PRE-FINAL
VALUE ENGINEERING REPORT
FOR THE
TUSSEY MOUNTAIN SCHOOL DISTRICT
DEFIANCE, ROBERTSDALE AND SAXTON-LIBERTY
ELEMENTARY SCHOOLS

SAXTON, PENNSYLVANIA

SEPTEMBER 14, 2009

September 14, 2009

TABLE OF CONTENTS (Continued)...

TABLE OF CONTENTS (Continued)...

A. INTRODUCTION

As part of the Agreement between the Tussey Mountain School District and Pathline, Inc., Pathline is submitting the following Value Engineering Report. The basis for the report was progress drawings provided by Crabtree Rohrbaugh & Associates, the project Architects, in July, 2009. No PlanCon submittals or progress specifications information were also provided.

B. OBJECTIVES

The goal of this report is to assess the decisions which have been made and suggest specific options which may still be incorporated into the engineering and materials/equipment/finishing aspects of the design. Each item which follows consists of a summary of the current design and the reasoning for that design, potential options, discussion of the advantages and disadvantages of each option and conclusions/recommendations. These conclusions reflect not only capital cost, but in some cases also life-cycle present worth costs such as operation, maintenance and replacement, so that a present worth assessment of value may be made.

C. SUMMARY OF POTENTIAL SAVINGS

Section to be added after review and written comment by all involved parties, including Crabtree Rohrbaugh & Associates and their consultants.

D. IMPLEMENTED RECOMMENDATIONS

Section to be added after review and written comment by all involved parties, including Crabtree Rohrbaugh & Associates and their consultants.

The following represents the current design, to the best of our knowledge, and incorporates assumptions of typical construction practices where necessary.

The project consists of the renovations and additions to three elementary school buildings and site improvements.

GENERAL

1. Defiance Elementary School

   A. Demolition – Major demolition components include removal of windows and doors, roofing, removal of most existing flooring, removal of restroom facility components and some kitchen equipment, removal of chalk/tack boards, removal of ceilings in certain areas and removal of exterior stairs and handrail to accommodate a handicapped accessible ramp.

   B. Site – Minimal site work is planned. A geothermal well field is planned, as well as the associated water line placement. Erosion and sedimentation controls will be required. Some minor site revisions are indicated included work at the proposed elevator shaft, and at the main building entrance.

   C. Architecture – The major exterior architectural features of the proposed construction are designed, we assume, to compliment the existing building.

   D. Structure – The structural components of the building addition (elevator) are masonry bearing walls supporting steel roof framing members. The stair and ramp modifications involve concrete retaining walls and slabs on grade.

   E. HVAC – The HVAC system for Defiance Elementary School is to be a geothermal heat pump system. The geothermal heat pump system shall consist of thirty (30), four-hundred foot (400') deep wells spaced at twenty feet (20'), as determined by in-depth test well series prior to construction.

      The piping loop will be pumped throughout the building by pumps located in the existing mechanical room and to each water source heat pump. The system shall be controlled by a web accessible, inter operable Building Management System (BMS) based on server/thin client architecture which includes full programing capability of all controller outputs. The Disect Digital Control (DDC) controls circulating pumps, water source heat pumps, rooftop energy recovery units, radiant ceiling panels, exhaust fans, horizontal unit heater, cabinet unit heaters, and occupied/unoccupied changeover modes.

Energy recovery units are to be installed on the roof to supply required outdoor air to the water source heat pump units while providing additional energy saving.

The kitchen make-up air/energy recovery unit shall handle the high outside air requirement and be interlocked with the kitchen exhaust hood to maintain proper building pressurization.

F. Plumbing – Existing piping, fixtures, and equipment are to be removed and replaced with new fixtures. Minor piping alterations are required throughout to incorporate the new piping with the existing. Where fixtures are being replaced, pipe is being reused where feasible.

The Building will be sprinklered in accordance with all Federal, State, and Local codes.

G. Electrical – The service configuration will be comprised of a new main switchboard and 120/208 volt, 3 phase, 4 wire distribution system. There are 120/208 volt, 3-phase, 4 wire distribution panels located throughout the school.

Emergency power will be supplied from a 100 KW diesel generator. The generator feeds an emergency distribution panel board. Items that will be powered from this panel are two transfer switches. One transfer switch feeds critical life safety circuits. The other transfer switch feeds emergency circuits that would cause large financial loss to the school district.

Fluorescent lighting will be utilized in the classroom and corridor areas. The fixtures will utilize energy savings ballasts and T5 energy saving lamps that operate at 120 volts. Occupancy sensors have been included with the dual energy savings ballasts. Generator Transfer Device ballasts will be utilized in lighting that will also be utilized under emergency conditions. The ballast will automatically switch between the normal power feed to the fixture and the emergency power feed to the fixture.

The current plans indicate one (1) telephone outlet and a minimum of one to as many as twenty-seven (27) data outlets in classrooms. Fiber optic cabling connects the MDF and IDF's. Cat 6 cabling has been utilized for horizontal cabling from IDF patch panels. Basket or cable tray is being utilized above accessible ceilings to route communication cables between the MDF and IDFs and between the IDFs and station outlets.

A door access control system, limited motion detection in corridors and at outside door access areas, and CCTV cameras to record all points of egress comprise the security system.

The fire alarm system will consists of fire alarm control panel, annunciator panel, heat detectors, smoke detectors, pull station, horns, and visual devices.

2. Robertsdale Elementary School

A. Demolition – Major demolition components include removal of windows and doors, removal of most existing flooring, removal of restroom facility components and some kitchen equipment, removal of chalk/tack boards and removal of ceilings.

B. Site – A geothermal well field is planned, as well as the associated water line placement. Additionally, erosion and sedimentation controls will be required at the proposed building additions. Beyond this work, there is little site work planned.

C. Architecture – No new construction planned. The work to be completed involves finishes, restoration and replacement of items in kind.

D. Structure – It appears that no new structural components are required.

E. HVAC – The HVAC system for Robertsdale Elementary School is to be a geothermal heat pump system. The geothermal heat pump system shall consist of thirty (30), four-hundred foot (400') deep wells spaced at twenty feet (20'), as determined by in-depth test well series prior to construction.

The piping loop will be pumped throughout the building by pumps located in the existing mechanical room and to each water source heat pump. The system shall be controlled by a web accessible, inter operable Building Management System (BMS) based on server/thin client architecture which includes full programing capability of all controller outputs. The Direct Digital Control (DDC) controls circulating pumps, water source heat pumps, rooftop energy recovery units, radiant ceiling panels, exhaust fans, horizontal unit heater, cabinet unit heaters, and occupied/unoccupied changeover modes.

Energy recovery units are to be installed on the roof to supply required outdoor air to the water source heat pump units while providing additional energy saving.

The kitchen make-up air/energy recovery unit shall handle the high outside air requirement and be interlocked with the kitchen exhaust hood to maintain proper building pressurization.

F. Plumbing – Existing piping, fixtures, and equipment are to be removed and replaced with new modern fixtures. Minor piping alterations are required throughout to incorporate the new piping with the existing. Where fixtures are being replaced, piping is being reused where feasible.

G. Electrical – The service configuration will be comprised of a new main switchboard and 120/208 volt, 3 phase, 4 wire distribution system. There are 120/208 volt, 3-phase, 4 wire distribution panels located throughout the school.

Emergency power will be supplied from a 100 KW diesel generator. The generator feeds an emergency distribution panel board. Items that will be powered from this panel are two transfer switches. One transfer switch feeds critical life safety circuits. The other transfer switch feeds emergency circuits that would cause large financial loss to the school district.

Fluorescent lighting will be utilized in the classroom and corridor areas. The fixtures will utilize energy savings ballasts and T5 energy saving lamps that operate at 120 volts. Occupancy sensors have been included with the dual energy savings ballasts. Generator Transfer Device ballasts will be utilized in lighting that will also be utilized under emergency conditions. The ballast will automatically switch between the normal power feed to the fixture and the emergency power feed to the fixture.

One telephone outlet and a minimum of one to as many as twenty-seven (27) data outlets will be installed in classrooms. Fiber optic cabling will connect the MDF and IDF's. Cat 6 cabling has been utilized for horizontal cabling from IDF patch panels. Basket or cable tray is being utilized above accessible ceilings to route communication cables between the MDF and IDFs and between the IDFs and station outlets.

A door access control system, limited motion detection in corridors and at outside door access areas, and CCTV cameras to record all points of egress comprise the security system.

The fire alarm system will consisting of fire alarm control panel, annunciator panel, heat detectors, smoke detectors, pull station, horns, and visual devices.

3. Saxton-Liberty Elementary School

A. Demolition – Major demolition components include removal of windows and doors, removal of most existing flooring, removal of restroom facility components and some kitchen equipment, removal of chalk/tack boards and removal of ceilings.

B. Site – A geothermal well field is planned, as well as the associated water line placement. Additionally, erosion and sedimentation controls will be required at the proposed building additions. Beyond this work, there is little site work planned.

C. Architecture – The major exterior architectural features of the proposed construction are designed, we assume, to compliment the existing building. These would involve the two story elevator, and single story multi-purpose room.

D. Structure - The structural components of the building addition (elevator) are masonry bearing walls backing supporting steel roof framing members.

E. HVAC – The HVAC system for Saxton-Liberty Elementary School is to be a geothermal heat pump system. The geothermal heat pump system shall consist of forty five (45), four-hundred foot (400') deep wells spaced at twenty feet (20'), as determined by in-depth test well series prior to construction.

The piping loop will be pumped throughout the building by pumps located in the existing mechanical room and to each water source heat pump. The system shall be controlled by a web accessible, inter operable Building Management System (BMS) based on server/thin client architecture which includes full programing capability of all controller outputs. The Direct Digital Control (DDC) HVAC controls circulating pumps, water source heat pumps, rooftop energy recovery units, radiant ceiling panels, exhaust fans, horizontal unit heater, cabinet unit heaters, and occupied/unoccupied changeover modes.

Energy recovery units are to be installed on the roof to supply required outdoor air to the water source heat pump units while providing additional energy saving.

The kitchen make-up air/energy recovery unit shall handle the high outside air requirement and be interlocked with the kitchen exhaust hood to maintain proper building pressurization.

F. Plumbing – Existing piping, fixtures, and equipment are to be removed and replaced with new fixtures. Minor piping alterations are required throughout to incorporate the new piping with the existing. Where fixtures are being replaced, piping is being reused where feasible.

The Building will be sprinklered in accordance with all Federal, State, and Local codes.

G. Electrical – The service configuration will be comprised of a new main switchboard and 120/208 volt, 3 phase, 4 wire distribution system. There are 120/208 volt, 3-phase, 4 wire distribution panels located throughout the school.

Emergency power will be supplied from a 100 KW diesel generator. The generator feeds an emergency distribution panel board. Items that will be powered from this panel are two transfer switches. One transfer switch feeds critical life safety circuits. The other transfer switch feeds emergency circuits that would cause large financial loss to the school district.

Fluorescent lighting will be utilized in the classroom and corridor areas. The fixtures will utilize energy savings ballasts and T5 energy saving lamps that operate at 120 volts. Occupancy sensors have been included with the dual energy savings ballasts. Generator Transfer Device ballasts will be utilized in lighting that will also be utilized under emergency conditions. The ballast will automatically switch between the normal power feed to the fixture and the emergency power feed to the fixture.

The current plans indicate one telephone outlet and a minimum of one to as many as 15 data outlets in classrooms. Fiber optic cabling connects the MDF and IDF's. Cat 6 cabling has been utilized for horizontal cabling from IDF patch panels. Basket or cable tray is being utilized above accessible ceilings to route communication cables between the MDF and IDFs and between the IDFs and station outlets.

A door access control system, limited motion detection in corridors and at outside door access areas, and CCTV cameras to record all points of egress comprise the security system.

The fire alarm system will consisting of fire alarm control panel, annunciator panel, heat detectors, smoke detectors, pull station, horns, and visual devices.

ALL ELEMENTARY SCHOOLS

1. UTILITIES – ALL ELEMENTARY SCHOOLS

CURRENT DESIGN

- A water line is planned from the geothermal well field to the Existing Schools.

REASONING FOR CURRENT DESIGN

- This is necessary for heating/cooling of the building utilizing the new geothermal system.

ALTERNATIVES TO CURRENT DESIGN

- None

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- None

CONCLUSIONS

- Because of the very minimal amount of site utility related work, there no practical options available. It is our opinion that the utility routing as indicated on the drawings provided is the best option available.

2. PHASING OF CONSTRUCTION – ALL ELEMENTARY SCHOOLS

CURRENT DESIGN

- No phasing information was available. This will be reviewed upon receipt.

3. EARTHWORK – ALL ELEMENTARY SCHOOLS

CURRENT DESIGN

- Minimal earthwork is required. More than adequate stockpile areas have been accounted for.

REASONING FOR CURRENT DESIGN

- The current design utilizes standard measures to accommodate construction conditions and final site conditions. Because of the relatively small areas of disturbance and the naturally open nature of the site, the options relating to earthwork, the associated stockpiling, and stormwater controls are limited.

ALTERNATIVES TO CURRENT DESIGN

- None

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- None

CONCLUSIONS

- It is our opinion that the site design as indicated on the drawings provided is the best option available.

4. LANDSCAPING – ALL ELEMENTARY SCHOOLS

CURRENT DESIGN

- None planned.

REASONING FOR CURRENT DESIGN

- Presumably a combination of monetary concerns and the adequacy of the existing landscaping on site.

ALTERNATIVES TO CURRENT DESIGN

- Additional landscaping

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- The obvious disadvantage of adding landscaping to the project is the associated cost.

CONCLUSIONS

- There are numerous options available relating to landscaping. It is often beneficial to incorporate a "wish list" of desirable landscaping as a Bid Alternate in order to obtain accurate values associated with plantings which would be completed by certified landscapers. If this value is beyond what would be acceptable, then the Bid Alternate can be rejected, and the only added cost incurred by the District are design fees associated with drawing preparation.

5. DRAINAGE – ALL ELEMENTARY SCHOOLS

CURRENT DESIGN

- No additional drainage is required per the drawings provided.

