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Lighting/Electrical Option
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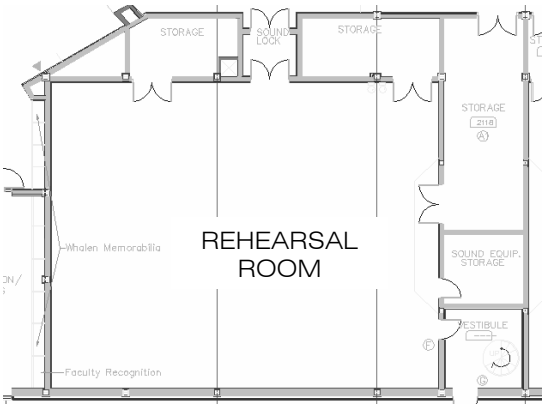
Lighting Existing Conditions and Design Criteria Report
October 8, 2003

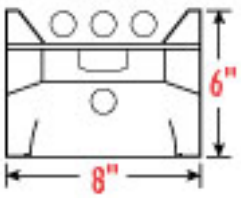
Photo courtesy of HOLT Architects, P.C.

Large Work Space

General Description



-Room #219 is a large rehearsal room with an open seating plan used for regularly scheduled instrumental rehearsals. The space is approximately 2800 sf with an additional 800 sf of adjacent storage space. The floor is a sealed hard maple. (ρ=.5) The ceiling is approximately 25' AFF and there is a small observation space hanging over the space in the northeast corner of the room starting at 15' AFF. The North, South, and West walls are painted CMU block capable of being covered from ceiling to 9' AFF with acoustic velour curtains. (ρ=.2) The East wall is painted gypsum board. (ρ=.6) All four walls are covered from floor to 7'4" AFF with acoustic panels. The only permanent architectural features are a 10' chalk board on the North wall, and two water fountains on the North wall. See attached plans, sections, and elevations, including a proposed furniture layout plan.



Lighting System

-All lighting for the open space is currently supplied from a system of direct/indirect rectangular pendants where the direct and indirect lamps are completely separated in the luminaire. The specs indicate there are four 32W T8 lamps in cross section, and I am assuming they are used in the one down, three up configuration as indicated in cross section. The plans indicate A and B switched lamps, controlled separately and running to separate spaces on panel board PP-4A. Note 8 on drawing E106 indicates that the A lamps are downlights and B lamps are uplights. There are no special controls in this space, only standard light switches. The adjacent percussion storage room has 1x4' recessed 2F32-T8 static troffers, and the two generic storage rooms use 2x4' recessed 2F32-T8 static troffers. Ballasts were supplied as appropriate by the luminaire manufacturer to provide lowest initial cost. There are no exterior facing windows, and therefore daylight control is not an issue in this space.

Design Criteria

-This space, although technically an educational facility, does not necessarily have all of the same requirements of an IES defined educational facility. There are three criteria that must be met in the design of a instrumental rehearsal room lighting design. First, adequate horizontal and vertical illuminance must be provided. The most important task in this space involves focusing on sheet music. Sheets of small size, high contrast, low specularity text and graphics are placed almost vertically on a music stand. (approx. 80º above horizontal) The other visual focus point of a musician during rehearsal is the conductor, their arm movements, as well as subtle facial expressions must be easily recognized. Horizontal luminance from 40-50fc and vertical illuminance from 20-30fc should be sought. Secondly, the lighting system must also address the issue of adaptation between these two visual foci. Musicians must be able to quickly change their focus from their music to the conductor and back, with minimal adaption time and strain. The luminance ratio between the sheet music and the music stand should be less than 1:3 The luminance ratio between the sheet music and the directors face should be the same minimum, 1:3 The luminance of the wall behind the conductor should be no less than one fifth of the sheet music luminance. Thirdly, the lighting system should avoid any direct glare. Direct lamp view or reflected lamp image will increase the adaption time when changing focus within the room. Direct glare is distracting, and leads to a feeling of discomfort. The goal is for the musicians to remain comfortable and attentive for long periods of time, and through control of horizontal and vertical illuminance, task adaption, and direct glare this goal can be achieved.

