and Casting         Casting Practices         Mold Assembly and Release Application         Pre-batching Final Structural Mix         Pre-batching Reinforcement         Preparing Aesthetic Components         Conorete Placement         Initial Curing         Seating         Seating         Seating Cure         Finishes Complete         Product Display         Construction         Stands Construction         Stands Construction         Stands Construction	Thu 11/21/13 Mon 12/2/13 Mon 10/7/13 Wed 12/4/13 Mon 10/7/13 Wed 12/4/13 Mon 12/2/13 Thu 12/5/13 Wed 12/4/13 Sat 12/7/13 Sat 12/21/13 Sat 12/21/13 Sat 12/21/13 Sat 12/21/13 Sat 12/21/14 Mon 1/13/14 Sun 2/9/14 Sun 3/16/14 Mon 3/17/14 Wed 3/26/14 Sat 12/14/13 Sat 12/14/13 Sat 12/14/13 Sat 12/14/13 Sat 12/14/13 Sat 12/14/13 Sat 12/14/14 Tue 1/14/14 Tue 1/14/14 Tue 1/14/14 Tue 1/14/14 Tue 1/14/14 Wed 2/26/14 Wed 2/19/14 Wed 2/26/14 Wed 2/19/14 Wed 2/26/14 Wed 2/19/14	With         11/20/13         Hith           Fri         12/6/13         Wed 1           Sun 3/16/14         Mon 1           Fri         12/6/13         Mon 1           Fri         12/6/13         Sat 1/           Mon 12/2/13         Tute 12           Fri         12/6/13         Sat 1/           Mon 12/2/13         Tute 12           Fri         12/6/13         Sat 1/           Fri         12/6/13         Sat 1/           Fri         12/6/13         Sat 1/           Sat 12/7/13         Sat 1/         Sat 1/           Sat 12/21/13         Sat 2/         Sat 2/2/14           Sat 2/2/14         Sun 2/2/14         Sun 2/2/           Wed 3/26/14         Mon 2         Sat 3/15/14           Mon 2/26/14         Thu 3/         Sat 2/2/           Sat 3/15/14         Sat 1/         Sat 3/15/14           Sat 3/15/14         Sat 1/         Sat 3/           Sat 3/15/14         Sat 3/         Sat 3/           Mon 2/17/14         Tute 1         Tute 1           Mon 2/17/14         Tute 2         Sat 3///4           Wed 3/26/14         Wed 2         Wed 2/2           Wed 3/26/14	22/1/3         Tue 1/2           11/14         San 3/2           07/13         Thu 1/2           11/14         Sat 1/2           11/14         Sat 1/2           22/14         Sat 1/2           22/14         Sat 1/2           22/14         Sat 2/2           25/14         Sat 3/2           26/14         Thu 3/2           27/14         Thu 3/2           27/14         Thu 3/2           27/14         Thu 3/2           21/14         Sat 3/2           11/14         Sat 3/2           11/14 <th>1/14       1/14</th> <th></th> <th>Cassing Practices Cassing Practices Cassing Practices Concrete Placem Concrete</th> <th>and Release Ap</th>	1/14       1/14											Cassing Practices Cassing Practices Cassing Practices Concrete Placem Concrete	and Release Ap
35         6         C           35         36         C         37           38         39         40         41           42         43         44           45         46         F           40         41         42           43         44         45           46         F         55           56         57         C           55         56         57           56         57         C           58         59         60           61         65         65           66         6         6	Procurement of Final Reinforcement Fabrication of Reinforcement Construction and Casting Casting Practices Mold Assembly and Release Application Pre-batching Final Structural Mix Pre-cutting Reinforcement Preparing Aesthetic Components Concrete Placement Initial Cure with Mold Mold Removal Final Curing Initals and Aesthetics Sanding and Honing Inlays, Outlays, and Staining Sealing Sealing Cores Section Construction Tabletop Display Construction Display Components Complete Product Display Construction Display Construction Stands Construction Display Components Complete Product Display Final Reviews	Thu 11/21/13 Mon 12/2/13 Mon 10/7/13 Wed 12/4/13 Mon 10/7/13 Wed 12/4/13 Thu 12/2/13 Thu 12/2/13 Sat 12/7/13 Sat 12/21/13 Sat 12/21/13 Sat 12/21/13 Sat 12/21/13 Sat 12/21/13 Sat 12/21/14 Mon 1/13/14 Sat 12/14/13 Sat 12/14/13 Sat 12/14/13 Sat 12/14/13 Sat 12/14/13 Sat 12/14/13 Sat 12/14/13 Sat 12/14/13 Sat 12/14/14 Tue 1/14/14 Tue 1/14/14 Tue 1/14/14 Tue 1/18/14 Sat 3/1/14 Fri 3/28/14 Wed 2/26/14 Fri 3/28/14 Fri	With         11/20/13         Hith           Fri         12/6/13         Wed 1           Sun 3/16/14         Mon 1           Fri         12/6/13         Mon 1           Fri         12/6/13         Sat 1/           Mon 12/2/13         Tue 12           Fri         12/6/13         Sat 1/           Mon 12/2/13         Tue 12           Fri         12/6/13         Sat 1/           Sat 12/2/13         Sat 1/           Sat 12/2/13         Sat 1/           Sat 12/2/13         Sat 1/           Sat 12/2/13         Sat 2/           Wed 3/26/14         Sun 2/           Wed 3/26/14         Sun 3/           Wed 3/26/14         Mon 1           Sat 3/15/14         Mon 1           Sat 3/15/14         Sat 3/           Wed 3/26/14         Tue 1           Sat 3/15/14         Sat 1/           Sat 3/15/14         Sat 1/           Sat 3/15/14         Sat 3/           Sat 3/15/14         Sat 3/           Sat 3/11/14         Tue 1           Thu 2/20/14         Tue 2           Sat 3/11/14         Fri 2/           Sat 3/11/14         Fri 2/ <t< th=""><th>Yaz Yir 3         Tue Yir 2           Yir 211'3         Tue Yir 2           Yir 211'3         Tue Yir 2           Yir Yir 3         Sun 3/Y           Yir Yir 3         Tue Yir 2           Yir Yir 3         Sun Yir 2           Yir Yir 3         Sun Yir 2           Yir Yir 4         Sun Yir 2           Yir 4         Ya Yir 4           Yir 4         Ya Yir 4</th><th>1/14       1/14</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th>Casting Practices     Casting Practices</th><th>and Release Ap</th></t<>	Yaz Yir 3         Tue Yir 2           Yir 211'3         Tue Yir 2           Yir 211'3         Tue Yir 2           Yir Yir 3         Sun 3/Y           Yir Yir 3         Tue Yir 2           Yir Yir 3         Sun Yir 2           Yir Yir 3         Sun Yir 2           Yir Yir 4         Sun Yir 2           Yir 4         Ya Yir 4	1/14       1/14											Casting Practices	and Release Ap
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2013-2014







