

# *“Planning for Operation & Maintenance of New Schools”*



*Massachusetts School Building Authority  
November 7, 2019*

# AGENDA

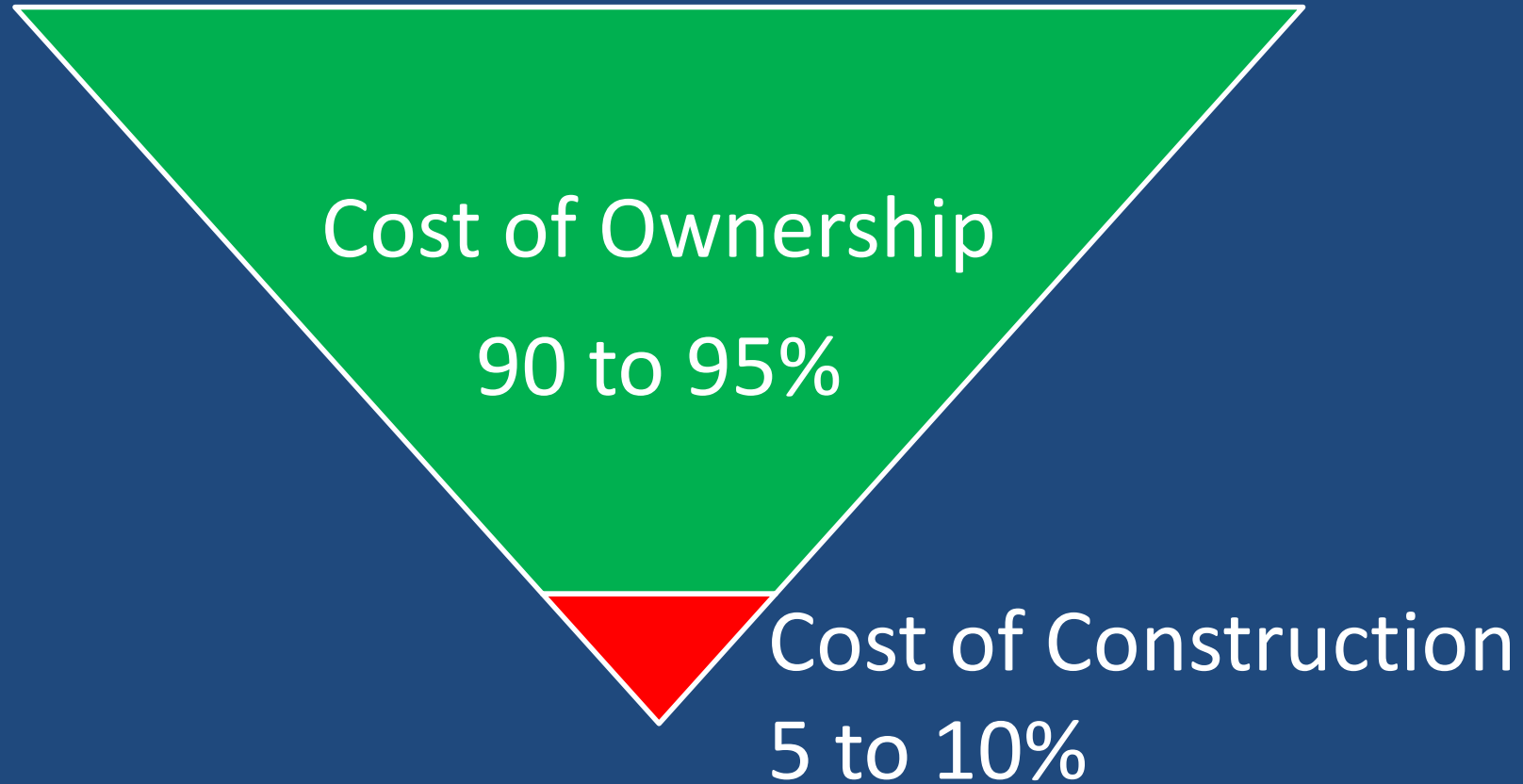
- Cost of Ownership
- Typical Project Schedules
- Commissioning Agent
- Design Issues Impacting Start-up Operations
- Furniture, Fixtures and Equipment (FFE)
- Operations & Maintenance Budgets
- Preventive Maintenance
- Project Closeout
- Cloud-Based Project Portals

# COST OF OWNERSHIP

*'...The total cost of facility ownership is the "total of all expenditures an owner will make over the course of the building's service lifetime" (NRC, 1990). These costs will include conceptual planning; design; construction; maintenance; repairs; replacements; alterations; and normal operations, such as heating, cooling, lighting, and disposal. **Of the total ownership costs, design and construction expenditures, the so-called "first costs" of a facility, will account for 5-10 percent of the total life-cycle costs. In contrast, operation and maintenance costs will account for 60-85 percent of the total life-cycle costs, with land acquisition, conceptual planning, renewal or revitalization, and disposal accounting for the remaining 5-35 percent (NRC, 1998).<sup>1</sup>***

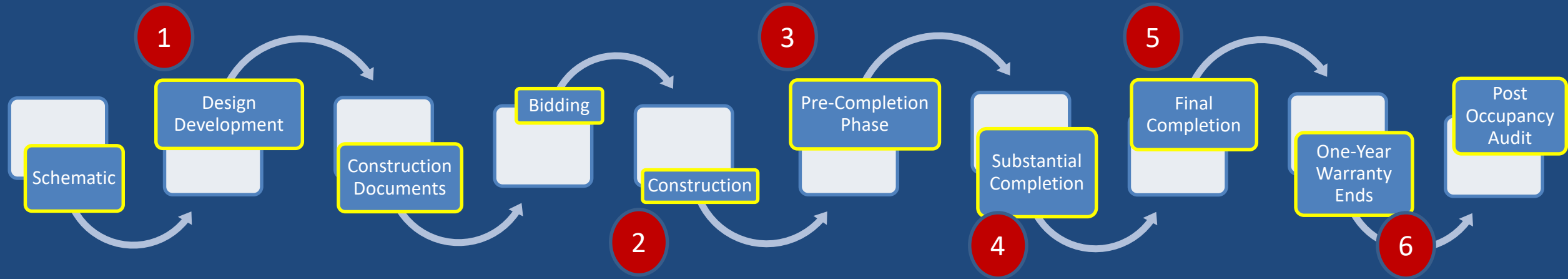
*<sup>1</sup>National Research Council, 1990, **Committing to the Cost of Ownership: Maintenance and Repair of Public Buildings***

