EPiC Series in Built Environment

Volume 3, 2022, Pages 326–334

ASC2022. 58th Annual Associated Schools of Construction International Conference

Project Delivery Method for Facility Condition Assessments – A Study of Industry Practices by AEC Service Providers

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Abstract
The practice of Facility Condition Assessments (FCA's) in the built environment can be the first step in development of new business opportunities for architecture, engineering, construction and asset management firms. In the United States, more than $279 billion in building retrofit investment opportunities exist across all market segments, which could yield more than $1 trillion in owner savings over the next 10 years. (Rockefeller Foundation 2012). AEC providers have risen to the need by providing FCA services, however, little is understood of which AEC providers are providing FCA services and project delivery approaches of FCA services. This study identified key inputs and outputs of FCA project delivery, resulting in an FCA project delivery method. Additionally, this study took the first step towards evaluating how FCA results are integrated with technology. This is the first global study of its kind and sets in motion a call for AEC stakeholders to provide FCA interoperability with asset management, facility management and capital planning.

Key Words: Facility condition assessment, AEC service providers, engineering management, architectural engineering

Introduction

In the United States, more than $279 billion in building retrofit investment opportunities exist across all market segments, which could yield more than $1 trillion in owner savings over the next 10 years. (Rockefeller Foundation 2012). A byproduct of Facility Condition Assessments (FCA's) is savings through the replacement of inefficient systems and or assets. Upgrading and replacing energy-consuming equipment in buildings offers an important capital investment opportunity and owners can utilize an FCA to develop and defend capital funding allocations. AEC providers have risen to the need by providing FCA services, however, little is understood of which AEC providers are providing FCA services and project delivery approaches of FCA services.

The practice of Facility Condition Assessments (FCA's) in the built environment can be the first step in development of new business opportunities for architecture, engineering, construction and asset management firms. Federal assistance programs may present additional opportunities for AEC industry, specifically in government and K-12 AEC sectors (AGC, 2021). Arguably, the first step in capital project work is to measure existing conditions to determine a course of action for which to take and which capital projects should be pursued. In addition, there appears to be a need for post-pandemic design and retrofit of existing buildings, which will benefit the AEC profession (AIA, 2021). Further, there is uncertainty of new commercial construction trends due to shifts in space utilization, identifying potential for existing buildings renovations to be an opportunity for AEC service providers.

The purpose of this study was to identify a review of literature on who is providing FCA services in the built environment and which inputs and outputs are included in the practice of FCA's. An additional research objective for this study was to investigate FCA results integration with technology.

Literature Review

Purpose and Value of FCA's

Previous research reviewed facility condition assessment literature and 94 various sources of literature were mapped to various purpose themes based upon content presented (Hillestad, et. al 2021). Results indicated that FCA's are used to increase knowledge of assets within an organization, with special emphasis related to strategic capital renewal or budget planning. Hillestad (2021) also found the practice of FCA's assists in determining capital funding allocations within organizations.

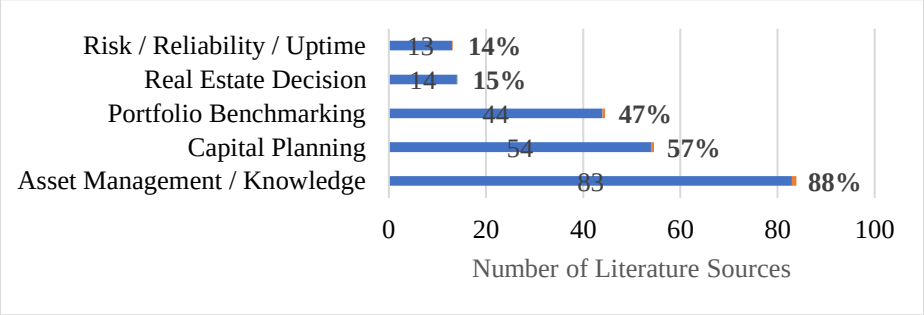


Figure 1. Purpose of a Facility Condition Assessment (Hillestad, et al. 2021)

FCA Project Delivery

Facility Condition Assessments contain information that is collected and filtered from multiple sources. The provider must figure out historical information such as when the building was originally constructed, any renovations or upgrades that have been performed over the lifespan of the building and an estimate of probable costs associated with potential capital projects (Ezovksi, 2009). If an FCA provider is stating that there are only 1 or 2 professionals that will participate in their services, a red flag should be raised by the facility manager as an FCA is recommended to be administered by a multi-disciplinary team of AEC professionals (IFMA, 2018; Bartels, 2014; RICS, 2020).

