ORIGINAL ARTICLE

Radiology Architecture Project Primer

Raymond W. Sze, MD[a], *Laurie Hogan, MBA*[a], *Satoshi Teshima, AIA, LEED AP*[b], *Scott Davidson, AIA*[c]

Abstract

The rapid pace of technologic advancement and increasing expectations for patient- and family-friendly environments make it common for radiology leaders to be involved in imaging remodel and construction projects. Most radiologists and business directors lack formal training in architectural and construction processes but are expected to play significant and often leading roles in all phases of an imaging construction project. Avoidable mistakes can result in significant increased costs and scheduling delays; knowledgeable participation and communication can result in a final product that enhances staff workflow and morale and improves patient care and experience. This article presents practical guidelines for preparing for and leading a new imaging architectural and construction project. We share principles derived from the radiology and nonradiology literature and our own experience over the past decade completely remodeling a large pediatric radiology department and building a full-service outpatient imaging center.

Key Words: Architecture, design, patient experience, project management

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INTRODUCTION

Imaging technology advancements and increased family expectations for patient-friendly environments make it common for radiology leaders to embark on construction projects. These can range from remodeling a radiography room to construction of an entire department. Construction projects can run from hundreds of thousands to tens of millions of dollars. The high cost of health care construction is magnified in radiology because of imaging equipment costs and construction complexity. Although radiologists and radiology business directors are expected to play leadership roles, most have no background in architectural or construction planning; avoidable mistakes can have serious consequences, including running over budget, construction delays, and a final product that disappoints patients, families, and staff. The current literature is sparse on guidance for navigating an imaging construction project, emphasizing reading room and conference room design [1,2].

The purpose of this article is to provide radiology leaders with a road map for imaging construction projects. We draw lessons from the radiology and architectural literature and our experience over the past decade remodeling a radiology department within a 300-bed tertiary care pediatric hospital, with projects ranging from equipment replacement to building a freestanding imaging center. Different organizations will have different processes depending on the size and scope of the project and the number of people involved and their backgrounds, and the project schedule can vary widely depending on the complexity and budget. Nonetheless, many aspects of approach and terminology can be generalized to most imaging architectural projects.

BUSINESS AND FINANCIAL ASSESSMENT

Defining Project Scope

The first task is determining what will and will not be included. Imaging projects are often first considered in the context of updating or acquiring new technology. Space planning goes hand in hand with imaging equipment discussions; "swapping" a new unit for the old will not improve long-standing workflow challenges of a poorly designed space. New technology may not fit in the existing room, and building codes may have changed. Scope must balance competing demands for financial resources and space. Data-driven needs assessments help

[a]Children's National Health System, Washington, DC.
[b]HGA Architects and Engineers, Los Angeles, California.
[c]HGA Architects and Engineers, Minneapolis, Minnesota.
Corresponding author and reprints: Raymond W. Sze, MD, Children's National Health System, 111 Michigan Avenue NW, Washington, DC 20010; e-mail: rsze@childrensnational.org.

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define future modality count and justify scope recommendations. Large health care institutions often have in-house specialists to aid in this exercise; for those without in-house expertise, consultants specializing in needs assessment can help with planning.

Scope includes square footage, complexity of construction, and schedule, which directly impact cost. Complexity is the key driver of cost per square foot. As an example, if office space can be built in your locale for $100 per square foot, a new MRI suite may cost 7 to 10 times as much. Schedule considerations can occur, including the time-of-day of construction, weekend or evening work requiring overtime labor, phasing, and maintaining clinical services. Fewer phases and shorter timelines translate into fewer dollars required for construction.

Building the Budget

Budgets include project and operational costs.

Project costs represent the true cost to build and fit out a project:

- Construction costs: These include amount paid to a construction manager (CM) or general contractor (GC) to build the project.
- Soft costs: These include design, management and permitting fees, owner's administration, insurance, legal, financing, moving, and all other miscellaneous costs.
- Furniture, fixtures, and equipment: These costs are often incurred by the owner as a separate line item cost.
- Major equipment: imaging equipment is capital intensive and traditionally broken out from other costs.

Operational costs are long-term costs associated with operating the program and include the following:

- Staffing costs: These include the number of people who will work in the department.
- Supply costs: These are the supplies stored in the department and their turn rate.
- Patient costs: This is a broad subcategory including nosocomial infections, patient falls, and lost business for various reasons.
- Building infrastructure: This includes the cost of heating, cooling, and lighting a building.

Building a project budget is best performed in partnership with the organization's facilities, project management, and engineering departments when available. Smaller institutions may not have access to these departments and should consider contracting with external design and construction professionals.

Forecasting the project cost includes various expense categories, which are discussed next. [3].

Architectural, Engineering, and Design Fees

These fees are typically acquired using a request for proposal (RFP) process. Architecture firms can provide a budgetary proposal once an approximate scope and gross square footage are determined. Selecting one firm to handle space planning, interior design, engineering, and construction documents is recommended to minimize complexity. Imaging departments have many highly specialized engineering aspects, and architecture firms will typically propose their engineering team within their RFP response. The complete team should be considered when selecting a design partner.

Phasing

Proper phasing is important for renovation projects within a busy clinical facility to minimize service disruption and to maintain patient experience. Ideally, space for new imaging rooms is available for construction while the existing service is fully operational. Often, construction needs to take place in the footprint of the existing suite. Phasing is the process by which the least disruption to clinical service is sequenced. This process requires close collaboration between the architects, CM, imaging staff, and facility's operation team because infrastructure shared with other departments such as air, water, or gases could be impacted. This requires careful planning and can sometimes influence the design of the project. Sometimes creative solutions are required. Two successful examples from our experience include using recovery rooms as temporary clinical scan rooms for portable equipment (eg, ultrasound machines) and using a C-arm in an interventional radiology suite to perform procedures (including upper gastrointestinal procedures and voiding cystourethrograms) during a 3-month fluoroscopy renovation. Frequent communication of the phasing plan and the anticipation of returning to a newly built environment help staff accept and make the best of disruptions associated with phased construction.

Permit and Legal Fees

Permit fees are determined by local requirements. The project manager, contractor, or architect can assist with this. Projects also require *attorney fees* for legal review of architectural, contractor, and imaging vendor contracts.