# COST OF OWNERSHIP



# *TYPICAL PROJECT SCHEDULES*

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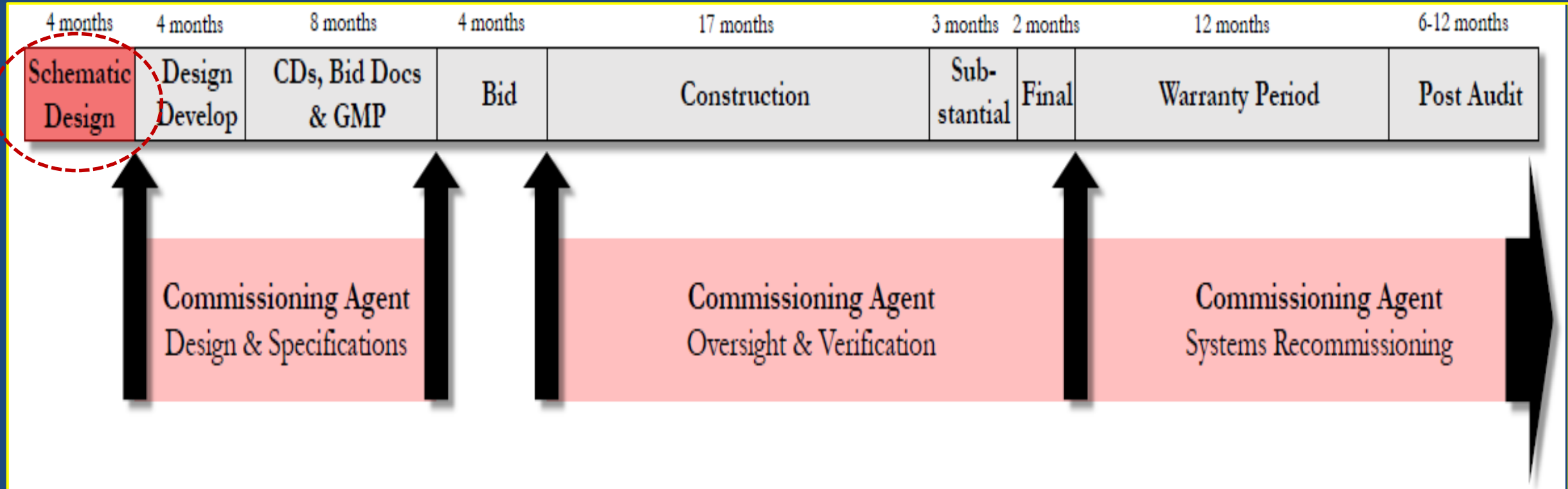


## *Key Milestones for Facilities Managers*

1. Design Development Phase
2. Start of Construction
3. Pre-Completion Phase
4. Substantial Completion
5. Final Completion
6. End of One-Year Warranty

# *COMMISSIONING AGENT*

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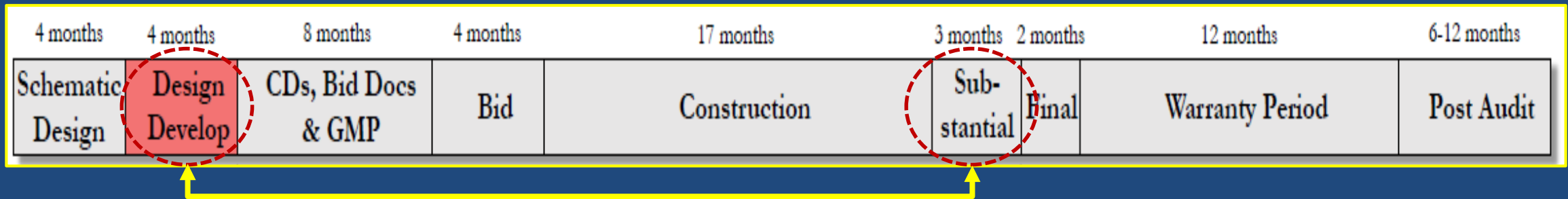


# COMMISSIONING AGENT (Cx)

- Independent third-part paid by MSBA
- Entire building or systems (HVAC, envelope, etc.)
- Engaged early in design process
- Continues through occupancy
- *Interim & final reports very helpful to facilities staff*

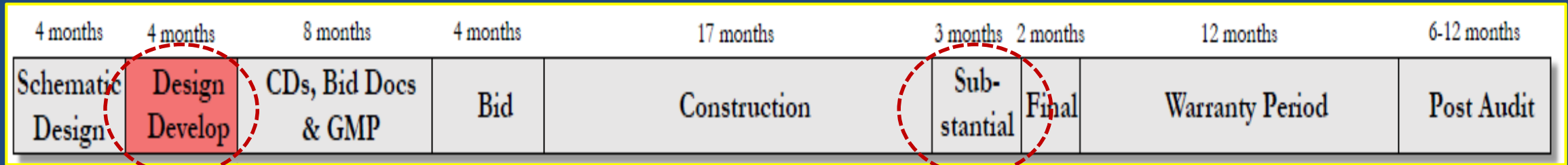
*DESIGN ISSUES  
IMPACTING START-UP  
OPERATIONS*

