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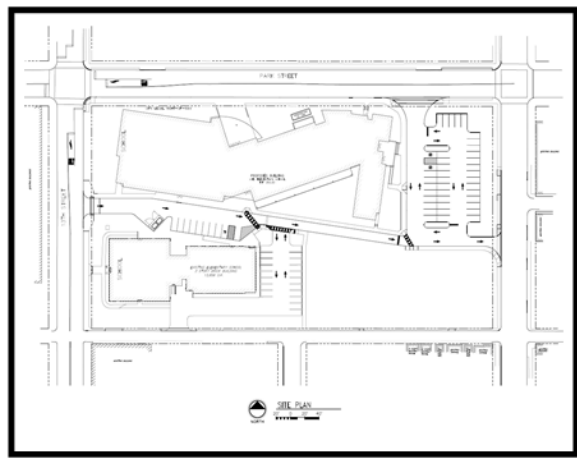
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- BIM EX PLAN ●
- RESEARCH ●
- INTEGRATION ●
- MODEL ●
- CODES ●
- LOOKING FORWARD ●



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BIM PROJECT EXECUTION PLAN
VERSION 1.0 FOR
AEI STUDENT COMPETITION
ELEMENTARY SCHOOL - READING, PA
DEVELOPED BY
creation.
9/7/12





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BIM PROJECT EXECUTION PLAN OVERVIEW

MISSION STATEMENT

“Creation’s one true aim is to enhance the quality of the communities we work with through innovative ideas and sustainable design.”

PROJECT MISSION STATEMENT

“To create a ‘high performance’ elementary school that functions as a multipurpose space for the community through a collaborative, multi-disciplinary environment.”

-INGENUITY

-QUALITY

-ENJOYMENT

-INTEGRITY



BIM PROJECT EXECUTION PLAN OVERVIEW

GOALS FOR BIM

- Design a constructable elementary school for the community
- Integrate on the design to enhance the building for a broader user group
- Incorporate energy efficiency while being mindful of cost by focusing on both short term and lifetime cost benefits
- Use BIM as a tool to improve our building design & construction process



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BIM PROJECT EXECUTION PROJECT SCHEDULE

PROJECT MILESTONE	ESTIMATED START	ESTIMATED COMPLETION	PROJECT DELIVERABLE	INVOLVED PROJECT STAKEHOLDERS
Preliminary Planning	9/1/12	9/14/12	Presentation 1	MEP, Struct, CM
Schematic Design	9/14/12	10/3/12	Presentation 2	MEP, Struct, CM
Design Development	10/3/12	10/24/12	Presentation3	MEP, Struct, CM
Construction Documents	10/24/12	11/12/12	Proposal	MEP, Struct, CM
AEI Submission	11/12/12	2/22/12	Electronic Submission	MEP, Struct, CM
Short List Selection	2/22/12	3/8/12	None	MEP, Struct, CM
Finalist Presentation	3/8/12	4/3/12	Final Presentation	MEP, Struct, CM
Award	4/5/12	4/5/12	None	MEP, Struct, CM



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BIM PROJECT EXECUTION ROLES & ORGANIZATION

FOR EACH PHASE OF THE PROJECT, THE PROJECT TEAM WILL

- Check and ensure completeness and accuracy of model
- Check & ensure completeness and accuracy of BIM Project Execution Plan
- Coordinate all updates for individual models, specialized discipline models, and construction updates

TEAM RESPONSIBILITIES

- Develop BIM Model
- Update & Synchronize changes with Central Files
- Proper Maintenance of Model and File Saving
- Maintain & Revise BIM Plan
- Integrate Discipline Models into Architectural BIM Model



BIM PROJECT EXECUTION ROLES & ORGANIZATION

CONSTRUCTION MANAGEMENT:

- Scheduling & Sequencing
- Site Logistics
- Equipment Procurement
- Cost Estimating
- Constructability Analysis
- 4D Modeling Needs
- Construction Trends
- Clash Detection & Coordination
- Value Engineering

LIGHTING/ELECTRICAL

- Lighting Plan
- Power Plan
- Load Calculations
- Electrical Equipment Proposal
- Daylighting
- Clash Detection & Coordination
- Value Engineering

MECHANICAL

- Heating & Cooling Loading
- Mechanical System Design
- Plumbing Design
- Energy Saving Analysis
- Clash Detection & Coordination
- Value Engineering

STRUCTURAL

- Structural System Design
- Analysis of Structural System Options
- Load Calculations
- Clash Detection & Coordination
- Value Engineering

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BIM PROJECT EXECUTION ROLES & ORGANIZATION

TASK	ROLE	Staff Size	Hours Planned	Weeks
Model Development	Architect(Collaborative)	8	2 hrs/wk	3
	CM	2	8 hrs/wk	8
	Electrical	2	8 hrs/wk	8
	Lighting	2	8 hrs/wk	8
	Mechanical	2	8 hrs/wk	8
Model Review	Structural	2	8 hrs/wk	8
	CM	2	1 hr/wk	16
	Electrical	2	1 hr/wk	16
	Lighting	2	1 hr/wk	16
	Mechanical	2	1 hr/wk	16
Structural Analysis & Design	Structural	2	10 hrs/wk	8
	Structural	2	10 hrs/wk	8
Lighting/Electrical Analysis & Design	Lighting/Electrical	2	10 hrs/wk	8
Mechanical Analysis & Design	Mechanical	2	10 hrs/wk	8
LEED Certification Plus+ Reviews	Collaborative	8	4 hrs/wk	6
Schedule Development	Construction Manager	2	5 hrs/wk	2
Cost Estimating	Construction Manager	2	10 hrs/wk	2
Value Engineering	Collaborative	8	3 hrs/wk	Ongoing
3D Coordination	Structural	2	4 hrs/wk	3
	Lighting/Electrical	2	4 hrs/wk	3
	Mechanical	2	4 hrs/wk	3
	Construction Manager	2	7 hrs/wk	3
4D Modeling	Construction Manager	2	5 hrs/wk	3

