an axis through nature: ranger station at pandapas pond

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Thesis submitted to the faculty of Virginia Polytechnic Institute and State University in partial fulfillment of the requirements for the degree of Master of Architecture.

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KEYWORDS: Pandapas Pond, Jefferson National Forest, nature, axis, ellipse, ranger station, layers
I would like to thank my father Edward, and my mother Carmen, for their continuous support throughout the years.

I would like to thank my thesis committee members Jim Jones, Bill Galloway, and Hans Rott for their constructive criticism, wisdom, and guidance along the way.

I would like to thank my friends and family for all the encouragement they provided.
My thesis is a human intervention into the tranquil and natural environment of Pandapas Pond and the Jefferson National Forest. Although the form of the intervention embraces the landscape and natural land formations, its purpose is to take the visitor along a path that translates the experience from one of participation to that of observation of the park’s surroundings. This is both an investigation of an architectural integration with the site and a partial separation of the inhabiter from his/her natural surroundings.
My thesis serves as both an observation area for the general public and a shelter and work environment for the support staff of the Jefferson National Forest. For the public, the ranger station is designed to limit access to nature by way of a bridge elevated from the forest floor, an observation platform to the pond, and a spiral ramp located just behind the building's skin. The education area on the top floor offers panoramic views of the park, as well. For the staff of the Jefferson National Forest, this building allows...
the exterior environment to visually penetrate into the interior work space. Light is diffused through the trees and the building's skin, illuminating the interior with natural light in the lower two work levels. The circulation space between floors allows park employees to leave the conditioned space and experience the temperature fluctuations and liveliness of the outdoors, reminding the people who work there that they are surrounded by nature.
Located 3 miles west of Blacksburg, VA on Route 460 in the valley between Brush Mountain and Sinking Creek Mountain, Pandapas Pond is a man-made, 8-acre body of water serving as the headwaters of Poverty Creek. The land surrounding the pond is generally undisturbed. The park has a varied terrain and is dense with vegetation, as shown in images 7 through 15. The many horse paths and walking trails weaving through the forest serve as circulation in and around the park.
Especially during the warmer months, people visit the park to fish, bike, horseback ride, and enjoy nature. Since this area of the Jefferson National Forest is so popular with the public, the hilly landscape surrounding the pond makes for an ideal location for a park headquarters and educational facility.
Presently, much of this area of the Jefferson National Forest appears to be completely natural, however, human intervention has impacted this site. As previously stated, Pandapas Pond is man-made and the area surrounding it was once logged for its timber. Since that time, trees and other vegetation have returned to the site to make homes for various species of wildlife.
The construction of a ranger station has the potential to adversely impact the serenity and natural beauty of the area, however, the proposed solution is designed to architecturally speak to the topography and intimately enhance one’s experience with the landscape. It also provides a home to the park rangers who work to protect both the wildlife and the public.
The building’s form is a response to the site on which it sits. Its vertical curvature (Image 20) visually continues the site’s immediate topography onto the building’s facade and upwards into the tree tops and sky. The mathematical process used to generate this curvature was established to formally translate this sense of visual continuation. A curvature too steep or shallow would not accurately integrate this form with the site.
The elliptical plan directly corresponds to the golden ratio of 1.618. This ratio occurs throughout nature in humans & animals (Image 21), plant components including geometrical figures inside of flowers (Image 22), parts of shells of mollusks (Image 23), and ratio of leaves to branches. Although the ranger station is an intervention in nature, it should visually harmonize with its natural surroundings.
The elliptical plan shifts slightly towards the pond side (Image 25), whereas in elevation the curved wood screen responds to the knob on which the building sits (Images 24, 26, 27, 28). Its steeper vertical curvature traces the hill down towards the pond and the shallower curvature near the base of the building responds to the uphill grade. The horizontal slats of the wood screen function as the building’s skin, while the vertical spacing gradates from more to less dense as the eye is
intended to be seamlessly drawn upward from the forest floor along the building's facade and into the tree tops and sky (Image 20). The site's wooded surroundings are disturbed as little as possible, so that the intervention of this human element can successfully coexist with the natural environment.
The proposed project has formal references to the projects by Renzo Piano and Tadao Ando, although the form generators are distinctly different.