# DESIGN ISSUES IMPACTING OPERATIONS



- *Lighting Controls*
  - Set outside lighting schedules to adhere to permits
- *Building Management Systems (HVAC)*
  - Establish set points and operating schedule per Owner
- *Fire and Intrusion Alarms*
  - Coordinate with central monitoring station
- *Keying and Proximity Cards*
  - Master keying system, credentials, issuance/control

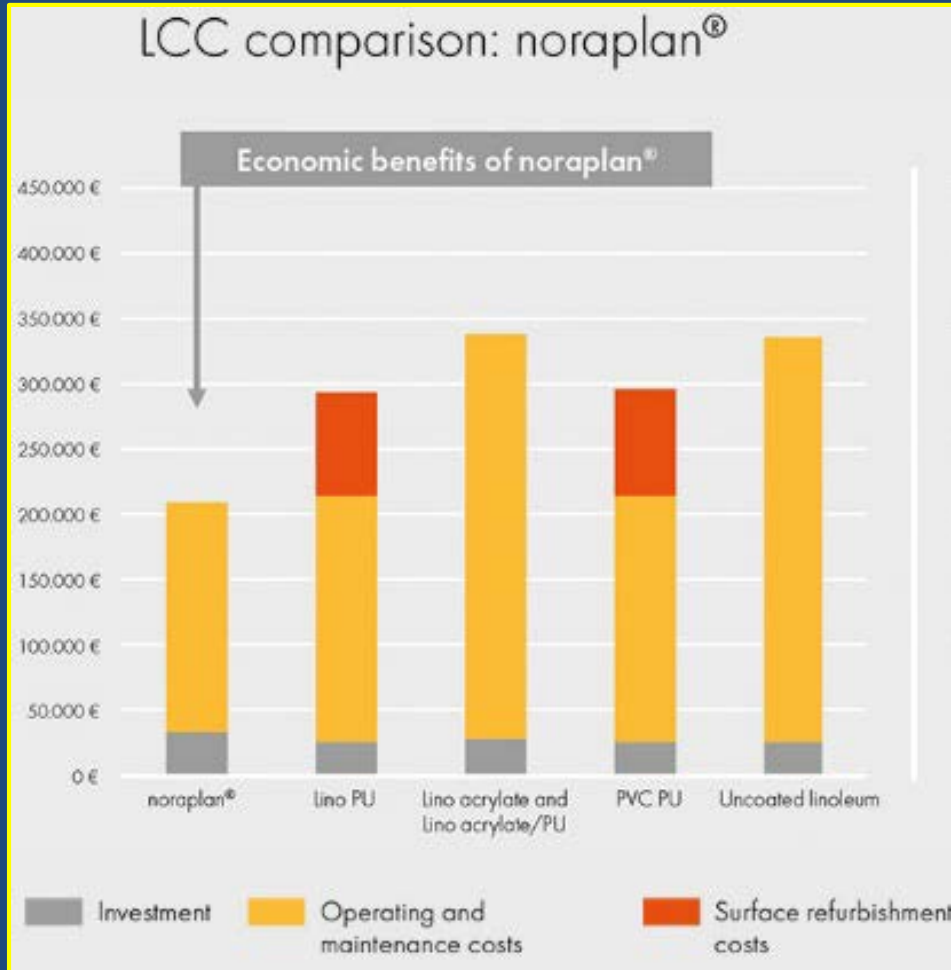
# DESIGN ISSUES IMPACTING OPERATIONS (Cont.)



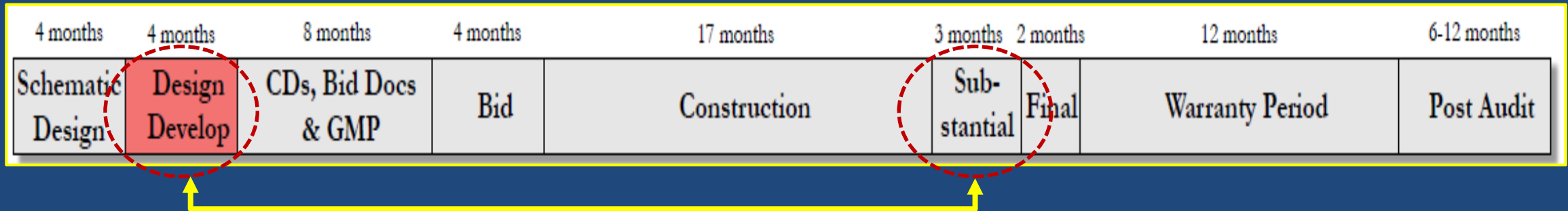
- **Landscape Maintenance**
  - Review ConCom requirements with available budget
- **Compost, Waste and Recycling**
  - Ensure adequate space and power for bins and compactors
- **Floor and Other Finishes**
  - Confirm required maintenance (and if facilities will wax)
  - Evaluate rubber and other wax-less flooring - **reduces operational costs**
- **Warranties**
  - Review specifications to *determine if any PM required during warranty period*

