

# North Dakota State University Graduate School

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**Title**

Domus Dei: The House of God

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**MASTER OF ARCHITECTURE**

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DOMUS DEI: THE HOUSE OF GOD

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By

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## **ABSTRACT**

The architecture of Catholic church buildings has an intrinsic connection with the liturgy, theology, and tradition of the Church. Creating transcendent spaces to engage in the worship of God has been an essential part of Catholic life since the earliest days of Christendom. The questions this project seeks to address are as follows: How can the beauty of a contemporary church building signify the unchanging solemnity of Catholic worship and aid in the search for the Divine, and how can this beauty be returned to new churches in an economical way through form, current construction methods, and materials? How can these principles be applied to design a transcendent sacred space for a small parish with limited resources? This project resulted in a design solution for a new Catholic church building that incorporates each of the following design ideals: beauty, liturgy, geometry, materiality, and accessibility.

## **ACKNOWLEDGMENTS**

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## **DEDICATION**

To my grandfather, Gerald. Thank you for your example of integrity, ingenuity, and faith.

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## **1. INTRODUCTION**

The architecture of Catholic churches has an intrinsic connection with the liturgy, theology, and tradition of the Church. Creating sacred spaces to engage in the worship of God has been an essential part of Catholic life since the earliest days of Christendom, but sacred architecture has undergone many notable shifts over the last century. These design changes in modern sacred architecture have partly stemmed from liturgical reform within the Church, but also from societal turmoil from without. This has resulted in many churches built over the last 70 years that fail to live up to their potential, through a lack of architectural beauty, shoddy construction, and tawdry materials. The era of the beautiful Catholic church building had stopped.

### **1.1. Problem Statement**

#### **1.1.1. Research Question**

The questions this research seeks to address are as follows: How can the beauty of a contemporary church building signify the unchanging solemnity of Catholic worship and aid in the search for the Divine, and how can this beauty be returned to new churches in an economical way through modern construction methods? How do different forms/floorplans affect the affordability of constructing a new church?

#### **1.1.2. Proposed outcomes**

The research section of the project seeks to provide both subjective and objective data that will help identify key design principles to follow in the development of new Catholic church that is seeking to balance beauty and attainability. The subjective data will result from analysis of existing sources on the Catholic view of beauty and its application and role in sacred architecture. The objective data will be related to the cost analysis portion of the research,

resulting in a comparison of material costs for several church floorplan forms and material options.

## **1.2. Objective**

### **1.2.1. Aim**

This research project examined designs for a new Catholic church building through the lens of each of the following four categories:

- Form
- Liturgy
- Structure
- Cost

The goal of this research was to find the optimal combination of the above categories for a new church construction project, in order to create a sacred space appropriate for the Catholic liturgy in a cost-effective manner. Variations in form were explored in multiple ways, with the vesica piscis shape serving as the proportioning system for the floorplan shapes and changes in verticality throughout building elements. The progression of possible forms were digitally modeled and the material costs for each were estimated, with the focus being on how each iteration affects the estimated construction costs. The desired outcome will be a joint architectural form and structural method that provides a sanctuary that expresses the four transcendentals of Catholic theology: truth, goodness, beauty, and unity, and does so in an easily constructible way that is financially accessible for small parish communities.

### 1.2.2. Significance

The role of sacred architecture in worship is one of high significance. The church building can and should embody signs and symbols of the faith. The United States Council of Catholic Bishops, in the document *Built of Living Stones: Art, Architecture and Worship*, wrote:

Because the church is a house of prayer in which the Eucharist is celebrated and the Blessed Sacrament is reserved, a place where the faithful assemble, and a setting where Christ is worshiped, it should be worthy of prayer and sacred celebration, built in conformity with the laws of the Church, and dignified with noble beauty and intrinsically excellent art. (2000, p.9)

The church building serves not only as a space for the congregation to gather, but it also serves as a meeting point between God and man. Sacred architecture in the Christian tradition is a physical representation of the Incarnation in which God became man, and as such holds immense value in the Church for its ability to facilitate a sacramental encounter with God.

Sorting through the numerous styles and forms of Catholic church architecture in the pursuit of a building methodology that captures the transcendental nature of the sacred liturgy in an attainable design is a valuable exercise due to the relevance of the questions this process seeks to answer. New parish churches are constructed regularly as communities and congregations ebb and flow and old structures fall into disrepair or become too expensive to maintain. Having a church in which the faithful can come and worship God has always been a priority for the Catholic community and will continue to be so in the future.

## **2. BACKGROUND**

### **2.1. Background**

The Catechism of the Catholic Church, paragraph 1145, states: “A sacramental celebration is woven from signs and symbols. In keeping with the divine pedagogy of salvation, their meaning is rooted in the work of creation and in human culture, specified by the events of the Old Covenant and fully revealed in the person and work of Christ.” The church building is itself viewed as a type of sacramental, full of signs and symbols that can facilitate an encounter with God. Since the earliest days of Christianity, and even earlier in the days of the Jewish temple in Jerusalem, the church has served as a place set apart, a place reserved solely for the worship of God.

There has been much debate about the proper and correct way to design a church throughout the twentieth century, and especially after the conclusion of the Second Vatican Council in 1965. Architectural interpretation of the results of the council has varied widely, and many Catholic churches constructed in the United States since the conclusion of this council have strayed from the precedent of centuries of sacred architecture in efforts to make the practice of the Catholic faith and liturgy more accessible to lay people. This has resulted in contemporary Catholic churches being constructed in a plethora of architectural styles and forms. While this has allowed sacred architecture to express the universality of the Church through a variation of styles and forms, it has also led to many churches that completely eschew many traditional design elements and liturgical symbolism. However, over the last decade or two, there has been a significant movement within the Catholic Church in America that has seen a return to more classical forms of sacred architecture in many new parish building projects.

## 2.2. Literature Review

### 2.2.1. Previous Research

The importance of beauty in Catholic church architecture has been chronicled for centuries, and a sizeable body of literature on the subject has been produced examining the state of modern liturgical architecture and the divergence from historic architectural precedent that has occurred post-Second Vatican Council. The design process and construction methods of church buildings is another topic that is covered in a number of books, due to the unique approach required for this building typology.

*Architecture in Communion*, by Steven Schloeder, gives the argument that churches built in the “true spirit of the Second Vatican Council” can indeed be built in a way that gives glory to God and helps sanctify His people (1998, p. 12). Beginning by asserting the importance of properly determining the purpose of a church building and the theological implications of art and architecture, the author analyses the role of traditional church forms in the liturgy and how sacred architecture emerging in the recent past “is in a state of confusion... It is directionless” (Schloeder, 1998, p. 20). The architecture that has emerged after Vatican II is “spiritually sterile” (Schloeder, 1998, p. 20), which introduces a contradiction when it is compared to the vibrancy of the liturgy that the council intended to produce. Further confusion has arisen due to various interpretation of if the form of the church should emphasize the Body of Christ, or the people of God.

Historically and traditionally, the church was a space serving to elevate the minds and hearts of the congregation to heavenward to God. During the 20<sup>th</sup> century, many liturgists began seeking spaces that brought God down amongst the people, emphasizing the Mass as communal meal rather than sacrifice (Schloeder, 1998, pp. 26-28). Schloeder argues that focusing only on



the people of God misses the most important parts of the liturgy, namely the spiritual, and points out that there is a false dichotomy between these two elements; the true task and purpose of sacred architecture is to create a transcendent space that unifies the human and the spiritual (1998, p. 28). However, although God is truly present amongst His people, “this is neither the only way nor even the primary way in which God is encountered in the liturgy” (Schloeder, 1998, p. 29). An emphasis on the spiritual elements of the Mass, especially the Eucharist, is an essential component that is missing in many modern churches. The author states that there is a strong correlation between the state of theological understanding in the Church and the quality and spiritual expressiveness of her architecture (Schloeder, 1998, p. 31).

This book will be informative in informing the liturgical and theological implications of the church design options. However, Schloeder does not address church construction methods and budget in depth, which are included in the scope of this research.

In his book *The Church Building as a Sacred Place*, prominent church architect and professor Duncan Stroik emphasizes the role of a church as a place to facilitate an encounter with God. He clarifies that the church is sacred regardless of its aesthetics and symbolizing:

But is not a church building by definition “sacred,” in spite of its architecture and iconography? Is it not the dedication of the church, the altar stone, the places for the sacraments, the holy icons, and the faithful who worship there that make a building sacred? (Stroik, 2012, p. 2).

However, Stroik writes, the architecture, art, and materials of a church have great potential to inspire the mind towards God, as a truly beautiful space can rouse the spirits of both those worshipping and those outside: “And so we witness the great effect of Chartres and St. Peters on believers and unbelievers alike, due in part to their soaring spaces, durable construction,

exquisite iconography, and representation as the house of God within the landscape” (Stroik, 2012, pp. 2-3). A Catholic church should express to the world the intrinsic sacredness of the sacred liturgies that take place there. In order to express this sacred mission, Stroik proposes three essential attributes for churches: “It is common to describe architecture as having three characteristics: *Firmitas*, *Utilitas*, and *Venustas*. These are the ancient principles of Durability, Convenience, and Beauty...” (Stroik, 2012, p. 8). Durability and strength of construction represents the unchanging truths of the Catholic faith. Just as the doctrine of the Church has been unchanging over millennia since the Incarnation of Jesus Christ, so too the architecture of the church building should signify the unchanging lineage of the faith today. The space should be designed to fully accommodate the celebration of the Mass and the sacramental life of the parish. Above all, the church should be built with great beauty, as beauty calls the heart and mind out of oneself and towards God.

Another publication that discusses liturgical design is *Sacred Geometry: Form and Practice* by Robert Lawlor. There is an unbreakable bond between houses of worship and symbolism expressed through the built form, particularly in ordered forms and proportion. “To seek truth has always been to seek the Invariable... To enter a temple constructed wholly of invariable geometric proportions is to enter an abode of eternal truth” (Lawlor, 2003, p. 10). Geometry, numbers, and religion have been intertwined since ancient times, and Lawlor analyzes some of the numerical and proportional significance that has emerged over time from cultures and religions around the world.