Piano’s Tjibaou Cultural Centre in New Caledonia may appear similar in design to the ranger station, however, the ranger station form generator was a reaction to the site and terrain of the Jefferson National Forest and Piano’s started with the...
analysis and documentation of the indigenous Kanak people and their culture. For Piano, the idea behind the Cultural Centre was to “both commemorate the traditional society of the Kanaks and provide a focus in the inevitable evolution of its culture”. Music, dance, exhibitions, and other special events take place here, so that the Kanak culture does not lose contact with its historic roots. The building's design was inspired by aspects of this rich traditional culture.
Piano’s design also integrates the natural climate of the south Pacific Island of New Caledonia into the building’s interior. Each “hut” aids in passive ventilation either by directing breezes into the building from above or by inducing convection currents up and out by way of the venturi effect. To control this natural ventilation strategy, the wooden slat cladding needed to be widely spaced towards the top and bottom but more densely spaced towards the middle where the air flow would.
be more inhibited. In the design of the ranger station, the horizontal wood skin is both a reaction to the knob on which the building sits and a method of filtering sunlight into the interior space.
Tadao Ando's design for the Museum of Wood located in Hyogo, Japan, also shares a similar form as the ranger station. Approaching the museum along an axis raised above the forest floor, the museum is conceived as a truncated cone looming in the trees. The interior space is as refined and simple as the exterior, with the circulation through the building occurring along an interior ramp. In this space, light filters through a narrow incision in the roof, revealing the post and
beam construction. The visitor is led through a courtyard at the building’s center that is flooded with both light from above and water from the fountains below. The presence of overhead light in the courtyard inspired a similar feature in the ranger station, however, in the Ranger Station this area marks the intersection of the entrance and building axes and offers the only opportunity to have an unobstructed view of the sky above.
Upon arrival at the parking lot, you are greeted with dirt walking trails that wind through the woods, around the pond, and up onto Brush Mountain. The ranger station is an intervention to nature, and therefore breaks the winding nature of these trails, imposing two stacked linear bridges starting near the parking lot and carrying the visitor in and through the ranger station.
The threshold of the top bridge is where the journey to the ranger station begins. At this point the intervention is clear. The visitor has just emerged from a dirt trail and is standing at the beginning of a very linear concrete and steel path (Image 52). As the visitor moves onto the bridge, he/she becomes a limited observer of their natural surroundings. As he/she continues, the vertical bridge supports frame the ranger station and visually reinforces the axial penetration through (cont.)
the visitor then passes through the building into a circular light well opening to the sky above. Here, light floods the space, emphasizing the sky in the midst of the dense forest. Just offset from the center of this space is the intersection of the bridge axis and the building axis (Image 55). Just past this point of the journey, the bridge cantilevers past the exterior screen, offering the visitor his/her first view of the pond (Image 54). From here the visitor can
either enter the public education center, which encompasses the entire top floor, or they can move back through the light well and start their descent along the perimeter ramp (Images 60, 61). While descending the ramp, the horizontal wood slats become more dense, decreasing light and visibility towards the forest and pond. As the visitor moves along this ramp, he/she has two opportunities to enter the building’s office spaces for rangers and other support staff for the Jefferson
National Forest. However, as they continue towards the bottom of the ramp, the slats become more dense until he/she descends below grade where only diffuse light penetrates from above. At the end of the ramp, darkness serves as the threshold between the building and nature (Image 62). After moving through the tunnel below grade, the visitor is re-introduced into the forest just above the level of the pond (Image 63).
exiting the tunnel, transitioning from the interior to the exterior

view towards ranger station from pond
The golden ratio that is used to infinitely subdivide the golden rectangle was applied to the length and width of the ellipse (Image 64). This ratio of 1.618 is seen throughout nature, reinforcing the connection of the ranger station with its natural surroundings. Once the length and width of the ellipse are known, its construction can be followed by the example in Image 65. This approximation method uses the curvature of three circles to produce one quadrant.
Approximation Method for Constructing an Ellipse:

Since we know the longer axis of the ellipse is 1.618 times greater than the shorter axis, the basket weaver’s method can be used to generate one elliptical quadrant. This quadrant can then be mirrored horizontally and vertically to form the remainder of the ellipse.

