CHRISTOPHER NEWPORT UNIVERSITY

Paul & Rosemary Trible Library

Existing Electrical Systems & Conditions

11.4.2020 - TECH REPORT 2

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Contents

I. Power Distribution Systems Report

1. Summary & Details

a. EXECUTIVE SUMMARY

The Paul & Rosemary Trible Library lies at the heart of Christopher Newport University's campus. Due to its age, the building has undergone a number of additions and renovations. This report focuses on the 2016 addition which nearly doubled the size of the existing system, and included new general and emergency electrical distribution equipment. Despite this, a few elements remain from the existing system and will not be covered in depth in this summary. What follows is a comprehensive overview of the systems within Trible Library, including distribution, loads, major equipment, specialty equipment, grounding, low-voltage systems, and a single-line diagram of the addition.

b. SUMMARY OF ELECTRICAL DISTRIBUTION SYSTEM

The electrical distribution in Paul & Rosemary Trible Library begins at a DVP pad-mounted service transformer, which feeds the main switchboard MSB.

MSB serves 33 existing or relocated branch panelboards, some of which serve 480/277V loads and some of which serve 208/120V loads.

480-208/120V transformers are located throughout the building at the panelboards, rather than one central transformer. They transform the voltage from 480/277V at both these existing panelboards and at the 15 new branch panelboards, which are also fed by MSB.

MSB also directly feeds the chiller, located in the mechanical room on the second floor (see f. Major Equipment for details).

The emergency system is fed by a natural gas engine generator (see I. Emergency Power Systems for details), and consists of 3 existing branch panelboards and 1 new panelboard. They are controlled by two 225A automatic transfer switches.

Also fed by the generator is the fire pump, which has an additional 225A ATS.

c. LOCAL UTILITY INFORMATION

Due to the project's status as an addition, no utility information was included on the drawings beyond its identification as "existing."

Information has been requested from owners; response pending.

d. SERVICE ENTRANCE EQUIPMENT

Because the project is an addition, information on the service entrance is limited due to its location in the existing portion of the project. The following service entrance equipment is specified on the riser diagram (sheet E6.10) of the drawings:

One (1) existing DVP pad-mounted service transformer at the existing portion of the building

6 sets each of 4-600KCMIL in 5" conduit (existing) - connected to below
6 sets each of 4-600KCMIL in new 5" conduit - feeds MSB

e. BUILDING UTILIZATION VOLTAGES & BREAKDOWN

Receptacles, data, small unlisted loads	120V
General lighting	277V, 120V (see sheet E6.10 for breakdown)
Miscellaneous	120/208V
FA System	120V
RTUs, Chiller, Water heaters	480V
VAV System	277V
Misc. HVAC equipment	120/208V
Audio / Visual equipment	120V

Figure 1: Table summarizing building utilization voltages & breakdown by broad use category.

f. MAJOR EQUIPMENT

On the following page in Table T2.1 is a summary of the major electrical distribution equipment, including switchboards, branch panelboards, and transformers.

Table T2.1 Summary of New / Relocated Major Electrical Equipment

Equipment Tag	Type of Equipment	Level	Room #	Sheet	Existing?
MSB	Switchboard	1	1223	E6.10	EXIST
NH1	Branch panelboard	1	1209	E4.10, E6.10	
NH2	Branch panelboard	2	2319	E4.10, E6.10	
NH3	Branch panelboard	3	3007	E4.10, E6.10	
NHM	Branch panelboard	2	2302	E4.11, E6.10	
NHMA	Branch panelboard	2	2302	E4.11, E6.10	
NL1A	Branch panelboard	1	1209	E4.10, E6.10	
NL2A	Branch panelboard	2	2319	E4.10, E6.10	
NL3A	Branch panelboard	3	3007	E4.10, E6.10	
NLM	Branch panelboard	2	2302	E4.11, E6.10	
NL1B	Branch panelboard	1	1209	E4.10, E6.10	
NL2B	Branch panelboard	2	2319	E4.10, E6.10	
NL3B	Branch panelboard	3	3007	E4.10, E6.10	
NL1C	Branch panelboard	1	1209	E4.10, E6.10	
NL2C	Branch panelboard	2	2319	E4.10, E6.10	
NL2D	Branch panelboard	2	2319	E4.10, E6.10	
EH1	Emergency branch panelboard	2	2302	E4.11, E6.10	
EP1	Emergency branch panelboard	2	2302	E4.11, E6.10	EXIST
AH1	Relocated branch panelboard	1	149	E4.10, E6.10	EXIST
AL1	Relocated branch panelboard	1	149	E4.10, E6.10	EXIST
-	Service transformer	EXISTING	N/A	E6.10	EXIST
T-NL1	Transformer (dry type)	1	1209	E4.10, E6.10	
T-NL2	Transformer (dry type)	2	2319	E4.10, E6.10	
T-NL3	Transformer (dry type)	3	3007	E4.10, E6.10	
T-NLM	Transformer (dry type)	2	2302	E4.11, E6.10	

See Sheet E6.10 and Sheet E4.10, Details 7 and 8 for locations of remaining existing panelboards / transformers

g. TRANSFORMERS

Trible Library has 480-208/120V, 3P/4W distribution transformers located throughout the building at branch panels, rather than a single transformer located at a central location. This is likely due to the building's large size and varied floor plan.

At the service entrance there is an additional existing DVP pad-mounted service transformer.

Covered on the following page in Table T2.2 are the four distribution transformers which serve the newly-installed panelboards. For details on the existing distribution transformers, see sheets E6.10 and E4.10.

h. GROUNDING

Grounding conductors (copper) and conduits are detailed on the building riser (sheet E6.10), as is a detail of the distribution transformer grounding (unlabeled, sheet E6.10). Additional grounding is shown on the electrical Roof Plan (sheet 2.50).

