Farnsworth GROUP

APPA Spring Conference

Commissioning: Critical to Sustainability & Operations

4.16.2024

Credit(s) earned on completion of this course will be reported to American Institute of Architects (AIA) Continuing Education Session (CES) for AIA members.

Certificates of Completion for both AIA members and non-AIA members are available upon request.

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Questions to specific materials, methods or services will be addressed at the conclusion of this presentation.

AIA Approved Continuing Education

Course Description

- Early and frequent engagement with Cx has consistently demonstrated alignment with campus design standards and sustainability objectives

- We aim to demystify the commissioning process, examine its methodology, and underscore its significance in campus decarbonization and facility management strategies

Learning Objectives

- Understand the significance of commissioning in ensuring system efficiency
- Familiarize attendees with commissioning from design through operation
- Exhibit how engaged commissioning teams can help campuses work toward establishing and achieving de-carbonization/ electrification goals
- Gain insights into common challenges and best practices in commissioning

Introductions/Agenda

Dave Reynolds, PE, CEFP, F.SAME

Sr. Director of Business Development

- **41 years** of experience including eight years as the Associate Vice President for Facilities at the University of North Texas.

Brian Barnes, CxA, LEED AP BD+C

Commissioning Section Leader

- **18 years** of experience including commissioning for various higher educational facilities.

- Introductions / Agenda
- De-mystifying Cx
- Cx Approach & Process
- Why Cx?

Introductions

Brian Barnes, CxA, LEED AP BD+C

Commissioning Section Leader

- 18 years of experience in construction, performance evaluation, sustainable certification, and commissioning of higher education projects

- His areas of expertise include HVAC commissioning, building enclosure commissioning, sustainability certification and project management

- Secretary for Georgia Chapter of International Institute for Sustainable Laboratories (I2SL)

- Some higher-ed clients include University of Georgia, Georgia Tech, University of West Georgia, Georgia State University, University of Southern California, University of California Los Angeles, Kennesaw State University, Emory University, University of North Georgia, University of South Alabama

What is Commissioning

The purpose of commissioning is to ensure that systems are designed to meet the project's goals, installed, tested and function as intended, are operating to maximum efficiency and allow ease of maintenance.

History

- Relatively new – approximately 40 years old
- Blossomed in 1990s and early 2000s

Value Increased due to:

- LEED requirements
- State requirements for high performing facilities
- Energy efficiency
- Operational efficiency

What is Commissioning

- Quality-based Process
- Third-Party Verification
- Holistic Partner to the Owner
- Supplement Owner's in-house Expertise

Types of Commissioning

- New Building Commissioning
- Retro-Commissioning
- Re-Commissioning
- Continuous Commissioning
- Monitoring-Based Commissioning

Systems Included

- Mechanical Systems
- Plumbing Systems
- Electrical Systems
- Building Enclosure Systems
- Fire Alarm
- Network/IT
- Access Controls
- Medical Gas

What is Commissioning

01 **Inspection**

- Determine what risks are most likely to affect your project.
- Document which risks are most important.

02 **Quantification & Planning**

- Assess the risks carefully.
- Identify the possible outcome of these risks.

03 **Response Monitoring & Control**

- Monitor risk responses and determine if the risk exposure has changed.
- Monitor risk metrics, milestones, and effectiveness of your risk management solution.

What is Commissioning

Quality Assurance

More process oriented

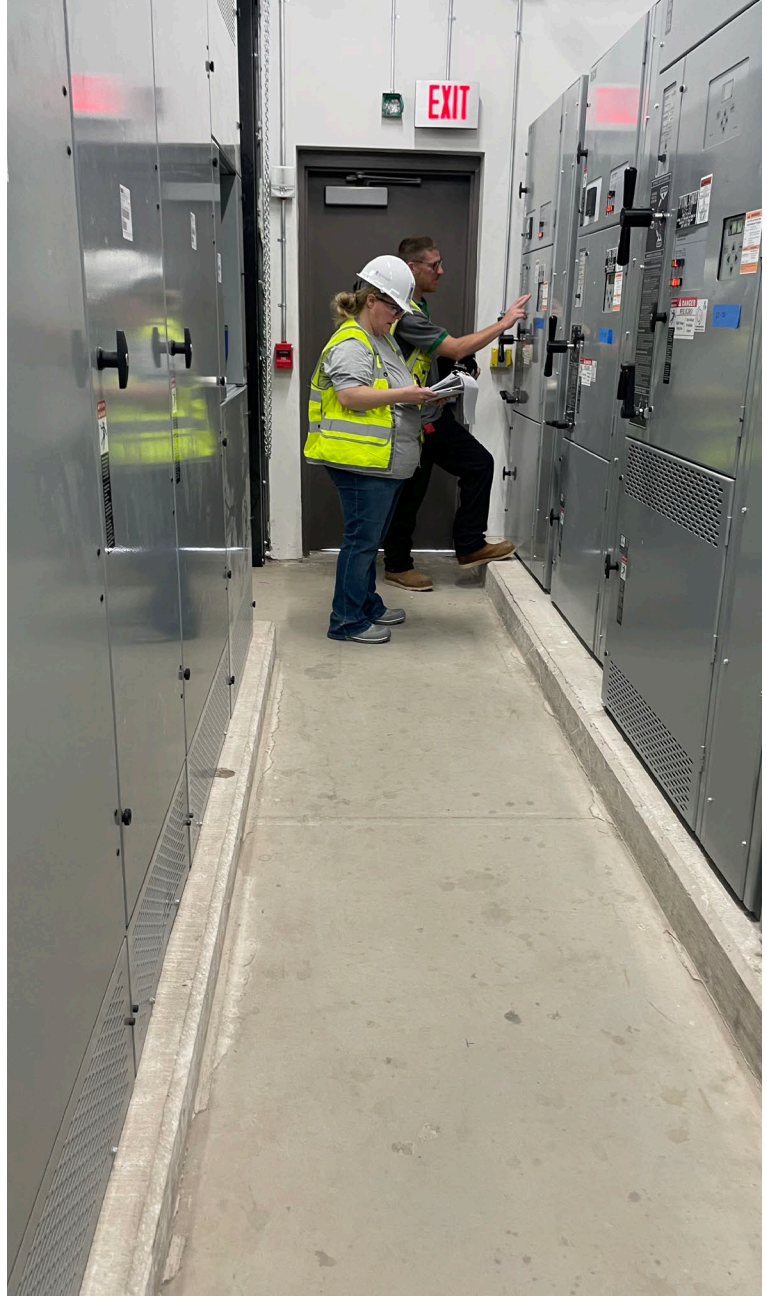
- ***Example:*** setting up review and approval process for construction drawings.