The book opens with a quote taken from book 5, chapter 14 of *De Consideration* by St. Bernard of Clairvaux: “What is God? He is length, width, height and depth.” While this may seem to reduce God to a mere mathematical formula or ordering of numbers, Bernard continues

by writing: “Length because of His eternity, Breadth because of His charity, Height because of His majesty, Depth because of His wisdom.” Precisely because God is infinite and all-encompassing, this is why everything that is measured and ordered and beautiful is dependent on Him.

Numerical significance often derives from the importance of unity. As Lawlor writes: “Unity, as the perfect symbol for God, divides itself from within itself, thus creating Two: the 'self' and the 'me' of God, so to speak; the creator unity and the created multiplicity” (2003, p. 23). From the Christian perspective, the shape of the vesica piscis is especially important. This shape can be seen from the earliest days of Christianity in the symbolic ‘Ichthys’ fish shape historically representative of Jesus Christ, both as a fisher of men and as creator:

The overlapping circles - an excellent representation of a cell, or any unity in the midst of becoming dual - form a fish-shaped central area which is one source of the symbolic reference to Christ as a fish. Christ, as a universal function, is symbolically this region which joins together heaven and earth, above and below, creator and creation. (Lawlor, 2003, p. 33)

Deriving from the first circle, the overlapping circles of the vesica piscis radiate out from origin, just as all creation radiates out from the creator.

Another key proportioning method found in religious architecture since ancient times is the golden section. Often understood as only a ratio, Lawlor explains the increased intricacy of a proportional relationship:

Not only then is a ratio  $a : b$  the fundamental notion for all activities of perception, but it signals one of the most basic processes of intelligence in that it symbolizes a comparison between two things, and is thus the elementary basis for conceptual judgement. A

proportion, however, is more complex, for it is a relationship of equivalency between two ratios, that is to say, one element is to a second element as a third element is to a fourth: a is to b as c is to d, or a: b: : c:d. (2003, p. 44)

The golden section can be found in numerous historical Catholic churches and is often used to develop floorplans and facades. The symbolic significance of the proportion derives from its depiction of unity:

It is the most intimate relationship, one might say, that proportional existence - the universe -can have with Unity, the primal or first division of One.

For this reason the ancients called it 'golden', the perfect division, and the Christians have related this proportional symbol to the Son of God. (Lawlor, 2003, p. 46)

Just as the golden section's appearances in nature point to one common created origin, so to does the manifestation of the golden section in the built environment point to God as the universal One from which all things proceed. Lawlor relates it to the beginning of the Gospel of John: "In the beginning was the Word, And the Word was with[in] God, And the Word was God" (John 1:1, as cited Lawlor, 2003, p. 47). Sacred architecture is meant to be a physical representation of the divine truths that are professed there, and the geometrical proportioning systems of the vesica piscis and the golden section point to God as the creator and origin of all things, a fitting theme for a building intended to serve as a house of God amongst His creation.

*Building Type Basics: Places of Worship*, by Nicholas W. Roberts, provides a detailed look at the design procedures for a church building project. Roberts describes the process of working with a parish throughout the process as a journey of faith, and emphasizes the obligation of the architect: "For an architect, it is a responsibility that elevates the meaning of professionalism to a new plane: Worship spaces will stand as landmarks for years to come, they

play a central role in the life of the community, and they are built through the sacrifice and devotion of congregants” (2004, p. 1). Spaces created for religious worship require a unique set of programmatic and schematic design decisions, designed around the liturgy and ritual that will take place. This involves integrating special considerations for symbolism, sound, light, art, and scale into the standard architectural design issues, such as structure, site planning, HVAC, emergency egress, and environmental sustainability.

Roberts touches on the process of meeting with parishioners and clergy, a slightly different process than most clients require. Materiality and constructability are two more topics present in this book, which are topics that are vital to this research. Additionally, the budgetary estimation present in the book will serve as a helpful index for the cost portion of the research to be done.

### **2.2.2. Gap Identification**

One evident gap in the literature reviewed appears to be a synthesis of the topics of each of the sources into a cohesive design directive that would benefit a parish undertaking an actual church building project. This research aims to draw from each of the resources listed and develop the parameters of such a design directive.

## **2.3. Project Type**

This thesis project is an examination of beauty in Catholic liturgical architecture, its influence on cost, and creating a Catholic church building design that serves as a possible design solution that strikes a balance between beauty and attainability. Many existing and planned Catholic church buildings seem to fall firmly on one side or the other of the beauty/cost line, so harmonizing these ideals into a single design is the predominant aim of this thesis. Catholic

churches around the region and the nation as a whole have, over the past two decades, begun to return to placing an emphasis on beauty expressed through the architecture and highlighting the integral link between the built form and the liturgy celebrated within.

#### **2.4. Project Issues**

The principal issues addressed in this thesis are the dearth of architectural beauty and symbolism in contemporary and recent Catholic churches, and the normally high cost of constructing a Catholic church that is classically beautiful. The first issue stems from many sources, but several of the main factors are a secularization of cultures, misunderstanding of Church liturgical ideals and directives, and a lack of knowledge of what beauty in architecture is and how it can influence the spiritual life. The second issue, the issue of high construction costs, is somewhat inherent to the building type. Churches are typically large buildings meant to hold many people in a vertically oriented central space, often with ornate decorations, quality materials, and a high degree of craftsmanship. Some of the expense is largely hidden from the users, especially the costs due to the necessary structural, HVAC, electronics and plumbing costs of a large community orientated space. However, much of the additional expense that is unique to buildings of the sacred architecture typology are due to the visible elements that help denote the church as a holy place, set apart from the outside world. These costs are largely derived from the richness of materials and furnishings and the presence of artwork.

### **3. METHODOLOGY**

#### **3.1. Approach**

The methodology of this research consisted of the following stages:

1. Three distinct building forms were chosen, determined by systems of geometrical proportioning for sacred spaces, existing case studies, and Catholic liturgical guides.

- a. The geometry of each floorplan was based off of the shape of the vesica piscis. Consisting of overlapping equal circles, this shape has deep theological symbolism and has been used in the design of churches in for centuries. The size of the building was determined by a seating capacity of 250 people for each form.
  - b. The case studies were used as a basis for the overall shape and proportioning of each floorplan, and for the structural materials.
  - c. Each church layout was designed around the main function of the space, the Catholic liturgy. Each space consists of a nave with space for seating 250 congregants, a sanctuary with altar and tabernacle, confessional, entry space, sacristy space, restrooms, and secondary storage spaces.
2. Each floorplan design was modeled in Revit and was built into a potential three dimensional building form, with floors, walls, windows, doors, roofs, structural columns, and the main structural trusses each building necessitated.
- a. A common steeple design shares between each iteration.
  - b. Each floor type was modeled as structural floor, with the intention of adding a basement underneath.
  - c. A brick on steel stud wall type was used for all exterior walls, and a 6” partition wall type was used for all interior walls.
  - d. The timber roof trusses are 6 panel scissor trusses and the steel roof beams are steel I-beams.
3. The material cost for the modeled elements of each floorplan iteration was estimated using RSMeans software databases.
4. The costs for each element were compared throughout the iterations, and an

estimated cost per square foot for each design was determined.

### 3.1.1. Data Collection

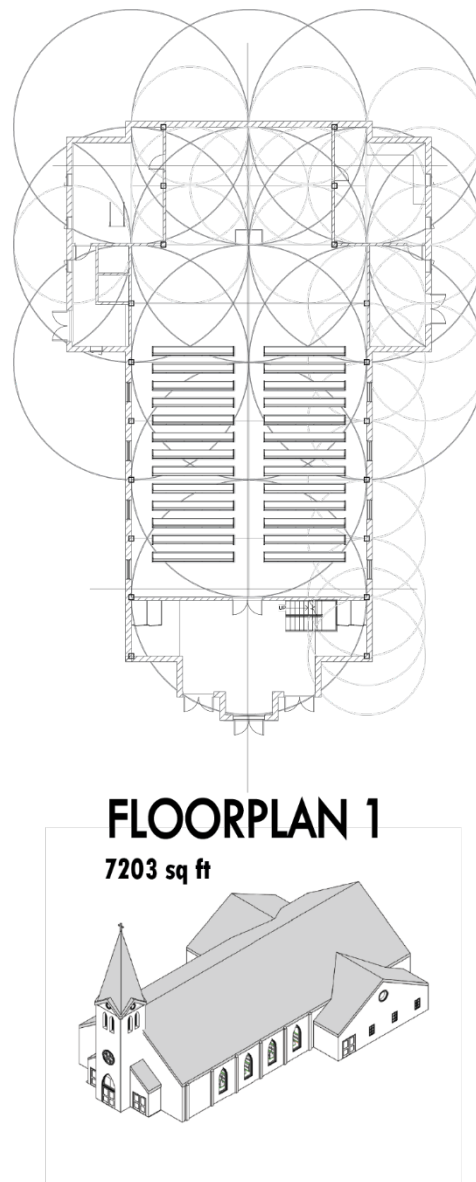
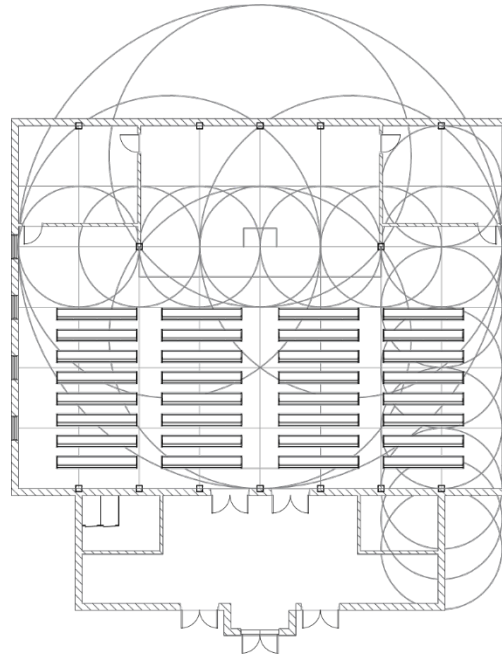


Figure 1. Research floorplan 1

- Floorplan 1: The first option is a traditional Latin cross plan, with a linear nave connecting the narthex to the apse, intersected by a transept. The focus remains on the front of the church and the altar. The vesica piscis shape derives from circle 48 feet in diameter. The floor area is 7203 square feet.





