MSBA Commissioning Roundtable

Post-Occupancy Evaluation Presentation
April 29, 2020

Meeting Agenda:

- Introduction
  - Sarah Przybylowicz, MSBA
    Sarah.Przybylowicz@MassSchoolBuildings.org
- Pilot Overview and POE Implementation
  - Chris Alles, MSBA
- Process and Development
  - Brooke Trivas, Brad Rogers, Perkins & Will
- Pilot Visits and Summary of Findings
  - Brad Jones, Cadmus
- Discussion and Survey

Post-Occupancy Pilot Program

Historic Timeline

FY17

- Internal Kick-off
- Establish Pilot Scope
- Identify Participants
- Pilot Recommendation

FY18

- Pilot Test
- District Outreach
- Develop Application
- Initial Building Visits
- Analyze Data
- Designer Roundtable
- Pilot Extension

FY19

- Establish Scope
- District Outreach
- Consultant Procurement
- Building Visits to Observe Operation/Performance (Performed by Cadmus)
- Thorough Review of the MSBA Process, Guidelines, Data Collection Opportunities (Performed by Perkins & Will)
- Consultant Collaboration

FY20/21

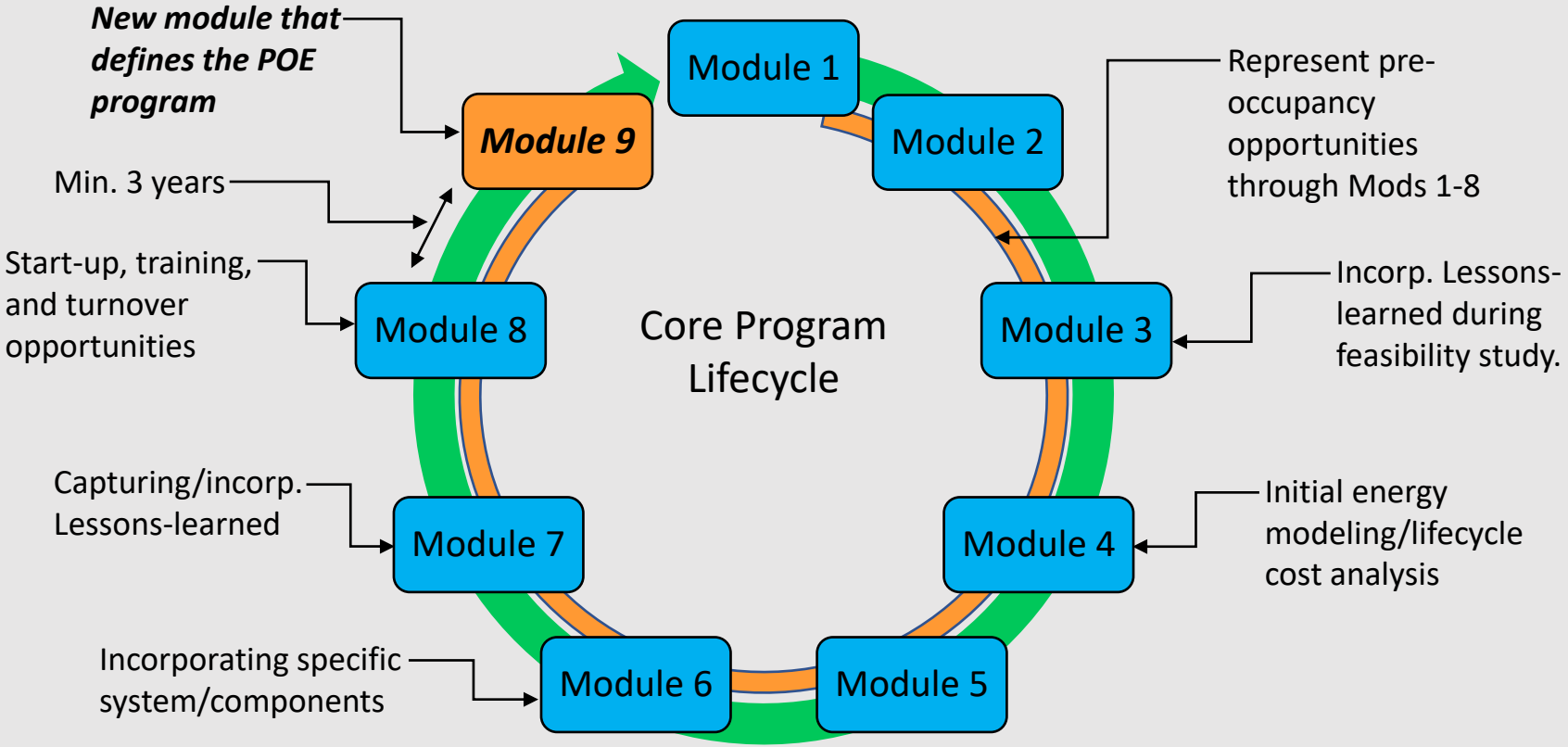
- Consultant Collaboration
- Final Reporting
- Implementation Approval
- Ongoing Development
- Onboarding & Startup
- POE Commencement

MSBA's Support for Public School Construction

Learning from the experience and protecting the investment!