Below is a detail of a typical ground bus bar detail.

In the specifications, grounding is addressed in Volume 3B of the project manual, Section 260500 - ELECTRICAL GENERAL PROVISIONS, Part 2.6.

Figure 2: Detail of typical ground bar bus; Sheet E5.13.

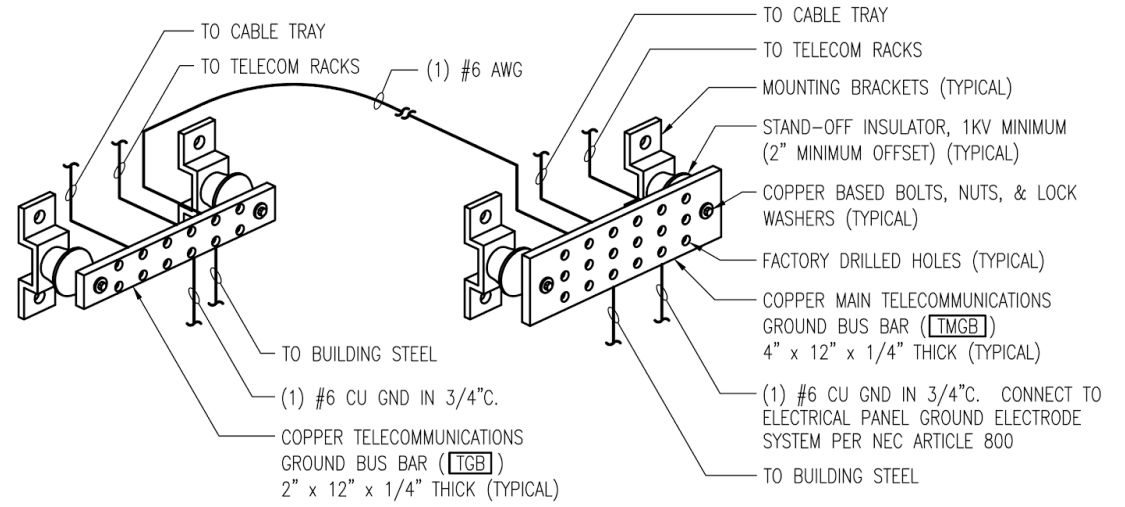


Table T2.2 Summary of New Transformers

Equipment Tag	Primary Voltage	Secondary Voltage	Size (kVA)	Type	Temperature Rise	Mounting
T-NL1	480/277V	208/120V	112.5	Dry	115 C	Floor (on concrete)
T-NL2	480/277V	208/120V	112.5	Dry	115 C	Floor (on concrete)
T-NL3	480/277V	208/120V	45	Dry	115 C	Floor (on concrete)
T-NLM	480/277V	208/120V	30	Dry	115 C	Floor (on concrete)

See Sheet E6.10 and Sheet E4.10, Details 7 and 8 for locations of remaining existing panelboards / transformers

Table T2.3 Summary of Specialty Equipment

Equipment Tag	Description	Load Magnitude	Load Unit (HP, kW)	FLA (A)	Voltage	Phase	Assumed Power Factor	Load (kVA)
REFRIG L1-C-05	Refrigerator	1.02	kW	10	120	1	0.85	1.2
MICRO L1-C-05	Microwave	1.224	kW	12	120	1	0.85	1.44
MICROWAVE	Microwave	1.224	kW	12	120	1	0.85	1.44
DISH WASHER	Dishwasher	1.224	kW	12	120	1	0.85	1.44
REFRIGERATOR	Refrigerator	0.612	kW	6	120	1	0.85	0.72
MICROFILM 143	Microfilm reader	1.224	kW	12	120	1	0.85	1.44
PRINTER 1221	Printer	0.612	kW	6	120	1	0.85	0.72
PRINTER 1220	Printer	0.612	kW	6	120	1	0.85	0.72
BAND BOX	Band box	6.12	kW	60	120	1	0.85	7.2

i. SPECIALTY EQUIPMENT

Table T2.3 on the previous page details specialty equipment found in Trible Library.

While not much specialty equipment was present in the library, several smaller pieces of kitchen and office equipment have been included to account for all loads. For additional smaller kitchen equipment, see the panelboard schedules E8.10 and E8.11.

j. SUMMARY OF HVAC SYSTEMS

Heating and cooling is primarily regulated through a variable air volume (VAV) system, with units located in multiple zones throughout the building. These units are detailed in the mechanical section of k. Additional Equipment. The VAV system is served by four rooftop units.

Ductless split units provide heating and cooling in electrical closets and other small areas. Despite these few units, the building is not ductless.

A chiller, located on Level 2, also provides cooling for the library.

k. ADDITIONAL EQUIPMENT

The tables on the following pages detail the main pieces of equipment in various systems of the library. They have been included on the following pages in the below order.

Table T2.4, Mechanical Equipment
Table T2.5, Plumbing Equipment
Table T2.6, Architectural Equipment

For more detailed Equipment Connection Schedules, see Sheets E2.11-12, E2.21-22, and E2.31-32.