## FLOORPLAN 2

6503 sq ft

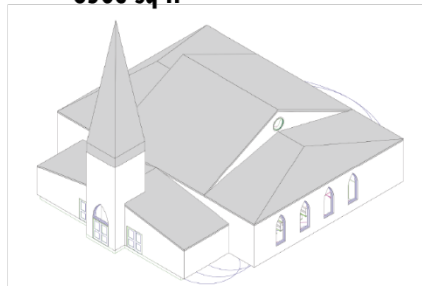
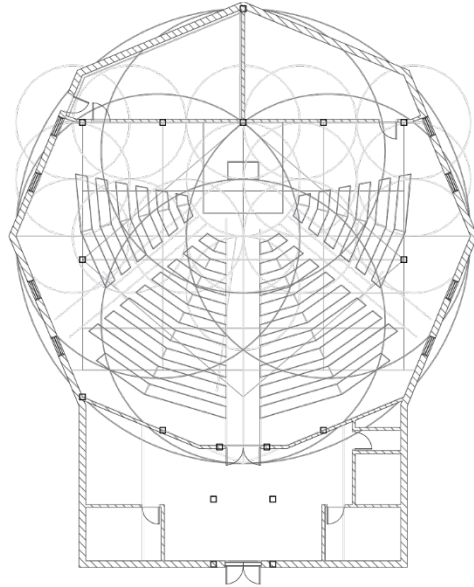


Figure 2. Research floorplan 2

- Floorplan 2: The second form is rectangular, with the altar along one of the walls and the seating for the congregation arranged throughout the center of the plan. The focus is directed towards the back wall and angled towards the altar. The vesica piscis is derived from a circle 80 feet in diameter. The floor area is 6503 square feet.



### FLOORPLAN 3

6291 sq ft

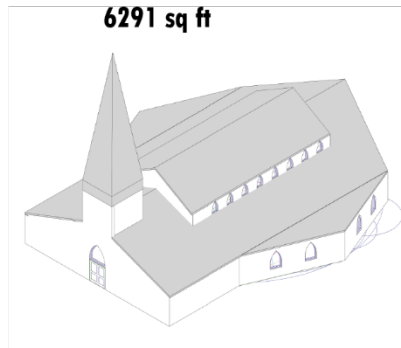


Figure 3. Research floorplan 3

- Floorplan 3: The third design is a radial form arranged around the altar. The congregation all are in close proximity to the altar, with different viewing angles. The vesica piscis is derived from a circle with a diameter of 50 feet. The floor area is 6291 square feet.

### 3.1.2. Analysis

Table 1. Material cost analysis for each floorplan

	FLOOR COST	ROOF COST	STRUCTURAL COLUMN COST	TIMBER STRUCTURAL FRAMING COST	WALL COST
FLOORPLAN 1	270535	130351	30300	106100	198514
FLOORPLAN 2	245724	106894	21000	72000	186676
FLOORPLAN 3	244731	103876	30600	93460	152409

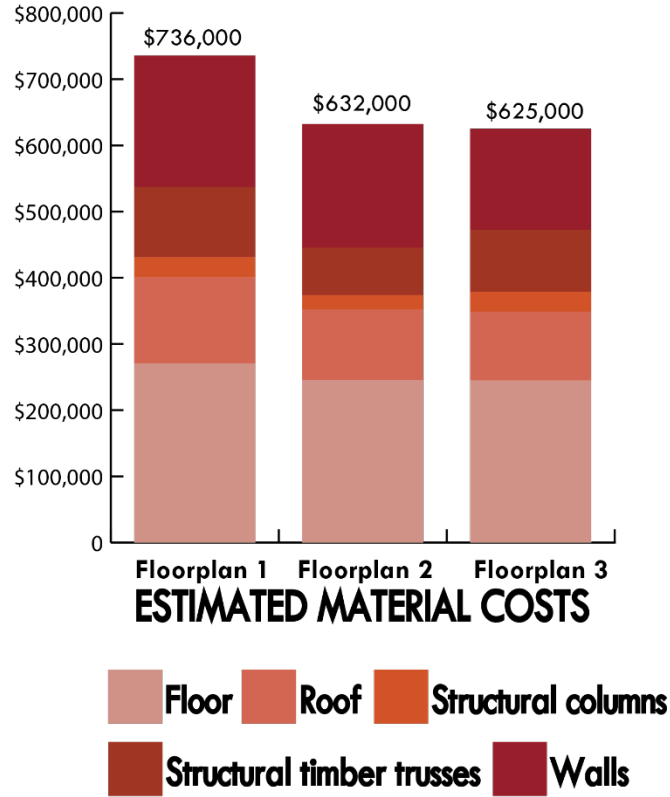


Figure 4. Estimated material costs for the each of the three floorplans analyzed

Table 2. Total cost analysis for each floorplan

	TOTAL PRICE	SQUARE FOOTAGE	COST PER SQ FT
FLOORPLAN 1	735800	7203.00	102.16
FLOORPLAN 2	632294	6503.00	97.23
FLOORPLAN 3	625077	6291.00	99.36

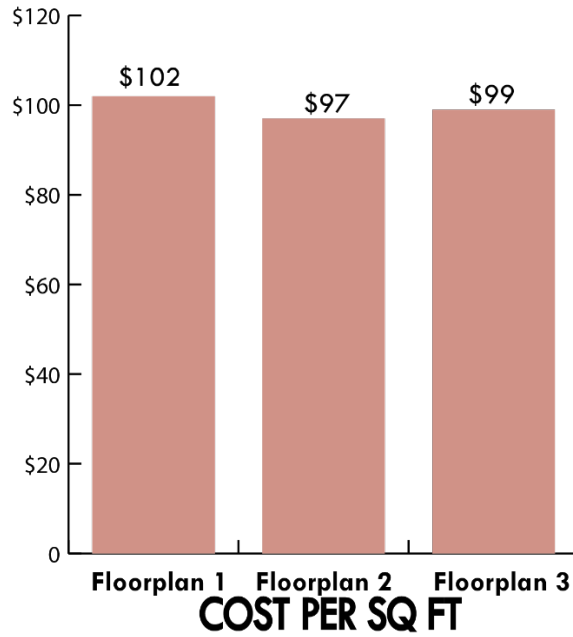


Figure 5. Estimated cost per square foot for each of the three floorplans analyzed

After reviewing the data that was collected in this research, it is clear that the shape of the floorplan has significant effects on the building costs of a church building. Each form has different spatial layouts, material considerations, and structural needs. Using the collected data, floorplan 2 would be most affordable to construct, with an estimated cost per square foot of \$97 with a heavy timber structure and \$103 with a steel structure.

Floorplan 1 had the highest estimated cost per square foot with the timber structure, at \$102, which is 5% higher. Floorplan 3 had the smallest floor area, at 6291 square feet, but had an estimated cost of \$99 per square foot with the timber structure and was the most expensive per square foot with the steel structure, at \$113. Overall, using a steel structure for the roof system would cost between 6-14% more per square foot than using a heavy timber structure.

While each building form can be reduced to a number for easy cost comparison, the liturgical appropriateness and potential for beauty of each must also be considered.

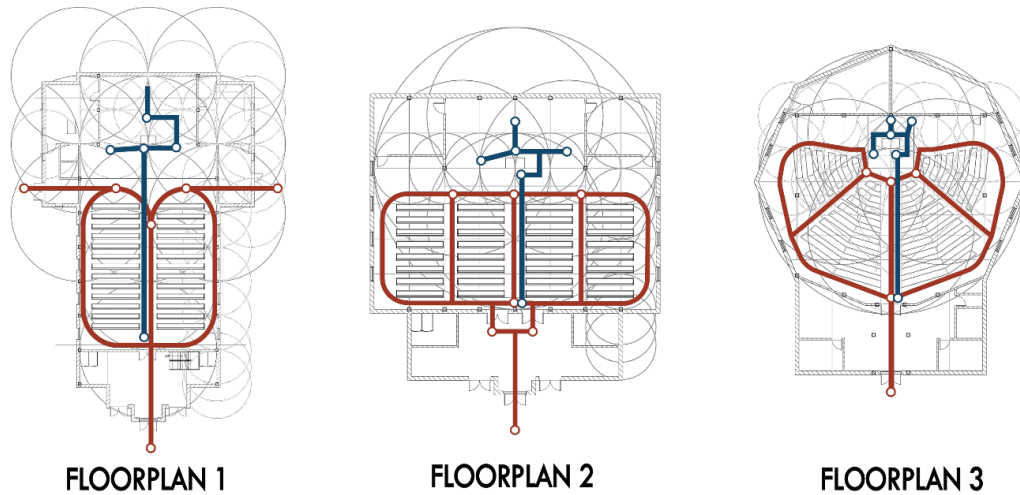


Figure 6. Circulation diagrams for the three floorplans analyzed

In the first floorplan, the Latin cross shape creates a long nave leading forward to the sanctuary, representing the journey from the outer world into the holiness of house of God. The focus of the architecture is on the sanctuary, and the congregation faces the same way during Mass, emphasizing the importance of the altar and the tabernacle.

The rectilinear second floorplan is the most cost effective design, however it does not provide the same liturgical focus that the first floorplan offers. While the altar and tabernacle are on the central axis of the space, the nave does not embody the metaphor of the spiritual journey. The pews are all facing the same way, but the outer rows are directed towards blank walls, rather than the sanctuary, distracting from the central purpose of the space as a place for the faithful to encounter God. Ultimately, this form is largely devoid of spiritual symbolism and potential to enhance the liturgy.

In the third floorplan, the octagonal shape calls to mind the traditional 8-sided shape of Catholic baptistries. The arrangement of the floorplan brings the sanctuary and altar to the center,

with the nave and pews in close proximity. While this allows the people to be closer physically to the liturgy, it also shifts the focus of the space from emphasizing the sacredness of the sanctuary to creating a more theatrical approach to liturgy. The distinction between the Mass as a divine sacrifice and the Mass as only a gathering of God's people is diminished, limiting the liturgical efficacy of this form.

