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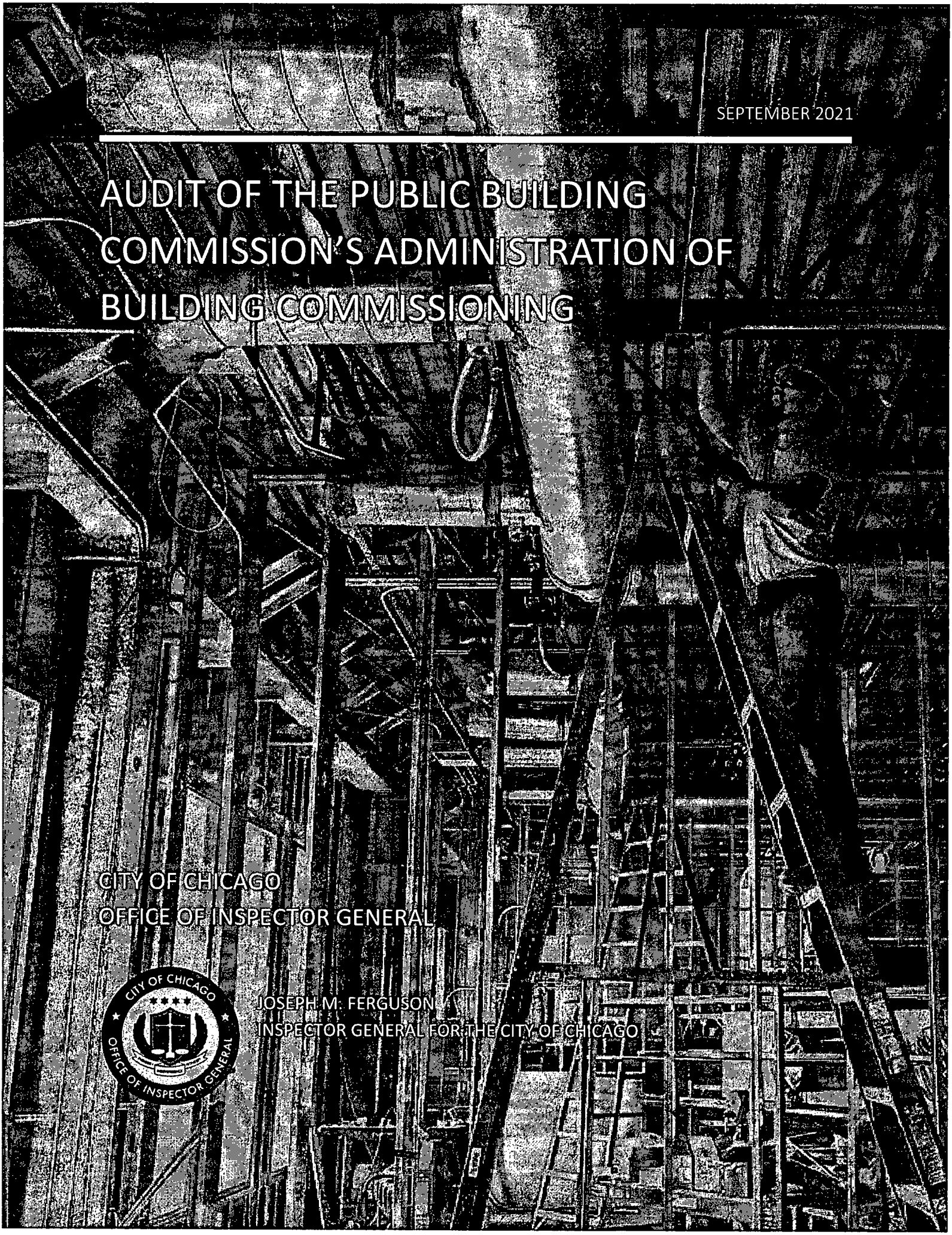

