WHO DOES WHAT | A GUIDE TO YOUR TEAM ON A CAPITAL CONSTRUCTION PROJECT

Temporary steel beams being installed at Trinity Episcopal Church Abbeville, SC. Photo by Preservation South Carolina.

A capital construction project can be very complicated and require a variety of different people working together to complete it successfully. Most teams on preservation projects include the building owner, an architect, engineers, and contractors. They have different ways of approaching a project, different methods of analysis, and different areas of expertise. The teamwork between each team member is what makes a successful capital construction project. But what does each team member do?

Not all architects, engineers, and contractors are qualified to work on historic buildings. It is important that the individuals you bring to your team to work on your historic sacred place know how to work on historic buildings.

OWNER

As the owner of the historic sacred place, you are an important part of the team. The congregation or the judicatory are typically the building owners for historic places of worship. It is best practice to establish a Building Committee that will represent the congregation throughout the capital construction project. This committee will oversee all aspects of the capital construction project for the congregation.

Some congregations decide to hire an owner's representative to help them through the project. This is a professional that will act as the congregation's advocate and help oversee the capital construction project from start to finish. They serve as an extension of the Building Committee to help keep the project on track. They are contracted directly with the owner.

WHAT DOES THE OWNER DO?

The owner leads the project. A capital construction project does not start without identifying that your building needs work. You might notice that there are active water leaks, new cracks in your ceilings or walls, or the carpet in the sanctuary is worn. Identifying these issues leads to hiring your team to do a capital construction project.

After you have identified that you need to do a capital construction project and created a Building Committee, the committee might find it helpful to develop the goals and objectives of the project. It is typically helpful to get input from the congregation, but this can be challenging because there are many diverse opinions among the members of your congregation. It is best to synthesize these opinions and develop an internal list of priorities.

Your next goal is to hire the team to create a new or update an existing Building Conditions Assessment. While this is not required for the National Fund, it is a helpful step to document your building's existing conditions and identify needed repairs. During this phase you will help the design team by identifying ongoing issues in the building, providing answers to questions the design team might have during the assessment, providing access throughout the building for the assessment, and making decisions. After the assessment is completed, the Building Committee should review the prioritized recommendations to identify your potential scope of work for the project. Reference "Building Conditions Assessment" for more information about these assessments.

With a potential scope of work for your capital construction project, you hire a design team. This can be the same team that created the Building Conditions Assessment or a different team. See "How to Hire an Architect" for more information about this process. The design team is typically led by an architect. Throughout the design phase and as the design team is creating the necessary documents needed for construction, you actively work with the design team to make sure your goals are met and to make decisions.

Once the design phase is done, you work with the design team to bid the project to contractors. See "How to Hire a Contractor" for more information about this process. This leads you to hiring the contractor. As the contractor starts construction, you are still an active participant in the team making final decisions on the project. It is important that you stay informed on the ongoing construction, so best practice is to attend regular meetings or tour the construction site with the design team and contractor.

During construction, it is also important to monitor cash flow with the Capital Campaign Committee to ensure there is enough money to pay the contractor's invoices.

ARCHITECTS

An architect is defined as "a person who designs buildings and advises in their construction."[1] While this basic definition is true, it misleads people to think that architects only design new buildings and does not encompass all that an architect does. Architects bring a wide range of skills to a capital construction project that make them a critical member of the design team.

EDUCATION AND LICENSURE[2]

In the United States, a person must be licensed to legally practice architecture independently and use the title of "Architect". There are four steps to the licensure process, and it takes, on average, 11 years to complete. The first step is to get an architecture degree from a program accredited by the National Architectural Accrediting Board (NAAB). These degrees include a five-year Bachelor of Architecture, a six-year (four years of undergraduate school + 2 years of graduate school) Master of Architecture, and a Doctor of Architecture. The next requirement is to gain a minimum of 3,740 hours of experience under the supervision of a licensed architect through the Architectural Experience Program. The experience is split into areas that mirror the phases of a typical architectural project and identify key skills an architect will need to practice. The final requirement is to pass the Architect Registration Examination (ARE). The ARE includes six multi-part tests, and each test covers a different aspect of architectural practice. All three of these requirements can take place concurrently, but after they are completed, the final step is to apply for an architecture license. Each jurisdiction (state or territory) issues its own license, which requires an architect to be licensed in each jurisdiction where they are working. Some jurisdictions have additional requirements that are needed in addition to the ones described above.

After initial licensure, each jurisdiction has specific requirements that must be met to maintain an architectural license. Most jurisdictions require licensed architects to earn continuing education credits (CEUs) annually, and they may specify which courses or topics must be covered by the CEUs. Architect licenses are typically renewed annually or biannually.

