1.06 EXISTING CONDITIONS

C. EXISTING CONDITIONS REPORT

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I. OBJECTIVE

MSBA and the Town of Shrewsbury have undertaken a study of the 50 acre school site at Oak and Sherwood Streets to determine its suitability to support an expanded Sherwood Middle School for 900 students in Grades 5 and 6. The study will consider additions and renovations to the existing school structure, as well as the option of replacing the existing building with new construction. The building evaluation will consider code implications for additions and renovations as well as the condition of existing building systems. The MSBA middle school space template allows up to 144,000 gross square feet to support a 900 student enrollment.

II. OVERVIEW

Constructed in 1964 as a junior high school, the three story, 88,000 s.f. Sherwood Middle School is of steel frame construction with masonry bearing interior partitions with a design capacity of 700 students. An 11,000 s.f. modular classroom addition set on concrete piers contains 10 classrooms. The approximately 25 year old modulars were purchased used and installed in 1995. An elevator was added to the original building in 1993.

For the purpose of this study, it will be assumed that the modulars will not be part of a permanent solution for the middle school expansion. While the modulars might be suitable for temporary structures during phased construction or for another town use elsewhere, MSBA recognizes they would not be appropriate for a long term educational facility. Also, the age and construction type of the modulars would indicate that their expected useful service is nearing completion. Further, the current location of the modulars would impede future site development options.

Given the scale of additions and renovations necessary to support the 900 student projected enrollment, the construction will be classified as "Substantial Renovation". As such, the Massachusetts Building Code and Architectural Access Board Rules & Regulations mandate that specific upgrades and wholesale replacement of certain systems to comply with requirements for new construction. While requests for compliance alternatives and variances may be appropriate, evaluation of existing building systems were conducted from the perspective of code compliance. The study therefore not only assessed the physical conditions of the building and its systems but also any current code noncompliance and mandatory code upgrades required by a "Substantial Renovation". The study did not include destructive testing or investigation because, at this time, we do not see the need for such methods as a means for gathering relevant information for successful completion of the study. If the addition/renovation option is pursued, some destructive testing and observation may be required for full detailing of contract documents.

The building is Type 2B Construction (non-combustible) probably permitted under the BOCA Code or Massachusetts Building Code extant in 1964. Although the building does not meet the minimum standards or requirements of the 7th Edition (2004) Massachusetts Building Code, the structure can be renovated and expanded pursuant to Chapter 34 of the code for continuation of existing use. Building Code requirements are explained in greater detail elsewhere in this report and will trigger an array of mandatory upgrades should the renovation/addition option be selected as the preferred solution.

The building has been generally well maintained although most building systems and construction components have exceeded their life expectancy reaching a point that rehabilitation or removal and replacement is warranted.

III. EVALUATION

Representatives of Lamoureux Pagano Associates and its consulting engineers have reviewed existing drawings of the building supplied by the town, observed and recorded pertinent existing conditions, discussed the scope of the study and prepared individual reports.

Architectural

Building Exterior

Observations by the design team (of the 1964 construction) led to the conclusion that the building envelope is in good condition and all observed deficiencies are repairable with ordinary measures. However, a number of discretionary improvements will be recommended that result in a reduction of operating costs and better protection of the building from weather.

Virtually all openings, i.e. windows and doors need re-caulking. The windows are single glazed non-thermal units which are the single greatest heat loss for the building. In several locations the mortar has failed and/or cracked allowing penetration of water into the wall cavity. While these issues are not unusual for a building of this age, combined they represent costly repairs but are strongly recommended should the building continue to be used as a school. It should be noted that window replacement would be "code mandated" since the building code requires any component of the building exterior which is modified during construction must be brought up to code requirements as indicated in Chapter 34 of the Building Code.

The condition of existing doors and hardware ranges from "good" to "in need of replacement". Since the building project will exceed minimum thresholds for full compliance with the Architectural Access Board Rules & Regulations, all hardware will need to be replaced.

The existing cast-in-place concrete stairs which form two of the means of egress from the gymnasium are not protected as required by the Massachusetts Building Code.

While it is unknown whether the code required protection of the stairways at the time the building was permitted, the current building code requires that exit stairs be protected from snow and ice to maintain a safe escape from the building in an emergency if the building official deems the condition as hazardous.

The original built-up roof remains in place with a 20 year old rigid insulation and membrane roof installed over it. The membrane roof, with 10 year warranty, has been patched as required and currently requires reseaming and possibly reflashing. The gymnasium tectum deck was damaged in places due to previous roof leaks. The roof and insulation needs to be replaced per the minimum required insulating value to comply with Chapter 34.

Building Interior

There are a range of upgrades that will be addressed elsewhere in this report which will have a substantial impact on the scope of work, cost of construction, and complexities of renovation work while the building is occupied. This section will focus only on the condition of the building interior systems and finishes.

The interior materials are primarily vinyl asbestos tile flooring (except the first floor corridors which have replacement vinyl composition tile), painted masonry block walls, glazed block corridor walls, and painted plaster ceilings. Many classrooms have ceramic tile wainscot walls and built in shelving units at the exterior walls.

Many building finishes, particularly original flooring, have exceeded their life expectancy and require replacement. The presence of asbestos bearing materials has been addressed in a separately commissioned report and will clearly affect the cost for floor tile replacement and other work. Further assessment of existing finishes is as follows:

- Most doors and all hardware from the original construction are worn and in need of replacement.
- Many outside corners of ceramic tile wainscot are damaged as well as interior plaster window jambs where water has infiltrated.
- Millwork, in most cases, does not meet ADA standards and is beyond consideration for refinishing.
- Approximately 60% of the original lockers have been replaced with double tier 15″ wide units of economy grade. Original lockers are less than 6″ wide rendering them obsolete for current student storage needs including backpacks and insulated jackets.
- The original wire lath plaster ceiling, while in excellent condition and found to be asbestos free (except in the Boiler Room), is covering areas of construction that may need to be accessed for systems replacement and code required upgrades.
- Some of the original wood framed chalkboards have been replaced with markerboards, but many have not.
- Original block and brick walls are in very good condition, though they are a challenge to integration of new systems and the original paint is assumed to contain lead.

- Student toilet rooms have recent solid plastic toilet compartments in excellent condition, most other toilet rooms are in original condition.
- Stairs have either vinyl or linoleum treads and are in fair condition; replacement is recommended.

We anticipate the vast majority of interior construction would be code mandated upgrades and, to a lesser extent, renovations to accommodate program changes. The "IV Code Compliance" section of this report addresses the mandatory upgrades relative to Massachusetts Building Code, Architectural Access Board Rules & Regulations, etc. Since the building structure is masonry bearing with non-bearing masonry partitions, it is less flexible and more costly to modify the interior to accommodate anticipated program driven changes.

Mechanical Systems

The HVAC systems were examined by Seaman Engineering, Inc. The entire report is attached. Highlights of SEI's report and implications for renovation and expansion of the building can be described as follows. The 45 year old heating and ventilating system requires replacement year as it has exceeded its useful life. The scope of work for mechanical systems will require total replacement of the building systems and components affected. Further, an Indoor Air Quality Report authored by the Massachusetts Executive Office of Health and Human Services included with Shrewsbury MSBA Statement of Interest for the project raises concerns about the effectiveness of the existing ventilation system and associated controls.

The fire protection and plumbing systems were reviewed by AKAL Engineering. Classified as a "substantial renovation", the addition and renovation will require the installation of a fire suppression system. Also, all plumbing fixtures must be replaced to comply with the code for 1.6 gallon flush fixtures. For the purposes of this report, it is assumed that the underslab piping is in adequate condition to remain in place. If the addition/renovation option is selected, it is recommended that further testing be conducted to confirm the condition.

Electrical

The building's electrical systems including power, lighting, and emergency systems were assessed by ART Engineering, Inc. Similar to the mechanical systems, they have identified major age related upgrades and a substantial number of program driven improvements. In essence, all components of electrical systems from the service through lighting are in need of replacement. Also, the existing interior masonry partitions dictate that many more wireless hubs are required than for metal stud construction due to transmittance restrictions.

Structural

The structural evaluation and report prepared by Bolton & DiMartino, Inc. is attached.

As indicated in their report, the building is structurally stable, however, well below current building codes given the implications for major renovations and additions. With the scope of work anticipated for expansion of the building and configuration of any additions, the code would require major upgrades to the building structure to resist lateral stress. The cost to comply with a building code for structural reinforcement and the implications for the entire building structure may combine to result in costly building improvements dependant on scope of renovations and any additions. Also, the economically designed original building would require additional structure to support any new dead loads (rooftop units, etc.) that may be planned for the project.

Food Service

The Colburn and Guyette report notes many conditions that do not meet current code requirements, including incorrect materials and plumbing and Board of Health regulations, and would require replacement in a substantial renovation project. The former dishwash room is no longer operable, but dishwashing is required for the Sherwood program. The space is minimally and efficiently designed.

Hazardous Materials

The testing report by Universal Environmental Consultants references many hazardous materials present that were typically installed in educational buildings of the 1960's including asbestos flooring and pipe insulation, pcb's in caulking and light fixtures, and lead paint. Any phased construction project while occupied will need to be carefully structured to allow for sequential abatement without endangering the building occupants. Demolition of the existing building to allow for new construction will require a budget for hazardous material abatement.

As noted earlier, many existing architectural features including the masonry partitions and wire lath plaster ceilings will increase the expense and complexity of integrating new systems and code required upgrades. The new HVAC systems would be design predicated on the replacement of existing windows, doors, and roof with more energy efficient features.

IV. CODE COMPLIANCE

A. Architectural Access Board Regulations

The Massachusetts Building Code, Rules & Regulations of the Architectural Access Board, and NFPA 101 are the primary codes that must be considered when renovations and additions are planned. The Massachusetts Building Code stipulates that any legal conforming use of a building may continue until such a time that upgrades are undertaken. The building code requires that renovations and additions must meet certain criteria of the code and particular upgrades to an existing building require full compliance for new construction. Unique to Massachusetts is Chapter 34 of the Massachusetts Building Code, which addresses special conditions for repairs and renovations to existing buildings.

The Massachusetts Architectural Access Board Rules and Regulations, which encompass ADA Compliance, require that any new construction and/or renovation comply with the rules and regulations for accessibility. Also, two significant thresholds must be considered when planning additions and renovations relative to the value of the construction work. The AAB Rules and Regulations state that if any construction project is valued at more than $100,000.00 the building must provide a handicap accessible entrance and a handicap accessible toilet. Also, if any building renovation/addition value exceeds 30% of the 100% equalized assess value of the existing building, **the entire facility must be brought up to the AAB Rules & Regulations for new construction.** Since the scope of anticipated renovations and additions will greatly exceed all thresholds for AAB Compliance, the building project must be considered as requiring complete upgrade to meet the code for new construction.

To comply with AAB Rules & Regulations, every room, every building component, virtually every feature of the building will be affected and require improvement or replacement. In our opinion, compliance with the Access Board Rules and Regulations at the Sherwood School would be enormously expensive and impractical. As with the Oak Middle School project, we would expect to appeal to the Massachusetts Access Architectural Board for relief from those elements of the rules and regulations that are exceedingly expensive and provide little, if any, benefit to staff, faculty or students. Nevertheless, even with a successful appeal for relief from the Access Board Rules & Regulations the scope of work and associated construction costs to satisfy the intent of Access Board Rules and AAB Compliance will be substantial.

As described elsewhere in this report, the size of the addition and cost of construction exceeds all thresholds requiring compliance with the building code for new construction. The following scope of work is provided to generally describe the level of renovation and mandatory upgrades should MSBA and the townproceed with renovation/additions to the existing Sherwood Middle School building. Beyond the mandatory/code upgrades, a number of highly recommended discretionary improvements are listed in the second part of this section.

B. Town of Shrewsbury Zoning

B-1 Residential District Minimum Requirements for "All Other Uses" (other than single family)

- 40,000 sf lot area
- 150' lot frontage
- 50' front yard setback
- 30' side yard setback
- 50' rear yard setback
- 10% maximum lot coverage
- 35' max. building height
- 2-1/2 story building maximum

Note: The Building Inspector has indicated that educational facilities are **exempt** from the Zoning By-Laws under the "Dover Act".

Parking Requirements whichever is greater:
- 1 space per classroom and office or
- 1 space per each 3 seats in the auditorium

Site Plan review required

C. Mandatory Code Upgrades

Architectural:

- The entire building structure must be investigated and catalogued. Dependant on the level of new construction and existing structure, to conform with Chapter 34 of the Massachusetts Building Code, the building may require reinforcing for seismic restraint. See the Structural Report for more information.
- Protection of all existing means of egress with canopies over stairways, at exit ways, may be required if deemed hazardous by building official.
- Change door swings, hardware, and egress features at all rooms with occupant load in excess of 50.
- Eliminate storage room doors at stairways if deemed hazardous by building official.
- All handrails and guardrails must be replaced in stairways to comply with AAB Regulations and specific requirements for new construction.
- Full compliance with Architectural Access Board Rules & Regulations (or seek waivers from AAB)

    1. All entrances, except service entrances, must be made accessible
    2. All interior features including the cafeteria platform must be made accessible
    3. Redesign toilets to provide the required number of accessible fixtures
    4. Change all hardware to lever type
    5. Rebuild most doorways within the building to provide required push/pull clearances
    6. Eliminate all 2'-8" pair doors (typical at fire doors and exits) and install new entrances with code compliant hardware, etc.
    7. Rebuild stairways to eliminate nosings and non-compliant handrail systems
    8. Redesign the locker room for code compliance including aisle widths, fixture types, door widths, etc.
    9. Provide 2 means of egress on each floor complying with code for new construction, or, provide "Areas of Rescue" as defined by the code for new construction.
    10. Construct fire separations as required to ensure building area does not exceed code maximum.