SEPTEMBER 2021

AUDIT OF THE PUBLIC BUILDING COMMISSION'S ADMINISTRATION OF BUILDING COMMISSIONING

CITY OF CHICAGO

OFFICE OF INSPECTOR GENERAL

JOSEPH M. FERGUSON

INSPECTOR GENERAL FOR THE CITY OF CHICAGO

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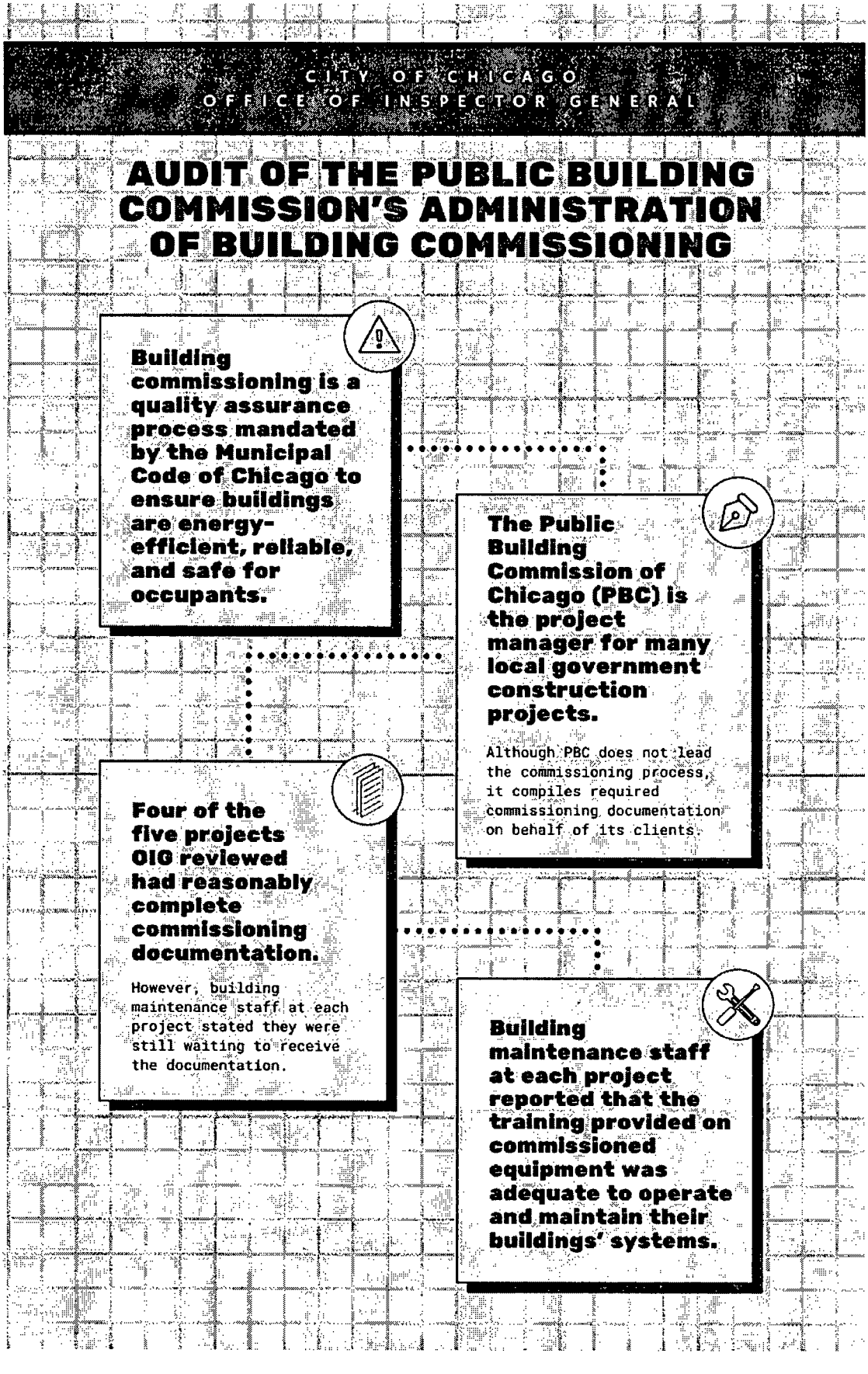
ACRONYMS