CONTRACTING

There are a variety of ways an architect can be contracted. The most common way is for the architect to be contracted directly with the owner of the building or congregation. In some unique cases, the architect can be subcontracted under a contractor (design-build) or an engineer.

WHAT DO ARCHITECTS DO?

Most people have an image of an architect leaning over a drafting table, drawing a new building, and think that is all an architect does. But architects do more than that. They manage projects, advocate for the congregation, interpret the congregation's visions and needs, and are involved in every phase of a project.

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[1] "Architect," Merriam-Webster, https://www.merriam-webster.com/dictionary/architect#:~:text=Kids%20 Definition-,architect,and%20advises%20in%20their%20construction.

[2] "NCARB Homepage," National Council of Architectural Registration Board, https://www.ncarb.org/.

ArchitectWorks assessing the condition of the foundation at 16th Street Baptist Church Parsonage Birmingham, AL

Photo by ArchitectWorks

In many design teams, the architect manages the team and project. They hire engineers or consultants needed to complete a project. They manage deadlines and deliverables, and coordinate with the team to make sure they are completing their portion of the project on time. Architects help make sure the project is running smoothly, is on time, and is on budget. We have found that many congregations underestimate the amount of time and energy it takes to manage capital construction projects, day in and day out. Grantees have consistently told us that working closely with an architect to manage their capital construction project was one of the best decisions they made, helping ensure the success of their project.

The first phase in most projects is the pre-design or planning phase. During this phase, the architect can work with a congregation to develop a scope of work that meets their needs and budget. They can help the congregation develop accurate budgets based on current construction costs. They can also help the congregation create reasonable and accurate schedules and timelines. While members of the congregation can do some of this before an architect is involved, an architect can help lead this process and make sure the goals of the congregation will be met.

During the pre-design or planning phase, the architect works with the congregation to make sure they understand their vision, needs, and ongoing issues with the existing building. Depending on the goal of the project, the architect can evaluate the existing conditions of the building, explore reasons for damage and deterioration, propose repair solutions, and make prioritized recommendations for repair and maintenance through a Building Conditions Assessment. They can also explore how the building is currently being used and develop a new master plan to ensure the building meets the current needs of its users.

The design phase is typically where people think an architect gets involved. They may think that during this phase the architect is only developing floor plans for a new building, creating the building form, and selecting the building materials, but they are doing a lot more. During this phase, architects solve problems and determine how best to meet the needs of the congregation. It can lead to designing a new building, but

it can also lead to creating new designs for existing buildings or finding solutions to ongoing problems in the building, like a leaking roof.

Architects explore all the different options for a project before fully committing to designing and constructing the scope. They can explore the pros and cons of each solution to help the congregation find the best one for their building.

Architects develop design concepts that have a holistic approach. They examine all the different building systems and materials to ensure they are working successfully together. In existing buildings, architects can work with all of the different building elements to develop a holistic repair. Architects also develop solutions that balance building code requirements, constructability, congregational goals, and budget. Architects also bring creativity and design expertise to the project.

The architect does not stop designing a project once the basic concept is developed. To ensure the project can be constructed, the architect develops more detailed information on the project, including specific details on where elements should be placed, how they should appear, or how they should be repaired.

Architects also specify what materials should be used in the project. This is especially important with projects on historic buildings. Some new materials do not work well with historic materials and could lead to damage to the historic materials. For example, new Portland cement mortar is too hard and can significantly damage historic masonry. Architects can also help find specialty materials or in-kind replacement materials. Some historic materials are difficult to find because they are no longer being fabricated, the quarry is no longer operational, or the original materials contained hazardous materials. Architects can research and explore options for replacement materials and determine other solutions if materials are not available before construction starts, ensuring a successful project that will not damage the historic building.

Architects help make sure all of the building codes, accessibility requirements, and other regulatory requirements are being followed. Building codes ensure buildings are safe and protect the general welfare of the public. There may be special requirements and exceptions to building code for historic buildings. Building codes are often also required for issuance of a building permit from your local municipality. In addition to any relevant local or state-level codes and regulations, the National Fund requires that projects follow the Secretary of the Interior's Standards for Rehabilitation. The Secretary of the Interior's Standards for Rehabilitation are widely accepted as the basis for how historic buildings should be rehabilitated and are regularly used at the federal, state, and local levels to guide and evaluate the appropriateness of repairs, alterations, and construction work. An architect with

INFORMATION AND RESOURCES

The Secretary of the Interior's Standards for Rehabilitation and Guidelines
www.nps.gov/articles/000/treatment-standards-rehabilitation.htm

National Park Service Preservation Briefs
www.nps.gov/orgs/1739/preservation-briefs.htm

historic preservation experience will make sure these standards are followed so that your project can ultimately be approved by National Fund staff.