Table T2.4 Summary of Mechanical Equipment

Equipment Tag	Description	Load Magnitude	Load Unit (HP, kW)	MCA (A)	Voltage	Phase	Assumed Power Factor	Load (kVA)
VAV4-1	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV4-2	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV4-3	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV4-4	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV4-5	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV4-6	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV4-7	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV4-8	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV4-9	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV4-10	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV4-11	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV4-12	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV4-13	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV4-14	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV3-1-7	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
FPVAV33-1	Variable air volume unit	1/3	HP	3.2	277	1	0.85	0.8864
WH-1	Water heater	12	kW	14.4	480	3	0.85	11.97
DSS-2A	Ductless split system	-	-	1	208	1	0.85	0.208
DSS-3	Ductless split system	-	-	1	208	1	0.85	0.208
HWRP-1	Hot water recirculation pump	1/6	HP	4.4	120	1	0.85	0.528
H-1	Heating unit	2.059	kW	5.7	120	1	0.85	0.684
FCU-1	Fan coil unit	FHP	HP	1	120	1	0.85	0.12
FCU-2	Fan coil unit	FHP	HP	1	120	1	0.85	0.12
FCU-4	Fan coil unit	FHP	HP	7	120	1	0.85	0.84
UH-1	Unit heater	FHP	HP	1.5	120	1	0.85	0.18
UH-2	Unit heater	FHP	HP	1.5	120	1	0.85	0.18
FCU-3	Fan coil unit	FHP	HP	1.5	120	1	0.85	0.18
DSS-1	Ductless split system	-	-	1	208	1	0.85	0.208
DSS-5	Ductless split system	-	-	1	208	1	0.85	0.208
VAV1-3	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV1-4	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV1-5	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV1-6	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV1-10	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV2-6	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV2-11	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV2-14	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV2-15	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV3-8	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV3-9	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV3-10	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV3-11	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV3-12	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV3-13	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV3-14	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV3-15	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV3-16	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV3-17	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV3-18	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV3-19	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV4-14	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV4-15	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV4-16	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV4-17	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV4-18	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV4-19	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV4-20	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV4-21	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV4-22	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV4-23	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV4-24	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV4-25	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV4-26	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
FCU-4	Fan coil unit	FHP	HP	7	120	1	0.85	0.84
DSS-2B	Ductless split system	FHP	HP	1	208	1	0.85	0.208
DSS-4	Ductless split system	FHP	HP	1	208	1	0.85	0.208
VAV1-10	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV1-2	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV1-7	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV1-8	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV1-9	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV1-11	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV1-12	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV2-1	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV2-2	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV2-3	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV2-4	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV2-5	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV2-7	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV2-8	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV2-9	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV2-10	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV2-12	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV2-13	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
FCU-5	Fan coil unit	FHP	HP	1.5	120	1	0.85	0.18
WH-2	Water heater	4.5	kW	14.4	480	3	0.85	11.97
HWRP-2	Hot water recirculation pump	0	HP	4.4	120	1	0.85	0.528
DSS-5	Ductless split system	-	-	18	208	1	0.85	3.744
VAV3-20	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV3-21	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV3-22	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV3-23	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV3-24	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV3-25	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV3-26	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV3-27	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV3-28	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV3-29	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV3-30	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV3-31	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
VAV3-32	Variable air volume unit	FHP	HP	0.5	277	1	0.85	0.1385
FCU-6	Fan coil unit	0.12	kW	1	120	1	0.85	0.12
FCU-7	Fan coil unit	0.12	kW	1	120	1	0.85	0.12
RTU-1	**Rooftop unit**	**(2) 5, (2) 2**	**HP**	**26**	**480**	**3**	**0.85**	**12.48**
RTU-2	**Rooftop unit**	**(2) 7.5, (2) 3**	**HP**	**35.6**	**480**	**3**	**0.85**	**17.09**
RTU-3	**Rooftop unit**	**(2) 12.5, (2) 5**	**HP**	**59.3**	**480**	**3**	**0.85**	**28.46**
RTU-4	**Rooftop unit**	**(2) 13, (2) 5**	**HP**	**60.6**	**480**	**3**	**0.85**	**29.09**
DSS-2A	Ductless split system	-	-	25	208	1	0.85	5.2
DSS-2B	Ductless split system	-	-	25	208	1	0.85	5.2
DSS-2C	Ductless split system	-	-	25	208	1	0.85	5.2
DSS-3	Ductless split system	-	-	13	208	1	0.85	2.704
DSS-4	Ductless split system	-	-	18	208	1	0.85	3.744
DSS-5	Ductless split system	-	-	1	208	1	0.85	0.208
EF-1	Exhaust fan	1/3	HP	7.2	120	1	0.85	0.864
EF-2	Exhaust fan	1/3	HP	7.2	120	1	0.85	0.864

Table T2.5 Summary of Plumbing Equipment

Equipment Tag	Description	Load Magnitude	Load Unit (HP, kW)	FLA (A)	Voltage	Phase	Assumed Power Factor	Load (kVA)
SUMP EL-03	Sump pump	0.408	kW	4	120	1	0.85	0.48

Table T2.6 Summary of Architectural Equipment

Equipment Tag	Description	Load Magnitude	Load Unit (HP, kW)	FLA (A)	Voltage	Phase	Assumed Power Factor	Load (kVA)
ELEV EQUIP RM 1214	Elevator equipment room (misc.)	0.408	kW	4	120	1	0.85	0.48
ELEVATOR	Elevator	84.80	kW	120	480	3	0.85	99.77

l. EMERGENCY POWER SYSTEMS

The building occupancy types are as follows, as given by the applicable code (VUSBC, which references IBC 2012; used for this project as it was completed in 2016):

A3 - Assembly (Library)
B - Business (Office)
S1 - Moderate-hazard storage

The new portion of the building, which this report focuses on, is Type II A construction, while the existing portion is Type II B. A building occupant count yields a total of 3385 occupants, which qualifies the library as an Assembly-type structure with over 1000 people. This yields the following requirements:

According to NFPA 70, Article 700.12(B), equipment for emergency power sources should be located in a space either fully protected by automatic fire protection or with a 2-hour fire rating. The building also qualifies for this requirement as it is over 75 ft tall (85') and Assembly type.