### **3.1.3. Conclusion**

Building a new church is a long, intensive process that relies on the creative input and financial support of many people in a parish. Striking a balance between beautiful design and cost efficiency will always be a challenge for new sacred architecture projects, but the underlying goal should always be to create a worthy space for God to dwell amongst His people. Finding an affordable way to construct such a space will allow many more people to enter into the liturgy in beautiful churches. This can be achieved through many methods, with different building forms, structural types, and materials. Each design choice has the potential to help create a transcendent place to celebrate the liturgy, a place that serves as a physical icon of the beauty of the Catholic faith. However, the symbolic and aesthetic potential of floorplan 1 and its unparalleled suitability for the Catholic liturgy outweigh its marginally higher costs and make it the best option for achieving the goals of this project.

### **3.2. Project Location (larger scale)**

The project is located in the town of Holdingford, Minnesota. Holdingford is located in Stearns County in Central Minnesota and has a population of 740. The town was first settled around 1851, largely by German and Polish immigrants encouraged to settle there by Catholic priest Fr. Francis Xavier Pierz. According to author Marilyn J. Chiat, "Stearns County retains in

its German character and is still home to one of the largest rural Catholic populations in Anglo-America.” (1997, p.146)



Figure 7. Project location within the state of Minnesota



Figure 8. Project location within the town of Holdingford, MN

### 3.3. Project Location (smaller scale)

Holdingford, MN currently has 2 Catholic church buildings: St. Mary's, built by German immigrants, and St. Hedwig's, built by Polish immigrants. The two parishes have since merged and operate as a parish cluster with several nearby churches. The two Holdingford churches are each over a century old and will be closed soon due to maintenance expenses and disrepair.



Figure 9. Project location in relation to existing Catholic churches in Holdingford

### 3.4. Specific Site

The specific site is located at the southeast corner of Prairie and Third Streets, on property currently owned by the existing Church of All Saints. The proposed new church site is directly north of the existing St. Mary's church and parish rectory. This allows for the new



church to use the existing parking lot, located across Third Street. The new site plan follows the traditional liturgical orientation of Catholic churches, with the narthex on the west end, across from the parking lot, and the altar on the east end of the nave, symbolizing Christ as the sunrise, bringing light to the world.

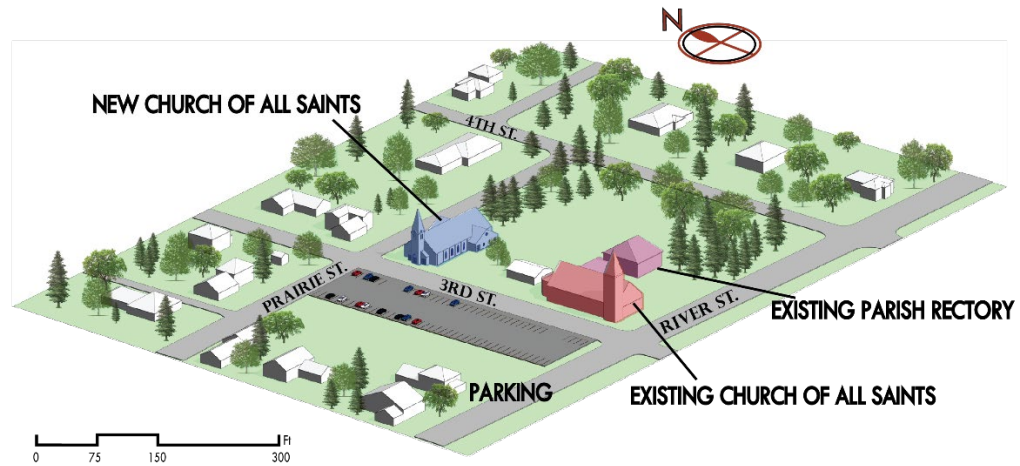


Figure 10. Isometric perspective of new church location on site

### 3.5. Any Other Pertinent Research

One area of pertinent research consisted of examining design trends in Catholic church architecture throughout the Minnesota area over the last 150 years. There have been several major shifts in Catholic sacred architecture during this time. The earliest churches were built with traditional forms, often with Gothic or Romanesque elements. In the 1950s, design language began to shift in a more modern direction, with less refined geometric forms and less ornate detailing. After the Second Vatican Council, which lasted from 1962-1965, many existing norms in sacred architecture were thrown out. A debate arose on the function of the church building, with some arguing for the focus of the church on being firstly a house of God and others arguing for a focus on the church as a house of God's people. This resulted in churches deemphasizing the hierarchy of the sanctuary and altar, in an effort to make these elements more present to the

congregation. Much of the ornament and art traditionally found in Catholic spaces of worship was removed, which was intended to make the people experience God in their midst rather than raising their minds towards God. In the last 20 years, a widespread shift back to traditional forms, materials, and artwork has occurred, spurred by a return to deeper theology and a renewed appreciation for the liturgy as a reliving of the divine sacrifice of the Cross. This has led to a renaissance of churches that emphasize the importance of the altar and the tabernacle.

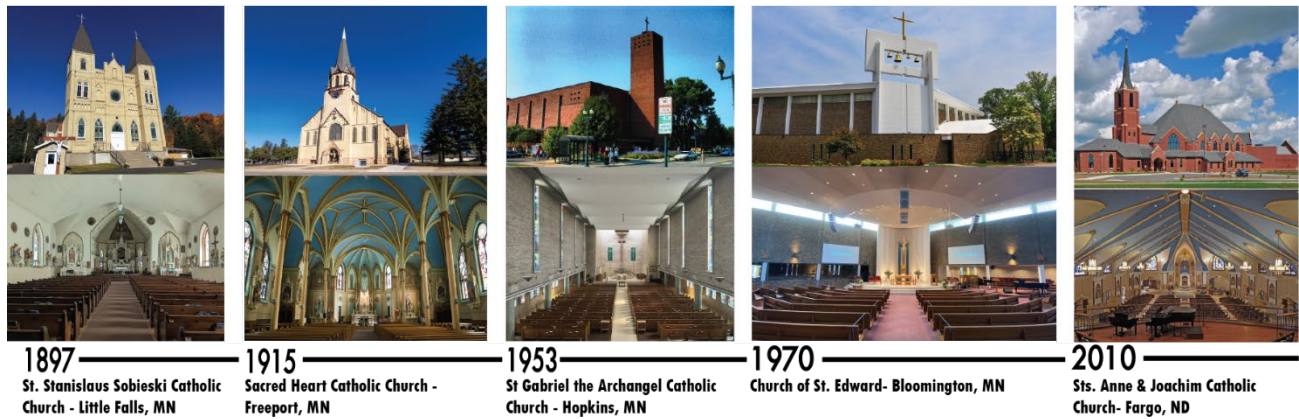


Figure 11. Timeline of regional Catholic church architecture

### 3.6. Precedents / Case Studies

The vast and varied range of architectural approaches to Catholic churches in the United States gives testimony to the importance of the church in worship. Several existing church buildings served as primary precedent studies for this project. The two listed churches exemplify different structural methods but share a common overall form.

#### 3.6.1. St. Michael the Archangel



Figure 12. Church of St. Michael the Archangel interior

The Church of St. Michael the Archangel, located in Pawcatuck, CT, is a historic nineteenth century church that was rebuilt in 2020 utilizing a new heavy timber truss roof structure for the nave and sanctuary. The trusses are arched hammerbeam style, with powder coated steel tie rods and joinery, constructed by Vermont Timber Works. The trusses rest on steel columns, built on new concrete foundations. The walls were also rebuilt, using steel framing. The interior features a simple and yet colorful paint scheme, with the white ceilings highlighting the exposed timber. The exterior of the church features traditional New England clapboard siding and modest ornamentation, capped by a towering spire. The architect was Geddis Architects.



Figure 13. Church of St. Michael the Archangel exterior

### 3.6.1. St. John the Evangelist



Figure 14. St. John the Evangelist's Catholic Church exterior

St. John the Evangelist's Catholic Church in Waynesboro, VA is an example of a new-build church building that uses a steel superstructure throughout the entire building. The structure is comprised of steel columns, single span steel beams, and steel purlins supporting the



roof deck. The structural system is entirely concealed in the finished building. The exterior is clad in a fieldstone masonry veneer, giving the church a traditional look that matches the classical Latin cross form. The interior is similarly designed in a traditional style, with a exposed wooden rafter beams supporting a vaulted ceiling hiding the superstructure above. The nave and sanctuary have a dual tone paint finish, as the walls are painted in light earth tones while the ceiling is painted blue, symbolizing the blue of the skies above the earth. The architect was Harrison Design.

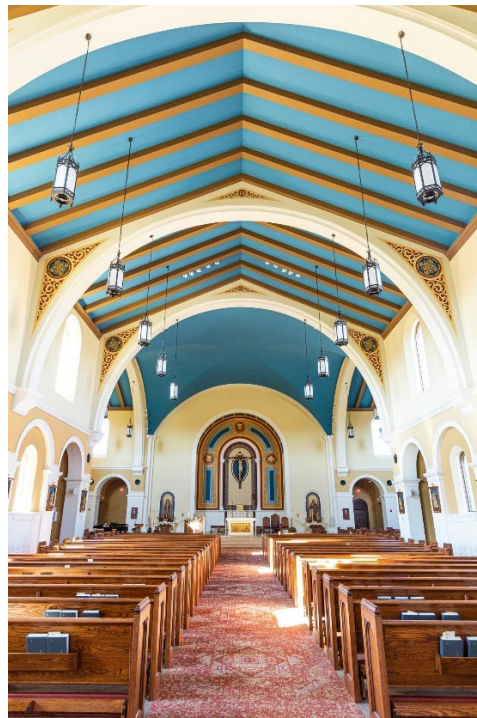


Figure 15. St. John the Evangelist Catholic Church interior

### **3.7. Detailed Space Program**

The major programmatic spaces to be included in the new church are:

- Narthex: this is the main vestibule/lobby space that connects the entrance to the nave. This space serves as the hub of circulation before and after Mass, and should be connected to the basement, restrooms, and choir loft spaces.

- Nave: The main body of the church, the nave consists of a high ceilinged space with pews for the congregation to sit in during the Mass and a central aisle for circulation and liturgical processions.
- Sanctuary: This is the holiest part of the church, holding the altar and tabernacle. This is primarily reserved for the clergy and for altar servers and other volunteers assisting with the liturgy.
- Choir loft: Situated in direct proximity to the nave, this space should be placed to maximize acoustic performance while reducing distraction from the liturgy. The choir loft should be equipped to hold a choir, a variety of musical instruments, and storage for missals, sheet music, and other songbooks.
- Social gathering space: The small town church can serve as a primary space for community events, usually with a large hall in the basement for meals and other functions.