REASONING FOR CURRENT DESIGN

- No additional drainage is required or, we assume, desired by the District

ALTERNATIVES TO CURRENT DESIGN

- Additional drainage to address any areas that may have been problematic in the past

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- The obvious disadvantage to adding drainage is cost. If any areas are of concern, they should be addressed.

CONCLUSIONS

- No drainage should be considered unless it is desired at certain locations by the District to remedy any existing problems.

ITEMIZED BY SCHOOL

DEFIANCE ELEMENTARY SCHOOL

1. SPACE ALLOCATION

CURRENT DESIGN

- Two story, 247 square foot addition to house an elevator and elevator equipment room. Additionally, the administrative area is being modified with the addition of three partition walls.

  Because of the relatively small scope of this work, analysis of alternative layouts is not justified.

2. FLOORING

CURRENT DESIGN

- Replacement of existing carpet: 3,720 square feet (SF) on the first floor, 8,800 SF on the second floor. Total carpet replacement: 12,520 SF or 1,400 square yards (SY)

  Replacement of existing ceramic tile: 430 SF on the second floor

  Addition of approximately 140 SF of entry mats

  This work is all to be done as a bid alternate

REASONING FOR CURRENT DESIGN

- The majority of the work is "replacement in kind", so we assume that the carpet utilized in corridors and classrooms has worked well, but simply needs replaced do to wear

ALTERNATIVES TO CURRENT DESIGN

- Replace carpet with linoleum or VCT in instructional/classroom spaces, approximately 7,400 SF
- Replace carpet in corridors with terrazzo; corridor area is approximately 2,500 SF

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- Linoleum is a natural "green" building product, which has approximately twice the life of VCT. The disadvantage is an increase in up-front costs
- The obvious disadvantage of the terrazzo alternative is up-front cost, as it will be more costly than the current design. However, over the life of the flooring, maintenance, repair and replacement will be much greater for the less expensive flooring.
- The greatest advantage of the alternate system is the appearance and durability which the alternate flooring incorporates. The appearance, of course, is greatly dependent on individual taste. The terrazzo floors would last the entire life of the building with minimal need of repair or replacement. Linoleum should last about twenty (20) years and carpet about ten (10) years.

CONCLUSIONS

- Substitution of linoleum flooring for carpet in instructional spaces would decrease initial costs by approximately $5,000.

  Substitution of VCT flooring for carpet in instructional spaces would decrease initial costs by approximately $30,000.

- The substitution of terrazzo for carpet in the corridors would result in an added cost of about $75,000.

3. ROOFING SYSTEM

CURRENT DESIGN

- The 7,650 square foot roof above the classroom wing of the school is to be demolished and replaced as a bid alternate.

  The replacement roofing material is specified as Cold-Process Built-Up Asphalt Roofing (BUR). Specified warranty is 20 years.

REASONING FOR CURRENT DESIGN

- Presumably, the existing roof is original to the building, and should be replaced.

ALTERNATIVES TO CURRENT DESIGN

- Conventional BUR is a common installation using redundant layers of protection which will have a high puncture resistance. However, the materials used are petroleum based, and therefore, it is difficult to estimate specific project and location costs accurately

- Other flat roofing systems utilizing the existing structural limitations such as Thermoplastic Polyolefin (TPO), which are single ply rubber roofs, EPDM, or Modified Bitumen roofing.

- The total replacement of the existing insulation and roofing material will assure all new materials with no hidden or structural or moisture leak problems. This system can also be specified with a total system warranty, if it is completed by a single source supplier.

- Placing a new roofing system over the old membrane can create moisture trapping issues, which can cause premature failure of the new roofing system. Detection of leaks in the new roofing could also go undetected into the old system causing more damage than would normally occur in that situation. This option would also require a more detailed inspection, which could delay and complicate the bidding process.

- TPO system: “Green” building product - recyclable and energy efficient. Similar installation to EPDM roofing, both of which require high quality control due to the many seams.

- Modified Bitumen roofing is similar to BUR, but is factory laminated. This system has greater flexibility and better low temperature service characteristics, but provides less puncture resistance than BUR systems.

- All products are fairly common for this type of construction; decision is normally based on up front cost and building life expectancy.

CONCLUSIONS

- BUR will initially cost approximately $100,000 more than an equivalent TPO membrane roof. Assuming a standard warranty period of 20 years, any savings that may be related initial costs compared to energy efficiency, will not be returned in Pennsylvania's climate, in a school that minimally operates during the summer.

- BUR will initially cost approximately $40,000 more than an EPDM system.

- The life expectancy of a built-up roofing system versus a modified bitumen roofing system or fully adhered membrane roof will be approximately the same.

- The specified warranty for the BUR system is 20 years. Warranties for EPDM from 20 up to 30 years are available, with 20 years being available as a standard warranty for a 60 mil membrane. A standard warranty on a TPO roofing system is 20 years.

- Maintenance costs on any of the systems described above will be relatively similar over the life of the roof.

- It is our recommendation that a bid alternate be utilized to obtain actual values from bidding contractors on various roofing materials to permit the District the opportunity to base their decision on a fair monetary comparison rather than estimated amounts which will vary over time. It is very important that whichever roofing system is selected that a minimum 20 years Total System Manufacturers Warranty be provided for quality assurance.

4. INTERIOR WALLS

CURRENT DESIGN

- The elevator shaft, equipment room, and lobby are 8" and 12" masonry construction
- The majority of existing interior walls are to be painted as included in the finishes bid alternate
- Several new walls are to be constructed in the administrative area. These appear to be stud framed gypsum walls.

REASONING FOR CURRENT DESIGN

- Sound isolation
- Abuse resistant
- Meeting required fire ratings
- Provides structural stability

ALTERNATIVES TO CURRENT DESIGN

- Utilize more metal stud and impact resistant gypsum where subject to abuse and sound attenuating insulation in lieu of masonry walls

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- The main advantage to the alternative is a reduction in both costs and time of construction. Items placed within the plane of the walls, such as electrical outlets, lighting switches and windows, are much easier to install with a full width of metal stud framing opposed to masonry (i.e. the masonry has to be cut away).
- The painted finish will receive the same amount of abuse regardless of the structural wall construction.

CONCLUSIONS

- A metal stud option is not practical at elevator shafts due to fire-rating requirements and structural requirements.

5. EXTERIOR WALLS

CURRENT DESIGN

- Two story, 247 square foot addition to house an elevator and elevator equipment room both have brick veneer cavity walls with masonry backing.

REASONING FOR CURRENT DESIGN

- Complement the aesthetics of the existing building
- Cost effective
- Minimal maintenance/painting

ALTERNATIVES TO CURRENT DESIGN

- Incorporate a combination of masonry and stud frame construction with differing exterior finishes

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

Metal siding panels with masonry bacing
- Metal panels can provide a more modern appearance to the currently specified system and can be specified to contain recycled material. A 2" thick insulated metal panel can obtain an R-value of 16. This would create a more thermally efficient exterior wall configuration.
- Standard warranty is five (5) years.

Fiber-cement siding
- Fiber-cement siding is widely produced by several major manufacturers which could create a more competitive bidding environment and a lower cost.
- Fiber-cement siding manufacturers can provide up to a 50-year system warranty. However, fiber-cement siding will require painting every ten or so years whereas the specified masonry veneer will never require any maintenance beyond washing.

Exterior insulated finish system (EIFS)
- Warranties are offered up to 12 years on the entire system.
- Repainting and recoating will be necessary over the life of the building

CONCLUSIONS

- The current masonry veneer and CMU backing is expected to cost approximately $35,000 at the addition perimeter.
- Replacing the veneer with a 2" insulated metal panel would represent decrease of about $12,000.
- Replacing the veneer with fiber-cement siding would represent an up-front cost savings of about $15,000. The downside of the fiber-cement siding is the frequent painting. The added maintenance of repainting every five (5) to ten (10) years over an assumed life of 40 years totals an additional $30,000 to $40,000.
- Replacing the veneer with an exterior insulated finish system (similar to stucco) would represent a decrease of about $8,000. The added maintenance cost of repainting every five (5) to ten (10) years over an assumed life of 40 years totals an additional $30,000 to $40,000.

6. DOORS

CURRENT DESIGN

- Defiance Elementary: Replacing exterior entrance doors, frames, sidelights and transoms, and 5 other exterior doors. The doors and frames for entering into utilitarian areas are hollow metal, and the doors and frames for use by students and staff are aluminum. The doors which are necessitated by the building addition are included in the base bid, and the replacements in other areas are identified as alternates.

REASONING FOR CURRENT DESIGN

- Appearance
- Aluminum doors will not corrode when exposed weather and, therefore, require minimal maintenance
- Ease of construction; i.e. acceptable metal frames are to remain rather than be demolished and replaced

ALTERNATIVES TO CURRENT DESIGN

- Steel doors and frames

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- Aluminum doors require very little maintenance opposed to steel doors. They will not require painting and will not rust.
- Aluminum doors and frames are not as abuse resistant as steel doors and frames and may require more extensive repairs or replacement if damaged.

CONCLUSIONS

- The current total cost for new aluminum doors per the current design is approximately $10,000.
- Approximately $2,500 could be saved if similarly constructed steel doors and frames were used
- Steel doors and frames with a similar appearance will require painting every five to ten years.

7. EXTERIOR WINDOWS

CURRENT DESIGN

- Total exterior window replacement is identified as a bid alternate. The replacement windows are specified to be aluminum with a three (3) year warranty. The existing windows are of several different sizes throughout the building.

REASONING FOR CURRENT DESIGN

- Provide superior insulation
- Low maintenance
- Long-term energy savings
- Aluminum frame will require little to no maintenance
- Outside noise reduction

ALTERNATIVES TO CURRENT DESIGN

- Aluminum clad wood windows in lieu of the specified aluminum system

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- All aluminum windows will be more durable and possibly require less maintenance than wood framed windows. However, wood windows can provide a more attractive appearance and slightly better thermal characteristics.

CONCLUSIONS

- The cost of aluminum framed windows with the features of the specified windows (excluding integral blinds which are not available with aluminum windows and including interior blinds) is estimated to be approximately $125,000. The estimated cost for aluminum clad wood windows of equal size and shape is about $55,000. This represents a decrease of $70,000.

8. CEILINGS

CURRENT DESIGN

- A majority of existing ceiling tile is to be replaced with medium texture 2'x4' acoustic ceiling tile, with some smaller areas receiving fine texture 2'x2' acoustic tile, gypsum finish, or metal soffit. The total areas to be replaced are as follows:

  First Floor – 8,200 SF
  Second Floor – 15,280 SF
  Total – 23,480 SF

REASONING FOR CURRENT DESIGN

- Most economical solution to replacing the existing ceiling throughout the building

ALTERNATIVES TO CURRENT DESIGN

- Utilize different building materials or incorporate different acoustical ceiling tile options

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- Any variation from standard acoustical tiles will be driven by aesthetic preferences rather than function. Variations in tile and grid selection beyond the presumed specified material will represent increase in costs.

- Deleting this requirement will represent an approximate $45,000 reduction in construction cost.

CONCLUSIONS

- It is our opinion that the ceiling tile and grid specified is adequate for the application if a significant amount of new ductwork and lighting necessitates replacement.

ROBERSTDALE ELEMENTARY SCHOOL

1. SPACE ALLOCATION

CURRENT DESIGN

- No building addition or modification is planned

2. FLOORING

CURRENT DESIGN

- Replacement of existing carpet: 16,400 SF or 1,820 square yards (SY)

  Replacement of existing VCT: 1,050 SF (Art/Music room)

  Addition of approximately SF of entry mats: 370 SF

  This work is all to be done as a bid alternate

REASONING FOR CURRENT DESIGN

- The majority of the work is "replacement in kind", so we assume that the carpet utilized in the corridors and classrooms has worked well, but simly needs replaced due to wear.

ALTERNATIVES TO CURRENT DESIGN

- Replace carpet with VCT or linoleum in instructional/classroom spaces; area is approximately 6,400 square feet
- Replace carpet in corridors with terrazzo; corridor area is approximately 2,500 square feet

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- Linoleum is a natural "green" building product, which has approximately twice the life of VCT. The disadvantage is an increase in up-front costs
- The obvious disadvantage of the terrazzo alternative is up-front cost, as it will be more costly than the current design. However, over the life of the flooring, maintenance, repair and replacement will be much greater for the less expensive flooring.
- The greatest advantage of the alternate system is the appearance and durability which the alternate flooring incorporates. The appearance, of course, is greatly dependent on individual taste. The terrazzo floors would last the entire life of the building with minimal need of repair or replacement. Linoleum should last about twenty (2) years and carpet about ten (10) years.

CONCLUSIONS

- Substitution of linoleum flooring for carpet in instructional spaces would decrease initial costs by approximately $4,000.

  Substitution of VCT flooring for carpet in instructional spaces would decrease initial costs by approximately $20,000.

- The substitution of terrazzo for carpet in the corridors would result in an added cost of about $70,000.

3. ROOFING SYSTEM

CURRENT DESIGN

- Removal and replacement of approximately 20,000 SF of existing built up roofing and associated flashing

REASONING FOR CURRENT DESIGN

- Presumably, the existing roof is original to the building, and should be replaced.

ALTERNATIVES TO CURRENT DESIGN

- Conventional BUR is a common installation using redundant layers of protection which will have a high puncture resistance. However, the materials used are petroleum based, and therefore, it is difficult to estimate specific project and location costs accurately

- Other flat roofing systems utilizing the existing structural limitations such as Thermoplastic Polyolefin (TPO), which are single ply rubber roofs, EPDM, or Modified Bitumen roofing.

- The total replacement of the existing insulation and roofing material will assure all new materials with no hidden or structural or moisture leak problems. This system can also be specified with a total system warranty, if it is completed by a single source supplier.

- Placing a new roofing system over the old membrane can create moisture trapping issues, which can cause premature failure of the new roofing system. Detection of leaks in the new roofing could also go undetected into the old system causing more damage than would normally occur in that situation. This option would also require a more detailed inspection, which could delay and complicate the bidding process.