Plumbing/Fire Suppression:

- Add a fire suppression system throughout the entire building
- Associated with the fire suppression system will be the need to upgrade the existing service
- Replace toilets, lavs, etc. to water conservation type
- Modify system to assure appropriate/code required temperature to fixtures
- Consolidate gas service to single point with emergency shutoff
- Replace all domestic hot and cold water piping

HVAC:

- For all systems and components replaced or added as new to comply with the code for new construction
- Provide modifications to existing system to comply with 20 cfm per person fresh air during occupied mode
- Convert existing exhaust system to direct exhaust to exterior
- Modify/replace automatic temperature control system to comply with current energy codes

Electrical:

- For all systems and components replaced or added as new to comply with the code for new construction
- Replace main electrical room design to meet current building codes
- Provide two way communication system throughout the building to all occupied spaces
- Replace the fire alarm system in total, designed to meet current codes and standards
- Emergency distribution system must be substantially upgraded or replaced to meet current codes
- Refer to the Electrical report for a complete description of mandatory code upgrades

Structural:

- Significant upgrade of lateral reinforcement structural system will be required based on scope of renovation, additions and existing structural conditions

Food Service:

- All plumbing fixtures must meet current code including interior and exterior grease traps
- All materials and equipment configurations must meet Board of Health regulations
- Ansul fire protection, gas shut offs, etc. must be updated

Hazardous Materials

- Full abatement or encapsulation required

D. High Priority/Discretionary Repairs

Given the age of the building ±45 years and the fact that much of the equipment is original and exceeded its life expectancy, an addition/renovation solution should address replacement of key MEP and Architectural components now rather than face the prospect of continued repairs and replacement over the next several years. The highly recommended but discretionary repairs and improvements are as follows:

Architectural:

- Replace all hardware (beyond AAB requirements) including closers, stops, hinges, etc. throughout the building
- Re-point all brick masonry and seal
- Re-caulk all openings at the exterior
- Replace roof

MEP/Electrical:

- Replace entire heating and ventilating system
- Provide technology infrastructure to support wireless communications
- Refer to the individual reports for discretionary improvements in Divisions and 15 & 16

Food Service:

- Provide gas service to replace current electric equipment

Hazardous Materials:

- Remove (rather than encapsulate) all hazardous materials

V. SUMMARY

The construction of the 1964 Sherwood Middle School building features economy grade systems for the building shell, structure, and MEP systems. The building has virtually no insulation, single pane non-thermal windows, metal frames without thermal breaks, and a marginal structural design, all well below the standards of current building codes and current engineering practice.

Coupled with the high level of code upgrades required, the cost of renovation is predicted to be high. Virtually every system will require replacement or major upgrade. All building systems (HVAC, Plumbing, Electrical) are nearing or have exceeded their expected life span and in several instances do not meet current building codes. Structural code requirements for lateral reinforcement may have significant cost and complexity implications. In addition, the masonry partitions seriously limit flexibility for layout changes.

The installation of updated systems within the existing building will require demolition of the existing wire lath plaster ceilings to allow space for new piping, ductwork, conduits, etc. as well as required structural connection reinforcement. While the plaster does not contain asbestos, it is expected that the ceiling demolition will expose asbestos insulated piping, etc. that will require abatement prior to demolition. Also, existing block walls will require significant core drilling to facilitate new mechanical and electrical system installation.

The Sherwood Middle School is currently fully occupied including the 10 modular classrooms. An addition/renovation project will include a phased occupancy plan to maintain continuity in the education program for the 900 students. The added complexity of phased construction will extend the construction period, will require consideration for maintenance of life safety and mechanical systems as they are updated in a sequential manner, and may include moving the existing modulars and/or purchasing additional temporary classrooms.

The level of renovation and additions required to accommodate the enrollment of the projected grade 5 & 6 program will exceed every threshold for compliance with AAB Rules & Regulations as well.

The structural report notes that reassignment of current uses may require structural analysis to determine if additional structure is required. Since the original building was constructed as a junior high school, the conversion to a Grades 5/6 middle school will undoubtedly include changes to the existing configuration to satisfy the program.

Despite the deficiencies described above and the implications for an expansive scope of work given the scale of renovation and addition, through competent and regular maintenance the building is generally in good condition and suitable for renovation. The analysis of any addition/renovation option will include the implications of construction during occupancy including the schedule and cost factors, the impact on the educational experience, and health and safety issues related to noise, dust, contractor access, etc. Further, an assessment of the feasibility of incorporating mandatory systems will be incorporated including: issues related to access for structural upgrades, physical space and routing for new mechanical, electrical, plumbing and fire protection systems, and maintenance of all services while school is in session.

SHERWOOD MIDDLE SCHOOL
SHREWSBURY, MA

Existing Condition Survey Report

Plumbing and Fire Protection

Prepared By

Anup S Khatra P.E, LEED AP
AKAL Engineering Inc.

July 2009

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Existing Condition- Plumbing and Fire Protection

PLUMBING

Fixtures

Existing water closets are floor mount flush valve type and most of which are not equipped with water conserving 1.6 gallon per flush type valve. The lavatory sinks are of the wall hung type, some of which have been converted to the ADA complaint type. Most main bathroom groups have been retrofitted to allow for ADA and/or MA accessibility compliance. This retrofit has forced the loss of at least one water closet in each of the main bathroom groups. Urinals appear to be more than adequate in number to accommodate current code requirements. The existing buildings plumbing systems will need to be verified for adequacy in quantity based on planned occupancy use.

Boys' locker rooms have showers of a gang configuration and girls' locker rooms have individual stalls. In each locker room, the shower water supply is controlled via a central water tempering control valve. In the boys locker room this results in water flowing from all the shower heads whenever someone must shower as opposed to utilizing water saving individual controls at each shower station. The girl's locker room showers have been retrofitted with water shut-off controls at each shower head.

Drinking fountains observed are original china fountains and are not ADA compliant

In the kitchen there are one three-bowl pot/scullery sink and a 2-bowl preparation sink and one small hand wash sink typically required to satisfy Board of Health requirements.

It appears with the exception of the ADA fixtures, most of the fixtures are of original vintage many of which are not of the water saving type. Apparently maintenance is routinely performed on faucets, toilet fill valves, etc. as needed.

During a substantial renovation and addition project, code would require that all the water closets, lavs, etc.. be modified to be of the water conservation type and that of those a certain percentage would need to be ADA complaint. In addition, water of the appropriate temperature would need to be supplied to fixtures whether by a two temperature piping system or through the use of tempering valves and/or fixtures.

Domestic Cold Water Service:

The 4" water service enters the building within the Boiler Room and reduces to 3" and runs through water meter prior to feeding the buildings domestic water loads. The 3" meter has no valve by-pass connection and no backflow preventer was found at the main line. Water piping is copper, with soldered joints. Valves are gate, butterfly and ball.

Cold water is provided to the boiler as make-up complete with backflow preventers as to avoid cross contamination. Most of the piping is insulated. Insulation appears to be mostly fiberglass covering. Water piping appears to be in fair condition and no active leaks were noticed anywhere around fitting. However, due to the pipe age, there is a probability that the water service could have lead containing solder in the fittings or contain high lead content brass pipe. We recommend water quality shall be tested and monitored for any possible lead contamination and corrected if found to be a problem. If the project involves substantial renovation, we would recommend complete replacement of all domestic water piping, valves and accessories. New backflow flow preventer will be required at the main supply line.

Domestic Hot Water Service:

The domestic hot water needs of the building are primarily supported by an indirect fired storage tank which utilizes the heating plant boiler water to generate domestic hot water. This tank has an estimated storage capacity of 1500 gallons. The current configuration requires that the heating boiler plant remain active whenever the building is occupied so as to generate the code required domestic hot water for the building, fixtures. There is a mixing valve located on the discharge of the water storage tank which tempers the water for general building use. There does not appear to be a two temperature system which would be required to satisfy code requirements for occupant fixtures (bathroom sinks) to discharge hot water at a temperature no greater than 110-112°F for safety reasons, whereas the service fixtures (janitor's sinks, kitchenette sinks, etc) are required to have hot water temperatures in excess of 120°F for sanitation reasons. The two temperature tempering system can be addressed via a separate pipe system or locally at fixtures. A separate tempering valve is provided at the locker rooms to support code required shower discharge temperatures.

No problem with pressure, quality and hot water temperature were reported during our site visit. However, due to the pipe age, there is a probability that the water service line could be deteriorated and lead containing solder may exist in the fittings or contain high lead content brass pipe. We recommend pressure test and water quality test and monitored for any possible lead contamination. If the project involves substantial renovation, we would recommend complete replacement of all domestic water piping, valves and accessories.

Soil Waste & Vent

The soil piping observed was a combination of extra heavy cast iron, with bell and spigot joints. Visible vents are galvanized steel with threaded fittings. The sanitary sewer flow is by gravity and the all the piping run below the slab and exit the building to a municipal sewer system. We noticed no outward sips of sanitary system failure. There are two grease traps inside the building. One grease trap is located in the copy room and is presently inactive. The other grease trap is in the kitchen and collects the grease laden waste from the kitchen. The building also has acid waste discharge system

and is separated from the normal sanitary system until it exits the building. Presently the acid waste discharge does not get diluted through the neutralizing tank. This type of configuration is prohibited by the current plumbing code. Per plumbing code section 248CMR 10.13, hazardous waste must be treated prior to discharge to the municipal sewer system. Also it was noted that the art room sink do not have a sediment interceptor and must be addressed for any renovation work.

Roof Drainage

The roof drains all seem to be relatively in good condition. The drains consisted of cast metal dome tops, flashing clamps/ gravel stops and cast iron bodies. Piping observed was No-Hub cast iron soil pipe and fittings. No problems with the roof drain system were observed. If areas have had blockages in the past we would recommend scoping of those, underground lines to verify their condition and address them accordingly.

Natural Gas

Natural gas enters the building in the Boiler Room. The Gas company meters and pressure regulators are located inside the boiler room. The 1-1/4" gas line enters the boiler room where it runs through a gas meter and PR. Regulator and increasing, back to a 1-1/4" line to support the heating boiler burner pilots. The gas was also size to supply to the science room table gas outlets. Presently that line has been disconnected. There is another gas service to the modular classrooms which has its own dedicated gas meter.

Plumbing Code Deficiencies and Improvement Summary

During a substantial renovation and addition project, code would require that all the water closets, lavs, etc. be modified to be of the water conservation type and that of those a certain percentage would need to be ADA complaint. In addition, water of the appropriate temperature would need to be supplied to fixtures whether by a two temperature piping system or through the use of tempering valves and/or fixtures. The main cold water supply shall be protected with the back flow preventer.

During a substantial renovation, gas piping to the building must be consolidated to one service entrance to facilitate a central point of shutoff during an emergency situation. In addition, the meter in the boiler room may need to relocated to the exterior unless a waiver can be obtained from the gas utility.

An acid neutralizing system must be provided for all fixtures discharging acidic waste. This includes upgrade of associated waste and vent piping with code complaint acid waste rated products.

Due to the age of the water piping, we consider it mandatory to replace all the domestic cold water and hot water piping within the building. This would also include

replacement of the hot water heating system so as to not need to rely on the buildings heating boilers in the warmer months.

We recommend that the entire underground sanitary sewer system shall be tested for any leakage, backup and pipe aging condition by executing static pressure test and video camera inspection.

Horizontal above ground waste and storm piping should be changed during a substantial renovation due to ***its*** *age and its susceptibility for excessive corrosion. In addition, new fixture layouts will most likely require replacement of most of the piping.*

Following is a summary of the plumbing fixture counts in the existing building and the fixtures required by Mass. Plumbing Code 248 CMR 10.10 Table 1 (educational) for 900 student occupancy.

		Plumbing Fixtures in the existing building			**Plumbing Fixtures required by Code**		
		W.C	**UR**	**LAV**	**W.C**	**UR**	**LAV**
STUDENTS (900)	Male (450)	9	10	7	5	5	5
	Female (450)	11	-	7	15	-	5
STAFF (100)	Male (50)	4	1	4	2	1	2
	Female (50)	5	-	4	3	-	2
Cafetorium (Assembly) (500)	Male (50)	-	-	-	1	1	1
	Female (50)	-	-	-	2	-	1
Kitchen	Male	1	-	1	1	-	1
	Female				1	-	1
Janitor Sink		Ground and 1st floor			Required on each floor		
Drinking Fountains		5			12		

W.C Water Closet, UR Urinal, LAV Lavatory

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FIRE PROTECTION

There is no building wide fire suppression system and no hose cabinets present in the main building. The kitchen hood in the main building has a chemical fire suppression system configured to protect the area over the gas range..
The fire suppression system serving the modular buildings is of the wet pipe type and provides essentially complete coverage throughout the modular units and interconnecting corridor. The service consists of one 4" water line which enters the modular units in a closet and runs through supervised OS&Y valves and a double check backflow preventer as required by current codes. There is also a water flow switch and a 2-1/2" single port fire department connection located adjacent to the service entrance on the front side of the building.

Fire Protection Code Deficiencies and Improvement Summary

If the existing building is renovated to any substantial degree, a building wide fire suppression system must be provided as required by code
During a substantial renovation and addition project, code would require that all areas of the building shall be protected with wet fire suppression sprinklers. The existing water supply entrance is not adequate to support the buildings fire suppression needs. Upgrade of the existing services or introduction of a new adequately sized and configured service would be required to comply with the Commonwealth of Massachusetts building code and the National Fire Protection Association (NFPA).

Following hydrant flow test information was obtained from the town:

Static Pressure: 85 psi, Residual Pressure 43 psi, Flow 840 GPM

Based on the above hydrant flow data, we feel fire pump is not required. However detail hydraulic calculation will be required during design phase to determine the viability of such requirements.

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July 6, 2009

Mr. Michael Pagano, AIA
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Re: Revised Preliminary Mechanical Systems Survey at the Sherwood Middle School
Shrewsbury, MA

Dear Mr. Pagano:

The following is a preliminary summary report outlining our observations and comments regarding the status of the HVAC, plumbing and fire suppression systems at the Sherwood Middle School in Shrewsbury, MA.

SITE INSPECTION

On June 24, 2009 we performed a site inspection of the existing building. Our observations along with review of the original contract documents and information provided by Mr. Robert Cox - Shrewsbury Superintendent of Public Buildings regarding the current building operating status were used extensively in assembling this report.

GENERAL

The building is a 2-story structure with a lower/ground floor level which varies in its below grade depth. The building was constructed in circa 1964. Within the last several years several modular classroom units have been added to the left side of the original building.

The building is primarily constructed of masonry brick/block and steel with the primary exception being that of the modulars which are of steel, wood and gypsum board construction. Most windows in the building is still of the single pane type with the exception of that of the modulars which are double pane insulating type.

HVAC – Existing Conditions

Boilers:

The buildings heating and domestic hot water requirements are currently supported by two (2) Cleaver Brooks fire tube hot water boilers. The boilers each have a rated input capacity of 5,230,000 BTUH. Each boiler has an atomizing type power burner both of which fire fuel oil.

In addition to the fuel oil supply, each the burner requires a small natural gas supply to support ignition pilot operation. This is fed from a natural gas service which enters the building in the boiler room.

The boilers discharge flue gases into a common breeching prior to entering a masonry chimney. The internal condition of the chimney is unknown.