Michigan Technological Universit

1400 Townsend Dr. Concrete Canoe Houghton MI, 49931

### Bill of Materials

No.	Qty.	Descriptior				
1	6 Parts	Polystyrene Foam				
2	1 gal	Ероху				
3	48 ft <sup>2</sup>	3/4" OSB				
4	56 LFT	2x6 Lumber				
5	56 LFT	2x4 Lumber				
6	2 ea.	3/8"x8" Bolt Assembl				

Drawing Name: Mold Desigr

Boat Name: Katsuo Maru

Drawn By: Philip Doederlein

Checked By: Mike Larson

Date: 14 Feb. 2014

Scale: 1:30 Sheet: 1



#### **Appendix A – References**

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#### **Appendix B- Mixture Proportions**

	Mixture ID:	Hayate		Design Proportions		Actual Batched		Vielded	Proportions
$Y_D$	Design Batch Siz	e (ft <sup>3</sup> ):	0.195	(Non	SSD)	Propo	ortions	liciaca	
Cem	entitious Materials		SG	Amount (Ib/yd <sup>3</sup> )	Volume (ft <sup>3</sup> )	Amount (Ib)	Volume (ft <sup>3</sup> )	Amount (lb/yd <sup>3</sup> )	Volume (ft <sup>3</sup> )
CM1	Federal White Type I Port	3.15	394.22	2.006	2.84	0.014	403.50	2.053	
CM2	Lafarge NewCem®GGBF	S	2.99	149.68	0.802	1.08	0.006	153.20	0.821
CM3	VCAS™ 140		2.60	65.09	0.401	0.47	0.003	66.62	0.411
CM4	VCAS™ 160		2.60	130.15	0.802	0.94	0.006	133.22	0.821
	Total Cement	itious Materials	:	739.14	4.011	5.33	0.029	756.54	4.106
Fibe	rs			_			_		_
F1	1 Nycon-PVA RF4000			6.72	0.083	0.05	0.001	6.88	0.085
F2	Nycon-PVA RECS15		1.30	5.50	0.068	0.04	0.000	5.63	0.069
F3	FORTA® ECONO-NET®	)	0.91	0.46	0.008	0.00	0.000	0.47	0.008
		Total Fibers	:	12.68	0.159	0.09	0.001	12.98	0.162
Aggr	egates			,					
A1	Poraver 1-2 mm	Abs: 0	2 0.39	124.47	5.115	0.90	0.037	127.40	5.235
A2	Poraver 0.5-1.0 mm	Abs: 0.2	5 0.47	74.99	2.557	0.54	0.018	76.76	2.617
A3	Poraver 0.25-0.5 mm	Abs: 0	3 0.59	62.77	1.705	0.45	0.012	64.25	1.745
A4	3M™ K-1	Abs: 0.2	2 0.13	48.41	5.967	0.35	0.043	49.55	6.108
A5	Elemix	Abs: 0.05	5 0.04	4.46	1.702	0.03	0.012	4.57	1.742
	Т	otal Aggregates	:	315.10	17.046	2.27	0.123	322.52	17.448
Wate	r			1	1				
W1	Water for CM Hydration (	W1a + W1b)		280.87	4.501	2.03	0.032	287.49	4.607
	W1a. Water from Admixt	ures	1.00	6.07	-	0.32	-	6.22	
	W1b. Additional Water			274.80		1.70		281.27	
W2	Water for Aggregates, SS	SD	1.00	73.37		0.53		75.09	_
	Total	Water (W1 + W2	) :	354.24	4.501	2.56	0.032	362.58	4.607
Solid	Is Content of Latex, Dye	s and Admixture	s in Pov	der Form					
S1			1.05	13.85	0.211	0.10	0.002	14.18	0.216
	Total Solid	s of Admixtures	:	13.85	0.211	0.10	0.002	14.18	0.216