"To establish a process intended to focus on understanding that Core Program projects that have received a grant from the MSBA are operating and performing per the intended design"

Adding ‘Module 9’ to Core Program Projects



MSBA Post-Occupancy Pilot Program - Building Visits

Sample Findings & Recommendations

"White Roofs – The majority of new schools are equipped with white roofs for their benefits of reducing heat island effect and earning points under LEED or CHPS. However, the white roof materials pose slip and fall hazards when moisture is present (dew, rain, snow, and ice). "

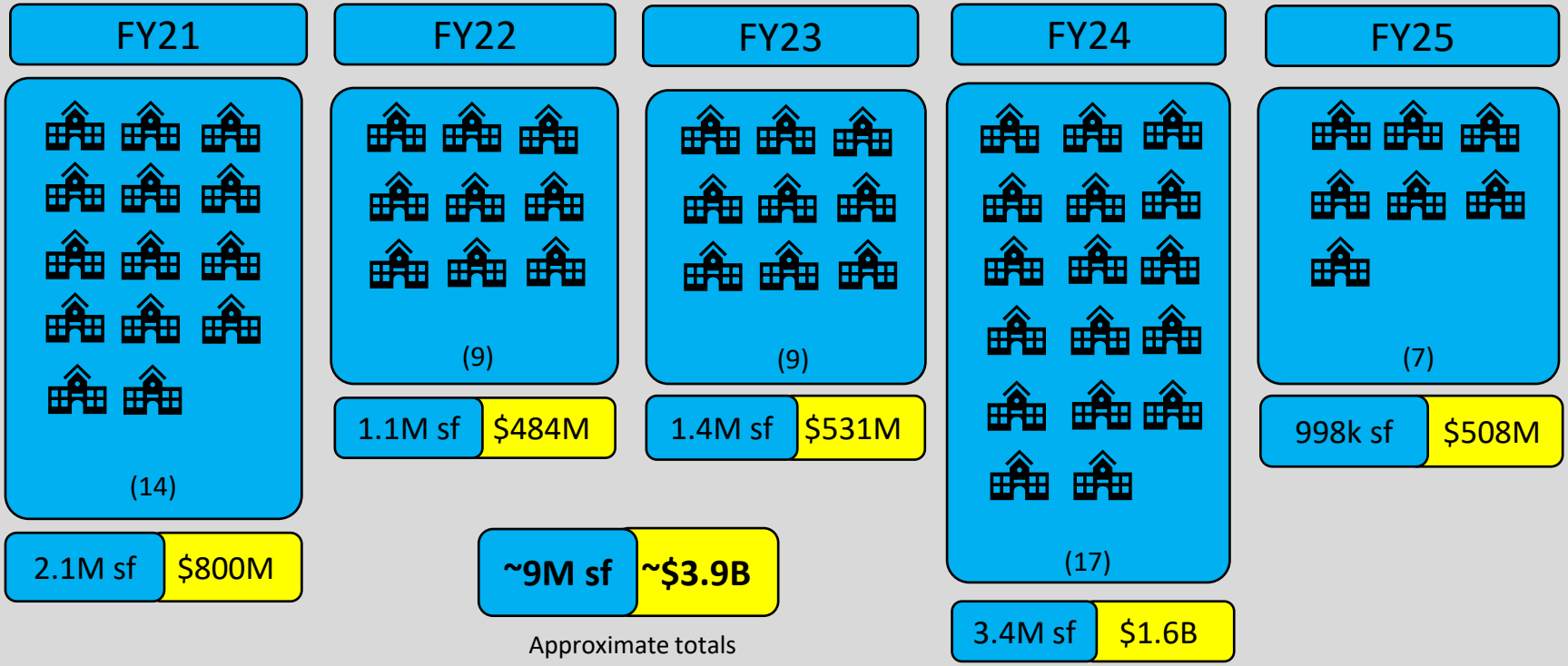
"Training at Project Turnover - Dissatisfaction with current training processes at project turnover; Spread sessions out over time; Engage building staff on walkthroughs early; Consider requiring OPMs take responsibility for coordination; Staff felt that training at handoff was short, poorly formatted, and generally of low use. "

"Lighting controls - Centralized lighting control systems are not user-friendly; Consider integration with HVAC controls, they are generally easier for O&M staff to monitor and adjust."

"Submetering - Buildings have submetering systems that have been designed and installed but it appears they are not being used. 43% of the buildings surveyed have energy submetering installed, but none of the building staff monitor or use the submetering systems. "