An important part of what an architect does is preparing documents for construction, including drawings and specifications. Today, architects are no longer hunched over their drafting table producing these drawings, they are using Computer Aided Design (CAD) or Building Information Modeling (BIM) to develop drawings. There are a variety of different drawings an architect produces, including:

- As-built or existing building floor plans, elevations, and sections, which document the location of elements before a capital construction project begins.
- Conceptual drawings or schematic design drawings can include 3D images, renderings, basic floor plans, basic elevations, and basic sections. These drawings help create a general plan for the project and help the congregation visualize the finished project.
- Design development drawings, which can include 3D images, renderings, floor plans, elevations, sections, and basic details. These drawings build on schematic design drawings and include more detail and more technical information.
- Construction documents or contract documents, which include technical drawings and specifications. The drawings include the information from the earlier phases (renderings, floor plans, elevations, sections, and details), but with more information. The specifications are a written set of instructions that help the contractors execute the project. The drawings and specifications should provide the contractor with all of the information they need to construct the project.
- Bid documents are very similar to construction documents and contain the same information, but they are issued to contractors to bid on the project.
- Permit documents are also very similar to construction documents and have the same information, but these documents are issued to the city or Authority Having Jurisdiction (AHJ) for a building permit. In most AHJs, the documents are required to be stamped and signed by a licensed architect or engineer.

Architects are also important during construction. Even after the design phase is complete, architects ensure that the project is being constructed properly and in accordance with the construction documents. They do this through monitoring the construction and reviewing product information and shop drawings (highly detailed technical drawings and documents created by contractors, fabricators, or suppliers to show the exact fabrication and installation of components or systems within a construction project). Architects are also there to help review changes, redesign, or re-detail something if the conditions are different than what was expected. Architects can also help with reviewing the contractor's monthly invoice to confirm that work has been completed. Most importantly, the architect is there to be the congregation's advocate. The architect acts as the congregation’s representative to make sure the project is done properly and meets the needs of the congregation.

ENGINEERS

An engineer is a person who uses scientific knowledge and mathematics to analyze, design, invent, code, build, and create solutions to solve problems and improve machines, products, systems, and structures. There are many different types of engineers, but the main types that work on buildings are:

- Structural Engineers perform in-depth studies of the loads, stresses, and tensions on different building elements and create ways to support a new building or reinforce or replace deteriorated elements in an existing building.
- Mechanical engineers analyze and design the mechanical systems in a building, such as heating and cooling the air within the building and providing ventilation. Many mechanical engineers will also work on the building's plumbing system and fire protection system (sprinkler system).
- Electrical engineers analyze and design the electrical systems within a building, such as power distribution, lighting, and fire alarm systems.
- Civil engineers analyze and design the infrastructure and built environment that surrounds the building. This can include everything from getting utilities into a building, regrading the site, designing roads and bridges, water systems, energy systems, and transportation networks.

Each engineer brings a unique skill set to a preservation project that makes them an important part of the design team.

EDUCATION AND LICENSURE[3]

In the United States, a person must be licensed to legally practice engineering independently or offer services to the public. An unlicensed engineer can work under the supervision of a licensed Professional Engineer. The licensing requirements for a professional engineering license vary from state to state. However, most states typically require certain levels of education, professional experience, and examinations and it takes, on average, 8 to 9 years to complete. The first step is to earn an engineering degree from a program accredited by the state's licensing board. The boards typically approve engineering programs accredited by the Accreditation Board for Engineering and Technology, Inc. (ABET). At a minimum, a person is required to earn a four-year bachelor's degree in engineering, but it can also include an engineering master's degree or a doctorate in engineering. The next requirement needed is to pass the Fundamentals of Engineering (FE) exam. The test is offered in seven different disciplines and covers basic engineering technology and principles. Most people take this exam during the final year of their bachelor's program or shortly after they graduate. The next step is to gain a certain number of years of experience under the supervision of a Professional Engineer. It is typically four years, but can be more or less, depending on the state. The final requirement is to pass the Principles and Practice of Engineering (PE) exam. The exam tests the knowledge and skills in a specific engineering discipline and engineering ethics. Each state and territory has its own licensure board, which administers its own exam, so the tests differ from state to state. Some states require individuals to complete professional experience before taking the PE exams, while others do not. After all these requirements have been completed, the final license is issued

[3] "Licensure," National Council of Examiners for Engineering and Surveying, https://ncees.org/licensure/ and "Licensure," National Society of Professional Engineers, https://www.nspe.org/resources/licensure.

through the state or territory. Each jurisdiction (state or territory) issues its own license, which requires an engineer to be licensed in each jurisdiction in which they are doing work. Some jurisdictions have additional requirements that are needed in addition to the ones described above.