The EPSS should be of Class 2 (2 hr duration) and Type 10 (10 seconds until power restoration). This building has no life-critical systems that require emergency power, beyond emergency and egress lighting.

The EPSS is powered by a natural gas engine generator (230 kW, 480/277V, 3P/4W) with a weatherproof and sound-attenuated enclosure, which is adequately protected to meet the requirement of Article 700.12(B).

One new branch panel, EH1, and three existing panels, EP1, are fed by the MSB and the generator. In the event of an outage, two automatic transfer switches (one for EH1 and EP1, another for) will switch them to being served from the generator.

m. SPECIAL OCCUPANCY REQUIREMENTS

Trible Library has a small auditorium / theater on level two that qualifies for special occupancy requirements.

See NFPA 70 / NEC, 2020 edition: Article 520 - Theaters, Motion Picture & Television Studios, & Similar Locations.

n. PRELIMINARY LOAD CALCULATION

Primary occupancy type: A-3 - Assembly (Library)
Construction type: Type II A
Total footprint of addition: 63,000 SF

Lighting: 1.5 VA/ft^2 = 94.5 kVA
Receptacle: 1 VA/ft^2 = 63 kVA
HVAC: 6 VA/ft^2 = 378 kVA
Miscellaneous: 1/VA/ft^2 = 63 kVA

Total = **598.5 kVA**

All loads / ft^2 taken from Article 220 of NFPA 70 / NEC 2020.

o. DESIGN DEVELOPMENT-LEVEL CALCULATION

Lighting: 94.5 kVA
Demand factor: 100%
Spare factor: 25%
= 94.5 + 0.25 (94.5)
= 188.13 kVA

Receptacle: 63 kVA
Demand factor: 1st 10 kVA, 100%, Remainder over 10 kVA, 50%
= 10 kVA + 0.5 (53 kVA)
= 36.5 kVA

HVAC: 378 kVA
Demand factor: 100%
= 378 kVA

Miscellaneous: 63 kVA
Demand factor: 100%
=63 kVA

Total = **665.63 kVA**

All demand factors taken from Article 220 of NFPA 70 / NEC 2020.

p. SUMMARY OF ACTUAL LOAD

The demand factor has been included in these totals, which were provided on the drawings at Sheet E6.10.

Lighting: 54.2 kVA
Exterior lighting: 3.1 kVA
Combined lighting: 57.3 kVA
Receptacles: 132.6 kVA
Air conditioning: 368.8 kVA
Heating: 0.2 kVA
Ventilation: 3.5 kVA
Water heater: 22.1 kVA
Combined HVAC: 394.6 kVA
Miscellaneous: 65.1 kVA
Elevator: 33.2 kVA
Existing load: 500.0 kVA

NOTE ON EXISTING LOAD: This existing load has been included as a rounded-up estimate of the loads from the previous portions of the building. The use of this lump sum is valid because this report and overall thesis project focus solely on the new construction and systems of Trible Library; this value is sufficient when accounting for the existing system.

Total connected load: 1182.7 kVA (682.7 kVA without existing)
Total demand load: **1114.5 kVA** (614.5 kVA without existing)

q. COMPARISON OF CALCULATION vs. ACTUAL

The preliminary and design development calculations were remarkably close to the actual loads given (when existing load is excluded, as I calculated only for the new addition). My estimate was 665.63 kVA, and the given load with demand factors was 614.5 kVA.

While the totals are similar, however, the breakdown is not. The largest discrepancy is between lighting loads and receptacle loads. This is possibly due to the fact that student libraries have many individual lamps as opposed to general illumination; or possibly, the electrical lighting was able to be supplemented by daylighting, as large skylights are present in the central reading room. The given values were also not specified to contain spare capacity.

In terms of the receptacle load, it tracks that a university library would have many more outlets per square foot than the typical non-residential use case, which was as specific as NFPA 70 Article 220 allowed for. The fact that it's such a greater amount (132.6 kVA vs. 36.5 kVA) is somewhat surprising, but not completely unprecedented.

The HVAC load is remarkably similar, as is the miscellaneous load.

r. ELECTRICAL DESIGN ISSUES & PRIORITIES

Although there are no especially prevalent issues, integration with the existing system (both distribution and low-voltage) likely presented a number of challenges. Obtaining as much information as possible about the existing system should be made a priority as thesis progresses.

In terms of priorities, I'd infer that reliability and life cycle cost were paramount to the design. University building, especially libraries, see high amounts of use at a wider breadth of hours than many other building types. They are also intended to last for a long time under these strenuous use conditions, possibly without the ability to be updated for a number of years.

For that reason, it's likely that the university would prioritize long-term functionality and cost benefits rather than worrying about first cost or flexibility. Instead, something high-quality and lasting appears to be more the focus in this design, even if that system doesn't necessarily lend itself to easy updating.