# DESIGN ISSUES IMPACTING OPERATIONS (Cont.)

## Rubber Flooring Example



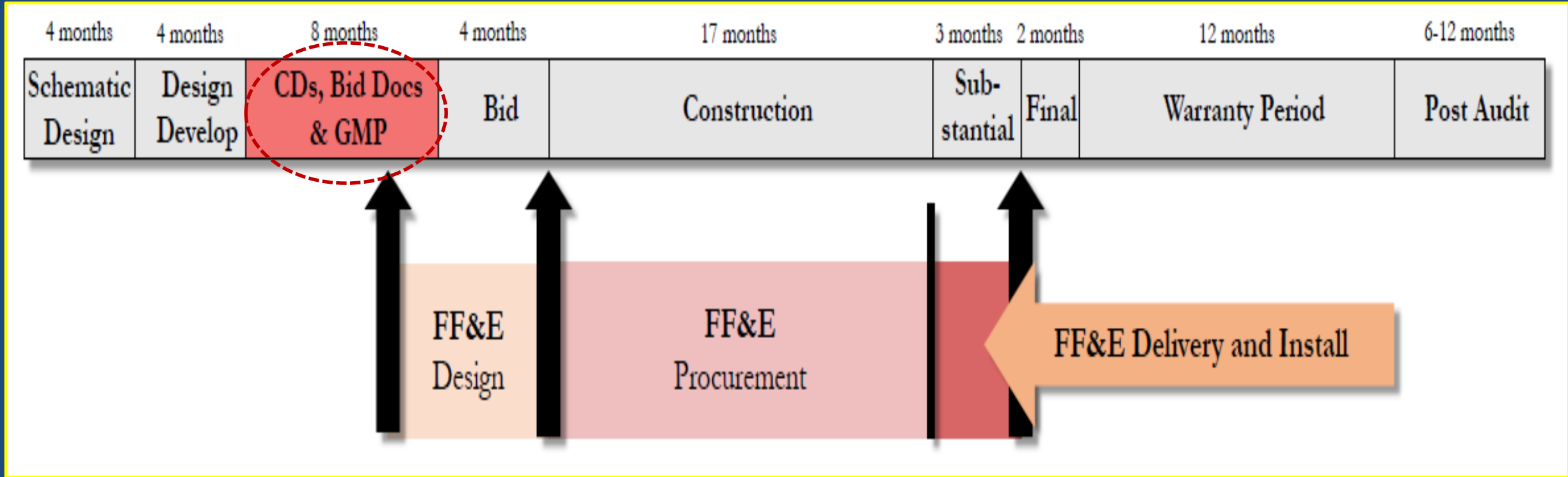
# DESIGN ISSUES IMPACTING OPERATIONS (Cont.)



- *Parking and Pickup/Drop Off*
  - Information/graphics/rules should be sent to parents
- *Custodial Cleaning Plan*
  - Procedures will impact staffing and FFE purchased
  - Ionized water cleaning systems
    - Sustainable and **reduces operational costs**
  - Team cleaning approaches
    - Less equipment and staff needed – **reduces operational costs**

# *FURNITURE, FIXTURES AND EQUIPMENT (FFE)*

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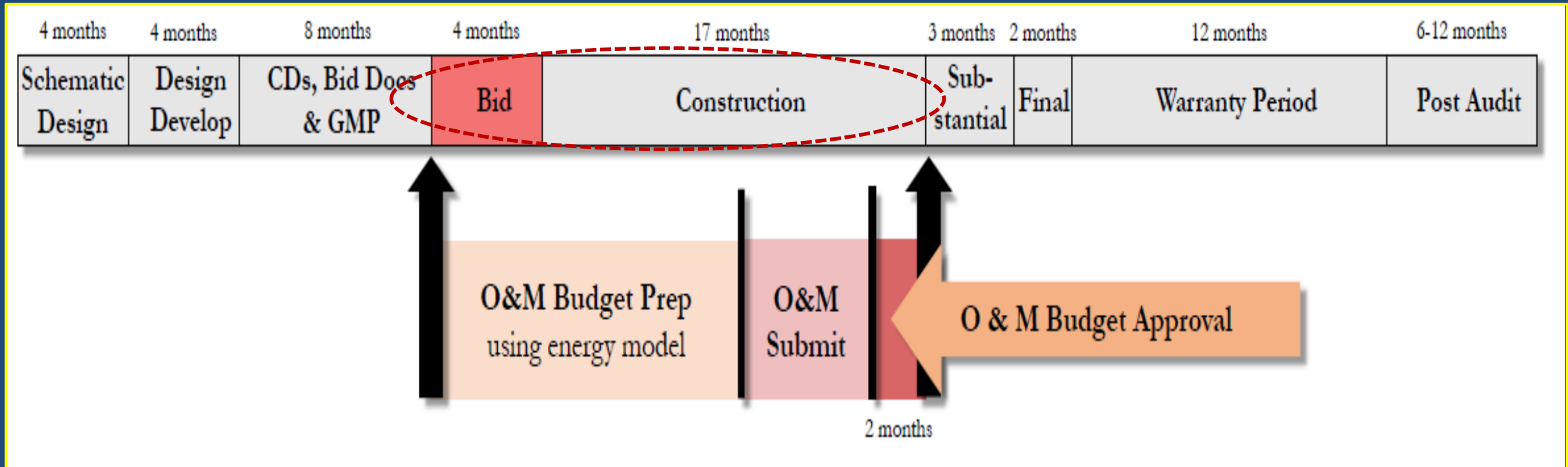
# FURNITURE, FIXTURES AND EQUIPMENT (FFE)

## *Facilities FFE*

- Custodial, Grounds & Maintenance Equipment
- *Impacts operational budget* if not included in project
- Thorough assessment required to determine needs
  - Lifts to access all locations
  - Custodial equipment that reflect operations
    - Team cleaning needs fewer pieces of equipment
  - Ionized water generators
    - saves significant operational cost of cleaning supplies