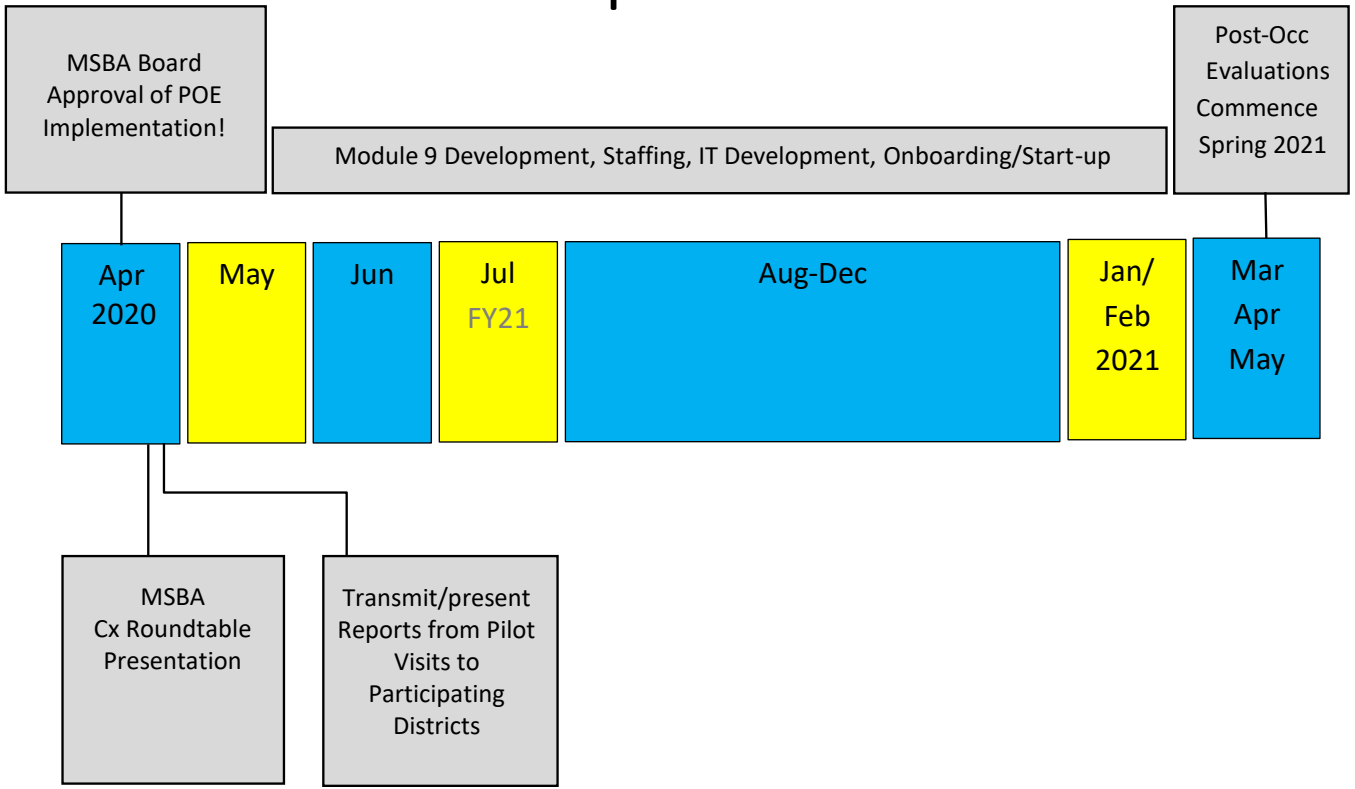
MSBA Post-Occupancy Evaluation Program

Projected POE's & Associated Construction Cost (FY21 -FY25)*

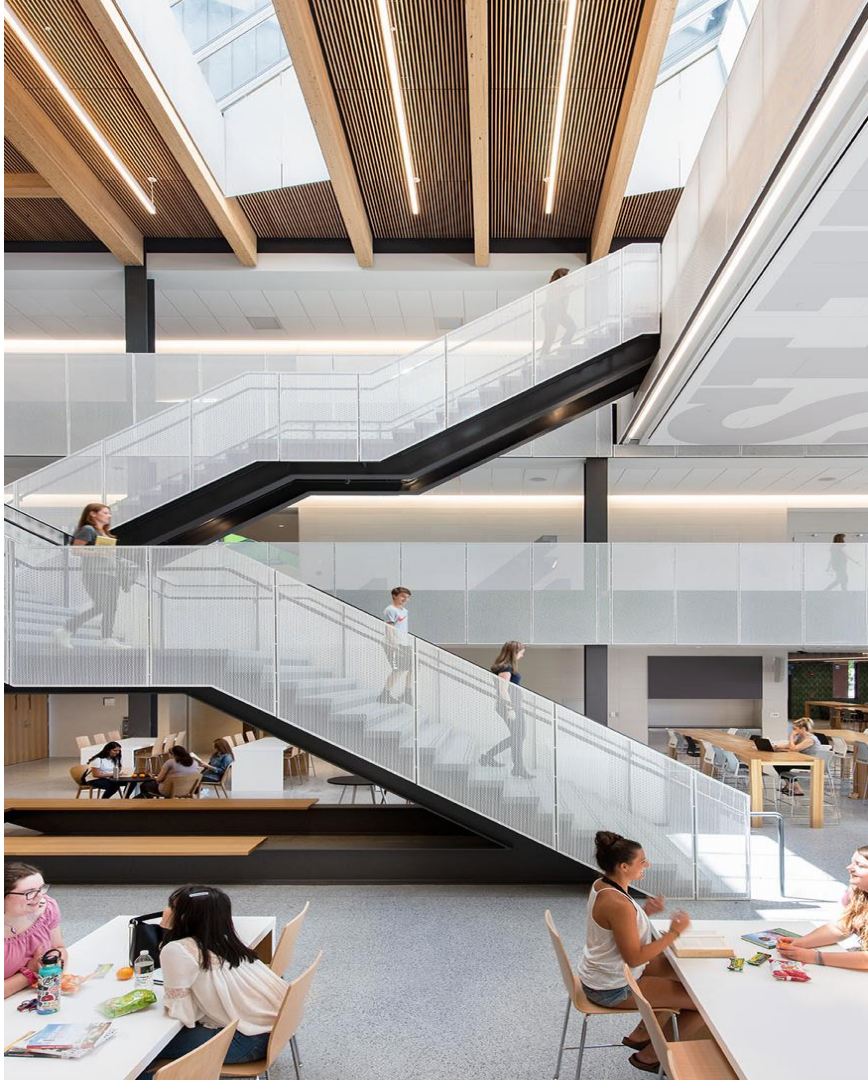


*Based on project schedules, this assumes an average of 11.2 evaluations or (12) per year. Assume 50-60 evaluations through FY25.

MSBA Post-Occupancy Evaluation Program
Anticipated Roll-out



MSBA
Post-Occupancy
Evaluation Pilot



Perkins&Will

Agenda

01 — Project Overview

02 — POE Process Recommendations

03 — Data Collection Tactics

04 — Database & Dashboard

05 — Report Template

06 — Next Steps

→

Massachusetts School Building Authority Mission

Partner with Massachusetts communities to support the design and construction of educationally-appropriate, flexible, sustainable, and cost-effective public school facilities.

A systematic study of site systems, building performance, and human experience measured against pre-established objectives to understand the impacts of the built environment.