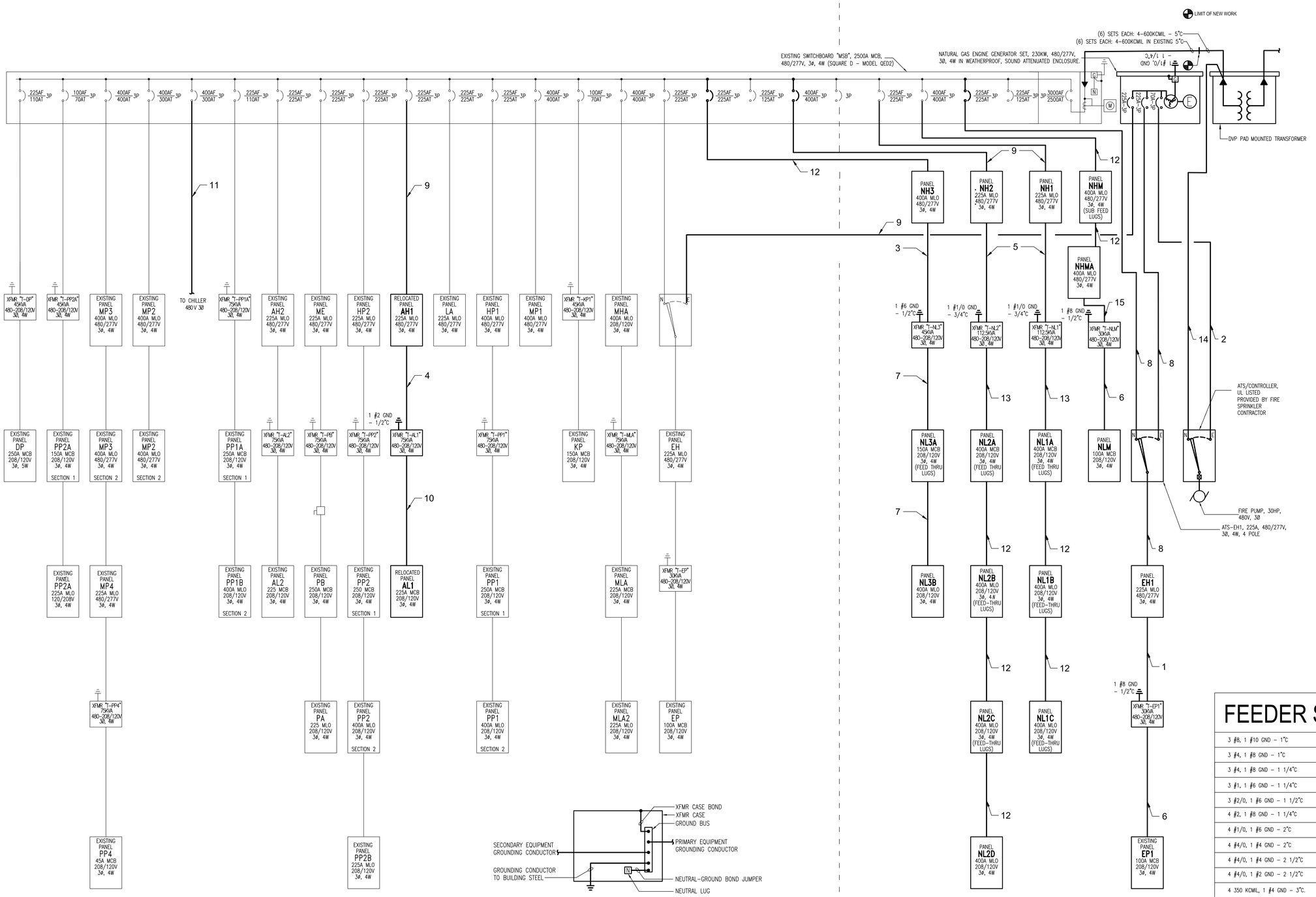
2. Single-Line Diagram

A single-line diagram of the main and emergency distribution systems is included on the following page.

For reference, riser diagrams are located at pages E6.10 and E6.11 in the drawings.

MAIN SYSTEM

EMERGENCY



TRANSFORMER GROUNDING

FEEDER SCHEDULE

3 #8, 1 #10 GND - 1"C	1
3 #4, 1 #8 GND - 1"C	2
3 #4, 1 #8 GND - 1 1/4"C	3
3 #1, 1 #6 GND - 1 1/4"C	4
3 #2/0, 1 #6 GND - 1 1/2"C	5
4 #2, 1 #8 GND - 1 1/4"C	6
4 #1/0, 1 #6 GND - 2"C	7
4 #4/0, 1 #4 GND - 2"C	8
4 #4/0, 1 #4 GND - 2 1/2"C	9
4 #4/0, 1 #2 GND - 2 1/2"C	10
4 350 KCMIL, 1 #4 GND - 3"C.	11
4-500KCMIL, 1 #2 GND - 4"C	12
4-600KCMIL, 1 #1/0 GND - 4"C	13
4 #4, 1 #8 GND - 1"C	14
3 #8, 1 #10 GND - 3/4"C	15

E6.00	AE 481W 04 NOVEMBER, 2020
MAIN & EMERGENCY SINGLE-LINE DIAGRAM	TECH REPORT 2 MADELINE HESS

TRIBLE LIBRARY
CHRISTOPHER NEWPORT UNIVERSITY, VA
1 AVENUE OF THE ARTS
NEWPORT NEWS, VIRGINIA 23606

CHRISTOPHER NEWPORT UNIVERSITY
OWNER
804 649 9303

Pace COLLABORATIVE
MEP CONSULTANT
757 499 7223

II. Low-Voltage Systems Report

1. Summary & Details

a. VOICE / DATA / SECURITY

The voice and data system is fairly standard, distributed from a central location to the outer areas of each floor. Most tele- and data-outlets are provided with 1"C with pull string stubbed above an accessible ceiling. There are several ceiling-mounted wireless access points as well.

There is also a campus alert system with a few emergency telephone outlets throughout the space. For the locations of tele- and data-drops, see sheets E2.11-12, E2.21-22, and E3.31-32.

The electronic security system (ESS) includes CCTV cameras and electronic door security (contacts, card readers, etc.). Below is a detail of these electronic security systems.

