Benjamin Hagan
Lighting/Electrical Option
James J. Whalen Center for Music, Ithaca, NY
Primary Faculty Consultant: Mistrick

# Lighting Existing Conditions and Design Criteria Report

October 8, 2003

Photo courtesy of HOLT Architects, P.C.

## Executive Summary

This report contains analysis of the existing lighting systems at the James J. Whalen Center for Music at Ithaca College. Design criteria for the four spaces to be redesigned have been developed using IESNA guidelines and regulations set by ASHRAE/IESNA Standard 90.1-1999. It is noted that this facility was designed before Standard 90.1 took effect, and therefore nearly all lighting systems do not conform. This report also investigates architectural features, as well as required tasks, that will impact the lighting system design for each space. It is found that many special conditions exist within the facility, including the need for nearly 24/7 operation of all corridor lighting systems as students have continuous access to the building. The need to reduce power densities and add control devices is a recurring issue throughout the building, but it is also important to consider the aesthetic and task specific goals that are not achieved. The lighting system in the rehearsal room achieves most task requirements, but does not comply with Standard 90.1 requirements. The architectural lighting system in the recital hall has an extremely high power density compared to system output, and lacks a certain aesthetic continuity. The lighting systems in the three main circulation spaces consume more than the allowance set by Standard 90.1 and lack automated controls. Although the pathways adjacent to the Whalen center are well lit and safe, façade lighting is virtually non existent, and the appearance of the building could benefit greatly from the addition of an architectural lighting system. In conclusion, the Whalen Center for Music has very unique architectural features and serves the school of music well, yet suffers from an underdeveloped lighting system. With the use of automated control systems and more energy efficient lighting, all regulatory, aesthetic and task-specific design goals will be reached in the redesign of the four selected spaces.

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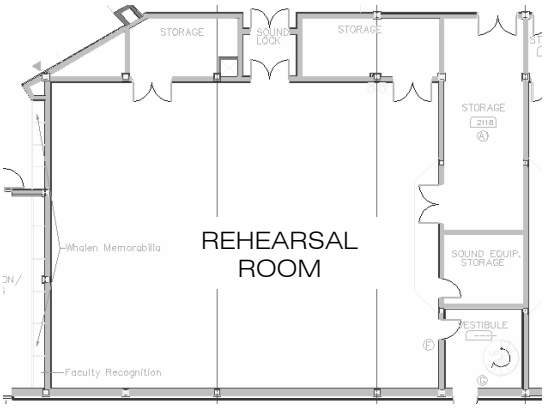
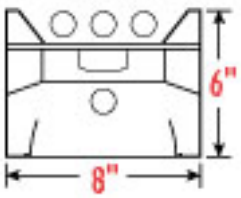
## Large Work Space

### 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.

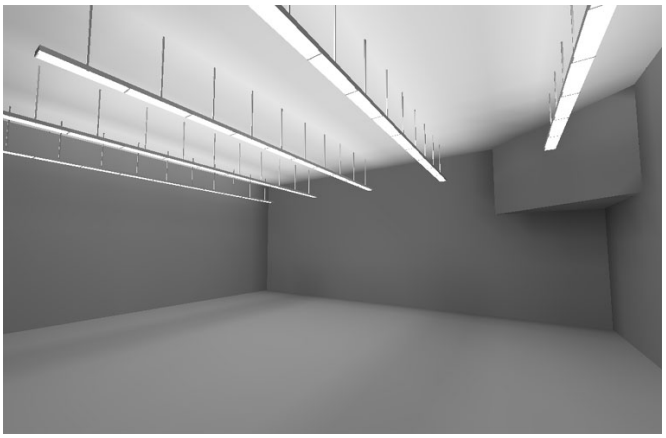
## Analysis

-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

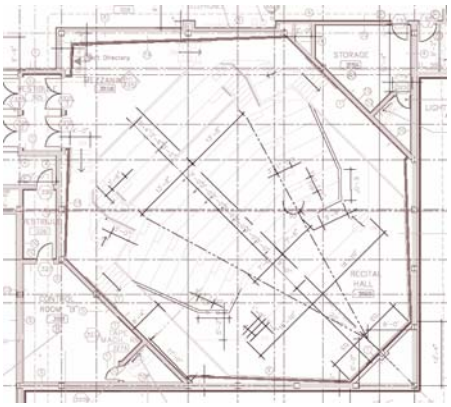


-Overall the current lighting system achieves most design goals, but does not address Standard 90.1 requirements. A similar system will most likely be the most appropriate choice, but various layouts and approaches will be used in developing a new lighting system for this space.

# 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;

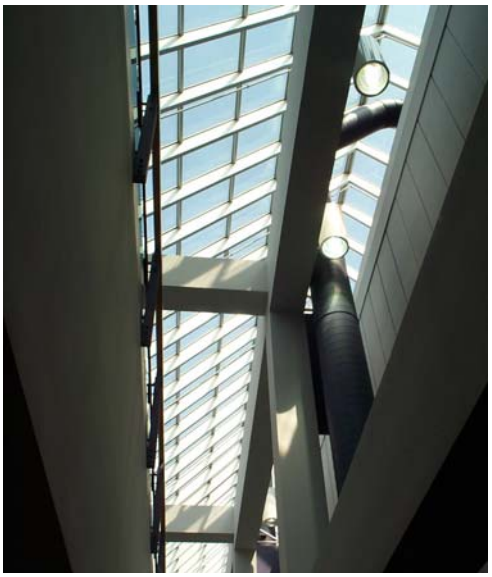
- Ceiling ρ=.7
- Wall Average ρ=.3
- Floor ρ=.2
- Total LLF=.71

-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 4$^{th}$ 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

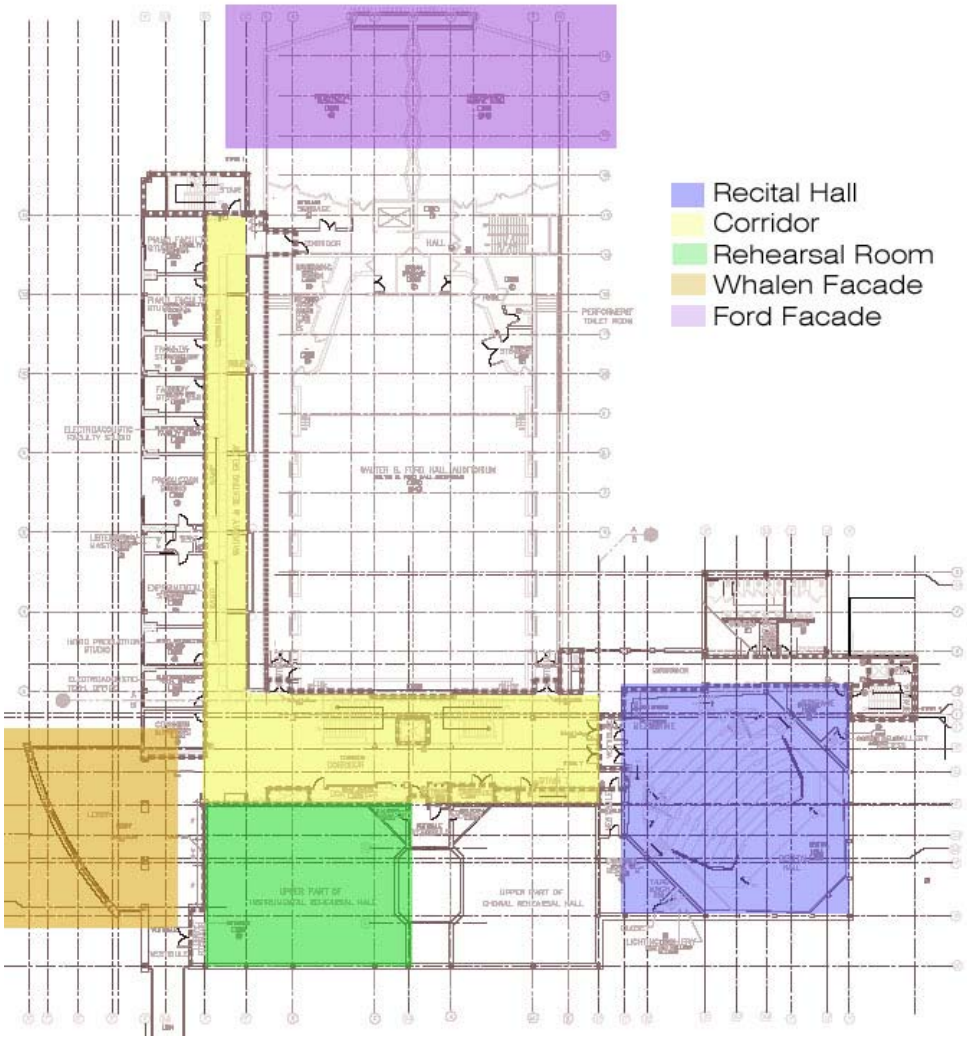
-Currently the new Whalen façade is lit by four 70W MH downlights mounted to the four pillars supporting the canopy above. There are 6" 100W MH downlights integrated into the canopy, flooding the entrance with light. Adjacent walkways are lit with decorative pole mounted luminaires with two heads oriented 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.



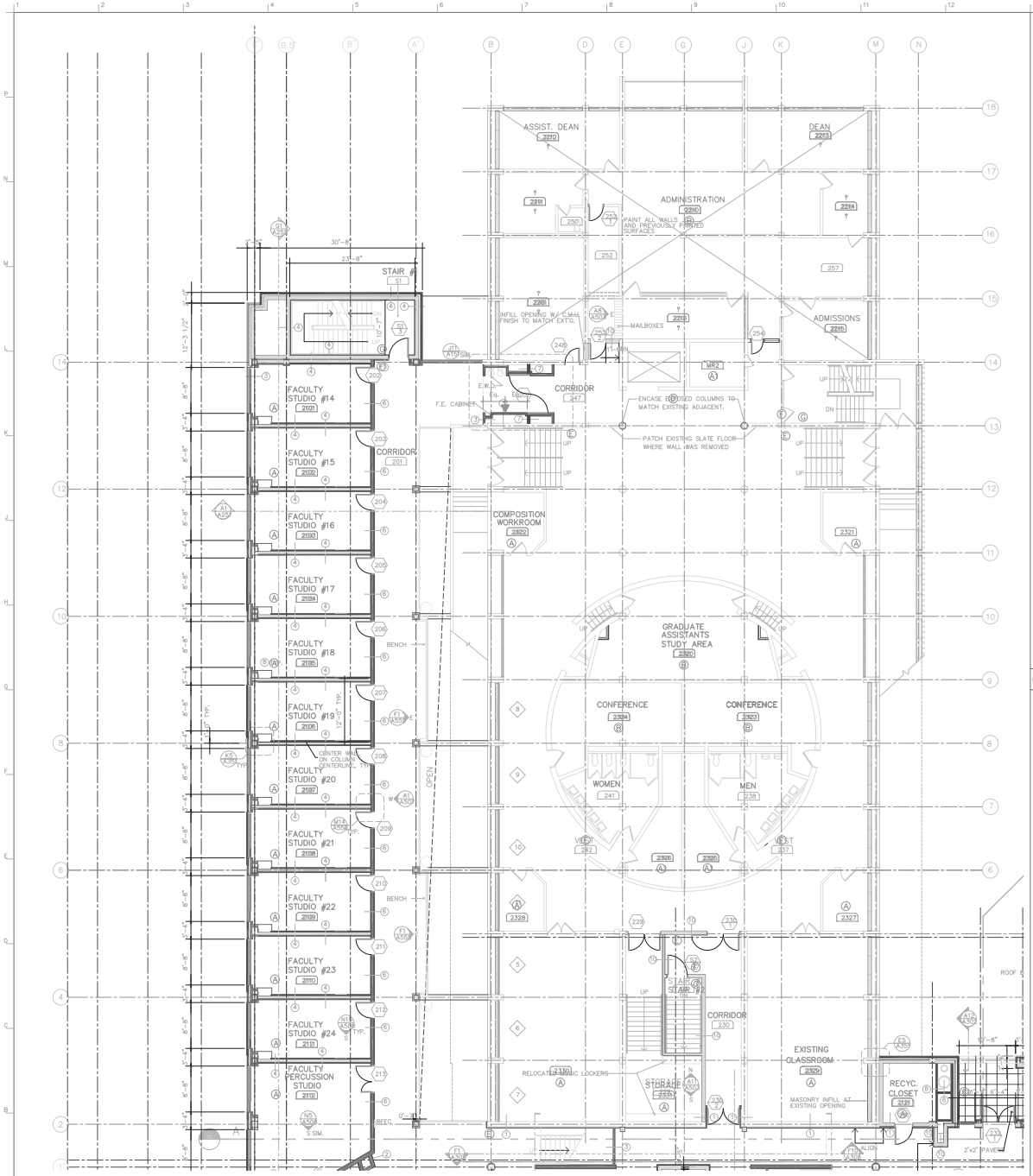
## File Listing

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

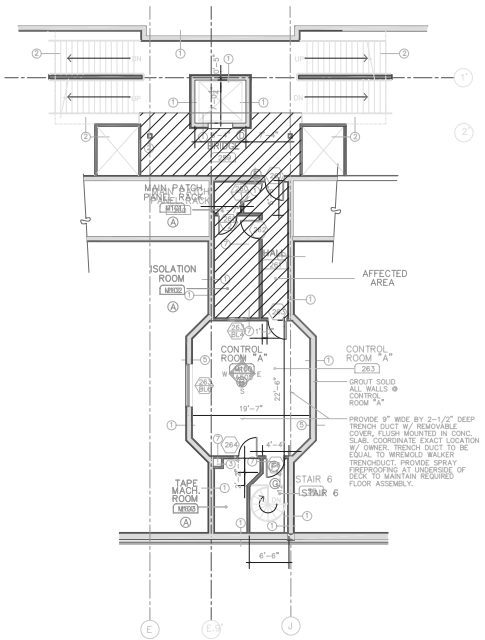
E105.pdf – 3rd Floor Lighting Plans
E106.pdf – 3rd Floor Lighting Plans
E107.pdf – 4th Floor Lighting Plans
E108.pdf – 4th Floor Lighting Plans

16500.pdf – Spec. Section 16500 – Lighting

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




A1 SECOND FLOOR PLAN "A"
1/8"=1'-0"




G1 ENTRESOL PLAN
1/8"=1'-0"

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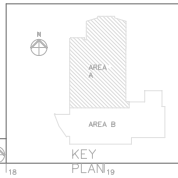
# James J. Whalen Center for Music
## Ithaca College
Ithaca, New York