TASK	ROLE	Staff Size	Hours Planned	Weeks
Model Development	Architect(Collaborative)	8	2 hrs/wk	3
	CM	2	8 hrs/wk	8
	Electrical	2	8 hrs/wk	8
	Lighting	2	8 hrs/wk	8
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	CM	2	1 hr/wk	16
	Electrical	2	1 hr/wk	16
	Lighting	2	1 hr/wk	16
	Mechanical	2	1 hr/wk	16
	Structural	2	1 hr/wk	16



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BIM PROJECT EXECUTION SOFTWARE

SOFTWARE	VERSION	PROJECT STAKE HOLDER	TASK TYPE
Revit	2013	ARCH	Design Authoring
3DS Max	2013	ARCH,L/E	Design Rendering
Revit MEP	2013	ME	Mechanical Authoring
Trane Trace	v700	ME	Mechanical Calculations
Revit MEP	2013	L/E	Lighting/Electrical Authoring
ComCheck	2013	L/E	Lighting Requirements
DaySim	2013	L/E	Lighting Daylighting
Agj32	Version 2.2	L/E	L/E Calculations
ComFen	2013	L/E	Glazing Analysis
Revit Structure	2013	STRUCT	Structural Authoring
RAM	v14.03	STRUCT	Structural Analysis
SAP	2013	STRUCT	Frame Analysis
Structure Point	2013	STRUCT	Structural Analysis
RS Means CostWorks	2013	CM	Cost Estimation
Primavera	2013	CM	Project Scheduling
Navisworks	2013	CM	4D Modeling
Navisworks	2013	CM	Clash Detection
Record Modeling	2013	CM	Revit
Revit, Navisworks	2013	MEP,CM	Revit, Navisworks



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BIM PROJECT EXECUTION FILE NAMING

FILE SHOULD BE NAMED ACCORDING TO THE FOLLOWING: AEITEAMNUMBER_DISCIPLINE_PHASE_DATE.XYZ	
ARCHITECTURAL MODEL	AEI1_ARCH_SCHEMATIC_DATE.RVT
MECHANICAL/PLUMBING MODEL	AEI1_MECH_SCHEMATIC_DATE.RVT
ELECTRICAL MODEL	AEI1_ELEC_SCHEMATIC_DATE.RVT
LIGHTING MODEL	AEI1_LTG_SCHEMATIC_DATE.RVT
STRUCTURAL MODEL	AEI1_STRUCT_SCHEMATIC_DATE.RVT
CONSTRUCTION MODEL	AEI1_CONST_SCHEMATIC_DATE.RVT
COORDINATION MODEL	AEI1_COORD_SCHEMATIC_DATE.RVT
ENERGY MODEL	AEI1_ENERGY_SCHEMATIC.RVT



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BIM PROJECT EXECUTION QUALITY CONTROL

CHECKS	DEFINITION	RESPONSIBLE PARTY	RECOMMENDED PROJECT MILESTONES
Visual	Ensure there are no unintended model components and the design intent has been followed	ALL	Daily
Interference Check	Ensure there are no collisions among disciplines through clash detection methods	CM	Daily
Model Integrity	Ensure that the BIM model has no undefined, incorrectly defined, or duplicated elements; ensure a reporting process and corrective action plans have been developed for noncompliant elements; ensure all disciplines are using same origin and dimension scale	All	Daily

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LOCAL MATERIALS
RECYCLABILITY/ REUSABILITY
EFFICIENT SYSTEMS
INFORMED DECISIONS

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LOCAL MATERIALS



- Native wood products
- Local vendors





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RECYCLABILITY/ REUSABILITY

- Reduce cement CO² emissions
 - Fly ash
 - Slag
- Ground up concrete for parking lot

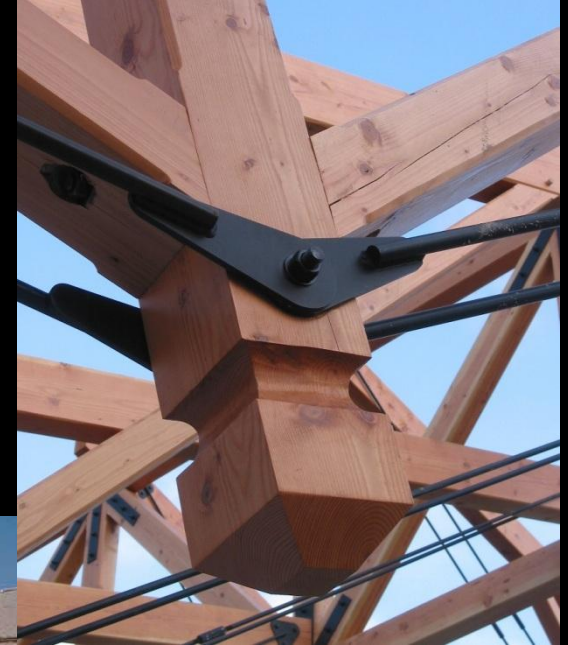




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EFFICIENT SYSTEMS

- Combine materials to optimize the performance of each
- Braced frame
- CMUs
- Metal stud walls