This building was designed before ASHRAE/IESNA Standard 90.1-1999 took effect, and therefore most requirements for lighting are not met. Standard 90.1 requires that there be automatic lighting shutoff, and although there are various exemptions, there are no exemptions for this space. According to School/University allowances, the Classroom/Lecture/Training power density is 1.6 W/sf. Currently this space uses approximately 3.1 W/sf, nearly double the allowed value. Considerable redesign will be needed to meet Standard 90.1 requirements.

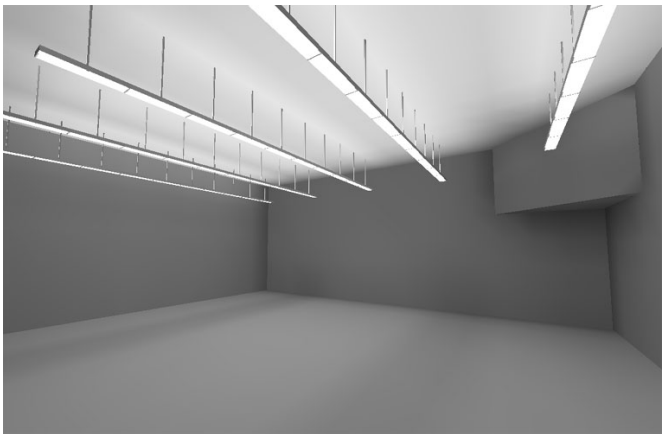
Analysis

-The following data was generated with AGI32;

- Horizontal Illuminance at task -64fc
- Vertical Illuminance at task -18fc
- Power Density -3.1W/sf

-Calculations based on;

- Ceiling ρ=.8
- Wall Average ρ=.4
- Floor ρ=.5
- Total LLF=.79

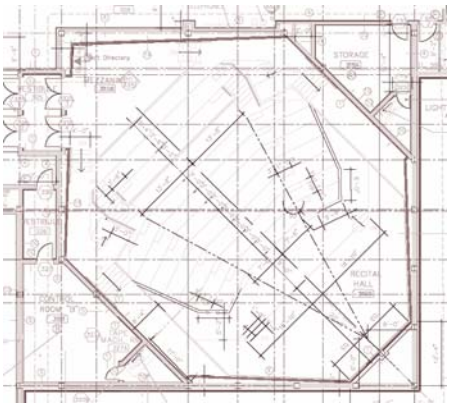


-Overall the current lighting system achieves most design goals, but does not address Standard 90.1 requirements. A similar system will most likely be the most appropriate choice, but various layouts and approaches will be used in developing a new lighting system for this space.

Special Purpose Space

General Description

-Room #227 is a 250-seat recital hall designed primarily for solo and chamber music recitals. The space is approximately 3800 sf with approximately 750 sf stage area. There are lighting galleries to the left and the right of the stage, and an acoustic panel and lighting system hanging over the stage. The floor is dark carpet (ρ=.2) The walls are gypsum painted a dark maroon color (ρ=.3) The ceiling is gypsum painted slightly off white (ρ=.7) The maximum floor to ceiling height is 41', and the mezzanine access from the 3rd floor is 18.5' above the lowest point of the floor. The main seating area is split into three separate sections, and is flanked on both sides by box style seats. There is access to the room from the 3rd floor, which is the main lobby floor, as well as the second floor for performers and emergency exit purposes.



Lighting System

-The architectural lighting in this space is provided by 21 wall mounted indirect ceiling washing lights with 500W tungsten halogen lamps and four custom chandeliers each with four indirect bowls housing one 500W tungsten halogen lamp each. All of these luminaires are controlled by the recital hall dimmer and are integrated with the stage lighting. Low level lighting is provided by recessed wall luminaires with 20W 12V lamps, and is also controlled by the hall dimmer. The walkways under the mezzanine providing access to the second floor are lit with 26W CF downlights. The hall dimming system uses IPS type dimmers that use IGBTs (Integrated Gate Bipolar Transistors) to regulate and control load voltage and, therefore, light level. IGBTs, in contrast to standard rheostat dimmers, produce no mechanical noise.