## **4. RESULTS AND CONCLUSIONS**

### **4.1. Final Project Description**

The final design solution of this project is the Church of All Saints, a 14,400 sq ft church building serving the community of Holdingford, MN. The church has a seating capacity of 260 people in the nave, a large entry narthex, a basement social hall and kitchen, and a choir loft. The plan of the church is built in a traditional Latin Cross plan, proportioned by the geometric system of the vesica piscis.



Figure 16. Rendered exterior perspective of proposed design solution; west view

#### 4.2. Project Objectives

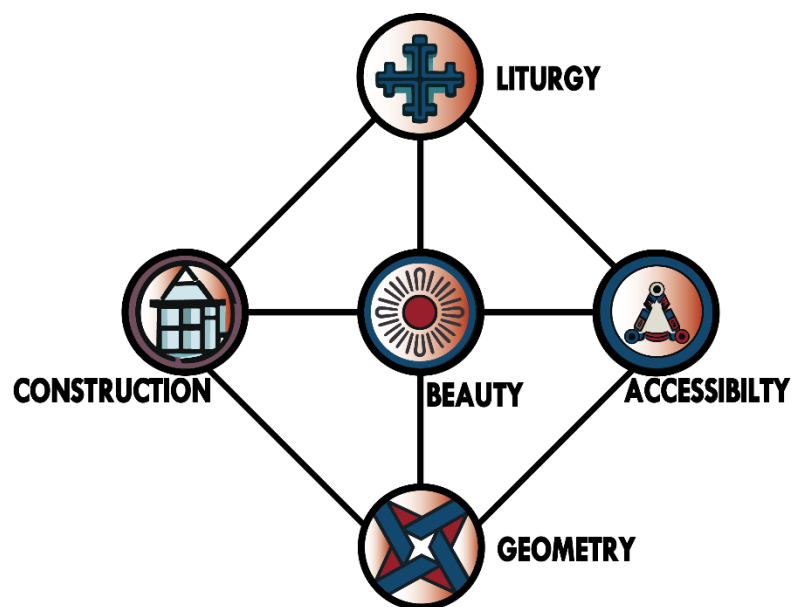


Figure 17. Icons representing design premises

The primary objective of the design was to create a church that illustrates principles of a beautiful Catholic church designed to be affordable for a small parish community. A set of five design premises informed by the project research guided the final design. These five design premises are beauty, liturgy, geometry, construction, and accessibility.

#### **4.2.1. Beauty**

Beauty is one of four transcendentals of the Catholic tradition, along with truth, goodness, and unity. All four of these ideals are intrinsically connected. Beauty raises our senses beyond ourselves to something greater and serves as a visible manifestation of the goodness of God. St. Thomas Aquinas lists integrity, proportion, and clarity as the three essential conditions for beauty.

#### **4.2.2. Liturgy**

The United States Council of Catholic Bishops, writes: “Because the church is a house of prayer in which the Eucharist is celebrated and the Blessed Sacrament is reserved, a place where the faithful assemble, and a setting where Christ is worshiped, it should be worthy of prayer and sacred celebration, built in conformity with the laws of the Church, and dignified with noble beauty and intrinsically excellent art.”(2000)

#### **4.2.3. Geometry**

There is an unbreakable bond between houses of worship and symbolism expressed through the built form, particularly in ordered forms and proportion. The ordered rhythms of geometrical proportion represent the unchanging truths of the Church and provide the basis for symmetry and aesthetic beauty.



#### **4.2.4. Construction**

The construction methods and materials of a building hold the key to its affordability. Choosing simple, attainable methods and materials that are durable and structurally honest allow for the church to be constructed in an economical way without compromising on the potential of the space to facilitate an encounter with God.

#### **4.2.5. Accessibility**

The word ‘Catholic’ means universal, and just so the Catholic church should echo this title by being accessible to all people of all abilities. Building the new church with the main floor at grade and providing an ADA elevator, ramp, and restroom allow for all congregants to come worship.

### **4.3. Project Design and Documentation**

#### **4.3.1. Vesica Piscis**

Vesica piscis translates from Latin to “Vessel of the Fish” and refers to the shape of two equally sized circles arranged so that the edge of one intersects with the center point of the other. This shape symbolizes many important teachings of Christianity, and is the basis of the fish shape, or Icthis, that early Christians used to identify their churches and homes. The recurring presence of fish in the Gospels and Jesus’ call to become “Fishers of Men” (Mk 1:17) give the shape symbolic importance in the mission of the church building to lead people to Christ. The floorplan, elevations, and structural system are proportioned by a vesica piscis derived from circles 48 ft in diameter. This results in a nave that is 48 ft wide, and main structural timber trusses that are 12 ft apart. The tip of the spire is 60 ft high.

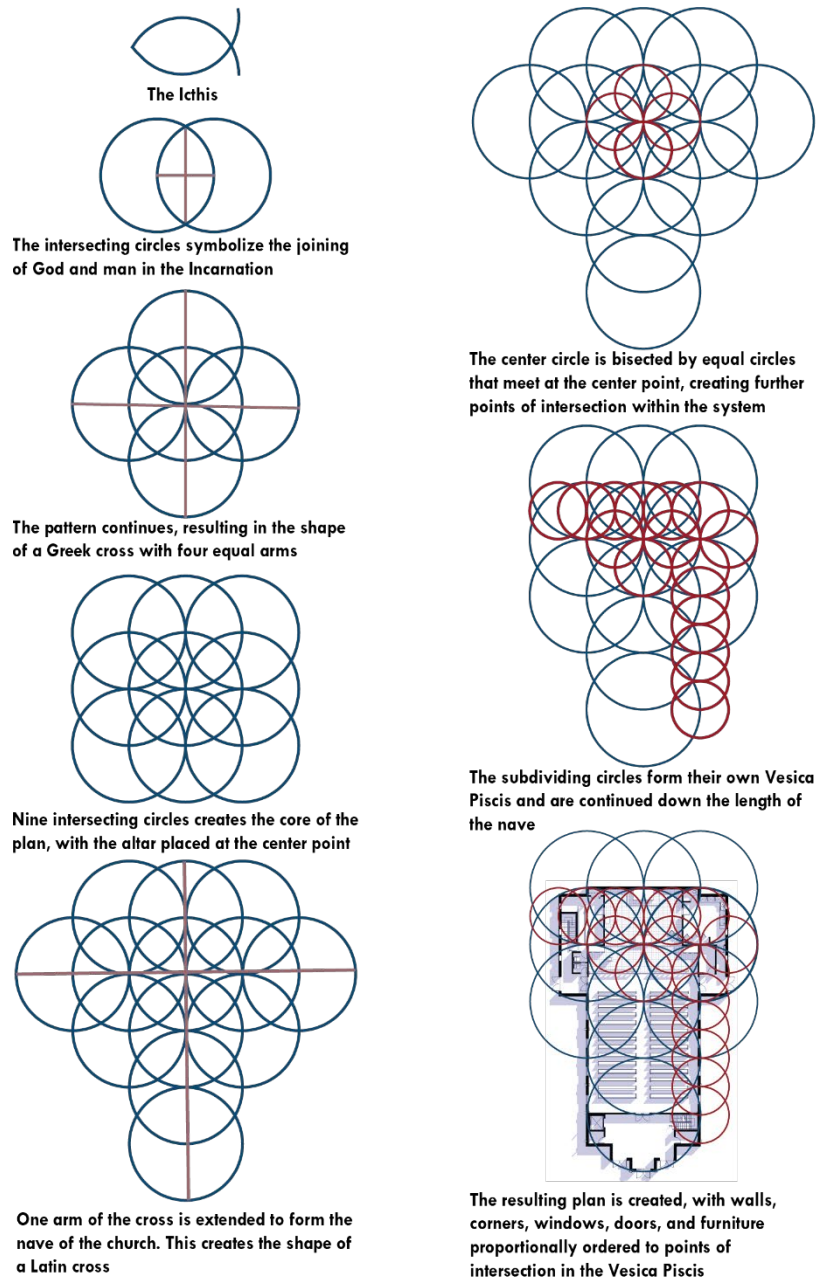


Figure 18. Diagram of vesica piscis geometric system ordering floorplan

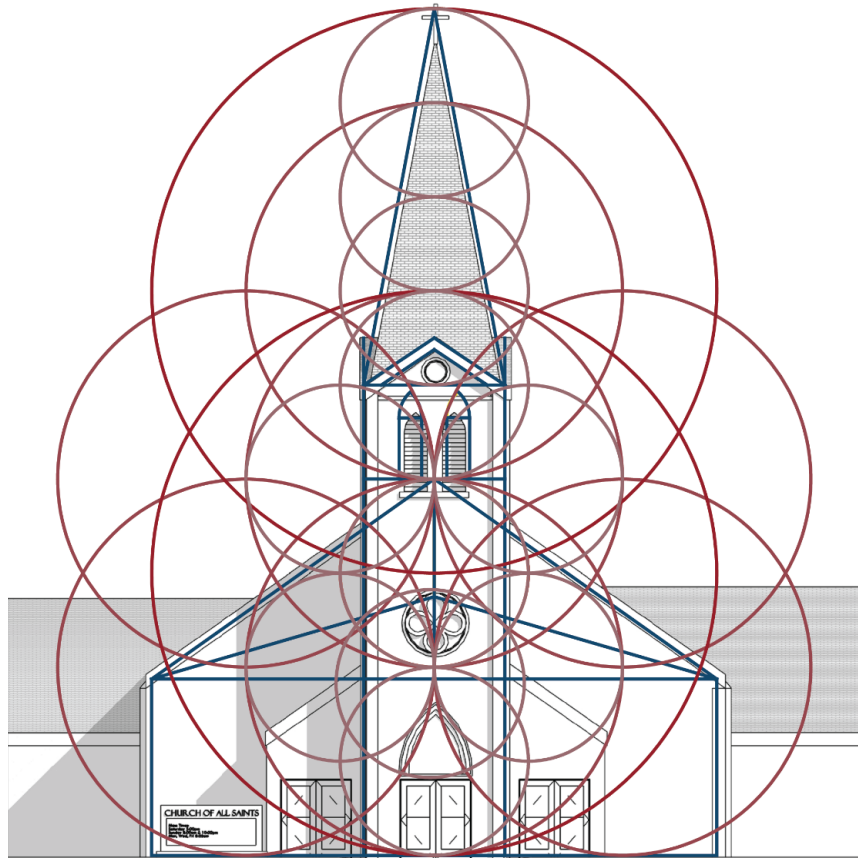


Figure 19. Diagram of vesica piscis geometric system ordering façade and spire

#### 4.3.2. Floorplans

The floorplans are shaped in a traditional Latin cross form and are derived from floorplan 1 from the research section of this project. On the main floor, the main entrance and narthex are on the west, leading to the linear nave. The visual focus is drawn to the altar. The sacristy is located directly off of the sanctuary space. Secondary entrances on the north and south transepts allow for easy access from the sidewalk and from the existing rectory, located to the south.