VS.

Quality Control

Focused on final product

- ***Example:*** technical specs and checklist to check the completed construction.



Commissioning for Sustainability

01 **Define Campus Goals**

- Determine energy savings, EUI, electrification/de-carbonization goals
- Establish priorities associated with each goal

02 **Evaluate & Plan**

- Identify most resource intensive buildings
- Perform retro-Cx to evaluate for ECMs and FIMs.
- Integrate campus goals into master plan

03 **Implementation**

- Create OPR including campus design guidelines
- Perform design reviews
- Construction oversight and direction
- Performance verification
- Continuous Cx
- MBCx

Total Building Commissioning

Commissioning Recommendations

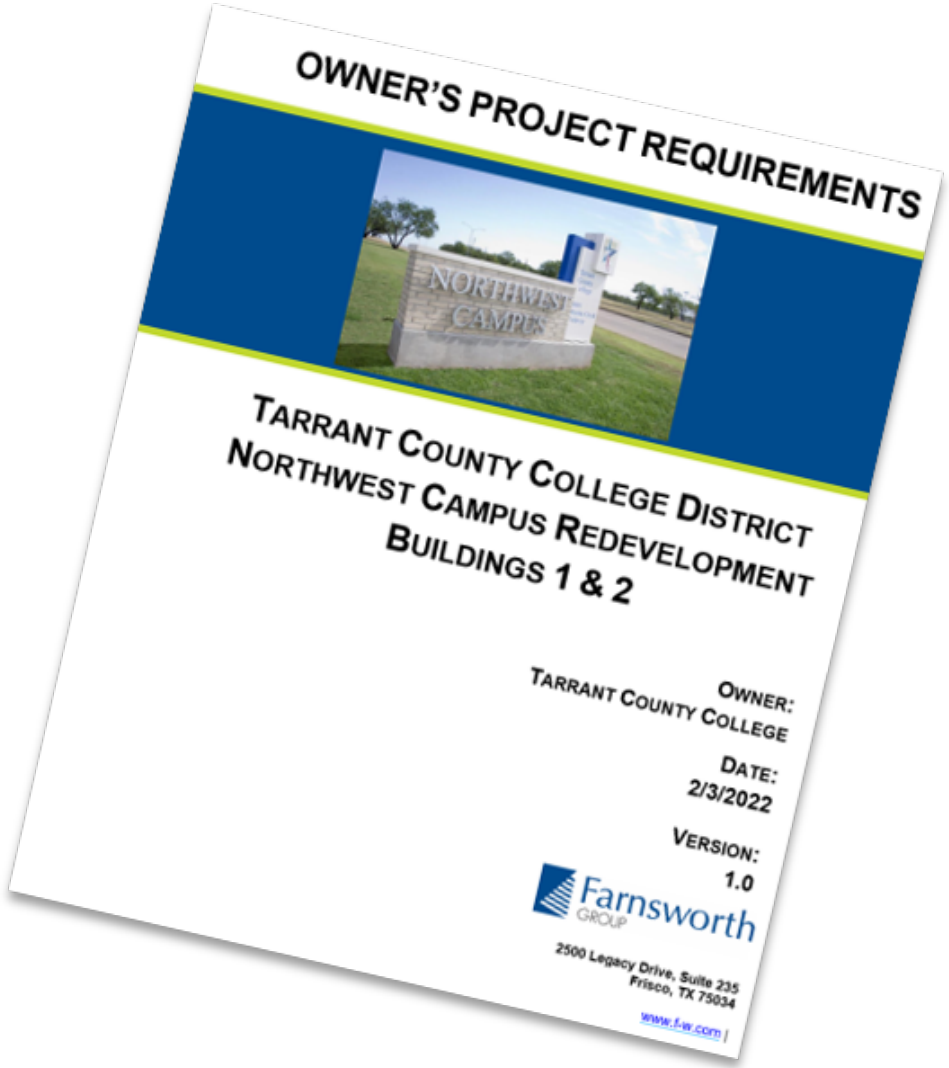
- The CxA should be selected early in the conceptual design and stay engaged through the warrantee period
- The CxA acts as a means to validate the staff is adequately trained and have the resources needed for proper operations and maintenance
- The CxA should be considered a member of the integrated design and construction team and be drawn on as a subject matter expert when needed

**pulled from the Georgia Tech Yellow Book*

Commissioning Recommendations

- CxA performs the following during pre-design & design
  - Facilitates and leads draft of OPR (incorporating campus guidelines during this process)
  - Ensures BOD aligns with OPR
  - Ensure design documents align with BOD, OPR
  - Facilitate design phase meetings between EOR and O&M staff
  - Ensure capabilities for M&V Plan to be supported with design review comments.
  - Act as peer reviewer (as needed)
    - Can review energy model
    - Develop & Execute M&V Plan (execution during warranty period)