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INFORMED DECISIONS



- Recovery time after high wind or seismic event
- Bolted connections
- Prefabricated materials & precast concrete



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MECHANICAL SYSTEM OPTIONS

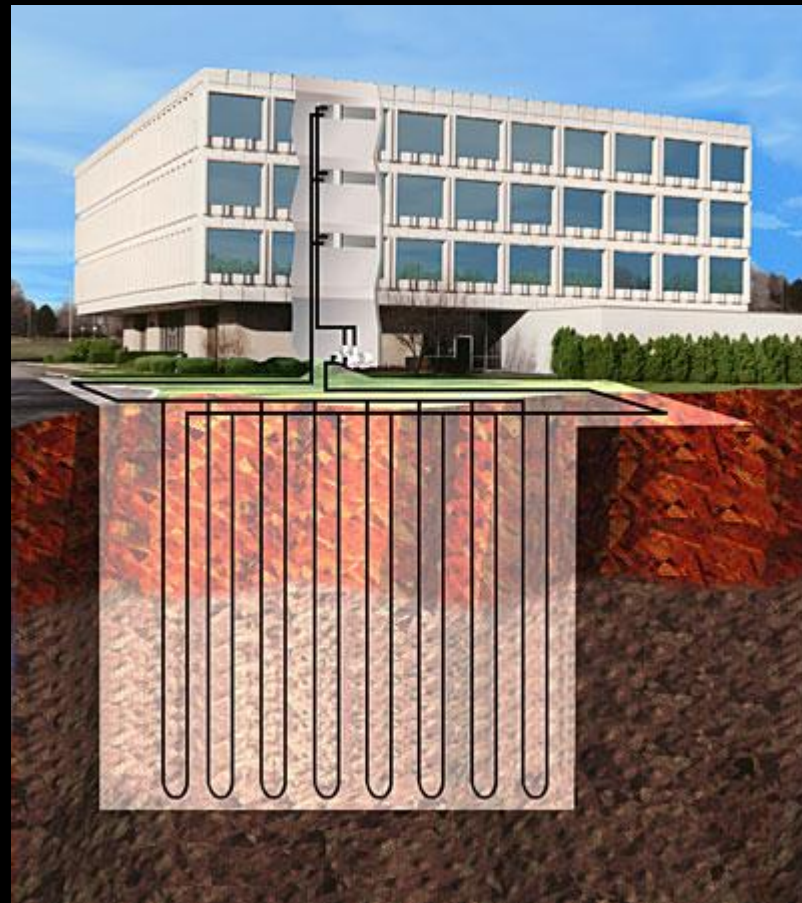
GEOHERMAL HEAT PUMP WITH GROUND LOOPS

ADVANTAGES

- No boiler necessary
- Good controllability
- Simultaneous heating and cooling
- Good for larger buildings

DISADVANTAGES

- Higher first cost
- Requires large footprint





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MECHANICAL SYSTEM OPTIONS

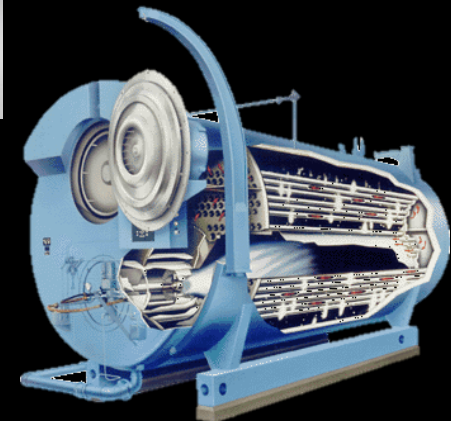
WATER SOURCE HEAT PUMP

ADVANTAGES

- Less initial cost
- Good controllability
- Simultaneous heating and cooling
- Good for larger buildings

DISADVANTAGES

- Requires boiler & cooling tower
- Can leak humidity indoors while unit is off
- Does not address latent load effectively





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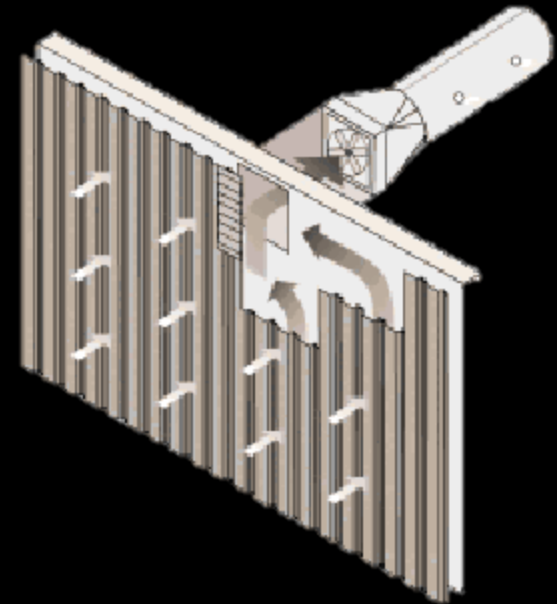
MECHANICAL SYSTEM OPTIONS

SOLAR WALL

- Heats air before entering building system
- 75% efficient
- South facing solar- air absorbs wall warmth
- Maintenance free
- 1SF of collection wall produces 4-10CFM warm air

