An Architecture of Light: A Catholic Church for Blacksburg, Virginia

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Catholic Church, concrete, light, structure
to my mother
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Abstract

This thesis is an investigation on how in architecture structure and material modulate the perception of light. This idea was implemented in the design of a catholic church for the parish of Blacksburg, Virginia.

The vision of the church as a community in constant interaction resulted in the design of a complex, in which the chapel is accompanied by a pre-school and a third building containing facilities for the administration of the parish and the residence for the priest.

The plaza on which all the buildings have been arranged allows the opportunity for outdoor activities, as well as the contemplation of the beautiful ever-changing views of the mountains that surround the church. The difference in the nature of the activities that take place in each one of the buildings has been expressed through the way structure and materials interact with the natural light producing a distinctive interior quality.
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Program

The program for this thesis was strongly influenced by my formative years, in which I experienced the Catholic Church as a community that gathers to worship, to participate in the sacraments, to learn, to communicate ideas, to celebrate life, to care for one another, to play. The fact that these activities exist in constant interaction but at the same time demand a specific disposition in order to be better manifested led me to design the church as a complex conformed by several buildings. Each building has been designed for specific activities, while the proximity between them promotes the desired interactions.

The complex includes a chapel, a school and one building that houses facilities for the administration of the parish and the residence for the priest. The plaza on which the buildings are arranged serves not only as a means of connection between buildings, it also offers a place where non-programmed activities, such as outdoor plays, festivals, play or even standing alone enjoying a moment of silence contemplating the beauty of the ever-changing mountains, can happen.

Like a series of pure monolithic cast-in-place concrete prisms, the buildings stand as a strong presence set in opposition to the gradually sloping surrounding landscape and by means of the modulation of light through structure and treatment of materials I produced an interior quality that emphasizes the differences between the activities that take place in them.
Site

The site chosen for this project is rural, located by Prices Fork road, at the edge of the corporate limit of the town of Blacksburg. The topography of the site slopes down gently as one moves to the north, allowing an uninterrupted view of Brush Mountain.

A grid generated using the ratio of the golden section provided regulating lines to bring rational order to the site. The church complex has been set in a composition that responds to the orientation, the path of the sun through the site and the regulating lines to produce the desired effects of natural light both inside and out the buildings.
1 Chapel
2 Administrative Office Building / Residence for the priest
3 School
4 Plaza
5 Bell Tower
6 Parking lot

Church Complex 1" = 75' - 0"
Precedents

Notre Dame du Haut a Ronchamp.  Le Corbusier
Detail of the south facing wall
Photograph by Héctor Mendoza
The design of the chapel was significantly influenced by the cathedral of Notre Dame de Paris and the chapel of Notre Dame du Haut at Ronchamp, works of architecture characterized for being rather dim spaces surrounded by thick walls. The atmosphere inside them makes one feel at peace, sheltered from the worries of the everyday world and in disposition for introspection.

The presence of natural light in the interior of these places is always carefully controlled and by contrasting light and shadows the attention of the visitor is directed toward focal points. Additionally, I found the use of geometry as a regulating principle in their design fascinating.

Cathedral of Notre Dame de Paris

At Notre Dame, the natural light filtered by the stained glass windows enters the cathedral in layers, an effect that is easier to grasp in section. The closer to the ground the windows are, the farther apart they are from the nave, surrounding the congregation in a glow. Two large rose windows located at the transept bring bright light from the north and the south that direct attention towards the altar as one enters the cathedral.
Notre Dame du Haut a Ronchamp

At Ronchamp, luminosity and darkness coexist in harmony as the natural light that enters the chapel is modulated in different ways. The powerful light that penetrates the thick walls through the tapered rectangular openings seems to be amplified, then dissipates gradually as one moves away from the wall. Deflectors above the doors and on top of high towers bring diffuse natural light down into the space. The presence of a window in the eastern wall directs the attention towards the image of the Virgin Mary to which the chapel is consecrated.
The chapel is anchored in the western corner of the complex, closer to Prices Fork road. In plan, the external walls of the chapel follow the geometry of a trapezoid inscribed within a golden rectangle. The southern and northern walls are vertical and have the responsibility of carrying the load of the roof, while the eastern and western walls are inclined 13 degrees, 24 minutes from the vertical. The four walls are connected forming a continuous boundary. The external walls of the chapel are made of two layers of reinforced cast-in-place concrete with insulation in between.

The chapel has been designed to provide spaces for the activities that take place in a regular parish with the idea of an open plan. Internal walls separate the core, intended for the celebration of the liturgy, from the ambulatory spaces. Carefully positioned openings and a height lower than the height of the ceiling make the interior walls a permeable boundary that allows the circulation of the worshippers and light from the periphery to the core and vice versa.