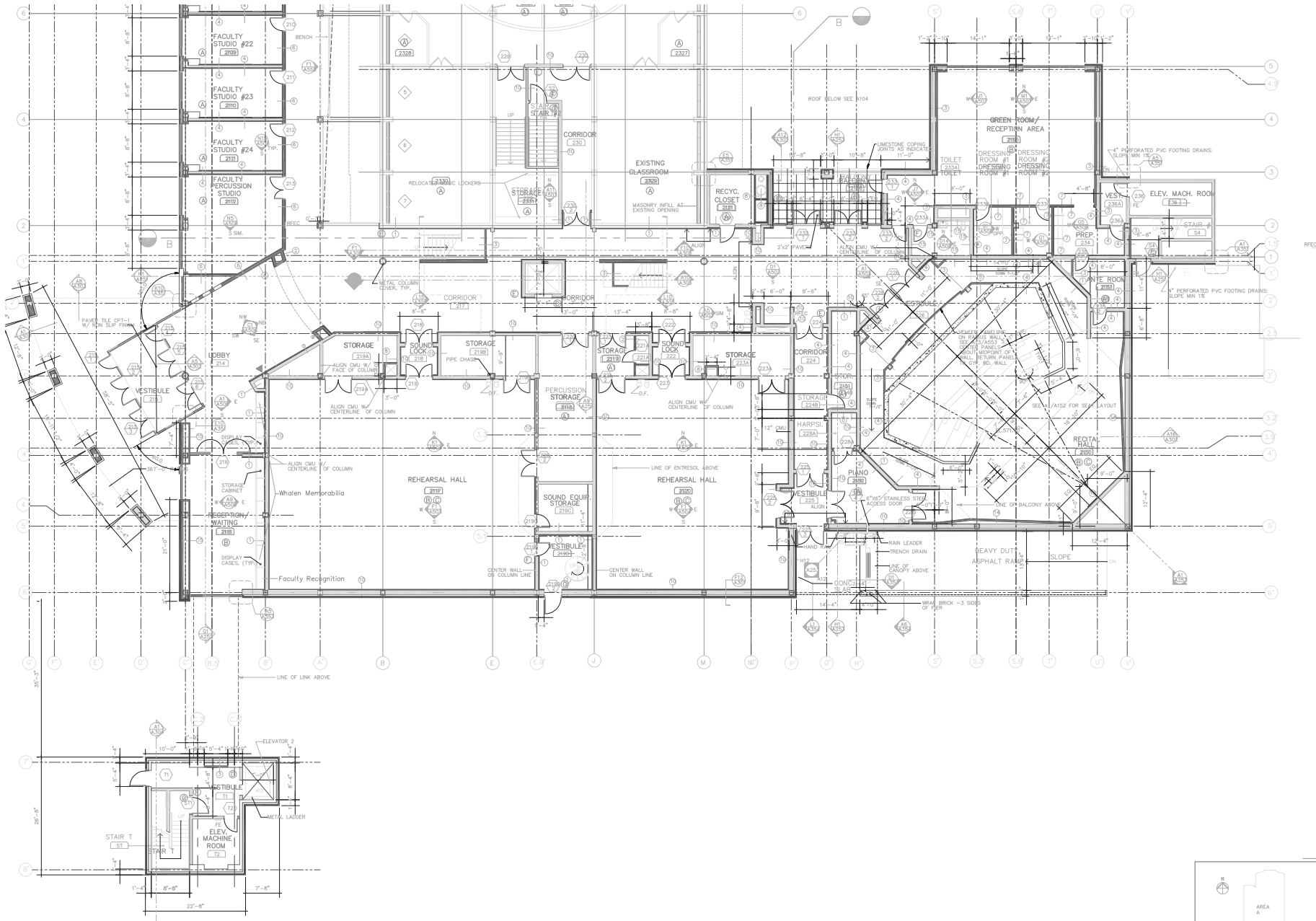
FINAL SET FOR CONSTRUCTION

DATE: 19 December 1997
PROJECT No. 97012
DRAWN BY:

SECOND FLOOR PLAN "A"/ ENTRESOL PLAN

A105






A1 SECOND FLOOR PLAN "B"
1/8"=1'-0"


Hoffman O'Brien Look Yaube & Chiang, P.C.
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DATE: 19 December 1997
PROJECT No. 97012
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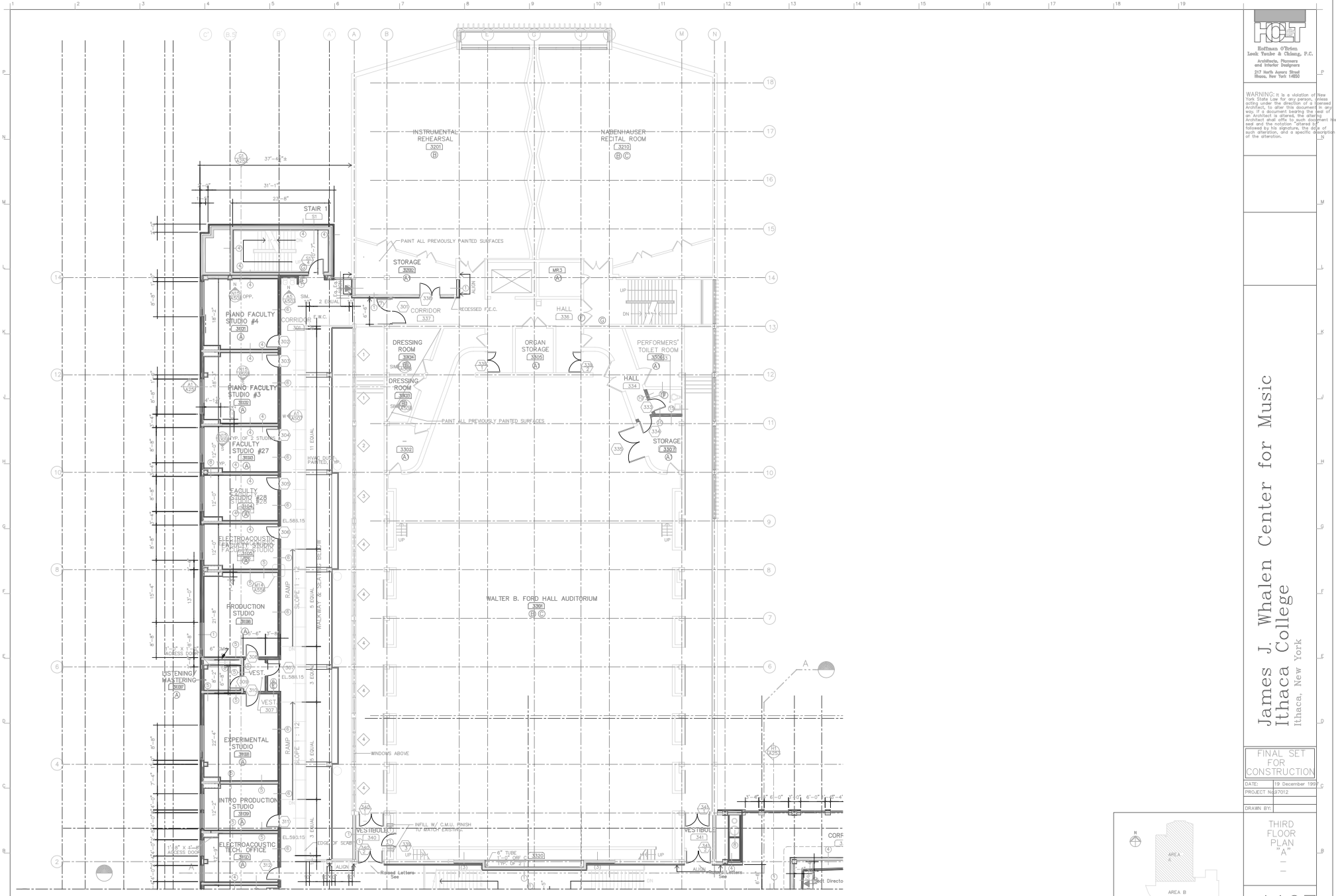
SECOND FLOOR PLAN "B"

A106

KEY PLAN

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DATE: 19 December 1997
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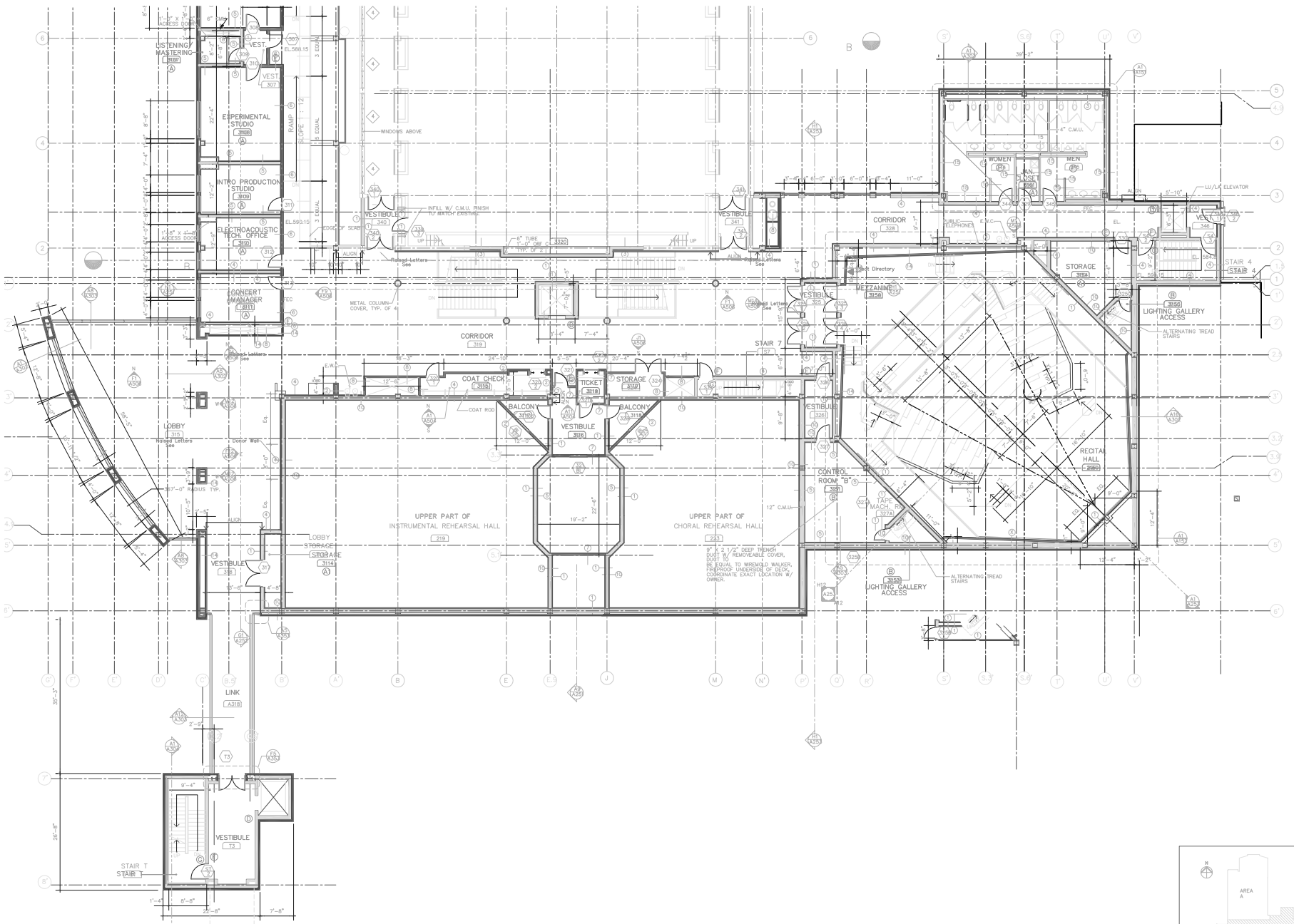
DRAWN BY:

THIRD FLOOR PLAN "A"

A107

KEY PLAN




A1 THIRD FLOOR PLAN "B"
1/8"=1'-0"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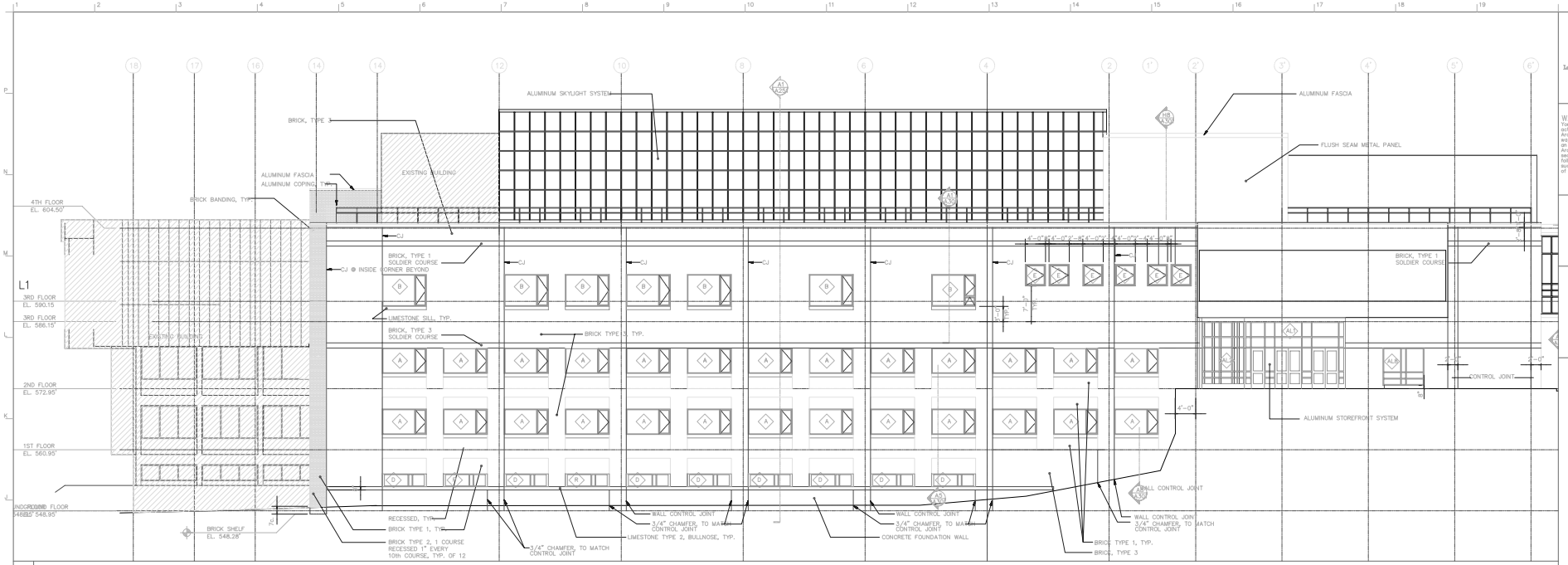
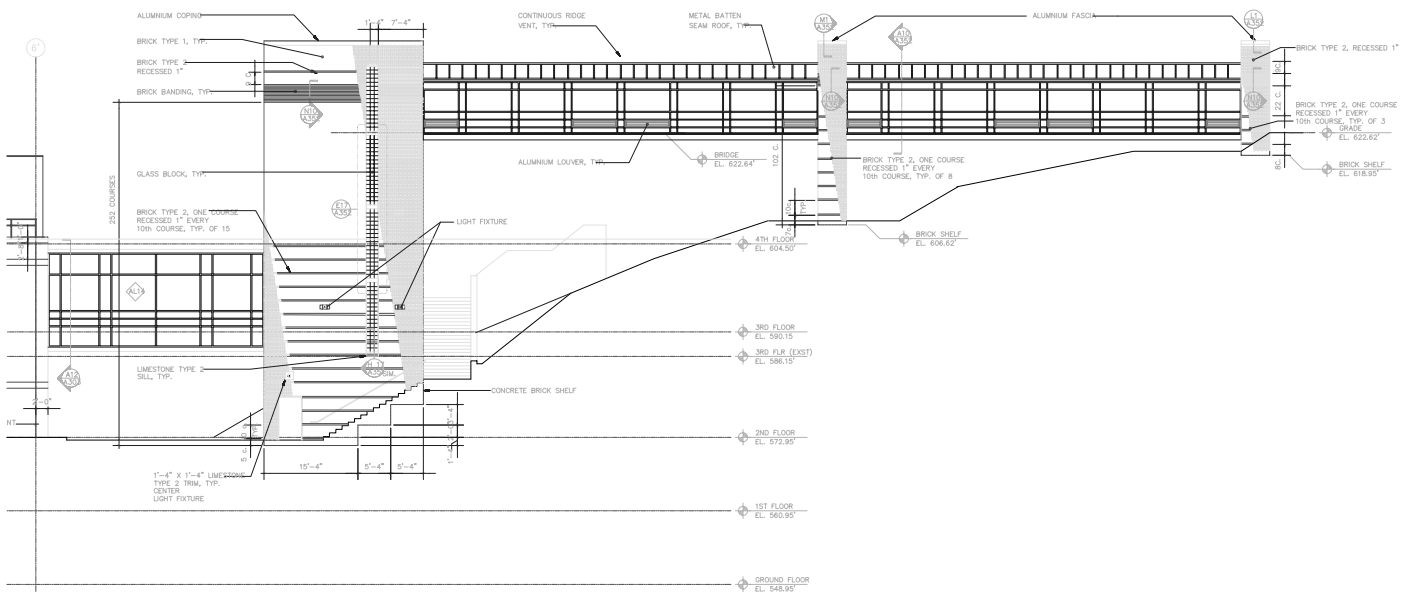
THIRD FLOOR PLAN "B"