KEYS FOR USING

- South facing wall
- Good for large ventilation loads
- For cooling- bypass





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LEED DESIGN IDEAS

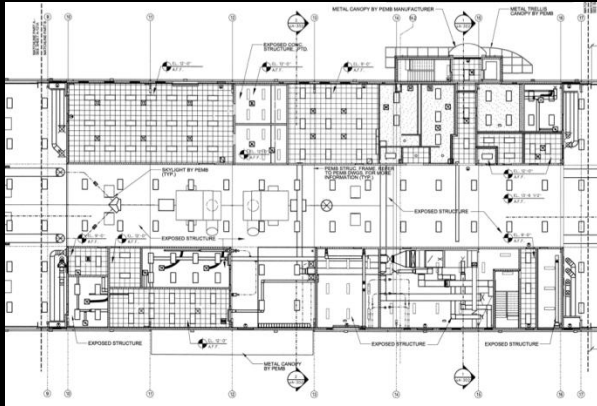
- Water use reduction
- Enhanced refrigeration management
- Tobacco smoke control
- Outdoor air delivery monitoring
- Increased ventilation
- Thermal comfort





ELECTRICAL DESIGN

- Lighting Layout & Circuiting
- Switching/Controls
- Receptacle/AV Layout
- Fire Alarm/Security Design



SUPPLEMENTAL ENERGY

- Photovoltaics/Solar Arrays
- Solar Panel Windows
- Solar Roofing Material
- Solar Heat Harvesting

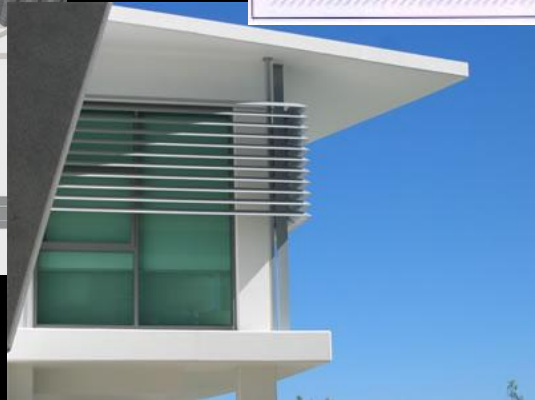
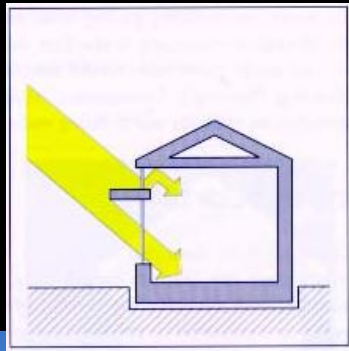
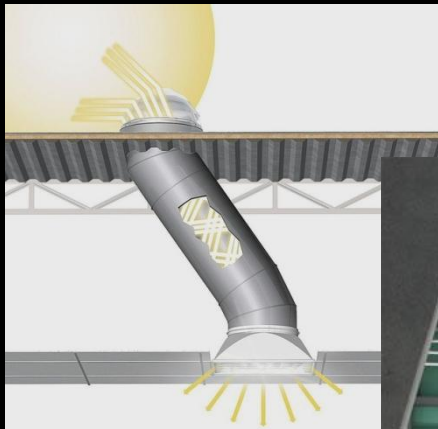
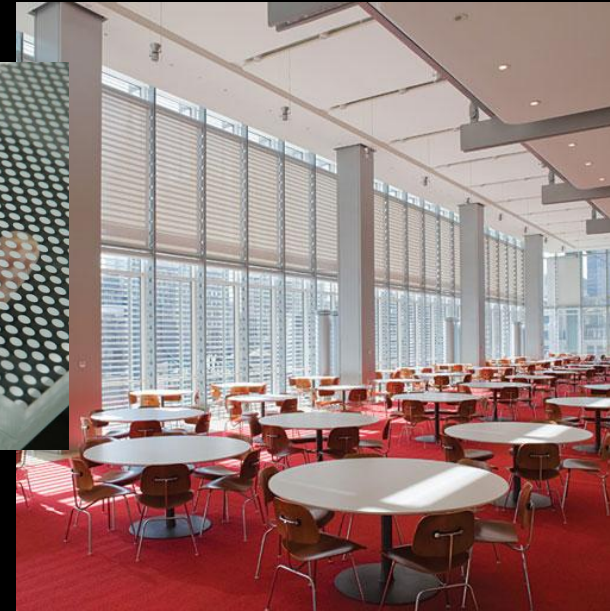
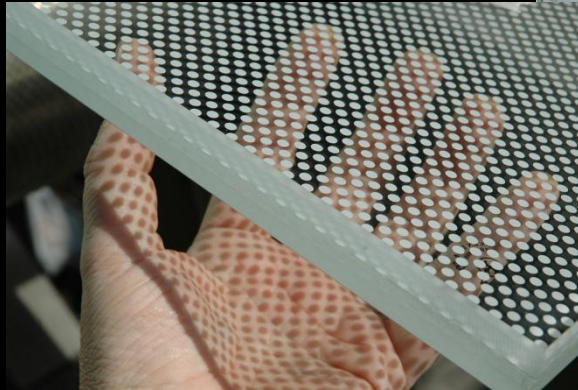




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DAYLIGHTING

- Solatubes
- Clerestories
- Sky lights
- Light shelves
- Overhangs
- Vertical fins
- louvers