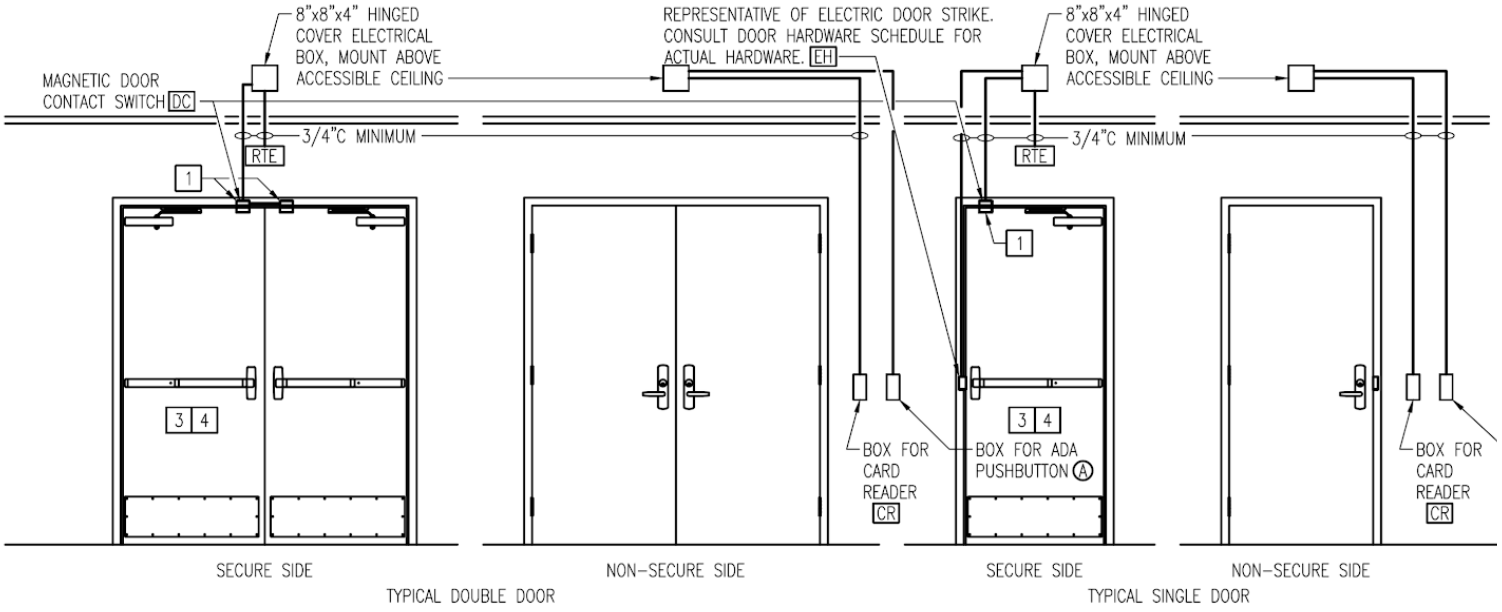


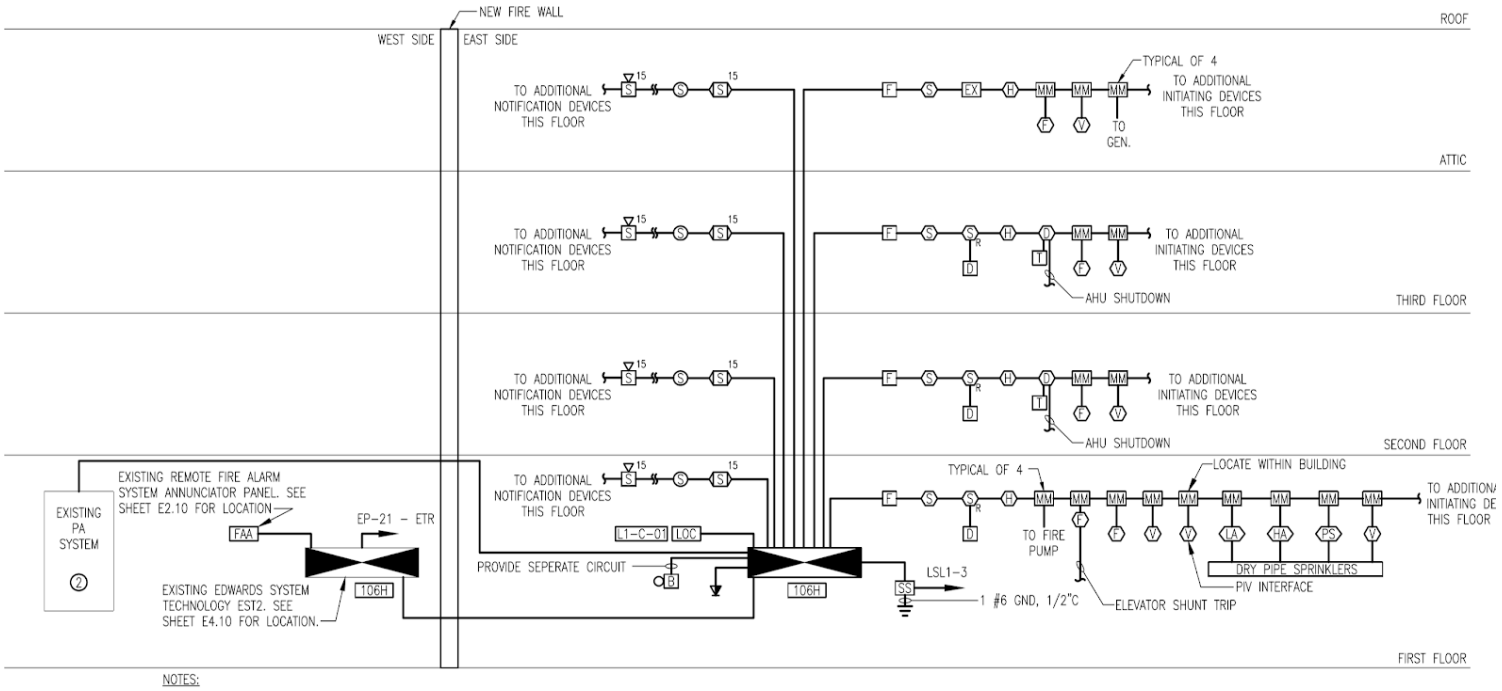
Figure 3: Detail of electronic door security system; Sheet 5.13

As far as the drawings indicate, these systems stem from the existing Voice / Data / Security systems.

b. FIRE ALARM

The fire alarm system extends from the existing system installed by Edwards System Technology, located in the existing portion of the building. The distribution is located centrally on the first floor and proceeds vertically up the building, into the attic.