Key FCA Inputs

In this section, key inputs and outputs of FCA project delivery methods are explored with the assistance of industry standards. ASTM (2015) identifies key inputs as interviews with stakeholders, building walk-throughs and a review of provided facility information. Key outputs or deliverables of FCA projects may include a condition report, opinions of probable cost for projects or capital equipment replacements and additional considerations.

Review of Existing Facility Information Provided by Owner

Another method to discover information is to administer a survey to chief engineers, facility managers, administrators and facility occupants. This feedback can be helpful in determining space utilization trends and potential areas for further investigation. ASTM (2015) recommends owner provided documentation and information to assist with assessment development:

- Warranty information, safety inspection records, previous FCA reports
- Records indicating age of material building systems (roof, chillers, boilers, electrical, etc.)
- Pending proposals or contracts for capital equipment replacement
- Description of future improvements planned
- ADA survey and status of any improvements
- Drawings and specifications (as-built or construction)

Interviews to Discover Facility Information

Sullivan (2010) states the interview is the most dominant transfer of information in the selection process of a design services for a project. Comparatively, an informational interview with the facility manager or chief engineer can increase knowledge of existing systems and assets, thereby allowing for a more comprehensive review of existing conditions. While it is important to conduct an interview with a C-suite or executive level position responsible for identifying the purpose of the FCA for the organization, information obtained from executive level interviews may not reveal enough detailed information on building assets and systems for the assessor. Another challenge in this arena is executive turnover whereas newer employees may not have the necessary experience or knowledge with the organization's decision-making history relative to FCA's, building systems, assets and overall condition.

Building Walk-Throughs

ASTM (2015) suggests the objective of the FCA walk-through survey is to visually observe the property so as to obtain information on material systems and components. Learning a building through drawings can be a good starting point for developing knowledge, but a physical site walk-through allows confirmation of as-built conditions, identifies additions or renovations that have occurred since the date stamp on drawings and creates a more realistic snapshot of the current conditions. It is common for equipment to be replaced without documentation and by visiting each asset, an assessor can create increased accuracy with results.

The use of photogrammetry to visualize findings obtained from the building walk-through can be valuable for owner or client reporting. ASTM (2015) recommends that capture technology should be used to include typical elevations of exteriors, site work, parking area, roofing, structural systems, plumbing, HVAC, electrical systems, conveyance systems, life safety systems, representative interiors

and or special or unusual conditions present. Before the building walk-through, there should be an agreement between the owner and contractor on components and or building systems to be included in scope of the report. For example, if the owner is in the public assembly facility sector, inclusion of videoboards may be a core assessment component, whereas in other sectors of facility management videoboards may not even be an asset for the owner.

Key FCA Outputs

Condition Report

A key output or deliverable of a facility condition assessment project is a condition report. This report includes a representative description of observed conditions (ASTM, 2015). Documentation includes photographic evidence of findings. Report content varies by facility type, size, use, location, construction type and design style (ASTM, 2015).

Opinions of Probable Costs

Winters (2003) notes facility managers should embrace the concept of requiring opinions of probable construction cost, which ordinarily occurs at the end of each design phase. FCA's are typically a reporting of a snapshot in time, and cost projections can fluctuate based upon economic and or market conditions. Winters (2003) advocates for cost consultants to be used for large or complex project types, like an FCA for institutional owners of a large facilities portfolio. Winters also notes that a reputable construction manager can also provide this function.

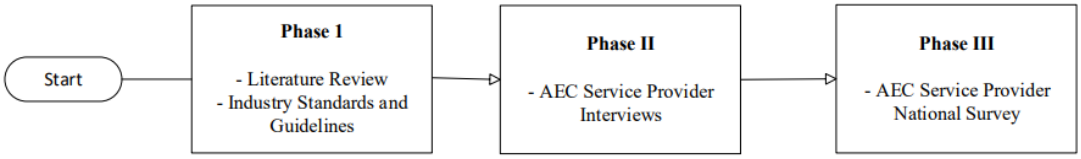
Additional Considerations

The final report can take varying directions based upon owner focus areas. Considerations typically out of scope may include engineering calculations to determine assets or systems compliance with design requirements, pest management observations, destructive testing, opinions on security posture of the facility and environmental assessments such as asbestos, potable water quality and hazardous wastes (ASTM, 2015).