BTU	British Thermal Unit
MTEC	Manufacturing Technology & Engineering Center
MCC	Municipal Code of Chicago
OIG	Office of Inspector General
PBC	Public Building Commission of Chicago


CITY OF CHICAGO
OFFICE OF INSPECTOR GENERAL
AUDIT OF THE PUBLIC BUILDING COMMISSION'S ADMINISTRATION OF BUILDING COMMISSIONING
Building commissioning is a quality assurance process mandated by the Municipal Code of Chicago to ensure buildings are energy-efficient, reliable, and safe for occupants.
The Public Building Commission of Chicago (PBC) is the project manager for many local government construction projects.
Although PBC does not lead the commissioning process, it compiles required commissioning documentation on behalf of its clients.
Four of the five projects OIG reviewed had reasonably complete commissioning documentation.
However, building maintenance staff at each project stated they were still waiting to receive the documentation.
Building maintenance staff at each project reported that the training provided on commissioned equipment was adequate to operate and maintain their buildings' systems.

I. EXECUTIVE SUMMARY

The Office of Inspector General (OIG) conducted an audit of the Public Building Commission of Chicago's (PBC) administration of building commissioning required by the Chicago Energy Conservation Code. Building commissioning is the process of documenting and verifying how buildings' mechanical systems are designed, installed, and tested to meet their owners' specific needs. Proper commissioning ensures these systems interact well and efficiently.

The objective of the audit was to determine if PBC ensures that all required building commissioning documentation is developed and provided to its clients in accordance with the Chicago Energy Conservation Code. OIG reviewed documents for a sample of five projects completed in 2018 and 2019. We assessed whether the documentation was complete and accessible to building maintenance staff. We also spoke with staff from each of these projects about the quality of the commissioning process and any related equipment trainings.

A. CONCLUSION

OIG concluded that although PBC's projects had most of the required commissioning documentation and building maintenance staff were trained on commissioned equipment, PBC should do more to ensure its clients receive the documentation as it becomes available, including the training materials necessary to preserve institutional knowledge.

B. FINDING

OIG found that commissioning teams created reasonably complete documentation for four of the five projects we reviewed. However, this commissioning documentation was not always accessible to building maintenance staff. PBC stated that building maintenance staff at two projects received the required documentation electronically and that staff at the other three projects received hard copies. Despite this, building maintenance staff from all five projects stated they were still waiting to receive complete commissioning documents, but believed the trainings they attended were adequate to operate and maintain their buildings' systems.

C. RECOMMENDATIONS

OIG recommends that PBC define, document, and implement a process for ensuring that all projects subject to the Chicago Energy Conservation Code are fully commissioned, collecting all required commissioning documentation, and providing each document to the client agency within its specified time frame. We also recommend PBC follow up with building maintenance staff at recently commissioned projects and ensure they can access the commissioning documentation they need.

D. PBC RESPONSE

In response to our audit findings and recommendations, PBC stated that it will work to ensure its contract documents define all project requirements and due dates, and will track their delivery.

PBC will advise its clients of the Chicago Energy Conservation Code's commissioning requirements, ensure commissioning documents are provided within the specified time frames, and ensure staff at client agencies have access to these documents through its electronic project management information system. PBC will also ensure that relevant maintenance staff are included in its warranty walk-throughs, and will work with clients to resolve building-specific issues that maintenance staff have identified.

The specific recommendations related to each finding, and PBC's response, are described in the "Finding and Recommendations" section of this report.