*OPERATIONS &  
MAINTENANCE (O&M)  
BUDGETS*

# OPERATIONS & MAINTENANCE BUDGETS



# OPERATIONS & MAINTENANCE BUDGETS

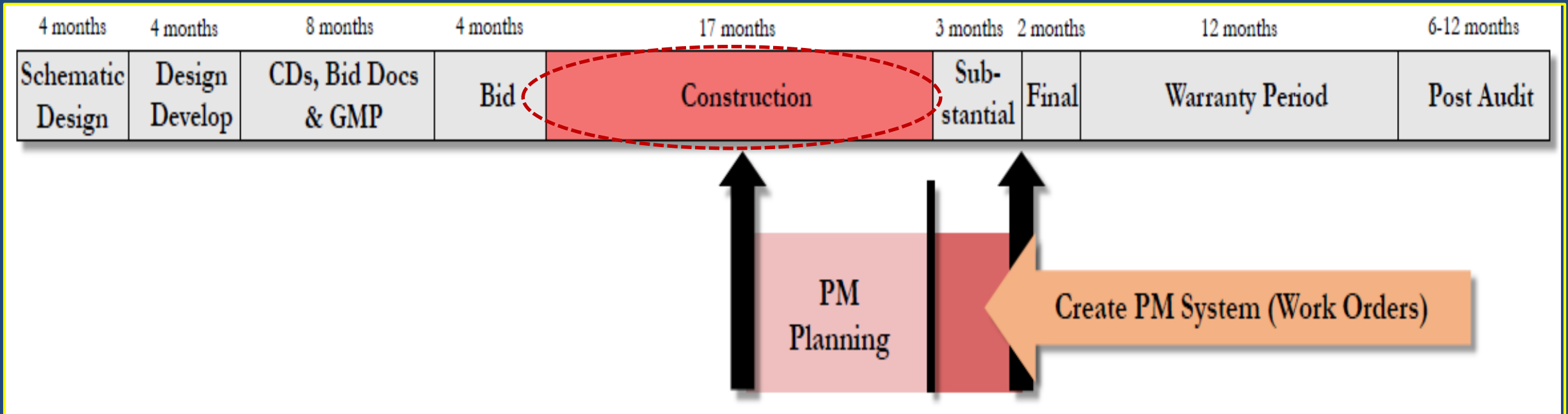
- Three main categories:
  1. Utilities
  2. Expenses
  3. Personal Services (Salaries)
- Utilities: *Use final energy model to estimate*
- Personal Services:
  - Will you add custodians or maintenance staff for new school?
  - Can “team cleaning” reduce no. custodians needed?

# OPERATIONS & MAINTENANCE BUDGETS (Cont.)

- Expenses:
  - Separate PM from Routine/Repair
  - Identify all required PM tasks
    - Solicit input from contractors
    - Determine if outsourced or performed in-house
    - Estimate costs
  - Assume lower level of repair expenses

# *PREVENTIVE MAINTENANCE*

# PREVENTIVE MAINTENANCE



# PREVENTIVE MAINTENANCE

- Establish Required PM tasks
  - Review drawings, specifications and O&M manuals
  - Solicit input from contractors on project
  - Outsourced or in-house?
    - Based on require skills, budget and staff availability
  - Assess level of PM (scope) *based on likely available budget*
  - *Prioritize most critical PMs* if budget inadequate for full PM



# PREVENTIVE MAINTENANCE (Cont.)

- What PM is required by CDs during warranty period?
- Utilize cloud-based Computerized Maintenance Management Systems (CMMS), such as *School Dude*
  - “Preload” O&M Material to PM work orders
- *Ensure that you have staff and budget to perform established PM Work Orders!*
  - *Analyze required effort vs. resources*

# PREVENTIVE MAINTENANCE (Cont.)

## Typical Building Systems Requiring PM (Critical Systems ●)

Item	Equipment Description			PM		18	3	Plumbing	Grease Traps	●	X
	Group	Class	Type	Inhouse	Outsource						
1	1	Electrical	Electrical (MSB, PBs, MCCs)	X		19	3	Plumbing	HW Tanks	●	X
2	1	Electrical	Generators/ATSS	●	X	20	3	Plumbing	Hydration Stations/Filters		X
3	2	HVAC	AHUs	●	X	21	3	Plumbing	Sewage Ejection Pumps	●	X
4	2	HVAC	Boilers/Furnaces	●		22	3	Plumbing	Sump Pumps		X
5	2	HVAC	Chillers	●	X	23	4	Safety	CO/CO2 Systems	●	X
6	2	HVAC	Circulation Pumps	●	X	24	4	Safety	Elevators/Inspections		X
7	2	HVAC	Controls (PM before others)	●	X	25	4	Safety	Fire Alarm	●	X
8	2	HVAC	Cooling Towers	●		26	4	Safety	Fire Extinguishers	●	X
9	2	HVAC	ERUs	●	X	27	4	Safety	Fire Pumps	●	X
10	2	HVAC	Fans	●	X	28	4	Safety	Security - Cameras		X
11	2	HVAC	FCUs/FPBs/HPs/CUHs	●	X	29	4	Safety	Security - Access		X
12	2	HVAC	Heat Exchangers	●	X	30	4	Safety	Sprinkler System	●	X
13	2	HVAC	Packaged AC Units	●	X	31	5	Other	Acid Tank System (MS)		X
14	2	HVAC	UVs	●	X	32	5	Other	Chemical/Water Treatment		X
15	2	HVAC	VAVs	●	X	33	5	Other	OH Doors		X
16	2	HVAC	VRF Compressors	●	X	34	5	Other	PH Neutralization (HS)		X
17	2	HVAC	VRF Panels	●	X	35	5	Other	Rainwater Harvesting		X
						36	5	Other	Roof Inspections		X
						37	5	Other	Vehicle Gates		X