Fuel oil is supplied from a 10,000 gallon underground fuel oil tank located adjacent to the boiler room. The tank was installed in circa 1994 and as such should be in fairly good condition being of a double wall fiberglass type with monitoring system. Fuel oil transfer pumps located in the boiler room circulate fuel oil between the tank and the oil burners.

Combustion air for the boiler room is supplied from ductwork connecting to an exterior louver. The ductwork appears to be slightly undersized to support current code requirements for combustion air. According to facility personnel, a combustion air damper in this duct is interlocked to the boiler operation.

Boiler controls appear very simple, enabling the plant into heating mode manually as determined by facility personnel. There appears to be an outdoor air reset control which controls a 3-way valve diverting water flow around the boilers and adjusting system hot water temperature in response to outdoor temperatures. This type of configuration is not recommended in that the boilers can undergo increased thermal stresses by not having adequate water flow thru the boilers and/or proper limit control of return water temperature.

The boilers are of original vintage and at 45 years of age have well exceeded their useful service life as defined in the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Applications Handbook. This coupled with their lower combustion efficiency by current standards make them prime candidates for replacement during any substantial renovation and/or addition project.

Hydronic Distribution:

Hot water from the heating plant is distributed to the building via a supply and return distribution system. The system circulates hot water to fin-tube radiation, classroom unit ventilators and heating & ventilating units located throughout the building. According to facility personnel, the pumps are enabled upon a fall in outdoor air temperature below preset limit.

The boiler room has three (3) Bell & Gossett end suction floor mounted pumps which serve the entire buildings heating needs. One pump supports two segments of the building originally defined as unit #1 & #2 and the other pump supports unit #3. Each of these pumps is backed up by a common pump which can be valved to support either zone. Unit #1 & 2 pump and the common stand-by pump are each rated (based on plan schedules) for 210 GPM at 40 ft. hd.

Unit #3 pump is rated 187 GPM at 40 ft. hd. An additional in-line pump supports the demands of the domestic hot water tank.

The pumps appear to be in operational condition however, they do show signs of both motor replacements and bearing assembly servicing which would be expected for pumps of this age. The pumps have exceeded there useful expected service life as defined in ASHRAE and as such should be considered as serious candidates for major refurbishing and/or replacement during any substantial renovation.

System water expansion is accommodated through the use of five (5) 120-gallon captive air type expansion tanks located overhead in the boiler room. The major drawback with captive air tanks is that the air will naturally migrate into the water over time, in essence oxygenating the water, and rendering the tanks ineffective. This in turn increases the amount of air in the system which can cause air binding and accelerated corrosion of ferrous components. In addition, someone must manually purge the tank of water on a regular scheduled basis to insure its effectiveness. During any significant renovation project we would recommend replacing the captive air tanks with bladder type tanks. A bladder tank creates a physical separation between the air and water used to control system water expansion whereas captive air tanks have no such separation.

The piping system and associated equipment has been designed using high temperature hot water at 220°F with a large temperature drop of 40°F. However, according to facility personnel, the system has been set to not exceed 180°F. In design of a replacement plant, we would highly recommend the use of condensing gas boiler technology and new equipment designed for a maximum water temperature of 140°F to improve overall system efficiency. If the piping system were to be reused, the equipment would have to be selected to support the high temperature drop of 40°F as well whereas a 20°F drop is more typical.

Although there were no outward signs of leakage during our inspection the condition of the piping system is unknown. Being that the piping system is of original vintage and primarily constructed of ferrous metals being exposed to oxygen from the expansion tanks, we would recommend the systems complete replacement. Or, if there were an economic need to save the piping, we would recommend having several sections of pipe analyzed to determined pipe integrity prior to allowing its reuse.

Ventilation:

Classroom style unit ventilators as manufactured by Herman Nelson (AAF) are located throughout the building, primarily supporting classroom areas. These units are located along exterior walls and each has an outdoor air louver and associate control dampers to allow outdoor air to enter the respective spaces through the unit ventilator. During occupied periods, the unit fans run continuous to provide space ventilation and pneumatic damper operators modulate face & bypass and outdoor & return air dampers to maintain space temperature. Most

units incorporate a 2-way hot water control valve with larger units utilizing 3-way diverting control valves.

The units still being operational is a testimant to good maintenance. However, they appear to be in fair to poor condition due to the high number of years of service and all have exceeded their expected service life of 20 years as defined by ASHRAE. As such, any substantial renovation should include replacement of these units.

Classroom exhaust in the building is supported by a ducted exhaust system serving each room and tying into multiple common exhaust systems. First floor systems are ducted to roof fans however, second floor classroom spaces are exhausted to the ceiling plenum space. Several gravity relief ventilators on the roof apparently open to relief the exhaust air generated by these fans. The fans, ductwork and relief terminals are not sized or configured to support relief of excessive pressure in the building when the classroom unit ventilators go into 100% outdoor air mode (i.e. late spring, summer and early fall typically). Utilizing the ceiling space as a positively pressurized relief plenum is not desirable as it promotes reinfiltration back into the classroom areas.

The original classroom outdoor air ventilation rates appear to comply with current ventilation standards of at least 15 CFM of outdoor air per occupant. However ventilation in other areas such as offices do not meet the 20 CFM per person of outdoor air required. Further review of ventilation requirements utilizing most current ASHRAE Ventilation Standard be must be performed to ascertain outdoor air requirements to specific spaces.

Most all the corridors and office spaces currently have little or not active ventilation as required by code and will need to be brought up to current ventilation standards during a renovation project. These areas are primarily heated with fin-tube radiation with local pneumatic control. Although exterior office areas have operable windows which may satisfy the natural ventilation code intent, it is not reasonable to expect one to open their window in the cold of winter or heat of summer so as to obtain the proper amount of fresh air ventilation. In addition, Interior office spaces currently utilize exhaust systems which exhaust these spaces pulling air in from adjoining rooms to support ventilation which does not adequately address the intent of the ventilation standards.

The gymnasium area is served by two (2) suspended heating and ventilation units which free blow into the space and have ducted outdoor ventilation air. These units have also exceeded their useful expected service life as defined by ASHRAE and as such should be replaced during a renovation project.

All bathrooms have ducted exhaust systems which, according to the original drawings, meet or exceed the current code required ventilation levels. According to facility personnel, all fans are operational.

There is a 100% make-up air unit for the kitchen to compensate for the hood exhaust and other exhaust systems within the kitchen. The kitchen hood exhaust system does not appear to comply with code on several issues as follows: 1) The hood grease filters and collection system do not appear to be properly configured; 2) The exhaust duct does not appear to be welded steel or be separated from combustibles and is configured as low velocity; 3) The exhaust fan does not appear to be UL listed and NFPA compliant for kitchen grease hood use; 4) Schedules indicate a backdraft damper whereas these are not allowed in kitchen hood applications.

Modular classroom HVAC needs are supported through the use of ten (10) packaged rooftop gas-fired heating & electric cooling units which are ducted to each respective classroom as well as adjoining corridors.

Controls:

Much of the control throughout the building is pneumatic with local thermostats for space temperature control and simple night setback functions established via a control panel located in the boiler room. As noted earlier, the system does appear to incorporate an outdoor reset scheme which resets the supply hot water temperature in response outdoor ambient temperatures. Modulars incorporate electric control thermostats. Any major renovation should incorporate DDC controls which can incorporate intelligent energy saving routines and ventilation control to achieve compliance with current energy code.

HVAC Improvement Summary

All the equipment in the buildings including, boilers, unit ventilators, air handlers, exhaust fans, pumps, etc… are of original vintage and have exceed the end of their useful expected service life (approx. 25-years) as defined in the American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE) Applications Handbook. As such, any substantial renovations should include replacement of all these components.

Kitchen exhaust hood and associated exhaust system must be modified to meet current codes and to protect against potential fire hazard. As a minimum the hood ductwork must be welded and of the proper gauge and the fan must be replaced to a UL 762 compliant type. In addition, proper grease filters with drainage and grease cup must be provided.

All areas of the building must have positive ventilation to meet current ventilation codes and standards. Office areas must include active ventilation to comply with most current edition of the building code and ASHRAE ventilation standard.

Current classroom exhaust systems only allow for minimum ventilation exhaust whereas the energy code would require 100% exhaust in economizer mode presuming the classrooms shall be air conditioned (cooled). If the classrooms are not being air-conditioned the classroom exhaust is adequate as configured.

The classroom exhaust systems should be ducted directly to the exterior, as the current discharge to plenum application is not allowed unless all wiring above the ceiling is plenum rated which it is most likely not.

The controls on the system must be modified to comply with current energy codes. Optimally, the new system should be a centralized energy management system capable of performing the energy saving control and setback routines as well as communicating with the Town's Johnson Controls network or equivalent open protocol system.

The entire heating plant should be considered for total replacement. In design of a replacement heating plant, we would highly recommend the use of natural gas fired condensing gas boiler technology either solely or in conjunction with a fuel oil boiler. These boilers would operate at lower system water temperatures not exceeding 140°F so as to maximize operation in the high efficiency condensing combustion mode. This type of plant can also be mated to a hybrid geothermal chiller/heater plant for supplemental heating as well as cooling.

Various options exist for improvement of the current heating distribution system. These can range from replacing the current unit ventilators with new to design of a new heating distribution system using either fin-tube radiation and/or ducted diffusion systems. Review of various options must take place to ascertain most viable solution(s).

Due to the age of the heating piping, it would be highly recommended that all the piping be replaced. As a minimum the piping systems should be tested to verify its internal condition and if found to be deteriorated this replacement would become mandatory.

If you have any questions regarding this report please do not hesitate to call.

Sincerely Yours,
Seaman Engineering Corporation

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Existing Electrical Systems Review
Sherwood Middle School
Shrewsbury, MA

Date: July 21, 2009
Prepared by: Azim Rawji, P.E.

SUMMARY

ART Engineering Corporation (ART) has been retained by Lamoureux Pagano Associates to provide an electrical systems analysis for the Sherwood Middle School in Shrewsbury, Massachusetts. ART has completed site surveys and reviewed available electrical drawings for the existing building. We have developed a Good/Fair/Poor rating system for the various electrical systems.

The Good/Fair/Poor rating system was developed to give a concise, overall assessment for each system. In general, a system rated "Good" typically is up to date with current codes and well suited for current and future space intent. A "Fair" rated system may have some equipment in need of replacement or portions not suited for current or future space programming. Systems that are rated "Poor," are not well served for current or future space programming, and are outdated or obsolete. The report considers the implications of a large addition of approximately 55,000 sq. ft. to the existing 88,000 sq. ft. building.

Most of the systems included in the study were found to have fair or poor overall ratings. There are many reasons for this, including the age and systems that do not meet current code requirements. Our good/fair/poor rating system takes into account the condition of the electrical systems as well as the types of systems, sizing and applicability for their respective spaces. We recommend that all electrical systems in the main building be replaced with new systems.

It will be difficult and costly to run new raceways and cabling in the main building due to space limitations in the corridors and masonry wall construction. If the walls are not furred out during renovations, new systems will have to be installed in surface raceways throughout the building. A new electrical service with an exterior pad-mounted transformer will have to be provided. The existing service will be maintained for the duration of the project to maintain power to the existing building.

The Massachusetts State Building Code 780 CMR requires all buildings and structures and all parts thereof, both existing and new, and all systems and equipment therein which are regulated by 780 CMR shall be maintained in a safe, operable and sanitary condition. All service equipment, means of egress, devices and safeguards which are required by 780 CMR in a building or structure, or which were required by a previous statute in a building or structure, when erected, altered or repaired, shall be maintained in good working order. The owner shall be responsible for system compliance.

The majority of the electrical systems in the building are either outdated or obsolete. It is unknown whether any of the existing systems have been maintained or tested per the manufacturer's recommendations. Future programming will require the existing systems to be replaced.

MAIN BUILDING

Electrical Service (primary and secondary);

The building electric service is rated 1600A, 208Y/120V, 3-Phase, 4-Wire. The main switchboard is located in the electric room in the basement. The switchboard is fed from three 37kVA transformers located in the utility company vault adjacent to the electric room. The transformers are fed from the utility company primary distribution system. The switchgear is by Westinghouse Company. The switchgear has an integral transfer switch and distribution section for emergency/standby power. The transfer switch is no longer in service. The switchgear is 40+ years old and at the end of its useful life. The electric room does not comply with the clearance requirements of the Massachusetts & National Electrical Code.

Based on a gross square footage of the building, the existing service capacity is approximately 7 watts/sq. ft. The electrical service is inadequate for future programming.

Normal Distribution

The panelboards are by Westinghouse Company. The panelboards are located throughout the building and are circuit breaker type. The majority of panelboards appear to be approximately 40+ years old and past their useful life. The panelboards and feeders will have to be replaced.

General Purpose Power

The general purpose power in the building is inadequate. Most of the classrooms were originally provided with only two duplex receptacles. Additional outlets have been installed in some rooms over the years but additional outlets will be required for future programming needs. The existing branch wiring is 40+ years old and will have to be replaced.

Emergency /Standby Power

The building emergency/standby power is by Katolight Corporation 125kW/156.25kVA, 208Y/120V, 3-Phase, 4-Wire generator. The generator and an Asco transfer switch is located in the generator room in the basement. The generator serves various standby/emergency loads throughout the building. The transfer switch feeds the emergency/standby distribution section in the switchgear. . Although the generator is in good condition, it is not sized to meet the future space requirements. We recommend that the generator be salvaged for use at another town facility.

The existing emergency system does not comply with the current Life Safety provisions of the Massachusetts Electrical Code (MEC) 527 CMR. MEC requires all emergency system equipment and emergency system feeders located outside of two-hour rated rooms, closets, or shafts to be enclosed within two-hour fire resistive rated enclosures or be part of an assembly that has a two-hour fire resistive rating. Existing emergency system equipment and feeders are not enclosed within two-hour fire resistive rated enclosures or part of an assembly that has a two-hour fire resistive rating. The emergency systems are required to be electrically and physically

separated from normal power equipment and wiring. The existing emergency/standby power equipment will have to be replaced.

Egress & Exit Lighting

The egress lighting consists of recessed incandescent light fixtures located in the egress pathways and in assembly (gymnasium and cafeteria) areas. The overall coverage appears to be inadequate; there are no emergency light fixtures in the classrooms or outside exit doors. The exit signs are lit by incandescent lamps, many lamps where observed to be burnt out and the overall coverage of exit signs appears to be inadequate.

Exit signs and emergency egress lighting must be provided with an emergency power backup to assure continued illumination for a duration of not less than 1½ hours in case of primary power loss, exit signs shall be connected to an emergency electrical system that complies with MEC.