Owner Defined Success



OPR & BOD

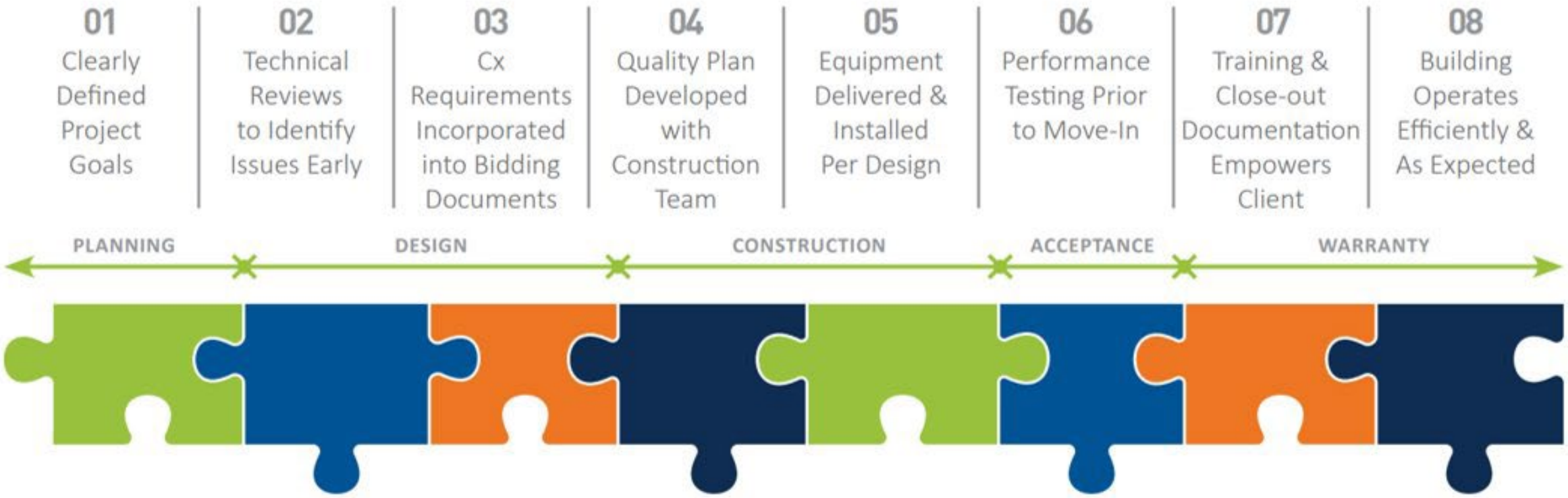
OWNER'S PROJECT REQUIREMENTS (OPR)

- An informal set of goals that define project success
- Can be developed via a Cx lead workshop or assembled from early-stage DP planning documents
- Documented and Managed by the CxA

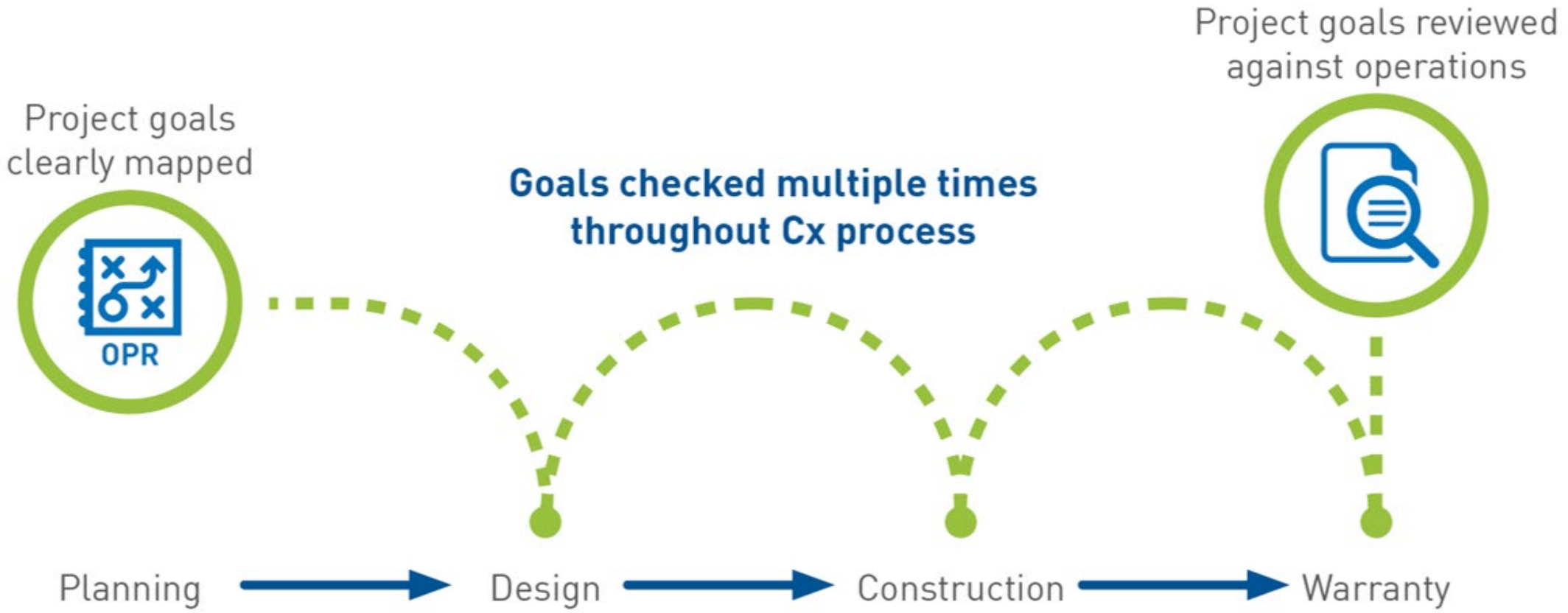
BASIS OF DESIGN (BOD)

- A formal response to the OPR
- Developed by the Design Professional and reviewed by the CxA
- Contains:
  - System narratives
  - Code compliance planning
  - Documents the intended path forward to meet space programming requirements