- TPO system: “Green” building product - recyclable and energy efficient. Similar installation to EPDM roofing, both of which require high quality control due to the many seams.

- Modified Bitumen roofing is similar to BUR, but is factory laminated. This system has greater flexibility and better low temperature service characteristics, but provides less puncture resistance than BUR systems.

- All products are fairly common for this type of construction; decision is normally based on up front cost and building life expectancy.

CONCLUSIONS

- BUR will initially cost approximately $275,000 more than an equivalent TPO membrane roof. Assuming a standard warranty period of 20 years, any savings that may be related initial costs compared to energy efficiency, will not be returned in Pennsylvania's climate, in a school that minimally operates during the summer.

- BUR will initially cost approximately $100,000 more than an EPDM system.

- The life expectancy of a built-up roofing system versus a modified bitumen roofing system or fully adhered membrane roof will be approximately the same.

- The specified warranty for the BUR system is 20 years. Warranties for EPDM from 20 up to 30 years are available, with 20 years being available as a standard warranty for a 60 mil membrane. A standard warranty on a TPO roofing system is 20 years.

- Maintenance costs on any of the systems described above will be relatively similar over the life of the roof.

- It is our recommendation that a bid alternate be utilized to obtain actual values from bidding contractors on various roofing materials to permit the District the opportunity to base their decision on a fair monetary comparison rather than estimated amounts which will vary over time. It is very important that whichever roofing system is selected that a minimum 20 years Total System Manufacturers Warranty be provided for quality assurance.

4. INTERIOR WALLS

CURRENT DESIGN

- No new interior wall construction is planned
- All other interior walls are to be painted as included in the finishes bid alternate

5. EXTERIOR WALLS

CURRENT DESIGN

- No exterior wall construction planned.

6. DOORS

CURRENT DESIGN

- We assume that a similar scope to the Defiance Elementary is planned, based on dashed lines indicated at exterior doors on the Demolition Plan.

REASONING FOR CURRENT DESIGN

- Appearance
- Aluminum doors will not corrode when exposed weather and, therefore, require minimal maintenance
- Ease of construction; i.e. acceptable metal frames are to remain rather than be demolished and replaced

ALTERNATIVES TO CURRENT DESIGN

- Steel doors and frames

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- Aluminum doors require very little maintenance opposed to steel doors. They will not require painting and will not rust.
- Aluminum doors and frames are not as abuse resistant as steel doors and frames and may require more extensive repairs or replacement if damaged.

CONCLUSIONS

- The current total cost for new aluminum doors per the current design is approximately $5,000.
- Approximately $1,500 could be saved if similarly constructed steel doors and frames were used
- Steel doors and frames with a similar appearance will require painting every five to ten years.

7. EXTERIOR WINDOWS

CURRENT DESIGN

- The replacement windows are specified to be aluminum with a three (3) year warranty. The existing windows are of several different sizes throughout the building.

REASONING FOR CURRENT DESIGN

- Provide superior insulation
- Low maintenance
- Long-term energy savings
- Aluminum frame will require little to no maintenance
- Outside noise reduction

ALTERNATIVES TO CURRENT DESIGN

- Aluminum clad wood windows in lieu of the specified aluminum system

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- All aluminum windows will be more durable and possibly require less maintenance than wood framed windows. However, wood windows can provide a more attractive appearance and slightly better thermal characteristics.

CONCLUSIONS

- The cost of aluminum framed windows with the features of the specified windows (excluding integral blinds which are not available with aluminum windows and including interior blinds) is estimated to be approximately $170,000. The estimated cost for aluminum clad wood windows of equal size and shape is about $75,000. This represents a decrease of $95,000.

8. CEILINGS

CURRENT DESIGN

- Approximately 20,000 SF of acoustical ceiling tile is to be replaced

REASONING FOR CURRENT DESIGN

- Most economical solution to replacing the existing ceiling throughout the building

ALTERNATIVES TO CURRENT DESIGN

- Utilize different building materials or incorporate different acoustical ceiling tile options

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- Any variation from standard acoustical tiles will be driven by aesthetic preferences rather than function. Variations in tile and grid selection beyond the presumed specified material will represent increase in costs.

- Deleting this requirement will represent an approximate $55,000 reduction in construction cost.

CONCLUSIONS

- It is our opinion that the ceiling tile and grid specified is adequate for the application if a significant amount of new ductwork and lighting necessitates replacement.

SAXTON-LIBERTY ELEMENTARY SCHOOL

1. SPACE ALLOCATION

CURRENT DESIGN

- One story, 1,384 square foot multi-purpose room and two story, 374 square foot elevator and corridor.

- Because of the relatively small scope of this work, analysis of alternative layouts is not justified.

2. FLOORING

CURRENT DESIGN

- Replacement of existing carpet: 15,070 square feet (SF) on the ground floor, 16,890 SF on the second floor. Total carpet replacement: 31,960 SF or 3,550 square yards (SY)

  Replacement of 1,680 SF of VCT on the First Floor

  Replacement of 5,000 SF of wood flooring on First Floor

  Addition of approximately 240 SF of entry mats

REASONING FOR CURRENT DESIGN

- The majority of the work is "replacement in kind", so we assume that the carpet utilized in corridors and classrooms has worked well, but simply needs replaced do to wear

ALTERNATIVES TO CURRENT DESIGN

- Replace carpet with linoleum or VCT in instructional/classroom spaces, approximately 20,500 SF
- Replace carpet in corridors with terrazzo; corridor area is approximately 6,500 SF

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- Linoleum is a natural "green" building product, which has approximately twice the life of VCT. The disadvantage is an increase in up-front costs
- The obvious disadvantage of the terrazzo alternate is up-front cost, as it will be more costly than the current design. However, over the life of the flooring, maintenance, repair and replacement will be much greater for the less expensive flooring.
- The greatest advantage of the alternate system is the appearance and durability which the alternate flooring incorporates. The appearance, of course, is greatly dependent on individual taste. The terrazzo floors would last the entire life of the building with minimal need of repair or replacement. Linoleum should last about twenty (20) years and carpet about ten (10) years.

CONCLUSIONS

- Substitution of linoleum flooring for carpet in instructional spaces would decrease initial costs by approximately $27,500.

  Substitution of VCT flooring for carpet in instructional spaces would decrease initial costs by approximately $80,000.

  Substation of terrazzo for carpet in the corridors would result in an added cost of about $200,000.

3. ROOFING SYSTEM

CURRENT DESIGN

- The 12,500 square foot roof above t school is to be demolished and replaced as a bid alternate, and the roof at the proposed 1,760 square foot Multi-Purpose room and elevator is included in the base bid.

  The replacement roofing material is specified as Cold-Process Built-Up Asphalt Roofing (BUR). Specified warranty is 20 years.

REASONING FOR CURRENT DESIGN

- Presumably, the existing roof is original to the building, and should be replaced.

ALTERNATIVES TO CURRENT DESIGN

- Conventional BUR is a common installation using redundant layers of protection which will have a high puncture resistance. However, the materials used are petroleum based, and therefore, it is difficult to estimate specific project and location costs accurately

- Other flat roofing systems utilizing the existing structural limitations such as Thermoplastic Polyolefin (TPO), which are single ply rubber roofs, EPDM, or Modified Bitumen roofing.

- The total replacement of the existing insulation and roofing material will assure all new materials with no hidden or structural or moisture leak problems. This system can also be specified with a total system warranty, if it is completed by a single source supplier.

- Placing a new roofing system over the old membrane can create moisture trapping issues, which can cause premature failure of the new roofing system. Detection of leaks in the new roofing could also go undetected into the old system causing more damage than would normally occur in that situation. This option would also require a more detailed inspection, which could delay and complicate the bidding process.

- TPO system: “Green” building product - recyclable and energy efficient. Similar installation to EPDM roofing, both of which require high quality control due to the many seams.

- Modified Bitumen roofing is similar to BUR, but is factory laminated. This system has greater flexibility and better low temperature service characteristics, but provides less puncture resistance than BUR systems.

- All products are fairly common for this type of construction; decision is normally based on up front cost and building life expectancy.

CONCLUSIONS

- BUR will initially cost approximately $200,000 more than an equivalent TPO membrane roof. Assuming a standard warranty period of 20 years, any savings that may be related initial costs compared to energy efficiency, will not be returned in Pennsylvania's climate, in a school that minimally operates during the summer.

- BUR will initially cost approximately $70,000 more than an EPDM system.

- The life expectancy of a built-up roofing system versus a modified bitumen roofing system or fully adhered membrane roof will be approximately the same.

- The specified warranty for the BUR system is 20 years. Warranties for EPDM from 20 up to 30 years are available, with 20 years being available as a standard warranty for a 60 mil membrane. A standard warranty on a TPO roofing system is 20 years.

- Maintenance costs on any of the systems described above will be relatively similar over the life of the roof.

- It is our recommendation that a bid alternate be utilized to obtain actual values from bidding contractors on various roofing materials to permit the District the opportunity to base their decision on a fair monetary comparison rather than estimated amounts which will vary over time. It is very important that whichever roofing system is selected that a minimum 20 years Total System Manufacturers Warranty be provided for quality assurance.

4. INTERIOR WALLS

CURRENT DESIGN

- The elevator shaft and lobby are 8” and 12” masonry construction
- No other work is indicated on the drawings

REASONING FOR CURRENT DESIGN

- Sound isolation
- Abuse resistant
- Meeting required fire ratings
- Provides structural stability

ALTERNATIVES TO CURRENT DESIGN

- Utilize more metal stud and impact resistant gypsum where subject to abuse and sound attenuating insulation in lieu of masonry walls

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- The main advantage to the alternative is a reduction in both costs and time of construction. Items placed within the plane of the walls, such as electrical outlets, lighting switches and windows, are much easier to install with a full width of metal stud framing opposed to masonry (i.e. the masonry has to be cut away).
- The painted finish will receive the same amount of abuse regardless of the structural wall construction.

CONCLUSIONS

- A metal stud option is not practical at elevator shafts due to fire-rating requirements and structural requirements.

5. EXTERIOR WALLS

CURRENT DESIGN

- One story, 1,384 square foot multi-purpose room and two story, 374 square foot elevator and corridor both have brick veneer cavity walls with masonry backing.

REASONING FOR CURRENT DESIGN

- Complement the aesthetics of the existing building
- Cost effective
- Minimal maintenance/painting

ALTERNATIVES TO CURRENT DESIGN

- Incorporate a combination of masonry and stud frame construction with differing exterior finishes

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

Metal siding panels with masonry bacing
- Metal panels can provide a more modern appearance to the currently specified system and can be specified to contain recycled material. A 2" thick insulated metal panel can obtain an R-value of 16. This would create a more thermally efficient exterior wall configuration.
- Standard warranty is five (5) years.

Fiber-cement siding
- Fiber-cement siding is widely produced by several major manufacturers which could create a more competitive bidding environment and a lower cost.
- Fiber-cement siding manufacturers can provide up to a 50-year system warranty. However, fiber-cement siding will require painting every ten or so years whereas the specified masonry veneer will never require any maintenance beyond washing.

Exterior insulated finish system (EIFS)
- Warranties are offered up to 12 years on the entire system.
- Repainting and recoating will be necessary over the life of the building

CONCLUSIONS

- The current masonry veneer and CMU backing is expected to cost approximately $45,000 at the addition perimeter.
- Replacing the veneer with a 2" insulated metal panel would represent decrease of about $14,000.
- Replacing the veneer with fiber-cement siding would represent an up-front cost savings of about $18,000. The downside of the fiber-cement siding is the frequent painting. The added maintenance of repainting every five (5) to ten (10) years over an assumed life of 40 years totals an additional $30,000 to $40,000.
- Replacing the veneer with an exterior insulated finish system (similar to stucco) would represent a decrease of about $9,000. The added maintenance of repainting every five (5) to ten (10) years over an assumed life of 40 years totals an additional $30,000 to $40,000.

6. DOORS

CURRENT DESIGN

- Replacing exterior entrance doors, frames, sidelights and transoms, and other exterior doors is assumed. Twelve (12) doors total.

REASONING FOR CURRENT DESIGN

- Appearance
- Aluminum doors will not corrode when exposed weather and, therefore, require minimal maintenance
- Ease of construction; i.e. acceptable metal frames are to remain rather than be demolished and replaced

ALTERNATIVES TO CURRENT DESIGN

- Steel doors and frames

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- Aluminum doors require very little maintenance opposed to steel doors. They will not require painting and will not rust.
- Aluminum doors and frames are not as abuse resistant as steel doors and frames and may require more extensive repairs or replacement if damaged.

CONCLUSIONS

- The current total cost for new aluminum doors per the current design is approximately $10,000.
- Approximately $2,500 could be saved if similarly constructed steel doors and frames were used
- Steel doors and frames with a similar appearance will require painting every five to ten years.

7. EXTERIOR WINDOWS

CURRENT DESIGN

- The replacement windows are specified to be aluminum with a three (3) year warranty. The existing windows are of several different sizes throughout the building.

REASONING FOR CURRENT DESIGN

- Provide superior insulation
- Low maintenance
- Long-term energy savings
- Aluminum frame will require little to no maintenance
- Outside noise reduction

ALTERNATIVES TO CURRENT DESIGN

- Aluminum clad wood windows in lieu of the specified aluminum system

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- All aluminum windows will be more durable and possibly require less maintenance than wood framed windows. However, wood windows can provide a more attractive appearance and slightly better thermal characteristics.

CONCLUSIONS

- The cost of aluminum framed windows with the features of the specified windows (excluding integral blinds which are not available with aluminum windows and including interior blinds) is estimated to be approximately $160,000. The estimated cost for aluminum clad wood windows of equal size and shape is about $70,000. This represents a decrease of $90,000.

8. CEILINGS

CURRENT DESIGN

- A majority of existing ceiling tile is to be replaced with medium texture 2'x4' acoustic ceiling tile, with some smaller areas receiving a gypsum finish. The total areas to be replaced are as follows:

  Ground Floor – 15,000 SF
  First Floor – 18,800 SF
  Total – 33,800 SF

REASONING FOR CURRENT DESIGN

- Most economical solution to replacing the existing ceiling throughout the building

ALTERNATIVES TO CURRENT DESIGN

- Utilize different building materials or incorporate different acoustical ceiling tile options

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- Any variation from standard acoustical tiles will be driven by aesthetic preferences rather than function. Variations in tile and grid selection beyond the presumed specified material will represent increase in costs.