Research Method

This research examines the current state of FCA practice by AEC providers through three phases:

- Phase I – Literature Review
- Phase II – Interviews with AEC FCA Service Providers (N=7)
- Phase III – National survey sent to 228 AEC firms advertising FCA services (N=30)



Phase 1

A limited presence of academic research on the practice of facility condition assessments exists. Therefore, a review of applicable industry standards and guidelines helped form a basis of themes to conduct an FCA.

Phase II

Seven interviews were conducted with AEC service providers of FCA's. The interview questions and answers were recorded via Zoom and then documented for further data analysis. The interview included demographic questions that asked position title and how many years of experience in the built environment interviewees possessed. Open ended questions were asked to further data collection. The participants were asked to identify the primary purpose of their firm (architecture, engineering, asset management, specialty FCA service). Additional questions asked participants to list key inputs and outputs of an FCA project, what industry standards or guidelines are used and valuation opinions of an FCA. For the sake of convenience, delimitations included geographic representation. Interviews were limited to FCA service providers working in Minnesota, Georgia, Arizona and California.

Phase III

A list of FCA service providers throughout the United States was assembled through using internet searches using the term "facility condition assessment", "building condition assessment" with the added State. This process was repeated for all 50 states. This resulted in a distribution list of 228 email addresses associated with organizations that are advertising on their respective websites that facility condition assessment services are offered as part of their professional services. Qualtrics was used to distribute the survey via a direct email to the distribution list. The survey was sent to 4 FCA service providers within the author's network to pilot the survey and obtain feedback on ease of navigating the survey and flow of questions and answers. Then, the survey was sent on July 27, 2021 to the assembled email addresses. 21 responses were recorded from this method. 19 responses were 100% complete and 2 responses were partial. On August 14, 2021, an anonymous survey link with survey purpose narrative was posted by the author on the social media platform LinkedIn to further data collection within the built environment. This added 9 responses to the survey for a total of 30 responses for data analysis.

Survey questions focused on answering questions linked to research objectives, specifically which inputs and outputs are included in the practice of FCA's. An additional research objective for this study was to investigate FCA results integration with technology.

Results and Findings

Results indicate diversity in who is conducting FCA's. There is not a dominant AEC stakeholder that performs FCA's, rather the data shows a multi-disciplinary approach with a collaborative team of AEC professionals in the delivery of FCA services. In this study, 81% of respondents indicated their organization has the ability to integrate FCA results into a capital planning software tool or Computerized Maintenance Management Systems (CMMS) program that their organization owns. This signals strength of interconnected facility and asset information across varying facility management functions. To that end, it appears the firms that offer a fully integrated architecture, engineering, construction, and capital/asset management consulting with software solutions are best positioned in the FCA market.

Table 1.1	Research Phase	
AEC Stakeholder Study Participant	Phase 2	Phase 3
Multi-discipline engineering firm	X	X
Multi-discipline architecture and engineering firm	X	X
Asset management firm	X	X
Architecture firm		X
Engineering firm		X
Construction General Contractor		X
Specialty consultant for facility condition assessments	X	X
Owners' representative / facility management consultant		X
Outreach institute of an educational institute		X
Mechanical contracting firm that offers engineering consulting services		X

The practice of FCA's in the AEC profession may be an emerging trend, but results of this survey indicate organizations have been offering FCA services for decades. This study found that 48% of organizations have been performing FCA's for 20 years or more and 74% of respondents indicated their organization has been performing FCA's for 10 years or more.

FCA Inputs

This study aimed to analyze which inputs are offered at a base level and if other inputs are used, would result in increased costs for the client requesting the FCA. Findings from the national survey are organized in Table 1.2 by percentage of respondents to each question as yes, offered as a base service or yes, offered as an additional cost to the client. This study confirmed the top inputs for conducting an FCA are interviews with chief engineer or lead maintenance personnel and a walk-through survey of building, spaces and equipment. Other key inputs included an interview with chief executive and use of information from previous FCA reports or client owned asset information systems, such as a CMMS.

Table 1.2		
Base Inputs vs. Added Cost Inputs	Yes, offered as a base service	Yes, offered as an additional cost to client
Interviews with chief engineer or lead maintenance personnel	100%	0%
Walk-through of building, spaces and equipment	100%	0%
Interview with chief executive (CFO, COO, etc.)	85%	15%
Occupant survey	61%	39%
Use of information from previous FCA reports or client owned asset information systems such as CMMS	57%	43%
Historical review of code permits associated with properties assessed	29%	71%
Energy management analysis	26%	74%
Drone inspections of roof or envelope	22%	78%

FCA Outputs

Similar to measurement of FCA inputs, questions were developed to better understand which FCA outputs are provided as a base FCA service and which outputs are offered at an increased cost to the

client. Results from the national survey indicate the presentation of visual evidence, identification and or prioritization of capital projects and opinions of probable costs associated with capital projects as leading outputs of an FCA. Please refer to Table 1.3 for further analysis.