Design Criteria

-Again, this space does not quite fit directly into one of the IES definitions. It is in an Educational Facility, yet is a performance hall that sees activity like many public theatres. The adjacent hallways serve many other areas of the facility, and therefore the adjoining circulation space cannot be treated purely as a theatre lobby. Although the technical aspects of theatre/performance lighting are slightly out of the scope of this thesis, the architectural elements of this space will be considered. Because this space will serve multiple purposes from recital venue to lecture hall, the architectural lighting must accommodate these various tasks. The seating area should have a diffuse, comfortable 15-20fc while a performance is not taking place. This general seating lighting should be dimmable, and capable of being controlled from several locations within the space. Higher levels of 30-

40fc should be attainable to support reading and note-taking. There should also be adequate exit signs and emergency powered lights to get people safely out of the theatre in case of an emergency. The architectural lighting in the recital hall should serve three main purposes, to usher people safely to their seats, to provide adequate light to achieve whatever task they may be attempting while at their seat, and to induce a calm, formal and anticipatory attitude in the audience. The lighting in spaces adjacent to the recital hall should be attractive and should direct the flow of foot-traffic into the theatre. A minimum of 20fc should be maintained for safe navigation and informal discussions outside of the theatre. According to the ASHRAE/IESNA Standard 90.1-1999 there should be automatic lighting shutoff, but since this is a very controlled environment, and architectural lighting elements are powered on an average of 20 hours per week, automatic controls can be left out of the design. Also, this space would be considered a Performing Arts space within a Theatre Building by Standard 90.1, which is allowed a power density of 1.8 W/sf for the Audience/Seating Area. Currently the architectural lighting in this space consumes a whopping 5.1 W/sf Either exemptions from Standard 90.1 will have to be found, or serious redesign of the space will be needed to achieve all design goals including power density allowance.

Analysis

-The following data was generated with AGI32;

- Horizontal Illuminance at task -18fc
- Vertical Illuminance at task -10fc
- Power Density -5.1W/sf

-Calculations based on;

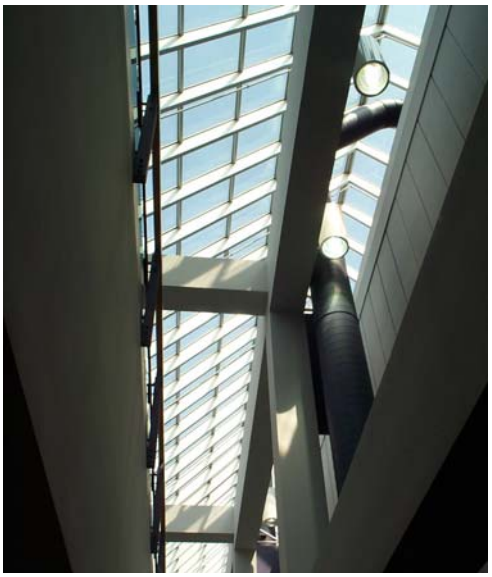
- Ceiling ρ=.7
- Wall Average ρ=.3
- Floor ρ=.2
- Total LLF=.71

-Overall the architectural lighting system in the recital hall is quite poor. Chandeliers of inappropriate scale and odd material choice with inefficient halogen lamping top the list of issues that need to be addressed. Also, the high level washing of the walls and ceilings causes ugly silhouettes of the lighting equipment, unfortunately increasing the equipments visibility The hallways adjacent to the recital hall are dark and gloomy and do nothing to identify the contents of the space behind the doors. The lighting system, even though at a beefy 5.1W/sf, at full output can only produce a horizontal illuminance of 18fc once LLF's are applied. And even though the incandescent lighting in the space is easily dimmed, what is the point in being capable in dimming below any usable light levels? (ie. below 15fc) Maintaining dimming system compatibility while addressing the aesthetic and regulatory design goals will be difficult.