- Deleting this requirement will represent an approximate $90,000 reduction in construction cost.

CONCLUSIONS

- It is our opinion that the ceiling tile and grid specified is adequate for the application if a significant amount of new ductwork and lighting necessitates replacement.

1. FOUNDATIONS AND FLOOR SLABS – ALL BUILDINGS

CURRENT DESIGN

- Strip footings around the perimeter of the new construction supporting the exterior masonry walls. Slab on grade utilized in all new single story construction.

REASONING FOR CURRENT DESIGN

- Standard construction practices based on information provided.

ALTERNATIVES TO CURRENT DESIGN

- No alternatives

CONCLUSIONS

- The foundation drawings should be revised to reflect any revisions to the structural framing system, if necessary.

RESPONSE

- None required.

2. ROOF FRAMING – ALL BUILDINGS

CURRENT DESIGN

- Open web joists, all bearing on masonry walls.

REASONING FOR CURRENT DESIGN

- Minimize overall structural depth
- Open web joists and joist girders create a loftier feel in open areas (vs. solid steel beams)

ALTERNATIVES TO CURRENT DESIGN

- None which are practical in this application.

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- None

CONCLUSIONS

- The structural system as preliminarily designed is a common method utilized in this size and type of construction.

ITEMIZED BY SCHOOL

DEFIANCE ELEMENTARY SCHOOL

1. GEOTHERMAL SYSTEM

CURRENT DESIGN

- Geothermal Water Source Heat Pump System

REASONING FOR CURRENT DESIGN

- Replacement of outdated less efficient equipment. Antiquated equipment may not meet new energy code requirements. Reduce energy heating and cooling cost by using energy saving and high efficiency equipment.

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- There water source heat system has several advantages over existing systems.

WATER SOURCE HEAT PUMP (GEOTHERMAL SYSTEM)

- System Advantages:

  Very energy efficient, low mechanical operation and the excess heat in the building moves to where the heat is needed.

  The required amount of ventilation air can be entrained directly into the zone, limits outside air requirements.
  Gives individual control over zones. Designed for specific zone requirements.

  Decentralized equipment, allows for servicing of individual units, affects only the zone being served by the unit, not the whole building.

  Easy to incorporate energy recovery for additional savings.

- System Disadvantages:

  Units are in occupied space. Takes up usable space and servicing of units has to be schedule as to not interrupt occupants.

  Compressor and fan noise can become an interruption to occupants.

  Requires a dedicated ventilation system.

  No diversity can be taken. Water source heat pump must be design for connected load of the zone being served.

  Higher initial cost to install system.

EXISTING SYSTEMS

- System Advantages:

  Low capital cost.

  The required amount of ventilation air can be entrained directly into the zone, limits outside air requirements.

  Gives individual control over zones. Designed for specific zone requirements.

  Decentralized equipment, allows for servicing of individual units, affects only the zone being served by the unit, not the whole building.

  Allows for 100% outdoor air (Air Economizer) used to avoid mechanical cooling during cooler weather.

  Diversity can be applied to system instead of being sized on the block load of the building.

  CO2 Control Ventilation can limit outside air to save additional energy.

  Less expensive to upgrade system as to replace with new system.

- System Disadvantages:

  Units are in occupied space. Takes up usable space and servicing of units has to be schedule as to not interrupt occupants.

  Requires floor space.

  Requires access to exterior wall for ventilation air.

  Energy recovery is not a viable option.

  Humidity control problems.

  Not as energy efficient the proposed system.

CONCLUSION

- In review of the comparison of the existing system and the geothermal system, it was noted that the lowest energy usage and internal heat gain could be recovered by using heat recovery units. The geothermal water source heat pump systems are considerably more efficient than the existing system and will pay for the increase in the initial cost of installation through future energy savings.

The other disadvantages of the geothermal water source heat pump systems can be reduced or eliminated by locating unit outside of the classroom when possible and by using soundproofing materials, such as Quietrock, Acousticblok, and Batt insulation.

The geothermal water source heat pump systems are recommended for school applications and have a lower life cycle cost than conventional school HVAC systems.

We recommend the design of the geothermal water source heat pump system as the more cost effective and energy efficient system to be purchased and installed. Overall this design follows good engineering practices and utilizes reputable manufacturers and equipment. It will provide the school with energy efficient way to battle rising energy cost in the future and will pay for the additional initial cost of the system in a relatively short period of time.

2. WELL FIELD LOOP

CURRENT DESIGN

- The geothermal system will consist of thirty (30) wells spaced at 20', 400' in depth. The existing mechanical was reused to house new equipment needed.

ALTERNATIVES TO CURRENT DESIGN

- None

CONCLUSIONS

- The HVAC loads for the building indicate that it will serve the building load. Therefore, the current design is optimal and no improvements or cost saving were found.

3. ADMINISTRATION AREA

CURRENT DESIGN

- Multiple ducted type Horizontal WSHP's serving rooms A102, A103, A104, A108, and A109.

REASONING FOR CURRENT DESIGN

- Allows for zone control and the utilization of the geothermal system.

ALTERNATIVES TO CURRENT DESIGN

- One larger ducted WSHP to serve the all rooms.

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- Current Design Advantages:

  The advantage of the current design is multiple zone control for different occupied and unoccupied spaces.

  Redundancy with multiple units. If a unit goes down it only effects the zones it serves.

- Current Design Disadvantages:

  The disadvantage of the current design is multiple units.

  More units to maintain.

- Alternate Design Advantages:

  The advantage of the alternate design is one larger unit to supply all administration area.

  Less units to maintain.

- Current Design Disadvantages:

  The disadvantage of the alternate design is no zone control, one thermostat to control all areas.

  No redundancy, if unit is down, all administration is effected.

CONCLUSIONS

- Administration area could be served by one large unit instead of three smaller units, which would have a small cost savings. It would decrease control and occupant comfort.

4. MULTIPURPOSE ROOM

CURRENT DESIGN

- Ducted type horizontal WSHP's serving the Multipurpose Room.

REASONING FOR CURRENT DESIGN

- Ducted type horizontal WSHP's allow for individual zone control and large outside air requirement. They can be cycled on and off to closely match the space heating and cooling load.

ALTERNATIVES TO CURRENT DESIGN

- None

CONCLUSIONS

- Due to the amount of outside air required, and specific zone requirements for heating and cooling this is the best design for this zone. There are no alternate design that are practical to this zone.

5. VESTIBULES

CURRENT DESIGN

- Ducted type horizontal WSHP's serving the vestibule.

REASONING FOR CURRENT DESIGN

- Ducted type horizontal WSHP's allows for individual zone control and the utilization of the geothermal system.

ALTERNATIVES TO CURRENT DESIGN

- Extend ductwork from ERV-1 to serve the vestibule.

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- Current Design Advantages:

  The advantage of the current design fast recovery to design temperature.

- Current Design Disadvantages:

  Unit cost.

- Alternate Design Advantages:

  Minimal cost for ductwork.

  Less units to maintain.

- Current Design Disadvantages:

  Less control of design temperature.

  Longer recovery time needed to bring temperature to design temperatures.

CONCLUSIONS

- This revision would represent a cost decrease of about $3,000, and will require less maintenance.

6. KITCHEN

CURRENT DESIGN

- Ducted type horizontal WSHP serving the Kitchen Area. Incomplete design, Code required exhaust and make-up air not shown.

REASONING FOR CURRENT DESIGN

- Incomplete.

ALTERNATIVES TO CURRENT DESIGN

- One Ducted Heating and Ventilating Kitchen Make-Up System to serve the Kitchen Area to provide the necessary requirements for the Kitchen Hood Systems.

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- The advantage of this system allows the use of the geothermal system. The disadvantage of this system is cost. A custom heat pump make up air unit will have to be utilized to handle the high outside air load. The heat pump make up air unit would be interlocked with the kitchen exhaust hoods to maintain proper building pressurization.

CONCLUSIONS

- There should be One Heating and Ventilating System serving the Kitchen Area in lieu of the ducted type horizontal WSHP. Because of the current status of the design drawings, a cost estimate cannot be completed at this time.

7. COMPUTER LAB

CURRENT DESIGN

- Vertical cabinet with ERV serving the computer lab.

REASONING FOR CURRENT DESIGN

- Vertical cabinet with ERV allows for the utilization of the geothermal system while also utilizing energy recovery.

ALTERNATIVES TO CURRENT DESIGN

- Ductless Split System A/C type units serve the computer lab.

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- The disadvantage of this system is having water in proximity of computer/data equipment. The geothermal well field pumps will have to operate 24 hours per day, 7 days a week to accommodate these spaces. Advantage of alternate systems for these spaces would be to keep the constant load on a separate air conditioning system.

CONCLUSIONS

- There could be one ductless split A/C system serving the computer lab in lieu of One vertical cabinet with ERV serving each of these rooms. This revision would represent a cost increase of about $9,000.

8. CORRIDORS

CURRENT DESIGN

- Ducted type horizontal WSHP's and Cabinet Unit Heaters serving the corridor.

REASONING FOR CURRENT DESIGN

- Ducted type horizontal WSHP's design allows for the utilization of the geothermal system. The Cabinet Unit heaters are located where WSHP's are not a viable option.

ALTERNATIVES TO CURRENT DESIGN

- None

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- None

CONCLUSIONS

- Due to the location, and specific zone requirements for heating and cooling this is the best design for these areas. There are no alternate design that are practical to this zone.

9. CLASSROOMS

CURRENT DESIGN

- Serving the Classrooms.

REASONING FOR CURRENT DESIGN

- Vertical Cabinet WSHP's with ERV's allows for individual zone control and large outside air requirement. They can be cycled on and off to closely match the space heating and cooling load.

ALTERNATIVES TO CURRENT DESIGN

- None

CONCLUSIONS

- Due to the amount of outside air required, and specific zone requirements for heating and cooling this is the best design for this zone. There are no alternate design that are practical to this zone.

10. COST COMPARISON SUMMARY- HVAC

(Estimated costs are not guaranteed. Actual cost could vary significantly due to equipment,Contractor installation cost, Etc.)

Estimated costs of the proposed systems are as follows:

Administration Area:	
Ducted horizontal WSHP's (estimated)	$45,000.00
(1) Ducted horizontal WSHP's (estimated)	$35,000.00
Potential estimated cost savings:	$10,000.00
Vestibule:	
(1) Ducted horizontal WSHP's (estimated)	$10,000.00
Served with ERV-1 (estimated)	$5,000.00
Potential estimated cost savings:	$5,000.00
Kitchen:	
(1) Ducted WSHP	$_____
(1) Kitchen Make-up Air System estimated)	$_____

(Need additional information on exhaust requirements in order to complete an accurate cost estimate.)

Computer Lab:	
(1) Console WSHP's (estimated)	$9,000.00
(1) Ductless Split systems (estimated)	$18,000.00
Potential estimated cost addition:	$9,000.00 (add)
Total Potential estimated cost savings:	$15,000.00
Total Potential estimated additions:	$9,000.00 (add)

ROBERSTDALE ELEMENTARY SCHOOL

1. GEOTHERMAL SYSTEM

CURRENT DESIGN

- Geothermal Water Source Heat Pump System

REASONING FOR CURRENT DESIGN

- Replacement of outdated less efficient equipment. Antiquated equipment may not meet new energy code requirements. Reduce energy heating and cooling cost by using energy saving and high efficiency equipment.

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- There water source heat system has several advantages over existing systems.

WATER SOURCE HEAT PUMP (GEOTHERMAL SYSTEM)

- System Advantages:

  Very energy efficient, low mechanical operation and the excess heat in the building moves to where the heat is needed.

  The required amount of ventilation air can be entrained directly into the zone, limits outside air requirements.
  Gives individual control over zones. Designed for specific zone requirements.

  Decentralized equipment, allows for servicing of individual units, affects only the zone being served by the unit, not the whole building.

  Easy to incorporate energy recovery for additional savings.

- System Disadvantages:

  Units are in occupied space. Takes up usable space and servicing of units has to be schedule as to not interrupt occupants.

  Compressor and fan noise can become an interruption to occupants.

  Requires a dedicated ventilation system.
  No diversity can be taken. Water source heat pump must be design for connected load of the zone being served.

  Higher initial cost to install system.

EXISTING SYSTEMS

- System Advantages:

  Low capital cost.

  The required amount of ventilation air can be entrained directly into the zone, limits outside air requirements.

  Gives individual control over zones. Designed for specific zone requirements.

  Decentralized equipment, allows for servicing of individual units, affects only the zone being served by the unit, not the whole building.

  Allows for 100% outdoor air (Air Economizer) used to avoid mechanical cooling during cooler weather.

  Diversity can be applied to system instead of being sized on the block load of the building.

  CO2 Control Ventilation can limit outside air to save additional energy.

  Less expensive to upgrade system as to replace with new system.

- System Disadvantages:

  Units are in occupied space. Takes up usable space and servicing of units has to be schedule as to not interrupt occupants.

  Requires floor space.

  Requires access to exterior wall for ventilation air.

  Energy recovery is not a viable option.

  Humidity control problems.

  Not as energy efficient the proposed system.

CONCLUSION

- In review of the comparison of the existing system and the geothermal system, it was noted that the lowest energy usage and internal heat gain could be recovered by using heat recovery units. The geothermal water source heat pump systems are considerably more efficient than the existing system and will pay for the increase in the initial cost of installation through future energy savings.

The other disadvantages of the geothermal water source heat pump systems can be reduced or eliminated by locating unit outside of the classroom when possible and by using soundproofing materials, such as Quietrock, Acousticblok, and Batt insulation.

The geothermal water source heat pump systems are recommended for school applications and have a lower life cycle cost than conventional school HVAC systems.

We recommend the design of the geothermal water source heat pump system as the more cost effective and energy efficient system to be purchased and installed. Overall this design follows good engineering practices and utilizes reputable manufacturers and equipment. It will provide the school with energy efficient way to battle rising energy cost in the future and will pay for the additional initial cost of the system in a relatively short period of time.