For a more detailed look at the system, the riser diagram and fire alarm matrix found on Sheet E6.11 of Volume 3B are included below (proceeds onto the following page).



NOTES:

① CONTRACTOR SHALL INTERFACE (I.E. ANY INCIDENT SIGNAL RECEIVED BY EITHER PANEL SHALL CAUSE THE OTHER PANEL TO REACT THE SAME) NEW EMERGENCY VOICE ALARM SYSTEM CONTROL PANEL WITH THE EXISTING EDWARDS SYSTEM TECHNOLOGY EST2 SYSTEM CONTROL PANEL AND ANNUNCIATOR IN ACCORDANCE WITH VUSBC 2012 AND NFPA 72-2010. EXISTING FIRE ALARM SYSTEM DEVICES ON THE WEST SIDE OF THE NEW FIRE WALL SHALL BE CONNECTED TO THE EXISTING EDWARDS SYSTEM TECHNOLOGY EST2 CONTROL PANEL WITH THE EXCEPTION OF RENOVATED AREAS. ALL NEW FIRE ALARM SYSTEM DEVICES TO THE EAST SIDE OF THE NEW FIRE WALL SHALL BE CONNECTED TO THE NEW EMERGENCY VOICE ALARM SYSTEM CONTROL PANEL.

② PROVIDE INTERFACE FROM NEW EMERGENCY VOICE/ALARM COMMUNICATION SYSTEM TO THE EXISTING PUBLIC ADDRESS SYSTEM. BUILDING PUBLIC ADDRESS SYSTEM SHALL UTILIZE NEW EMERGENCY VOICE/ALARM SYSTEM SPEAKERS.

FIRE ALARM SYSTEM RISER DIAGRAM ①
NO SCALE

Figure 4: Fire alarm and emergency voice / PA riser diagram.

		ACTUATE COMMON ALARM SIGNAL	ACTUATE AUDIBLE ALARM SIGNAL	ACTUATE COMMON SUPERVISORY SIGNAL INDICATOR	ACTUATE AUDIBLE SUPERVISORY SIGNAL	ACTUATE COMMON TROUBLE SIGNAL INDICATOR	ACTUATE AUDIBLE COMMON TROUBLE SIGNAL	ACTIVATE DISPLAY ON FACP AND ANNUNCIATORS	ACTUATE AUDIBLE EVACUATION SIGNALS	ACTIVATE VISUAL EVACUATION SIGNALS	ACTUATE INDIVIDUAL CO2 DETECTOR ALERT	TRANSMIT FIRE ALARM SIGNAL TO SUPERVISING STATION	TRANSMIT SUPERVISORY SIGNAL TO SUPERVISING STATION	TRANSMIT TROUBLE SIGNAL TO SUPERVISING STATION	RECALL ELEVATORS TO PRIMARY RECALL FLOOR	RECALL ELEVATORS TO ALTERNATE RECALL FLOOR	ACTIVATE SHUNT TRIP FOR ELEVATOR CAR	RELEASE DOOR HOLDERS	SPRINKLER BELL	SHUTDOWN ASSOCIATED AHU LOCALLY	
		CONTROL UNIT ANNUNCIATION							NOTIFICATION						FIRE SAFETY CONTROL					SUP.	
	SYSTEM INPUTS BELOW	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	
1	MANUAL FIRE ALARM BOXES	X	X					X	X	X		X						X			1
2	SMOKE DETECTORS – 1ST FLOOR ELEVATOR LOBBY	X	X					X	X	X		X				X		X			2
3	SMOKE DETECTORS – 1ST FLOOR OTHER AREAS	X	X					X	X	X		X						X			3
4	SMOKE DETECTORS – 2ND FLOOR ELEVATOR LOBBY	X	X					X	X	X		X			X			X			4
5	SMOKE DETECTORS – 2ND FLOOR OTHER AREAS	X	X					X	X	X		X						X			5
6	SMOKE DETECTORS – ALL OTHER ELEVATOR LOBBY'S	X	X					X	X	X		X			X			X			6
7	SMOKE DETECTORS – TOP OF ELEVATOR SHAFT	X	X					X	X	X		X			X			X			7
8	SMOKE DETECTORS – ALL OTHER AREAS	X	X					X	X	X		X						X			8
9	SMOKE DETECTORS – ELEVATOR MACHINE ROOM	X	X					X	X	X		X			X			X			9
10	DUCT SMOKE DETECTORS FOR AHU'S			X	X			X					X							X	10
11	HEAT DETECTORS – 1ST FLOOR PIT	X	X					X	X	X		X						X			11
12	HEAT DETECTORS –ALL AREAS OTHER THAN ELEVATOR CONTROL	X	X					X	X	X		X						X			12
13	HEAT DETECTORS – TOP OF ELEVATOR SHAFT	X	X					X	X	X		X						X			13
14	HEAT DETECTORS – ELEVATOR MACHINE ROOM	X	X					X	X	X		X						X			14
15	VOLTAGE MONITOR FOR SHUNT TRIP CIRCUIT					X	X	X						X							15
16	WATERFLOWS – ALL FLOORS	X	X					X	X	X		X						X	X		16
17	WATERFLOW – ELEVATOR MACHINE ROOM/ELEVATOR SHAFT DEDICATED	X	X					X	X	X		X					X	X	X		17
18	SPRINKLER CONTROL VALVES TAMPER SWITCH – ALL FLOORS			X	X			X					X								18
19	FIRE PUMP RUNNING	X	X					X	X	X		X						X			19
20	FIRE PUMP POWER FAILURE/PHASE REVERSAL					X	X	X						X							20
21	FIRE PUMP POWER PHASE LOST					X	X	X						X							21
22	FIRE PUMP ALTERNATE POWER SOURCE					X	X	X						X							22
23	DRY SPRINKLER PRESSURE SWITCH – FLOW	X	X					X	X	X		X						X			23
24	DRY SPRINKLER HIGHOW PRESSURE SWITCH – TROUBLE							X													24
25	DRY SPRINKLER CONTROL VALVE TAMPER SWITCH							X													25
26	GENERATOR RUNNING			X	X			X					X								26
27	GENERATOR FAULT			X	X			X					X								27
28	GENERATOR SWITCH IN NONAUTOMATIC POSITION			X	X			X					X								28
29	GENERATOR GAS VALVE MONITORING			X	X			X					X								29
30	FIRE ALARM AC POWER FAILURE					X	X	X						X							30
31	FIRE ALARM SYSTEM LOW BATTERY					X	X	X						X							31
32	OPEN CIRCUIT					X	X	X						X							32
33	GROUND FAULT					X	X	X						X							33
34	NOTIFICATION APPLIANCE CIRCUIT SHORT					X	X	X						X							34
35	POST INDICATOR VALVE (PIV)			X	X			X				X	X								35
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	