Mixed Method

Enables in depth understanding of complex issues **while increasing the validity and reliability** of data collected.

+

Multi-Perspective

Build a **richer understanding of how the built environment is performing** from multiple perspectives.

Project Objectives

1

Establish a POE process, **specific to MSBA-funded K-12 schools**

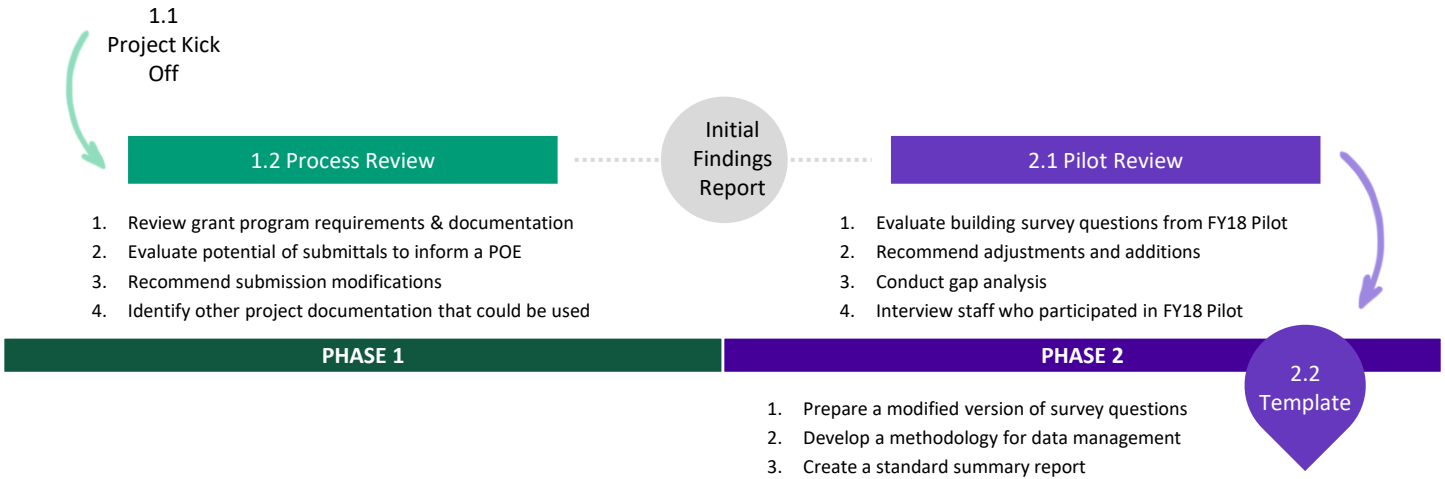
2

Understand if the schools funded by the Authority are **operating and performing as designed**.

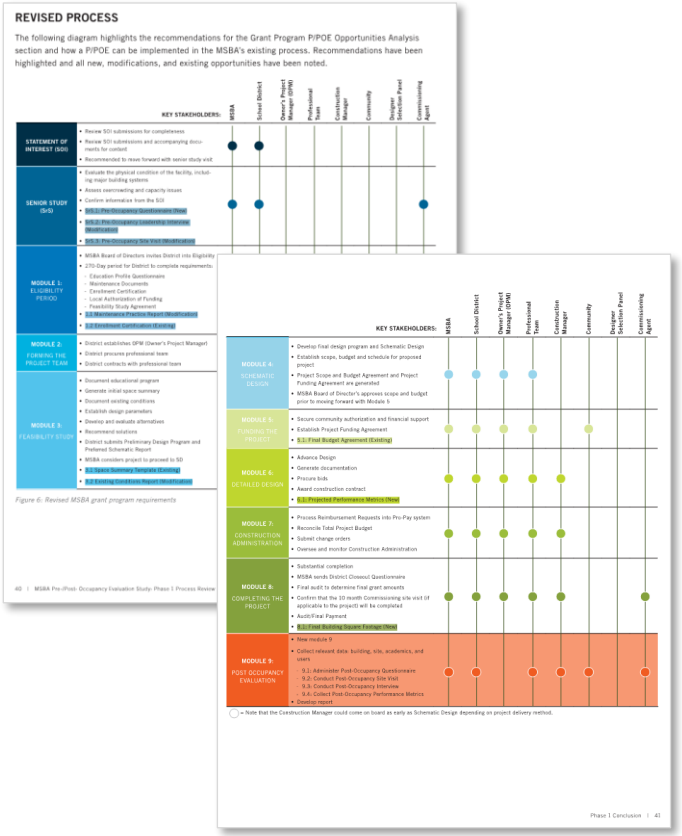
3

Measure the impact of design on site systems, building performance, and human experience.

Project Schedule



Phase 1 identified opportunities for the MSBA to collect data during Modules 1-8



Phase 2 identified opportunities to improve data collection in the existing POE process

Create a baseline

Reduce number of questions

Gather multiple perspectives

Make survey anonymous

Implement rating scales

Develop mixed method

POE Process Recommendations

POE Process Recommendations

01
Create Module 9 — Post Occupancy Evaluation as part of the standard grant funding process

02
Expand on POE Pilot by implementing **multiple data collection tactics**, including a site visit, pre-visit questionnaire, and an online survey

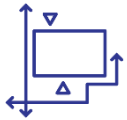
03
Capture data submitted in Modules 1-8 as part of the POE process to compare actual outcomes vs original intent

04
Co-locate POE data for all completed schools in a **central database with an online dashboard** for comparison and analysis of trends

05
Summarize POE findings in a **standard report template** that will be used for each school

Proposed process

Modules 1-8 Form



Online Survey

Pre-Visit Questionnaire

Site Visit

Post Occupancy Evaluation Central Database

- Web-based Reporting Dashboard
- Standard Building POE Report

Provide actionable items for District's to address, and lessons learned to improve future MSBA funded projects

Data Collection Tactics

Four data collection tactics.