2. WELL FIELD LOOP

CURRENT DESIGN

- The geothermal system will consist of thirty (30) wells, spaced at 20', 400' in depth. The existing mechanical was reused to house new equipment needed.

ALTERNATIVES TO CURRENT DESIGN

- None

CONCLUSIONS

- The HVAC loads for the building indicate that it will serve the building load. Therefore, the current design is optimal and no improvements or cost saving were found.

3. ADMINISTRATION AREA

CURRENT DESIGN

- Multiple Console WSHP's serving rooms A154, A155, and A156.

REASONING FOR CURRENT DESIGN

- Allows for zone control and the utilization of the geothermal system.

ALTERNATIVES TO CURRENT DESIGN

- One larger ducted WSHP to serve the all rooms.

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- Current Design Advantages:

  The advantage of the current design is multiple zone control for different occupied and unoccupied spaces.

  Redundancy with multiple units. If a unit goes down it only effects the zones it serves.

- Current Design Disadvantages:

  The disadvantage of the current design is multiple units.

  More units to maintain.

- Alternate Design Advantages:

  The advantage of the alternate design is one larger unit to supply all administration area.

  Less units to maintain.

- Current Design Disadvantages:

  The disadvantage of the alternate design is no zone control, one thermostat to control all areas.

  No redundancy, if unit is down, all administration is effected.

CONCLUSIONS

- Administration area could be served by one large unit instead of three smaller units, which would have a small cost savings. It would decrease control and occupant comfort.

4. MULTIPURPOSE ROOM

CURRENT DESIGN

- Ducted type horizontal WSHP's serving the Multipurpose room.

REASONING FOR CURRENT DESIGN

- Ducted type horizontal WSHP's allow for individual zone control and large outside air requirement. They can be cycled on and off to closely match the space heating and cooling load.

ALTERNATIVES TO CURRENT DESIGN

- None

CONCLUSIONS

- Due to the amount of outside air required, and specific zone requirements for heating and cooling this is the best design for this zone. There are no alternate design that are practical to this zone.

5. VESTIBULES

CURRENT DESIGN

- Console WSHP's serving the vestibule.

REASONING FOR CURRENT DESIGN

- Console WSHP's allows for individual zone control and the utilization of the geothermal system.

ALTERNATIVES TO CURRENT DESIGN

- None

6. KITCHEN

CURRENT DESIGN

- Ducted type horizontal WSHP serving the Kitchen Area. Incomplete design, Code required exhaust and make-up air not shown.

REASONING FOR CURRENT DESIGN

- Incomplete.

ALTERNATIVES TO CURRENT DESIGN

- One Ducted Heating and Ventilating Kitchen Make-Up System to serve the Kitchen Area to provide the necessary requirements for the Kitchen Hood Systems.

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- The advantage of this system allows the use of the geothermal system. The disadvantage of this system is cost. A custom heat pump make up air unit will have to be utilized to handle the high outside air load. The heat pump make up air unit would be interlocked with the kitchen exhaust hoods to maintain proper building pressurization.

CONCLUSIONS

- There should be One Heating and Ventilating System serving the Kitchen Area in lieu of the ducted type horizontal WSHP. Because of the current status of the design drawings, a cost estimate cannot be completed at this time.

7. CORRIDORS

CURRENT DESIGN

- Cabinet Unit Heaters serving the corridor.

REASONING FOR CURRENT DESIGN

- The Cabinet Unit heaters are located where WSHP's are not a viable option.

ALTERNATIVES TO CURRENT DESIGN

- None

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- None

CONCLUSIONS

- Due to the location, and specific zone requirements for heating and cooling this is the best design for these areas. There are no alternate design that are practical to this zone.

8. CLASSROOMS

CURRENT DESIGN

- Serving the Classroom's.

REASONING FOR CURRENT DESIGN

- Vertical Cabinet WSHP's with ERV's allows for individual zone control and large outside air requirement. They can be cycled on and off to closely match the space heating and cooling load.

ALTERNATIVES TO CURRENT DESIGN

- None

CONCLUSIONS

- Due to the amount of outside air required, and specific zone requirements for heating and cooling this is the best design for this zone. There are no alternate design that are practical to this zone.

9. COST COMPARISON SUMMARY- HVAC

(Estimated costs are not guaranteed. Actual cost could vary significantly due to equipment,Contractor installation cost, Etc.)

Estimated costs of the proposed systems are as follows:

Administration Area:	
Console WSHP's (estimated)	$25,000.00
(1) Ducted horizontal WSHP's (estimated)	$15,000.00
Potential estimated cost savings:	$5,000.00
Kitchen:	
(1) Ducted WSHP	$_____
(1) Kitchen Make-up Air System estimated)	$_____

(Need additional information on exhaust requirements in order to complete an accurate cost estimate.)

Total Potential estimated cost savings: $5,000.00

SAXTON-LIBERTY ELEMENTARY SCHOOL

1. GEOTHERMAL SYSTEM

CURRENT DESIGN

- Geothermal Water Source Heat Pump System

REASONING FOR CURRENT DESIGN

- Replacement of outdated less efficient equipment. Antiquated equipment may not meet new energy code requirements. Reduce energy heating and cooling cost by using energy saving and high efficiency equipment.

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- There water source heat system has several advantages over existing systems.

WATER SOURCE HEAT PUMP (GEOTHERMAL SYSTEM)

- System Advantages:

  Very energy efficient, low mechanical operation and the excess heat in the building moves to where the heat is needed.

  The required amount of ventilation air can be entrained directly into the zone, limits outside air requirements.

  Gives individual control over zones. Designed for specific zone requirements.

  Decentralized equipment, allows for servicing of individual units, affects only the zone being served by the unit, not the whole building.

  Easy to incorporate energy recovery for additional savings.

- System Disadvantages:

  Units are in occupied space. Takes up usable space and servicing of units has to be schedule as to not interrupt occupants.

  Compressor and fan noise can become an interruption to occupants.

  Requires a dedicated ventilation system.

  No diversity can be taken. Water source heat pump must be design for connected load of the zone being served.

  Higher initial cost to install system.

EXISTING SYSTEMS

- System Advantages:

  Low capital cost.

  The required amount of ventilation air can be entrained directly into the zone, limits outside air requirements.

  Gives individual control over zones. Designed for specific zone requirements.

  Decentralized equipment, allows for servicing of individual units, affects only the zone being served by the unit, not the whole building.

  Allows for 100% outdoor air (Air Economizer) used to avoid mechanical cooling during cooler weather.

  Diversity can be applied to system instead of being sized on the block load of the building.

  CO2 Control Ventilation can limit outside air to save additional energy.

  Less expensive to upgrade system as to replace with new system.

- System Disadvantages:

  Units are in occupied space. Takes up usable space and servicing of units has to be schedule as to not interrupt occupants.

  Requires floor space.

  Requires access to exterior wall for ventilation air.

  Energy recovery is not a viable option.

  Humidity control problems.

  Not as energy efficient the proposed system.

CONCLUSION

- In review of the comparison of the existing system and the geothermal system, it was noted that the lowest energy usage and internal heat gain could be recovered by using heat recovery units. The geothermal water source heat pump systems are considerably more efficient than the existing system and will pay for the increase in the initial cost of installation through future energy savings.

The other disadvantages of the geothermal water source heat pump systems can be reduced or eliminated by locating unit outside of the classroom when possible and by using soundproofing materials, such as Quietrock, Acousticblok, and Batt insulation.

The geothermal water source heat pump systems are recommended for school applications and have a lower life cycle cost than conventional school HVAC systems.

We recommend the design of the geothermal water source heat pump system as the more cost effective and energy efficient system to be purchased and installed. Overall this design follows good engineering practices and utilizes reputable manufacturers and equipment. It will provide the school with energy efficient way to battle rising energy cost in the future and will pay for the additional initial cost of the system in a relatively short period of time.

2. WELL FIELD LOOP

CURRENT DESIGN

- The geothermal system will consist of forty-five (45) wells spaced at 20', 400' in depth. The existing mechanical was reused to house new equipment needed.

ALTERNATIVES TO CURRENT DESIGN

- None

CONCLUSIONS

- The HVAC loads for the building indicate that it will serve the building load. Therefore, the current design is optimal and no improvements or cost saving were found.

3. ADMINISTRATION AREA

CURRENT DESIGN

- Multiple ducted type Horizontal WSHP's and WSHP Console units serving rooms A223, A225, A226, A227, A230, A232, A234, A235, A236, AND A237.

REASONING FOR CURRENT DESIGN

- Allows for zone control and the utilization of the geothermal system.

ALTERNATIVES TO CURRENT DESIGN

- One larger ducted WSHP to serve the exterior load one larger ducted unit to serve interior load.

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- Current Design Advantages:

  The advantage of the current design is multiple zone control for different occupied and unoccupied spaces.

  Redundancy with multiple units. If a unit goes down it only effects the zones it serves.

- Current Design Disadvantages:

  The disadvantage of the current design is multiple units.

  More units to maintain.

- Alternate Design Advantages:

  The advantage of the alternate design is two larger units to supply all administration area.

  Less units to maintain.

- Alternate Design Disadvantages:

  The disadvantage of the alternate design is no zone control, one thermostat to control exterior zone and one thermostat to control interior zone.

  No redundancy, if unit is down, all administration is effected.

CONCLUSIONS

- Administration area could be served by two larger units instead of five smaller units, which would have a small cost savings. It would decrease control and occupant comfort.

4. MULTIPURPOSE ROOM

CURRENT DESIGN

- Ducted type horizontal WSHP's serving the Multipurpose Room.

REASONING FOR CURRENT DESIGN

- Ducted type horizontal WSHP's allow for individual zone control and large outside air requirement. They can be cycled on and off to closely match the space heating and cooling load.

ALTERNATIVES TO CURRENT DESIGN

- None

CONCLUSIONS

- Due to the amount of outside air required, and specific zone requirements for heating and cooling this is the best design for this zone. There are no alternate design that are practical to this zone.

5. VESTIBULES

CURRENT DESIGN

- Cabinet Unit Heater serving the vestibule.

REASONING FOR CURRENT DESIGN

- Allows for individual zone control and quick space temperature response to outdoor air conditions.

ALTERNATIVES TO CURRENT DESIGN

- None

6. KITCHEN

CURRENT DESIGN

- Ducted type horizontal WSHP serving the Kitchen Area. Incomplete design, Code required exhaust and make-up air not shown.

REASONING FOR CURRENT DESIGN

- Incomplete.

ALTERNATIVES TO CURRENT DESIGN

- One Ducted Heating and Ventilating Kitchen Make-Up System to serve the Kitchen Area to provide the necessary requirements for the Kitchen Hood Systems.

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- The advantage of this system allows the use of the geothermal system. The disadvantage of this system is cost. A custom heat pump make up air unit will have to be utilized to handle the high outside air load. The heat pump make up air unit would be interlocked with the kitchen exhaust hoods to maintain proper building pressurization.

CONCLUSIONS

- There should be One Heating and Ventilating System serving the Kitchen Area in lieu of the ducted type horizontal WSHP. Because of the current status of the design drawings, a cost estimate cannot be completed at this time.

7. COMPUTER LAB

CURRENT DESIGN

- Two Ducted type horizontal WSHP's serving the computer lab.

REASONING FOR CURRENT DESIGN

- Ducted type horizontal WSHP's allows for the utilization of the geothermal system.

ALTERNATIVES TO CURRENT DESIGN

- Ductless Split System A/C type units serve the computer lab.

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- The disadvantage of this system is having water in proximity of computer/data equipment. The geothermal well field pumps will have to operate 24 hours per day, 7 days a week to accommodate these spaces. Advantage of alternate systems for these spaces would be to keep the constant load on a separate air conditioning system.

- Recommend finding alternate routing for water piping serving WSHP's in Classroom's A261, and A262.

CONCLUSIONS

- There could be one ductless split A/C system serving the computer lab in lieu of One vertical cabinet with ERV serving each of these rooms. This revision would represent a cost increase of about $15,000.

8. CORRIDORS

CURRENT DESIGN

- ERV and Cabinet Unit Heaters serving the corridor.

REASONING FOR CURRENT DESIGN

- The Cabinet Unit heaters are located where WSHP's are not a viable option.

ALTERNATIVES TO CURRENT DESIGN

- None

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- None

CONCLUSIONS

- Due to the location, and specific zone requirements for heating and cooling this is the best design for these areas. There are no alternate design that are practical to this zone.

9. CLASSROOMS

CURRENT DESIGN

- Serving the Classrooms.

REASONING FOR CURRENT DESIGN

- Vertical Cabinet WSHP's with ERV's allows for individual zone control and large outside air requirement. They can be cycled on and off to closely match the space heating and cooling load.

ALTERNATIVES TO CURRENT DESIGN

- None

CONCLUSIONS

- Due to the amount of outside air required, and specific zone requirements for heating and cooling this is the best design for this zone. There are no alternate design that are practical to this zone.

10. COST COMPARISON SUMMARY- HVAC

(Estimated costs are not guaranteed. Actual cost could vary significantly due to equipment,Contractor installation cost, Etc.)

Estimated costs of the proposed systems are as follows:

Administration Area:	
Five Ducted horizontal and Console WSHP's (estimated)	$55,000.00
One Ducted horizontal WSHP's (estimated)	$40,000.00
Potential estimated cost savings:	$15,000.00
Kitchen:	
One Ducted WSHP	$_____
One Kitchen Make-up Air System estimated)	$_____
(Need additional information on exhaust requirements in order to complete an accurate cost estimate.)	
Computer Lab:	
Two Ducted horizontal WSHP's (estimated)	$20,000.00
One Ductless Split systems (estimated)	$35,000.00
Potential estimated cost addition:	$15,000.00 (add)
Total Potential estimated cost savings:	$15,000.00
Total Potential estimated additions:	$15,000.00 (add)

DEFIANCE ELEMENTARY SCHOOL

1. PLUMBING EQUIPMENT

CURRENT DESIGN

- Low water consumption tank type water closets, Low water consumption manual flush valves, and manual lavatory faucets.