Circulation Space

Gerneral Description

-The 3rd floor entrance on the Southeast corner of the building serves as the formal entrance to the school of music, and the most important spaces within the building can be reached directly from this entrance. Slightly to the right is a multi level space which feeds directly to both the Recital Hall and the larger Ford Hall. This area is dominated by low ceilings and heavy shadows, and is meant to serve as a lobby while performances are taking place, yet must serve as circulation corridors at all other times. This space has drop ceilings (ρ=.7) The walls in the circulation space are of various construction, painted CMU (ρ=.7), painted gypsum (ρ=.6), wallpaper (ρ=.4) and include features like bulletin boards (ρ=.4)



Slightly to the left after coming in the entrance is a completely different feeling space, a 4 story sky lit atrium with gently sloping walkways creates the interface with the remaining exterior of Ford Hall. The sloped walkways at the top levels access faculty studios, and then continue down to the lowest level where there are student lockers and private rehearsal rooms. The walls on the new construction side of the atrium are lightly colored painted gypsum (ρ=.5) and the existing Ford Hall side of the atrium the walls are slightly off white painted concrete (ρ=.7) and glass (ρ=.08)

Lighting System

-Lighting in the main entrance is provided by 9” compact fluorescent downlights with (2)26W TT horizontal lamps and staggered strip fluorescent cove mounted fixtures using F32T8 lamps. There is significant daylight that spills into the main entrance area through the glass doors and adjacent glazing, but there is no provision for controlling or compensating for the additional light. Lighting in the area to the right of the main entrance is provided solely by the same 9” (2)26W TT compact fluorescent downlights recessed into the 2x2’ drop ceiling. There are no daylight openings in this space and daylight control does not need to be

considered. In the atrium to the left of the main entrance there is significant daylight that needs to be considered. The skylight that runs the length of the atrium contributes significant amounts of light into the space, and should be controlled appropriately. However, there are no apparent attempts at controlling or accounting for the daylight additions to this space. Artificial light in this space is provided by 16" 400W ceramic metal halide downlights tucked behind structural elements and decorative 100W metal halide wall mounted Louis Poulsen luminaires with remote mounted HPF encapsulated ballasts. Control of the lighting in all three circulation spaces is away from public access, and is probably left on 24 hours a day. The project documents do not clearly indicate any specific controls for any of these areas.

Design Criteria

-In any circulation space, regardless of adjacent spaces, the goal of the lighting system should be to safely and effectively draw people towards their destination. Horizontal illuminance should be around 10fc to ensure safe travel and should not go much over that so that accent illumination on points of interest can stand out. Vertical illuminance should be relatively similar to horizontal illuminance to ensure good facial rendering. Direct glare should be avoided so that attention is not drawn away from the visual goal within the circulation space. For the main entrance, daylight should be considered because this space serves as an adaption space while people are entering the space. Illuminance inside this area should be very high during daylight hours to help transition outdoor light levels to the interior light levels. While at night, the illuminance in this area should be relatively low, as to bring patron's vision out of the mesopic and into photopic range.

The corridor to the right of the main entrance should be treated differently than the main entrance. The lighting in this area should hint at the purpose of the spaces adjacent to the corridor. It should have a heavier mood, more distinct shadows, and a warmer more comfortable feel. The general rules of circulation spaces should still apply, vertical illuminance should still be significant enough for facial identification and light levels should remain high enough to be safe yet low enough to allow for high contrast with points of interest. (~10fc)

The atrium to the left of the main entrance has an undeniably different feel than the other two circulation spaces. The skylight brings vibrant cool light into the space and constantly changes the feel of the space, with naturally changing color temperatures, light levels, and sun angles. The lighting system during daylight hours does not need to be running at full output, and some daylight integration controls should be added to let the lighting system serve as a supplement to the daylight. The system at night should mimic the feel of a skylit atrium as much as possible. Even though the walkways in this area are not considered stairs, there should be a slightly higher horizontal illuminance than the other circulation spaces, to aid in navigating the sloping corridors. (15-20fc)

Power density on the first three floors of the atrium should be kept to 1.3 W/sf and .2 W/sf for the fourth floor, averaging to 1.0 W/sf for all levels. The current power density is 1.9 W/sf for the atrium, which is too high according to ASHRAE/IESNA Standard 90.1-1999. The allowed power density for the main entrance and corridor to the right is 0.7 W/sf by Standard 90.1. Currently, these spaces average to 1.7 W/sf, more than double the allowed value. Since all of these systems are apparently left on 24 hours a day, a significant cost savings will come from Standard 90.1 compliance, both in power density reduction and controlled operation.