Modules 1-8 Form

Data from 2 modules
15 total questions

Online Survey

5 respondent groups
35 total questions

Pre-Visit Questionnaire

4 respondent groups
84 total questions

Site Visit

1 day visit
Team assigned by MSBA

Modules 1-8 Form

Recommendation — Capture data points already collected during Modules 1-8 and utilize it in the POE process to measure the performance of the new building compared to the design intent.

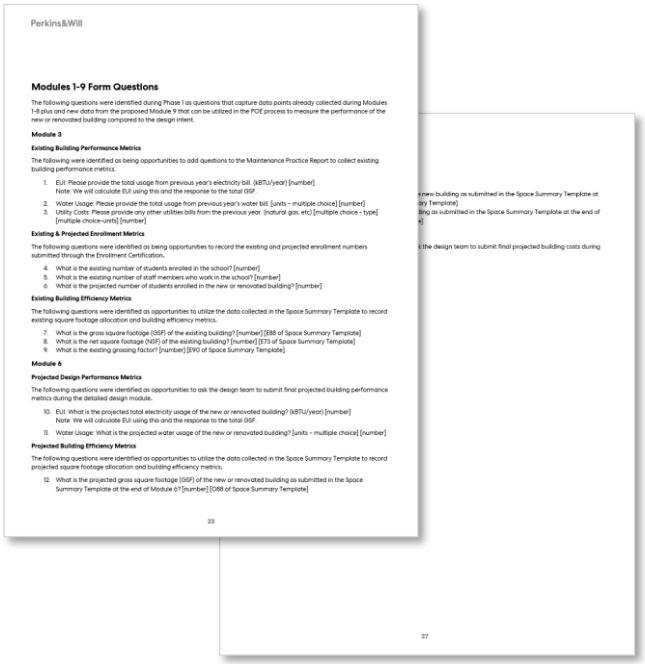
Tool — Develop a form that collects specific data points already submitted in Modules 1-8 and feeds into the central POE database like the form used in the FY18 POE Pilot.

Respondents — MSBA and Design Team.

Timeline — To be completed during Modules 3 & 6.

Implementation — MSBA to provide the appropriate forms to the design teams and log data as it is submitted during Modules 3 & 6. Design team to record data points about projected building performance during Module 6.

Analysis — MSBA to log data from in central POE database from the proposed questions for Modules 3, 6, & 9.This includes reviewing the appropriate submittal documents and recording the specified data points. Summarize findings in the POE summary report.


Perkins&Will

Modules 1-9 Form Questions

The following questions were identified during Phase 1 as questions that capture data points already collected during Modules 1-8 plus and new data from the proposed Module 9 that can be utilized in the POE process to measure the performance of the new or renovated building compared to the design intent.

Module 3

Existing Building Performance Metrics

The following were identified as being opportunities to add questions to the Maintenance Practice Report to collect existing building performance metrics.

1. EUI: Please provide the total usage from previous year's electricity bill. (kBTU/year) [number]
   Note: We will calculate EUI using this and the response to the total GSF.
2. Water Usage: Please provide the total usage from previous year's water bill. [units – multiple choice] [number]
3. Utility Costs: Please provide any other utilities bills from the previous year. [natural gas, etc] [multiple choice - type] [multiple choice-units] [number]

Existing & Projected Enrollment Metrics

The following questions were identified as being opportunities to record the existing and projected enrollment numbers submitted through the Enrollment Certification.

4. What is the existing number of students enrolled in the school? [number]
5. What is the existing number of staff members who work in the school? [number]
6. What is the projected number of students enrolled in the new or renovated building? [number]

Existing Building Efficiency Metrics

The following questions were identified as opportunities to utilize the data collected in the Space Summary Template to record existing square footage allocation and building efficiency metrics.

7. What is the gross square footage (GSF) of the existing building? [number] [E88 of Space Summary Template]
8. What is the net square footage (NSF) of the existing building? [number] [E73 of Space Summary Template]
9. What is the existing grossing factor? [number] [E90 of Space Summary Template]

Module 6

Projected Design Performance Metrics

The following questions were identified as opportunities to ask the design team to submit final projected building performance metrics during the detailed design module.

10. EUI: What is the projected total electricity usage of the new or renovated building? (kBTU/year) [number]
    Note: We will calculate EUI using this and the response to the total GSF.
11. Water Usage: What is the projected water usage of the new or renovated building? [units – multiple choice] [number]

Projected Building Efficiency Metrics

The following questions were identified as opportunities to utilize the data collected in the Space Summary Template to record projected square footage allocation and building efficiency metrics.

12. What is the projected gross square footage (GSF) of the new or renovated building as submitted in the Space Summary Template at the end of Module 6? [number] [D88 of Space Summary Template]

33

37

Image: Example screen shot of Module 1-9 Form

Online Survey

Recommendation — Collect subjective data from multiple perspectives through an online survey to develop a comprehensive understanding of how the facility is functioning and measure effectiveness of the new building.

Tool — Utilize a third-party survey tool to streamline survey administration and analysis.

Respondents — Multiple respondents have been identified including: School and District leadership, facilities personnel, teachers and staff, students, and parents. Each audience will respond to a set of questions that is appropriate for them.

Timeline — The survey should remain open for a 2-week period to assure participants have ample time to respond.

Implementation — MSBA to schedule online survey deployment with district, provide district with survey communications, deploy online survey, monitor responses, and troubleshoot any problems.

Analysis — MSBA to download raw survey data, summarize overall findings and input those into the central POE database and POE summary report.

