Higher Education Cafeteria and Cold Storage

Owner's Project Requirements – 2021 ASHRAE Design Competition

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Introduction

A higher education campus has decided to build a new 50,000 square foot (ft^2) [4,645 square meter (m^2)], two-story cafeteria, associated office, and commercial kitchen and storage space in Prince George, British Columbia, Canada. The new facility will consist of approximately 25,000 ft^2 [2,323 m^2] (of dining/kitchen/servery area on the main floor and 25,000 ft^2 [2,323 m^2] of offices and storage space on the lower floor. The cafeteria is meant to serve an average of 3,000 students per day.

The Project

The project is to create a new building that will provide safe and healthy storage of food materials on the lower level in a manner that prevents spoiling and the growth of bacteria. The building will also provide enough kitchen/servery space and permanent seating to serve a peak occupancy of 720 students and about 3,000 students per day. The project team will use the lean integrated project delivery method. In order to minimize construction disturbances on campus, the project team should consider the impact of alternate techniques such as off-site construction and waste eliminating design elements. Looking to the future, this building project should incorporate elements of Industry 4.0 to push the boundaries of the project team's thought process.

Building space types include cold storage rooms, non-cold storage rooms, office space, dining spaces/servery, restrooms, telecommunications, mechanical/electrical spaces, and kitchens.

The building operates from 7:00 to 20:00 seven days per week. There are no temperature or relative humidity setbacks during unoccupied operation for spaces where materials are stored, but there are for other areas.

Owner's Directives

The design team shall make every effort to provide a sustainable design, taking into account: energy efficiency, health and safety, occupant comfort, functionality, longevity, flexibility, and serviceability/maintainability.

The design team shall select systems based on the lowest possible life cycle cost that includes first cost of materials and long term operating costs, as well as other owner goals.

- This project should use the latest innovative technologies and concept to meet ASHRAE Standard 189.1
- Excellent indoor environmental quality that ensures materials are not damaged
- Excellent indoor environmental quality that facilitate occupants' use of the space by providing a comfortable and safe environment while avoiding the design attributes related to poor HVAC system performance, poor space utilization, poor acoustical qualities, inconsistent interior style, and low durability of finishes
- Operation and maintenance needs are for an easily serviceable, maintainable, and secure facility that has low utility and maintenance costs
- Provide a building which has the best life cycle cost for the applicable climate and the owner's budget
- Cold storage areas must be maintained to a temperature and relative humidity per the below table
- The building must be operated at positive pressure to prevent unwanted infiltration
- Designers can assume that each cooler door will be open for a period of one-minute per occupied hour
- Ensure all food products are maintained at temperature and humidity levels per ASHRAE 2018 Refrigeration Handbook
- Assume coolers and freezers are constructed on site with 4-8 inch [10-20 cm] panels and include suitable washdown construction surfaces
- Based on the sizes of coolers and freezers in the drawings assume each one will be used for various food items as determined to be appropriate for a facility of this size serving the visitors referenced earlier

Design Requirements

	Cooling	Heating
Various Meat Coolers	***	***
Various Meat Freezers	***	***
Various Produce Coolers	***	***
Various Produce Freezers	***	***
Dry Storage	40% Max RH 75°F [24°C]	40% Max RH 70°F [21°C]
Conference Room/Lunch Room	Occupied: 72°F [22°C] Unoccupied: 80°F [27°C]	Occupied: 68°F [20°C] Unoccupied: 60°F [16°C]
Enclosed Office	Occupied: 75°F [24°C] Unoccupied: 80°F [27°C]	Occupied: 70°F [21°C] Unoccupied: 60°F [16°C]
Open Office	Occupied: 75°F [24°C] Unoccupied: 80°F [27°C]	Occupied: 70°F [21°C] Unoccupied: 60°F [16°C]
Telecommunications/Storage	Unoccupied: 80°F [27°C]	Unoccupied: 60°F [16°C]
Restrooms	Occupied: 75°F [24°C] Unoccupied: 80°F [27°C]	Occupied: 70°F [21°C] Unoccupied: 60°F [16°C]

(Note: All coolers have a height of 9 ft [2.7 m], food items arrive in refrigerated trucks that are at their required temperatures)
*** Per ASHRAE Handbook Refrigeration 2018 – Chapter 21

Budget Considerations and Limitations

The approach to allocating resources for the HVAC systems is to examine life cycle costs, including capital investment, operating cost, maintenance costs, and employee productivity. The key values are:

- Assume the owner's budget is 350 USD/ft^2 [3,767 USD/m^2]
- Life of the building: 50 years
- Return on investment: 7%
- Inflation rate: 3%
- Utility escalation rate based on a 10-year average increase for utility provider (water, gas, etc.) in the area.

Building Assumptions

Assume building envelope construction and all insulating values meet ASHRAE Standard 189.1 minimum values while incorporating the owner's goals listed below:

- Synergy with surrounding architecture
- Exterior walls to be masonry mass wall construction
- All floors to be concrete poured as slab on grade
- Double-glazed, fixed windows, one-half inch air space, low emissivity coating on third surface, bronze tint
- Superior acoustic criteria in all spaces with minimal sound transmission from the adjacent spaces and low noise produced from HVAC systems
- Available utilities on site include natural gas (8 psig [55 kPa] from main), electrical power (400V/3 phase/50 Hertz), city water (60 psig [414 kPa]), and associated sewer
- Assume that the top of the drawings is oriented North

Codes and Standards

Codes as determined by the local Authority Having Jurisdiction (AHJ)

- ASHRAE Standard 15
- ASHRAE Standard 34
- ASHRAE Standard 55
- ASHRAE Standard 62.1
- ASHRAE Standard 90.1
- ASHRAE Standard 189.1
- ASHRAE Handbooks

Use the latest available versions of all ASHRAE Standards.