# *PROJECT CLOSEOUT*

# PROJECT CLOSEOUT: *Substantial Completion*

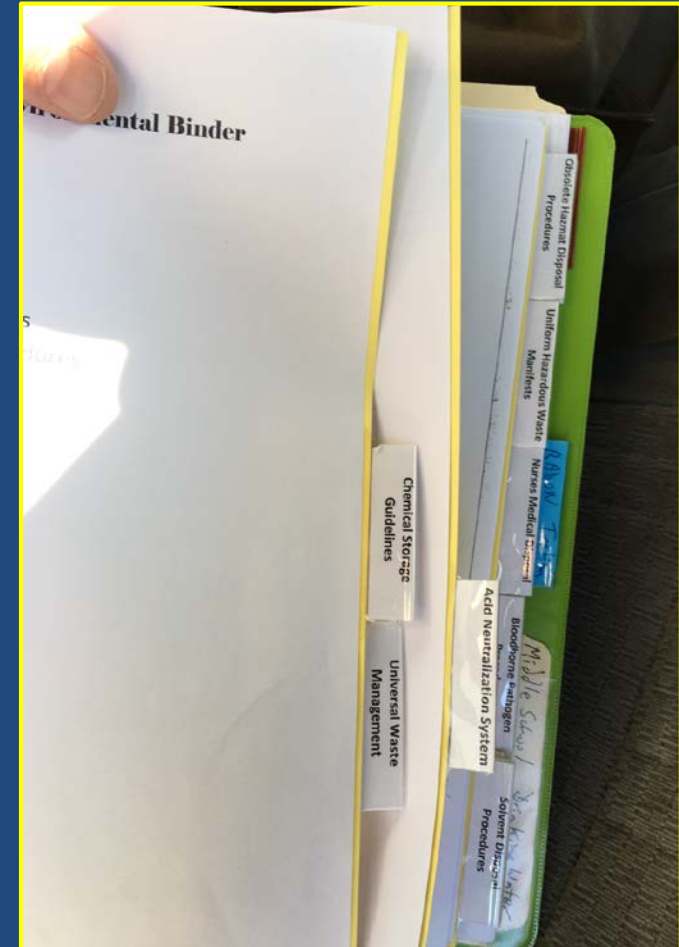
4 months	4 months	8 months	4 months	17 months	3 months	2 months	12 months	6-12 months
Schematic Design	Design Develop	CDs, Bid Docs & GMP	Bid	Construction	Substantial	Final	Warranty Period	Post Audit

- Prepare Facilities-Generated Punch List
- Verify Adequacy of Training
- Transfer Utilities to Owner
- Confirm SPED and Other User “Fit-Up” Needs
- Obtain and Review Warranties
- Update Rental and Building Use Policies
- Prepare *Environmental Binder*

# PROJECT CLOSEOUT (Cont.)

## Environmental Binder

- Chemical Storage Guidelines
- Universal Waste Management
- Acid Neutralization System
- Solvent Disposal Procedures
- Art Department Photo Chemicals
- Obsolete Hazmat Disposal Procedures
- Uniform Waste Manifests
- DEP Source Registration
- Emergency Generator
- Nurses Medical Disposal
- Blood-borne Pathogen Procedures
- IPM Plans



# PROJECT CLOSEOUT: *Final Completion*

4 months	4 months	8 months	4 months	17 months	3 months	2 months	12 months	6-12 months
Schematic Design	Design Develop	CDs, Bid Docs & GMP	Bid	Construction	Substantial	Final	Warranty Period	Post Audit

- Obtain *Contact List* for GC and subcontractors
- O&M Manuals – *hard copy and/or PDFs*
- As-Built Drawings – *Confirm accuracy via spot-check*
- Inspections/Certifications
- Attic Stock *transfer*
- Final Shop Drawings
- Manifests & Final Test Reports

# *CLOUD-BASED PROJECT PORTALS*

- Submittal
- Closeout
- RFI
- RFP
- ASI
- Meeting Minutes
- Photos
- Punchlist/Issue Management
- Change Order
- Memos
- Reports
- Resquisitons
- Drawings
- Proposal Requests
- Schedules
- Daily Clerk Reports

Project Name: **Wellesley School Security Systems Upgrades** | Project Number:

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Download Multiple Files  Filter: None

#	Description	Supplier or Manufacturer	Date Expected	Submittal from Subcontractor		Submittal from GC			Review by Consultant				Review by Architect			Returned to Sub
				Date	Type	Date	Type	Sent to Arch.	Sent to	Reviewed	Type	Action	Returned to GC	Type	Action	Date
0	Product Data Locks	Von Duprin				7/25/17	PDF	7/25/17	7/25/17				8/22/17	PDF	AAN	8/23/17
0	Product Data Surface...	Von Duprin				7/25/17	PDF	7/25/17	7/25/17				8/22/17	PDF	AAN	8/23/17
0	Product Data Strike ...	Von Duprin				7/25/17	PDF	7/25/17	7/25/17				8/22/17	PDF	AAN	8/23/17
0	Product Data Strikes...	Von Duprin				7/25/17	PDF	7/25/17	7/25/17				8/22/17	PDF	AAN	8/23/17
0	PowerSupply	Von Duprin				9/12/17	PDF	9/12/17	9/12/17	9/26/17	1 copies	FAS	9/26/17			10/24/17
	Certificates of Comp...															
	Door Hardware Schedu...												9/26/17	PDF	APP	
	Key Schedule															
	Product Certificates															
	Product Test Reports															
	Qualification Data															
	Riser and Wiring Dia...															
0	Product Data					6/20/17	PDF	6/20/17	6/20/17				7/18/17	PDF	REJ	8/23/17
0	Selection Samples					6/20/17	PDF	6/20/17	6/20/17				7/18/17	PDF	REJ	8/23/17
0	Performance Submitta...					6/20/17	PDF	6/20/17	6/20/17				7/18/17	PDF	APP	8/23/17
0	UltraS800	3M	6/28/17			6/28/17	PDF	6/28/17	6/28/17				7/18/17	PDF	APP	8/23/17
	Verification Samples															