Lighting & Controls

The lighting in the building is primarily fluorescent fixtures, some incandescent track fixtures and metal halide fixtures on the exterior of the building. Parking lot and building perimeter lighting is inadequate. Fluorescent fixtures with T12 lamps are located throughout the building. Lighting control is by wall mounted snap, key or push-button switches. There are no automatic light controls in the building. A few replacement fixtures and fixtures in renovated areas were equipped with T8 lamps. The T12 lamps are inefficient and the building has an approximate light power density of 1.6 to 2 watts/sq. ft. The applicable energy codes mandate a maximum light power density of 1 watt/sq. ft. for schools and Executive Order 484 requires designs to be 20% better than code.

Telecommunications

The telecommunications system comprises mostly of Category 5 cables for data and Category 3 cables for voice communications. Recent additions to the system comprise of Category 5e cables. The system is outdated and does not comply with the BICSI standards for telecommunications infrastructure. Telecommunications equipment is not installed in dedicated rooms or closets and does not comply with clearances required by the BICSI standards. A wireless data communications system is installed throughout the building. The system meets current requirements but will have to be upgraded for future building use requirements.

Fire Alarm System

The fire alarm system is a conventional panel by Simplex Recorder Company. The panel is located in the administration office. A Knox box is located on the exterior of the building. The fire alarm system is obsolete; heat detectors are located in some rooms, there are no visual signaling devices, the height and location manual pull stations does not comply with current codes. The system appears to be original to the building and doesn't appear to have a direct reporting capability to the fire department or a central monitoring station. Overall coverage of the automatic fire detection and signaling devices is poor.

Fire protection systems are required for additions where required by 780 CMR for the specific use group; for existing buildings and additions to existing buildings, where required by 780 CMR

to satisfy height and area requirements; Existing buildings, or portions thereof which are substantially altered or substantially renovated, and where otherwise required by 780 CMR for the specific use group. Future programming needs will require the building to undergo substantial renovations and the existing fire detection and signaling system will have to be replaced with new system.

School Communications and Clock Systems

The school communications system is Dukane 3200. The system comprises a main console with microphone and selector switches in the administration office, and speakers with push-to-talk buttons in the classrooms. The system is obsolete. The clock system is by Simplex Time Recorder, the system is no longer in service. The system clocks have been replaced with battery operated clocks.

Audio-Video Systems

The audio-video system comprises of TV sets on mobile carts with VCR/DVD players. There are no audio-video teaching aids (smart board, electronic media retrieval, etc.) in the classrooms. The current system is outdated.

Video Surveillance & Access Control Systems

There is no video surveillance or access control system at the school. The district is currently in the process of installing district wide access control system in all schools.

Point-of-Sale System

There is no point-of-sale system at the school.

Good / Fair / Poor Ratings

Electric Service: Poor - This building is rated poor because the service equipment is at the end of its useful life. The equipment is at a high risk of failure due to age.

Normal Distribution: Poor - This building is rated poor because the distribution equipment is at the end of its useful life. The equipment is at a high risk of failure due to age.

Emergency/Standby Power: Fair - This building is rated fair because the generator and the transfer switch are in good condition. However, distribution panels and feeders do not comply with current codes for supplying life safety loads.

Egress & Exit Lighting: Poor - This building is rated poor due to poor coverage of egress lighting and non-compliant emergency power system. The equipment poses a life safety risk due to poor coverage and non-compliance with current codes.

Lighting & Controls: Poor - This building is rated poor due to inefficient T12 fluorescent fixtures and lack of automatic controls. The equipment contributes to higher operating costs for the building.

Telecommunications: Poor - This building is rated poor due to the outdated cabling infrastructure.

Fire Alarm: Poor - This building is rated poor due to the obsolete fire alarm system and lack of proper coverage of the automatic fire detection and signaling devices. The equipment poses a life safety risk due to poor coverage and non-compliance with current codes.

School Communications & Clock Systems: Poor - This building is rated poor due to the obsolete school communications system and non-working clock system.

Audio-Video Systems: Poor - This building is rated poor due to the outdated audio-video systems.

Video Surveillance & Access Control Systems: Poor - This building is rated poor due to the lack of video surveillance and access control system.

Recommendations

Any new building system or portion thereof shall conform to 780 CMR for new construction to the fullest extent practical. However, individual components of an existing building system may be repaired or replaced without requiring that system to comply fully with the code for new construction unless specifically required by 780 CMR.

The majority of the electrical systems in the building are either obsolete or outdated. Individual components cannot be repaired or replaced. All systems will have to be replaced with new.

Repairs / upgrades

a. Upgrade electrical service and provide new main switchgear and distribution equipment.
b. Install energy meter at the electrical service with Ethernet communications and software.
c. Provide new emergency/standby generator, transfer and power equipment. Emergency equipment must be separated from normal and standby power equipment per the Massachusetts Electrical Code. All emergency equipment and feeders must be installed in 2-hour rated rooms/closets or must be 2-hour rated.
d. Replace existing light fixtures with new super T8, T5, compact fluorescent and/or LED light fixtures.
e. Provide new egress lighting to provide adequate coverage. Properly feed egress lighting from an emergency power supply to comply with applicable codes. Provide new exit signs with LED lamp source.
f. Install occupancy sensors in all offices, bathrooms and classrooms. Install low voltage lighting control panels to control corridor and common area lighting.
g. Integrate lighting controls with HVAC system to optimize energy performance of the building.
h. Provide new telecommunications cabling infrastructure per the BICSI standards. Utilize Category 6/6A cabling infrastructure. Install telecommunications equipment in dedicated rooms/closets.
i. Provide new managed wireless data communications system with a controller and a/b/g/n radios.
j. Provide new fire alarm system to provide proper coverage of the automatic fire detection and signaling devices.
k. Provide new school communication and clock systems.
l. Provide new VoIP PBX system.
m. Provide new audio-video systems in classrooms.
n. Provide new sound system in the gymnasium.
o. Provide new video surveillance and access control system.

MODULAR BUILDING

Electrical Service (primary and secondary);

The building electric service is rated 600A, 208Y/120V, 3-Phase, 4-Wire. The main switchboard is located in the electric room on the first floor. The switchboard is fed the utility company primary distribution system. The switchgear is by Westinghouse Company. The switchgear is approximately 15 years old.

Based on a gross square footage of the building, the existing service capacity is approximately 19 watts/sq. ft. The electrical service is adequate for future building use.

Normal Distribution

The panelboards are by Westinghouse and Siemens Company. The panelboards are located throughout the building and are circuit breaker type. The majority of panelboards appear to be approximately 15 years old.

General Purpose Power

The general purpose power in the building appears to be adequate. Additional outlets may be required depending on the future program and use changes.

Emergency/Standby Power

The modular building does not have an emergency/standby power system.

Egress & Exit Lighting

The egress lighting consists of recessed self-contained emergency lighting units located in the egress pathways. The overall coverage appears to be adequate; there are no emergency light fixtures outside the exit doors. The exit signs are lit by incandescent lamps, some lamps where observed to be burnt out and the overall coverage of exit signs appears to be adequate.

Lighting & Controls

The lighting in the building is primarily fluorescent fixtures with T8 lamps. There are no automatic lighting controls in the building.

Telecommunications

The telecommunications system comprises mostly of Category 5 cables for data and voice communications. Recent additions to the system comprise of Category 5e cables. The system is outdated and does not comply with the BICSI standards for telecommunications infrastructure. Telecommunications equipment is not installed in dedicated rooms or closets.

Fire Alarm System

The fire alarm system is an addressable panel by Gamewell Company. The panel is located in the lobby. Automatic fire detection devices were observed in the corridors and classrooms; fire signaling devices were observed in the corridors and classrooms; manual pull stations were observed at egress doors. The system appears to be code compliant.

School Communications and Clock Systems

The school communications system is an extension of the Dukane system in the main building. Clocks are battery operated.

Audio-Video Systems

The audio-video system comprises of TV sets on mobile carts with VCR/DVD players. There are no audio-video teaching aids (smart board, electronic media retrieval, etc.) in the classrooms. The current system is outdated.

Video Surveillance & Access Control Systems

There is no video surveillance or access control system at the school. The district is currently in the process of installing district wide access control system in all schools.

Point-of-Sale System

There is no point-of-sale system at the school.

Good / Fair / Poor Ratings

Electric Service: Good - This building is rated good because the service is adequately sized and the distribution equipment is in good condition.

Normal Distribution: Good - This building is rated good because the distribution equipment is in good condition.

Emergency/Standby Power: Poor- This building is rated poor because there is no emergency/standby system in the building.

Egress & Exit Lighting: Fair - This building is rated fair due to burnt out lamps in the exit signs.

Lighting & Controls: Poor - This building is rated poor due to lack of automatic controls.

Telecommunications: Poor - This building is rated poor due to the outdated cabling infrastructure.

Fire Alarm: Good - This building is rated good because of the addressable fire alarm panel and adequate coverage of the fire alarm devices.

School Communications & Clock Systems: Poor - This building is rated poor due to the obsolete school communications system and non-working clock system.

Audio-Video Systems: Poor - This building is rated poor due to the outdated audio-video systems.

Video Surveillance & Access Control Systems: Poor - This building is rated poor due to the lack of video surveillance and access control system.

Recommendations

It is anticipated that the modular building will not be used in a permanent solution for the school. No repairs/upgrades are recommended other than maintenance of the equipment per the manufacturer's recommendations and the Massachusetts State Building Code 780 CMR.

Sherwood Middle School
30 Sherwood Avenue
Shrewsbury, Massachusetts

780 CMR 3408
Structural Review

July 24, 2009

Prepared by:
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Massachusetts State Building Code, Chapter 34
Structural Review- Sherwood Middle School

Shrewsbury, Massachusetts
July, 2009

Introduction:
The Sherwood Middle School is an approximately 88,000 ft^2 brick veneered building built by the Town of Shrewsbury in 1964, and is being investigated for a complete renovation with a structurally isolated addition to increase the area of the school to support an increasing student population. It is our understanding that the finished renovation/addition will contain approximately 144,000 ft^2. In addition to the existing main building, there is an approximately 11,000 ft^2 modular classroom building attached, but it is our understanding that the modular classrooms have reached the end of their useful life and will not be included in the future design options. Another possibility being considered is to abandon this school, and build an entirely new school, which will be designed in accordance to the building code requirements for new construction. This report will describe the existing conditions of the existing structure, as well as establish guidelines in accordance with the Massachusetts State Building Code to renovate the building while increasing the public safety of the building.

General:
This report presents the results of our Massachusetts State Building Code (MSBC) Structural review of the Sherwood Middle School. Our review has been completed in conformance with Chapter 3408 the Seventh Edition of the Massachusetts State Building Code, which became effective September 1, 2008.

Basis of the Report:
- This report is based on the visible observations during our site visit on June 24, 2009.
- Original Construction Drawings S1 through S7, by "Tiot Engineering, Inc." that were included in the full construction set by "Korslund, Le Norman & Quann, Inc. Architects" dated March 22, 1963.

Our observations of the existing building were limited to what was readily visible. We did not evaluate strengths of materials, remove finishes, or take measurements; therefore, we are unable to comment on any structural capacities or deficiencies of the existing structural systems.

Building Description:
The school consists of three structurally isolated wings that branch out from the main entry of the building; refer to Figure 1 for general building layout. The building does not appear to have undergone any major renovations other than installing an elevator in 1991. Regular maintenance has included reroofing the building approximately 18 years ago, and it is our understanding that the building is due to be reroofed in the near future. The school framing includes:

- Concrete foundation walls and spread footings.
- 4" Concrete slabs on grade.
- Unreinforced concrete masonry bearing walls isolated footings.
- Unreinforced concrete masonry partitions on thickened slabs.
- Brick veneer backed up by unreinforced concrete masonry bearing walls.
- Precast concrete columns at exterior wall window openings.
- Structural concrete slab (11 ¾") at second floor gymnasium.
- Elevated concrete slabs with metal deck centered on structural steel beams.

- 1 ½”- 18 GA metal deck
- 2” Shear studs at Units #1 & 2
- 3” Concrete slab (total thickness)

- 2 ½” wood fiber plank deck roof system with bulb tees on steel beams or long-span steel joists.

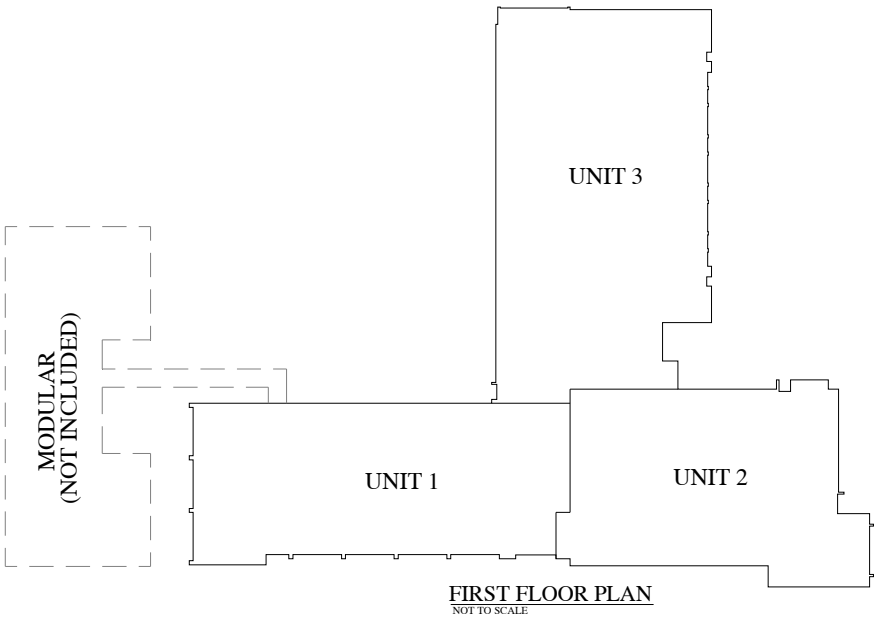


Figure 1-Plan

Existing Conditions:
In general, the existing building appears to be in good condition. The interior of the building appears to be well kept, showing minimal structural distress and minor aging at the exposed roof deck in the gymnasium. In the gymnasium there are several masonry cracks at the north and south interior walls due to concrete floor slab creep. It is our understanding that at least one masonry wall was added below the structural slab to reduce the effects of creep on the masonry bearing walls above the structural slab. Otherwise, the building is in generally good condition with minor masonry deterioration due to the age of the building that will require usual repointing during any renovation. The existing roof is an EPDM roof that is approximately 18 years old, and is due to be replaced with any renovation to the building.