Commissioning Plan



Project Role



Commissioning Recommendations

- Implement criteria to engage commissioning such as:
  - All new construction and major renovation projects
  - >10,000 SF
  - Project complexity
    - Labs or high-containment spaces

Commissioning Recommendations

- Engage early and often even after construction
  - Campus Measurement & Verification efforts
  - Sub-metering infrastructure for later analysis
  - Engage O&M Staff to ensure comprehensive understanding of operation, access, and maintenance requirements
  - Seasonal Testing
  - Quarterly trend analysis
  - M&V Plan Execution

Training & Empowering O&M Team

- Asset data captured during the commissioning process uploaded to Maintenance Management System (MMS)
- Reliability-Centered Maintenance Program
- Consolidation of warranty information
- Accuracy of closeout documents
- Systems Manual
- Enhanced training and recordings

Cost of Commissioning

- The newest research from Lawrence Berkeley National Laboratory (LBNL) and the Building Commissioning Association (BCxA) shows that building commissioning remains a cost-effective way to improve the operation of your building while lowering energy use and mitigating other risks associated with poor building performance. The study provides the world's largest and most current resource of commissioning cost and benefit data for commercial buildings.
- Among the findings:
  - Cx projects in existing buildings offered reliable cost-effective savings with a median simple payback of 2.2 years.
  - Data on new construction Cx projects showed lower costs in 2018 compared to LBNL's 2009 study, both in cost per square foot (median of $0.82 compared to $1.16 in 2009) and cost as a percent of overall construction cost (median of 0.25% compared to 0.57% in 2009).
- The top 4 reasons for implementing Cx in existing building have remained the same since 2009:
  - Capturing energy savings
  - Ensuring system performance
  - Improving thermal comfort
  - Maintaining proper indoor air quality

Retro-Commissioning Payback

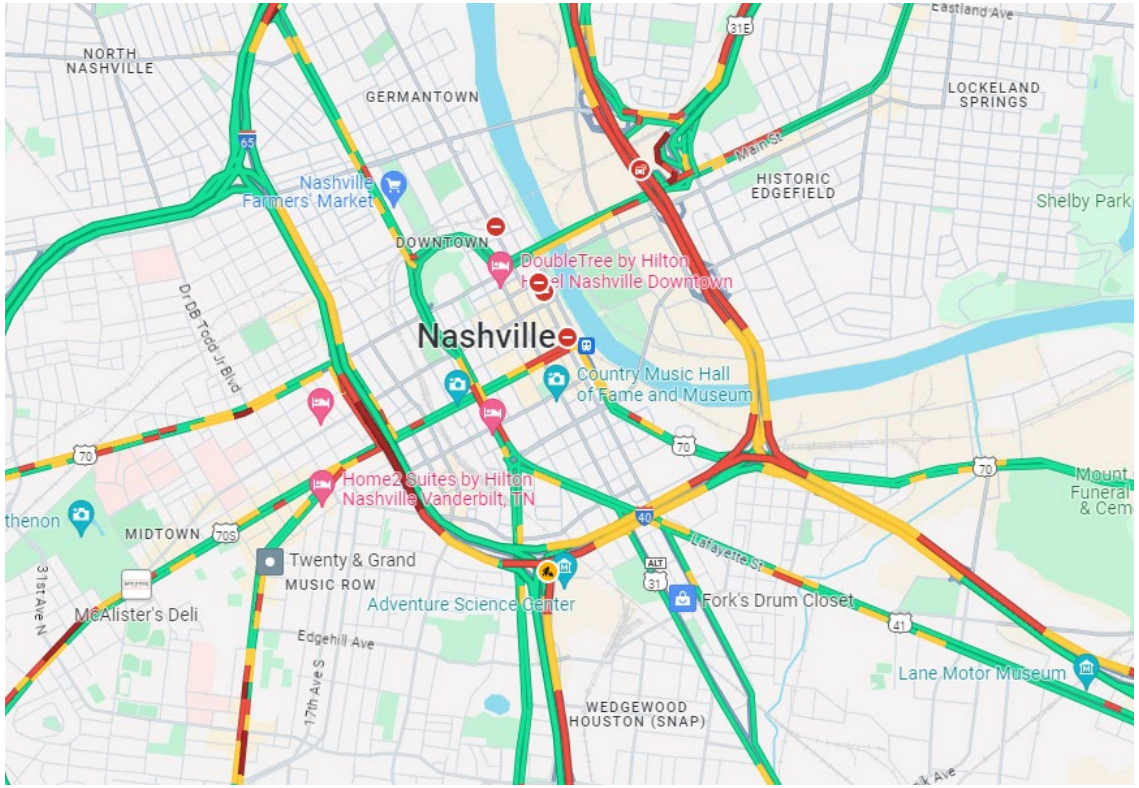
- Retro-Commissioning Paying for Energy Projects
  - Cost between $0.05 - $0.50/SF
  - Simple Payback – 0.2 - 2.2 years
  - Can roll energy savings into continuing retro-commissioning projects
  - Identifies lowest performing equipment for upgrades
    - Ensure all replacement equipment fits with campus plan
  - Identifies space programming changes and can help optimize performance to suit new space programming
  - Evaluate facility to align with campus electrification/de-carbonization goals
    - Insight for next tranche of projects