Admi	xtures (including Pigme	nts in Liquid	0/	Deserve	Water in	American	Water in	Desers	Water in
Form	1)		% Solids	(fl oz/cwt)	Admixture	(fl oz)	Admixture	(fl oz/cwt)	Admixture
				· · · ·	(lb/yd³)	. ,	(lb)	, ,	(lb/yd³)
Ad1	Xypex Xycrilic	8.8 lb/gal	28.02	38.05	5.39	2.03	0.29	38.95	5.52
Ad2	BASF Glenium® 3030NS	9.2 lb/gal	20.27	6.34	0.68	0.34	0.04	6.49	0.70
	Water from Ac	dmixtures (W1a	):		6.07		0.32		6.22
Cem	ent-Cementitious Materials	s Ratio		0.53		0.53		0.53	
Wate	er-Cementitious Materials F	Ratio		0.38		0.38		0.38	
Slump, Slump Flow, in.				1 in ± 0.5 in		0.5 in		0.5 in	
М	Mass of Concrete. Ibs		1435.02		10.35		1468.80		
V	V Absolute Volume of Concrete, $ft^3$			25.93		0.19		26.54	
Т	T Theorectical Density, $lb/ft^3 = (M / V)$			55.3		55.3		55.3	
D	Design Density, <i>lb/ft</i> <sup>3</sup>		53.1						
D	Measured Density, <i>lb/ft</i> <sup>3</sup>					54	4.4	54.4	
A Air Content, $\% = [(T - D) / T \times 100\%]$				3.	.97	1.	.71	1.71	
Y	Y Yield, $ft^3 = (M/D)$			2	27	0.	19		27
Ry	Relative Yield	$=(Y/Y_D)$				0.9	977		





#### Appendix C – Bill of Materials

Material	Units	Quantity	Unit Price	Total
Federal White Type I White Portland Cement	lb	67.75	\$0.27	\$18.29
Lafarge NewCem® GGBFS	lb	25.72	\$0.05	\$1.29
<b>VCASTM 140</b>	lb	11.18	\$0.35	\$3.91
VCAS <sup>TM</sup> 160	lb	22.37	\$0.35	\$7.83
Poraver® 1.0-2.0mm	lb	18.98	\$0.85	\$16.13
Poraver® 0.5-1.0mm	lb	11.45	\$0.85	\$9.73
Poraver® 0.25-0.5mm	lb	9.53	\$0.85	\$8.10
Poraver® 0.1-0.3mm	lb	1.51	\$0.85	\$1.28
3М <sup>тм</sup> К-1	lb	7.66	\$11.03	\$84.49
Elemix	lb	0.64	\$2.50	\$1.60
Nycon Kuralon <sup>TM</sup> RECS15 (8mm) PVA	lb	0.97	\$6.60	\$6.40
Nycon Kuralon <sup>TM</sup> RF4000 (30mm) PVA	lb	0.79	\$6.90	\$5.45
FORTA® ECONO-NET®	lb	0.13	\$5.30	\$0.69
Xypex Xycrylic-Admix	gal	0.50	\$5.10	\$2.55
BASF Glenium® 3030 NS	gal	0.10	\$15.00	\$1.50
Textile Products Kevlar® 4009-1	sq ft.	40.00	\$7.69	\$307.60
Fibre Glast 24K Carbon Tow	yd	750.00	\$0.19	\$142.50
CS Hyde 69 Kevlar Thread	yd	1200.00	\$0.06	\$72.00
Butterfield Color Elements <sup>TM</sup> Transparent Concrete Stain – Assorted Colors	OZ	36.00	\$1.85	\$66.60
Quikrete Liquid Cement Color – Charcoal	oz	2.00	\$0.70	\$1.40
Huron Technologies Release Coating 7572	gal	1.00	\$22.50	\$22.50
ChemMasters Crystal Clear - A	gal	1.00	\$22.00	\$22.00
10% Post-Consumer Recycled Foam Mold	LS	1.00	\$1,702.02	\$1,702.02
Canoe Finishing	LS	1.00	\$112.00	\$112.00
Design Stencil	LS	1.00	\$50.00	\$50.00
Total Production Cost				\$2,667.87