Figure 5: Fire alarm matrix for Trible Library addition.

c. AUDIO-VISUAL

The majority of the audio-visual system is located in the 100-person theater (room 2309) and its vestibule (2309A). Included is a riser diagram of the system within the room. A pull box is located above the stage, which feeds into speakers and equipment above the plenum, as well as equipment on and backstage.
Under the floor, 1-¼" conduits lead to four floor boxes.

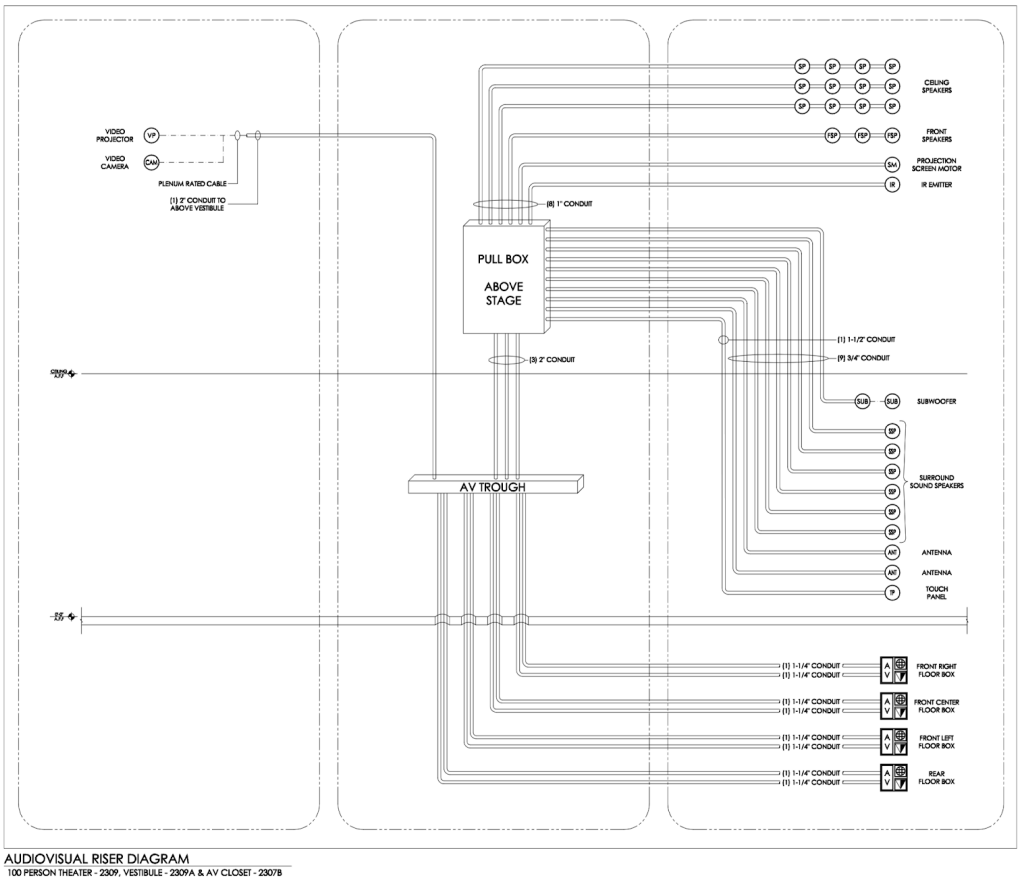


Figure 6: Audio-visual riser diagram for room 2309, the 100-person theater.

In addition to the theater, many classrooms and group study rooms in the library have minor A/V elements, such as TVs or projector screens. For additional A/V risers of these smaller areas, see sheet AV.05 in Volume 3B of the drawing set. NOTE: A/V information given in the drawings is raceway infrastructure only.