REASONING FOR CURRENT DESIGN

- Cost, familiarity

ALTERNATIVES TO CURRENT DESIGN - In Specifications (Alternate Bid)

- Automatic, photocell flushometers and lavatory faucets
- Waterless no-flush urinals

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- The current design presents a standard application of familiar products which are less expensive than the alternative
- Hands-off alternative presents a more sanitary restroom environment
- Waterless urinals are environmentally friendly; savings experienced due to less water usage over time

CONCLUSIONS

Lavatory Flush Valves:
Current Manual Style Valves
(10) Manual faucets for Lavs @ $197.00 = $1970.00

Alternative Automatic Style Valves
(10) Lav. Faucets (Auto) @ $1100 = $11,000
Alternate additional cost: $13,594

Urinals Flush Valves:
Current Manual Style Valves
(10) Urinals with manual flush valves @ $660.00 = $6,600.00

Alternative Automatic Style Valves
(10) Urinal with (Auto) flush valves @ $970 = $9,700

Waterless Urinal Option:
(10) Waterless Urinal @ $500 = $5,000

Alternate Urinal additional cost: $3,100.00

Waterless Urinal Est. Savings : $1,600.00

Advantages:
a. Water savings over time
b. Easier to install no water piping or valving

Disadvantages:
a. Requires more maintenance (replacing cartridges)

ROBERSTDALE ELEMENTARY SCHOOL

1. PLUMBING EQUIPMENT

CURRENT DESIGN

- Low water consumption tank type water closets, Low water consumption manual flush valves, and manual lavatory faucets.

REASONING FOR CURRENT DESIGN

- Cost, familiarity

ALTERNATIVES TO CURRENT DESIGN - In Specifications (Alternate Bid)

- Automatic, photocell flushometers and lavatory faucets
- Waterless no-flush urinals

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- The current design presents a standard application of familiar products which are less expensive than the alternative
- Hands-off alternative presents a more sanitary restroom environment
- Waterless urinals are environmentally friendly; savings experienced due to less water usage over time

CONCLUSIONS

Lavatory Flush Valves:
Current Manual Style Valves
(5) Manual faucets for Lavs @ $197.00 = $985.00

Alternative Automatic Style Valves
(5) Lav. Faucets (Auto) @ $1100 = $5,500

Alternate additional cost: $4,515

Urinals Flush Valves:
Current Manual Style Valves
(4) Urinals with manual flush valves @ $660.00 = $2,640.00

Alternative Automatic Style Valves
(4) Urinal with (Auto) flush valves @ $970 = $3,880

Waterless Urinal Option:
(4) Waterless Urinal @ $500 = $2,000
Alternate Urinal additional cost: $1,240.00

Waterless Urinal Est. Savings : $640.00

Advantages:
a. Water savings over time
b. Easier to install no water piping or valving

Disadvantages:
a. Requires more maintenance (replacing cartridges)

SAXTON-LIBERTY ELEMENTARY SCHOOL

1. PLUMBING EQUIPMENT

CURRENT DESIGN

- Low water consumption tank type water closets, Low water consumption manual flush valves, and manual lavatory faucets.

REASONING FOR CURRENT DESIGN

- Cost, familiarity

ALTERNATIVES TO CURRENT DESIGN - In Specifications (Alternate Bid)

- Automatic, photocell flushometers and lavatory faucets
- Waterless no-flush urinals

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- The current design presents a standard application of familiar products which are less expensive than the alternative
- Hands-off alternative presents a more sanitary restroom environment
- Waterless urinals are environmentally friendly; savings experienced due to less water usage over time

CONCLUSIONS

Lavatory Flush Valves:
Current Manual Style Valves
(16) Manual faucets for Lavs @ $197.00 = $3152.00

Alternative Automatic Style Valves
(16) Lav. Faucets (Auto) @ $1100 = $17,600
Alternate additional cost: $14,443

Urinals Flush Valves:
Current Manual Style Valves
(8) Urinals with manual flush valves @ $660.00 = $5,280.00

Alternative Automatic Style Valves
(8) Urinal with (Auto) flush valves @ $970 = $7,760
Waterless Urinal Option:

(8) Waterless Urinal @ $500 = $4,000
Alternate Urinal additional cost: $2,480.00

Waterless Urinal Est. Savings : $1,280.00

Advantages:
a. Water savings over time
b. Easier to install no water piping or valving

Disadvantages:
a. Requires more maintenance (replacing cartridges)

ITEMIZED BY SCHOOL

DEFIANCE ELEMENTARY SCHOOL

1. SITE WORK – ELECTRICAL POWER

CURRENT DESIGN

- The Electrical Site Plan indicates a new utility pad, pad mount transformer, new manhole and site lighting. The existing primary service lateral will be intercepted and spliced within an electrical manhole to new primary cable feeding the new pad mount transformer. Intercepting the existing primary service conductors and extending them with new primary cabling eliminates demolition of the existing basketball court. There are no details indicating concrete encasement of the primary service conductors.

REASONING FOR CURRENT DESIGN

- An underground service eliminates the need for additional utility poles to be set on the site.
- The installation of overhead secondary lines is impractical since the electrical room is located below grade.
- Intercepting the existing primary service conductors and extending them with new primary cable eliminates demolition of the existing basketball court.

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- Intercepting the existing primary service conductors and extending them with new primary cable eliminates demolition of the existing basketball court.
- Depending on the age of the existing primary cable, and if it has or has not been concrete encased, the potential exists for the existing primary service lateral to be the weak link in the building's electrical service. The possibility of primary cable failure is small but it does exist, especially given the fact that splicing must occur in the new manhole.

CONCLUSIONS

- The extension of the existing primary underground service later appears to be the most economical solution. The standard duct bank with select backfill appears to be the most economical solution.

2. SITE WORK – LIGHTING

CURRENT DESIGN

- The Electrical site plan indicates the addition of seven new architectural pole mounted site lights and two building mounted floodlights. The fixture schedule indicates all fixtures utilize metal halide lamps.

REASONING FOR CURRENT DESIGN

- The current design provides lighting at student drop-off areas, limited parking areas and for flag lighting.

ALTERNATIVES TO CURRENT DESIGN

- An alternate to this design would be to mount more floodlighting on the building exterior at the student drop-off area.

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- The advantage of using pole mounted site lighting is better light distribution with fewer fixtures than can typically be achieved with building mounted fixtures. The light standard also provides a platform for building security cameras.

- The disadvantages of using pole mounted site lighting are the cost associated with the light pole, pole arms, concrete light pole base and additional grounding electrode. In addition to these points, additional post construction expense may be incurred in re-lamping or photocell replacement if a bucket truck is required to reach the fixtures.

- The advantage of using building mounted lighting as opposed to light fixtures on light standards are the cost saving as a result of eliminating the light pole, concrete light pole base and additional grounding electrode.

- The disadvantages of using building mounted site lighting are 1) The fixture mounting height is limited as compared to using light standards, 2) limited mounting height may diminish the coverage area and require more fixtures to adequately mount the same area and 3) building mounted fixtures typically impact the esthetics of the building façade negatively.

CONCLUSIONS

- The pole mounted site lighting as designed will provide the most economical solution.

3. SERVICE CONFIGURATION

CURRENT DESIGN

- The current service configuration is comprised of a new main switchboard and 120/208 volt, 3 phase, 4 wire system. There are 120/208 volt, 3-phase, 4 wire distribution panels located throughout the school.

REASONING FOR CURRENT DESIGN

- A 120/208 volt system is primarily used for small commercial buildings where the lighting and motor load is minimal while the loads such as receptacles and small equipment loads are greater. A 120/208 volt system eliminates the need to step the voltage down to serve the smaller single phase loads thus reducing equipment costs by eliminating small step down transformers.

ALTERNATIVES TO CURRENT DESIGN

- An alternative to the current design would be the use of a 480/277 Volt, 3-phase, 4-wire system and one large step down transformer to reduce the voltage down to a 120/208 volt, 3-phase, 4-wire system. This would allow a combination of 480/277-volt distribution panels for lighting and motor loads while the majority of the system would be a 120/208 Volt system to serve receptacles and small motor loads.

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- The advantage of a 120/208 volt system eliminates the need to step the voltage down to serve the smaller single phase loads thus reducing equipment costs by eliminating step down transformers. Eliminating numerous step-down transformers also reduces space requirements in electrical rooms and heat dissipation that would have to be offset by increasing the size of the HVAC systems.

- The disadvantages to a 120/208-volt system are the need for more circuits and larger conductors to provide power to equipment as compared to a 480/277 volt, 3-phase, 4-wire system. Another disadvantage is the size of the service and distribution equipment gets larger and more expensive because of the larger currents of the 120/208-volt, three-phase system.

CONCLUSIONS

- Based on the size of the building, space in the main electrical room, and placement of distribution panels throughout the building, it appears as though the 120/208-volt system appears to be the most economical.

4. PANEL LOCATION

CURRENT DESIGN

- Panels are located throughout the building.

REASONING FOR CURRENT DESIGN

- The current design provides distribution panels adequately located so as to provide means of supplying the load of a given area without lengthy branch circuit runs.

ALTERNATIVES TO CURRENT DESIGN

- One alternative to the current design would be to centralize distribution panels in the center of the building.

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- The advantage of grouping panels together is one centralized location is the reduction of the length of the sub-feeds from the main switchboard to the distribution panels. The disadvantage to a central location for panels on each floor is increased conduit runs from the distribution panels to the individual loads on each floor. Code required working space also becomes a factor when combining all of the panels and transformers into one space. Chasing problems and conflicts with piping and structural members may arise because of the different locations of classrooms, corridors and stairways.

CONCLUSIONS

- After review and overlay of the architectural and electrical drawings, the current design appears to be the best layout of the distribution system.

5. EMERGENCY POWER

CURRENT DESIGN

- According to the current design, emergency power will be supplied from a 100 KW diesel generator. The generator feeds an emergency distribution panelboard. Items that will be powered from this panel are two transfer switches. One transfer switch feeds critical life safety circuits. The other transfer switch feeds emergency circuits that would cause large financial loss to the school district.

REASONING FOR CURRENT DESIGN

- The current design reduces costs for emergency distribution by limiting the items placed on emergency power. One transfer switch supplies circuits that are critical to life safety. The other transfer switch supplies power those items that would cause large financial loss to the school district if prolonged power outages occur.

ALTERNATIVES TO CURRENT DESIGN

- One alternative would be to provide a generator large enough to power the entire building. Based on the extent of the design at this time, the size and associated cost of such a generator cannot be determined.

- A second alternative would place all essential systems on the generator including and not limited to heating equipment, alarm systems, fire pumps, booster pumps, elevators and refrigeration equipment.

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- The advantage of providing emergency power to entire building is the elimination of individual emergency distribution panels and long circuit runs to the building extremities for emergency lighting and other equipment. The disadvantage of installing a generator large enough to power the entire building is the fact that most of the items that would be powered by the emergency system are not critically needed to protect the facility. Any additional KW that would not be needed to protect the facility would be wasted and would cost the school district approximately $350 per kilowatt of unused generator capacity.

- The advantage of placing all essential systems on emergency power is the facility can be better protected during power interruptions

CONCLUSIONS

- The generator should be sized to provide emergency power to all items that are critical to the protection of the building. The present design is the best for the building.

6. LIGHTING

CURRENT DESIGN

- Fluorescent lighting is currently being utilized in the classroom and corridor areas. The fixtures utilize energy savings ballasts and T5 energy saving lamps that operate at 120 volts. Occupancy sensors have been included with the dual energy savings ballasts. Generator Transfer Device ballasts will be utilized in lighting that will also be utilized under emergency conditions. The ballast will automatically switch between the normal power feed to the fixture and the emergency power feed to the fixture.

REASONING FOR CURRENT DESIGN

- Fluorescent fixtures conserve energy compared to incandescent fixtures.
- Fluorescent fixtures reduce the glare in areas where computers are being used.
- Fluorescent fixtures have lower heat dissipation than do incandescent fixtures.
- Occupancy sensors conserve energy when areas are unoccupied.
- The Bodine GTD ballast will save power by eliminating the need to have one or more lamps burning continuously to serve life safety code requirements.

ALTERNATIVES TO CURRENT DESIGN

- Provide fixtures that operate at 277 volts if the building service is modified to include the 480/277 volt system.

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- There are four advantages to providing fixtures that operate at 277 volts. 1) More fixtures can be placed on a circuit because the amperage of that circuit is reduced. 2) The reduction in amperage reduces the size of the wire that is needed to power the fixtures and in some cases; the wire size is reduced by half. 3) Fewer circuit breakers will be required because the number of circuits have been reduced. Each 120-volt single pole, 20-amp circuit breaker has an average cost of $35.

- The disadvantage in using lighting fixtures that operate at 277 volts is the need to introduce a 480/277 volt electrical service and step down to 120/208 to serve the receptacle and small motor loads. The cost to do so would not offset the savings in wire and circuit breakers.

CONCLUSIONS

- The multi-ballast, 120 volt, fixtures with dual switching and occupancy sensors provide a cost effective means of providing multiple light levels in classrooms, corridors and administrative areas.

7. DATA AND TELEPHONE SYSTEM

CURRENT DESIGN

- The current plans indicate one (1) telephone outlet and a minimum of one to as many as Twenty (27) data outlets in classrooms. Fiber optic cabling connects the MDF and IDF's. Cat 6 cabling has been utilized for horizontal cabling from IDF patch panels. Basket or cable tray is being utilized above accessible ceilings to route communication cables between the MDF and IDFs and between the IDFs and station outlets.

REASONING FOR CURRENT DESIGN

- The design provides for a good distribution for the data and telephone system.

ALTERNATIVES TO CURRENT DESIGN

- The current design and configuration is in line with TIA design standards. There are no evident alternatives to the current design.

DISCUSSIONS OF ADVANTAGES AND DISADVANTAGES

- The advantage of the cable tray system is easy additions and modifications.

CONCLUSIONS

- The present design appears to be the best and most economical installation.