A108

KEY PLAN
AREA A
AREA B




H1 WEST ELEVATION
1/8" = 1'-0"




A1 WEST ELEVATION
1/8" = 1'-0"

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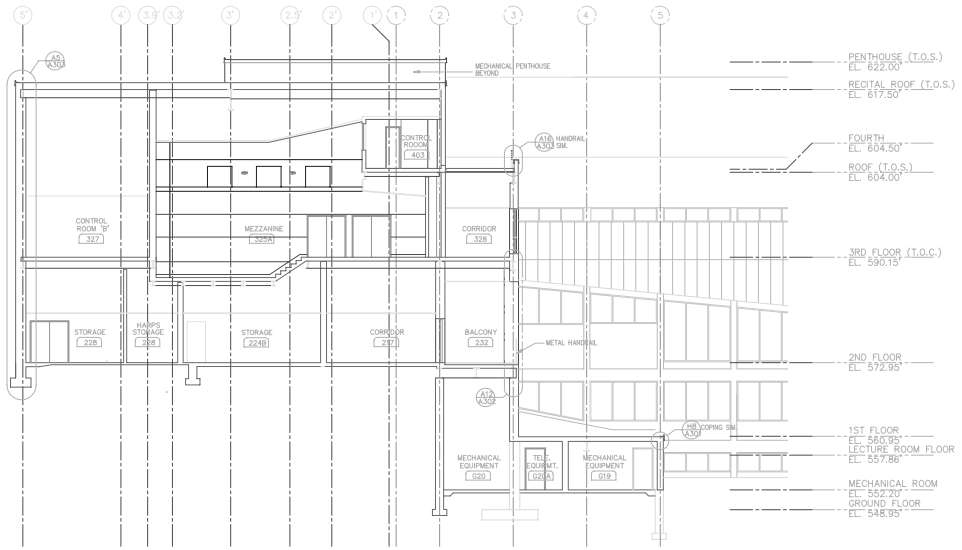
FINAL SET
FOR
CONSTRUCTION

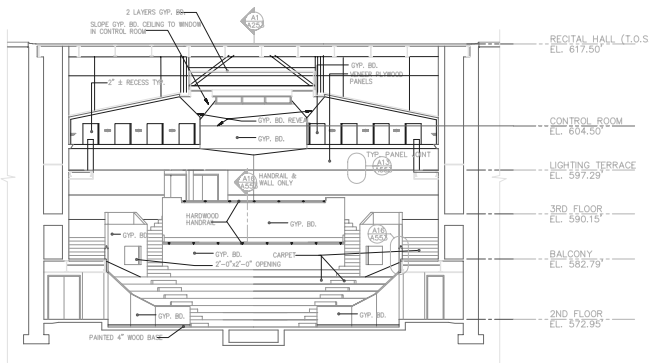
DATE: 19 December 1997
PROJECT No. 97012
DRAWN BY:

EXTERIOR
ELEVATIONS

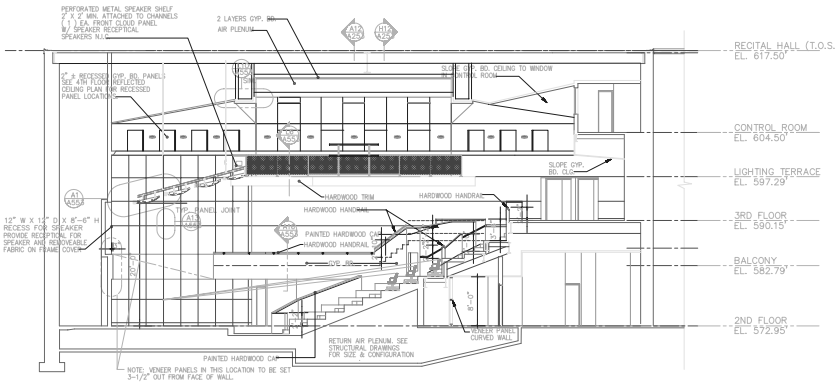
A201



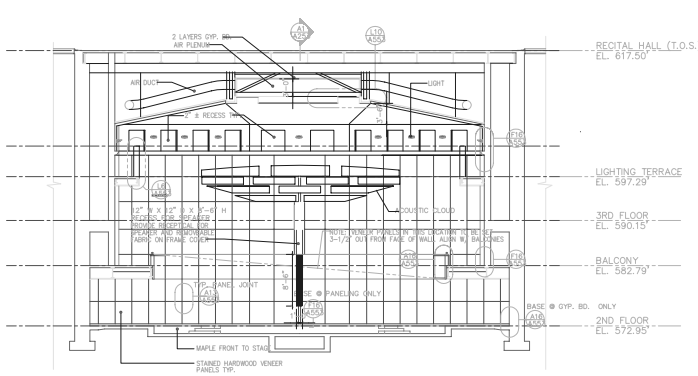

H1 SECTION 1/8"=1'-0"




H12 SECTION 1/8"=1'-0"




A1 SECTION 1/8"=1'-0"




A12 SECTION 1/8"=1'-0"

Hoffman O'Brien Look Yaube & Chhang, P.C.
Architects, Planners and Interior Designers
217 North Aurora Street Ithaca, New York 14850



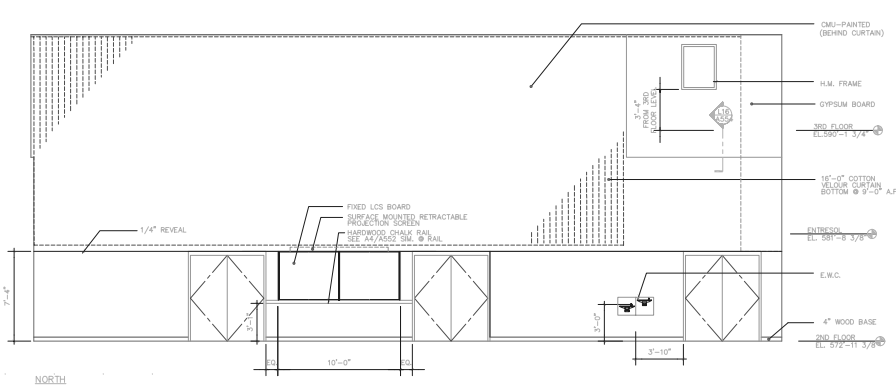
# James J. Whalen Center for Music
## Ithaca College
Ithaca, New York

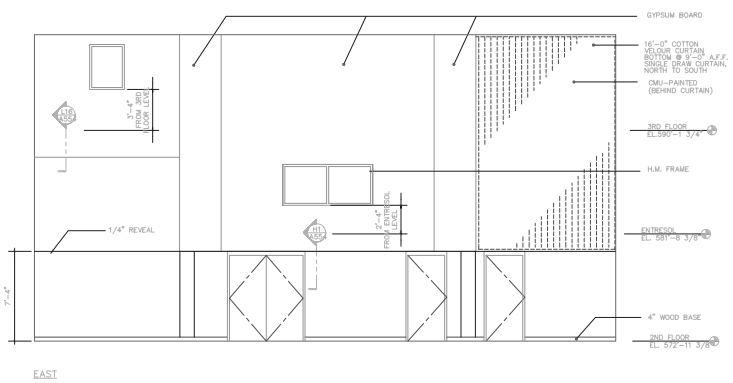
FINAL SET FOR CONSTRUCTION

DATE: 19 December 1997
PROJECT No. 9712
DRAWN BY:

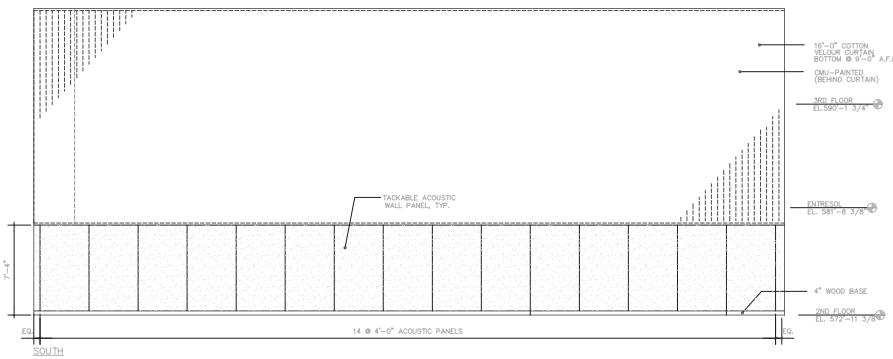
BUILDING SECTIONS / RECITAL HALL ELEVATIONS

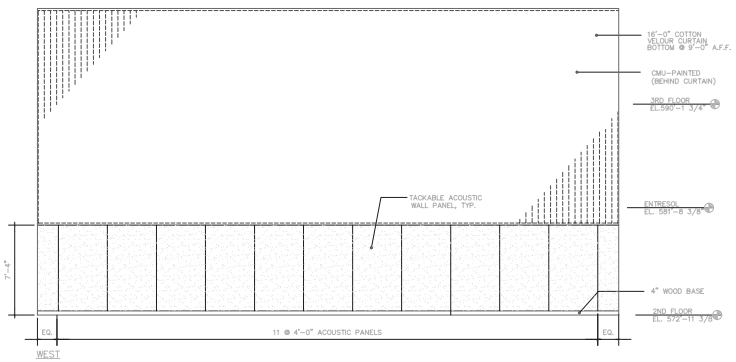
A253



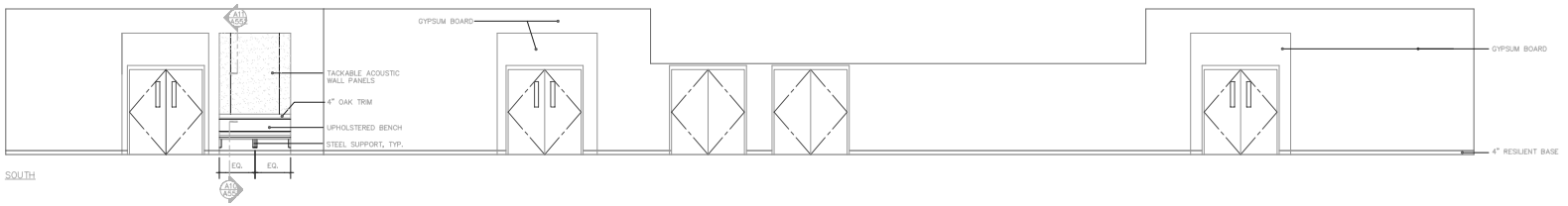




K1 REHEARSAL ROOM
1/4"=1'–0"

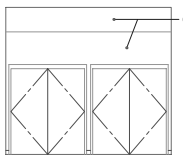


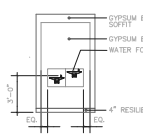

F1 REHEARSAL ROOM
1/4"=1'–0"



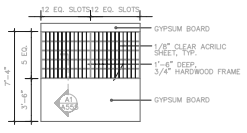

D1 CORRIDOR
1/4"=1'–0"



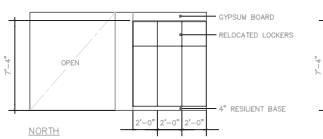

A1 CORRIDOR
1/4"=1'–0"

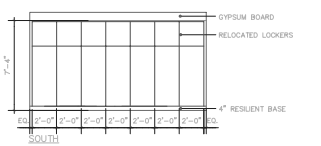



A5 CORRIDOR @ WATER FOUNTAINS
1/4"=1'–0"




A8 CORRIDOR @ MAILBOXES
1/4"=1'–0"




A1 STORAGE
1/4"=1'–0"

A11
1/4"=1'–0"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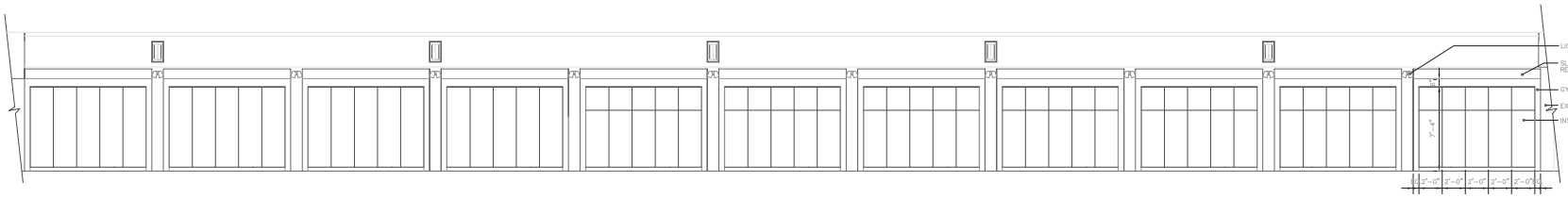
# James J. Whalen Center for Music
## Ithaca College
Ithaca, New York