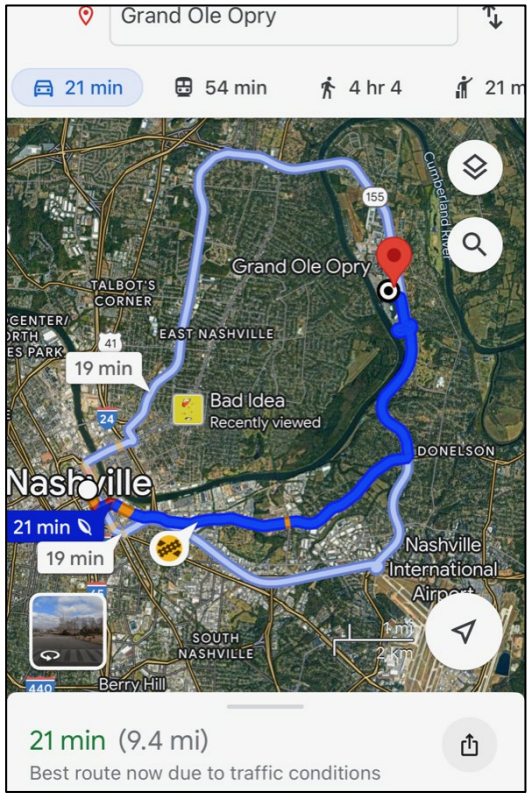
**Published by LBNL in 2020*

Benefits

- Simple payback of 2.2 years
- Lower costs in 2018 compared to 2009 study
- Capturing energy savings
- Better building documentation
- Improved occupant productivity
- Ensuring system performance
- Improving thermal comfort
- Maintaining proper indoor air quality
- Verification systems perform in accordance with the OPR

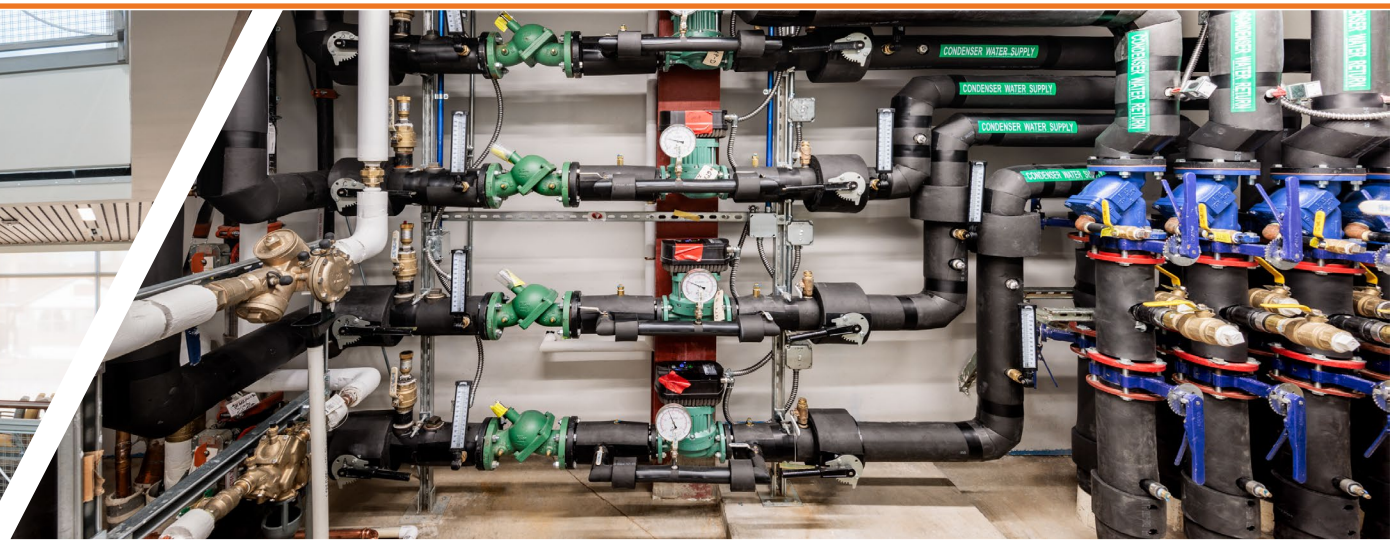
Visualize Success





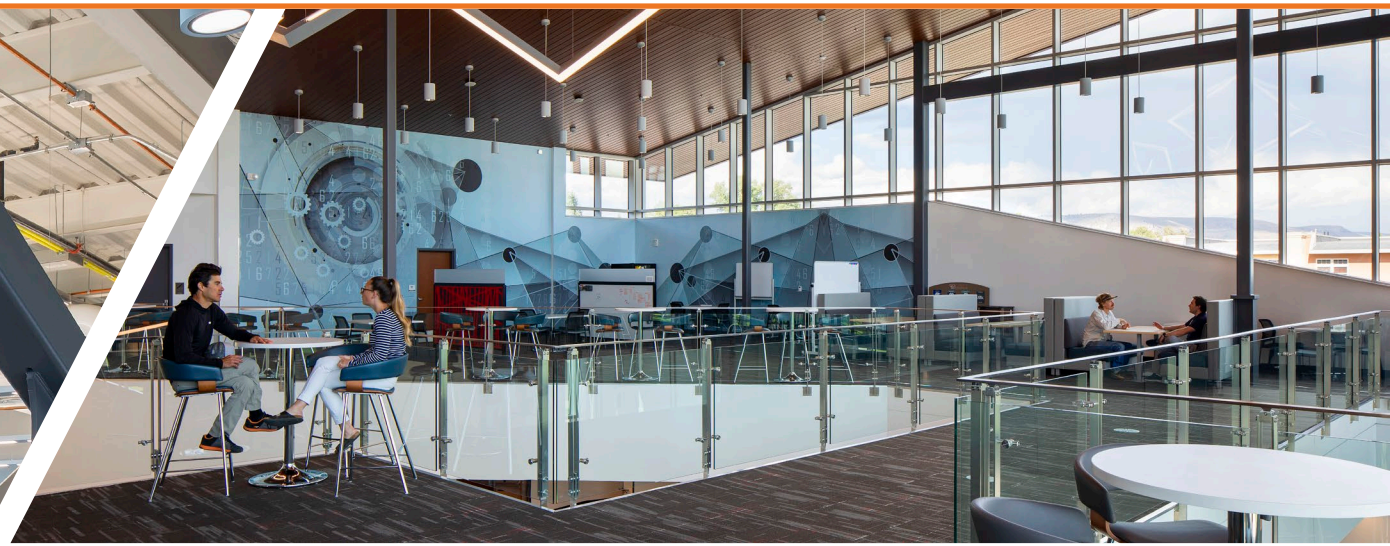
Pueblo Community Health East Side Clinic, Pueblo, CO

NBI-Certified First Zero Energy Outpatient Clinic in North America.