Table 1.3		
Base Outputs vs. Added Cost Outputs	Yes, offered as a base service	Yes, offered as an additional cost to client
Visual evidence (photos, videos, digital tours) of walk-through survey	95%	5%
Identification and prioritization of capital projects	95%	5%
Opinions of probable costs for capital projects	95%	5%
Asset useful life analysis	90%	10%
Calculation of FCI as portfolio measurement of building conditions	74%	26%
FCA results export to existing CMMS or enterprise asset management system used by client	39%	61%
FCA results upkeep services	21%	79%

Integration of FCA Results with Technology

Data from the national survey indicated a strong presence of software integration with FCA results. There appears to be robust adaptability by industry practitioners of FCA services to integrate results into a software that the client requesting the FCA owns or operates. Results also confirm a trend by FCA providers to offer a capital planning software that integrates FCA results.

Table 1.4		
FCA Results Integration Capabilities with Technology	% of Respondents	Rank
Ability to integrate FCA results into capital planning software or CMMS program the client owns	81%	1
Respondents' organization integrates FCA results into an existing CMMS software tool their client owns	66%	2
Respondents' organization integrates FCA results into a capital planning software tool they own	52%	3

Discussion

A proposed methodology to conduct an FCA includes purpose or project drivers, inputs and outputs. Figure 2 illustrates a conceptual method to conduct an FCA.

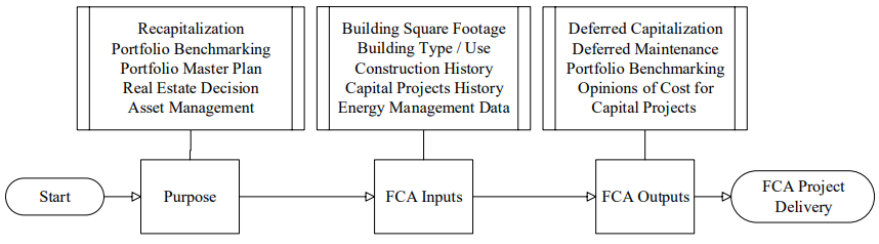


Figure 2. Facility Condition Assessment Project Delivery Method

Multi-Disciplinary Team

A key finding from this study was feedback that identified concern of hiring an FCA provider based upon business development objectives of the company. For example, if a construction general contractor is performing FCA's, FM's should carefully evaluate and structure FCA requirements to not encourage solicitation of new construction work, even though FCA results oftentimes end in capital projects. Likewise, a participant shared they would never award work to an FCA that has "skin in the game" for new work. Respondents with this view identified asset management or FCA specialty consultants as their FCA service provider. Thus, an inter-disciplinary team must be assembled to represent all phases of the facility lifecycle.

Interoperability of Asset Management, Facility Management and Capital Planning

An emerging practice of interdisciplinary FCA service providers answers the call of facility managers that are looking to integrate FCA results within a broader asset management and capital planning strategy for the organization. These companies offer FCA services as part of a combined analysis of asset data, leading to lifecycle and continuous management of facility engineering and operations. This approach typically would combine enterprise asset management (EAM) or computerized maintenance management (CMMS) platforms with customized FCA and capital planning capabilities. Further, possibilities exist with integrations of building automation systems (BAS) and energy consumption data to provide a comprehensive tool for facility managers to optimize their portfolio. Limited research has been performed connecting FCA proposed solutions to energy management practices over the lifecycle of a building. Significant opportunity exists to align FCA proposed solutions to energy efficiency (Lewis & Payant, 2000).

Conclusion

This study aimed to take the first step in identifying who is practicing FCA's in the built environment. 30 participants identified key inputs and outputs of an FCA project delivery method, resulting in a proposed project delivery method for the practice of FCA's by AEC service providers. Globally, this is the first study of its kind and serves as a call to research for further investigations into the practice of FCA's. Further research opportunities include analysis of energy management, interconnectedness of facility management practices with FCA results and how technology can be utilized with FCA results for improved owner decision making.

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