Unit 1: Two-Story Classroom Building
The main structure at the two-story classroom building consists of:

- Concrete foundation walls and spread footings.
- Concrete slabs on grade.
- Unreinforced concrete masonry bearing walls at the exterior walls and along the interior corridor.
- Brick veneer.
- Precast concrete columns at exterior wall window openings.
- Second floor- Concrete slab centered on metal deck and steel beams.
- Roof- Wood fiber plank decking on structural steel beams.

There are interior unreinforced CMU partitions that run perpendicular to the main corridor separating the classrooms. These interior partitions are most likely not adequately braced at the top of wall at both the floor and roof, and will require structural supports to resist the code mandated loads in- and out-of-plane of the walls.

Figure 2: Unit 1 South Elevation with Modular Classroom

Unit 2: One & Two-Story Classroom and Dining Building

The two-story classroom section represents a minor portion of Unit 2 at the intersections with Units 1 & 3, otherwise the majority of Unit 2 is a one-story building. The construction type and condition for the two-story portion is similar to Unit 1.

The one-story dining/common area building consists of:

- Concrete foundation walls and spread footings.
- Concrete slabs on grade.
- Unreinforced concrete masonry bearing walls at the exterior walls and along the interior corridor.
- Brick veneer.
- Precast concrete columns at exterior wall window openings.
- Roof- Wood fiber plank decking on structural steel beams.

Originally, there was a 4 foot wide roof structure cantilevered off the face of the building above the dinning room windows, and it has been removed leaving the steel beam at the head of the windows exposed.

There are interior unreinforced CMU partitions that run perpendicular to the main corridor separating the classrooms. These interior partitions are most likely not adequately braced at the top of wall at both the floor and roof, and will require structural supports to resist the code mandated loads in- and out-of-plane of the walls.

Figure 3: Unit 2 North Elevation

Unit 3: Two-Story Classroom and Gymnasium Building with Partial Basement

The two-story classroom and gymnasium building with a walkout basement consists of:

- Concrete foundation walls and spread footings.
- Concrete slabs on grade.
- Unreinforced concrete masonry bearing walls at the exterior walls and along the interior corridor.
- Brick veneer.
- Cast-in-place concrete framed slab at the gymnasium (11 ¾" slab, bearing walls at exterior edges and three interior posts and drop panels).
- Precast concrete columns at exterior wall window openings.
- Roof- Wood fiber plank decking on structural steel beams at the classroom portion, and wood fiber plank decking on long span joists at the gymnasium.

Similar to the other units, there are many unreinforced masonry partitions perpendicular to the main corridor. These interior partitions are most likely not adequately braced at the top of wall at both the floor and roof, and will require structural supports to resist the code mandated loads in- and out-of-plane of the walls.

Figure 4: Unit 3 East Elevation

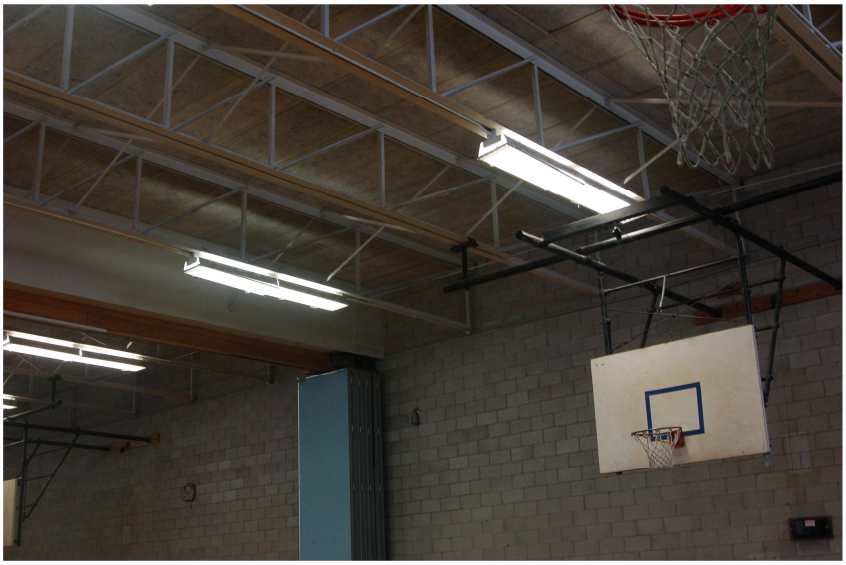


Figure 5: Gymnasium

Building Code Review- Structural:
This review presents our interpretation of the structural requirements of the 780 CMR 3408 "Structural Requirements for Existing Buildings," of the Massachusetts State Building Code, Seventh Edition, as they apply to the renovation of the Sherwood Middle School. In general, "The provisions of 780 CMR 34 are intended to maintain or increase public safety, health, and general welfare in existing buildings by permitting repair, alteration, addition, and/or change of use without requiring full compliance with the code for new construction except where otherwise specified in 780 CMR 34."[1]

3408.3 The building is classified as Pre-1975 building. The original construction drawings are dated March 22, 1963.

3408.4 Level of Work on Existing Building: Level 3 (3408.4.4)
Level 3 was chosen because it is our professional opinion that installation of new shear walls or vertical frames that will provide more than 35% of the lateral force resistance required for level 2 work, mainly in the orthogonal direction that is perpendicular to the corridors, will be required.

3408.5 Restricted Uses:
It is our understanding that portions of the building will be classified as Assembly Use Group A-3, but the occupancy load for the Assembly Use areas will not exceed the 1,200 occupant threshold specified for Assembly Use Group A-3. Therefore, the requirements set forth under Restricted Uses will not be applicable to this project.

3408.6 Structural Investigation of Existing Building: Level 3 to meet 3408.6.2 requirements.

3408.6.2.1.1 Gather documentation of existing building: Original construction drawings were gathered by the Architect.

3408.6.2.1.2 Dimensions and layout were determined from existing drawings.

3408.6.2.1.3 Perform field survey to assess condition of structural elements: Field visit was completed June 24, 2009 to review exposed conditions. Hidden conditions that may arise during construction will be reviewed as required.

3408.6.2.1.4 Identify load paths: The building has load paths consisting of roof and floor diaphragms and unreinforced masonry walls acting as bearing/shear walls. The gravity load paths appear to be schematically adequate, but the lateral load resisting systems do not appear to be adequate to resist the required seismic loads that are now required by the Building Code. The roof diaphragm consists of fiber cement panels on bulb tee sub-frames, which will need to be reviewed to verify adequate diaphragm resistance.

3408.6.2.2 Foundations and geotechnical explorations:
3408.6.2.2.2 Level 3 Work: It is our understanding that a structurally isolated addition to the existing building will most likely be included with any building renovation, so a geotechnical investigation will be required for any new construction. Also, any modifications to the existing foundations for new loads or seismic systems will require a geotechnical investigation. It should be noted that the existing foundations were installed with 3'-6" (minimum) of frost protection, current building code

[1] Massachusetts State Building Code, Seventh Edition, 780 CMR 3400.1

requirements are 4'-0" (minimum) of frost protection. During our site visit, we did not witness any damage to the building from frost heaving. Any future work adjacent to the existing structure may require local underpinning or special design of frost protection systems in accordance with ASCE 32-01 "Design and Construction of Frost-Protected Shallow Foundations" in order to meet current frost protection requirements.

3408.6.2.3 Structural evaluation of the existing building:

3408.6.2.3.1 Existing structural materials: In accordance with 780 CMR 3408.9.2.3 we have used the following material properties for our review:

Structural Steel: A36, Fy= 36,000 psi
Steel Joists: A36 Materials, Fy= 36,000 psi, Joist allowable = 30,000 psi
CMU, Masonry: F'm= 1,500 psi

It should be noted that the original Architectural Drawings label the masonry walls as either "pumice, cinder, or concrete." Based on our site visit, both the interior partitions and bearing walls appear to be concrete masonry units.

3408.6.2.3.2 Repairs: There were no structurally hazardous conditions noticed during our site visit. Should hazardous conditions be discovered during construction, they will be addressed.

3408.6.2.3.4 Level 3 Gravity load capacity:
The original Construction Documents indicate design Live Loads of:

Classrooms & Laboratories:	50 psf
Other Floors:	100 psf
Roof:	30 psf + local drift of 50 psf

Roof note: Roof to be reviewed with Code Mandated load of 85% of current snow loads = 0.85 x 0.7 x 55 x 1 x 1 x 1 = 33 psf.

The classroom floors are typically framed with a 3" concrete slab (total thickness) with 1 ½"-18 gage metal deck centered on wide flange steel beams. The steel beam sizes are increased where supporting CMU walls, indicating the beams have been designed to support the increased dead loads at walls, which will make it difficult to relocate walls during a renovation. We have reviewed the gravity load capacity of several typical beams, and it is our opinion that the existing floor framing was designed near the allowable limits of the material. Due to the beams being designed close to their allowable structural limits, any additional loads or modifications to the existing framing will not be easily accomplished without installing new framing members, which will be difficult with unreinforced masonry bearing walls.

The roof is typically framed with precast wood fiber planks supported on bulb tees that span between steel beams or joists. The spacing of the steel beams is typically just less than 9'-0" on-center. We have reviewed the gravity load capacity of the plank and steel beams, and it is our opinion that the precast wood fiber plank is capable of supporting the current snow loads, provided the planks and their supports are in good condition. If a new building addition is installed adjacent to the existing roof, causing banked snow, the roof framing would have to be reviewed for the additional loads. The steel beams appear to be designed very near the allowable stress limits of the members, so they will most likely not be able to support any new loads (mechanical, banked snow, etc.) without installing supplemental framing, which

similar to the floor framing, may not be easily accomplished with the unreinforced masonry walls and wood fiber planks.

In general, the building appears to be designed to adequately support the original gravity loads, but any new sizeable loads will most likely overstress the existing members.

Modifications to the existing framing will be difficult due to the types of framing used, and may require installing new reinforced masonry walls or steel framing with new foundations.

3408.6.2.3.5 Lateral load capacity: Loads were developed according to the requirements of 3408.7.4 (Lateral load for existing buildings, Level 3). The seismic loads were generated in accordance with ASCE-7 for unreinforced masonry shear walls, which would not be acceptable for new construction, but would be structurally acceptable for buildings renovated in accordance with Chapter 3408 of the MSBC.

The lateral load governing the four building segments were as follows:

Unit 1:	1. Wind:	N-S Direction =	37 Kips
		E-W Direction =	17 Kips
	2. Seismic:	35% of Code Mandated Current Load	
		= 0.35 x 410 Kips =	**142 Kips**
Unit 2:	1. Wind:	N-S Direction =	17 Kips
		E-W Direction =	13 Kips
	2. Seismic:	35% of Code Mandated Current Load	
		= 0.35 x 410 Kips =	**56 Kips**
Unit 3:	1. Wind:	N-S Direction =	38 Kips
		E-W Direction =	65 Kips
	2. Seismic:	35% of Code Mandated Current Load	
		= 0.35 x 640 Kips =	**224 Kips**

The three school buildings were designed with no primary lateral force resisting system, which was typical at the time of construction. The unreinforced masonry bearing walls are currently acting as shear walls, and we will assume that the walls will continue to provide lateral load resistance. With these loads, we reviewed the shear capacity of the existing unreinforced masonry walls based on f'm = 1,500 psi. The allowable shear stress for the unreinforced masonry walls is 37 psi in accordance with ACI 530.

In order to review the lateral load capacity of the existing buildings, assumptions had to be made concerning the ability of the existing masonry walls to resist lateral loads, and whether the existing diaphragms are able to resist and distribute the loads to the walls. The existing unreinforced masonry walls include bearing walls, interior partitions, and exterior walls.

Our assumptions include:

- Interior masonry partitions will not be included in resisting the lateral forces due to lack of connection details to the diaphragms and adequate foundations are not present.

- Interior and exterior bearing walls will act as the lateral load resisting elements, with the understanding that should the building be renovated, additional connections from the diaphragm to the walls may be required.
- Brick veneers will not be included in the lateral force resisting calculations.

Floor diaphragms: The framed floors for Units #1, #2 & #3 include 1 ½" steel deck with 3" of concrete fill, or an 11 ¾" structural concrete slab. Both types of slabs have at least minimal reinforcing. It is our opinion that the existing floor diaphragm meets the minimum requirements of the building code, as long as the diaphragm spans between shear walls or structural bracing is limited to short distances to limit the chord forces. Currently, the locations and spacing of the bearing walls exceed, or provide poor diaphragm conditions orthogonal to the main corridor of each building. This will need to be addressed with installing new shear walls or bracing in each building to limit the diaphragm forces at the floors.

Roof diaphragms: The roof diaphragm for all three buildings consists of precast wood fiber planks supported on bulb tees with a cement binder. This type of construction provides minimal resistance to roof shear loads, even when properly constructed and maintained. The design shear values would be reduced to near zero if there has been any water infiltration damage to the tiles. Similar to the floor, the spacing between bearing walls, as well as their location will determine chord forces as well as the tributary lateral load at each wall. The current spacing and location currently creates high chord forces between walls in the direction perpendicular to the main corridors at each building. It is our opinion that the existing roof diaphragm does not provide adequate resistance to seismic loads mandated by the current Building Code. We would recommend either installing steel horizontal bridging below the existing planks, or removing the existing roof panels and installing metal decking to provide an adequate roof diaphragm. Also, additional shear walls or bracing will be required in each of the three buildings to limit the diaphragm spans as well as provide adequate resistance in each direction.

Masonry walls: With the assumption that the lateral loads will be able to be transferred to the unreinforced masonry bearing walls adequately, the shear stresses in the walls will be less than the allowable limits. This is assuming that the torsional resistance of the building will adequately distribute the loads to the masonry walls, which will require new walls or braces at even spacing or weak ends of the building in order to accomplish.

3408.6.2.4 Structural Details:

3408.6.2.4.1 Connectivity of the primary structural elements:

Floors: Typical framing consists of steel wide flange beams bearing on unreinforced masonry walls. The beams are connected to the walls with steel bearing plates and anchor bolts set in brick piers. Bearing walls are tied to the metal deck with continuous angles and anchor bolts where bearing walls are parallel to typical beam spans. In general, the connections are adequate for gravity loads, but due to lack of reinforcing in the walls, do not provide adequate resistance for out of plane loads to the walls. At the large window openings, where precast columns are located, the main floor beams are bolted to the precast columns at the floor level, but the spandrel beams are not connected to the floor decking or slab and only support the exterior wall at the window opening. This condition causes a discontinuity of the

diaphragm edge, as wells as reduces the ability to develop chord forces in the diaphragm.