FINAL SET
FOR
CONSTRUCTION

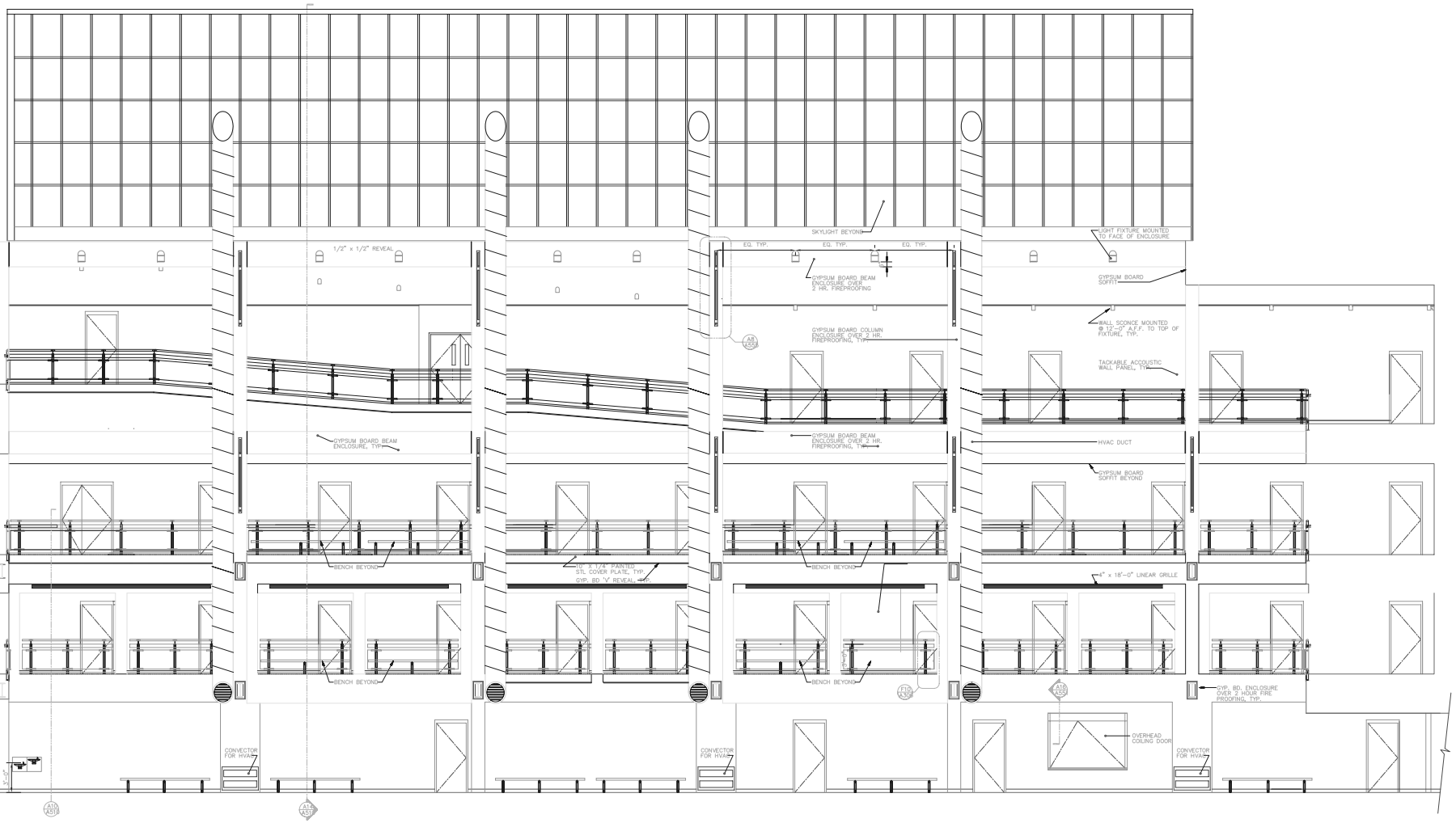
DATE: 19 December 1997
PROJECT No. 97012
DRAWN BY:

INTERIOR
ELEVATIONS

A503




M1 ATRIUM GROUND FLOOR ELEVATION EAST
1/4"=1'-0"




A1 ATRIUM SECTION WEST
1/4"=1'-0" 002, 101, 201, 301


HOLT
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Ithaca, New York 14850



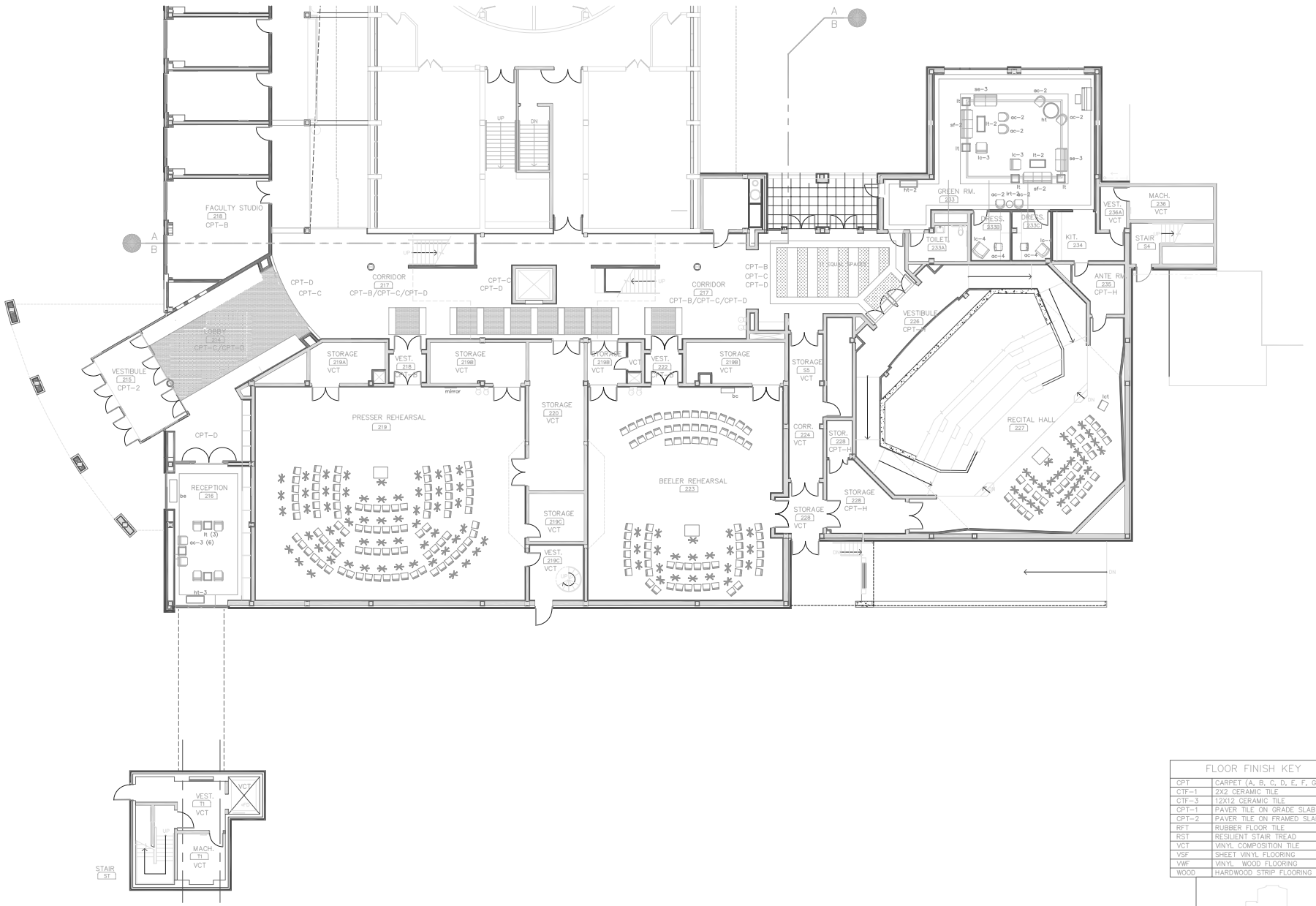

# James J. Whalen Center for Music
## Ithaca College
Ithaca, New York

FINAL SET FOR CONSTRUCTION

DATE: 19 December 1997
PROJECT No. 97012
DRAWN BY:

INTERIOR ELEVATIONS

A509




| FLOOR FINISH KEY | |
|---|---|
| CPT | CARPET (A, B, C, D, E, F, G, H) |
| CTF-1 | 2X2 CERAMIC TILE |
| CTF-3 | 12X12 CERAMIC TILE |
| CPT-1 | PAVER TILE ON GRADE SLAB |
| CPT-2 | PAVER TILE ON FRAMED SLAB |
| RFT | RUBBER FLOOR TILE |
| RST | RESILIENT STAIR TREAD |
| VCT | VINYL COMPOSITION TILE |
| VSF | SHEET VINYL FLOORING |
| VWF | VINYL WOOD FLOORING |
| WOOD | HARDWOOD STRIP FLOORING |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# James J. Whalen Center for Music
## Ithaca College
Ithaca, New York

FINAL SET FOR CONSTRUCTION

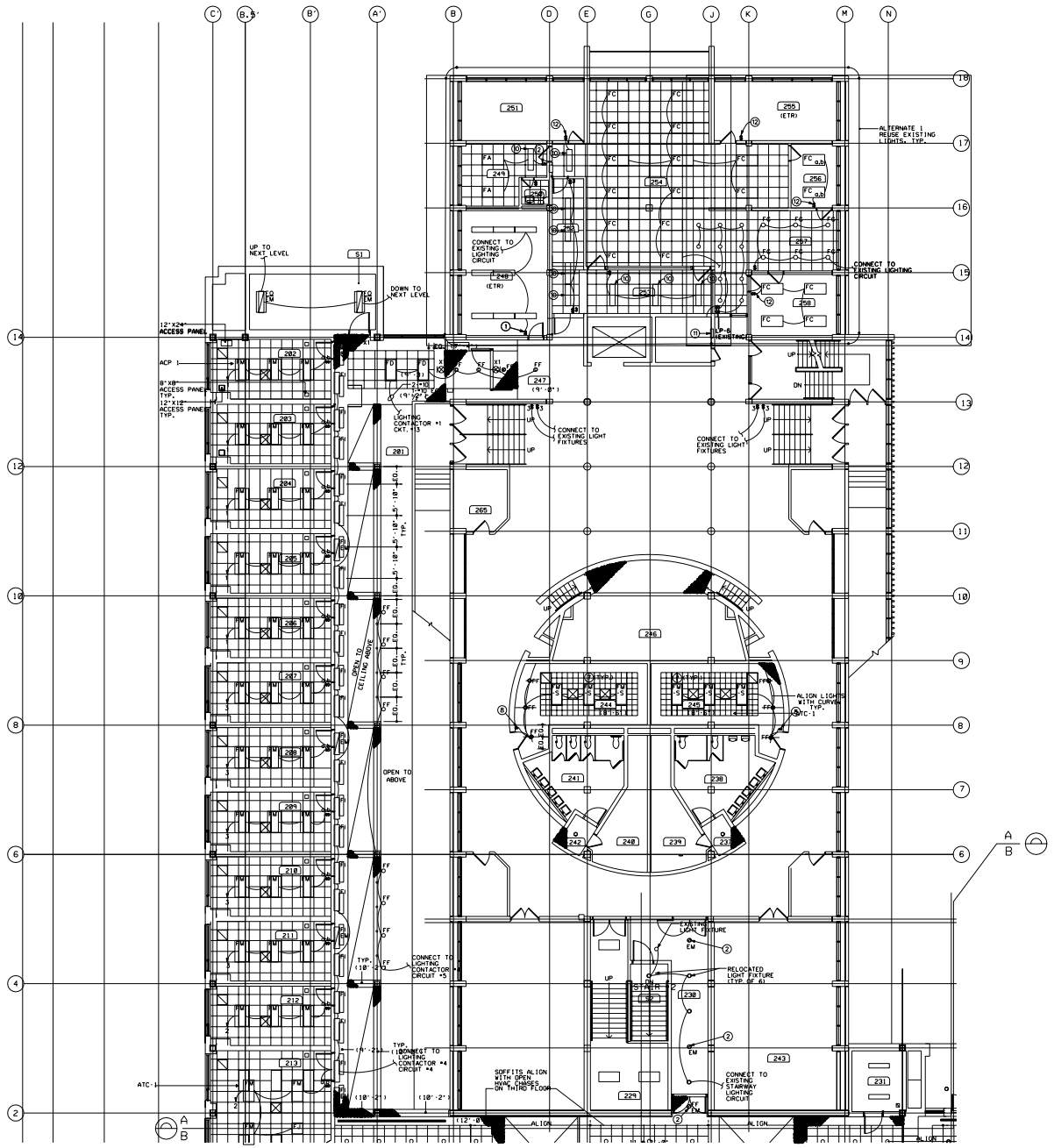
DATE: 19 December 1997
PROJECT No. 97012
DRAWN BY:

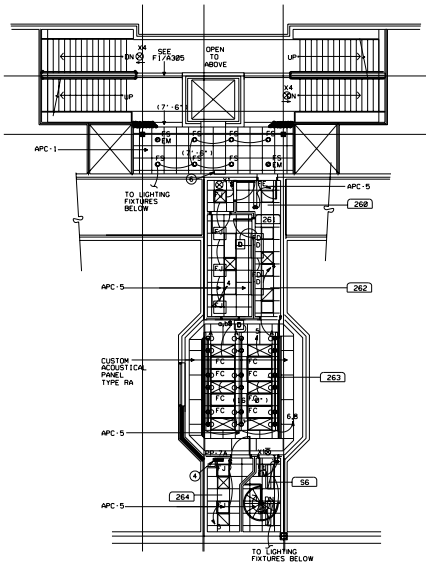
SECOND FLOOR FURNITURE PLAN "B"

7 October 1998

A856

A1 SECOND FLOOR PLAN "B"
1/8"=1'-0"




H14 ENTRESOL PLAN
1/8" = 1'-0" LIGHTING LAYOUT

GENERAL NOTES:

A. EXISTING LIGHTING, SWITCHING, OUTLETS, CIRCUITRY, ETC. IN EXISTING BUILDING SHALL REMAIN UNLESS NOTED OTHERWISE.

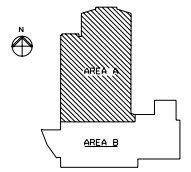
B. ALL CIRCUITS SHOWN ON THIS DRAWING SHALL BE CONNECTED TO PANELBOARD PP-4A UNLESS NOTED OTHERWISE.