8. SECURITY SYSTEMS

CURRENT DESIGN

- The current plans indicate a door access control system, limited motion detection in corridors and outside door access areas and CCTV cameras to record all points of egress.

REASONING FOR CURRENT DESIGN

- The design provides for a minimal card access control and building security coverage.

ALTERNATES TO CURRENT DESIGN

- A coverage of the CCTV could be increased slightly in some locations.
- The security system could be designed as a component of the fire alarm system.

DISCUSSIONS OF ADVANTAGES AND DIADVANTAGES

- The advantage to adding cameras is more complete security coverage. The disadvantage is the significant cost increase.

CONCLUSIONS

- The present design appears to be the best and most economical for this facility.

9. FIRE ALARM SYSTEM

CURRENT DESIGN

- The current plans indicate a fire alarm system consisting of fire alarm control panel, annunciator panel, heat detectors, smoke detectors, pull station, horns, and visual devices.

REASONING FOR CURRENT DESIGN

- The design provides for the minimal required fire alarm system.

ALTERNATES TO THE CURRENT DESIGN

- Since the plans are not complete and specification have not been provided for this review; our assumption will be that the fire alarm cabling will be installed in conduit. The wiring can be in conduit, In cable tray or “lay in” the ceilings.

DISCUSSIONS OF ADVANTAGES AND DISADVANTAGES

- The advantage of installing cable in cable tray or “lay-in” method is a significant cost savings. If the cable tray that is utilized for the data communications is large enough, and basket dividers are used, the fire alarm wiring could be grouped and installed in the same basket tray as the telecommunications cabling.

CONCLUSIONS

- Provide code compliant power limited fire alarm cable and eliminate conduit from the fire alarm wiring. This revision could be a $11,000 in savings.

10. MISCELLANEOUS – BRANCH CIRCUIT HOMERUNS

DESIGN OF BRANCH CIRCUITS

- Normally homerun circuits are in individual conduits

COST SAVINGS RECOMMENDATION

- Combine branch circuit homeruns to limit 3 circuits to share (1) neutral and ground conductor in a common raceway. Computer and kitchen equipment circuits to remain separate.

DISCUSSIONS OF ADVANTAGES AND DISADVANTAGES

- The advantage to sharing neutrals and grounding conductors is obviously reduced conductor quantities and the number of conduit runs.

- The disadvantage to sharing neutrals and grounding conductors is the potential for noise distortion on circuit serving electronic equipment.

CONCLUSIONS

- Sharing neutral and grounding conductors will meet National Electrical Code requirements and should be considered as a potential cost savings.

ESTIMATED COST SAVINGS

- $20,000

11. ESTIMATED ELECTRICAL COSTS SAVINGS - SUMMARY

SITE WORK – ELECTRICAL POWER	$ 0
SITE WORK – LIGHTING	$ 0
SERVICE CONFIGURATION	$ 0
PANEL LOCATION	$ 0
EMERGENCY POWER	$ 0
LIGHTING	$
DATA AND TELEPHONE	$ 0
SECURITY SYSTEMS	$ 0
FIRE ALARM SYSTEM	$ 11,000
MISCELANIOUS – BRANCH CIRCUIT HOMERUNS	$ 22,000
ESTIMATED TOTAL POTENTIAL SAVINGS	$ 33,000

ROBERTSDALE ELEMENTARY SCHOOL

1. SITE WORK – ELECTRICAL POWER

CURRENT DESIGN

- The Electrical Site plan indicates a new underground primary service lateral from the existing utility terminal pole to a new pad mount transformer located at the building. Existing pole mounted site lighting shall be removed and replaced with additional poles and fixtures.

REASONING FOR CURRENT DESIGN

- An underground service eliminates the need for additional utility poles to be set on the site.
- The installation of overhead secondary lines is impractical since the electrical room is located below grade.

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- An underground service eliminates the need for additional utility poles to be set on the site.
- The installation of overhead secondary lines is impractical since the electrical room is located below grade.

CONCLUSIONS

- The underground non-encased duct bank appears to be the most economical and aesthetically pleasing option.

2. SITE WORK – LIGHTING

CURRENT DESIGN

- The Electrical Site plan indicates seven (7) pole mounted site lights and two (2) – stanchion mounted floodlights.

REASONING FOR CURRENT DESIGN

- The current design provides lighting at student drop-off areas, walkways, parking areas and for flag lighting.

ALTERNATIVES TO CURRENT DESIGN

- An alternate to this design would be to mount more flood lighting on the building exterior at the student drop-off area.

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- The advantage of using pole mounted site lighting is better light distribution with less fixtures than can typically be achieved with building mounted fixtures. The light standard also provides a platform for building security cameras.

- The disadvantages of using pole mounted site lighting are the cost associated with the light pole, pole arms, concrete light pole base and additional grounding electrode. In addition to these points, additional post construction expense may be incurred in re-lamping or photocell replacement if a bucket truck is required to reach the fixtures.

- The advantage of using building mounted lighting as opposed to light fixtures on light standards are the cost saving as a result of eliminating the light pole, concrete light pole base and additional grounding electrode.

- The disadvantages of using building mounted site lighting are 1) The fixture mounting height is limited as compared to using light standards, 2) limited mounting height may diminish the coverage area and require more fixtures to adequately mount the same area and 3) building mounted fixtures typically impact the esthetics of the building façade negatively.

CONCLUSIONS

- The pole mounted site lighting as designed will provide the most economical The advantage of encasing the conduit in concrete is to protect the conduit when exposed to heavy traffic. Due to the incompleteness of the site plan, we cannot evaluate the need for concrete encasement of the conduit in heavy vehicle traffic areas.

3. SERVICE CONFIGURATION

CURRENT DESIGN

- The current service configuration is comprised of a new main switchboard and 120/208 volt, 3 phase, 4 wire distribution system. There are 120/208 volt, 3-phase, 4 wire distribution panels located throughout the school.

REASONING FOR CURRENT DESIGN

- A 120/208 volt system is primarily used for small commercial buildings where the lighting and motor load is minimal while the loads such as receptacles and small equipment loads are greater. A 120/208 volt system eliminates the need to step the voltage down to serve the smaller single phase loads thus reducing equipment costs by eliminating small step down transformers.

ALTERNATIVES TO CURRENT DESIGN

- An alternative to the current design would be the use of a 480/277 Volt, 3-phase, 4-wire system and one large step down transformer to reduce the voltage down to a 120/208 volt, 3-phase, 4-wire system. This would allow a combination of 480/277-volt distribution panels for lighting and motor loads while the majority of the system would be a 120/208 Volt system to serve receptacles and small motor loads.

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- The advantage of a 120/208 volt system eliminates the need to step the voltage down to serve the smaller single phase loads thus reducing equipment costs by eliminating step down transformers. Eliminating numerous step-down transformers also reduces space requirements in electrical rooms and heat dissipation that would have to be offset by increasing the size of the HVAC systems.

- The disadvantages to a 120/208-volt system are the need for more circuits and larger conductors to provide power to equipment as compared to a 480/277 volt, 3-phase, 4-wire system. Another disadvantage is that the size of the service and distribution equipment gets larger and more expensive because of the larger currents of the 120/208-volt, three phase system.

CONCLUSIONS

- Based on the size of the building, space in the main electrical room, and placement of distribution panels throughout the building, it appears as though the 120/208-volt system appears to be the most economical.

4. PANEL LOCATION

- Panels are located throughout the building.

REASONING FOR CURRENT DESIGN

- The current design provides distribution panels adequately located so as to provide means of supplying the load of a given area without lengthy branch circuit runs.

ALTERNATIVES TO CURRENT DESIGN

- One alternative to the current design would be to centralize distribution panels in the center of the building.

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- The advantage of grouping panels together is one centralized location is the reduction of the length of the sub-feeds from the main switchboard to the distribution panels. The disadvantage to a central location for panels on each floor is increased conduit runs from the distribution panels to the individual loads on each floor. Code required working space also becomes a factor when combining all of the panels and transformers into one space. Chasing problems and conflicts with piping and structural members may arise because of the different locations of classrooms, corridors and stairways.

CONCLUSIONS

- After review and overlay of the architectural and electrical drawings, the current design appears to be the best layout of the distribution system.

5. EMERGENCY POWER

CURRENT DESIGN

- According to the current design, emergency power will be supplied from a 100 KW diesel generator. The generator feeds an emergency distribution panel board. Items that will be powered from this panel are two transfer switches. One transfer switch feeds critical life safety circuits. The other transfer switch feeds emergency circuits that would cause large financial loss to the school district.

REASONING FOR CURRENT DESIGN

- The current design reduces costs for emergency distribution by limiting the items placed on emergency power. One transfer switch supplies circuits that are critical to life safety. The other transfer switch supplies power those items that would cause large financial loss to the school district if prolonged power outages occur.

ALTERNATIVES TO CURRENT DESIGN

- One alternative would be to provide a generator large enough to power the entire building. Based on the extent of the design at this time, the size and associated cost of such a generator cannot be determined.

- A second alternative would place all essential systems on the generator including and not limited to heating equipment, alarm systems, fire pumps, booster pumps, elevators and refrigeration equipment.

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- The advantage of providing emergency power to entire building is the elimination of individual emergency distribution panels and long circuit runs to the building extremities for emergency lighting and other equipment. The disadvantage of installing a generator large enough to power the entire building is the fact that most of the items that would be powered by the emergency system are not critically needed to protect the facility. Any additional KW that would not be needed to protect the facility would be wasted and would cost the school district approximately $350 per kilowatt of unused generator capacity.

- The advantage of placing all essential systems on emergency power is the facility can be better protected during power interruptions.

CONCLUSIONS

- The generator should be sized to provide emergency power to all items that are critical to the protection of the building. The present design is the best for the building.

6. LIGHTING

CURRENT DESIGN

- Fluorescent lighting is currently being utilized in the classroom and corridor areas. The fixtures utilize energy savings ballasts and T5 energy saving lamps that operate at 120 volts. Occupancy sensors have been included with the dual energy savings ballasts. Generator Transfer Device ballasts will be utilized in lighting that will also be utilized under emergency conditions. The ballast will automatically switch between the normal power feed to the fixture and the emergency power feed to the fixture.

REASONING FOR CURRENT DESIGN

- Fluorescent fixtures conserve energy compared to incandescent fixtures.
- Fluorescent fixtures reduce the glare in areas where computers are being used.
- Fluorescent fixtures have lower heat dissipation than do incandescent fixtures.
- Occupancy sensors conserve energy when areas are unoccupied.
- The Bodine GTD ballast will save power by eliminating the need to have one or more lamps burning continuously to serve life safety code requirements.

ALTERNATIVES TO CURRENT DESIGN

- Provide fixtures that operate at 277 volts if the building service is modified to include the 480/277 volt system.

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- There are four advantages to providing fixtures that operate at 277 volts. 1) More fixtures can be placed on a circuit because the amperage of that circuit is reduced. 2) The reduction in amperage reduces the size of the wire that is needed to power the fixtures and in some cases; the wire size is reduced by half. 3) Fewer circuit breakers will be required because the number of circuits have been reduced. Each 120-volt single pole, 20-amp circuit breaker has an average cost of $35.

- The disadvantage in using lighting fixtures that operate at 277 volts is the need to introduce a 480/277 volt electrical service and step down to 120/208 to serve the receptacle and small motor loads. The cost to do so would not offset the savings in wire and circuit breakers.

CONCLUSIONS

- The multi-ballast, 120 volt, fixtures with dual switching and occupancy sensors provide a cost effective means of providing multiple light levels in classrooms, corridors and administrative areas.

7. DATA AND TELEPHONE SYSTEM

CURRENT DESIGN

- The current plans indicate one telephone outlet and a minimum of one to as many as twenty-seven (27) data outlets in classrooms. Fiber optic cabling connects the MDF and IDF's. Cat 6 cabling has been utilized for horizontal cabling from IDF patch panels. Basket or cable tray is being utilized above accessible ceilings to route communication cables between the MDF and IDFs and between the IDFs and station outlets.

REASONING FOR CURRENT DESIGN

- The design provides for a good distribution for the data and telephone system.

ALTERNATIVES TO CURRENT DESIGN

- The current design and configuration is in line with TIA design standards. There are no evident alternatives to the current design.

DISCUSSIONS OF ADVANTAGES AND DISADVANTAGES

- The advantage of the cable tray system is easy additions and modifications.

CONCLUSIONS

- The present design appears to be the best and most economical installation.

8. SECURITY SYSTEMS

CURRENT DESIGN

- The current plans indicate a door access control system, limited motion detection in corridors and outside door access areas and CCTV cameras to record all points of egress.

REASONING FOR CURRENT DESIGN

- The design provides for a minimal card access control and building security coverage.

ALTERNATES TO CURRENT DESIGN

- A coverage of the CCTV could be increased slightly in some locations.
- The security system could be designed as a component of the fire alarm system.

DISCUSSIONS OF ADVANTAGES AND DIADVANTAGES

- The advantage to adding cameras is more complete security coverage. The disadvantage is the significant cost increase.

CONCLUSIONS

- The present design appears to be the best and most economical for this facility.

9. FIRE ALARM SYSTEM

CURRENT DESIGN

- The current plans indicate a fire alarm system consisting of fire alarm control panel, annunciator panel, heat detectors, smoke detectors, pull station, horns, and visual devices.

REASONING FOR CURRENT DESIGN

- The design provides for the minimal required fire alarm system.

ALTERNATES TO THE CURRENT DESIGN

- Since the plans are not complete and specification have not been provided for this review; our assumption will be that the fire alarm cabling will be installed in conduit. The wiring can be in conduit, In cable tray or “lay in” the ceilings.

DISCUSSIONS OF ADVANTAGES AND DISADVANTAGES

- The advantage of installing cable in cable tray or “lay-in” method is a significant cost savings. If the cable tray that is utilized for the data communications is large enough, and basket dividers are used, the fire alarm wiring could be grouped and installed in the same basket tray as the telecommunications cabling.

CONCLUSIONS

- Provide code compliant power limited fire alarm cable and eliminate conduit from the fire alarm wiring. This revision could be an $11,000 in savings.