Roofs: Similar to the floor framing, the roof beams bear on steel plates with anchor bolts. Otherwise the roof plank is clipped to a continuous steel plate anchored to the walls. Similar to the floor, the structural connections at the roof provide adequate resistance to gravity loads, but seismic loads will exceed the allowable connection capacity under the current wall configuration. Installing new seismic resisting walls or bracing will most likely reduce the connection loads to an acceptable level, otherwise new bracket connections will need to be installed at the tops of designated shear walls.

3408.6.2.4.2 Existence of anchors connecting floor and roof diaphragms to masonry walls: We have reviewed the details shown on the existing Architectural and Structural Drawings, and it appears that the masonry bearing walls are connected to the floor and roof diaphragms with either steel beams and anchor bolts, steel angles bolted to the walls, or plates with straps to the walls. We were unable to determine if interior masonry partitions are adequately connected to the floor or roof diaphragms since the details were not found on the original Construction Drawings, and ceilings were covering the conditions in the field. Based on our experience, the interior partitions are most likely built up to the underside of the floor or roof framing, but are not connected to the diaphragm adequately to resist the code mandated loads in- and out-of-plane for the wall. These conditions would need to be field verified, and adequate connections would need to be developed under any plans to renovate the building.

3408.6.2.4.3 Existence of unreinforced masonry parapets and their connection to the roof diaphragms and their thickness: The only roof parapets are located at the elevator enclosure, and the heights of the parapets are within specified requirements.

3408.6.2.4.4 Masonry walls, ratio of distance between lateral supports to thickness of walls. The current limitation is a ratio of 18 for unreinforced masonry walls. We have reviewed the three structures and the masonry walls appear to conform to the span-thickness ratios.

3408.6.2.4.5 Existence of brittle connections of precast concrete cladding components: The veneer of the building is mainly brick that was connected to the masonry backup with headers. The only precast concrete elements at the exterior of the building are at the window openings, which include; columns between the window frames, sill members, and header lintels. Typically, the precast columns are connected to the structural steel beams with a bolted connection, and the head and sill members are built integrally with the masonry wall. We did not identify any brittle connection to precast concrete cladding.

3408.9.1.1 Stiffness and deflection control for Unreinforced Masonry (URM) bearing wall building: The maximum allowable story drift for seismic loads shall not exceed 0.007h, where h is the story height. The floor to floor height of the building is typically 11'-4", which limits the story drift to 0.95". We have performed calculations to determine the story drift based on the seismic loads required by 3408.6.2.3.5, with the assumption that the seismic loads will adequately be transferred to the masonry walls. The calculated story drift was 0.005", which was well below the allowable requirement.

Conclusions and Recommendations:
The purpose of this report is to identify any structural deficiencies and liabilities that will need to be addressed during any substantial renovation, which we understand, is being considered. The report is based on the premise that the existing building will remain in use as a school, and room live loads will not change; otherwise the structural framing will need to be reviewed for the higher design loads and will most likely exceed allowable design stresses. We have reviewed the existing Sherwood Middle School in accordance to Chapter 3408 of the Massachusetts State Building Code, Seventh Edition. We have reviewed the general conditions of the building, as well as the structural modifications that will need to be addressed as part of the renovation to increase the public safety of the building. This report, in its entirety, shall be used as the basis for the renovation. The following items are meant to highlight conditions or deficiencies noted in the report, but do not limit the work required.

General Information:

- Existing main building area is 88,000 ft^2. There is also an 11,000 ft^2 modular classroom.
- The 11,000 ft^2 wood framed modular classrooms are approximately 15 years old and are in need of regular maintenance. We understand that the modular classrooms will not be included in future building use after any addition/renovation.
- The proposed renovation/addition will produce a finished building of approximately 144,000 ft^2.
- The existing roof membrane is approximately 18 years old, and is due to be replaced.
- Any structural work associated with the renovation/addition shall conform to 780 CMR 3408, and specifically any additional requirements for Level 3 work.
- The Assembly Use A-3 occupancy does not exceed the 1,200 occupant threshold for Restricted Uses, and does not trigger a change from the Level 3 review to a more restrictive review.
- Should the renovation project be abandoned and an entirely new building be considered, the new building design shall be in accordance with the Massachusetts State Building Code, current edition.

Existing Conditions:

- Unreinforced masonry partitions are most likely built-up to the underside of the framing, but do not appear to have been adequately connected to the floor and roof diaphragms to resist seismic loads. We recommend remedial action be taken during the construction phase to install new anchors at the floor and roof to secure the masonry walls to the diaphragms for in- and out-of-plane loads required by the Building Code.
- Masonry settlement cracks in the gymnasium require remedial work. Distress is due to concrete floor creep, which has been arrested with the installation of CMU walls below the concrete slab. Distressed walls will need to be re-pointed.
- Existing foundation designed with 3'-6" of frost protection. Any future work adjacent to the existing foundation to meet current 4'-0" frost protection requirements. Local underpinning or special frost protection systems may be required at interface of new and existing foundations.

Structural Requirements:

- Geotechnical exploration will be required for any new construction, as well as any structural foundation work to the existing building.
- Roof snow loads:

    - Original: 30 psf.
    - Renovation: 33 psf plus drift caused by any additions or new roof elements.
    - Additions: In accordance with Massachusetts State Building Code
- Gravity load resisting systems appear to be designed close to allowable design limits, which will limit the ability to change use, framing layout, or add sizeable loads.
- Lateral load resisting system requires significant modification to conform to current Code requirements.
    - Diaphragms at the roof level require strengthening with either new metal decking, or horizontal bracing to resist and transfer diaphragm forces.
    - New shear walls or bracing systems are required to provide a regularly spaced and organized system layout, in accordance with accepted engineering practices. Also, to reduce the diaphragm chord forces at each of the three buildings in the direction perpendicular to the main corridor of each building.
        - Existing interior and exterior bearing walls can remain in service as unreinforced masonry shear walls.
        - New shear walls/braces will require structural attachment to the existing diaphragms, as well as new foundations to resist the Code mandated loads.

Based on our review of the existing conditions, as well reviewing Chapter 3408 of the Massachusetts State Building Code, it is our professional opinion that the existing building is structurally capable of being renovated and reused as a school, but it may not be financially feasible. Should the Town of Shrewsbury choose to renovate the building, it should be done with the understanding that required structural upgrades noted in this report will only bring the building up to the minimum standards of the Building Code for existing buildings, and will not meet the Building Code requirements for new buildings. The requirements noted in this report will <u>not</u> increase the gravity load capacity of the structure, which will limit the flexibility of any renovation. Limitations include changing room uses to higher load requirements, changing wall layouts, and ability to install new roof mounted equipment.

FOODSERVICE NARRATIVE

Sherwood Middle School

30 Sherwood Avenue

Shrewsbury, MA

Prepared By:

Colburn & Guyette Consulting Partners, Inc.

201 Oak Street, Suite 12

Pembroke, MA 02359

July 10, 2009

FOODSERVICE

The following is a narrative description of the existing foodservice operation at the Sherwood Middle School.

EXISTING CONDITIONS

At the time of the inspection the kitchen and servery equipment were secure and idle for the summer break. Typical back of house functions are in place. Major functions include items such as storage that have a combined walk-in cooler/freezer, dry storage room, food preparation tables, sinks, and associated equipment, cooking equipment (all electric), pot washing area and bakery work space. The kitchen exhaust hood, fire suppression system and associated ductwork/fan are in place as well.

The existing contiguous straight-line servery includes six points of service consisting of three hot food sections, three utility service sections. Two of the utility service sections hold countertop iced cold wells. The remaining utility service section holds a pass-through refrigerated countertop merchandiser. There are three entrances and a single door and a double-door exit. Self-service areas include a mobile salad bar, refrigerated beverage merchandisers, condiments and tray-pick-up. The existing contiguous straight-line serving counter is constructed from all stainless steel on legs. The fronts are stainless steel with laminate panels. Tops are solid stainless steel with tubular stainless steel tray slides. Tray slides have been retro-fitted with clear fiberglass tops. Within the serving counters are existing electrical and plumbing connections. There is a canopy exhaust hood over the cooking equipment.

Some existing equipment can be reused. An authorized service agent will perform an evaluation on the existing equipment. This process will identify equipment that is either in need of repair or requiring replacement. As part of this process, an existing equipment inventory will be preformed to document all items, this will assist in determining/identifying equipment that will be reused, removed or replaced. In general, the cooking equipment appears to be in good shape, which opens the opportunity for re-use, with the exception of the exhaust hood, (2) double convection ovens and the fryers. The ductwork/fan(s) associated with the kitchen exhaust hood require evaluation before use. The ductwork should be viewed for grease build-up on the interior, and the mechanical system to be evaluated for current mechanical code compliance. The exhaust air quantities require testing to ensure they are meeting necessary CFM volumes for current cooking equipment below and consideration of any changes made in the cooking line.

In the servery, the contiguous straight-line service counter, while it appears to be in re-usable conditions, provides limited flexibility for serving food. The hot food wells will be evaluated for working condition. There are no refrigerated cold food wells. The stainless steel top of the service counter has several screws that appear to have been cut at the countertop level rather than removing them with a screw driver. Tray pick-up,

condiment, trash and cashier counters should be provided in addition to the main serving counters.

The original dishroom no longer exist. A new dishroom with adequate equipment should be considered based on needs.

The one handsink in the kitchen will not meet Department of Health Code.

Iced cold wells at the service line are not allowed by Health Code. Typical for non-packaged product.

The exposed Philips head screws that were used to secure the Plexiglas at the stainless steel tubular tray slides are not up to health code because they are not a smooth cleanable surface.

There is standing condensate water in a bin below the Dasani reach-in refrigerated merchandiser. Standing water is not allowed by Health code.

Floor tiles are missing. They should be replaced.

Some electrical box faces are rusted. They should be replaced.

Other than as a bakery table, wooden top table are typically not allowed by the Health Department. There are three wooden top tables.

The layout of the kitchen can be remodeled to allow for more efficient production.

At the time of inspection the cooking equipment was not in use but the kitchen and servery area were very hot. When kitchen is in full-use the working conditions must be difficult.

In a couple areas there were tripping hazards due to the location of electrical panels that were stubbed-up in the floor.

There should be a review with the foodservice operator to confirm that the size of the walk-in cooler/ freezer is adequate based on current and future needs. In addition, existing walk-in cooler/ freezer is old. Parts of the flooring are starting to buckle. If utility savings are important a new walk-in cooler/ freezer should be considered.

Drawers in work tables and service counter were either very difficult to open or they would not open at all.

Mobile ingredient bin has rusted casters. Should be replaced.

All cooking equipment is electrical. If gas is available it should be considered in lieu of electric.

RECOMMENDATIONS

ADDITION/ RENOVATION SCOPE

The current kitchen/ servery, which includes storage and office space, is approximately 2100 square feet. If part of the goal is to add a dishroom we suggest that an area of approximately 2700 – 3200 square feet is more appropriate, contingent upon whether a straight-line or scattered service line is implemented.

There are currently three serving lines. The kitchen servery needs to be able to serve 900 total students. Assuming there will be three separate lunch periods, each lunch period with have 300 students. A typical guideline for the amount of serving lines is one serving line per 100 students. Therefore, three serving lines are appropriate.

The existing equipment for the serving lines should be replaced. The existing serving lines have very little flexibility and components that will not pass Health Department scrutiny. The iced-cold food wells should be replaced with refrigerated cold food wells that meet NSF-7 regulations and proper tray slides should be provided at the serving counters to satisfy Department of Health requirements. By replacing the existing service lines with new modular units there will also be an opportunity to re-arrange the serving lines at a later date if the program changes. There will also be an opportunity to improve upon the flow of the service lines by incorporating key food stations such as the salad bar to the line, and potentially moving the cashier station further into the seating area.

The exhaust hood is old and does not appear to have a UL listing and should be replaced. The associated duct and fan system should be evaluated by the engineering team for code compliance. The air volume should be calculated / measured and these volumes should be compared to current code requirements for the cooking equipment below. In addition, the existing fire suppression system for the hood should be tested and replaced as necessary.

Of the existing cooking equipment below the hood the two double convection ovens and the fryer should be replaced with new models. We recommend a complete audit of all the existing equipment be done and that a report be provided that details the condition of this equipment. The report would typically include an evaluation on the usability of each item, a list of any modifications/ repairs that may be required as well as any cost associated with any repair work.

One, possibly two, handsinks will need to be added to the serving area.

If adding a dishroom is a goal, then it should be located in close proximity to the kitchen and seating area. Typically a drop-off window is the best option for students to facilitate disposal of trash and return trays, cups and silverware to dishroom. A properly sized conveyor type dishmachine with external booster heater should be used.

There are various work/ prep tables in kitchen. With the exception of the one wooden top bakery table, the wooden top tables should be replaced with stainless steel work tables with necessary splashes, drawers and undershelves for storage. Except for the pot sink, the remaining existing stainless steel work/ prep tables should be replaced with new stainless steel tables with necessary splashes, drawers and undershelves for storage. Wall shelf/ storage space should also be maximized by adding stainless steel wall shelves.

If the walk-in cooler/ freezer is the original unit it would be approximately 45 years old. We recommend replacing this with a new unit. A discussion with the foodservice operator would help determine if the current size is appropriate for their needs.

Due to the fact the school was in summer break the dry storage area was full of racks and carts packed away. We were unable to get a clear idea if the storage was adequate. A discussion with the foodservice operator would help determine if the current size is appropriate for their needs.

All of the wooden shelves in the janitor's closet need to be removed and replace with either a new stainless steel wall shelf or a multi-tier shelving unit.

If the two Dasani refrigerated merchandisers and the "Got Milk?" refrigerated merchandiser are supplied by a vendor, solicit vendor to supply new units. If not supplied by a vendor, the audit report will determine the usability of units.

The engineering team needs to do a thorough code assessment of the electrical, plumbing and mechanical systems related to the foodservice spaces and equipment. A determination should be made as to whether the utilities all need to be brought up to code: i.e. electrical outlets may need to be changed to GFI outlets, the plumbing engineer should confirm that adequate back flow prevention exists.

There are electrical panels stubbed up in the floor located in front some of the cooking equipment. These panels must be relocated.

The grease trap(s) will need to be reviewed by the plumbing engineer. There are new codes for grease traps that may require that a Dishmachine, other sinks and floor drains be run through an internal and/ or external grease trap.

NEW CONSTRUCTION SCOPE

As stated in the Addition/ Renovation Scope we believe that an area of approximately 2700 – 3200 square feet to accommodate a kitchen/ servery is appropriate for the school population of 900 students.