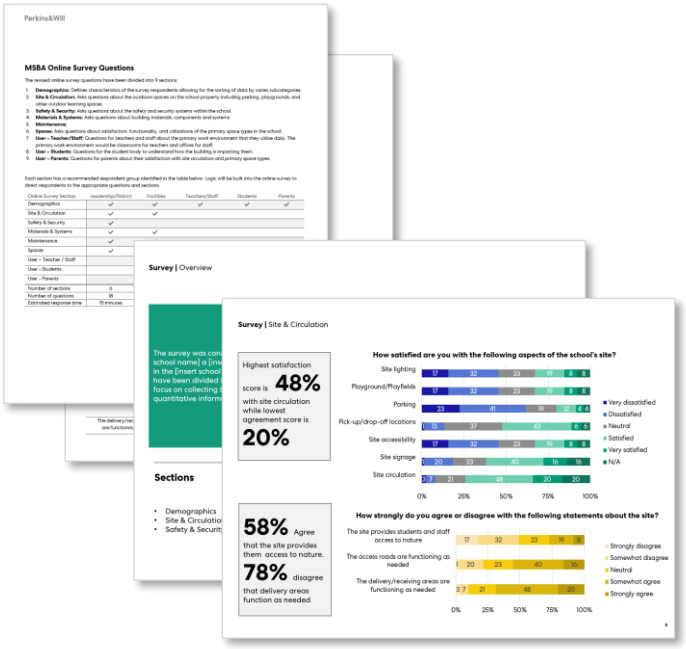


Image: Example screen shot of Online Survey questions and Survey Summary Template

Pre-Visit Questionnaire

Recommendation — Create a form that collects information from select individuals prior to the MSBA site visit.

Tool — Develop a form that collects data and feeds into the central POE database like the form used in the FY18 POE Pilot.

Respondents — MSBA and School and District leadership.

Timeline — To be completed before the site visit to provide the MSBA with insight to how the building is performing prior to being on site.

Implementation — MSBA to send form to School. District leadership and fill out the MSBA section of the form.

Analysis — MSBA to review content submitted, note anything important to follow-up on during site visit, input data into central database and the POE summary report.

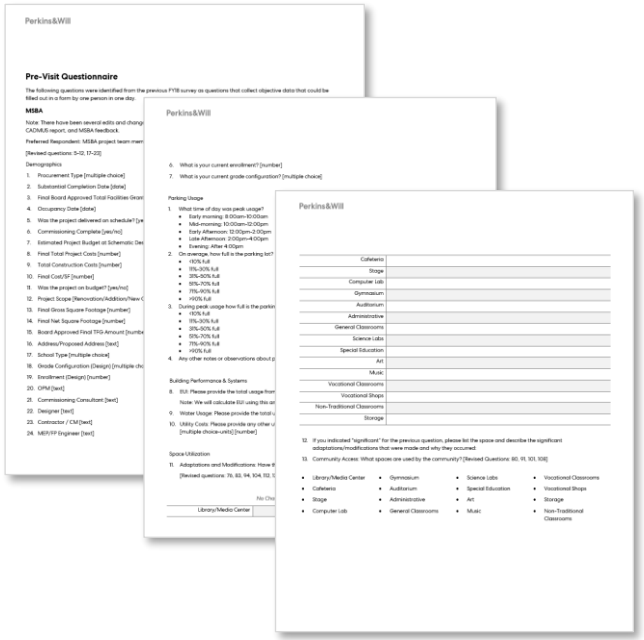


Image: Example screen shot of Pre-Visit Questionnaire

Site Visit

Recommendation — Continue to conduct one day non-invasive site visit with two MSBA employees. One to ask the district questions and take necessary photos and the other to log information in the site visit form on a tablet.

Tool — Edit the existing FY18 POE Pilot application with the revised site visit questions.

Respondents — MSBA

Timeline — To be conducted after the online survey is administered and the pre-visit questionnaire is received. Any spaces or topics that might have had low scores from the survey can be followed up on during the site visit.

Implementation — MSBA to schedule site visit with district, fill out form and document findings while on site.

Analysis — MSBA to save form and any supporting photographs from the visit, input data into central database, and summarize findings in the POE summary report.

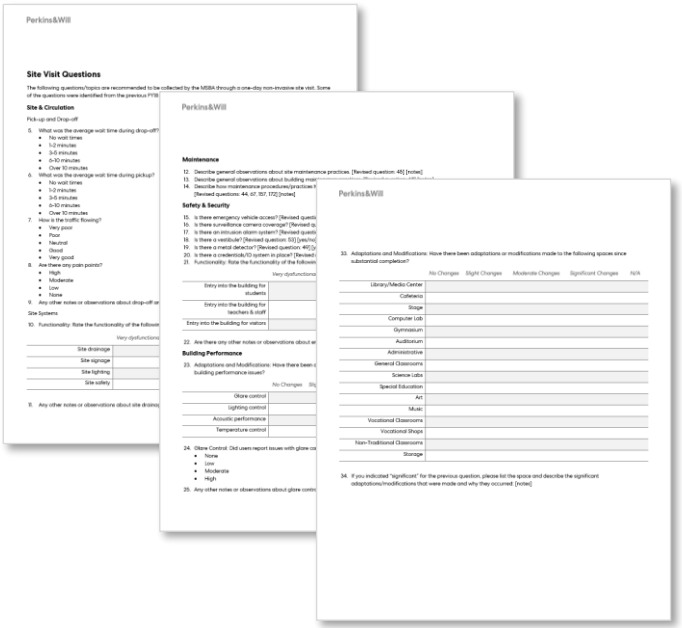


Image: Example screen shot of Site Visit questions

Database & Dashboard

Data Tables and Fields

Modules 1-8 Form

- **Building ID**

- Square footage
- Building capacity
- Design enrollment
- Budget
- Program

+/- 30 fields

Online Survey

- **Building ID**

- Demographics
- Site & Circulation
- Safety & Security
- Materials & Systems
- Maintenance
- Spaces
- User – Teacher/Staff
- User – Student
- User – Parent

