

Executive Summary

Geothermal Heat Pump Analysis

The quantity, construction impact, layout, and on-site place of geothermal heat pumps were identified as based on the maximum capacity of the air handling units. A general estimate was performed on the major components of the existing system and geothermal system in order to obtain a general idea of what the cost difference would be in switching to a geothermal system. In addition, a LEED analysis was performed to identify how switching to a geothermal system would affect the building's LEED rating. The analysis found that the geothermal system would not significantly affect constructability or schedule. It would increase the cost of the mechanical contract by 18.4% and the overall construction cost by 3.4%. It also found that the geothermal system would increase the LEED rating of the building from silver to gold.

Mechanical Breadth

The original intent of this breadth was to calculate any possible reduction in size of the existing mechanical equipment with the addition of geothermal heat pumps. It was discovered in Analysis 1 that the addition of geothermal heat pumps would allow the elimination of the existing mechanical equipment altogether.

Standardized Modular Classroom Analysis

The classroom wings were broken up into modules and the total quantity of modules was determined. Through discussions with industry professionals, estimates of cost savings per square foot and modules set per day were determined. From these estimate the costs savings and duration of module construction was calculated. The analysis found that utilizing modular construction would save 14.1% of the overall construction cost and would accelerate the substantial completion date of the classroom wings by nearly a year. In addition, codes regarding classroom design for the state of Pennsylvania were analyzed and it was determined that all Pennsylvania schools had to conform to the same codes. It was determined that all Pennsylvania schools could utilize the same classroom design by adjusting the number of modules used or by adjusting the modules themselves. Standard configurations for different size classrooms were presented.

Acoustical Breadth

An analysis of noise reduction capability of the existing wall assembly between classrooms and the proposed metal stud wall assembly was performed. It was shown that the assemblies had similar capability in the low frequency octave bands but differed significantly in the 2k and 4k bands. Although the metal stud assembly performs much less noise reduction for these octave bands it was shown that it still performed an adequate amount of noise reduction for the classroom spaces to be sufficiently isolated from one another.

Electrical Rough-In Method Analysis

The electrical rough-in method, underground, was analyzed and compared with overhead rough-in. An estimate of duration and cost was performed for both methods. It was determined that utilizing OH rough-in could have saved the activity 35 working days as well as \$50,000. In addition, a schedule analysis was performed using the new duration of OH rough-in and it was determined that it would have accelerated the dry-in dates of each area by an average of 23 days.

Project Delivery Method Analysis

An analysis of the Pennsylvania Separations Act of 1913 was conducted to determine whether or not there were any loopholes or other ways that contractors could deliver a project in which the government was the owner by any means other than multiple prime. It was shown that it is possible when the owner is the department of general services, a borough, a township, a county, a second-class township, or a third class city. The contractor has no influence over the decision when the owner is the department of general services. For all other state owners it was determined that the project must be delivered in a multiple prime delivery method.