With new construction we will have a greater opportunity of providing a full-service kitchen/ servery with all the typical aspects of a foodservice program. We will have much better control over the delivery of supplies, supply storage (dry and refrigerated), preparation of food product, cooking of meals, serving/ check-out lines, work flow, seating, disposal of waste and a dish/ pot washing room.

We recommend a complete audit of all the existing equipment be done and that a report be provided that details the conditions of this equipment. The report would typically include an evaluation on the usability of each item, a list of any modifications/ repairs that may be required as well as any cost associated with any repair work.

With that said, there appears to be several pieces of equipment that are in newer/ good working condition.

- Randell model #40048-AM refrigerated display/ merchandiser.
- Atlas mobile salad bar.
- Traulsen model #G20013 two door reach-in refrigerator.
- Beverage-Air model #KF74-5AS Three door reach-in freezer.
- Handsink – Griffin Products.
- Washer/ Dryer Stack – Whirlpool.
- Manitowoc Ice Machine/ Bin.
- Hobart slicer model #2712.
- Traulsen model #G20010P0A two door refrigerator.
- Metro model #C199 mobile heated cabinet.
- Hobart 60 Qt. floor mixer.
- Vulcan model #VEX3 hot top burner.
- Groen model #HY-6E steamer.
- Groen model #EE-40 kettle.
- CresCor model #121PH1816C mobile heated cabinet.
- Traulsen model #G12010 single door reach-in refrigerator.

END OF REPORT

FINAL REPORT
FOR
HAZARDOUS MATERIALS IDENTIFICATION SURVEY
AT
SHERWOOD MIDDLE SCHOOL
SHREWSBURY, MASSACHUSETTS

PROJECT NO: 29115.00

SURVEY DATES:
June 29 and July 2-3, 2009

SURVEY CONDUCTED BY:

UNIVERSAL ENVIRONMENTAL CONSULTANTS

UEC universal environmental consultants

July 9, 2009

Mr. Michael Pagano
Lamoureux Pagano Associates
14 East Street
Worcester, MA 01604

Reference: Report for Hazardous Materials Identification Survey at the Sherwood Middle School, Shrewsbury, MA

Dear Mr. Pagano:

Thank you for the opportunity for Universal Environmental Consultants (UEC) to provide professional services.

Enclosed please find the report for the Identification Survey for accessible asbestos containing materials and other hazardous materials at the Sherwood Middle School, Shrewsbury, MA.

The inspection was performed by a Massachusetts licensed asbestos inspector Mr. Leonard J. Busa (AI-030673).

Please do not hesitate to call should you have any questions.

Very truly yours,

Universal Environmental Consultants

Ammar M. Dieb
President

UEC:\29115\Report.DOC

Cc: Mr. Daniel Morgado, Town Manager, Town of Shrewsbury
Mr. Chris Simmler, PMA

Enclosure

1.0 INTRODUCTION:

Universal Environmental Consultants (UEC) has been providing comprehensive asbestos services since 2001 and has completed projects throughout New England. We have completed projects for a variety of clients including commercial, industrial, municipal, and public and private schools. We maintain appropriate asbestos licenses and staff with a minimum of fifteen years of experience.

UEC was contracted by Lamoureux Pagano Associates to conduct a determination survey for accessible Asbestos Containing Materials (ACM), PCB's in light fixtures and for underground oil tanks at the Sherwood Middle School, Shrewsbury, MA.

The scope of work included the inspection of accessible ACM, collection of bulk samples from materials suspected to contain asbestos, determination of types of ACM found and cost estimates for remediation. A comprehensive survey will be performed prior to final design phase.

Bulk samples analyses for asbestos were performed using the standard Polarized Light Microscopy (PLM) in accordance with EPA standard. The bulk samples were collected by a Massachusetts licensed asbestos inspector Leonard J. Busa (AI-030673) and analyzed by a Massachusetts licensed laboratory AmeriSci, Weymouth, MA.

Samples results can be found in Appendix A.

2.0 FINDINGS:

The regulations for asbestos inspection are based on representative sampling. It would be impractical and costly to sample all materials in all areas. Therefore, representative samples of each homogenous area were collected and analyzed or assumed.

All suspect materials were grouped into homogenous areas. By definition a homogenous area is one in which the materials are evenly mixed and similar in appearance and texture throughout. A homogeneous area shall be determined to contain asbestos based on findings that the results of at least one sample collected from that area shows that asbestos is present in an amount greater than 1 percent in accordance with EPA regulations. However, all suspect materials that contain any amount of asbestos must be considered asbestos if it is scheduled to be removed per the Department of Environmental Protection (DEP) regulations.

A. Number of Samples Collected

Eighty six (86) bulk samples were collected from the following materials suspected of containing asbestos:

1. Textured ceiling plaster type I at stage
2. Textured ceiling plaster type I at main corridor by administration
3. Textured ceiling plaster type I at classroom 138
4. Textured ceiling plaster type I at classroom 128
5. Textured ceiling plaster type I at classroom 120
6. Textured ceiling plaster type I at classroom 136
7. Textured ceiling plaster type I at basement main corridor
8. Textured ceiling plaster type I at classroom 007
9. Textured ceiling plaster type I at classroom 204
10. Textured ceiling plaster type I at classroom 232
11. Textured ceiling plaster type I at library kitchen
12. Textured ceiling plaster type II at cafeteria
13. Textured ceiling plaster type II at cafeteria
14. Textured ceiling plaster type II at media center
15. Textured ceiling plaster type II at classroom 028
16. Textured ceiling plaster type II at classroom 028
17. Smooth ceiling plaster at kitchen
18. Smooth ceiling plaster at first floor custodian room
19. Smooth wall plaster at classroom 137

20. Smooth wall plaster at classroom 006
21. Soft grey glazing for interior window over door at first floor staff office
22. Soft grey glazing for interior window in double door assembly at first floor main corridor
23. 1'x 1' Acoustical wall tile at classroom 127
24. Glue daub for 1'x 1' acoustical wall tile at classroom 127
25. 1'x 1' Acoustical wall tile at classroom 121
26. Glue daub for 1'x 1' acoustical wall tile at classroom 121
27. 1'x 1' Acoustical wall tile at classroom 136
28. Glue daub for 1'x 1' acoustical wall tile at classroom 136
29. 1'x 1' Acoustical wall tile at classroom 027
30. Glue daub for 1'x 1' acoustical wall tile at classroom 027
31. 1'x 1' Acoustical wall tile at classroom 232
32. Glue daub for 1'x 1' acoustical wall tile at classroom 232
33. Glue daub for 1'x 1' acoustical wall tile at band room
34. Associated gypsum wall for 1'x 1' acoustical wall tile at band room
35. Mastic for 9"x 9" vinyl floor tile at first floor staff office
36. 9"x 9" Vinyl floor tile at first floor classroom 138
37. Mastic for 9"x 9" vinyl floor tile at first floor classroom 138
38. Mastic for 9"x 9" vinyl floor tile at classroom 006
39. Mastic for 9"x 9" vinyl floor tile at art room
40. Linoleum covering on heating cabinets at band room
41. Linoleum covering on heating cabinets at classroom 127
42. Linoleum covering on heating cabinets at classroom 233
43. Mastic for linoleum covering on heating cabinets at classroom 233
44. Hard joint insulation off fiberglass insulated pipe at band practice room
45. Hard joint insulation off fiberglass insulated pipe at boiler room
46. Pipe insulation at boiler room
47. Duct insulation at boiler room
48. Tank insulation at boiler room
49. Grey ceiling paint at boiler room
50. Light blue linoleum floor covering at stairwell by classroom 139
51. Linoleum floor covering at stairwell by media center
52. New vinyl floor tile type I at classroom 011
53. New vinyl floor tile type II at main corridor by stage
54. New vinyl floor tile type III at basement
55. Glazing caulking for practice room door
56. Transite lab tops at classroom 120
57. Glazed wall brick at gymnasium
58. Mortar for glazed wall brick at gymnasium
59. Light cement plank deck above ceiling plaster at stage
60. Light cement plank deck above ceiling plaster at administration
61. Light cement plank deck above ceiling plaster at boy's locker room
62. Vertical caulking in brick wall at gymnasium
63. Grout for wall tile at classroom 234
64. Grout for wall tile at classroom 117
65. CMU block wall at basement electrical room
66. Black glue in foil paper in heating cabinet at classroom 117
67. Black glue in fiberglass insulated pipe at boiler room
68. Light cement plank deck above ceiling plaster at second floor main corridor
69. Black glue in fiberglass insulated duct at garage
70. Mortar for slate sill at staff office
71. Cork floor under wood floor at gymnasium
72. Paper for cork floor under wood floor at gymnasium
73. Cork floor under wood floor at gymnasium
74. Paper for cork floor under wood floor at gymnasium

75. Cork floor under wood floor at gymnasium
76. Paper for cork floor under wood floor at gymnasium
77. Exterior window framing caulking
78. Exterior window framing caulking
79. Exterior window framing caulking
80. Exterior window glazing caulking
81. Exterior window glazing caulking
82. Exterior window glazing caulking
83. Exterior door framing caulking
84. Unit vent grille caulking
85. New vinyl floor tile at portable
86. New suspended acoustical ceiling tile at portable

The following suspect materials were assumed to contain asbestos.

- Blackboards glue
- Insulation inside boiler
- Transite panels
- Wall flashing material
- Roofing material

B. <u>Sample Results</u>

Location/ Type of Material	Sample Result
1. Textured ceiling plaster type I at stage	None Detected
2. Textured ceiling plaster type I at main corridor by administration	None Detected
3. Textured ceiling plaster type I at classroom 138	None Detected
4. Textured ceiling plaster type I at classroom 128	None Detected
5. Textured ceiling plaster type I at classroom 120	None Detected
6. Textured ceiling plaster type I at classroom 136	None Detected
7. Textured ceiling plaster type I at basement main corridor	None Detected
8. Textured ceiling plaster type I at classroom 007	None Detected
9. Textured ceiling plaster type I at classroom 204	None Detected
10. Textured ceiling plaster type I at classroom 232	None Detected
11. Textured ceiling plaster type I at library kitchen	None Detected
12. Textured ceiling plaster type II at cafeteria	None Detected
13. Textured ceiling plaster type II at cafeteria	None Detected
14. Textured ceiling plaster type II at media center	None Detected
15. Textured ceiling plaster type II at classroom 028	None Detected
16. Textured ceiling plaster type II at classroom 028	None Detected
17. Smooth ceiling plaster at kitchen	None Detected
18. Smooth ceiling plaster at first floor custodian room	None Detected
19. Smooth wall plaster at classroom 137	None Detected
20. Smooth wall plaster at classroom 006	None Detected
21. Soft grey glazing for interior window over door at first floor staff office	None Detected
22. Soft grey glazing for interior window in double door assembly at first floor main corridor	<1% Asbestos
23. 1'x 1' Acoustical wall tile at classroom 127	None Detected
24. Glue daub for 1'x 1' acoustical wall tile at classroom 127	None Detected
25. 1'x 1' Acoustical wall tile at classroom 121	None Detected
26. Glue daub for 1'x 1' acoustical wall tile at classroom 121	None Detected
27. 1'x 1' Acoustical wall tile at classroom 136	None Detected
28. Glue daub for 1'x 1' acoustical wall tile at classroom 136	None Detected
29. 1'x 1' Acoustical wall tile at classroom 027	None Detected
30. Glue daub for 1'x 1' acoustical wall tile at classroom 027	None Detected

31.	1'x 1' Acoustical wall tile at classroom 232	None Detected
32.	Glue daub for 1'x 1' acoustical wall tile at classroom 232	None Detected
33.	Glue daub for 1'x 1' acoustical wall tile at band room	None Detected
34.	Associated gypsum wall for 1'x 1' acoustical wall tile at band room	None Detected
35.	Mastic for 9"x 9" vinyl floor tile at first floor staff office	None Detected
36.	9"x 9" Vinyl floor tile at first floor classroom 138	5% Asbestos
37.	Mastic for 9"x 9" vinyl floor tile at first floor classroom 138	None Detected
38.	Mastic for 9"x 9" vinyl floor tile at classroom 006	None Detected
39.	Mastic for 9"x 9" vinyl floor tile at art room	None Detected
40.	Linoleum covering on heating cabinets at band room	None Detected
41.	Linoleum covering on heating cabinets at classroom 127	None Detected
42.	Linoleum covering on heating cabinets at classroom 233	None Detected
43.	Mastic for linoleum covering on heating cabinets at classroom 233	None Detected
44.	Hard joint insulation off fiberglass insulated pipe at band practice room	None Detected
45.	Hard joint insulation off fiberglass insulated pipe at boiler room	None Detected
46.	Pipe insulation at boiler room	5% Asbestos
47.	Duct insulation at boiler room	60% Asbestos
48.	Tank insulation at boiler room	60% Asbestos
49.	Grey ceiling paint at boiler room	7% Asbestos
50.	Light blue linoleum floor covering at stairwell by classroom 139	None Detected
51.	Linoleum floor covering at stairwell by media center	30% Asbestos
52.	New vinyl floor tile type I at classroom 011	None Detected
53.	New vinyl floor tile type II at main corridor by stage	None Detected
54.	New vinyl floor tile type III at basement	None Detected
55.	Glazing caulking for practice room door	None Detected
56.	Transite lab tops at classroom 120	20% Asbestos
57.	Glazed wall brick at gymnasium	None Detected
58.	Mortar for glazed wall brick at gymnasium	None Detected
59.	Light cement plank deck above ceiling plaster at stage	None Detected
60.	Light cement plank deck above ceiling plaster at administration	None Detected
61.	Light cement plank deck above ceiling plaster at boy's locker room	None Detected
62.	Vertical caulking in brick wall at gymnasium	None Detected
63.	Grout for wall tile at classroom 234	None Detected
64.	Grout for wall tile at classroom 117	None Detected
65.	CMU block wall at basement electrical room	None Detected
66.	Black glue in foil paper in heating cabinet at classroom 117	None Detected
67.	Black glue in fiberglass insulated pipe at boiler room	None Detected
68.	Light cement plank deck above ceiling plaster at second floor main corridor	None Detected
69.	Black glue in fiberglass insulated duct at garage	None Detected
70.	Mortar for slate sill at staff office	None Detected
71.	Cork floor under wood floor at gymnasium	None Detected
72.	Paper for cork floor under wood floor at gymnasium	None Detected
73.	Cork floor under wood floor at gymnasium	None Detected
74.	Paper for cork floor under wood floor at gymnasium	None Detected
75.	Cork floor under wood floor at gymnasium	None Detected
76.	Paper for cork floor under wood floor at gymnasium	None Detected
77.	Exterior window framing caulking	10% Asbestos
78.	Exterior window framing caulking	Not Analyzed
79.	Exterior window framing caulking	Not Analyzed
80.	Exterior window glazing caulking	3% Asbestos
81.	Exterior window glazing caulking	<1% Asbestos
82.	Exterior window glazing caulking	2% Asbestos
83.	Exterior door framing caulking	2% Asbestos
84.	Unit vent grille caulking	2% Asbestos
85.	New vinyl floor tile at portable	None Detected

86. New suspended acoustical ceiling tile at portable None Detected

Various samples were not analyzed. The Environmental Protection Agency regulations states that should one sample from a homogenous area was found to be greater than 1 percent of asbestos, then the material must be considered asbestos containing.