SHADING

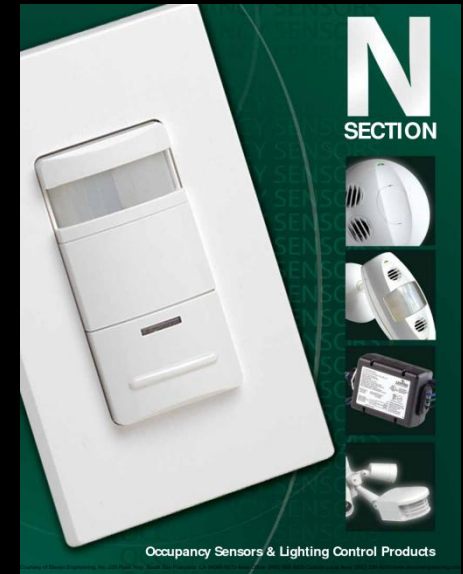
- Roller Shades
 - Automated?
- Window Glazing
- Frit



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LIGHTING

- LEDs
- High efficiency lamps and ballasts
- Indoor and Outdoor Fixtures



CONTROLS

- Grafik Eye
- Scene Control
- Dimming
- Photosensors
- Occ./Vacancy Sensors
- Override Switches
- Switching Panelboards



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LEED DESIGN IDEAS

- Lighting Controls
- Daylight Harvesting
- Mercury Reduction
- On-Site Renewable Energy
- Light Trespass Reduction
- Innovative Low-Energy Lighting Design





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FUNDING & COSTS

PROJECT DELAYS

- State Funding

COSTS

- Reading, PA
- 1 Story
- 45000 SF
- Union vs. Open Shop

Square Foot Cost Assuming Face Brick with Concrete Block Back-up / Steel Frame

Cost Estimate (Union Labor)	% of Total	Cost Per SF	Cost
Total		\$107.98	\$4,859,000
Contractor Fees (GC,Overhead,Profit)	25%	\$26.99	\$1,214,750
Architectural Fees	6%	\$6.48	\$291,540
User Fees	0%	\$0	\$0
Total Building Cost		\$141.45	\$6,365,290

Cost Estimate (Open Shop)	% of Total	Cost Per SF	Cost
Total		\$98.72	\$4,442,500
Contractor Fees (GC,Overhead,Profit)	25%	\$24.68	\$1,110,625
Architectural Fees	6%	\$5.92	\$266,550
User Fees	0%	\$0	\$0
Total Building Cost		\$129.33	\$5,819,675

<http://www.reedconstructiondata.com/rsmeans/models/elementary-school/pennsylvania/reading>



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PREFABRICATION & MODULARIZATION

BENEFITS OF PREFABRICATION

- Quality
- Cost
- Schedule
- Safety

OPPORTUNITIES

- Mechanical Systems
- Electrical Systems
- Redundant construction
(i.e. Classrooms)
- Bathroom Pods





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SUSTAINABLE MATERIALS

Sustainability- The Capacity to endure

POSSIBLE MATERIALS:

- Cork Flooring
- Agricultural Waste Products
- Green Roof & Cool Roof
- Supplementary Cementitious Materials





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PROACTIVE COMMISSIONING PLAN

Proactive - acting in anticipation of future problems, needs, or changes

COMMISSIONING GOALS:

- Optimize Energy Use
- Minimize Operating Costs
- Ensure Proper Building Systems Documentation