Paul M. Rady School of Computer Science & Engineering, Gunnison, CO

74,000 SF LEED Gold Certified Building on the Western Colorado University campus.



College of the Desert – Multiple Projects, Palm Desert, CA

Trusting Farnsworth Group as their LEED Advisor since 2009.

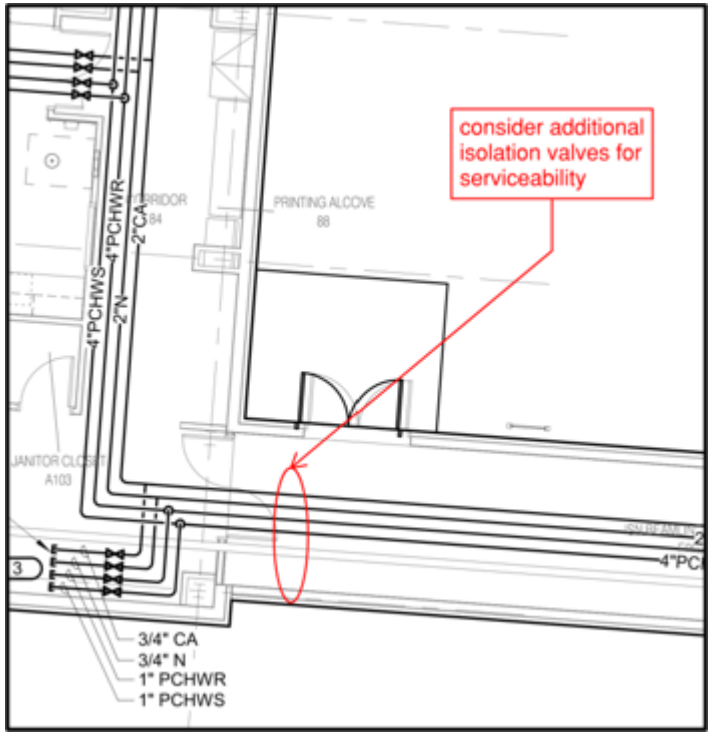
Wecker Hall Net-Zero Energy Roadmap, Colorado Springs, CO

Zero-energy roadmap development for the US Air Force Academy in Colorado Springs.

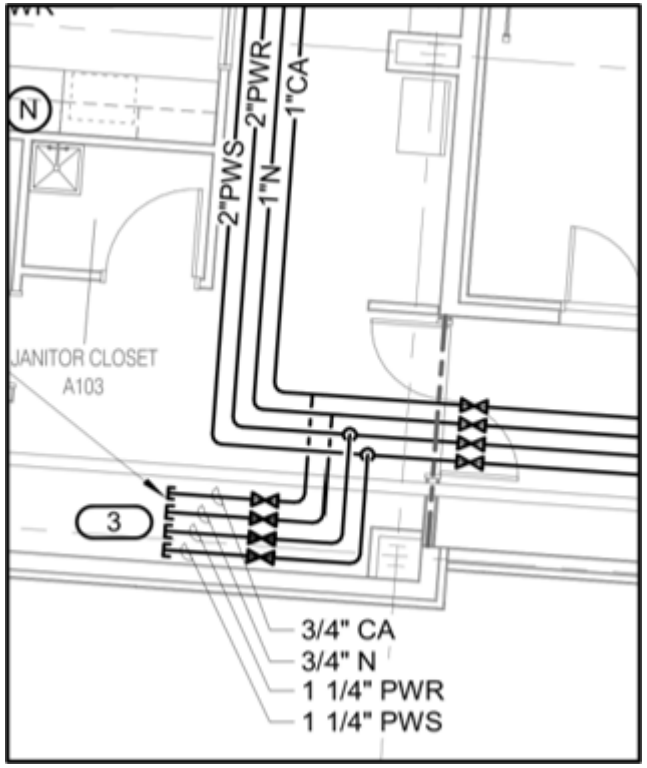
- On-site Energy Production with Photovoltaic (PV) Panels will convert total source energy used back to site energy
- The estimated dollar savings results in approximately $44,640 per year for the life of the building. On-site energy production will further reduce annual costs

Approach to Design Review

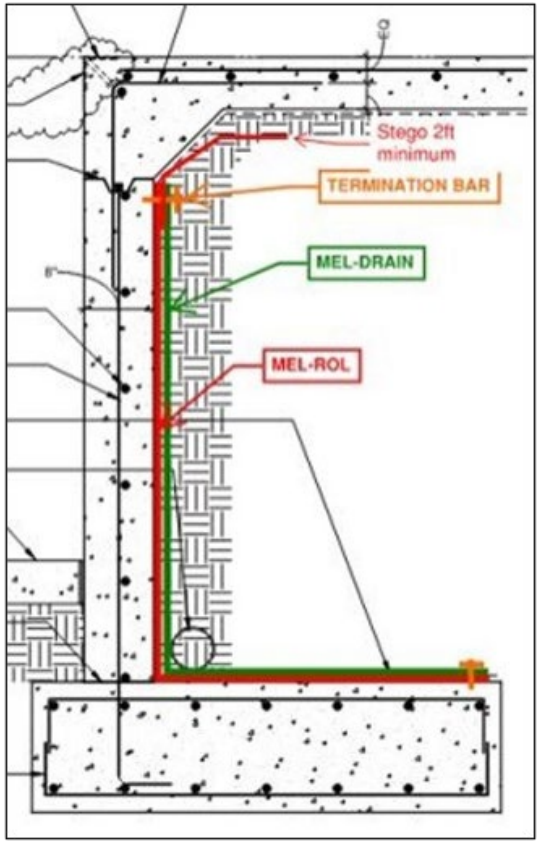
95% CD Design Review Comment.