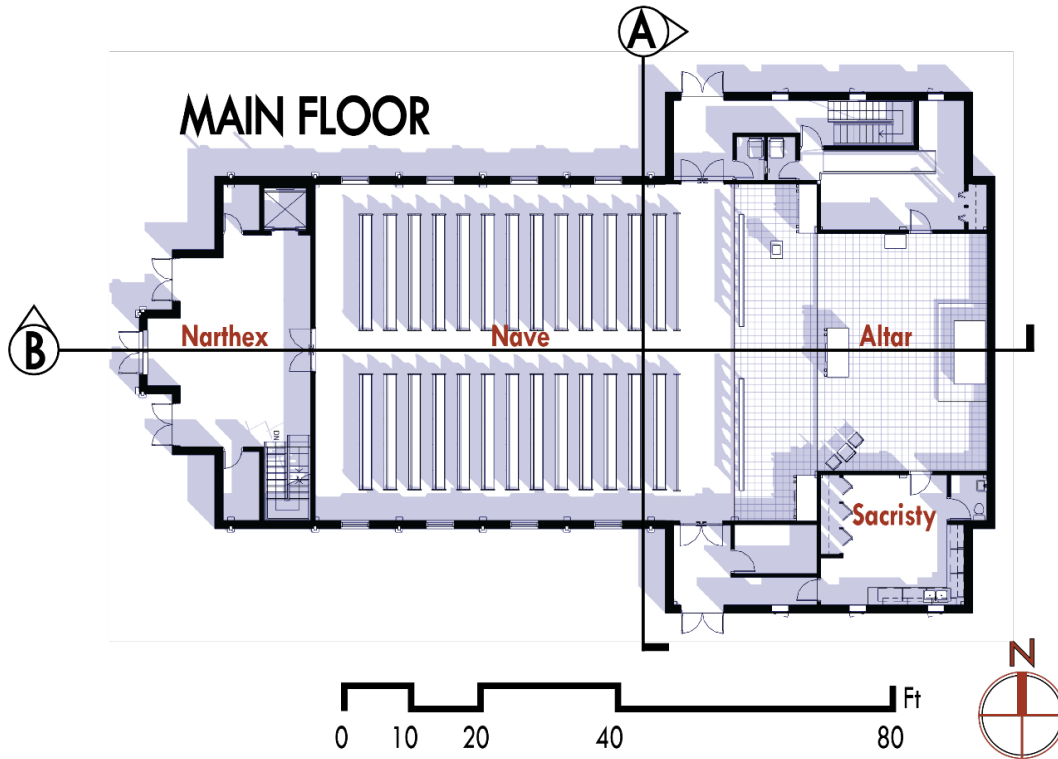


Figure 20. Main floor plan

The basement holds the restrooms, located beneath the narthex and accessible by stairway and by ADA elevator. The large gathering space has a capacity of 160 guests seated at tables, and there is a large commercial kitchen for prepping breakfasts and banquets. The mechanical space holds a 60-ton variable-volume package unit system and the other HVAC components.

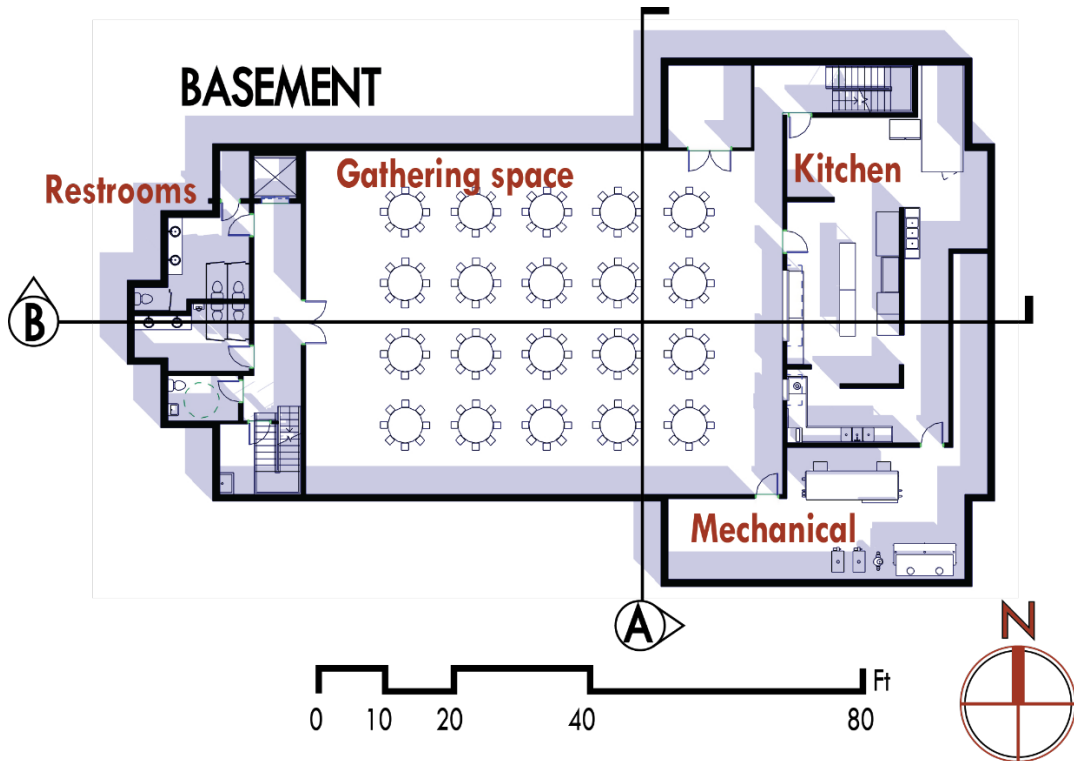


Figure 21. Basement plan

The choir loft is directly above the narthex. It is 12 ft above the floor of the nave. It holds a piano seating for a small choir. There is also an office for the music director, and storage for music, instruments, and audio equipment.

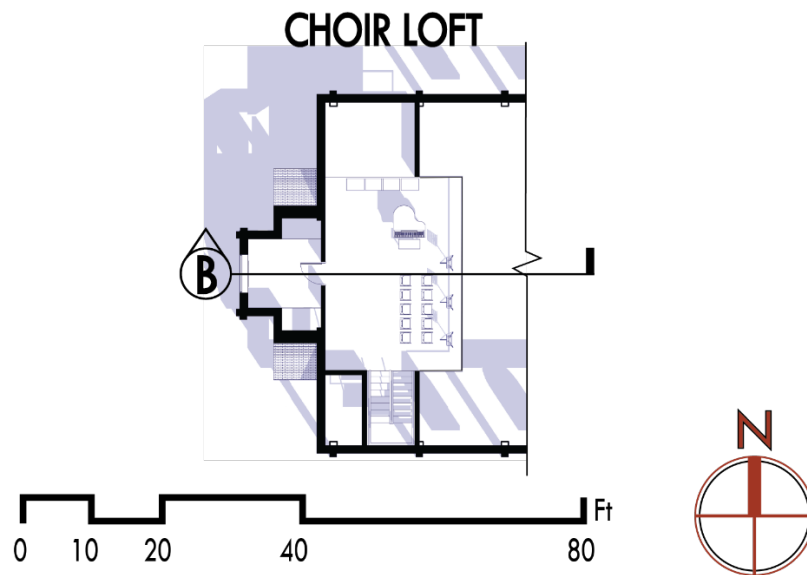


Figure 22. Choir loft plan

### 4.3.3. Sections

The sections show the spacing of the heavy timber scissor trusses above the nave and sanctuary, as well as the light wood attic trusses above the choir loft. The floor in the sanctuary is raised to emphasize the hierarchy of the altar and the tabernacle.

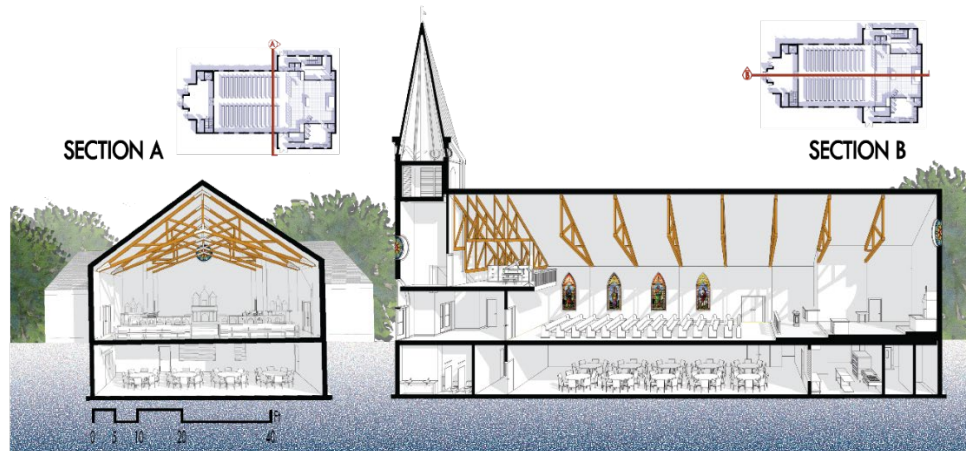


Figure 23. Longitudinal and transverse building sections

### 4.3.4. Structure

Prominent liturgical architect Duncan Stroik writes “It is common to describe architecture as having three characteristics: Firmitas, Utilitas, and Venustas. These are the ancient principles of Durability, Convenience, and Beauty...” (2012, p.8) Materials and structural components were chosen to uphold these ideals; simple, long lasting, and architecturally honest materials emphasize the role of the church building. The use of real brick, while initially more expensive than a brick veneer or siding, symbolizes the durability and permanence of the faith. The exposed heavy timber roof trusses embody a sense of structural honesty, allowing the users to see exactly what is holding up the building, while introducing a natural material to the interior.