C. ALL CONDUIT PENETRATIONS THRU WALLS OR FLOORS SHALL BE PROVIDED ACCORDING TO PENETRATION DETAIL ON DRAWING E501.

G14 GENERAL NOTES

1. PROVIDE NEW SWITCH, WALLBOX AND COVERPLATE IN NEW WALL AND RECONNECT TO EXISTING LIGHT FIXTURES AND CIRCUITING.
2. CONNECT ALL EMERGENCY LIGHTS ON THIS FLOOR TOGETHER WITH 2-#10, 1-#10 EG, ½" C. TO PANELBOARD EP-2A ON SECOND FLOOR, CIRCUIT #1.
3. CONNECT ALL NEW EXIT LIGHTS ON THIS FLOOR TOGETHER WITH 2-#10, 1-#10 EG, ½" C. TO PANELBOARD EP-2A ON SECOND FLOOR, CIRCUIT #2. ARRANGE CIRCUIT FOR FUTURE CONNECTION TO EXISTING EXIT LIGHTS ON THIS FLOOR.
4. PANELBOARD TO BE UTILIZED ONLY FOR RECEPTACLES, EQUIPMENT CONNECTIONS AND POWER CIRCUITS ON ENTRESOL LEVEL.
5. NOT USED.
6. PROVIDE "RECORDING-IN-PROGRESS" EDGELIGHT, SIMILAR TO LIGHTECH, INC. MODEL LR-9057M (2) 8W - T5 LAMPS. CONNECT TO CONTROL SWITCH IN CONTROL ROOM 'A' WITH 2-#12, 1-#12 EG, ½" C.
7. MOUNT FIXTURE TO NEW CEILING AND INDEPENDENTLY SUPPORT FROM BUILDING STRUCTURE. RECONNECT TO EXISTING LIGHTING CIRCUIT.
8. REPLACE WALL SWITCH, CONDUCTORS AND COVERPLATE. RECONNECT TO EXISTING CIRCUIT.
9. INSTALL SALVAGE LIGHT FIXTURES FROM THESE ROOMS IN NEW CEILING.
10. UTILIZE SALVAGED 1'x4' NOMINAL ACRYLIC WRAPAROUND FIXTURE AND SURFACE MOUNT ON CEILING.
11. CONNECT LIGHTING FIXTURE CIRCUITS TO PANELBOARD LP-6.
12. REPLACE WALLSWITCH AND COVERPLATE. REUSE CONDUCTORS AND CONDUIT.

C14 DRAWING NOTES



KEY PLAN

A1 PARTIAL SECOND FLOOR PLAN
1/8" = 1'-0" LIGHTING LAYOUT



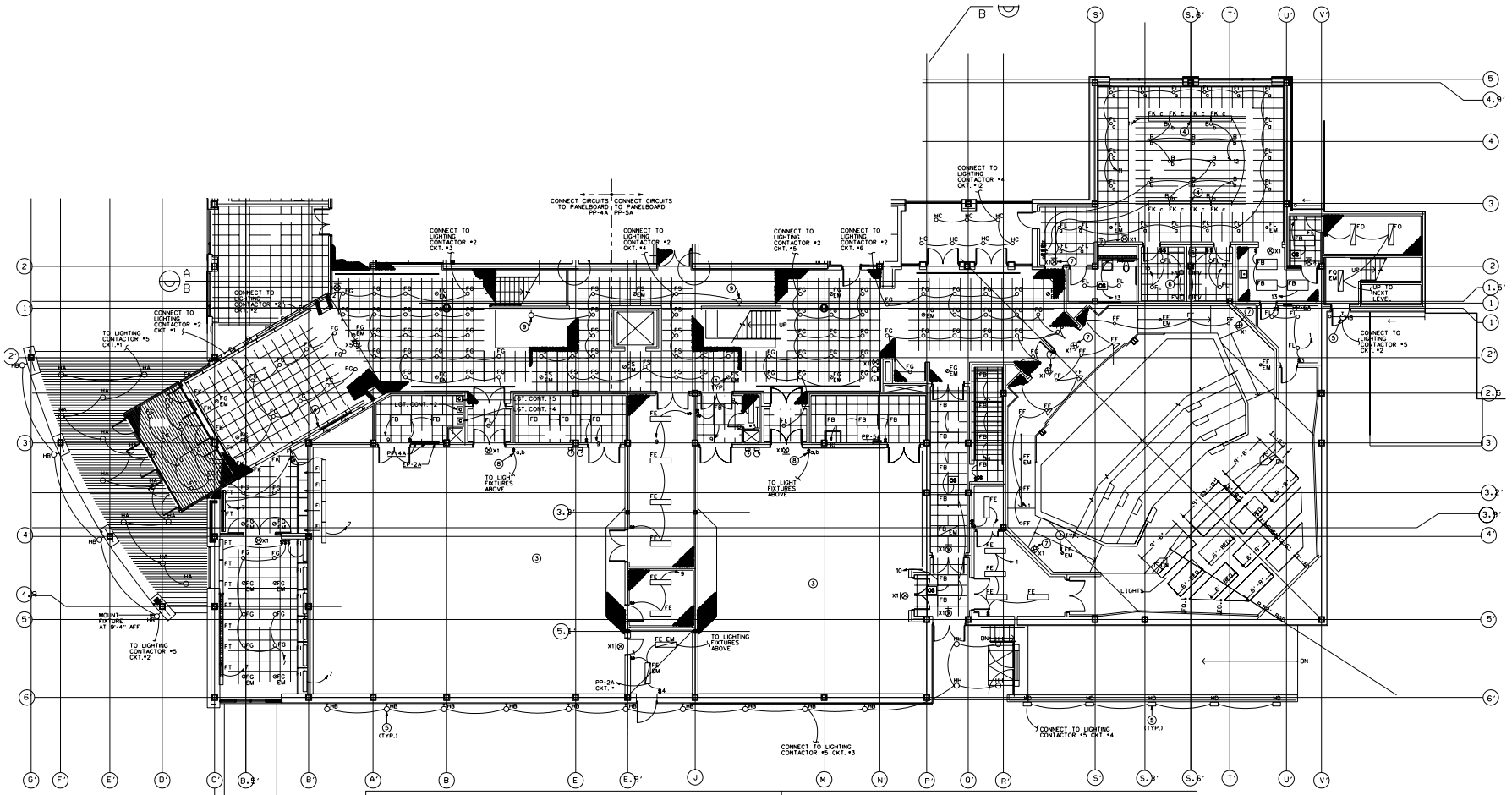
JAMES J. WHALEN CENTER FOR MUSIC
ITHACA COLLEGE
ITHACA, NEW YORK

FINAL SET FOR CONSTRUCTION

DATE: 19 DECEMBER 1992
PROJECT NO. 97012
DRAWN BY: JEP/DWS

PARTIAL SECOND FLOOR LIGHTING

E105




A. EXISTING LIGHTING, SWITCHING, OUTLETS, CIRCUITRY, ETC. IN EXISTING BUILDING SHALL REMAIN UNLESS NOTED OTHERWISE.

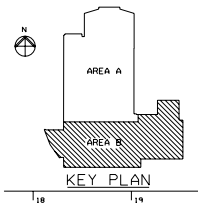
B. ALL CIRCUITING FOR RECITAL HALL AND ADJOINING STORAGE ROOMS SHALL BE CONNECTED TO PANELBOARD PP-6A.

C. ALL CONDUIT PENETRATIONS THRU WALLS OR FLOORS SHALL BE PROVIDED ACCORDING TO PENETRATION DETAIL ON DRAWING E501.

B7 GENERAL NOTES:

1. CONNECT ALL EMERGENCY LIGHTS ON THIS FLOOR TOGETHER WITH 2-#10, 1-#10 EG, ½" C. TO PANELBOARD EP-2A, CIRCUIT #1.
2. CONNECT ALL NEW EXIT LIGHTS ON THIS FLOOR TOGETHER WITH 2-#10, 1-#10 EG, ½" C. TO PANELBOARD EP-2A, CIRCUIT #2. ARRANGE CIRCUIT FOR FUTURE CONNECTION TO EXISTING EXIT LIGHTS ON THIS FLOOR.
3. REFER TO DRAWING E108 FOR LIGHTING ARRANGEMENT IN THIS ROOM.
4. LIGHTING FIXTURE LOCATED IN ARCHITECTURAL COVE. REFER TO ARCHITECTURAL DETAILS.
5. COORDINATE MOUNTING HEIGHT OF FIXTURE WITH ARCHITECT AND ARCHITECTURAL DETAILS.
6. MOUNT FIXTURES VERTICALLY ON WALL ADJACENT TO MIRROR. COORDINATE MOUNTING HEIGHT OF FIXTURE WITH ARCHITECT AND ARCHITECTURAL DETAILS.
7. PROVIDE GREEN ACRYLIC LENS FOR THIS EXIT LIGHT.
8. SWITCH 'a' CONTROLS DOWNLIGHTS IN FIXTURE, SWITCH 'b' CONTROLS UP LIGHTS IN FIXTURE. PROVIDE SEPARATE CIRCUITING FOR EACH LEVEL OF CONTROL IN EACH ROOM.
9. PROVIDE WSA AVATAR CB6130-0F40-EGT-BA-PMO (BA) WALL MOUNTED FIXTURE, MOUNT FIXTURE WITH CENTERLINE AT 6'-6" ABOVE FINISHED FLOOR.
10. PROVIDE SPAULDING LIGHTING, HUNTINGTON 1HTI-CM-M100-DP-120-DBZ SURFACE MOUNTED FIXTURE. MOUNT FIXTURE TO UNDERSIDE OF DECK BETWEEN STEEL SUPPORT BEAM.

B1 DRAWING NOTES:




KEY PLAN

A1 PARTIAL SECOND FLOOR PLAN
1/8" = 1'-0" LIGHTING LAYOUT



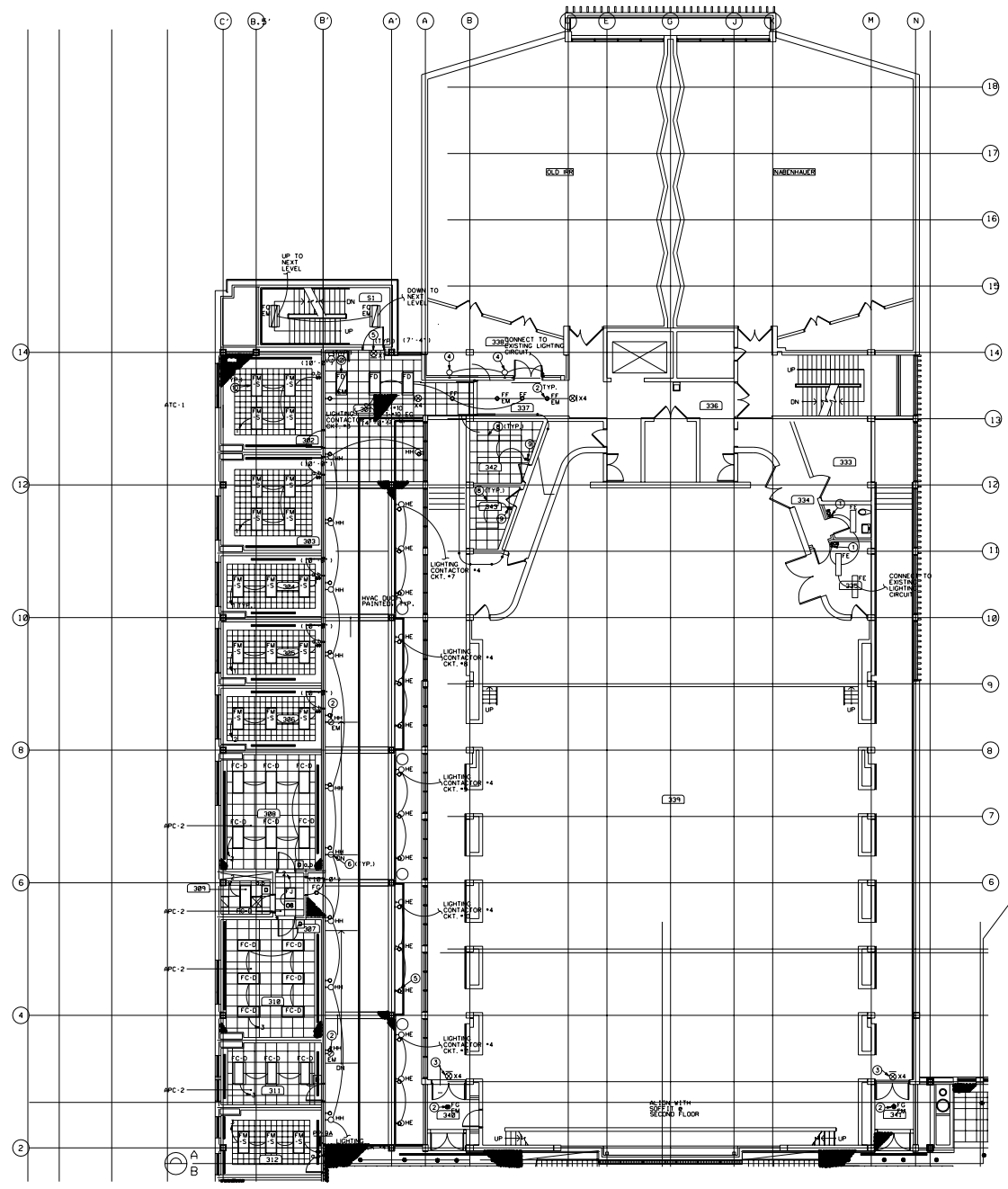
JAMES J. WHALEN CENTER FOR MUSIC
ITHACA COLLEGE
ITHACA, NEW YORK

FINAL SET FOR CONSTRUCTION

DATE: 19 DECEMBER 1992
PROJECT NO: 97012
DRAWN BY: JEP/DWS

PARTIAL SECOND FLOOR LIGHTING

E106




A. EXISTING LIGHTING, SWITCHING, OUTLETS, CIRCUITRY, ETC. IN EXISTING BUILDING SHALL REMAIN UNLESS NOTED OTHERWISE.

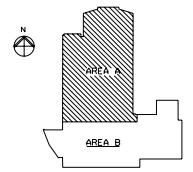
B. ALL CIRCUITS SHOWN ON THIS DRAWING SHALL BE CONNECTED TO PANELBOARD PP-10A UNLESS NOTED OTHERWISE.

C. ALL CONDUIT PENETRATIONS THRU WALLS OR FLOORS SHALL BE PROVIDED ACCORDING TO PENETRATION DETAIL ON DRAWING E501.

F14 GENERAL NOTES:

1. PROVIDE NEW SWITCH, WALLBOX AND COVERPLATE IN NEW WALL AND RECONNECT TO EXISTING LIGHTING CIRCUIT.
2. CONNECT ALL EMERGENCY LIGHTS ON THIS FLOOR TOGETHER WITH 2-#10, 1-#10 EG, ½" C. TO PANELBOARD EP-3A ON THIRD FLOOR, CIRCUIT *1.
3. CONNECT ALL NEW EXIT LIGHTS ON THIS FLOOR TOGETHER WITH 2-#10, 1-#10 EG, ½" C. TO PANELBOARD EP-3A ON THIRD FLOOR, CIRCUIT *2. ARRANGE CIRCUIT FOR FUTURE CONNECTION TO EXISTING EXIT LIGHTS ON THIS FLOOR.
4. PROVIDE KEYLESS PORCELAIN SOCKET WITH 150W FROSTED INCANDESCENT LAMP ON SURFACE WALLBOX.
5. MOUNT ON SIDE OF ENCLOSED BEAM AND ROUTE CONDUITS THROUGH ENCLOSURE. COORDINATE MOUNTING HEIGHT WITH ARCHITECT AND ARCHITECTURAL DETAILS.
6. COORDINATE MOUNTING HEIGHT WITH ARCHITECT AND ARCHITECTURAL DETAILS.
7. PANELBOARD TO UTILIZED ONLY FOR RECEPTACLES, EQUIPMENT CONNECTIONS AND POWER CIRCUITS IN STUDIOS AND TECH OFFICE.
8. MOUNT FIXTURE TO NEW CEILING AND INDEPENDENTLY SUPPORT FROM BUILDING STRUCTURE. RECONNECT TO EXISTING LIGHTING CIRCUIT.
9. REPLACE WALL SWITCH, CONDUCTORS AND COVERPLATE. RECONNECT TO EXISTING CIRCUIT.
10. INDEPENDENTLY SUPPORT FIXTURE FROM BUILDING STRUCTURE UTILIZING #10 SOLID SUPPORT WIRE. INSTALL SUPPORT WIRES AND FLEXIBLE CONDUIT WHIP PRIOR TO CEILING INSTALLATION LEAVING SUFFICIENT LENGTH FOR CONNECTIONS AFTER CEILING INSTALLATION. INSTALL FIXTURE TIGHT TO CEILING. DO NOT ANCHOR FIXTURE TO RESILIENT CEILING.