3.0 OBSERVATION AND COST ESTIMATES:

A. OBSERVATIONS:

1. Various types of flooring materials including 9"x 9" vinyl floor tile and linoleum floor covering were found to contain asbestos. The ACM was also found under carpets.
2. Pipe insulation was found to contain asbestos. The ACM was found at various locations in the building including above ceilings.
3. Hard joint insulation off fiberglass insulated pipes was found not to contain asbestos.
4. Thermal insulation in the boiler room was found to contain asbestos.
5. Insulation inside boilers was assumed to contain asbestos.
6. Ceiling paint was found to contain asbestos. The ACM was found in the boiler room, offices and garage.
7. Transite counter lab tops was found to contain asbestos. The ACM was found at science rooms.
8. Insulation inside wood fire doors was assumed to contain asbestos. The ACM was found at kitchen and receiving area.
9. Interior window glazing caulking was found not to contain asbestos, however, the caulking was assumed to contain PCB's.
10. Exterior window framing and glazing caulking was found to contain asbestos and was assumed to contain PCB's.
11. Unit vent grille caulking was found to contain asbestos and was assumed to contain PCB's.
12. Door framing caulking was found to contain asbestos and was assumed to contain PCB's.
13. Duct insulation was assumed to contain asbestos. The ACM was found at gymnasium.
14. Transite panels were assumed to contain asbestos. The ACM was found over doors.
15. All remaining suspect materials were found not to contain asbestos.
16. Ballasts in light fixtures are old and were assumed to contain PCB's.
17. Tubes in light fixtures were assumed to contain mercury.
18. Exit signs, switches, thermostats were assumed to contain mercury.
19. Painted surfaces were assumed to contain lead based paint. However, lead abatement is not required prior to renovation or demolition.
20. It appears that one underground oil tank exists. No records were found on-site.
21. Roofing material was assumed to contain asbestos. However, roofing material is not required to be removed by a licensed asbestos contractor prior to renovation or demolition.

B. COST ESTIMATES:

The cost includes removal and disposal of all accessible ACM, other hazardous material and an allowance for removal of inaccessible or hidden ACM that may be found during the demolition project.

Location	Material	Approximate Quantity	Cost Estimate ($)
Throughout	Flooring Material and Mastic	60,000 SF	180,000.00
	Pipe and Hard Joint Insulation	3,500 LF	70,000.00
	Ceiling and Wall Demolition to access ACM	Unknown	25,000.00
	Transite Panels over Doors	20 Total	2,000.00
	Interior Windows	275 Total	27,500.00
	Blackboards	320 Total	32,200.00
	Light Fixtures	950 Total	28,500.00
	Miscellaneous and Hidden ACM	Unknown	25,000.00
Science Rooms	Transite Lab Tops	5 Total	2,500.00

Location	Material	Approximate Quantity	Cost Estimate ($)
Gymnasium	Duct Insulation	120 SF	6,000.00
Kitchen and Receiving Area	Wood Fire Doors	5 Total	500.00
Boiler Room Area	Duct Insulation	300 SF	6,000.00
	Tank Insulation	250 SF	5,000.00
	Pipe and Hard Joint Insulation	500 LF	10,000.00
	Boilers	2 Total	15,000.00
	Ceiling Paint	1,900 SF	19,000.00
Various Locations	Thru-Wall Flashing	Unknown	25,000.00
Exterior	Windows, Doors, Unit Vents	470 Total	47,000.00
	Underground Oil Tank	1 Total	15,000.00
Construction Monitoring and Air Sampling Services			58,800.00
		TOTAL:	**$ 600,000.00**

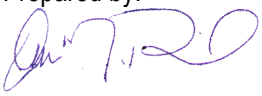
***: Glue was assumed to contain asbestos.**
****: ACM insulation was assumed to exist on the interior.**

4.0 DESCRIPTION OF SURVEY METHODS AND LABORATORY ANALYSES:

Asbestos samples were collected using a method that prevents fiber release. Homogeneous sample areas were determined by criteria outlined in EPA document 560/5-85-030a.

Bulk material samples were analyzed using PLM and dispersion staining techniques with EPA method 600/M4-82-020.

Prepared by:



Ammar M. Dieb
President

5.0 LIMITATIONS AND CONDITIONS:

This report has been completed based on visual and physical observations made and information available at the time of the site visits, as well as an interview with the Owner's representatives. This report is intended to be used as a summary of available information on existing conditions with conclusions based on a reasonable and knowledgeable review of evidence found in accordance with normally accepted industry standards, state and federal protocols, and within the scope and budget established by the client. Any additional data obtained by further review must be reviewed by UEC and the conclusions presented herein may be modified accordingly.

This report and attachments, prepared for the exclusive use of Owner for use in an environmental evaluation of the subject site, are an integral part of the inspections and opinions should not be formulated without reading the report in its entirety. No part of this report may be altered, used, copied or relied upon without prior written permission from UEC, except that this report may be conveyed in its entirety to parties associated with Owner for this subject study.

July 24, 2009

Lamoureux Pagano Associates
c/o Ms. Kathryn Crockett, AIA
Architectt
14 East Worcester Street
Worcester, MA 01604

RE: Nitsch Project #7683
Sherwood
Middle School
Feasibility Study
Shrewsbury, Massachusetts

Dear Katie:

Nitsch Engineering has performed research of the existing site & site utilities (drainage, sewer and water), for the Sherwood Middle School located at 30 Sherwood Avenue in Shrewsbury, Massachusetts. The "site" also includes the parcel of land adjacent to the Sherwood Middle School which currently houses the Oak School and associated athletic fields. The two sites combined have an area of approximately 50 +/- acres. Nitsch's research included a review of the plans and documents noted under section "Compiled Documents". Aaron Gallagher, PE, LEED AP conducted a site visits on July 17 and 19, 2009.

COMPILED DOCUMENTS

1. Plan entitled, "Existing Conditions Plan, Oak and Sherwood Middle Schools." prepared by Waterman Design Associates Inc., (Four Sheets).

2. Plan entitled, "Site Plan, Shrewsbury Junior High School." Prepared by Korslund, Le Normand & Quann Inc. Architects, dated March 22, 1963 (One Sheet).

3. Plan entitled, "Profiles and Details, Shrewsbury Junior High School." Prepared by Korslund, Le Normand & Quann Inc. Architects, dated March 22, 1963 (One Sheet).

4. Plan entitled, "Site and Road Sections, Shrewsbury Junior High School." Prepared by Korslund, Le Normand & Quann Inc. Architects, dated March 22, 1963 (Two Sheets).

5. Plan entitled, "Plumbing Utilities Plan, Shrewsbury Junior High School." Prepared by Korslund, Le Normand & Quann Inc. Architects, dated March 22, 1963 (One Sheet).

6. Plan entitled, "Electrical Plot Plan, Symbol List and Details, Shrewsbury Junior High School." Prepared by Korslund, Le Normand & Quann Inc. Architects, dated March 22, 1963 (Two Sheets).

7. Town of Shrewsbury Zoning Ordinances, as amended with amendments through May 22, 2008.

8. Email from Robert Cox (Superintendent of Public Buildings) regarding Flow Test for Sherwood School site, dated July 10, 2009.

9. Report Entitled "Revised Preliminary Mechanical Systems Survey at the Sherwood Middle School", prepared by Seaman Engineering Corp, dated July 6, 2009.

10. Report Entitled "Final Report for Hazardous Materials Identification Survey at Sherwood Middle School" prepared by Universal Environmental Consultants dated June 29 and July 2-3, 2009.

11. Town of Shrewsbury Zoning Map obtained from the http://gis.shrewsbury-ma.gov/ website.

CIVIL UTILITIES NARRATIVE

STORM DRAINAGE COMMENTS

The site is currently served by an open/closed drainage system.

The Sherwood Middle School site runoff is collected in a closed drainage system and drains south via a 15-inch RCP pipe and connects with a 12-inch RCP pipe conveying water from the wetlands located to the east. The two pipes combine in a drain inlet along the southern edge of the property before flowing south.

The areas around Oak School and the athletic fields appear to drain overland and via closed drainage to an open concrete channel that runs along the southern property line and discharges to an 18-inch RCP pipe flowing south in an existing drainage easement.

Roof drain connections from the original Sherwood School and Oak School appear to be connected directly into the closed drainage system surrounding the school buildings.

There were no plans available for the construction of the modular classrooms on the east side of the Sherwood School. It appears that the building has a gutter and downspout system that drains directly onto the surface.

DEP's stormwater regulations will apply to the Sherwood Middle School site as part of a renovation or new building development because of its proximity to the regulated wetland resource area located east of the Sherwood Middle School Building. Any development within the existing athletic fields will also fall under DEP stormwater regulations because of the small pocket of wetlands located adjacent to the football field to the northeast.

WATER

The Sherwood Middle School receives its water from the Town of Shrewsbury. The Sherwood School is serviced by a 4-inch domestic water line that enters the building at the boiler room on the west side of the building. The 4-inch line connects to a main of an unknown size in Hutchins Street.

There is currently no fire/sprinkler service to the Sherwood Middle School building however the modular classrooms located on the east side of the building were observed by Mr. Gallagher to have a fire department connection and a post indicator valve (PIV) along the north wall.

Mr. Gallagher observed one fire hydrant located at the front of the Sherwood School and one in the western parking lot area. A hydrant flow test was performed on these two hydrants to determine flow pressures and volumes. Nitsch Engineering presumes the Shrewsbury Department of Public Works conducted the flow test. In an email from Superintendent of Public Buildings, Robert Cox (dated 7-10-09) stated the following results for the flow test:

Hydrant in the western parking area:
Static Pressure = 85lbs
Residual Pressure = 42lbs.

Hydrant in front of school:
Flow = 840 gallons per minute
Pressure during test = 25 lbs

SEWER

The Sherwood Middle School is currently serviced by a 6-inch gravity sewer that flows to Crescent Street via the existing walking path located southeast of the Sherwood School building.

The Oak School is serviced by a 6-inch gravity sewer that flows west towards an abandoned leaching field and then continues in a southerly direction off the property after combining with another sewer line flowing southerly from an exiting sewer easement to the west.

A renovation of the existing school building would require a sewer capacity study to determine if the existing 6-inch line(s) would be sufficient to handle the increase in size to the school building and program. The construction of a new school building anywhere else on the 50-acre site may possibly require the sanitary waste to be pumped if the new building location can not facilitate a gravity feed to one of the two gravity sewer connections associated with either the Sherwood or Oak Schools.

GAS

The School appears to be served with a 1-1/4-inch gas service that enters the building at the boiler room on the west side of the school building. The gas service appears to service the school via Hutchins Street from the north.

The modular classrooms also have a dedicated gas line and meter located on the north side of the modular units.

UNDERGROUND/ABOVE GROUND TANKS

There are no above ground fuel tanks associated with the Sherwood Middle School. However there is a 10,000 gallon underground fuel storage tank that was installed in 1994. It is located in the parking area on the west side of the Sherwood School building. The tank is a double walled fiberglass tank in good condition with an associated monitoring system.

FLOOD PLAIN

Based on the Flood Insurance Rate Map (FIRM), Community Panel Number 250332 0003 B, dated June 4, 1980, the site is located within Zone C (Areas of minimal flooding, (No shading)

WETLANDS PROTECTION ACT (310 CMR 10.00)

The Wetlands Protection Act ensures the protection of Massachusetts' inland and coastal wetlands, tidelands, great ponds, rivers and floodplains. It regulates activities in coastal and wetlands areas, and contributes to the protection of ground and surface water quality, the prevention of flooding, and storm damage and the protection of wildlife and aquatic habitat.

The Sherwood Middle School Site has wetland resource areas located to the east within the wooded area between the school building and Crescent Street and also a small area located south west of the Sherwood School Building on the Oak School property.

NATURAL HERITAGE & ENDANGERED SPECIES PROGRAM

A review of the Massachusetts Natural Heritage Atlas, 13th Edition, dated October 1, 2008 appears to indicate that the Sherwood Middle School and Oak School sites are not within a Priority Habitat Of Rare Species and

a Priority Habitat of Rare Species and also Estimated Habitat of Rare Wildlife and that no certified vernal pools are shown.

ZONING

The Site is located within Residence B-1 as delineated on the City of Shrewsbury Zoning Map.

ASSESSOR'S MAP

The Sherwood Middle School School site is located on Parcel 27 - 093000. The Map indicates the site having 618,552± square feet or 14.2± acres in area.

The Oak School and Athletic Fields site is located on Parcel 27 – 085000. The Map indicated the site having 1,412,584± square feet or 32.4± acres in area

DIMENSIONAL REGULATIONS

Based on a review of the Town of Shrewsbury zoning by-laws, the dimensional regulations for the school site(s) are as follows:

District	Use	Lot Size Minimum	Lot Width Minimum	Street Frontage Minimum	Front Yard Setback	Side Yard Setback
RES B-1	All Other Uses	40,000 Square Feet (SF)	60 Feet (FT)	150 FT	50 FT	30 FT

District	Rear Yard Setback	Open Space Percent of Lot Area	Height Feet	Height Stories	Building Ground Coverage	Floor Area Ratio
RES B-1	50 FT	25%	35 FT	2 ½ Stories	n/a	n/a

SITE PLAN REVIEW

Section VII (F) of the Shrewsbury Zoning Bylaw states that any construction project where (a) the use requires off-street parking areas with the exception of one or two family dwellings, (b) all structures, off-street parking and loading areas permitted in Multi-Family, Residential, Apartment, Limited Business, Commercial Business or Limited Industrial Districts will require Site Plan Review under the guidelines set forth in Section VII of the Bylaws.

If you have any questions, please call.

Very truly yours,

Nitsch Engineering, Inc.

Approved by:

Aaron A. Gallagher, PE, LEED® AP
Senior Project Engineer

William R. Maher, PE
Project Manager

AAG/wrm

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