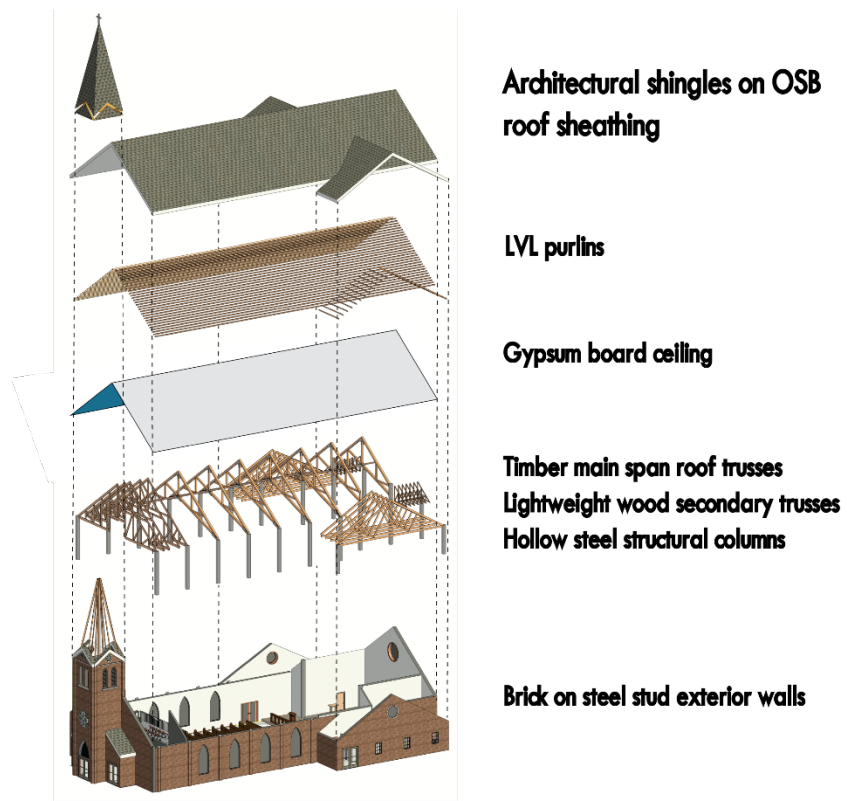


Figure 24. Exploded isometric showing structure and exterior materials

#### 4.3.5. Interior

Use of soft earth tones on walls and blue on ceiling signifies the heavens above the earth, and the transcendent nature of the space, which is further emphasized by the height of the ceiling. Arched stained glass windows filter the light and enhance the radiance of the space, while minimizing distractions from outside. The 14 stations of the cross are positioned on the walls around the nave, flanking the stained glass windows.





Figure 25. Interior rendered perspective showing nave and sanctuary

The 8 Gothic stained glass windows in the nave are sourced from the Sacred Window Rescue Project, an online database that preserves, rehabilitates, and catalogs stained glass and other liturgical art from churches undergoing renovations or closure. This project is run by the Beyer Studio in Philadelphia, PA. Designing for the reuse of existing windows results in a substantial cost savings, and introduces some traditional handcrafted elements into the new church.





Figure 26. Stained glass windows from the Sacred Window Rescue Project catalog

Other design elements that are present in the existing church buildings in Holdingford that can be integrated into the new church include the rose window above the entry to St. Hedwig's and the altarpiece and side altars from St. Mary's.

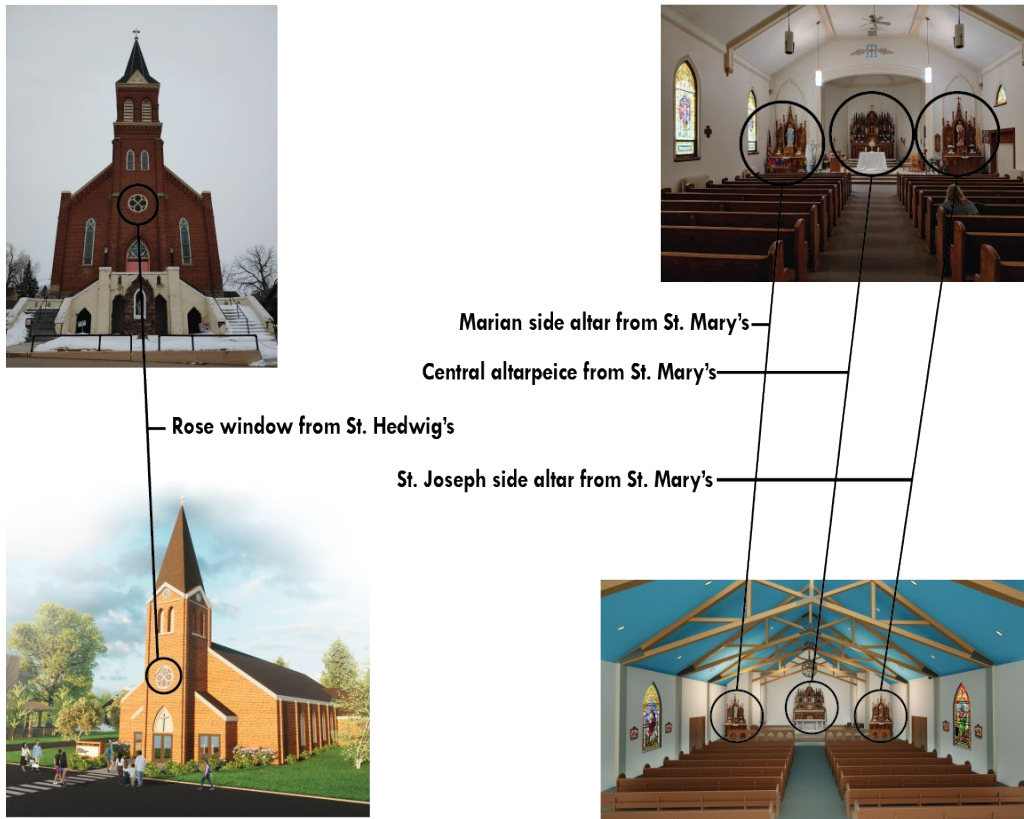


Figure 27. Diagram of reused elements from existing Holdingford churches

The altarpiece, tabernacle, and side altars from St. Mary's display an amazing level of craftsmanship, one that would be extremely expensive to replicate today. Integrating these familiar elements will also provide a sense of continuity, helping the parishioners of the current parish feel more at home in the new space. This passing on of sacred elements also symbolizes the tradition of the Catholic Church, and its evangelization from generation to generation.



Figure 28. Altarpiece from existing Church of St. Mary's in Holdingford



Figure 29. St. Joseph side altar from existing Church of St. Mary's in Holdingford



Figure 30. Blessed Virgin Mary side altar from existing Church of St. Mary's in Holdingford

#### 4.3.6. Liturgy

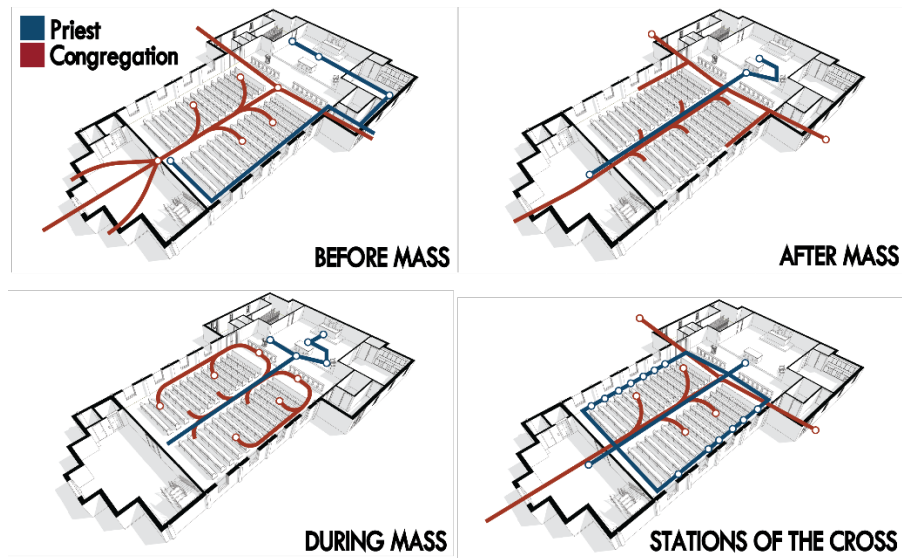


Figure 31. Interior liturgical circulation diagrams

The primary function of the church is to host the Mass. Circulation for this liturgy is divided between the movements of the priest and the movements of the congregation. The priest begins in the sacristy, vesting and preparing for Mass. He then moves to the back of the nave before processing up the central aisle at the beginning of Mass. During the Mass, the priest

remains in the sanctuary space, moving between the altar, pulpit, and presider’s chair. At the conclusion of Mass, the priest then processes back up the aisle to the narthex. The congregation primarily enters through the narthex at the back of the nave before the Mass and circulates around the nave for the reception of Holy Communion at the altar rails during the Mass. Following the conclusion of Mass, the congregation exits through the narthex. During the Stations of the Cross, the priest processes around to each of the fourteen stations, positioned along the outer edge of the nave.