II. BACKGROUND

Building commissioning is a construction quality assurance process that helps buildings meet their owners' operational needs. Proper commissioning ensures that a building's mechanical and energy systems—such as heating, ventilation, and lighting—will interact well and work efficiently. The commissioning process involves documenting and verifying how these systems are designed, installed, and tested. Commissioned buildings are less likely to face construction delays, equipment problems, and safety hazards, and more likely to save energy and have lower maintenance costs.

A. BUILDING COMMISSIONING PROCESS

The commissioning process begins before a building is designed and ends well after it is occupied. Before design begins, the building owner (or their representative) organizes the commissioning team. This team may include, but is not limited to, the owner or their representative, the architect, the general contractor, building maintenance staff, and a commissioning agent.[1] The team works together to define the owner's goals and requirements in areas such as energy efficiency, occupant safety, and power reliability. The team also defines the scope, schedule, and budget of the commissioned systems. It then creates a detailed commissioning plan that sets out each party's roles and documents project updates.

The commissioning agent ensures that the commissioning plan is consistent with design documents and gives detailed specifications to the construction contractor. During construction, the agent verifies that the contractor has installed and tested the correct equipment and systems, and that these are working properly. The agent documents this verification in a preliminary commissioning report.

Some systems testing may be done after construction is complete and the owner occupies the building. For example, a test of a heating system may have to wait until winter if construction is finished during the summer. During this occupancy and operations phase, the commissioning agent completes a final commissioning report, which outlines any differences between the owner's requirements and the as-built conditions, summarizes all resolved issues, and recommends resolutions for any unresolved issues. The commissioning agent also collects project drawings, a systems balance report, and a facility operations and maintenance manual from the other members of the commissioning team. These are essential reference documents for the building maintenance staff.

[1] "Commissioning Authority (or Agent): An entity identified by the Owner who leads, plans, schedules, and coordinates the commissioning team to implement the Commissioning Process." American Society of Heating, Refrigerating and Air-Conditioning Engineers, Presidential Ad-Hoc Committee Building Performance Alliance on Commissioning, "The Strategic Guide to Commissioning," June 24, 2014, accessed June 10, 2021, https://www.ashrae.org/File%20Library/Technical%20Resources/Bookstore/ENGLISH-ASHRAE_BPA-Brochure_FNL_6-24-14.pdf.

B. THE CHICAGO ENERGY CONSERVATION CODE

The Chicago Energy Conservation Code, which adopts the International Energy Conservation Code by reference, requires commercial building projects to undergo a commissioning process.[2] It exempts residential buildings and buildings with proposed cooling capacities less than 480,000 British Thermal Units (BTUs) per hour and heating capacities less than 600,000 BTUs per hour. The Chicago Energy Conservation Code was set out in Municipal Code of Chicago (MCC) Chapter 18-13 (repealed Jun 1, 2019) and is currently found in Title 14N (effective June 1, 2019). Projects in the scope of this audit were subject to MCC 18-13.[3] As shown in Figure 1, the Chicago Energy Conservation Code requires construction projects to create six key commissioning documents and provide them to the building owner.

FIGURE 1: The Chicago Energy Conservation Code requires six key commissioning documents

Document	Purpose	Deadline for Delivery
Commissioning Plan	Describes commissioning activities, equipment tests, and responsible parties.	None specified.
Preliminary Commissioning Report	Describes ongoing equipment tests, including items to be resolved before the project is closed.	Prior to final inspection.
Construction Drawings	Provide locations and performance data for each piece of equipment.	Within 90 days of certificate of occupancy.
Systems Balancing Report	Provides assurance that air and water flow rates are within equipment specifications.	Within 90 days of certificate of occupancy.
Operations and Maintenance Manual	Provides an overview of building systems, including calibrations, required maintenance, and individual equipment manuals.	Within 90 days of certificate of occupancy.
Final Commissioning Report	Describes completed equipment test procedures and results, including how any deficiencies were resolved.	Within 90 days of certificate of occupancy.

Source: International Code Council, "2015 International Energy Conservation Code." Incorporated by reference into Municipal Code of Chicago § 18-13-230.