The core includes the altar, positioned by the eastern wall following the Christian tradition, the baptismal font, the place for the choir and the section intended for the congregation. The ambulatory spaces contain the narthex, the Stations of the Cross, the shrine for the Virgin Mary and the passage that leads to the sacristy.

One vertical wall intersects the southern and western walls and extends beyond the perimeter of the chapel, emphasizing the main entrance and separating the corner from the rest of the narthex to provide a private space for the confessionary. Two walls at right angles pierce the northern wall to form the shrine dedicated to the Virgin Mary.

Since the chapel was designed as a rather dark space, the natural light admitted to the interior by means of three large skylights is modulated by the structure to produce diffused light that falls on the smooth surface of the concrete walls then spreads out as a soft luster. The placement of the skylights was carefully thought to bring the attention of the worshippers to the altar and the shrine of the Virgin Mary. Minor sources of natural light exist in the form of long and narrow vertical windows where the perimeter walls are pierced by secondary walls at the main entrance and the shrine for the Virgin Mary.
Ramp leading to the chapel

Main entrance to the chapel
Chapel Floor plan
5/64" = 1'-0"
Chapel
Longitudinal section
3/32" = 1'-0"
Chapel
Longitudinal section
1/8” = 1’ - 0”
Chapel

Roof structural system

1/16" = 1' - 0"
Chapel
Northwestern elevation
5/64" = 1'-0"
Chapel
Southeastern elevation
5/64" = 1' - 0"
Narthex

At the narthex light enters though a long and narrow skylight falling on the western wall like a glow that welcomes the worshippers as they enter the chapel. Only a little of the natural light that is admitted through the skylight at the narthex finds its way into the core of the chapel, as most of it is shielded by the walls that separate the ambulatory from the core.

The quality of the light at the narthex changes with the time of the day, due to the orientation of the skylight. This change makes attending the early morning, noon or afternoon service different experiences. In the early mornings and in the afternoons, a soft glow washes down the western wall and does not make a significant change from the time the service begins and the time the service ends. However, for the service starting at 11:15 am, the worshippers will notice a soft glow at the narthex as they arrive and will see the western wall lit by direct sunlight as they leave.
Chapel

Detail of the skylight at the narthex

1/2" = 1'-0"
View toward the narthex at 12:15 p.m.

View to the ambulatory from the main entrance at 12:15 p.m.

View toward the narthex at 5:00 p.m.

View to the ambulatory from the main entrance at 5:00 p.m.
Main Entrance

The main door of the chapel has been designed considering the difference that exists between the way the worshipers enter the chapel for the service, gradually and everyone at their own time, and the way they leave the chapel after the service, everyone at once. The main door is a door within a door. A large pivoting concrete door flush with the wall in which a smaller wooden door has been inserted.

Before the service starts the concrete pivoting door will be locked so the congregation will access the chapel using the smaller wooden door. Once the service ends, the usher will lock the wooden door and will open the large pivoting door.

Since the concrete pivoting door is much larger than the wooden door, the difference between the arrival and the departure will also be reinforced by means of allowing more natural light inside the chapel. At the arrival the wooden door admits a lesser amount of light as compared to the amount of light that will enter when the concrete pivoting door is open. This effect will be more noticeable for the 11:15 am service, because by the time the service ends at 12:15 pm the rays of the sun will be almost perpendicular to the main door.
View toward the narthex at 12:15 pm with the pivoting door closed

Floor plan detail showing the entrance to the chapel with the main door closed

View toward the narthex at 12:15 pm with the pivoting door open

Floor plan detail showing the entrance to the chapel with the main door open
Skylight above the altar

The semi-circular skylight above the altar is framed by a deflector that follows the geometry of the section of a cone. Made of reinforced cast in place concrete, the deflector is an integral part of the structure of the roof. The deflector receives the sunlight and directs it to the interior face of the eastern wall, spreading on the smooth surface of the concrete wall producing the effect of an aura of diffused light, a metaphor of the Divine Light.

Some not so desirable variations on the pattern of light cast on the eastern wall and even the presence of direct light were observed with changes in the time of the day and the seasons. In order to minimize these variations, a study was performed in which the angle of inclination of the deflector with respect to the vertical varied. The geometrical construction based on the section of a cone offered the best results. Additionally, a thin layer of alabaster inserted between the layers of the laminated glass will contribute to filter the light.

It was also observed that the aura of light was at its best when the rays of the sun were perpendicular to the deflector. For that reason the orientation of the chapel has been tuned so the best effect of the light was offered for the most important celebration of the year, Easter Mass.
The images show a slight difference in the pattern of light cast by two deflector geometries. The photographs on the left correspond with the geometry of a section of a cone and the photographs on the right correspond with the geometry of a section of a cylinder.
Shrine for the Virgin Mary
Shrine for the Virgin Mary

Providing a special place for the image of the Virgin Mary was of great importance for this project, as She is held in high regard in the tradition of the Catholic Church. Additionally, the parish of Blacksburg is dedicated to the Virgin Mary.