+/- 30 fields

Pre-Visit Questionnaire

- **Building ID**

- Grant information
- Current enrollment
- Project team
- Enrollment
- Configuration
- Programs
- Parking
- Building performance
- Space modifications
- Community uses
- Operating costs

+/- 50 fields

Site Visit

- **Building ID**

- Site & Circulation
- Site Systems
- Maintenance
- Safety & Security
- Building Performance
- Space Utilization
- Metering

+/- 40 fields

Data sets linked based on Building ID

Example Data Table

Building ID	Square Footage	Year Completed	Budget	Design Enrollment	Grade Levels	Other Fields…
Building 1						
Building 2						
Building 3						
Building 4						
Building 5						

Example Form

Building ID: _____

Square Footage: _____
Year Completed: _____
Budget: _____

Design Enrollment: _____
Additional Fields (see appendix)

Forms populate each row of the table

Each building is a row in the table

The online survey will be summarized before loading into the central database

Raw data:

100’s of responses x 30 questions

Raw data archived separately

Processing functions to calculate averages and totals – e.g. overall teacher satisfaction

Averages and totals loaded into central database.

Each school gets a single average or total value for each question

Dashboard Mockup

Images: Example screenshot of dashboard mockup

POE Report Template

Standard Building POE Report Template

Images: Example screenshot of Standard Building POE Report Template

Next Steps for Program Development

Based on the recent approval by the MSBA Board of Directors to implement an MSBA Post-Occupancy Evaluation Program for Core Program projects, Perkins & Will remains committed to the ongoing collaboration with MSBA staff to assist in making this process a successful reality.

01

Discuss with the community - commissioning, design, and facility maintenance

02

Develop the logistics and technology platforms to support the process

03

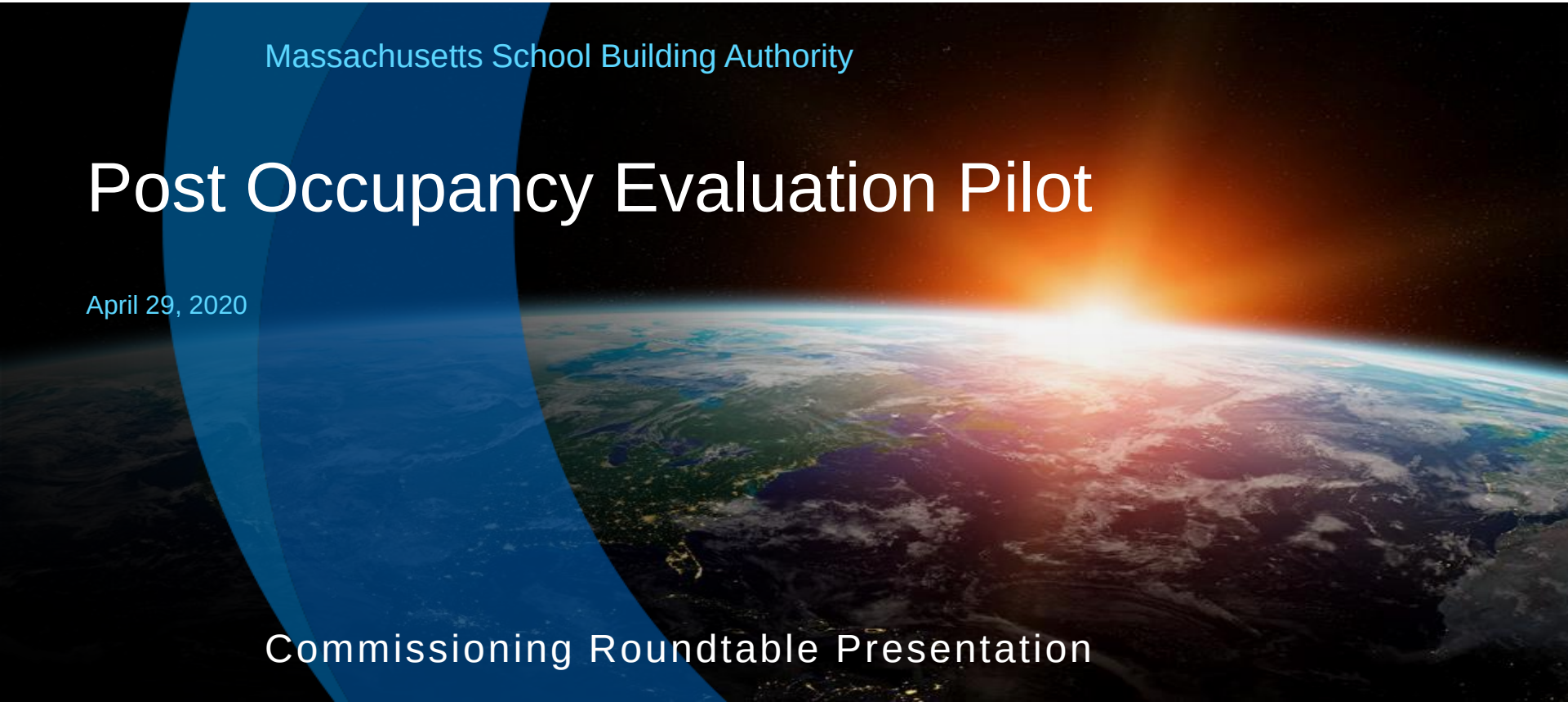
Test the new process and adjust as needed prior to going live in 2021.