[2] International Code Council, "2018 International Energy Conservation Code," Fourth Version: March 2020, Section C408, accessed June 21, 2021, https://codes.iccsafe.org/content/IECC2018P4. Per the MCC, this version applies to projects permitted after June 1, 2019. The 2015 International Energy Conservation Code applies to projects permitted before that date. Because the projects in our sample were permitted before June 1, 2019, we used the 2015 International Energy Conservation Code (Third Version: January 2016) as the standard for our analysis: https://codes.iccsafe.org/content/IECC2015.

[3] Distinctions between the previous and current versions of the Chicago Energy Conservation Code do not affect the broad requirements in this table. Although section numbers changed and some provisions added more specificity, general requirements remain intact.

C. PUBLIC BUILDING COMMISSION ROLE

The Public Building Commission of Chicago (PBC) manages many construction projects for the City of Chicago and its sister agencies. Contractual relationships vary among the projects PBC oversees. The commissioning agent may be hired directly by the building owner, the construction contractor, or PBC itself. As project manager, PBC helps coordinate these entities and is responsible for ensuring its clients receive the required commissioning documentation. PBC itself is not a commissioning agent.

III. FINDING AND RECOMMENDATIONS

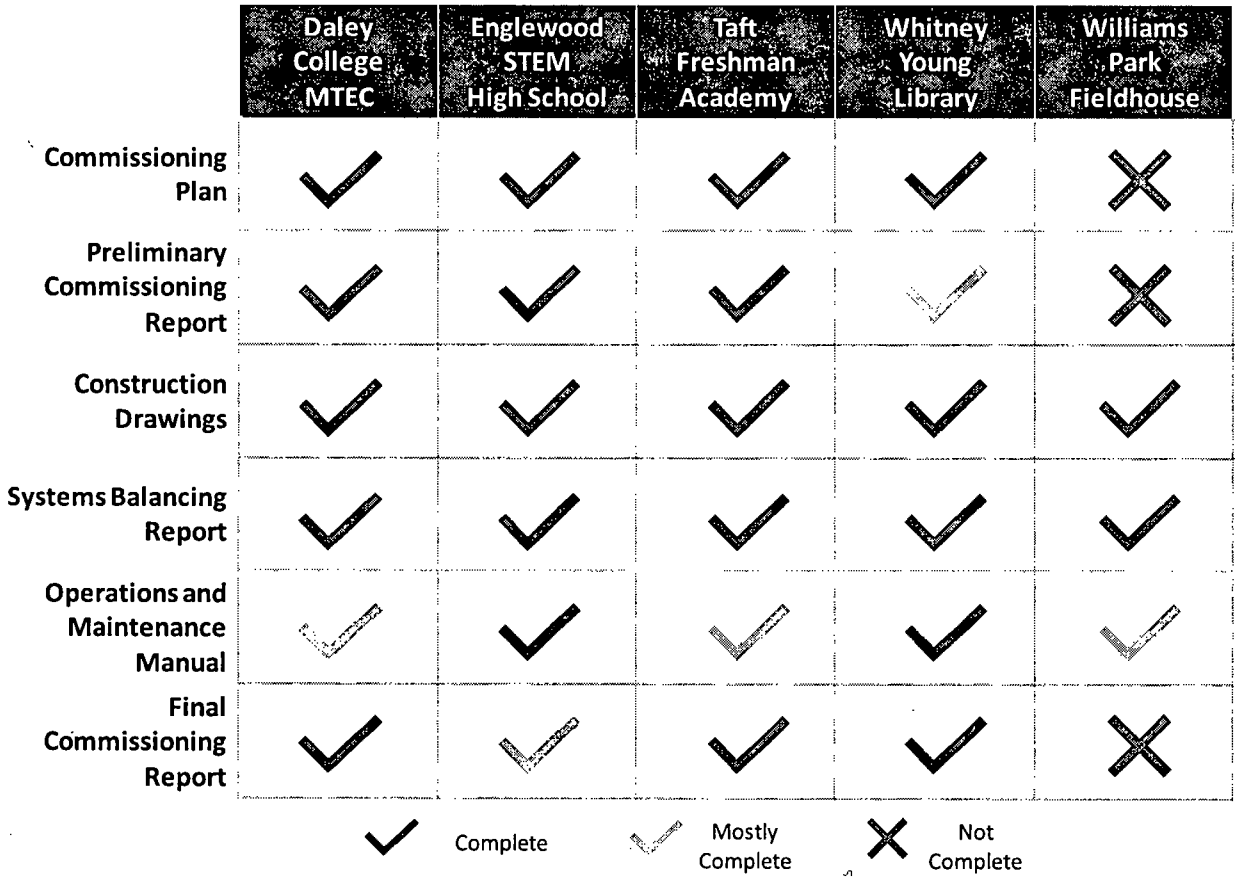
FINDING: Although most projects had reasonably complete training and commissioning documents, PBC did not ensure that building maintenance staff had access to these resources.