Analysis

-The lighting systems in all three circulation spaces are noticeably inadequate. The atrium, although breathtaking during daylight hours, has a disappointing lack of control systems. Also the main entrance and corridor to the right lack a certain aesthetic element. The ceilings are cluttered with downlights and air handling vents and seem to follow no rhyme or reason. Odd scallops are cast on walls and columns, and the low ceilings create extremely heavy shadows on faces in the corridor. Power density goals are far from being met, but with creative solutions do design criteria all Standard 90.1 regulations should be met.

Outdoor Space

General Description

-The weathered façade of the old Ford Hall faces the main mall on campus and is how most of the student population identifies the facility, where as the formal Southwest façade is what most visitors to campus see and associate with the building. There are many entrances to the facility, but the two that see the most traffic are at these two entrances. The old Ford Hall façade is primarily formed concrete, with some glazing, and odd wood accents along the 4th floor porch area. There is a built up base of stone surrounded by shrubbery addressing the mall, and the main path to the Ford Hall entrance leads just to the right of the building and enters at the intersection of the new and old construction. The new Whalen façade is composed of both light tan and traditional red brick, with limestone accents and sleek dark glazing with bright aluminum frames. Being on a college campus, there is very little room around the building, and therefore must it must match, or at least compliment the architectural context of surrounding buildings.

Lighting System

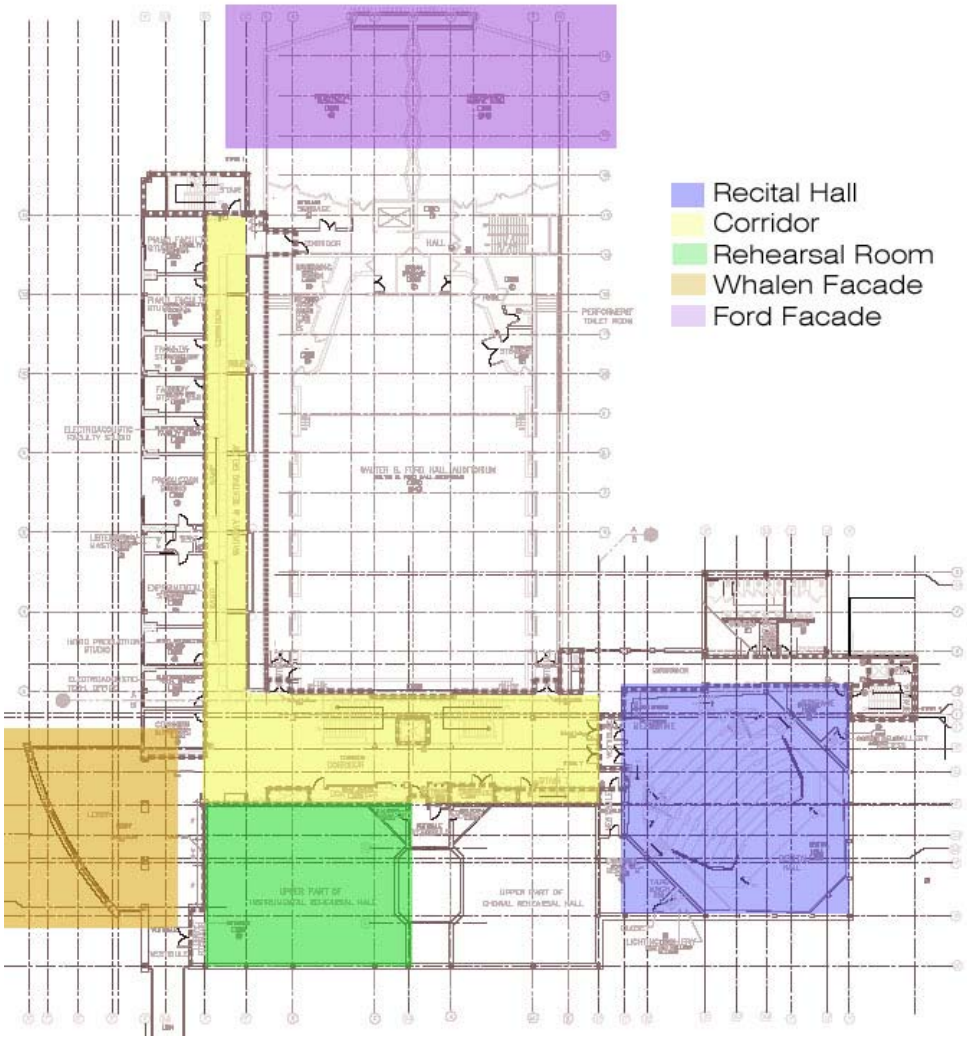
-Currently the new Whalen façade is lit by four 70W MH downlights mounted to the four pillars supporting the canopy above. There are 6" 100W MH downlights integrated into the canopy, flooding the entrance with light. Adjacent walkways are lit with decorative pole mounted luminaires with two heads oriented at 180º each with one 100W MH lamp as well as a number of luminaire/bollards with 100W MH lamps which serve both lighting and vehicular restriction purposes. The Ford façade has no lighting, except two 6"100W MH downlights under a small canopy over the only Northwest entrance. Controls for the system are not indicated on drawings, and the separation between building controlled luminaires and campus controlled luminaires is not clear. More detail will be sought from campus physical plant personnel.