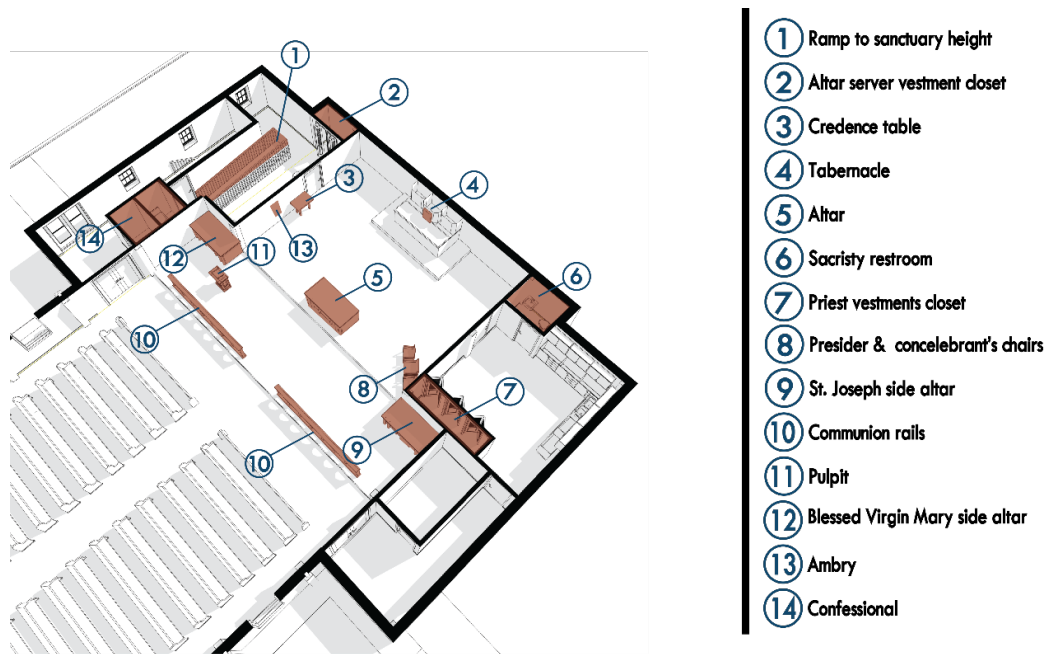


Figure 32. Diagram of sanctuary and liturgical elements

#### 4.3.7. Acoustic Performance

The human senses are all incorporated into the Catholic liturgy, and as such sound is an essential consideration in the design. For this project, acoustic performance was measured using Odeon room performance software. The geometry and materials of the nave and sanctuary were entered into the software, and sound sources were set at the altar, the pulpit, and the choir loft.

The software then generated diagrams showing the reverberation paths, sound pressure levels over time, sound decay rates, and echo curves. These were measured from each sound source for for both a receiver in the front pews and a receiver in the back pews.

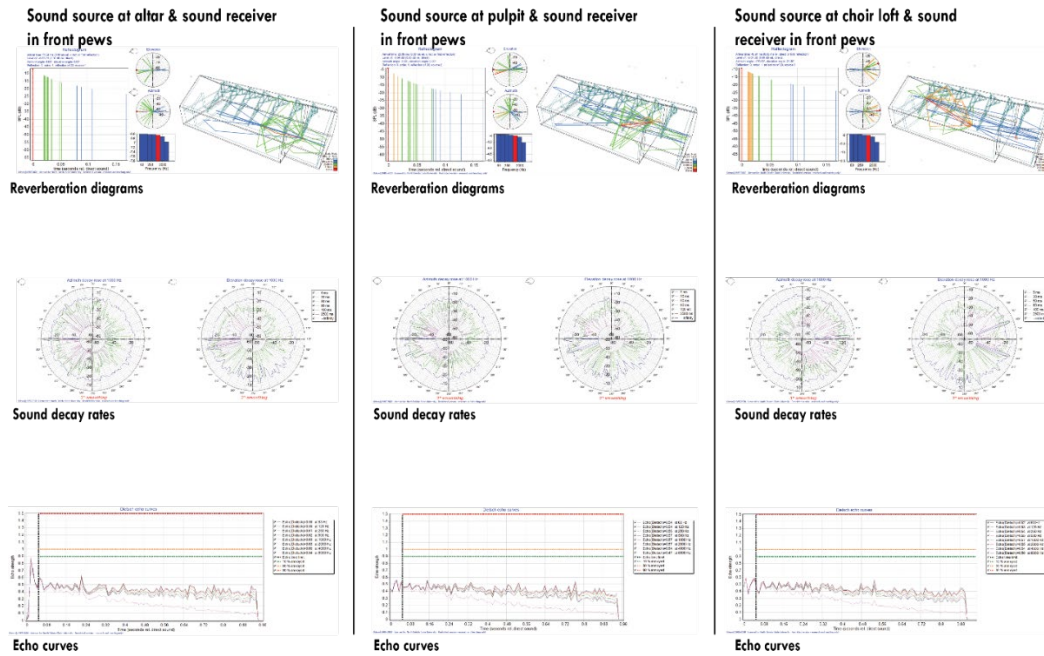


Figure 33. Acoustic performance graphs for audio receiver in front of nave

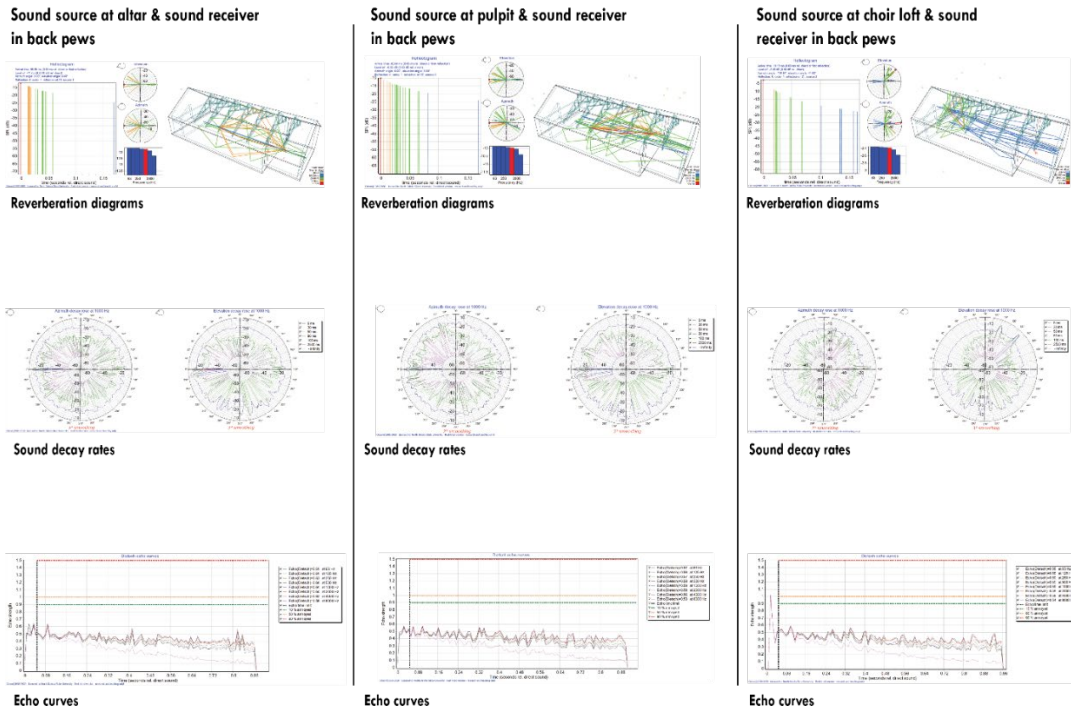


Figure 34. Acoustic performance graphs for audio receiver in back of nave

The resulting graphs show that the space performs well acoustically, with balanced reverberation rates and decay rates, as well as echo curves that remain below the minimum thresholds of annoyance. This means that as sound is bouncing around the space, people will hear it equally throughout the space and there will not be unwanted echoes lasting beyond the termination of the sounds.





Figure 35. Rendered exterior perspective of proposed design solution; northwest view

#### **4.4. Conclusions**

While Catholic liturgical architecture can be a very complex design typology, at its heart its purpose is simple: to create a space that leads people to God. Throughout the ages of Christendom, this space has taken many forms. Through the distinct eras and regions of Catholic sacred architecture, one goal has consistently remained: making God's presence known through beauty. This desire for transcendent beauty led to the construction of some of the greatest buildings in human history: Chartres Cathedral, Cathedral of Santa Maria del Fiore, La Sagrada Familia, and countless other Catholic churches that seem to exist as a bridge between heaven and

earth. Beauty has always had an unbreakable link to the search for the divine, and yet it is conspicuously absent in many of the contemporary churches of today.

This project seeks to balance two things that often seem diametrically opposed in the world of architecture. Beauty and affordable design do not often coalesce, but there are many Catholic parishes that seek to worship God in a space that helps lead them upwards toward them but cannot afford the extravagant price of soaring, ornate Gothic temple. Through a series of simple design premises, this project creates a framework for attaining beauty through simplicity, through proportion, through materiality, and through adherence to the teachings and tradition of the Catholic Church. The resulting design may not appear to be much different from many of the traditional Catholic church buildings constructed a century ago, but therein lies much of the point. A return to grace is something that is much needed in sacred architecture, and this design seeks to reconcile such design with modern construction and the needs of current parish churches.

The question of if a beautiful Catholic church can be designed and built in an attainable way is certainly rife with subjectivities and requires that distinctions and clarification be made in order to be answered fully. However, in examining the Catholic view of beauty, the significance of the church building in worship, and the application of current design and construction techniques to sacred architecture, this project presents a proposed design that harmonizes beauty, symbolism, and simplicity with the functions of a church. Such a design seeks to provide a *Domus Dei*, a house for God to dwell amongst his people here on earth.



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## APPENDIX A

### Previous Studio Experience:

- Fall 2020
  - Instructor: Charlott Greub
  - Projects: River Oaks Park artists dwelling, Hiawatha Boathouse
- Spring 2021
  - Instructor: Milton Yergens
  - Projects: Cripple Creek dwelling, The Dakotan Hotel
- Fall 2021
  - Instructor: Paul Gleye
  - Projects: Fargo Haitian Cultural Center, NP Plaza
- Spring 2022
  - Instructor: Regin Schwaen
  - Projects: Great Plains Native Cultural and Student Center, Fargo National Cemetery Visitors Center
- Fall 2022
  - Instructor: Bakr M. Aly Ahmed
  - Project: Rhodes Plaza (Capstone)
- Spring 2023
  - Instructor: Paul Gleye
  - Project: Downtown West Fargo