After the initial licensure, each jurisdiction has certain requirements that are needed to maintain a Professional Engineering license. Most jurisdictions require Professional Engineers to earn continuing education credits (CEUs) or participate in other professional development opportunities each year. Engineering licenses are typically renewed annually or biannually.

CONTRACTING

There are a variety of ways an engineer can be contracted. The most common way is for the engineer to be subcontracted by the architect. In some unique cases, the engineer can be contracted directly with the owner or subcontracted under a contractor (design-build).

WHAT DO ENGINEERS DO?

Some people may think of an engineer as a person running a math calculation or trying to determine if something is going to fail. Some engineers do that, but they are also problem solvers and creative thinkers who provide an in-depth knowledge of their specific discipline to protect the safety and comfort of the public. Engineers are involved in every phase of a project.

In many cases the engineer works on a design team managed by an architect. The architect manages the project, while the engineer provides their specific insight and knowledge on their discipline. In some cases, when the project is primarily focused on a building system (mechanical, electrical, or plumbing) or a structural component, the engineer can manage the project. In this scenario, the engineer manages deadlines, deliverables, and coordinates with other team members. The engineer will work with the

BALA Consulting Engineers reviewing the new chiller system and compressors at National City Christian Church Washington, DC

Photo by Rev. Steven C. Baines

congregation to make sure their needs and ongoing issues with the existing building are met, and would ensure that the projects are completed on time and within budget.

Engineers are not always involved in the pre-design or planning phase, but they can be very helpful and provide valuable information. Engineers can review and analyze the existing building systems (structural, electrical, mechanical, plumbing, fire alarm system, etc.) to identify any issues with the systems, evaluate different solutions, and provide prioritized recommendations for repair and maintenance. Engineers can also be consulted when master plans are being developed to understand the space requirements for the different building systems.

During the pre-design/planning phase or early in the design phase, engineers can also explore different options for building systems and weigh the pros and cons of each solution to help the congregation find the best one for their building. For example, there are several methods for heating and cooling a building. A mechanical engineer can explore different options (ducted system, ductless system, geothermal, split system, zone HVAC system, heat pumps, etc.) and determine a system that will meet the needs of the congregation and will not negatively impact significant features of the historic building.

In some design contracts, engineers may only get involved during the design development phase when more technical information is being incorporated into a design for a project. During this phase, each engineer works through their individual disciplines and provides practical solutions for very technical problems. As the architect continues to develop the project throughout the design phase, the engineers continue to refine their proposed solution to meet the congregation's needs and building code requirements. A structural engineer will develop repair solutions for areas where the existing structure is starting to fail. A mechanical engineer will make recommendations on how to update or completely replace the mechanical or plumbing system. An electrical engineer will provide solutions on how to update the electrical panels and wiring to make sure there are no safety issues or to meet the current electrical loads of the building. They may also consider how to install a fire alarm system in a building that has never had one before.

As the designs for the different building systems are being developed, engineers specify the equipment that is needed for these very complex building systems. Each building system is composed of numerous components that are necessary for it to function properly. There is more to an electrical system than outlets and wiring. Mechanical systems have many different parts that work together to heat and cool a building. Engineers diligently provide specific recommendations for every one of these pieces of equipment to make sure each system will work as it should.

All of the different building systems cannot be constructed if they are not documented. Similar to the architect, an important part of what an engineer does is prepare documents for construction – drawings and specifications. Engineers develop similar documents to those of architects and work through the different phases listed in the architect's section. Additionally, engineers, particularly structural engineers, provide structural calculations to verify that the building meets building code requirements.

Engineers' involvement in the project is not done when construction starts. Engineers monitor construction to make sure it is being done according to the construction documents. They review product information and shop drawings to make sure all of the equipment they have specified is being installed. Engineers also help review changes, redesign, or re-detail something if the conditions are different than what was expected. The structural engineer may also provide structural inspections to ensure everything meets building code.