CADMUS

Massachusetts School Building Authority

Post Occupancy Evaluation Pilot

April 29, 2020



Commissioning Roundtable Presentation

Agenda

Post Occupancy Pilot Process

Themes from Findings

Post Occupancy Pilot: Overview

- 14 Districts Participated
- Construction completion 2011-2015
- High Schools: Qty. 6
- Middle Schools: Qty 6
- Elementary Schools: Qty 2
- Areas of focus
  - Heating/Boiler Systems
  - Building Automation Controls
  - Lighting Controls
  - Building Envelope

Post Occupancy Process: Preparation

Outreach to Districts	• MSBA Introduction • Information Sheet
Utility Data	• Signed Data Release Forms • Data File Sharing • Monthly Summary, 15-minute Interval
MSBA File Transfer	• Schematic Design Documents • Bid Documents • As-built Documents • Commissioning Reports
Preliminary Call	• Introductions, Contact Information • Pilot Process Intent and Overview • School & Building System Information • Site Visit Coordination

Post Occupancy Process: Implementation

Site Visit	• 24-48 Hours Advance Confirmation • One Day • Administrative Staff, Facilities Staff • Meeting / Discussion • Walkthrough – Systems, Roof, Mech/Elec Rooms
Site Visit Follow- up	• Clarifications • Meter / Data Retrievals
Individual School Reports	• Overall Analysis • Benchmarking – How do they compare? • Recommendations for School – Energy, O&M
Overall MSBA Report	• MSBA Post Occupancy Process Feedback • Use of Facilities / Systems – Design Considerations? • Commissioning / Training / Turnover Enhancements

School Report Highlights

Energy Performance	• Overall Analysis • Benchmarking – How do they compare? • Energy Management • Points of Interest
System Performance	• Summary and Analysis • Recommendations for School
O&M Assessment	• Overall Analysis • Benchmarking – How do they compare? • Recommendations for School
Feedback to MSBA	• MSBA Process Feedback • Use of Facilities / Systems – design considerations? • Commissioning / Training / Turnover

Next Steps - Schedule

Finalize Analysis	• Complete
Individual School Reports	• Finalize and Distribute to Districts • Coordinate District Webinar Presentations
Overall Report	• Finalize and Submit to MSBA
MSBA Support	• Supplemental Information

O&M Assessment - Scale

4	• Best Practices are Implemented
3	• Activities Generally Performed
2	• Limited Activities Performed
1	• Opportunity for Improvement

O&M Assessment Results

Category	Average	Minimum	Maximum
HVAC (5 Criteria)	2.9	2.0	3.9
Building Automation/Controls (6 Criteria)	2.8	1.8	3.1
Lighting Controls (5 Criteria)	2.9	2.6	3.2
Preventive Maintenance (2 Criteria)	3.2	3.2	3.1
Energy Management (2 Criteria)	1.5	1.4	1.6

Satisfaction - Scale

4	• Very Satisfied
3	• Generally Satisfied
2	• Limited Satisfaction
1	• Dissatisfied

Satisfaction Feedback Results

Category	Average
Overall School	3.9
HVAC	3.4
HVAC Controls	3.0
Lighting Controls	2.7
Building Envelope	3.4
Project Turnover Training	2.4
Roof Access	3.1

Findings – Sample Theme #1

Operational Recommendations for Schools

Performance Feedback

Condensing Boilers	Schedules	Lighting Controls
• High efficiency based on lower water temperatures • Systems not set to operate at condensing conditions • Guidance on settings and impact	• You can't save more energy than shutting something off • System schedules don't match building schedules • How to see this from data & guidance on potential adjustments	• Lighting control system interfaces are not user friendly and are generally not used • Develop standard operating procedures for lighting system adjustments

Findings – Sample Theme #2

Design Feedback

Design Decisions that Impact O&M

Roof Access	Storage Space	White Roofs
• Equipment placed on roof needs to be maintained • Ladder access is common, but not suitable for moving filters and other materials • Design focus and maximizing sf within the grossing factor	• Lack of storage • Engage with O&M staff on adequate storage space for maintenance equipment and supplies • Maximizing sf within the grossing factor	• White roofs pose slip and fall hazard when moisture is present (dew, rain, snow, etc) • Material selection • Improved walk-way pad layout for circulation and work area around equipment

Findings – Sample Theme #2

Design Feedback

Design Decisions that Impact O&M

Submetering	HVAC Controls	Lighting
• Buildings have submetering but it is not being used. • Ensure meter management plan with individuals responsible are addressed in design • Tie in other standard meters	• Districts are burdened with unique systems in each building. • Guidance on proprietary specifications for district wide agreements	• Centralized lighting control systems are not user-friendly • Consider integration with HVAC controls • Ensure robust training requirements are specified

Findings – Sample Theme #3

MSBA Process Feedback

Commissioning

Reports	Training	Training
• Commissioning documentation not being used by O&M staff • Enhance direct contact between CxA and O&M staff	• Dissatisfaction with current training processes • Spread sessions out over time • Engage building staff on walkthroughs early • OPM coordination	• O&M staff turnover is common, so people receiving training are not with district • Outsourced maintenance • Plan for changing staff & outsourced maintenance


Thank you!

Discussion

To ask a question, please use the “Raise Hand” feature.

Please take a moment before you leave the meeting to complete few survey questions.

For additional information regarding MSBA’s POE Program, please contact Chris Alles at chris.alles@massschoolbuildings.org

For general information regarding MSBA’s Cx Roundtable, please contact Sarah Przybylowicz at sarah.przybylowicz@massschoolbuildings.org

Thank you for your participation!