Mechanical System Evaluation
Twining Middle School
Grand Forks Air Force Base, ND

Martin Mechanical Design, Inc. visited the Twining Middle School site to perform on-site visual inspection of the existing steam heating system and mechanical ventilation systems. The following depicts the findings of this investigation, along with a review of the existing documentation and interviews with local maintenance personnel.

Mechanical systems inspected include the following:

- Heating Plant
- Air Handling Units and Ventilation Systems

Mechanical Analysis - Infrastructure:

Central Heating Plant

The 117,000 square foot facility is served by a central low-pressure steam boiler plant. Steam and condensate are distributed via tunnels in the original 1961 building (Phase 2), 1966 building addition (Phase 2), and the 1964 building addition (Phase 1). The 2003 gymnasium addition is also served off the existing steam boilers, where a steam to hot water heat exchanger, located in the existing boiler room, converts the steam to hot water. The hot water is then pumped overhead through the ceiling of the main corridors to the air handling units located on the second floor of the gymnasium wing.

Currently plans are to keep the existing steam boiler plant to serve Phase 2 areas of the building and provide a new hot water heating plant to serve Phase 1 areas and the Gymnasium Addition.

Comments and recommendations:

The expected life of a water tube or fire tube boiler is approximately 25 years. New boilers will increase the efficiency and reduce the required maintenance efforts. The new boilers would be hot water boilers in lieu of steam boilers. This would allow the elimination of the steam to hot water heat exchanger, condensate receiver pumps, and steam traps. This solution would consolidate intensive piping, pumping, chemical treatment, and control functions of the facility, making inspection, maintenance and repair less time consuming.

Estimated Cost: $347,644.80

Phase 1 Hvac System

The 43,400 square foot addition is served by the central low-pressure steam boiler plant as noted above with the same steam & condensate distribution system. The area is served by perimeter classroom unit ventilator units for heating and ventilation is delivered by one existing air handling unit which delivers air via ductwork overhead into the space(s).

Comments and recommendations:

The HVAC system serving this area is well beyond its useful life and should be replaced. Existing steam piping and traps are a continual maintenance issue and the fresh air being provided into the classrooms does not meet current code requirements.

The proposed system to replace the existing would be an induction chilled beam system. A new fresh air handling unit would be provided which would temper the air and then distribute to induction beams located throughout the facility. The induction chilled beams act as heat exchangers, where they either heat or cool the air, depending on the needs of the space. If a heating system only replacement is desired, the system can operate independently of cooling, which can be added easily to the system at a later date. Below is the cost for heating and ventilation only, along with, an add to provide cooling to the system.

Estimated Heating and Ventilation Cost: $1,427,945
Estimated Cooling Cost: $208,663

Phase 2 Hvac System

The 49,366 square foot original building and addition is served by the central low-pressure steam boiler plant as noted above with the same steam & condensate distribution system. The area is served by perimeter steam fintube units for heating and fresh air ventilation is delivered by two existing air handling units which deliver air via ductwork in the tunnels through the floor into the spaces.

Comments and recommendations:

The HVAC system serving this area is well beyond its useful life and should be replaced. Existing steam piping and traps are a continual maintenance issue and the fresh air being provided into the classrooms does not meet current code requirements.

The proposed system to replace the existing would be an induction chilled beam system. A new fresh air handling unit would be provided which would temper the air and then distribute to induction beams located throughout the facility. The induction chilled beams act as heat exchangers, where they either heat or cool the air, depending on the needs of the space. If a heating system only replacement is desired, the system can operate independently of cooling, which can be added easily to the system at a later date. Below is the cost for heating and ventilation only, along with, an add to provide cooling to the system.

Estimated Heating and Ventilation Cost: $1,550,134

Estimated Cooling Cost: $249,762

Gymnasium Hvac System

The 25,000 square foot addition is served by the central low-pressure steam boiler plant via a hot water converter as noted above with the same hot water distribution system. 5 constant air volume air handling units serve the space, providing heating and ventilation. The system is relatively new in nature and no upgrades are recommended in this area, with the exception of offering a cost to provide mechanical cooling to the wing.
Estimated Cost: $120,260

Please feel free to contact our office with any questions and/or concerns.

Sincerely,

Josh D. Lunski, P.E.
Martin Mechanical Design Inc.
Mechanical Engineer