CONTRACTORS

A contractor is a person who supplies materials and performs certain tasks to construct the defined scope of work in a capital construction project. They take the design developed by the architect and engineer and turn it from drawings into reality. There are a variety of different contractors that can be involved in a construction project, including:

- General contractors or construction companies, which oversee the day-to-day management of the construction project, and coordinating and supervising tradespeople and suppliers. Some general contractors complete specific scopes of work, such as carpentry or masonry, but others only manage the overall construction.
- Tradespeople, which are skilled workers who specialize in a particular trade and provide those skills on a project. This can include masonry, plumbing, electrical work, plastering, etc. They are typically subcontracted and managed under the general contractor, but if the project is solely focused on one particular trade, they may be able to manage the project themselves.

EDUCATION AND LICENSURE

Most states have licensure requirements for contractors, although many states do not require a contractor to be licensed for smaller construction projects. States also have different types of licenses for each of the different trades (general contractor, electrician, plumber, etc.). The state typically grants the license, but it can also be granted at the city or county level. Licensing requirements can vary by state and by the type of contractor's license. However, most jurisdictions require a certain level of education, work experience, and examinations. On average, these requirements take 3 to 5 years to complete. Most jurisdictions require a high school diploma or GED to become a licensed contractor, but some states require an associate or bachelor's degree in construction engineering, business, construction management, or a related field. Contractors can also attain training through a vocational or trade school. The next requirement is to gain hands-on experience. This can be achieved by learning under a skilled contractor; however, most skilled trades require an apprenticeship. An apprenticeship is a structured program that usually combines training courses and supervised work experience. The length of the hands-on experience varies by state, but it is typically around 4 years. Earning a degree can fulfill some of the experience requirements for a contractor's license. Many states also require contractors to complete an OSHA (Occupational Safety and Health Administration) safety course to ensure contractors understand workplace safety protocols. The final step in obtaining a contractor's license is passing an examination. The exam varies by state, but usually covers legal, financial, safety regulations, and other professional topics.

CONTRACTING

Contractors are typically contracted directly with the building owner or congregation.

WHAT DO CONTRACTORS DO?

Most people think they know what a contractor does. They see the people doing work on a construction project and think that is what a contractor does. While that is a portion of what a contractor can do, they do more than just build something.

Contractors oversee construction projects from start to finish. Their involvement with a construction project typically starts when they bid on a project or provide a cost estimate. If they are selected as the contractor for the project, they will initiate a series of tasks to ensure the project is successful, including developing a method for communicating with the congregation, establishing a construction schedule, and hosting a construction kick-off meeting. The contractor hires all the building trade professionals required to complete the project. The contractor also obtains the necessary building permits from your municipality and handles any additional local requirements, such as road closures and utility shut-offs.

During construction, the contractor is managing the project. They manage the project's budget and schedule to make sure the project is running as planned. The contractor works with the architects and engineers to make sure the construction documents are being followed and raise issues or concerns if the existing condition differs from the construction documents. They also communicate with the congregation about their progress and if there are changes to the budget.

Ali'i Builders installing steel beams in Mokuaikaua Church Kailua-Kona, HI

Photo by Ali'i Builders

An important part of managing a construction project is coordinating tradespeople, supplies, and vendors. Typically, a variety of tradespeople are needed to complete each construction project. Most tradespeople require a different trade to complete a portion of the scope before they can start theirs. For example, to construct an interior wall, one tradesperson will install the framing for the wall, another will install the gypsum board (drywall) and finish it to seal all the seams and make it flat, and another tradesperson will paint the wall. If you are working with a general contractor, they will coordinate with each tradesperson to ensure their work is completed on schedule and in accordance with the construction documents.

Contractors purchase the different materials and equipment that are to be installed on the project. To ensure that they supply the correct material and equipment, contractors provide product information and shop drawings for the architects and engineers to review. After the review is complete, contractors and tradespeople order the necessary materials and equipment for the project. They estimate the amount required to make sure there is enough for the project, while making sure not to order too much to ensure there is not an excess at the end of the project. Contractors also ensure that the materials and equipment are ordered on time to keep the project on schedule. Some equipment takes a very long time to fabricate and ship to the construction site, so it is especially important that the contractor understands order timelines and schedules.

Contractors provide the construction equipment needed to complete the project. Most projects require specialty equipment such as a backhoe, scaffolding, temporary shoring, or lifts. The contractor will also coordinate the construction equipment to ensure it is on the construction site when needed by the different tradespeople.

Contractors execute the actual work outlined in the construction documents written by the architect and/or engineer. The construction documents outline the congregation's intent and goals, but the contractor develops the means and methods for executing that work. They make sure that the construction project follows federal, state, and local regulations, site safety, and OSHA compliance.