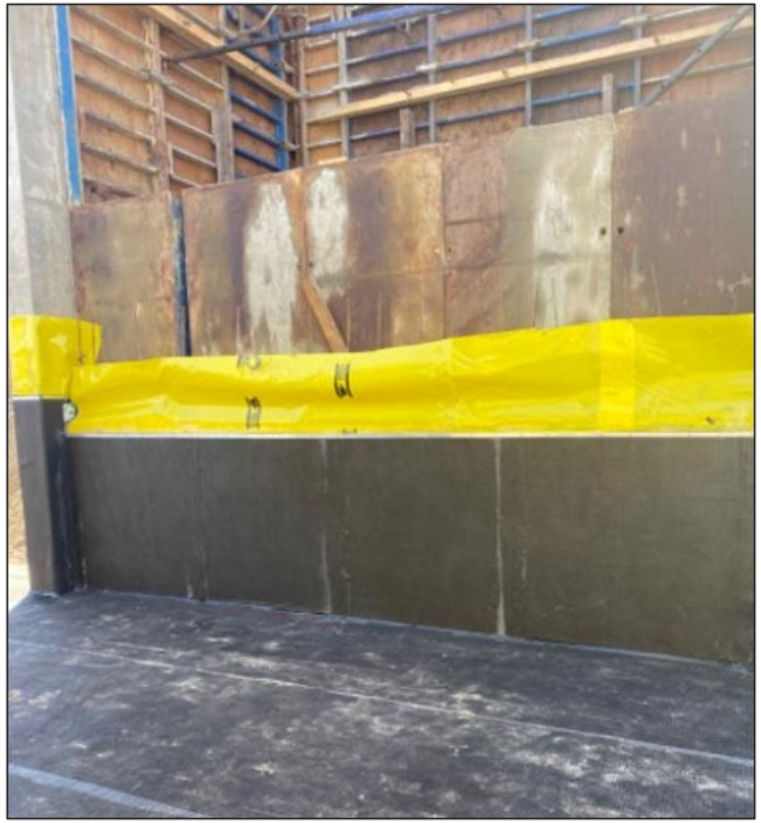
Improved 100% CD Documents.