Using a sample of five projects completed in 2018 and 2019, OIG assessed whether PBC ensured that its commissioning agents created and provided the documentation required by the Chicago Energy Conservation Code to its clients. We also assessed whether PBC ensured that building maintenance staff received training on commissioned equipment.

A. COMMISSIONING DOCUMENTATION

As illustrated in Figure 2, project commissioning teams created reasonably complete commissioning documentation for the Daley College Manufacturing Technology & Engineering Center (MTEC); the Englewood STEM High School; the Taft Freshman Academy; and the Whitney Young Library. However, the Williams Park Fieldhouse was missing most of its commissioning documentation.

FIGURE 2: The Williams Park Fieldhouse project did not create three required commissioning documents, but the other projects had most of their required documentation.[4]



Source: OIG illustration.

PBC joined the Williams Park Fieldhouse project after the building's design was completed. It stated that the project was not commissioned because the client, the Chicago Park District, did not include a commissioning agent in its scope or budget. However, the building's documented heating and cooling capacities are over the threshold that subjects the project to the Chicago Energy Conservation Code's commissioning requirements. Despite PBC joining the project after construction had begun, and the Chicago Park District's position that commissioning was outside

[4] OIG used the following standard to rate the completeness of these documents:
Complete: All or nearly all required components are present; any missing components can be worked around and have little impact on how the document can be used. For example, a lighting manual that describes maintenance processes but does not provide a maintenance schedule would still be considered part of a complete Operations and Maintenance Manual package.
Mostly Complete: Most required components are present; missing components are minor but have some impact on how the document can be used. For example, an Operations and Maintenance Manual package that contains manuals for all equipment except lighting controls would be considered mostly complete.
Not Complete: Document is missing entirely or is missing critical components; major limitations on how this document can be used, if at all. For example, a Preliminary or Final Commissioning Report that contains no information on equipment testing would be considered not complete.

its budget, the Chicago Energy Conservation Code requires that the Williams Park Fieldhouse complete a commissioning process.

PBC did not always ensure that building maintenance staff received or had access to documentation. OIG interviewed the building engineers on all five projects, who each told us they were still waiting to receive complete commissioning documents. PBC stated that project contractors provided operations and maintenance manuals to staff at Taft Freshman Academy and Daley College MTEC through a shared web platform. However, Daley College MTEC's engineer stated that they could not access the web platform and would have preferred hard copies. PBC also stated that contractors provided these manuals in person to staff on the remaining three projects, though staff report that they have not received them. Some buildings in the sample were open and occupied before a formal "closeout" process was completed. Delays in finalizing this process have led to delays in distributing some commissioning documentation.

Without complete commissioning documents, building owners have less assurance that their buildings were properly commissioned, which may lead to operational problems, voided equipment warranties, wasted energy, and environmental harm. In addition, building maintenance staff may not have the information they need to maintain a building's mechanical equipment.

