PERFORMING ARTS CENTER
UNIVERSITY OF DUBUQUE
DUBUQUE, IOWA

Cost
Total Project: $35,000,000
Construction: $30,000,000
MEP Const: $7,000,000

Owner
University of Dubuque
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Team
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Project History
This project provides a new 80,000 square foot home for the University of Dubuque Performing Arts Program. The project includes a 1,000-seat proscenium theatre with orchestra pit, 150-seat black box theatre, scene shop, costume shop, dressing rooms, rehearsal rooms, classrooms, practice rooms, offices, student commons and cafe.

Theatrical Design
The main proscenium theatre was designed for a wide variety of uses including orchestral, chamber music, opera and theatrical performances. The project included complete performance lighting and stage rigging systems.

Acoustic Design
Acoustical design was critical to this project and required incorporating careful detailing for sealing penetrations of acoustically sensitive construction and specialized vibration isolation into all aspects of mechanical and electrical systems design.

Energy Design Goals
The project incorporated a wide variety of energy efficiency measures totaling a 59% savings compared to a minimally code compliant building. The project was modeled as saving over $140,000 in energy costs every year and qualified for over $325,000 in incentives from the utility companies resulting in a payback of 3.8 years. The energy savings strategies included ground coupled cascading chiller/heaters, CO2 control of ventilation, displacement ventilation for the main auditorium, reduced lighting power density, occupancy sensor control of lighting and efficient wall/roof assemblies.

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HVAC Design

The core of the HVAC system consists of geothermal chiller/heaters connected in a unique cascading arrangement. The loop water is circulated through an external closed loop heat exchanger designed to transfer heat to and from the ground. On leaving the ground heat exchanger the loop water is directed to either the evaporator or condenser of the chillers depending on if the load is heating or cooling dominant. The ground heat exchanger consists of piping inserted into 144 bore holes 295 feet deep for a total of 33,000 ft of active borehole.

The air handling systems were designed with careful consideration for sound generation and vibration control including duct mounted sound attenuators, duct lagging, spring isolation hangers, sound caulk at duct penetrations through walls and duct sizing for low air velocities. The Auditorium system incorporates displacement ventilation air distribution with under floor plenums and floor diffusers located under the seats. It also incorporates three separate zones for improved thermal comfort and energy efficiency. The air handling system serving the general-use building spaces is a conventional variable volume system with terminal units and hot water reheat coils. However, the low temperature hot water required special care in selection of the reheat coils.

Ventilation air for the entire building is provided by a single 100% outdoor air energy recovery unit with distribution ductwork serving each air handler. The energy recovery unit incorporates a total heat recovery wheel for both sensible and latent energy recovery.

Humidification is provided by an electric steam injection system. Perimeter heating, where required, was accomplished using radiant floors.

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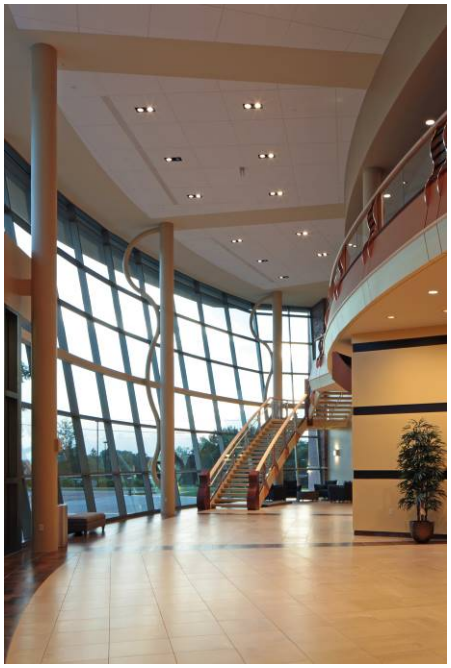

Electrical System Design

The building is served from a 3,000 amp 277/480V electrical service with distributed transformation at key locations within the facility to provide 120/208V power. Separate distribution branches were provided for emergency lighting loads, mechanical loads, audio video loads, theatrical loads and lighting/receptacle loads. Theatrical distribution systems were designed with 200% rated neutrals and the audio video distribution systems were designed with isolated neutrals and isolation transformers. All branch circuits were provided with dedicated neutrals. A breaker coordination study was included in the project to assure a well-coordinated system and to confirm the emergency system was selectively coordinated. Arcflash analysis was also conducted and appropriate labels provided at electrical equipment. Surge suppression was included on the main service. A central inverter serves all emergency lighting in the facility, both in classroom spaces and theatrical spaces.

The project also included removal of the last remaining 5kV systems owned by the University of Dubuque. The project was very unique in that it was the last piece of the puzzle to complete the primary power loop for north campus that started over 10 years ago. Close coordination with Alliant Energy was required to complete the design and assure that power would be available during construction. The north half of the UD campus now has the ability to be served from two directions to limit downtime for any future disruptions or power outages.

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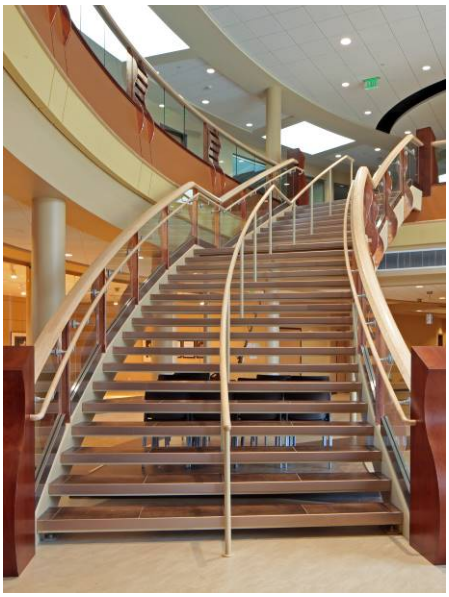

Lighting Design

Classroom lighting systems were based around a high lumen T8 lamp source (commonly referred to as “Super T8"), circulation spaces were based around LED and ceramic metal halide lamp sources and theatrical spaces were based around halogen lamps for their superior dimming control. Exterior lighting was LED wherever possible. Fixture efficiencies and lamp efficacies were studied to provide the most effective lighting technology for the application.

Lighting controls for non-theatrical spaces were based on a digital stand alone lighting control system that included occupancy sensors, daylight sensors and manual switches. Sensor adjustments are able to be made through an infrared remote in lieu of the traditional style of sensor dip switch settings. The commons area in the facility was equipped with a CPU controlled system for the complex nature and demanding flexibility of the space. Daylight harvesting was implemented in areas with adequate natural light. Each theatrical control system was dedicated for each independent performance space and included over 500 independent lighting zones. Some zones served dimmed loads and other zones were served by switching modules. An extensive theatrical dimming console was provided for user controls.

Emergency lighting was provided from the central inverter and used the general illumination fixtures as emergency via localized lighting transfer devices.

The exterior façade was lit with color changing LED fixtures, the porte-cochere was lit with linear fixtures that expressed the radial curves of the building. Site lighting was provided to match the

custom UD campus standard while decorative bollards were provided near the building to match the architectural expression of the facility.