Design Criteria

-The school of music holds a higher profile than most other departments on campus, and its facility should hold a higher profile on campus as well. Being on a college campus, the building does not need to, and in a way is restricted from, advertising itself. But being the staple of Ithaca College, the building should exude a feeling of permanency and significance at night. Low level silhouette lighting around the base of the Ford façade should create a grounded feel to the building, and the multiple protrusions and angles will serve nicely to catch light and create gradients. Every night around the facility should also be a safe night, and the design of lighting on adjacent pathways should ensure safe travel to and from the facility. On nights of scheduled performances, lighting system addressing these facades should have the capability to come alive, and really draw attention to the facility and the music being created within. The increased visibility and dramatic appearance of the facility on performance nights will serve to heighten the anticipation of both the musicians and the audience. The approach to the building should be dramatic and should make visitors think "something special is happening here tonight." This does not mean flooding the building, rather carefully selecting lighting elements that will draw visitors into the building and easily identify a night as a performance night. Exterior light levels should trigger controls for the exterior lighting of both entrances automatically, and there should be a control area accessible by maintenance staff to activate the 'performance night' lighting. According to ASHRAE/IESNA Standard 90.1-1999 the power density allowance for the canopied area of the Whalen façade is 3 W/sf and any additional façade lighting would be held to 0.25 W/sf of illuminated façade area. The same 0.25 W/sf would hold true for lighting the old Ford façade. There are no specific Standard 90.1 requirements for control devices, and any control devices would be for energy savings and performance variation only.

Analysis

-The current exterior lighting system currently satisfies all Standard 90.1 regulations for exterior building lighting power. The system also provides safe levels of illumination on all adjacent walkways, as security is always a top concern on college campuses. While functional, the lighting system unfortunately does not achieve any of the aesthetic design goals. There is vast room for improvement in the exterior illumination of the Whalen Center, and the fact that virtually no façade lighting exists, there is a blank slate open to may ideas. Although there are many possibilities for the exterior lighting system, any additional lighting of the Whalen Center should be subtle and ever conscious of adjacent buildings.



File Listing

A105.pdf – 3rd Floor Architectural Plans
A106.pdf – 3rd Floor Architectural Plans
A107.pdf – 4th Floor Architectural Plans
A108.pdf – 4th Floor Architectural Plans
A201.pdf – West Exterior Elevation
A253.pdf – Recital Hall Sections and Elevations
A503.pdf – Rehearsal Room Elevations
A509.pdf – Atrium Elevations
A856.pdf – 3rd Floor Furniture Layout

E105.pdf – 3rd Floor Lighting Plans
E106.pdf – 3rd Floor Lighting Plans
E107.pdf – 4th Floor Lighting Plans
E108.pdf – 4th Floor Lighting Plans

16500.pdf – Spec. Section 16500 – Lighting

P:\Thesis\agi\auditorium.a32 – Auditorium AGI32 Model
P:\Thesis\agi\rehearse.a32 – Rehearsal Room AGI32 Model