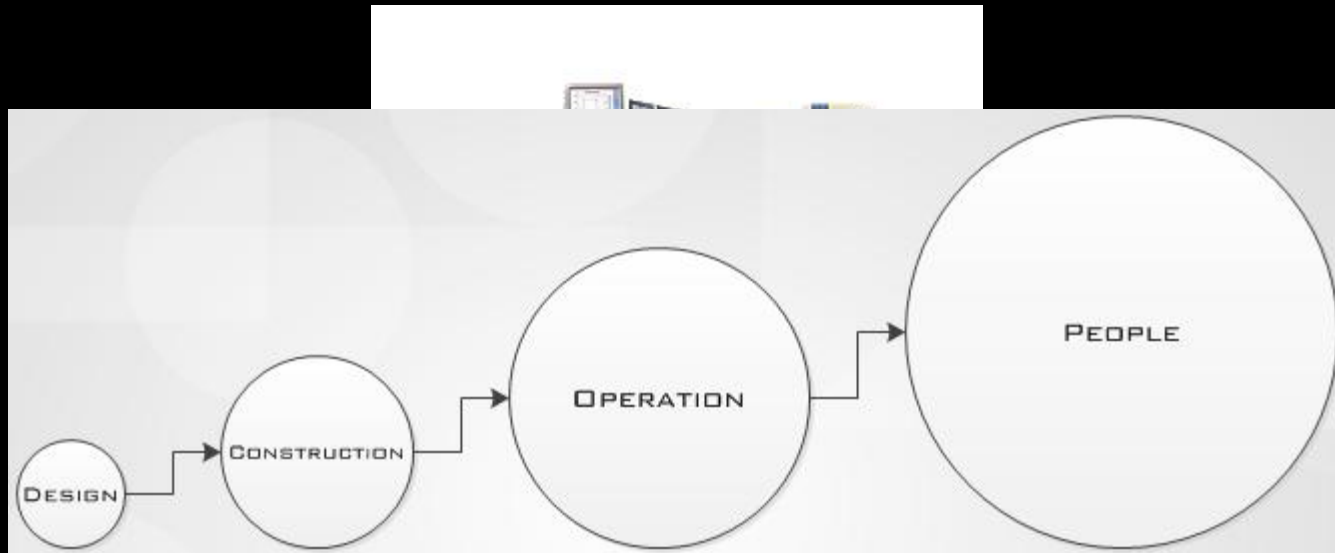




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OPERATIONS & MAINTENANCE

Carry design and construction earned benefits through to operations





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	Construction Management	Structural	Mechanical	Lighting/Electrical	Architecture
Construction Management		<ul style="list-style-type: none"> Scheduling Cost Crane Positioning & Size Sequencing Plenum Spaces 	<ul style="list-style-type: none"> Lead Times for Equipment Value Engineering of Systems Operating Costs of the Building 	<ul style="list-style-type: none"> Prefabbing MEP systems Photovoltaics Passive Lighting Systems Phasing/Sequencing Storage of materials Cost of equipment/installation 	<ul style="list-style-type: none"> Constructability Issues Material Selection Functionality
Structural	<ul style="list-style-type: none"> system selection phasing cranes and equipment cost excavation transport requirements 		<ul style="list-style-type: none"> Shaft locations Roof loads from equipment Loads in plenum space 	<ul style="list-style-type: none"> Column layout and bay spacing Ceiling depth for recessed fixtures Window/Daylighting area 	<ul style="list-style-type: none"> Façade/Appearance of building Overhangs Roof systems
Mechanical	<ul style="list-style-type: none"> Costs of equipment/installation Payback period of geothermal systems 	<ul style="list-style-type: none"> Intersection of duct work with structural beams/columns Thermal Mass Placement of air handlers Material selection 		<ul style="list-style-type: none"> Cooling/heating loads from equipment/daylighting Coordinate plenum space Location of diffusers w/ fixtures etc. 	<ul style="list-style-type: none"> Designated location for MEP room Limited plenum space
Lighting/Electrical	<ul style="list-style-type: none"> Costs of equipment/installation Payback period for photovoltaics 	<ul style="list-style-type: none"> Window/Daylighting area Material effects reflectance Equipment mounting Spacing of lighting Ceiling heights Cove/detail areas with specific lighting needs 	<ul style="list-style-type: none"> Location of fixtures w/ diffusers etc, Wiring for all elec/mech equipment Equipment loads Space in MEP room AV equipment Fire alarm layout Solar harvesting for heat/elec Coordinate plenum space 		<ul style="list-style-type: none"> Window Layout Materials Architectural Cove Spaces
Architecture	<ul style="list-style-type: none"> Material Selection 	<ul style="list-style-type: none"> Façade Bay spacing/location of columns Blending materials to environment Overall aesthetics Functionality 	<ul style="list-style-type: none"> Ceiling types for hidden duct/equipment Area for equipment 	<ul style="list-style-type: none"> Window location for daylighting/skylights Outdoor lighting will influence appearance Lighting to accent spaces 	



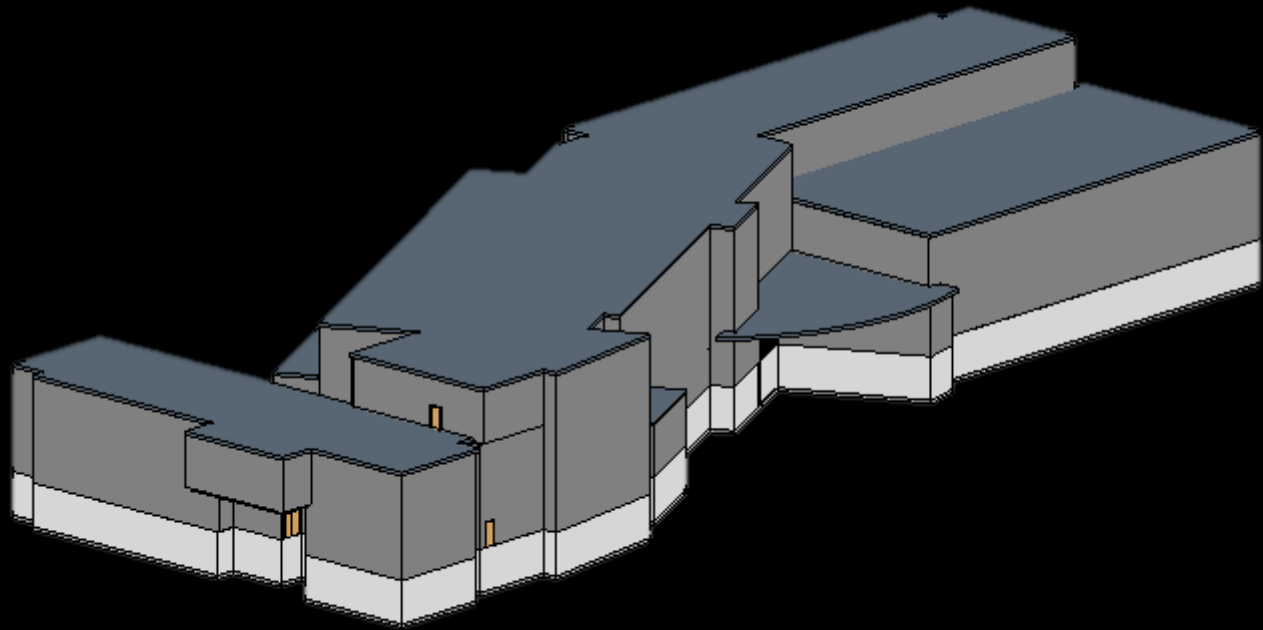
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A FEW EXAMPLES OF INTEGRATION POINTS

- Coordination of plenum space between MEP
- Scheduling of building process
- Effects of materials on other designs