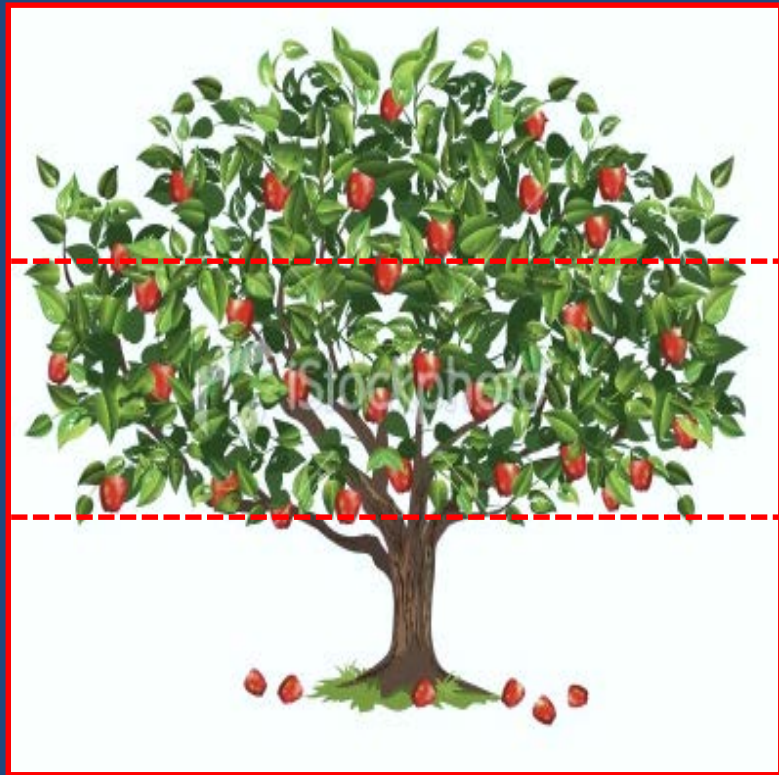


# CLOUD-BASED PROJECT PORTALS

- Secure, online system for electronically exchanging, reviewing, and archiving design and construction project documentation. Examples:
  - *Submittal Exchange*
  - *Procore*
- All documentation can be archived at end of project
- *Significant benefit to facilities staff*

# *“FMD’s RECOMMISSIONING” AND HVAC CONTROLS*

# Energy Conservation Measure (ECM) Opportunity Tree



FY30  
to  
FY21

5+ Year Simple Payback  
HVAC & Interior LEDs  
(PLANNED)

FY20

3-5 Year Simple Payback  
**Metasys** & Corridor LEDs  
(COMPLETED)

FY19  
to  
FY12

1-3 Year Simple Payback  
**ReCx** & Exterior LEDs  
(COMPLETED)

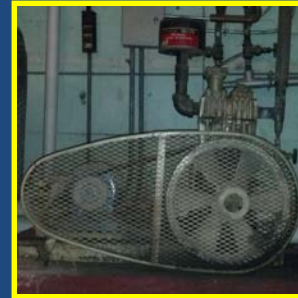
# FMD's HVAC Recommissioning

- Extraordinary maintenance – akin to a “major tune-up”
- Budgeted in cash-capital
- Perform on 5 to 7 year cycle based on age/complexity
- Improves safety, comfort, and performance
- Reduces natural gas use by 15% to 20%
- Extends service life of equipment
- Bid on Hourly basis under MGL Chapter 149
  - DCAMM Certification in HVAC *and* Energy Management

# FMD's HVAC Recommissioning

## *Typical Findings*

- Unit ventilators not operating (not enough pneumatic air pressure)
- Unit ventilators operating continuously (low-limit switches stuck closed)
- Thermostats not calibrated to UV output (set for 70°F but supplying 80°F)



# FMD's HVAC Recommissioning

## *Typical Findings*

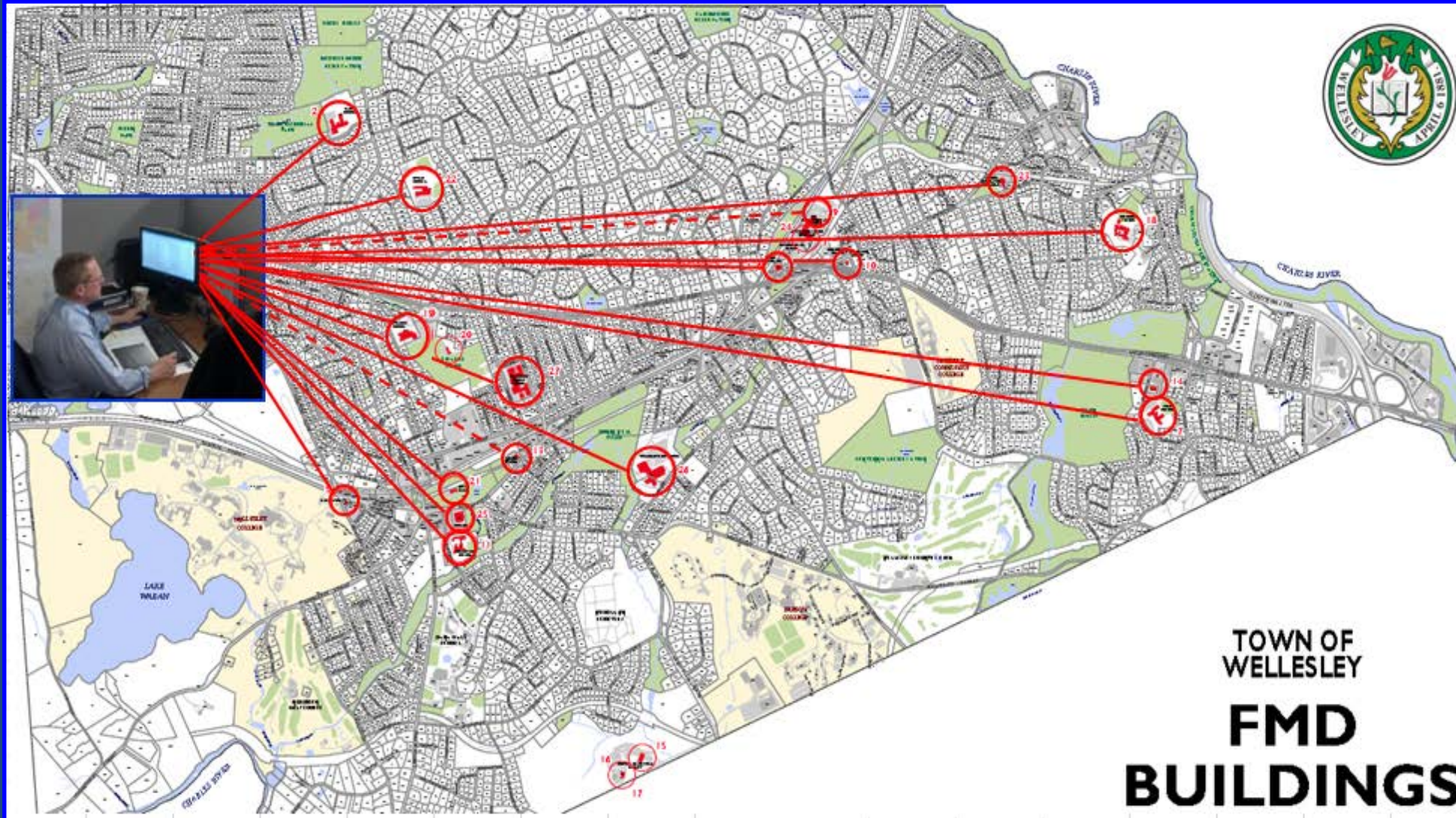
- HW/steam valves not operating or leaking (coils too cold or hot)
- Outside air dampers stuck open or closed (not enough/too much OA)
- No night setback (always mid-70°F+ day/night) and reset temperature setpoints