The shrine for the Virgin Mary was conceived as a side chapel located at the end of the ambulatory, close to the altar. A carefully placed opening on the internal wall that separates the nave from the ambulatory allows a visitor entering the chapel to make a visual connection with the shrine.

The space of the shrine is defined by two walls at right angles that pierce the external boundary of the chapel at the northern façade. Through its triangular glass ceiling, the shrine brings northern light into the chapel. The relationship between the height of the walls that define the space of the shrine and the opening through which it connects to the interior of the chapel is such, that the direct sunlight from the west that falls on the northern façade during the afternoon is deflected and transformed into diffused light. The light admitted in the afternoon is brighter and by the time of the sunset, it acquires a beautiful color providing a special atmosphere for the prayers of the Rosary.
Shrine for the Virgin Mary, preliminary design.
This design allowed direct sunlight into the chapel.

Shrine for the Virgin Mary, final design.
This design transforms the direct sunlight into diffused light.
Shrine for the Virgin Mary
Detail of the glass ceiling
Section A - A
1/2" = 1' - 0"

Shrine for the Virgin Mary
Detail of the glass ceiling
Section B - B
1/2" = 1' - 0"
Chapel
Section showing the access to the sacristy
5/32" = 1'-0"
Chapel
Access to the sacristy
Axonometric
1/16" = 1' - 0"
Administrative offices / Residence for the priest

Supporting spaces for the administration of the parish and the residence for the priest are located in a long and narrow two-story building, trapezoidal in plan across the plaza from the chapel. The lower level of the building is set against a retaining wall that produces an eleven-foot drop in the terrain with respect to the level of the plaza. One portion of the upper level of the building rests on the ground at plaza level and the remaining part projects out, resting on top of the lower level.

The public spaces, which include one meeting room, restrooms and the office for the administrator of the parish and the priest, are located on the upper floor at plaza level, while the private residence for the priest is located at the lower level.

Cast-in-place concrete walls, beams and floor and roof slabs, constitute the structure of the building. The external concrete walls are made of two layers of concrete, with a core of insulation in between. The interior and exterior surfaces of the cast-in-place architectural concrete are smooth, so when sunlight falls on them it creates a lustrous glow.

The south-east façade of the building, presented towards the plaza, with only one opening that creates the entrance to the building, reads as a less permeable boundary, while the northern wall opens up, with large portions of glazing, letting abundant northern light into the building and allowing great views toward the mountains. At the entrance of the building the first thing a visitor notices is an image of the Virgin Mary set against a glass wall with a splendid view to the mountains in the background.
Residence for the Priest
1  Entrance Hall
2  Meeting Room
3  Restrooms
4  Janitor’s closet
5  Administration Office
6  Access to the residence for the priest

Administration building
Floor plan
1/8" = 1' - 0"
Residence for the priest.
Floor plan
1/8" = 1'-0"
Administrative offices / Residence for the Priest
Section
3/16" = 1 - 0"
School

The school is located in the northeastern corner of the complex. Cast-in-place concrete walls, columns, beams and floor and roof slabs constitute the structure of this building.

The classrooms and all the supporting spaces of the school have been arranged in two stories on the southwestern side of the building, leaving the rest of the interior space open as a double height indoor play area. Three of the four walls that define the perimeter of the building are made of two layers of architectural cast-in-place concrete with a core of insulation in between.

At the northeast façade, the solid wall becomes a series of concrete columns. Enclosed by glazing this "transparent wall" allows a connection with the outdoors, lets abundant light from the north into the building, and connects to the outdoor play area.

Direct sunlight finds its way into the building in the early mornings and in time for the sunset, casting lines of light and shadows on the floor and the walls. Five skylights bring additional natural light to the classrooms, supporting spaces and indoor play area.
On materials
On Materials

Reinforced cast-in-place concrete is used throughout the church. More than a material, cast-in-place concrete is a process that registers the care, attention and effort that is put on it. Its plasticity contributes to achieve the monolithic character envisioned for the buildings that compose the church complex.

The material quality of the walls throughout the church is of great importance for this thesis, as they are the elements that receive the sunlight, modulate it and bring it into the buildings. For that reason their texture is intended to be smooth, so when sunlight falls on them it will spread out their surface as a lustrous glow.

The distinctive character of the walls is achieved using formwork built with high density overlay plywood boards. Minimal joints between the boards will also contribute to achieve the monolithic quality of the buildings.
Conclusion

In Architecture light can be modulated through structure and treatment of materials to create special atmospheres in buildings.
Bibliography


Image credits
All images by author
Vita

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