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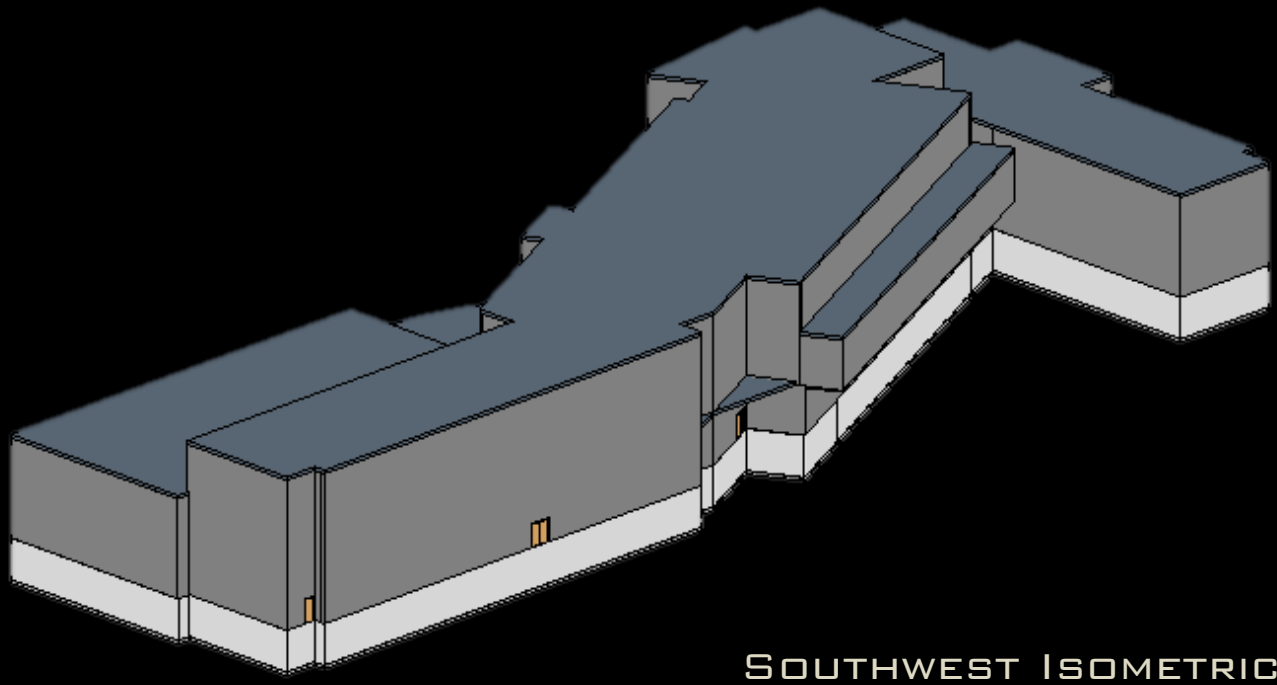
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NORTHEAST ISOMETRIC



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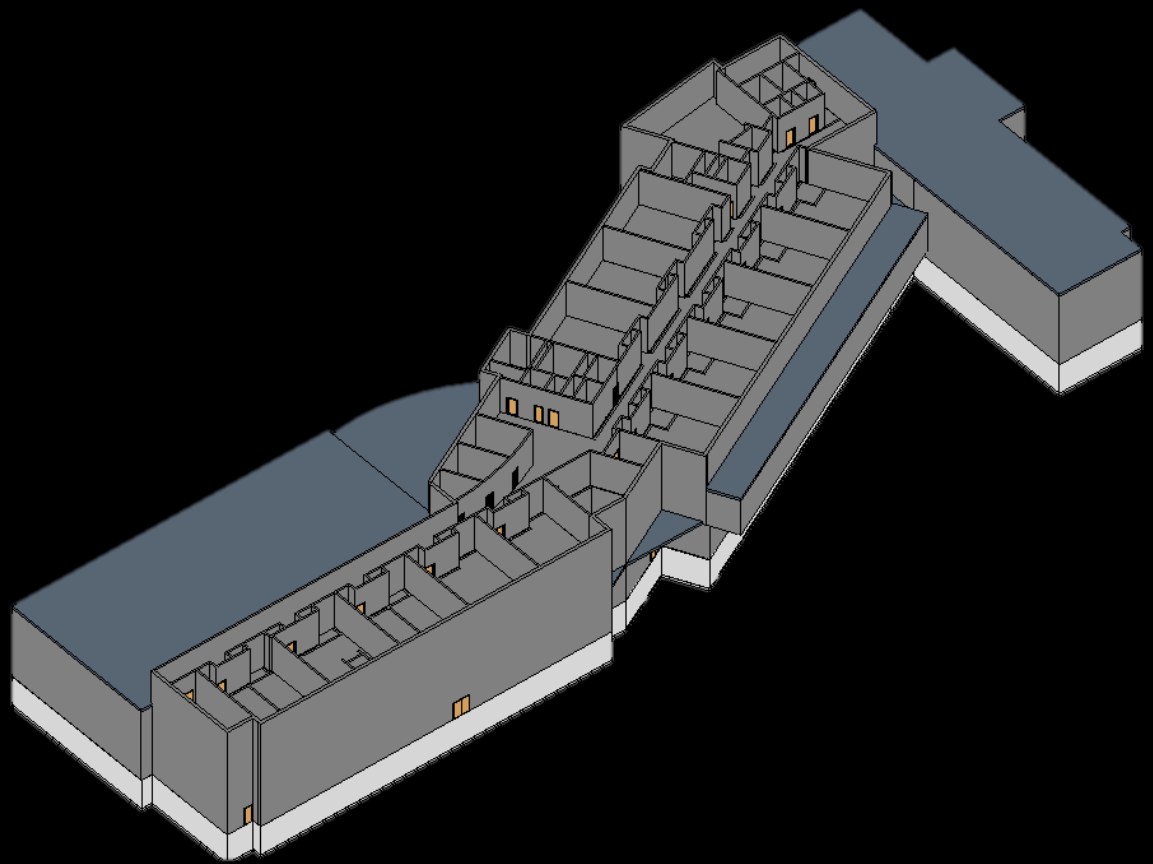