	Occupied		Unoccupied	
	Min	Max	Min	Max
Heating	68	72	60	64
Cooling	72	76	82	86

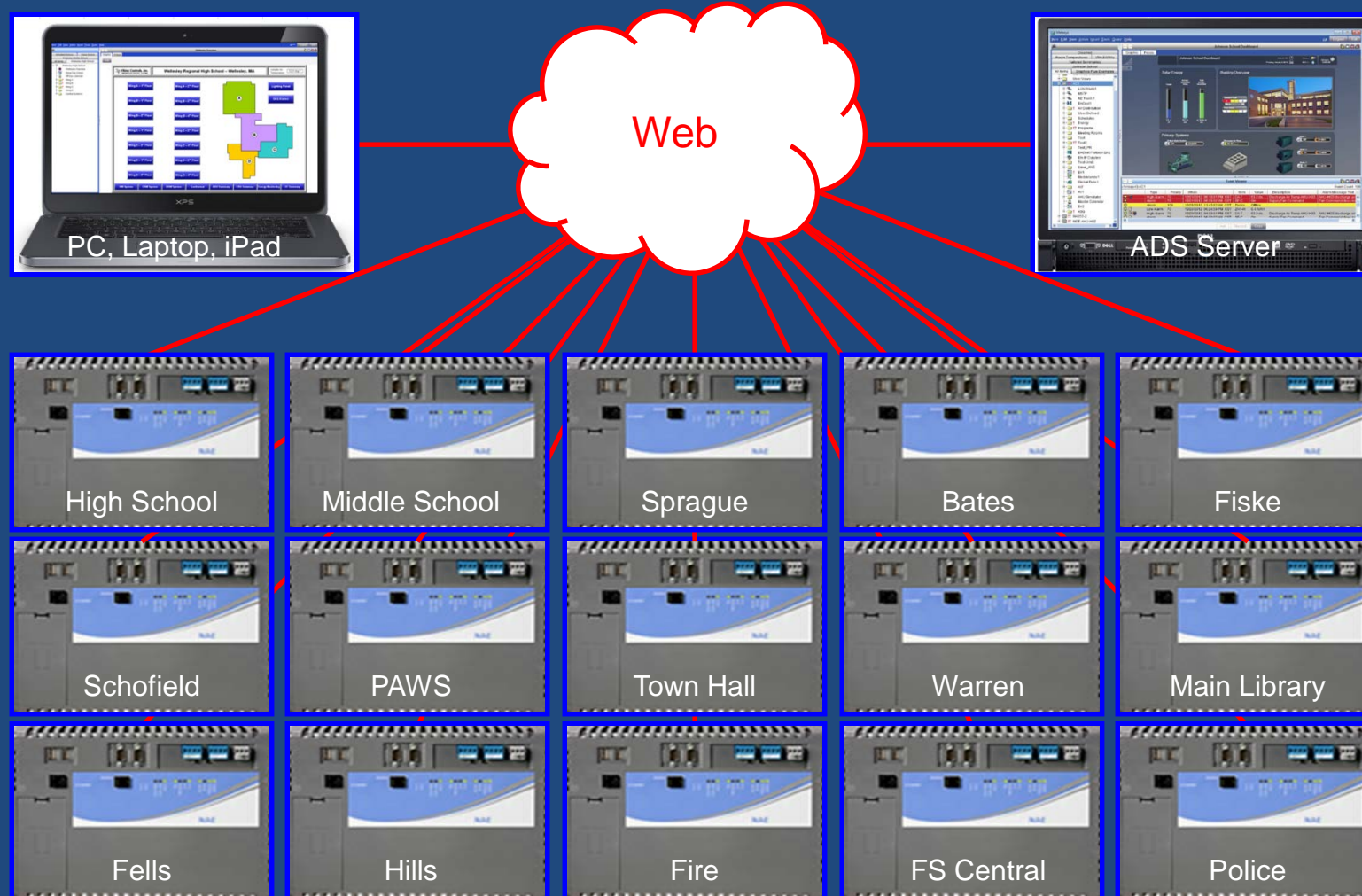


# Metasys – Town Network (“Metasized”)





# Metasys – Network Level



# Metasys – Building Level



*QUESTIONS?*