Because each of the projects we reviewed was substantially completed in 2018 or 2019, they have been operating without these documents for as long as three years. Engineers in those buildings reported that some mechanical equipment is not working properly. Problems include incompatible heating systems, a thermostat that gives low readings, an inaccessible coolant tank, and a malfunctioning heat pump. One engineer stated that the manufacturer will not service the heat pump because the equipment was not commissioned, per warranty guidelines. Providing this documentation directly to building maintenance staff reduces the risk that such issues will occur.

As project manager, PBC stated that it accepts responsibility for ensuring that a complete commissioning process occurs on each project, but it does not have standardized procedures to ensure the process is always completed.

B. EQUIPMENT TRAINING

PBC coordinated building maintenance staff training on commissioned equipment on all five projects we examined and documented several of these trainings with video recordings. While the Chicago Energy Conservation Code does not require training on commissioned equipment, PBC stated that training is an important project step. Training is also recommended by the

Building Commissioning Association's best practices.[5] Each of the building engineers reported that the trainings coordinated by PBC were adequate to operate and maintain building systems, although two of them reported that they had not received recordings of the trainings. Without access to the training videos, building maintenance staff may lose institutional knowledge on commissioned equipment as staff members eventually leave.

RECOMMENDATIONS

1. PBC should define, document, and implement a process for ensuring that all projects subject to the Chicago Energy Conservation Code are fully commissioned, collecting all required commissioning documentation, and providing each document to the client agency within its specified time frame. This may require adjusting the project closeout process so that documents are delivered by the milestones specified in the Chicago Energy Conservation Code, rather than at project closeout. This process should also include confirmation with building maintenance staff that they have received documentation in an accessible format.
2. PBC should review its recent commissioned projects and contact the staff members currently maintaining these buildings to ensure they have access to the necessary commissioning documentation, as well as video recordings of any trainings provided on commissioned equipment. PBC should then provide this staff with any missing documents or recordings identified in its review.

MANAGEMENT RESPONSE

1. *"PBC agrees with this recommendation.*

   PBC is committed to delivering quality Projects that meet its Client's requirements and comply with relevant current Codes, including the Chicago Energy Conservation Code.

   To achieve this, PBC develops Projects in accordance with defined scope and deliverables established in coordination with its Clients. PBC will continue to work to ensure that Contract Documents clearly define Project requirements and that deliverables are provided within the specified time frames. In addition, PBC will ensure the process is properly tracked, for compliance with the Contract Documents.

   PBC will continue to document when Commissioning is not required, not requested by the Client, and/or not part of the Project scope of PBC's Undertaking(s). In instances where Commissioning and/or the Commissioning Authority is not part of the Project scope and/or managed by the PBC, PBC will advise its Clients regarding the Chicago Energy Conservation Code requirements.

[5] Building Commissioning Association, "New Construction Commissioning Best Practices," 2018, pages 15-16 and 27, accessed June 15, 2021, https://www.bcxa.org/uploads/resources/New%20Construction%20Building%20Commissioning%20Best%20Practices.pdf.

Additionally, as part of Project completion, verification of Closeout requirements, including documentation and confirmation of Work items provided by the Contractor(s) has previously been established. Specified closeout requirements and documents provided by the Contractor(s) are reviewed throughout a Project. PBC will review the established verification list to ensure specific time frames required for Commissioning documents, if applicable, are clearly identified and information provided and accessible within the specified time frames.

Required, final PBC Project Documentation is managed through the PBC's electronic Project Management Information System. Client participants are provided with access to the System with ability to view and download documentation and Project processes throughout the life of the Project. PBC will follow-up with Client representatives to ensure that identified staff have access to the system to review documentation. Additionally, hard copies, where requested and specified, will be reviewed to confirm that documentation has been received in an accessible format."

