

INNOVATION AND COST CONAINMENT
Prototype Study: Outline of Building Systems
DRAFT: March 28, 2016

Scope of the Study:

The study will focus on alternative building technologies as applied to the North Frederick Elementary School prototype. The following building systems will be examined:

1. Structuralⁱ

- a. Steel Frame
- b. Exterior Bearing Wallⁱⁱ
- c. Pre-Engineered Steelⁱⁱⁱ

2. Mechanical HVAC (from Posey Engineering, "HVAC Cost Containment", see attached)

- a. Variable refrigerant flow (VRF) with supporting dedicated outdoor air systems (DX cooling + gas-fired heating) (see attached Posey Engineering analysis)
- b. Four-pipe variable air volume (VAV) rooftop units with single duct terminal units (need four-pipe arrangement with VAV, unless cooling is DX).
- c. Four-pipe fan coil units with supporting four-pipe dedicated outdoor air systems.
- d. Two-pipe fan coil units with supporting two-pipe dedicated outdoor air systems.
- e. Vertical geothermal heat pump units with supporting dedicated outdoor air systems.

3. Electrical

- a. LED lighting vs standard fluorescent lighting.
- b. Light harvesting.
- c. Rigid MC cable vs Flexible MC cable.
- d. Copper wire mains vs aluminum wire mains. From main electrical disconnect to subpanels only.^{iv}
- e. FEMA emergence generator and switch gear.^v

4. Plumbing

- a. Cast Iron vs. PVC for sanitary and storm water conveyance. Below ground and above ground.^{vi}
- b. Roof drains.^{vii}

5. Building Envelope

Exterior Walls

- a. Light gauge metal framing with 4" brick veneer 1¼" air space, 2½" cavity spray foam insulation with 5/8" gyp. sheathing, 6" metal studs, 5/8" gyp. board
- b. CMU with insulated cavity and 4" brick veneer
- c. Light gauge metal framing with insulated aluminum panels
- d. Light gauge metal framing with EIFS
- e. Pre-cast concrete wall panels (AAC) with 4" brick veneer

Windows and Storefronts

- a. Aluminum frame with thermal break & insulated low-E glass
- b. Vinyl frame with insulated glass
- c. Fiberglass frame with insulated glass
- d. Vinyl clad wood frame with insulated glass
- e. Metal clad frame with insulated glass

6. Roof

- a. Standard: 4 ply hot asphalt with CSPE (Hypalon) flashings over sloped structure with 2 part insulation system
- b. Single ply TPO
- c. Single ply mechanically fastened EPDM
- d. Cold 2 ply modified
- e. Steel standing seam metal (aluminized steel with Kynar finish)
- f. Fluid applied (urethane)

7. Floor

- a. Standard: Conventional vinyl composite (VCT) flooring systems

- b. Conventional quartz tile flooring systems
- c. Carpeted flooring systems
- d. Terrazzo flooring systems
- e. Epoxy or poured resinous flooring system

8. Wall

- a. Conventional CMU wall systems
- b. Conventional gypsum wallboard (drywall) system
- c. High impact gypsum wallboard (drywall) systems
- d. Tiled wall overlayment systems

9. Ceiling

- a. Conventional 4'x2' lay in acoustical ceilings tile and grid systems
- b. Conventional 2'x2' lay in acoustical ceilings tile and grid systems
- c. Drywall (hard) ceiling systems
- d. Perforated metal pan type ceiling systems

ADDITIONAL NOTES

2. Mechanical HVAC

- A. We will need some energy use data for a couple of elementary buildings similar in size and construction to the foot print we are studying. This information can be furnished in a monthly or yearly fashion. Please include a note with the following info; bldg. sf, wall type, roof type, mechanical system such as chillers, boilers, geotherm, etc., and if you know the hours of operation that might be useful.
- B. We are assuming a typical 20 year life cycle analysis for the mechanical systems. When looking at a building over time some of the systems Mike has suggested in the attachment will cost out differently. (Example: Ductwork and water supplies are often retained during a systemic project while a VRF system will most likely require line set replacement in addition to the unit replacement.)

4. Plumbing

1. Evaluation:
- Pros: Cast Iron is quieter. New maintenance guys can deal with PVC.
 - Cons: PVC can be problematic in some plenum applications.
2. Roof drains. This is more to do with roof design. Planning exterior scuppers for emergency relief instead of a secondary plumbing system to convey the same. This impacts the roof structural and possibly the taper plan sometimes more than off-setting the plumbing savings.

ⁱ It may require some coordination with building envelop or mechanical systems to fully understand the normal opportunities available to each of the structural systems.

ⁱⁱ

- Compare the value of bearing walls with partial steel frame due to the second floor structure.
- Other factors of deviation will be reviewed based on the actual building wall sections for completeness.

ⁱⁱⁱ Explore the possibility of a pre-engineered steel frame and list the other building system suitable to make this a viable alternate, such as; metal roofing, non-rooftop HVAC (or minimalized), overhangs and roof drainage compatibilities.

^{iv} Maintenance issue.

^v Unless buying a generator as part of the project a second emergency disconnect really isn't a major cost factor. Retrofitting a second emergency disconnect is another story.

^{vi}

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