C14 DRAWING NOTES:



KEY PLAN



JAMES J. WHALEN CENTER FOR MUSIC
ITHACA COLLEGE
ITHACA, NEW YORK

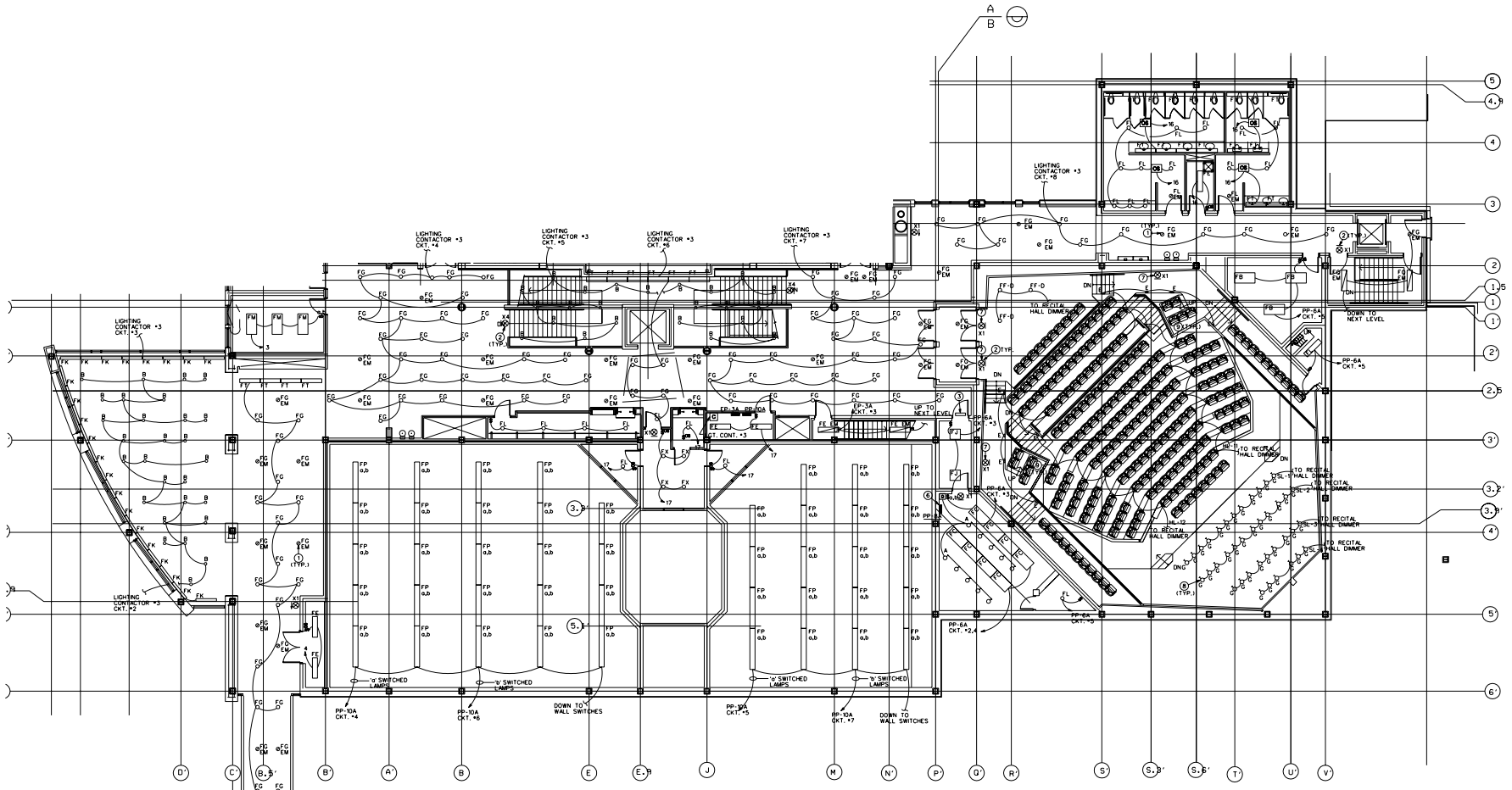
FINAL SET FOR CONSTRUCTION

DATE: 19 DECEMBER 1992
PROJECT NO. 97012
DRAWN BY: JEP/DWS

PARTIAL THIRD FLOOR LIGHTING

E107

A1 PARTIAL THIRD FLOOR PLAN
1/8" = 1'-0" LIGHTING LAYOUT




A. EXISTING LIGHTING, SWITCHING, OUTLETS, CIRCUITRY, ETC. IN EXISTING BUILDING SHALL REMAIN UNLESS NOTED OTHERWISE.

B. ALL CIRCUITS SHOWN ON THIS DRAWING SHALL BE CONNECTED TO PANELBOARD PP-10A UNLESS NOTED OTHERWISE.

C. ALL CONDUIT PENETRATIONS THRU WALLS OR FLOORS SHALL BE PROVIDED ACCORDING TO PENETRATION DETAIL ON DRAWING E501.

D1 GENERAL NOTES:

1. CONNECT ALL EMERGENCY LIGHTS ON THIS FLOOR TOGETHER WITH 2-#10, 1-#10 EG, ½" C. TO PANELBOARD EP-3A ON THIRD FLOOR, CIRCUIT *1.
2. CONNECT ALL NEW EXIT LIGHTS ON THIS FLOOR TOGETHER WITH 2-#10, 1-#10 EG, ½" C. TO PANELBOARD EP-3A ON THIRD FLOOR, CIRCUIT *2. ARRANGE CIRCUIT FOR FUTURE CONNECTION TO EXISTING EXIT LIGHTS ON THIS FLOOR.
3. PROVIDE "RECORDING -IN-PROGRESS" EDGELIGHT, SIMILAR TO LIGHTECH, INC. MODEL LR-9057M (2) 8W-T5 LAMPS. CONNECT TO CONTROL SWITCH IN CONTROL ROOM "A" WITH 2-#12, 1-#12 EG, ½" C.
4. NOT USED.
5. LIGHTING FIXTURE LOCATED IN ARCHITECTURAL COVE. REFER TO ARCHITECTURAL DETAILS.
6. PANELBOARD TO BE UTILIZED ONLY FOR RECEPTACLES, EQUIPMENT CONNECTIONS AND POWER CIRCUITS IN CONTROL ROOM 'B' AND ADJACENT SUPPORT ROOMS.
7. PROVIDE GREEN ACRYLIC LENS FOR THIS EXIT LIGHT.
8. MOUNT ON 'CLOUD' ACOUSTICAL ELEMENT. ROUTE CONDUIT AT BACK OF SUPPORT TO CEILING SPACE. CONDUITS SHALL NOT PASS HORIZONTALLY BETWEEN 'CLOUD' ELEMENTS. ALL CONDUIT SHALL BE PLACED WITHIN 'CLOUD' EXCEPT VERTICAL RISERS AND SHALL NOT BE VISIBLE.
9. INTEGRAL AISLE LIGHT IN END CHAIR. PROVIDE CONNECTION AS SHOWN. PROVIDE FLEXIBLE METAL CONDUIT FROM CHAIR TO OUTLET BOX IN RISER BEHIND CHAIR.

A1 PARTIAL THIRD FLOOR PLAN
1/8" = 1'-0" LIGHTING LAYOUT

A11 DRAWING NOTES:



JAMES J. WHALEN CENTER FOR MUSIC
ITHACA COLLEGE
ITHACA, NEW YORK

FINAL SET FOR CONSTRUCTION

DATE: 19 DECEMBER 1992
PROJECT NO. 87012
DRAWN BY: JEP/DWS

PARTIAL THIRD FLOOR LIGHTING

E108

SECTION 16500 - LIGHTING

## PART 1 - GENERAL

### 1.1 DESCRIPTION

a. Provide complete interior and exterior lighting systems, including fixtures, standards, poles, hangers, supports, fittings, lamps, wiring, connections and controls, as indicated in the Contract Documents. The lighting layouts on the drawings are diagrammatic only. Refer to architectural "Reflected Ceiling Plans" for exact location of interior fixtures. Fixtures, in general, have been specified for the particular type of ceiling in which they are to be installed. **Verify the ceiling construction details and provide fixtures suitable for the respective ceiling types**.

### 1.2 QUALITY ASSURANCE

a. All fixtures shall be new and bear the U.L. label for the service intended. Lighting fixtures shall be standard products of manufacturers regularly engaged in the manufacture of the specific type lighting fixtures specified and shall be the manufacturer's latest standard design that complies with specification requirements. Manufacturer's lighting fixture catalog numbers as indicated on the "Luminaire Schedule" indicate quality, type, and style, but may not cover required special design details. Provide lighting fixtures having such special details as noted in the "Luminaire Schedule" and as required for proper installation. Verify the availability of all fixtures proposed to be used in the execution of the work prior to submitting same for approval. The discontinuance of production of any fixture after such approval has been granted shall not relieve the Contractor from furnishing an approved fixture of comparable quality and design at no additional cost. Lighting fixtures shall be as specified in the "Luminaire Schedule." Fixture types, characteristics, photometrics, finishes, etc., correspond to the first manufacturer, and associated catalog number, listed in the "Luminaire Schedule." Products of other acceptable manufacturers shall be equivalent in every way to that of the fixture specified. The Owner's Representative reserves the right to disapprove any fixture type submitted which is not equal in quality, appearance or performance to the fixture specified.

### 1.3 SUBMITTALS

a. Submit shop drawings as described in Section 16010. Lighting fixture shop drawings shall include photometric data for each fixture utilizing the specified lens/louver type, lamp(s) and ballast(s). All lighting fixture types shall be submitted in a single complete brochure which shall be in the form of a soft cover binder with each fixture separated by an identified index tab. Information on each fixture shall include:

i. Manufacturer and Catalog Number.

ii. Dimensioned Construction Drawing(s).

iii. Standard Catalog "Cut" Sheet.

iv. Photometrics.

v. Schedule of Lens/Louver Types for each fixture.

vi. Schedule of Ballast Types and Rating for each fixture.

vii. Schedule of Socket Types for each fixture.

viii. Schedule of Lamp Types for each fixture.

1.4 DELIVERY, STORAGE, AND HANDLING

a. Lighting fixtures and equipment shall be delivered with UL and manufacturer's labels intact and legible. Broken, cracked and damaged materials and equipment shall be removed from the site immediately and be replaced with new materials and equipment. Fixtures and accessories shall be stored in protected dry locations in their original unbroken package or container. Fixtures shall be protected from dust and dampness both before and after installation. Fixtures shall be protected from paint and cleaning solvents during all phases of construction.

## PART 2 - PRODUCTS

2.1 MATERIALS

a. Fixtures shall be identical in construction features, options and appearance to the fixtures specified in the Luminaire Schedule.

i. Lamps:

1. Incandescent lamps shall be inside frosted, rated for 130 volt operation.

2. Fluorescent lamps shall be rapid start type as specified in the lighting fixture schedule. All lamps shall have a minimum CRI of 76, a minimum of 89 lumens per watt and meet all requirements of the New York State Energy Conservation Construction Code.

a) Acceptable Manufacturers:

| | | | |
|---|---|---|---|
| i) | GE F32T8/SP35/RS | 82 LPW | 73 CRI |
| ii) | Sylvania F032/35K | 83 LPW | 72 CRI |
| iii) | Phillips F032/35 | 83 LPW | 72 CRI |

3. Compact fluorescent lamps shall be as specified in Luminaire Schedule. In general, color of lamp shall match that specified in Paragraph b, above.

4. Metal halide lamps shall be phosphor coated or clear as called for by the fixture design, and suitable for the burning position dictated by the luminaire.

5. Acceptable manufacturers:

   a) General Electric
   b) Sylvania
   c) Phillips

b. Ballasts:

i. Ballasts shall be designed for continuous operation within the fixture provided, and utilizing the lamp(s) specified, without overheating or causing any other detrimental affects. Ballasts shall be quiet in operation and of the lowest noise level available. Fixtures shall in no way amplify ballast noise, but rather shall suppress ballast noise. Ballasts considered to have objectionable hum or noise shall be replaced immediately at no additional cost.

ii. Fluorescent ballasts shall conform to U.L and ANSI specifications and shall display symbols of approval by the U.L and of certification by the C.B.M. as tested by the E.T.L. The component parts of the ballast shall be designed, fabricated, and assembled in accordance with the latest NEMA requirements. Ballasts shall be marked "Class P" indicating approved integral ballast protection. Fluorescent ballasts not "P" rated shall be individually fused at the ballast; fuses shall be cartridge type, sized as recommended by the manufacturer. Ballasts shall be high-power-factor, series-sequence type. Fixtures with two lamps or multiples of two shall have two-lamp ballasts. Three-lamp ballasts shall not be used unless specified. Ballasts for compact fluorescent lamps shall be electronic type.

1. Electronic Ballasts: Operating temperature shall not exceed $25^{o}$ C temperature rise over $40^{o}$ C ambient. Sound rating shall be "A+" with sound levels less than 18 dBA. Maximum input wattage at stabilized temperatures shall be 89 watts for three lamp ballast, 60 watts for two lamp ballast, or 30 watts for one lamp ballast, when using standard 32 watt T-8 lamps at 120 VAC. Ballasts shall comply with Federal Communication Commission Rules and Regulation for EMI and RFI, Applicable ANSI Standards on harmonic distortion, surge protection, etc., IEEE Publication587, Category A for line transients.