2. *"PBC agrees with this recommendation.*

   Prior to Project Closeout and Final Acceptance, PBC will continue to conduct audits to ensure all deliverable items comply with the Contract Documents. In addition, during the planned 11-Month Walk-Through of the Projects, PBC will follow-up with the Client, enduser, and occupant regarding this matter. The PBC will continue to coordinate with its Clients to ensure appropriate attendees are included in the 11th Month Warranty Walkthroughs, including but not limited to assigned maintenance staff / building engineers and/or building occupants, where applicable.

   Separately, PBC will follow-up with its Client representatives to confirm the list of users for the PBC's Project Management System for recently commissioned projects as noted above.

   Finally, PBC has followed up on the Project issues reported by the building engineers in the audit report to support resolution of any identified issues. PBC will coordinate findings and follow-up with the Clients accordingly."

IV. OBJECTIVES, SCOPE, AND METHODOLOGY

A. OBJECTIVES

The objective of the audit was to determine if PBC ensured that all required commissioning and equipment documentation was developed and provided to clients in accordance with the Chicago Energy Conservation Code.

B. SCOPE

OIG examined the commissioning and equipment documentation PBC compiled for its clients as required by the Chicago Energy Conservation Code, as well as any related trainings. This included a sample of five newly constructed buildings PBC delivered to its clients in 2018 and 2019. We did not assess the quality of commissioning activities, whether the projects met the technical standards of the Chicago Energy Conservation Code, or the Department of Buildings' involvement with PBC projects.

C. METHODOLOGY

OIG interviewed PBC leadership and project managers, project commissioning agents, and building maintenance staff about PBC's commissioning process, how PBC ensures this process is followed, and how the process impacts the way its buildings are delivered and operated. To determine whether projects generated the commissioning documentation required by the Chicago Energy Conservation Code, we selected a targeted sample of 5 new-construction projects from a total of 16 in our audit scope, representing a diverse set of project risks, locations, and client agencies. We requested all required documents for each project from PBC, along with associated training videos and sign-in sheets. We reviewed these in detail to determine whether they met the specific requirements of the Chicago Energy Conservation Code. Lastly, we interviewed building engineers from all five projects to determine whether they had received this documentation, whether they had been adequately trained on commissioned equipment, and whether the commissioning process had been generally helpful to them. Throughout the audit, we researched industry guides and best practices on building commissioning to better inform our work.

D. STANDARDS

We conducted this performance audit in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

E. AUTHORITY AND ROLE

The authority to perform this audit is established in the City of Chicago Municipal Code § 2-56-030 which states that OIG has the power and duty to review the programs of City government in order to identify any inefficiencies, waste, and potential for misconduct, and to promote economy, efficiency, effectiveness, and integrity in the administration of City programs and operations. Our jurisdiction extends to PBC pursuant to an intergovernmental agreement executed by the City and PBC.

The role of OIG is to review City operations and make recommendations for improvement.

City management is responsible for establishing and maintaining processes to ensure that City programs operate economically, efficiently, effectively, and with integrity.

The City of Chicago Office of Inspector General (OIG) is an independent, nonpartisan oversight agency whose mission is to promote economy, efficiency, effectiveness, and integrity in the administration of programs and operations of City government. OIG achieves this mission through,

- administrative and criminal investigations by its Investigations Section;
- performance audits of City programs and operations by its Audit and Program Review Section;
- inspections, evaluations and reviews of City police and police accountability programs, operations, and policies by its Public Safety Section; and
- compliance audit and monitoring of City hiring and human resources activities by its Compliance Section.

From these activities, OIG issues reports of findings and disciplinary and other recommendations to assure that City officials, employees, and vendors are held accountable for violations of laws and policies; to improve the efficiency, cost-effectiveness government operations and further to prevent, detect, identify, expose and eliminate waste, inefficiency, misconduct, fraud, corruption, and abuse of public authority and resources.

OIG's authority to produce reports of its findings and recommendations is established in the City of Chicago Municipal Code §§ 2-56-030(d), -035(c), -110, -230, and -240.

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