1. Draw the rectangle over the two half diameters, ‘a’ and ‘b’.
2. Draw the diagonal ‘d’.
3. Starting at point ‘A’ draw line ‘e’ such that it is perpendicular to line ‘d’.
4. Continue lines ‘e’ and ‘b’ until they meet at point ‘C2’. ‘C2’ is the center point for the largest circle, forming a segment of the elliptical quadrant.
5. Point ‘C1’ lies at the intersection of lines ‘e’ and ‘a’. ‘C1’ is the center point for the smallest circle, forming another segment of the elliptical quadrant.
6. Draw a line from the midpoint of AC to ‘C2’ and another line from the midpoint of AB through ‘C1’, ending it at point ‘C3’. ‘C3’ is the center point for the middle-sized circle, forming the final segment of the elliptical quadrant.

An ellipse of the golden ratio can have three circles transcribed perfectly within it (Image 66). The larger circle shares its center point and boundary with the upper quadrant point of the ellipse. The two smaller circles each have a center point at the left and right quadrant points of the larger circle, 90° from its tangential surface with the ellipse. Each smaller circle is also tangent with the longer axis of the ellipse. In plan, consecutive ellipses splay outwards from the base (red) ellipse to the boundary (blue).
34 splay sequence

NOTE: the bold cross hair marking the base point for the splay sequence is not a focal point of the ellipse, but the midpoint of an imaginary line spanning the intersection of the larger and smaller circles.

ellipse. The base point for this splay sequence and source of the scaling factor occurs at the intersection of the bold cross hair on the right of Image 66. This base point is located at the midpoint of an imaginary line spanning from the left quadrant point of the right smaller circle to the right quadrant point of the larger circle along the longer axis of the ellipse. The scale factor of the splay sequence starts with 1.0025 and increases by .0025 with each consecutive ellipse; for example the scale factor of the smallest
The chosen scale factor produced a form reacting most appropriately to the site.
Each layer plays an integral role in the make-up of the building. They control light, weather, and temperature to make the interior comfortable for working productively and viewing the landscape. The material of the layers is primarily wood that darkens in hue from the exterior to the interior to emphasize the transition from one layer to the next.
The building's skin is the outermost layer (Image 70). This layer is primarily designed to control both the amount of light into the space and view out towards the park. It is constructed of birch wood slats (Image 71) that are connected to curved vertical members of the same material.
The weather barrier is located just behind the skin (Image 72). This layer of protection is designed to keep the rain and snow from penetrating into the building. Mullions made of western red cedar (Image 73) embrace glass panels and attach to the building’s roof, floor, and horizontal members used to support the circulation ramp. A channel cut into the concrete floor below carries away the rain water (Image 74).
This layer of the ranger station serves as the floor-to-floor circulation for the entire building (Image 75). The steel circulation ramp is an integral part of the journey through the building for park visitors. It also forces park employees outside the thermal barrier for a more intimate experience with nature while moving from one floor to another.
This layer acts as both the thermal barrier and structural support for the ranger station (Image 76). Double pane glass panels span the distance between the red oak (Image 77) vertical supports to provide a 360° view to the exterior (Image 74). The weight of the roof and floors is distributed amongst the 22 supports, maximizing the interior space.
From the interior, all of the external layers work in conjunction to maintain a constant comfortable temperature with plenty of natural light (Image 78). Visitors to the park will be able to observe the natural surroundings through the layers of glass and widely spaced horizontal slats. Park employees on the lower two floors will be able to enjoy a more diffused light condition for their work environment.
This internal layer provides supplemental light to the innermost spaces (Image 79). The upper two floors open to this space through narrow floor-to-ceiling windows, limiting supplemental light (Image 80). However, on the bottom, the most light starved area of the ranger station, are two skylights allowing light to penetrate into the conference space from above. The interior of the light well is clad with cedar shakes.
The above images illustrate how each layer is integrated into the building. In Image 81 each layer dissolves away from left to right, visually describing their order and relationship to the building. Image 82 shows the skin peeling away, exposing the weather barrier and demonstrating its location behind the concrete retaining wall.
top floor - public viewing & park education center
The ranger station serves both the general public and employees of the Jefferson National Forest. The top floor houses an educational center and viewing area of Pandapas Pond and the surrounding landscape (Image 83). The lower two floors serve as open office and conferencing space for the park employees (Images 84, 85).