Operate lamps at a frequency of 20 to 35 KHZ with no detectable flicker. Maintain a constant light output at an input voltage ranging from 90V to 145V for a 120V ballast. Average lamp current crest factor not to exceed 1.4. Total harmonic distortion (THD) shall not exceed 20%. Acceptable Manufacturer: Magnetek (No substitutions allowed).

| | |
|---|---|
| One Lamp: | B232I120RH |
| Two Lamp: | B232I120RH |

iii. High intensity discharge ballasts shall be constant wattage type; have power factor of not less than 90%; be approved by E.T.L. and C.B.M. and have a UL label. Sound rating shall be "B" with sound levels less than 30 dBA, where ballasts are used in indoor luminaires in occupied areas. Ballasts shall be encased and potted. Starting current shall not exceed operating current. Ballast shall maintain lamp operation for voltage fluctuations of plus or minus 10% of rated voltage. The voltage rating of each ballast shall correspond to the voltage of the circuit to which the ballast will be connected. Ballasts for exterior fixtures shall be rated for operation at ambient temperatures to minus 20$^{o}$F. All ballasts shall have a two-year material and labor guarantee.

c. Lenses:

i. Certify that the listed materials are tested in accordance with ASTM D-635, "Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position" and burns less than 2.5 inches per minute.

ii. Certify that the products have a smoke density of less than 75 when tested in accordance with ASTM D-2843, standard test method for "Density of Smoke from the Burning or Decomposition of Plastics."

d. Fixture Standards:

i. All exterior lighting fixture assemblies including luminaire, pole, and base shall be constructed to withstand the force of 100 MPH winds.

e. Exit Luminaires:

i. Electrical characteristics:

1. LED type for 120 volt supply. Utilized two LED strips for indirect illumination of the face.
2. Meet or exceed illumination requirements of NFPA-101, and all of the requirements of UL924.

ii. Construction:

1. Cast aluminum housing.
2. Natural brushed aluminum face plates(s).
3. Black finish for frame.
4. 6 in. H x 2 in. W x 3/4 in. stroke exit letters on cast stencil face.
5. Red fiberglass reinforced polyester diffusing panel(s), except as noted on drawings where green fiberglass is required.
6. Removable snapouts provided in stencil face housing for right, left, or double directional arrows.
7. Luminous bottom with prismatic lens for even downlighting.
8. Light tight assembly.
9. Provide Universal mount unit.
10. Provide single or double face and arrows as indicated on Contract Documents.
11. Acceptable Manufacturer: Prescolite Compass Series.

iii. EXIT Luminaire Schedule:

| Type | Mounting | Face |
|---|---|---|
| X1 | Back, Surface | Single |
| X2 | End Bracket | Single |
| X3 | End Bracket | Double |
| X4 | Top Surface | Single |
| X5 | Top Surface | Double |

f. Emergency Battery Pack Luminaries:

i. Completely self-contained in compact, low profile injection molded UL 94V-0 flame rated thermoplastic housing with universal mounting plate.

ii. Premium grade, pure lead maintenance free battery. Two with sufficient capacity to operate the lamps for 1-1/2 hours to an end voltage of 87-1/2% of nominal battery

voltage. Three stage charger (constant current, equalize and float charge), relay, low voltage battery disconnect and brownout protection circuits.

iii. Two fully adjustable glare-free 7.2 watt sealed beam type lighting heads. Test switch and charge rate indicator.

iv. 120 volt supply.

v. Make: Dual-Lite Spectron EZ-2 Series I.

g. Luminaire Schedule:

i. Luminaire schedule is found at end of this section.

ii. All luminaires shall meet the Total Luminaire Efficiency (TLE) requirements of the New York State Energy Conservation Construction Code.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

a. Mount fixtures in true vertical and horizontal alignment. Offset fixtures as required to avoid obstructions. Provide all necessary hangers and supports for proper fixture installation. Such supports shall be anchored to channels in the ceiling construction, to the structural slab or to structural members above the suspended ceiling. Fixture supports shall be capable of supporting a minimum of two and one-half times the load normally carried at point of support. Independently support fixture at two locations, using #10 steel wire similar to that used to support the ceiling grid. Directly attach steel wire to structural members.

b. Provide all necessary accessories for "end-to-end" mounting where continuous rows of fluorescent fixtures are indicated. All fixture assemblies shall be grounded. Where multiple switching of fluorescent fixtures is indicated, the outside two (2) lamps of each fixture in the controlled area shall be switched separately from the interior (center) lamps(s).

c. Exterior metallic poles shall be grounded by connecting the equipment ground conductor to each grounding bushing and to the pole grounding terminals. Foundations for exterior lighting standards shall be as detailed on the drawings. Anchor bolts shall be of minimum diameter and length as shown, four (4) per standard, and installed per the pole manufacturer's pole base requirements. Foundations shall be formed of concrete of 3000 psi minimum compressive strength at 28 days. All corners of foundations above grade shall be chamfered one 1 in. Each foundation shall be equipped with galvanized rigid conduit elbows and nipples of appropriate length to connect between pole base and underground wiring system. Provide grounding type bushings on each conduit. All wiring within exterior poles and luminaires shall be minimum No. 10 AWG copper with approved insulation.

## 3.2 REUSE AND REPAIR OF EXISTING LUMINAIRES

a. Reuse existing luminaires only where called for. Perform the following work, as required, to upgrade existing luminaire. Replace faulty, leaking, or noisy ballast. Replace broken, damaged, worn, or faulted lamp sockets. Provide new fixture wire. Provide new acrylic lens system to match existing, where existing is broken. Relamp luminaires. Completely damp clean lens and interior of luminaires.

b. If ballast have leaked, remove material deposited in fixture. Assume material was PCB contamination, or test samples to show material is not PCB and submit a test report. Dispose of material as required by EPA, including clean-up materials used. Dispose of ballasts as described below.

c. New fixtures may be provided to replace existing fixtures scheduled to remain or be reused, subject to shop drawing approval.

## 3.3 FINAL CLEANING

a. Immediately prior to acceptance, damp clean diffusers, glassware, luminaire trim, reflectors, lamps, louvers, lens and similar objects of all fixtures. Remove all dirt, corrosion, foreign material, finger marks, blemishes. Replace all burned out lamps and failed components.

## 3.4 REMOVAL OF BALLASTS IN EXISTING LIGHT FIXTURES

a. Assume ballasts contain PCB material unless labeled otherwise or test samples show materials are not PCB; submit a test report. Remove all ballasts from existing light fixtures indicated on contract documents. Dispose of all ballasts which do not have non PCB labels in PCB containers and pay all costs to have containers taken to EPA approved incinerators and disposed of all EPA regulations. Follow all EPA regulations for transporting material. If ballast has leaked in existing fixtures, remove material deposited in fixture and dispose of those materials as indicated above.

FLUORESCENT LUMINAIRE SCHEDULE

TYPE FA - 2 FT. X 4 FT., RECESSED, THREE LAMP STATIC TROFFER

1. Housing: Die-formed, minimum 22 gauge, baked white enamel finish suitable for grid mounting.

2. Door/Frame: Flush steel, mitered corners, hinged from either side with positive spring loaded latches.

3. Lens: A-12, acrylic prismatic.

4. Lamps: (3) F32/T8/SP35/RS.

5. Voltage: 120V.

6. Design Make: Columbia 4PS24-3.

7. Acceptable Manufacturers:

    a. Williams
    b. Lithonia
    c. Columbia

TYPE FB - 2 FT. X 4 FT., RECESSED, TWO LAMP STATIC TROFFER

1. Housing: Die-formed, minimum 22 gauge, baked white enamel finish suitable for grid or plaster ceiling mounting.

2. Door/Frame: Flush steel, mitered corners hinged from either side with positive spring loaded latches.

3. Lens: A-12, acrylic prismatic.

4. Lamps: (2) F32T8/SP35/RS.

5. Design Make: Columbia 4PS24-2.

6. Acceptable Manufacturers:

    a. Williams
    b. Lithonia
    c. Columbia

TYPE FC - 2 FT. X 4 FT., RECESSED, THREE LAMP PARABOLIC TROFFER

1. Housing: Die-formed steel, minimum 22 gauge, baked white enamel finish suitable for mounting.

2. Door/Frame: Aluminum, mitered corners, hinged from either side with positive spring loaded latches. Flat black finish inside perimeter reveal for “floating door” appearance.

3. Louver: 3 in. deep parabolic, semi-specular anodized aluminum with natural aluminum finish, 18 cell.

4. Lamps: (3) F32T8/SP35/RS.

5. Voltage: 120V.

6. Design Make: Columbia P4 Parabolic P424-3.

7. Acceptable Manufacturers:

    a. Williams
    b. Lithonia
    c. Columbia

TYPE FC-D - 2 FT. X 4 FT., DIMMABLE, RECESSED, THREE LAMP STATIC TROFFER

1. Same as Type FC, except provide three lamp electronic dimmable ballast and dimmer.

TYPE FD - 2 FT. X 4 FT, RECESSED, TWO LAMP PARABOLIC TROFFER

1. Housing: Die-formed steel, minimum 22 gauge, baked white enamel finish suitable for grid mounting.

2. Door/Frame: Regressed aluminum, mitered corners, hinged from either side with positive spring loaded latches.

3. Louver: 3 in. deep, parabolic, semi-specular anodized aluminum with natural aluminum finish, 12 cell.

4. Lamps: (2) F32T8/SP35/RS.

5. Voltage: 120V.

6. Design Make: Columbia PA Parabolic, P424-2.
7. Acceptable Manufacturers:

    a. Williams
    b. Lithonia
    c. Columbia

TYPE FE - 1 FT. X 4 FT., RECESSED, TWO LAMP STATIC TROFFER

1. Housing: Die-formed steel, minimum 22 gauge, baked white enamel finish suitable for grid mounting.

2. Door/Frame: Flush steel, mitered corners, hinged from either side with positive spring loaded latches.

3. Lens: A-12, acrylic prismatic.

4. Lamps: (2) F32T8/SP35/RS.

5. Voltage: 120V.

6. Design Make: Columbia 4PS14.

7. Acceptable Manufacturers:

    a. Williams
    b. Lithonia
    c. Columbia

TYPE FF - 6 IN. ROUND, COMPACT DOWNLIGHT

1. Housing: Die-formed steel, minimum 20 gauge. Adjustable “C” brackets and bar hanger.

2. Reflectors: Ellipsoidal primary reflector and parabolic shielding cone, specular clear alzak finish.

3. Lamps: (1) 26W Triple Tube horizontal mounted.

4. Voltage: 120V.

5. Design Make: Prescolite CFT632HEB.

6. Acceptable Manufacturers:

    a. Staff
    b. Prescolite
    c. Kurt Versen

TYPE FF-D - 6 IN. ROUND, DIMMABLE, COMPACT DOWNLIGHT

1. Same as Type FF, except provide electronic dimmable ballasts and dimmer.

TYPE FG - 9 IN. ROUND, COMPACT DOWNLIGHT

1. Housing: Die-formed steel, minimum 20 gauge. Adjustable “C” brackets and bar hanger.

2. Reflectors: Ellipsoidal primary reflectors and parabolic low brightness shielding cones, specular clear alzak finish.

3. Lamps: (2) 26W Triple Tube, horizontal mounted.

4. Voltage: 120V.

5. Design Make: Prescolite CFT932HEB.

6. Acceptable Manufacturers:

    a. Staff
    b. Prescolite
    c. Kurt Versen

TYPE FG-D - 9 IN. ROUND, DIMMABLE, COMPACT DOWNLIGHT

1. Same as Type FG, except provide electronic dimmable ballasts for compatible dimmer.

TYPE FH - 9 IN. X 4 FT., RECESSED, WALL WASH FIXTURE

1. Housing: Die-formed, minimum 20 gauge steel, baked matte white enamel finish suitable for grid mounting. Exposed flanges along fixture sides for ceiling tile supports.

2. Reflector: Die-formed .025" thick anodized aluminum, specular low glare. Asymmetric, wide light distribution.

3. Lamps: (2) F32T8/SP35/RS.

4. Voltage: 120V.

5. Design Make: Litecontrol GD1024 or approved equal.

TYPE FI - 9 IN. X 4 FT., RECESSED, STATIC TROFFER WITH PARABOLIC BLADE BAFFLE

1. Housing: Die-formed, minimum 20 gauge steel, baked matte white enamel finish suitable for grid mounting. Exposed flanges along fixture side for ceiling tile support.

2. Reflector: Steel with high reflectance white finish.

3. Parabolic Baffle: Die-formed specular, low iridescent anodized aluminum. Symmetrical distribution, 15 cells per fixture. Secured by four spring-wire clips.

4. Lamps: (2) F32T8/SP35/RS.

5. Voltage: 120V.

6. Design Make: Columbia VHC94-2.

TYPE FI-D - 9 IN. X 4 FT., DIMMABLE RECESSED STATIC TROFFER WITH PARABOLIC BLADE BAFFLE

1. Sam as Type FI, except provide electronic dimmable ballasts for compatible dimmer.

TYPE FJ - 2 FT. X 2 FT., RECESSED, TWO LAMP STATIC TROFFER WITH PARABOLIC LOUVER

1. Housing: Die-formed, minimum 22 gauge steel, baked white enamel finish suitable for grid mounting.

2. Door/Frame: Aluminum, mitered corners, hinged from either side with positive spring loaded latches. Flat black finish inside perimeter reveal for “floating door” appearance.

3. Louver: 3 in. deep, parabolic, semi-specular anodized aluminum with natural aluminum finish, 9 cell.

4. Lamps: (2) F32SP35/U/6.

5. Voltage: 120V.

6. Design Make: Columbia 422-2.

7. Acceptable Manufacturers:

    a. Williams
    b. Lithonia
    c. Columbia

TYPE FK - 6 IN. X 4 FT. STAGGERED STRIP FIXTURE

1. Housing: Die-formed, minimum 22 gauge steel, baked white enamel finish.

2. Reflector: Baked white enamel finish, high reflectance, asymmetrical type.

3. Lamps: (2) F32T8/SP35/RS.

4. Voltage: 120V.

5. Design Make: Lithonia SSO/SR248WH.

6. Acceptable Manufacturers:

    a. Williams
    b. Lithonia
    c. Columbia

TYPE FL - 9 IN. ROUND, COMPACT DOWNLIGHT

1. Housing: Die-formed steel, minimum 20 gauge adjustable “C” brackets and bar hanger.

2. Reflector: Ellipsoidal primary reflectors and parabolic low brightness shielding cones, specular clear alzak finish.

3. Lamps: (2) 13W Triple Tube, horizontal mounted.

4. Voltage: 120V.

5. Design Make: Prescolite CFJ932HEB

6. Acceptable Manufacturers:

    a. Staff
    b. Prescolite
    c. Kurt Versen

TYPE FM - 2 FT. X 4 FT. RECESSED, THREE LAMP, PARABOLIC LOUVER

1. Housing: Die-formed steel, minimum 20 gauge, baked white enamel finish, suitable for grid mounting.

2. Door/Frame: Regressed, aluminum, mitered corners, hinged from either side with positive spring loaded latches. Flat black finish inside perimeter reveal for "floating door" appearance.

3. Louver: 1 in. Deep, 1-1/2 in. X 1-1/2 in. Square, polystyrene silver parabolic.

4. Lamps: (3) F32T8/SP35/RS.

5. Voltage: 120V.

6. Design Make: Columbia P4 Parabolic

7. Acceptable Manufacturers:

    a. Williams
    b. Lithonia
    c. Columbia

TYPE FM-S - 2 FT. X 4. FT. SURFACE, THREE LAMP, MODULAR WITH PARABOLIC LOUVER

1. Housing: Die-formed steel, minimum 20 gauge, baked white enamel finish. Backplate recessed 1/8 in. For minimum fixture contact with ceiling and maximum heat dissipation.

2. Door/Frame: Regressed aluminum, mitered corners, hinged from either side with positive spring loaded latches. Flat black finish inside perimeter reveal for "floating door" appearance.