10. MISCELLANEOUS – BRANCH CIRCUIT HOMERUNS

DESIGN OF BRANCH CIRCUITS

- Normally homerun circuits are in individual conduits

COST SAVINGS RECOMMENDATION

- Combine branch circuit homeruns to limit 3 circuits to share (1) neutral and ground conductor in a common raceway. Computer and kitchen equipment circuits to remain separate.

DISCUSSIONS OF ADVANTAGES AND DISADVANTAGES

- The advantage to sharing neutrals and grounding conductors is obviously reduced conductor quantities and the number of conduit runs.

- The disadvantage to sharing neutrals and grounding conductors is the potential for noise distortion on circuit serving electronic equipment.

CONCLUSIONS

- Sharing neutral and grounding conductors will meet National Electrical Code requirements and should be considered as a potential cost savings.

ESTIMATED COST SAVINGS

- $20,000

11. ESTIMATED ELECTRICAL COSTS SAVINGS - SUMMARY

SITE WORK – ELECTRICAL POWER	$ 0
SITE WORK – LIGHTING	$ 0
SERVICE CONFIGURATION	$ 0
PANEL LOCATION	$ 0
EMERGENCY POWER	$ 0
LIGHTING	$ 0
DATA AND TELEPHONE	$ 0
SECURITY SYSTEMS	$ 0
FIRE ALARM SYSTEM	$ 11,000
MISCELANIOUS – BRANCH CIRCUIT HOMERUNS	$ 20,000
ESTIMATED TOTAL POTENTIAL SAVINGS	$ 31,000

SAXTON–LIBERTY ELEMENTARY SCHOOL

1. SITE WORK – ELECTRICAL POWER

CURRENT DESIGN

- The Electrical Site plan indicates a new underground primary service lateral from the existing utility terminal pole to a new pad mount transformer located at the building. Existing pole mounted site lighting shall be removed and replaced with additional poles and fixtures.

REASONING FOR CURRENT DESIGN

- An underground service eliminates the need for additional utility poles to be set on the site.
- The installation of overhead secondary lines is impractical since the electrical room is located below grade.

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- An underground service eliminates the need for additional utility poles to be set on the site.
- The installation of overhead secondary lines is impractical since the electrical room is located below grade.

CONCLUSIONS

- The underground non-encased duct bank appears to be the most economical and aesthetically pleasing option.

2. SITE WORK – LIGHTING

CURRENT DESIGN

- The Electrical Site plan indicates thirteen (13) pole mounted site lights and two (2) – stanchion mounted floodlights.

REASONING FOR CURRENT DESIGN

- The current design provides lighting at student drop-off areas, walkways, parking areas and for flag lighting.

ALTERNATIVES TO CURRENT DESIGN

- An alternate to this design would be to mount more flood lighting on the building exterior at the student drop-off area.

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- The advantage of using pole mounted site lighting is better light distribution with less fixtures than can typically be achieved with building mounted fixtures. The light standard also provides a platform for building security cameras.

- The disadvantages of using pole mounted site lighting are the cost associated with the light pole, pole arms, concrete light pole base and additional grounding electrode. In addition to these points, additional post construction expense may be incurred in re-lamping or photocell replacement if a bucket truck is required to reach the fixtures.

- The advantage of using building mounted lighting as opposed to light fixtures on light standards are the cost saving as a result of eliminating the light pole, concrete light pole base and additional grounding electrode.

- The disadvantages of using building mounted site lighting are 1) The fixture mounting height is limited as compared to using light standards, 2) limited mounting height may diminish the coverage area and require more fixtures to adequately mount the same area and 3) building mounted fixtures typically impact the esthetics of the building façade negatively.

CONCLUSIONS

- The pole mounted site lighting as designed will provide the most economical The advantage of encasing the conduit in concrete is to protect the conduit when exposed to heavy traffic. Due to the incompleteness of the site plan, we cannot evaluate the need for concrete encasement of the conduit in heavy vehicle traffic areas.

3. SERVICE CONFIGURATION

CURRENT DESIGN

- The current service configuration is comprised of a new main switchboard and 120/208 volt, 3 phase, 4 wire distribution system. There are 120/208 volt, 3-phase, 4 wire distribution panels located throughout the school.

REASONING FOR CURRENT DESIGN

- A 120/208 volt system is primarily used for small commercial buildings where the lighting and motor load is minimal while the loads such as receptacles and small equipment loads are greater. A 120/208 volt system eliminates the need to step the voltage down to serve the smaller single phase loads thus reducing equipment costs by eliminating small step down transformers.

ALTERNATIVES TO CURRENT DESIGN

- An alternative to the current design would be the use of a 480/277 Volt, 3-phase, 4-wire system and one large step down transformer to reduce the voltage down to a 120/208 volt, 3-phase, 4-wire system. This would allow a combination of 480/277-volt distribution panels for lighting and motor loads while the majority of the system would be a 120/208 Volt system to serve receptacles and small motor loads.

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- The advantage of a 120/208 volt system eliminates the need to step the voltage down to serve the smaller single phase loads thus reducing equipment costs by eliminating step down transformers. Eliminating numerous step-down transformers also reduces space requirements in electrical rooms and heat dissipation that would have to be offset by increasing the size of the HVAC systems.

- The disadvantages to a 120/208-volt system are the need for more circuits and larger conductors to provide power to equipment as compared to a 480/277 volt, 3-phase, 4-wire system. Another disadvantage is that the size of the service and distribution equipment gets larger and more expensive because of the larger currents of the 120/208-volt, three-phase system.

CONCLUSIONS

- Based on the size of the building, space in the main electrical room, and placement of distribution panels throughout the building, it appears as though the 120/208-volt system appears to be the most economical.

4. PANEL LOCATION

CURRENT DESIGN

- Panels are located throughout the building.

REASONING FOR CURRENT DESIGN

- The current design provides distribution panels adequately located so as to provide means of supplying the load of a given area without lengthy branch circuit runs.

ALTERNATIVES TO CURRENT DESIGN

- One alternative to the current design would be to centralize distribution panels in the center of the building.

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- The advantage of grouping panels together is one centralized location is the reduction of the length of the sub-feeds from the main switchboard to the distribution panels. The disadvantage to a central location for panels on each floor is increased conduit runs from the distribution panels to the individual loads on each floor. Code required working space also becomes a factor when combining all of the panels and transformers into one space. Chasing problems and conflicts with piping and structural members may arise because of the different locations of classrooms, corridors and stairways.

CONCLUSIONS

- After review and overlay of the architectural and electrical drawings, the current design appears to be the best layout of the distribution system.

5. EMERGENCY POWER

CURRENT DESIGN

- According to the current design, emergency power will be supplied from a 100 KW diesel generator. The generator feeds an emergency distribution panelboard. Items that will be powered from this panel are two transfer switches. One transfer switch feeds critical life safety circuits. The other transfer switch feeds emergency circuits that would cause large financial loss to the school district.

REASONING FOR CURRENT DESIGN

- The current design reduces costs for emergency distribution by limiting the items placed on emergency power. One transfer switch supplies circuits that are critical to life safety. The other transfer switch supplies power those items that would cause large financial loss to the school district if prolonged power outages occur.

ALTERNATIVES TO CURRENT DESIGN

- One alternative would be to provide a generator large enough to power the entire building. Based on the extent of the design at this time, the size and associated cost of such a generator cannot be determined.

- A second alternative would place all essential systems on the generator including and not limited to heating equipment, alarm systems, fire pumps, booster pumps, elevators and refrigeration equipment.

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- The advantage of providing emergency power to entire building is the elimination of individual emergency distribution panels and long circuit runs to the building extremities for emergency lighting and other equipment. The disadvantage of installing a generator large enough to power the entire building is the fact that most of the items that would be powered by the emergency system are not critically needed to protect the facility. Any additional KW that would not be needed to protect the facility would be wasted and would cost the school district approximately $350 per kilowatt of unused generator capacity.

- The advantage of placing all essential systems on emergency power is the facility can be better protected during power interruptions. The disadvantage of placing all essential systems on emergency power is the additional generator capacity required to power these systems; the cost would amount to an additional $350 per KW.

CONCLUSIONS

- The generator should be sized to provide emergency power to all items that are critical to the protection of the building. The present design is the best for the building.

6. LIGHTING

CURRENT DESIGN

- Fluorescent lighting is currently being utilized in the classroom and corridor areas. The fixtures utilize energy savings ballasts and T5 energy saving lamps that operate at 120 volts. Occupancy sensors have been included with the dual energy savings ballasts. Generator Transfer Device ballasts will be utilized in lighting that will also be utilized under emergency conditions. The ballast will automatically switch between the normal power feed to the fixture and the emergency power feed to the fixture.

REASONING FOR CURRENT DESIGN

- Fluorescent fixtures conserve energy compared to incandescent fixtures.
- Fluorescent fixtures reduce the glare in areas where computers are being used.
- Fluorescent fixtures have lower heat dissipation than do incandescent fixtures.
- Occupancy sensors conserve energy when areas are unoccupied.
- The Bodine GTD ballast will save power by eliminating the need to have one or more lamps burning continuously to serve life safety code requirements.

ALTERNATIVES TO CURRENT DESIGN

- Provide fixtures that operate at 277 volts if the building service is modified to include the 480/277 volt system.

DISCUSSION OF ADVANTAGES AND DISADVANTAGES

- There are four advantages to providing fixtures that operate at 277 volts. 1) More fixtures can be placed on a circuit because the amperage of that circuit is reduced. 2) The reduction in amperage reduces the size of the wire that is needed to power the fixtures and in some cases; the wire size is reduced by half. 3) Fewer circuit breakers will be required because the number of circuits have been reduced. Each 120-volt single pole, 20-amp circuit breaker has an average cost of $35.

- The disadvantage in using lighting fixtures that operate at 277 volts is the need to introduce a 480/277 volt electrical service and step down to 120/208 to serve the receptacle and small motor loads. The cost to do so would not offset the savings in wire and circuit breakers.

CONCLUSIONS

- The multi-ballast, 120 volt, fixtures with dual switching and occupancy sensors provide a cost effective means of providing multiple light levels in classrooms, corridors and administrative areas.

7. DATA AND TELEPHONE SYSTEM

CURRENT DESIGN

- The current plans indicate one telephone outlet and a minimum of one to as many as 15 data outlets in classrooms. Fiber optic cabling connects the MDF and IDF's. Cat 6 cabling has been utilized for horizontal cabling from IDF patch panels. Basket or cable tray is being utilized above accessible ceilings to route communication cables between the MDF and IDFs and between the IDFs and station outlets.

REASONING FOR CURRENT DESIGN

- The design provides for a good distribution for the data and telephone system.

ALTERNATIVES TO CURRENT DESIGN

- The current design and configuration is in line with TIA design standards. There are no evident alternatives to the current design.

DISCUSSIONS OF ADVANTAGES AND DISADVANTAGES

- The advantage of the cable tray system is easy additions and modifications.

CONCLUSIONS

- The present design appears to be the best and most economical installation.

8. SECURITY SYSTEMS

CURRENT DESIGN

- The current plans indicate a door access control system, limited motion detection in corridors and outside door access areas and CCTV cameras to record all points of egress.

REASONING FOR CURRENT DESIGN

- The design provides for a minimal card access control and building security coverage.

ALTERNATES TO CURRENT DESIGN

- A coverage of the CCTV could be increased slightly in some locations.
- The security system could be designed as a component of the fire alarm system.

DISCUSSIONS OF ADVANTAGES AND DIADVANTAGES

- The advantage to adding cameras is more complete security coverage. The disadvantage is the significant cost increase.

CONCLUSIONS

- The present design appears to be the best and most economical for this facility.

9. FIRE ALARM SYSTEM

CURRENT DESIGN

- The current plans indicate a fire alarm system consisting of fire alarm control panel, annunciator panel, heat detectors, smoke detectors, pull station, horns, and visual devices.

REASONING FOR CURRENT DESIGN

- The design provides for the minimal required fire alarm system.

ALTERNATES TO THE CURRENT DESIGN

- Since the plans are not complete and specification have not been provided for this review; our assumption will be that the fire alarm cabling will be installed in conduit. The wiring can be in conduit, In cable tray or “lay in” the ceilings.

DISCUSSIONS OF ADVANTAGES AND DISADVANTAGES

- The advantage of installing cable in cable tray or “lay-in” method is a significant cost savings. If the cable tray that is utilized for the data communications is large enough, and basket dividers are used, the fire alarm wiring could be grouped and installed in the same basket tray as the telecommunications cabling.

CONCLUSIONS

- Provide code compliant power limited fire alarm cable and eliminate conduit from the fire alarm wiring. This revision could be a $14,000 in savings.

10. MISCELLANEOUS – BRANCH CIRCUIT HOMERUNS

DESIGN OF BRANCH CIRCUITS

- Normally homerun circuits are in individual conduits

COST SAVINGS RECOMMENDATION

- Combine branch circuit homeruns to limit 3 circuits to share (1) neutral and ground conductor in a common raceway. Computer and kitchen equipment circuits to remain separate.

DISCUSSIONS OF ADVANTAGES AND DISADVANTAGES

- The advantage to sharing neutrals and grounding conductors is obviously reduced conductor quantities and the number of conduit runs.

- The disadvantage to sharing neutrals and grounding conductors is the potential for noise distortion on circuit serving electronic equipment.

CONCLUSIONS

- Sharing neutral and grounding conductors will meet National Electrical Code requirements and should be considered as a potential cost savings.

ESTIMATED COST SAVINGS

- $28,000

11. ESTIMATED ELECTRICAL COSTS SAVINGS - SUMMARY

SITE WORK – ELECTRICAL POWER	$ 0
SITE WORK – LIGHTING	$ 0
SERVICE CONFIGURATION	$ 0
PANEL LOCATION	$ 0
EMERGENCY POWER	$ 0
LIGHTING	$ 0
DATA AND TELEPHONE	$ 0
SECURITY SYSTEMS	$ 0
FIRE ALARM SYSTEM	$ 14,000
MISCELANIOUS – BRANCH CIRCUIT HOMERUNS	$ 28,000
ESTIMATED TOTAL POTENTIAL SAVINGS	$ 42,000