SOUTHWEST ISOMETRIC

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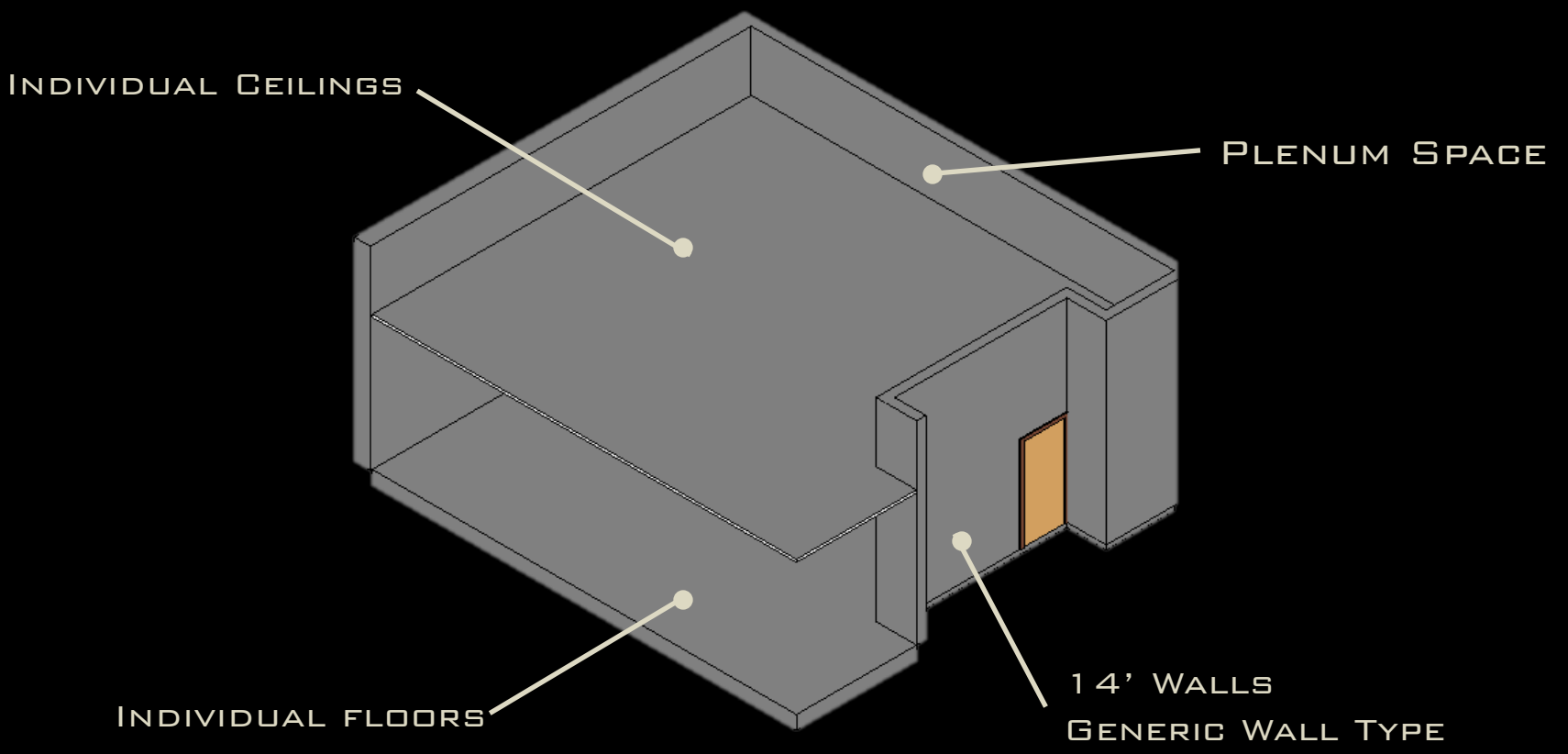


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Construction Codes	Mechanical Codes
PA Uniform Construction Code International Building Code OSHA Standards NFPA ADA	IMC ASHRAE 62.1 ASHRAE 55 ASHRAE 90.1
Lighting/Electrical Codes	Structural Codes
ASHRAE Standard 90.1 2009 NEC 2009 Reference – IESNA Lighting Handbook 2011	PA Uniform Construction Code International Building Code 2009 ASCE7



LOOKING FORWARD

- AWARE OF COMMUNITY
- TEAM EFFECTIVENESS
- ALL ENCOMPASSING
- INNOVATIVE IDEAS



DELIVERABLES

- DEVELOPMENT OF SYSTEM DESIGNS
- CREATE ARCHITECTURAL APPEAL
- DEVELOP MODEL TO LOD 200+
- PRELIMINARY COST & SCHEDULE
 - ROM
 - ASSEMBLIES ESTIMATE



MECHANICAL



LIGHTING/ELECTRICAL



INTEGRATION



CONSTRUCTION
MANAGEMENT



STRUCTURAL