3. Louver: 1 in. deep, 1-1/2 in. X 1-1/2 in. squares, polystyrene silver parabolic.

4. Lamps: (3) F32T8/SP35/RS.

5. Voltage: 120V.

6. Design Make: Columbia SM24-332-RAPC2.

7. Acceptable Manufacturers:

    a. Williams
    b. Lithonia
    c. Columbia

TYPE FN - NOT USED

TYPE FO - 4 FT., TWO LAMP, SUSPENDED INDUSTRIAL LUMINAIRE

1. Housing: Die-formed steel, minimum 20 gauge steel with continuous welded seams, baked white enamel finish with 85% minimum reflectance and 15% uplight.

2. Reflector: One-piece construction, with vertically die-formed ribs between apertures.

3. Lamps: (2) F32T8/SP35/RS.

4. Voltage: 120V.

5. Design Make: Columbia KL4-2.

6. Acceptable Manufacturers:

    a. Williams
    b. Lithonia
    c. Columbia

TYPE FP - 8 FT., DIRECT/INDIRECT, SQUARE PENDANT MOUNTED LUMINAIRE:

1. Housing: Two piece extruded aluminum forming an 8 in. X 7-3/4 in. rectangle. Die cast plates mechanically attached with concealed fasteners. Clear anodized satin finish. Electrostatic paint finish as selected by Architect from manufacturers standard colors.

2. Reflectors: Die-formed, 24 gauge steel with high reflectance white enamel finish, minimum of 92%.

3. Louver: Upper section open, lower section of parabolic, 2 in. High x 4 in. frequency, low iridescence semi-specular aluminum.

4. Mounting: Aircraft cable supported from building structure with coiled power cord, color to match fixture.

5. Lamps: (8) F32T8/SP35/RS.

6. Voltage: 120V.

7. Design Make: Columbia MS8.

8. Acceptable Makes:

    a. Peerless
    b. Lite Control
    c. Columbia

TYPE FQ - 1 FT. X 4 FT., SURFACE, WRAPAROUND LUMINAIRE

1. Housing: Die-formed steel, minimum 20 gauge, baked white enamel finish. Backplate recessed 1/8 in. for minimum fixture contact with ceiling and maximum heat dissipation.

2. Lens: Acrylic prismatic, flat bottom with vertical sides.

3. Lamps: (2) F32T8/SP35/RS.

4. Voltage: 120V.

5. Design Make: Columbia WPW4-2.

6. Acceptable Manufacturers:

    a. Williams
    b. Lithonia
    c. Columbia

TYPE FR - 2 FT. X 2 FT., RECESSED, TWO LAMP STATIC TROFFER

1. Housing: Die-formed steel minimum 22 gauge, baked white enamel; finish suitable for grid mounting.

2. Door/Frame: Flush steel, mitered corners, hinged from either side with positive spring loaded latches.

3. Lens: A-12 acrylic prismatic.

4. Lamps: (2) F32SP35/U/6.

5. Voltage: 120V.

6. Design Make: Columbia 4PS22-2.

7. Acceptable Manufacturers:

    a. Williams
    b. Lithonia
    c. Columbia

TYPE FS - 9 IN. ROUND, COMPACT DOWNLIGHT

1. Housing: Die-formed steel, minimum 20 gauge. Adjustable “C” brackets and bar hanger. Vented lamp compartment.

2. Reflector: Specular clear alzak, iridescence suppressed cross baffles.

3. Lamps: (2) 18 W Quad Tube T-4, horizontal mounted.

4. Voltage: 120V.

5. Design Make: Prescolite CFRCB818EB.

6. Acceptable Manufacturers:

    a. Staff
    b. Marco
    c. Prescolite

TYPE FT - 9 IN. X 4 FT., RECESSED WALL WASH LUMINAIRE

1. Housing: Die-formed steel, minimum 20 gauge, baked white enamel finish suitable for grid or flange mounting. 18 gauge steel integral near support channel. Galvanized spline legs provide continuous alignment. Provide continuous housing for specific location.

2. Reflector: Die-formed steel, minimum 24 gauge, high reflectance bake white enamel finished shield.

3. Baffle: Flush mounted parabolic, 1.4 in. High x 2 in. on center. Semi-specular finish.

4. Lamps: (2) F32T8/SP35/RS.

5. Voltage: 120V.

6. Design Make: Lite Control Wall/Slot II 85 N.

TYPE FU - NOT USED

TYPE FV - 4 IN. X 48 IN. SURFACE MOUNTED SHAPED STRIP FIXTURE

1. Housing: Anodized aluminum, white finish. Surface mounted. Polished brass end caps, square end shape.

2. Diffuser: Fluted, acrylic.

3. Lamps: (2) F32 T-8 GE Chroma 50 or Osram/Sylvania Octron 950.

4. Voltage: 120V.

5. Design Make: Artemide Ron Rezek Flute 491, no alternate accepted.

TYPE FW - NOT USED

TYPE FX - 5 IN. ROUND, COMPACT DOWNLIGHT, GLASS EXTENSION TRIM

1. Housing: Die-formed steel, minimum 20 gauge. Adjustable “C” brackets and bar hanger.

2. Reflector: Brushed clear cone.

3. Trim ring: Double tape ring of glass, solid cobalt blue.

4. Lamp: (1) 13 W Quad, vertical mounted.

5. Voltage: 120V.

6. Design Make: Lightolier 1002F1/1010 with Lytegem 1405. No alternates accepted.

TYPE FY - 9 IN X 2 FT., SURFACE WRAPAROUND LUMINAIRE

1. Housing: Die-formed steel, minimum 20 gauge, baked white enamel finish with matching end caps. Backplate recessed 1/8 in. for minimum fixture contact with ceiling and maximum heat dissipation.

2. Lens: Clear prismatic acrylic, flat bottom with vertical sides.

3. Lamps: (2) 17 W F32T8/SP35/RS.

4. Voltage: 120V.

5. Design Make: Columbia AWN2-2.

6. Acceptable Manufacturers:

   a. Williams
   b. Lithonia
   c. Columbia

INCANDESCENT LUMINAIRE SCHEDULE

TYPE A - TRACK LIGHTING, SPOT FIXTURES

1. Track: Low profile, heavy gauge extruded aluminum. Extruded PVC insulator. Three flat, 12 gauge solid copper conductors for one or two circuit capability. Twist-lock steel mounting clips. Black finish.

2. Light: Die cast aluminum housing with yoke for track connection. Heat dissipation vents. Front relamping. Black finish. Provide eight (8) lights for each run of track.

3. Lamp: Par 30/75 watt.

4. Voltage: 120V.

5. Design Make: Lightolier Lytespan 8430 or approved equal.

TYPE B - LOW VOLTAGE, RECESSED DOWNLIGHT

1. Housing: Die-formed steel, minimum 20 gauge. Adjustable “C” brackets and bar hanger. Pre-wired junction box with integral transformer.

2. Reflector: Pinhole with black baffle for Lobby 315. Black ridge baffle, adjustable for Green Room 233.

3. Lamp: MR16, 50 watt.

4. Voltage: 120V.

5. Design Make: Juno Lighting TC914-443B for Lobby 315. Juno Lighting TC914-44B for Green Room 233, or approved equal.

TYPE C - PENDANT CHANDELIER, 4 ARM

1. Four arm, bowl arrangement, each bowl spun aluminum, anodized with polished brass finish. Indirect lighting.

2. Mounting structure supports bowls and anchors assembly to structural framing. Painted finish as selected by Architect from manufacturer’s standard colors.

3. Lamps: (4) 500 W T4, vertical mounted.

4. Voltage: 120V.

5. Design Make: Visa Lighting CC8024T500. No alternates accepted.

TYPE D - WALL MOUNTED UPLIGHT

1. Housing: Die-formed steel, minimum 20 gauge steel, prime white finish. Universal back plate for mounting to standard outlet box. Color as selected by Architect.

2. Reflector: Specular electro-brightened anodized extruded aluminum ellipsoidal shape.

3. Lens: Heat tempered, rolled Pyrex lay-in glass.

4. Socket: Rear flange mounted, porcelain/nickel plated steel housing.

5. End plates: Die-formed steel, painted black.

6. Lamp: (1) Q500T4.

7. Make: Rambusch Lighting PAL-88-500 or Elliptipar T403-0350, no others accepted.

TYPE E - LOW VOLTAGE, WALL RECESSED

1. Housing: Die cast aluminum. Pre-wired junction box with integral electronic transformer.

2. Trim: Die cast aluminum, socket head stainless steel captive fasteners. Molded borosilicate glass spread lens.

3. Reflector: High reflectance white enamel finish, asymmetrical.

4. Lamp: (1) 20W, GA, 12 V.

5. Design Make: BEGA 114D, no alternates accepted.

TYPE F - NOT USED

TYPE G - 6 IN. ROUND DOWNLIGHT, WALL MOUNTED

1. Housing: Ridged heavy wall weather proof aluminum, stain white baked enamel. Cast wall brackets, matte black finish.

2. Reflector: Specular clear alzak. Parabolic conical shape.

3. Lamp: (1) PAR 38, 150 w.

4. Voltage: 120V.
5. Design Make: Kurt Versen M306, no alternates excepted.

TYPE H - NOT USED

TYPE I - WALL BRACKETED LUMINAIRE

1. Housing: Die cast aluminum and fabricated steel. Wall mounted to structure around standard recessed junction box.

2. Diffuser: Fully gasketed UV stabilized polycarbonate enclosure, opal.

3. Ballast: HPF encapulated, remote mounted in separate enclosure.

4. Lamp: (1) 3/18W/CF.

5. Voltage: 120V.

6. Design Make: Louis Poulsen ORW-MAX-377-White, no alternates accepted.

HID LUMINAIRE SCHEDULE

TYPE HA - METAL HALIDE, 6 IN. RECESSED ROUND DOWNLIGHT

1. Housing: Die formed steel, minimum 20 gauge. Adjustable “C” brackets and bar hanger. Provide damp label application.

2. Reflector: specular clear alzak lower cone.

3. Lamp: (1) 100W PAR-38 FL.

4. Voltage: 120V

5. Design Make: Prescolite 79M5..

6. Acceptable Manufacturers:

    a. Staff
    b. Marco
    c. Prescolite

TYPE HB - METAL HALIDE- WALL MOUNTED ROUND DOWNLIGHT

1. Housing: Die cast aluminum, powder coat black finish. Swivel arm bracket and canopy, finish to match housing.

2. Reflector: Full anodized aluminum with step baffle and tempered glass.

3. Lamp: (1) 70W, ED-17.

4. Voltage: 120V.

5. Design Make: Prescolite HC8W07.

6. Acceptable Manufacturers:

    a. Staff
    b. Kurt Versen
    c. Prescolite

TYPE HC - METAL HALIDE, POLE TOP DUAL LUMINAIRES

1. Pole: 5 in. straight cast aluminum, powder coat black finish. Pole top fitting for luminaire arm mounting. Handhole in base for ballast access. Suitable for wet locations. Design make: Valmont.

2. Fixtures: Twin configuration, 180$^{o}$ apart. Fixture housing and radius arms die cast aluminum, finished to match pole.

3. Lens: Three-ply opal glass with screw neck.

4. Lamps: (2) 100W, ED-17.

5. Design Make: Bega 9757MH, no acceptable alternates.

TYPE HD - METAL HALIDE, RECESSED WALKWAY LIGHT

1. Housing: Extra heavy walled die cast aluminum for use in concrete walls.

2. Reflector/Lens: Specular clear alzak reflector. Molded glass lens for direct symmetrical, downlight distribution.

3. Lamp: 100W, ED-17, medium base, coated.

4. Voltage: 120V.

5. Design Make: KIM LLF-I0, no acceptable alternates.

TYPE HE - METAL HALIDE, WALL MOUNTED ROUND DOWNLIGHT

1. Housing: Spun aluminum, satin brushed with baked white enamel finish. Side wall bracket finished to match housing.

2. Reflectors: Specular clear alzak upper reflector. Low brightness shielding cones.

3. Lamp: (1) 400W, E-37, clear.

4. Voltage: 120V.

5. Design Make: ESCO International SA7028.

6. Acceptable Manufacturers:

    a. Staff
    b. Marco
    c. ESCO

TYPE HF - METAL HALIDE, CUTOFF LUMINAIRE POLE MOUNTED AT 14 FT.

1. Housing: One piece, cast aluminum with removable ballast assembly compartment, dark bronze finish.

2. Door/frame: Gasketed, cast aluminum with temperized, impact resistant, glass lens.

3. Finish: Bronze color finish of powder-coat, thermoset acrylic enamel.

4. Reflector: Anodized semi-specular hydroformed aluminum, Type II distribution.

5. Voltage: 120V.

6. Lamp: (1).

7. Suitable for wet locations.

8. Pole: Nominal 14' high, round tapered aluminum with aluminum base and cover. Anchor bolts per manufacturer's requirements for 100 MPH wind rating. Flush hand hole and cover. Finish to match luminaire.

9. Design Make: Sterner Fontana to match existing campus sit lighting.

TYPE HG - METAL HALIDE, GROUND MOUNTED FLOODLIGHT

1. Housing: One piece, cast aluminum in a cylindrical shape with integral cooling fins. Removable ballast assembly compartment, dark bronze finish.

2. Door/frame: Gasketed, cast aluminum with temperized, impact resistant glass lens.

3. Swivel: Heavy duty cast aluminum for connection to cast aluminum stanchion.

4. Finish: Bronze color finish of powder-coat, thermoset acrylic enamel.

5. Reflector: specular alzak aluminum with vertical flood distribution.

6. Lamp: (1) 70W, ED-17, medium base clear.

7. Voltage: 120V.

8. Design Make: Kim Lighting AFL2 or approved equal.

TYPE HH - METAL HALIDE, WALL BRACKETED LUMINAIRE

1. Housing: Die cast aluminum and fabricated steel. Wall mounted to structure around standard recessed junction box.

2. Diffuser: Fully gasketed UV stabilized polycarbonate enclosure, clear.

3. Ballast: HPF encapsulated, remote mounted in separate enclosure.

4. Lamp: (1) 100W, ED-17, clear lamp.

5. Voltage: 120V.

6. Design Make: Louis Poulsen ORW-MAX-364-White, no alternates accepted.

TYPE HI - METAL HALIDE BOLLARD

1. Housing: One piece extruded aluminum shaft, .125 wall thickness with heavy case aluminum twist-lock anchor base concealed within shaft and concealed set screws. Top cap of one piece cast aluminum 3/8" minimum thickness. Color as selected by Architect.

2. Louvers: One piece aluminum casting with vertical support ribs at $90^{o}$ intervals, horizontal louver blades, 1 3/4" deep at $65^{o}$ upward pitch. Anchored to shaft with internal rods.

3. Lamp Enclosure: One-piece tempered molded glass with internal flutes and full bottom gasketing.

4. Anchor Bolts: Four (4) 3/8" x 10" and zinc plated “L” hoods and all hardware.

5. Lamp: One (1) 100W, ED-17 coated lamp.

6. Voltage: 120V

7. Design make: Kim Lighting VRB1/100MH120/WH-p, no acceptable alternates.

END OF SECTION