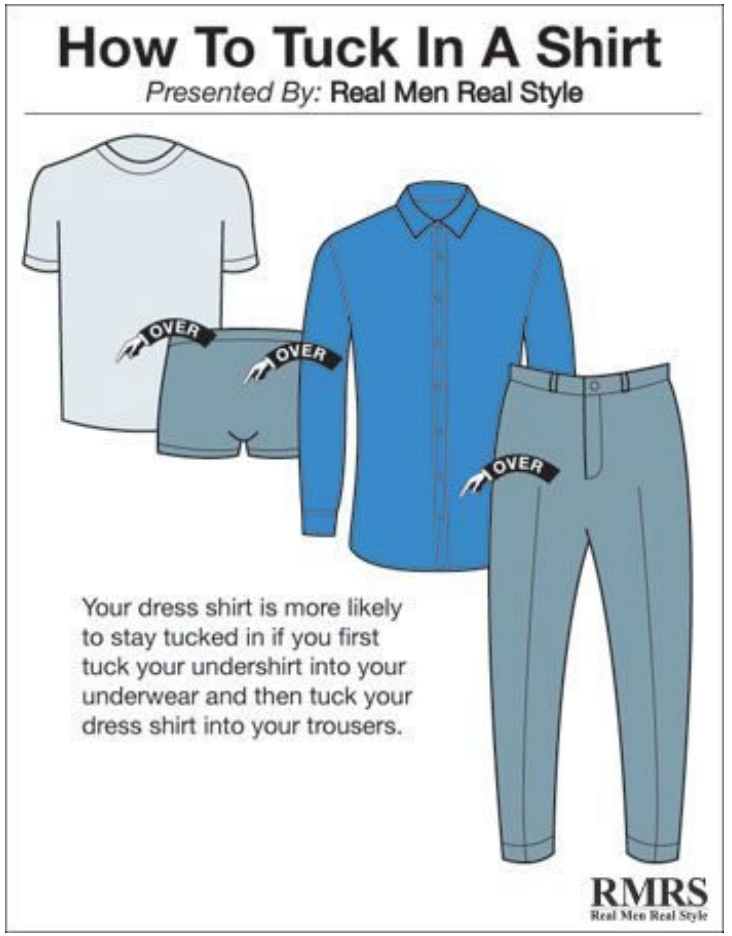
Case Study



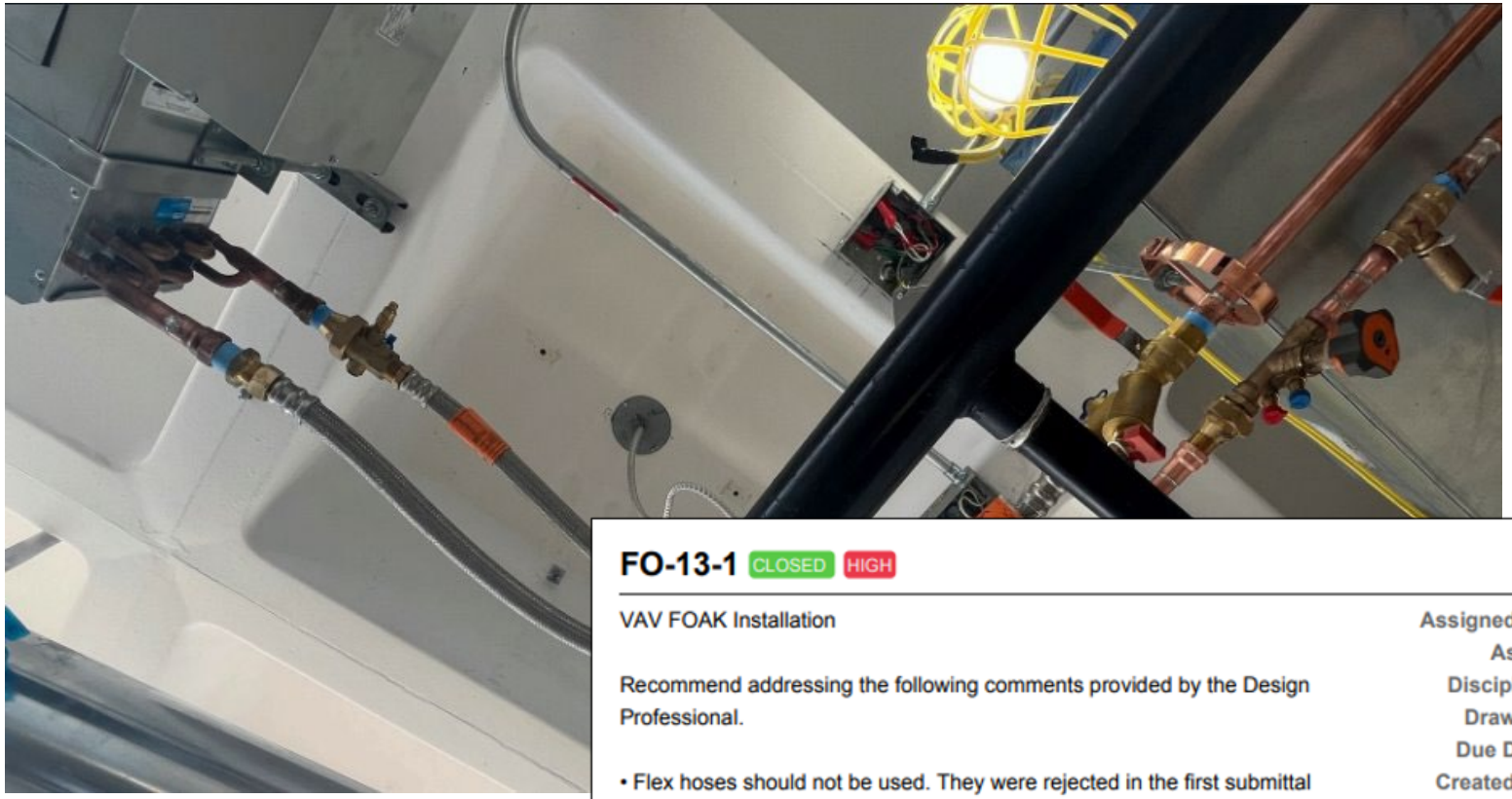
Below grade waterproofing – Design review



Below grade waterproofing – Site observation



First of a Kind Installation



FO-13-1 CLOSED HIGH

VAV FOAK Installation

Recommend addressing the following comments provided by the Design Professional.

- Flex hoses should not be used. They were rejected in the first submittal review, see attached.
- The air vent should be installed pointing up, not to the side as it appears to be installed.

Assigned To	Mechanical Contractor
Asset	VAV 1-16
Discipline	Mechanical
Drawing	M-103
Due Date	2/10/2023
Created By	Matt Cale
Identified On	1/27/2023 9:09 AM

Case Study

Uninsulated supply air ductwork and heating hot water piping was observed.

Case Study

Incorrect location of the discharge air temperature sensor for a supply air valve.

FO-1-13 CLOSED HIGH

Actions Watch

The following items relate to equipment located in Lab Perez 160J:

a. The room temp sensor shows 77 deg.F. on the CRC display when the actual room temp was measured at 70.9 deg.F.

b. The duct temp sensor shows 55 deg.F. on the CRC display when the actual duct temp was measured at 82 deg.F.

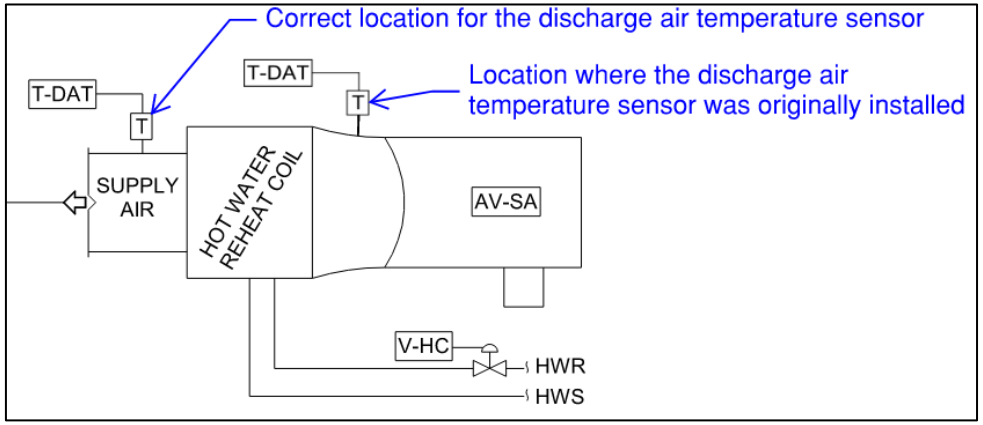
ASSIGNED TO Jessie Bone
Lab Controls, Trane

ASSET Laboratory Air Valve

DISCIPLINE Lab Controls / CRC

DRAWING

DUE DATE 10/6/2023



Case Study

Reheat coil access panel for a VAV box is blocked by a support.

This concludes The American Institute of Architects Continuing Education Systems Course

Select an area to comment on

Questions

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