**Top Floor Plan Legend:**
- A - Public Entrance Bridge
- B - Pond Overlook
- C - Reception Desk
- D - Park Education Area
- E - Toilets
- F - Exhibit Area / Map Reading Area
- G - Conditioned Observation Area
- H - Circulation Ramp
middle floor - private entrance, open office space
The public entrance into the building occurs on the upper bridge leading visitors in and through the top floor of the ranger station. The main entrance into the building leads the visitor into the educational area where information is provided by the support staff. Located in this main area are also public restrooms and desk space that could be used to read maps or provide visual/interactive displays. Opposite from the main entrance is a secondary entrance into a smaller space. In this area,
Bottom Floor Plan Legend:
A - Private Entrance
B - Conference Room
C - Open Office Area
D - Toilets
E - Work Stations
F - Circulation Ramp
G - Entrance to Tunnel
H - Tunnel Below Grade
J - Entrance to Park
K - Concrete Rainwater Collection Channel
visitors or park employees can relax and observe nature from a conditioned room separated from the potentially harsh weather conditions. Located at the very end of the bridge, just past the two entrances into the building, is an observation platform offering a view towards the pond. From here, the viewer can see the entire pond and wetlands, as well as the northern slope of Brush Mountain.
50 function building section
The entrance for the park employees occurs on the bridge that intersects the second (middle) floor of the ranger station. The public entrance bridge serves as a canopy to shelter the park employees who have to work in all weather conditions. The second floor entrance is located at the end of the bridge axis, whereas the lower entrance must be approached by descending the perimeter ramp. Restrooms are located on each floor. Along the exterior perimeter of the building section.
curved restroom walls are work areas for employees of the park. Directly beneath the light well penetrating the upper two floors is a circular conference space, flooded with natural light from skylights.
Upper and lower screen attachment arms connect with the vertical screen elements to stabilize the building's skin. The upper screen attachment arm (Image 89) is an extension of the roof supports, while the lower screen attachment arm (Images 90, 92) is anchored directly to the retaining wall below. The extension of each roof support also provides a connection point for the weather barrier located behind the vertical screen supports. The wall section (Image 91) illustrates how water is...
filtered by gravel and a metal screen before it leaves the roof via roof drains installed within the light well wall cavity. This wall section also shows the cedar shake siding, insulation, and skylight mounted above the conferencing space on the lower level.
The sections above (Images 93, 94, 95) are cut along the center of the bridge axis. Image 93 shows the bridges meeting with the ground via a concrete slab landing, providing a transition between the forest floor and the bridge. Images 94 & 95 illustrate wall construction, as well as the support connections of the bridges with the building. Two supports are integrated into the weather barrier allowing the observation platform to further cantilever past the building’s skin.
section through bridge penetration & overlook platform

floor materials of bridge & entrance into top floor of ranger station

wall section & floor materials
Images 97-106 illustrate the density change of the exterior skin from top to bottom, allowing light to become more diffuse as it enters the lower two production levels of the ranger station and providing a maximum view for the visitors to the park on the upper floor. The skin can also be seen hovering just above the grade line with the help of the lower screen attachment support arms mounted to the retaining wall.
These images also visually describe the bridge penetrating through the ranger station. Both bridges are tubular in structure to provide maximum self-support between the connections with the steel exterior vertical bridge supports and the connections with the building. The overlook platform stops short of the tubular structure to both continue the axis of the bridge through the site and protect onlookers from falling to the ground.
The opening of the light well to the sky, as well as the narrow vertical windows connecting it with the interior are also visible in some of these images. There is no protection from the weather in this interior light well, further reinforcing the building’s connection with its immediate surroundings.
The images above (107, 108) illustrate the lanternous glow of the building in the evening hours. As the park closes at dark, the building provides a beacon to visitors who may be on the last leg of their hike and on their way to the parking area.
My thesis is an integration of a man-made object in a “natural environment”. The ranger station provides a setting that is fully immersed in nature, but limits human interaction with it; thus providing only a path of observation.

The blend of public and private entities provides the public a means to experience the Jefferson National Forest, as well as a work environment for park rangers.
photograph credits

Image 21
http://www.goldenmuseum.com/2101Resolution_engl.html

Image 22

Image 23
http://www.worldofstock.com/closeups/NAB1487.php

RENZO PIANO BUILDING WORKSHOP - Images 29-44
Roger Boulay
Réunion Des Musées Nationaux
C Rives/M Folco Editions Du Pacifique
Michel Denancé

FOREST MONOLITH - Images 45-51
Mitsuo Matsuoka
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